Module Handbook

for the

Master Programme "Computer Science"

at

Rheinischen Friedrich-Wilhelms-Universität Bonn

revised version: January 20, 2017

The curriculum of the master programme is divided into four sub-curricula, each corresponding to one of the four main areas of competence in research of the Bonn Institute of Computer Science:

- 1. Algorithmics
- 2. Graphics, Vision, Audio
- 3. Information and Communication Management
- 4. Intelligent Systems

Module numbers **MA-INF ASXY** have been assigned according to the following key: vergeben:

- $\mathbf{A} =$ number of the area of competence
- $\mathbf{S} =$ semester within the master curriculum
- **XY** = sequential number within the semester and the respective area of competence (two digits)

According to the curriculum, all modules ought to be taken between the first and the third semester. The fourth semester is reserved for preparing the master thesis.

Contents

| 1 | Algorithmics | 2 |
|---|--|----------|
| 2 | Graphics, Vision, Audio | 36 |
| 3 | Information and Communication Management | 71 |
| 4 | Intelligent Systems | 119 |
| 5 | Master Thesis | 155 |

1 Algorithmics

| MA-INF 1102 | L4E2 | 9 CP | Combinatorial Optimization | 3 |
|---------------|-----------------------|-------------------|---|----|
| MA-INF 1103 | L4E2 | $9 \ \mathrm{CP}$ | Cryptography | 4 |
| MA-INF 1104 | L4E2 | 9 CP | Advanced Algorithms | |
| MA-INF 1201 | L4E2 | 9 CP | Approximation Algorithms for NP-Hard Problems | 6 |
| MA-INF 1202 | L4E2 | 9 CP | Chip Design | 7 |
| MA-INF 1203 | L4E2 | $9 \ \mathrm{CP}$ | Discrete and Computational Geometry | 8 |
| MA-INF 1204 | $\operatorname{Sem2}$ | 4 CP | Seminar Selected Topics in Information and Learning | |
| | | | Theory | 9 |
| MA-INF 1205 | $\mathrm{Sem}4$ | 6 CP | Graduate Seminar Discrete Optimization | 10 |
| MA-INF 1206 | $\operatorname{Sem2}$ | 4 CP | Seminar Design and Analysis of Randomized | |
| | | | Approximation Algorithms | 11 |
| MA-INF 1207 | Lab4 | 9 CP | Lab Combinatorial Algorithms | 12 |
| MA-INF 1209 | $\operatorname{Sem2}$ | 4 CP | Seminar Advanced Topics in Cryptography | 13 |
| MA-INF 1210 | L2E2 | 6 CP | Probabilistic Analysis of Algorithms | 14 |
| MA-INF 1211 | L4E2 | 9 CP | Parameterized Complexity | |
| MA-INF 1212 | $\mathrm{Sem}2$ | 4 CP | Seminar Parameterized Complexity | 16 |
| MA-INF 1213 | L4E2 | 9 CP | Randomized Algorithms and Probabilistic Analysis | 17 |
| MA-INF 1214 | L4E2 | 9 CP | Computational Complexity | 18 |
| MA-INF 1215 | L2E2 | 6 CP | Introduction to Computational Topology | 19 |
| MA-INF 1216 | L4E2 | 9 CP | Fine-Grained Analysis of Algorithms | 20 |
| MA-INF 1301 | L4E2 | 9 CP | Algorithmic Game Theory and the Internet | 21 |
| MA-INF 1302 | L4E2 | 9 CP | Advanced Topics in Algorithmics | 22 |
| MA-INF 1303 | L2E2 | 6 CP | Selected Topics in Algorithmics | 23 |
| MA-INF 1304 | $\mathrm{Sem}2$ | 4 CP | Seminar Geometric Distance Problems | 24 |
| MA-INF 1305 | $\mathrm{Sem}4$ | 6 CP | Graduate Seminar Chip Design | 25 |
| MA-INF 1306 | $\mathrm{Sem}2$ | 4 CP | Seminar Combinatorial and Geometric Optimization | 26 |
| MA-INF 1307 | $\mathrm{Sem}2$ | 4 CP | Seminar Advanced Algorithms | 27 |
| MA-INF 1308 | Lab4 | 9 CP | Lab Algorithms for Chip Design | 28 |
| MA-INF 1309 | Lab4 | $9 \ \mathrm{CP}$ | Lab Efficient Algorithms for Selected Problems: Design, | |
| | | | Analysis and Implementation | 29 |
| MA-INF 1312 | L4E2 | 9 CP | The Art of Cryptography | 30 |
| MA-INF 1313 | L4E2 | $9~\mathrm{CP}$ | Topics in Theoretical Cryptography | 31 |
| MA-INF 1314 | L4E2 | $9 \ \mathrm{CP}$ | Online Motion Planning | 32 |
| MA-INF 1315 | Lab4 | $9 \ \mathrm{CP}$ | Lab Computational Geometry | 33 |
| MA-INF 1317 | Lab4 | $9~\mathrm{CP}$ | Lab Parameterized Complexity | 34 |
| MA-INF 1318 | L2E2 | $6 \mathrm{CP}$ | Theoretical Aspects of Intruder Search | 35 |

| Module | Combinator | rial Optimi | zation | | | |
|--------------------|--|----------------|------------|---------------|------------------------------------|------------------|
| MA-INF 1102 | | | | | | |
| Workload | Credit points | Duration | Frequer | ncy | | |
| 270 h | 9 CP | 1 semester | at least | every y | ear | |
| Module | Prof. Dr. Jens | s Vygen | | | | |
| coordinator | | | | | | |
| Lecturer(s) | Prof. Dr. Jens | s Vygen, Prof | Dr. Nor | bert Blu | ım, | |
| | Prof. Dr. Stef | 0 0 | | | . / | |
| | Prof. Dr. Bern | nhard Korte, | Prof. Dr. | Stepha | n Held | |
| Classification | Programme | | Mode | Seme | | |
| | M. Sc. Compu | | Optional | | | |
| Technical skills | | 0 | | - | ization. Modelli | ng |
| | and developme | | n strategi | es for co | mbinatorial | |
| | optimization p | | | | | |
| Soft skills | Mathematical | | | | | |
| | thinking, prese | | | | | |
| Contents | Matchings, b-1 | 0 | 0 / | - | | |
| | matroids, subr | | | | , . | |
| D | _ | lem, polyhed | ral combin | natorics, | NP-hard probl | ems |
| Prerequisites | none | | • | | ** 7 11 1 7 1 | CD |
| | Teaching formation | at Gro | - | h/week | Workload[h] | CP 5.5 |
| Format | Exercises | | 60 30 | $\frac{4}{2}$ | 60 T / 105 S 30 T / 75 S | |
| | | | 1 | | , , | 3.5 |
| | T = face-to-fa | ce teaching; | S = indep | endent s | | |
| Exam achievements | Oral exam | | | | (0 | ided) |
| Study achievements | Successful exe | rcise particip | ation | | (not gra | .ded) |
| Forms of media | | | | | | |
| | | | | - | zation: Theory | and |
| | Algorithms. S | | , | | | |
| Literature | e e | | ial Optim | ization: | Polyhedra and | |
| | Efficiency. Spr | - | | | | |
| | , | 0 | , | | k, A. Schrijver: | |
| | Combinatorial Optimization. Wiley 1997 | | | | | |

| Module | Cryptography | | | | | | | |
|--------------------|-----------------|----------------------------------|------------|--------------|-------------------|-------|--|--|
| MA-INF 1103 | | | | | | | | |
| Workload | Credit points | Credit points Duration Frequency | | | | | | |
| 270 h | 9 CP | 1 semester | every | year | | | | |
| Module | Prof. Dr. Joac | chim von zu | Gathen | | | | | |
| coordinator | | | | | | | | |
| Lecturer(s) | Prof. Dr. Joac | chim von zu | Gathen, | Dr. Mich | nael Nüsken | | | |
| Classification | Programme | | Mode | Seme | ster | | | |
| Classification | M. Sc. Compu | ter Science | Optiona | al $ $ 1. or | 2. | | | |
| Technical skills | Understanding | g of security | concerns | and meas | sures, and of the | е | | |
| | interplay betw | een computi | ng power | and secu | rity requiremen | ıts. | | |
| | Mastery of the | e basic techn | iques for | cryptosys | stems and | | | |
| | cryptanalysis | cryptanalysis | | | | | | |
| Soft skills | Oral presentat | ion (in tuto: | rial group | os), writte | n presentation | (of | | |
| | | <i>, , , , , , , , , ,</i> | | ion in sol | ving homework | | | |
| | problems, criti | | | | | | | |
| Contents | | | | | ms: AES, RSA, | | | |
| | | • | | • | nge, cryptograp | | | |
| | | , . | | , | toring integers a | and | | |
| | discrete logari | thms; lower | bounds in | n structur | ed models. | | | |
| Prerequisites | none | | | I | 1 | | | |
| | Teaching forma | at Gr | oup size | h/week | Workload[h] | CP | | |
| Format | Lecture | | 60 | 4 | 60 T / 105 S | 5.5 | | |
| | Exercises | | 30 | 2 | 30 T / 75 S | 3.5 | | |
| | T = face-to-fa | ce teaching; | S = inde | pendent s | study | | | |
| Exam achievements | Written exam | | | | (gra | ded) | | |
| Study achievements | Successful exer | rcise partici | oation | | (not gra | (ded) | | |
| Forms of media | | | | | | | | |
| Literature | • Stinson, Cry | ptography: | Theory a | nd Practi | ce, 2nd edition | | | |
| | • Course notes | 3 | | | | | | |

| Module | Advanced Algorithms | | | | | | | | |
|--------------------|---------------------|----------------------------------|-----------|-------------|------------------|------|--|--|--|
| MA-INF 1104 | | | | | | | | | |
| Workload | Credit points | Credit points Duration Frequency | | | | | | | |
| 270 h | 9 CP | 9 CP 1 semester every year | | | | | | | |
| Module | Prof. Dr. Stef | Prof. Dr. Stefan Kratsch | | | | | | | |
| coordinator | | | | | | | | | |
| Lecturer(s) | Prof. Dr. Stef | an Kratsch, | Prof. Dr | . Heiko R | öglin | | | | |
| Classification | Programme | | Mode | Seme | ster | | | | |
| Classification | M. Sc. Compu | ter Science | Optiona | al 1. | | | | | |
| Technical skills | Deeper insight | s into select | ed metho | ds and te | chniques of mod | dern | | | |
| | algorithmics. | | | | | | | | |
| Soft skills | Presentation o | f solutions a | and metho | ods, critic | al discussion of | | | | |
| | applied metho | ds and tech | niques. | | | | | | |
| Contents | Advanced algo | rithmic tech | niques fr | om e.g. a | pproximation, | | | | |
| | randomized an | nd exact exp | onential | time algoi | rithms. We will | also | | | |
| | revisit some es | sential topic | s such as | linear pr | ograms and net | work | | | |
| | flows. | | | | | | | | |
| Prerequisites | none | | | | | | | | |
| | Teaching form | at Gr | oup size | h/week | Workload[h] | CP | | | |
| Format | Lecture | | 60 | 4 | 60 T / 105 S | 5.5 | | | |
| | Exercises | | 30 | 2 | 30 T / 75 S | 3.5 | | | |
| | T = face-to-fa | ce teaching; | S = inde | pendent s | study | | | | |
| Exam achievements | Written exam | | | | (gra | ded) | | | |
| Study achievements | Successful exe | rcise partici | pation | | (not gra | ded) | | | |
| Forms of media | | | | | | | | | |
| Literature | | | | | | | | | |

| Module MA-INF 1201 | Approximat | tion Algori | thms fo | or NP-H | Iard Problen | \mathbf{ns} | | | |
|------------------------------|---|--|-----------|-------------|----------------------------|---------------|--|--|--|
| Workload | Credit points | Duration | Freque | ency | | | | | |
| 270 h | 9 CP | 1 semester | - | t every y | ear | | | | |
| Module | Prof. Dr. Marek Karpinski | | | | | | | | |
| coordinator | | | | | | | | | |
| Lecturer(s) | Prof. Dr. Mar | Prof. Dr. Marek Karpinski, Prof. Dr. Norbert Blum, | | | | | | | |
| | Prof. Dr. Rolf Klein, Prof. Dr. Bernhard Korte, | | | | | | | | |
| | | Prof. Dr. Jens Vygen, Prof. Dr. Stefan Hougardy, | | | | | | | |
| | Prof. Dr. Step | Prof. Dr. Stephan Held | | | | | | | |
| Classification | Programme | | Mode | Seme | | | | | |
| | M. Sc. Compu | | Optiona | | | | | | |
| Technical skills | Introduction t | 0 | | | - | | | | |
| | approximation | 0 | | | | | | | |
| | | | | - | es for proving lo | ower | | | |
| C (t 1 11) | and upper bou | , 1 | | | | | | | |
| Soft skills | | | | bas, critic | al discussion of | | | | |
| | applied metho | | - | | ~ . | | | | |
| Contents | | | | | on Schemes. De | | | | |
| | | * * | 0 | | or selected NP-h | hard | | | |
| | problems, like | | | - | | | | | |
| | MAXSAT, TS | · – | | | | | | | |
| | Facility Locati techniques (lik | | | - | - | | | | |
| | Search, rando | | | | | | | | |
| | MCMC-Metho | | - | | ., | | | | |
| | approximation | | | | liarysis or | | | | |
| Prerequisites | Recommended | | | <i></i> | | | | | |
| | Introductory k | | foundati | ons of alg | orithms and | | | | |
| | complexity the | 0 | | C | | | | | |
| | Teaching form | at Gro | up size | h/week | Workload[h] | CP | | | |
| Format | Lecture | | 60 | 4 | 60 T / 105 S | 5.5 | | | |
| | Exercises | | 30 | 2 | 30 T / 75 S | 3.5 | | | |
| | T = face-to-fa | ce teaching: | S = inde | pendent s | study | | | | |
| Exam achievements | Oral exam | | | r ~ | | ded) | | | |
| Study achievements | Successful exe | rcise particip | ation | | (not gra | | | | |
| Forms of media | | | | | | / | | | |
| | • S. Arora, C. | Lund: Hard | ness of A | pproxima | tions. In: | | | | |
| | · · · · · | | | | | | | | |
| | Approximation Algorithms for NP-Hard Problems (D. S. Hochbaum, ed.), PWS, 1996 | | | | | | | | |
| | • M. Karpinski: Randomisierte und approximative Algorithmen | | | | | | | | |
| | für harte Berechnungsprobleme, Lecture Notes (5th edition), | | | | | | | | |
| Literature | Universität Bo | pnn, 2007 | | | | | | | |
| | | | | - | zation: Theory | and | | | |
| | Algorithms (5 | · · · | · | | | | | | |
| | • V. V. Vazira | ini: Approxir | nation A | lgorithms | , Springer, 2001 | 1 | | | |
| | V. V. Vazirani: Approximation Algorithms, Springer, 2001 D. P. Williamson, D. B. Shmoys: The Design of | | | | | | | | |
| | • D. P. William | mson, D. B. | Shmoys: | | gn of ersity Press, 201 | | | | |

| Module MA-INF 1202 | Chip Design | | | | | | | | |
|-----------------------|--|---|------------|------------------------|------------------|-------|--|--|--|
| Workload | Credit points | Credit points Duration Frequency | | | | | | | |
| 270 h | 9 CP | 1 semester | every y | | | | | | |
| Module | Prof. Dr. Jens | Prof. Dr. Jens Vygen | | | | | | | |
| coordinator | | | | | | | | | |
| Lecturer(s) | All lecturers o | f Discrete Ma | thematio | s | | | | | |
| | Programme | Programme Mode Semester | | | | | | | |
| Classification | M. Sc. Compu | ter Science | Optiona | $1 \mid 1. \text{ or}$ | 2. | | | | |
| Technical skills | Knowledge of | the central p | roblems a | and algor | rithms in chip | | | | |
| | design. Comp | etence to dev | elop and | apply al | gorithms for sol | ving | | | |
| | real-world pro | blems, also w | ith respe | ct to tec | hnical constrain | its. | | | |
| | Techniques to | develop and | impleme | nt efficier | nt algorithms fo | r | | | |
| | very large inst | | | | | | | | |
| Soft skills | Mathematical | Mathematical modelling of problems occurring in chip design, | | | | | | | |
| | development o | development of efficient algorithms, abstract thinking, | | | | | | | |
| | presentation of solutions to exercises | | | | | | | | |
| Contents | Problem form | ulation and d | esign flov | v for chip | o design, logic | | | | |
| | synthesis, plac | ement, routin | ng, timin | g analysi | s and optimizat | ion, | | | |
| | clocktree desig | ŋ | | | | | | | |
| Prerequisites | none | | | | | | | | |
| | Teaching form | at Gro | up size | h/week | | CP | | | |
| Format | Lecture | | 60 | 4 | 60 T / 105 S | 5.5 | | | |
| | Exercises | | 30 | 2 | 30 T / 75 S | 3.5 | | | |
| | T = face-to-fa | ce teaching; S | S = indep | pendent s | study | | | | |
| Exam achievements | Oral exam | | | | (gra | ided) | | | |
| Study achievements | Successful exe | rcise particip | ation | | (not gra | ided) | | | |
| Forms of media | | | | | | | | | |
| Literature | Algorithms for New York, 200 • S. Held, B. I optimization in Methods and Amsterdam 20 | C.J. Alpert, D.P. Mehta, S.S. Sapatnekar: The Handbook of Algorithms for VLSI Physical Design Automation. CRC Press, New York, 2008. S. Held, B. Korte, D. Rautenbach, J. Vygen: Combinatorial optimization in VLSI design. In: "Combinatorial Optimization: Methods and Applications" (V. Chvátal, ed.), IOS Press, Amsterdam 2011, pp. 33-96 J. Vygen: Chip Design. Lecture Notes (distributed during the course) | | | | | | | |

| Module | Discrete and Computational Geometry | | | | | | | | |
|---|--|--|---|--------------------------------|--|----------------------|--|--|--|
| MA-INF 1203 | | 1 | | | U | | | | |
| Workload | Credit points | Duration | Freque | ency | | | | | |
| 270 h | 9 CP | 9 CP 1 semester every year | | | | | | | |
| Module | Prof. Dr. Rolf Klein | | | | | | | | |
| coordinator | | | | | | | | | |
| Lecturer(s) | Prof. Dr. Rolf Klein, Prof. Dr. Norbert Blum, | | | | | | | | |
| | Prof. Dr. Marek Karpinski, PD Dr. Elmar Langetepe | | | | | | | | |
| Classification | Programme Mode Semester | | | | | | | | |
| Classification | M. Sc. Compu | ter Science | Optiona | al 1., 2., | 3. or 4. | | | | |
| Technical skills | To acquire fun | damental kn | owledge | on topics | and methods in | 1 | | | |
| | Discrete and Computational Geometry; to gain experience in, | | | | | | | | |
| | - | | | - | omously in solvi | ng | | | |
| | new problems, aiming at reliable experience. | | | | | | | | |
| Soft skills | Sozialkompeter | · · | | | | | | | |
| | eigener Lösung | , | | | | | | | |
| | Gruppenrahme | | - ,. | | - | | | | |
| | · • • | , | | , | en von Beweisen | ı), | | | |
| | Individualkom | - · | ungs- ur | nd Lernbe | reitschaft, | | | | |
| | Kreativität, Au | usdauer). | | | | | | | |
| | Social compete | ence(commu | nication. | presentir | ng one's own | | | | |
| | solutions, goal-oriented discussions in teams), methodical | | | | | | | | |
| | competence (a | nalysis, absti | action, j | proofs), in | ndividual | | | | |
| | competence (co | ommitment a | and willi | ngness to | learn, creativity | , | | | |
| | endurance). | | | | | | | | |
| Contents | Geometric dist | ance problem | ns in din | nension tv | vo and higher, | | | | |
| | Voronoi diagra | ams, well-sepa | arated pa | air decom | position, spann | $\operatorname{er},$ | | | |
| | metric space en | mbedding, di | mension | reduction | n, dilation, | | | | |
| | geometric ineq | ualities, VC- | dimensio | on, epsilor | n-nets, visibility | , | | | |
| | point location; | | | | | | | | |
| | randomized ind | cremental co | nstructio | on, Chan's | s technique. | | | | |
| Prerequisites | Recommended: | : | | , | | | | | |
| _ | BA-INF 114 – | Grundlagen | der algo | rithmisch | en Geometrie | | | | |
| | Teaching forma | at Gro | up size | h/week | Workload[h] | CD | | | |
| Format | | | up size | II/ WCCK | | CP | | | |
| Format | Lecture | | 60 | 4 | 60 T / 105 S | 5.5 | | | |
| | | | - | | | | | | |
| | Lecture Exercises | | 60 30 | 4 2 | 60 T / 105 S 30 T / 75 S | 5.5 | | | |
| Exam achievements | Lecture Exercises T = face-to-face | | 60 30 | 4 2 | 60 T / 105 S 30 T / 75 S study | $5.5 \\ 3.5$ | | | |
| Exam achievements Study achievements | $\begin{array}{l} \text{Lecture} \\ \text{Exercises} \\ \text{T} = \text{face-to-fac} \\ \text{Oral exam} \end{array}$ | ce teaching; S | $\begin{array}{c} 60\\ 30\\ S = \text{inde} \end{array}$ | 4 2 | 60 T / 105 S 30 T / 75 S study (gra | 5.5 3.5 | | | |
| Study achievements | Lecture Exercises T = face-to-face | ce teaching; S | $\begin{array}{c} 60\\ 30\\ S = \text{inde} \end{array}$ | 4 2 | 60 T / 105 S 30 T / 75 S study | 5.5 3.5 | | | |
| | Lecture Exercises T = face-to-face Oral exam Successful exer | ce teaching; s | $\begin{array}{c} 60\\ 30\\ S = \text{inde}\\ \text{ation} \end{array}$ | 4 2 pendent s | 60 T / 105 S 30 T / 75 S study (gra | 5.5 3.5 | | | |
| Study achievements | $\begin{array}{l} \text{Lecture} \\ \text{Exercises} \\ \text{T} = \text{face-to-fac} \\ \text{Oral exam} \end{array}$ | ce teaching; s rcise particip ectures on D | $\begin{array}{c} 60\\ 30\\ S = \text{inde}\\ \text{ation}\\ \text{iscrete } C \end{array}$ | 4 2 pendent s cometry | 60 T / 105 S 30 T / 75 S study (gra (not gra | 5.5 3.5 | | | |

| Module MA-INF 1204 | | Seminar Selected Topics in Information and Learning Theory | | | | | | |
|-----------------------|-------------------------------|---|-------------|------------|------------------|-------|--|--|
| Workload | Credit points | Credit points Duration Frequency | | | | | | |
| 120 h | 4 CP | 1 semester | at least | every 2 g | years | | | |
| Module | Prof. Dr. Nor | Prof. Dr. Norbert Blum | | | | | | |
| coordinator | | | | | | | | |
| Lecturer(s) | Prof. Dr. Nor | bert Blum | | | | | | |
| Classification | Programme | | Mode | Semest | ter | | | |
| Classification | M. Sc. Compu | ter Science | Optional | 2. | | | | |
| Technical skills | Ability to perf | form individu | al literatu | re search | , critical readi | ng, | | |
| | understanding | understanding, and clear didactic presentation | | | | | | |
| Soft skills | Presentation of | of own and of | hers' solut | tions and | methods, criti | ical | | |
| | discussion of a | pplied meth | ods, techni | ques and | solutions. | | | |
| Contents | Advanced topi | cs in informa | ation and I | learning t | theory based of | n | | |
| | modern resear | ch literature | | | | | | |
| Prerequisites | none | | | | | | | |
| Format | Teaching form | at G | oup size | h/week | Workload[h] | CP | | |
| romat | Seminar | | 10 | 2 | 30 T / 90 S | 4 | | |
| | T = face-to-fa | ce teaching; | S = indep | endent st | Judy | | | |
| Exam achievements | Oral presentat | tion, written | report | | (gra | .ded) | | |
| Study achievements | none | | | | (not gra | ded) | | |
| Forms of media | | | | | | | | |
| Literature | The relevant la previous seme | | be annou | nced tow | ards the end o | f the | | |

| Module MA-INF 1205 | Graduate S | eminar I | iscrete | Optimi | zation | | | | |
|-----------------------|-------------------------------------|---|------------|------------|-------------------|----------------------|--|--|--|
| Workload | Credit points | Credit points Duration Frequency | | | | | | | |
| 180 h | 6 CP | | | | | | | | |
| Module | Prof. Dr. Jens Vygen | | | | | | | | |
| coordinator | | | | | | | | | |
| Lecturer(s) | All lecturers of | All lecturers of Discrete Mathematics | | | | | | | |
| Classification | Programme | | Mode | Sem | ester | | | | |
| Classification | M. Sc. Compu | ter Science | Option | al 2. | | | | | |
| Technical skills | Competence to | o understar | nd new res | search re | sults based on | | | | |
| | original literat | original literature, to put such results in a broader context and | | | | | | | |
| | present such results and relations. | | | | | | | | |
| Soft skills | Ability to read | | | | | | | | |
| | thinking, prese | | | | | | | | |
| Contents | | | | | ation will be cho | sen | | | |
| | each semester | and discus | sed based | on origin | nal literature. | | | | |
| Prerequisites | Required: | | | | | | | | |
| | MA-INF 1102 | | torial Op | 1 | | | | | |
| Format | Teaching forma | at G | roup size | h/week | | CP | | | |
| rormat | Seminar | | 10 | 4 | 60 T / 120 S | 6 | | | |
| | T = face-to-face | ce teaching | ; S = inde | ependent | study | | | | |
| Exam achievements | Oral presentat | ion, writte | n report | | (gra | ided) | | | |
| Study achievements | none | | | | (not gra | ided) | | | |
| Forms of media | | | | | | | | | |
| Literature | - | | | ure will b | be announced tow | vards | | | |
| | the end of the | previous s | emester. | | | | | | |

| Module MA-INF 1206 | | Seminar Design and Analysis of Randomized Approximation Algorithms | | | | | | |
|-----------------------|-----------------|---|--------------|-------------|------------------|-------|--|--|
| Workload | Credit points | Credit points Duration Frequency | | | | | | |
| 120 h | 4 CP | 1 semeste | every y | ear | | | | |
| Module | Prof. Dr. Mar | ek Karpinsk | i | | | | | |
| coordinator | | | | | | | | |
| Lecturer(s) | Prof. Dr. Mar | ek Karpinsk | i, Prof. Di | r. Heiko I | Röglin | | | |
| Classification | Programme | | Mode | Semest | ter | | | |
| Classification | M. Sc. Compu | ter Science | Optional | l 2. | | | | |
| Technical skills | Ability to perf | form individ | ual literatu | ire search | , critical readi | ng, | | |
| | understanding | understanding, and clear didactic presentation. | | | | | | |
| Soft skills | Presentation of | of solutions a | and metho | ds, critica | l discussion of | | | |
| | applied metho | ds and tech | niques | | | | | |
| Contents | Current topics | in design a | nd analysis | s of rando | mized and | | | |
| | approximation | algorithms | based on l | lastest res | earch literatur | e | | |
| Prerequisites | none | | | | | | | |
| Format | Teaching form | at G | roup size | h/week | Workload[h] | CP | | |
| rormat | Seminar | | 10 | 2 | 30 T / 90 S | 4 | | |
| | T = face-to-fa | ce teaching; | S = indep | endent st | udy | | | |
| Exam achievements | Oral presentat | tion, written | report | | (gra | .ded) | | |
| Study achievements | none | | | | (not gra | ded) | | |
| Forms of media | | | | | | | | |
| Literature | The relevant l | iterature wi | l be annou | unced in t | ime. | | | |

| Module | Lab Combin | natorial Al | gorithm | ıs | | | | |
|--------------------|----------------------------------|--|------------|------------|-------------------|-------|--|--|
| MA-INF 1207 | | | | | | | | |
| Workload | Credit points | Credit points Duration Frequency | | | | | | |
| 270 h | 9 CP | 9 CP 1 semester every year | | | | | | |
| Module | Prof. Dr. Jens | Prof. Dr. Jens Vygen | | | | | | |
| coordinator | | | | | | | | |
| Lecturer(s) | All lecturers o | f Discrete Ma | athematic | CS | | | | |
| Classification | Programme | | Mode | Seme | ster | | | |
| Classification | M. Sc. Compu | ter Science | Optiona | l 2. | | | | |
| Technical skills | Competence to | o implement | advanced | combina | atorial algorithm | ns, | | |
| | handling nont | handling nontrivial data structures, testing, documentation. | | | | | | |
| | | Advanced software techniques. | | | | | | |
| Soft skills | Efficient imple | ementation of | complex | algorith | ms, abstract | | | |
| | thinking, docu | thinking, documentation of source code | | | | | | |
| Contents | Certain combi | natorial algo | rithms wi | ill be cho | sen each semest | er. | | |
| | The precise ta | sk will be ex | plained ir | n a meeti | ng in the previo | ous | | |
| | semester. | | | | | | | |
| Prerequisites | Required: | | | | | | | |
| | MA-INF 1102 | - Combinate | orial Opti | imization | | | | |
| Format | Teaching form | at Gro | oup size | h/week | Workload[h] | CP | | |
| roimat | Lab | | 8 | 4 | 60 T / 210 S | 9 | | |
| | T = face-to-fa | ce teaching; | S = indep | pendent s | study | | | |
| Exam achievements | Oral presentat | ion, written | report | | (gra | ded) | | |
| Study achievements | none | | | | (not gra | ded) | | |
| Forms of media | | | | | | | | |
| Literature | The topics and the end of the | | | re will be | announced tow | vards | | |

| Module MA-INF 1209 | Seminar Ad | Seminar Advanced Topics in Cryptography | | | | | |
|-----------------------|------------------------|--|--------|-----------|------------|----------------|-------|
| Workload | Credit points | Duration | | Frequer | NCV | | |
| 120 h | 4 CP | 1 semest | | every se | • | | |
| Module | Prof. Dr. Joac | | | | | | |
| coordinator | 11011 211 0000 | | | | | | |
| Lecturer(s) | Prof. Dr. Joac | Prof. Dr. Joachim von zur Gathen, Dr. Michael Nüsken | | | | | |
| | Programme | | | Iode | Semest | | |
| Classification | M. Sc. Computer Scienc | | e O | Optional | 2. or 3 | 3. | |
| Technical skills | Understanding | | | | | | |
| | | Distilling this into a presentation. Determination of relevant vs. | | | | | |
| | 0 | relevant material. Developing a presentation that fascinates | | | | | |
| | | fellow students. | | | | | |
| Soft skills | Understanding | Understanding and presenting material both orally and in visual | | | | | |
| | media. Motiva | ting other | stud | lents to | participa | te. Critical | |
| | assessment of | research re | esults | | | | |
| Contents | A special topic | e within cr | yptog | graphy, | changing | from year to g | year, |
| | is studied in d | epth, base | d on | current | research | literature | |
| Prerequisites | Required: | | | | | | |
| | MA-INF 1103 | - Cryptog | graph | у | | | |
| | and one furthe | er course in | n cryj | ptograp | hy like T | he Art of | |
| | Cryptography | or eSecuri | ity. | | | | |
| Format | Teaching form | at | Grou | p size | h/week | Workload[h] | CP |
| Format | Seminar | | 1 | 0 | 2 | 30 T / 90 S | 4 |
| | T = face-to-fa | ce teachin | g: S = | = indep | endent st | udv | |
| Exam achievements | Oral presentat | | | - | | | ded) |
| Study achievements | none | , | 1 | | | (not gra | / |
| Forms of media | | | | | | | , |
| Literature | Current confer | ence publi | icatio | ons, to b | e annour | nced in time | |
| | | | | | | | |

| Module MA-INF 1210 | Probabilistic Analysis of Algorithms | | | | | | | |
|---|--------------------------------------|--|------------|---------------|----------------------|-------|--|--|
| Workload | O 114 1 4 | | D | | | | | |
| | Credit points | Duration | Freque | | | | | |
| 180 h | 6 CP | 1 semester | every y | ear | | | | |
| Module | Prof. Dr. Heil | ko Roglin | | | | | | |
| coordinator | | | | | | | | |
| Lecturer(s) | Prof. Dr. Heil | ko Röglin | 1 | | | | | |
| Classification | Programme | | Mode | Semest | | | | |
| Classification | M. Sc. Compu | Optional | | | | | | |
| Technical skills | understanding | of models a | nd technic | ues for th | ne probabilistic | | | |
| | analysis of alg | analysis of algorithms | | | | | | |
| Soft skills | oral and writte | oral and written presentation of solutions and methods, abstract | | | | | | |
| | $\operatorname{thinking}$ | thinking | | | | | | |
| Contents | smoothed and | smoothed and average-case analysis | | | | | | |
| | • simpley algo | • simplex algorithm | | | | | | |
| | local search | | | | | | | |
| | clustering al | 0 | | | | | | |
| | combinatoria | 0 | on proble | ne | | | | |
| | • multi-object | * | * | 115 | | | | |
| Prerequisites | Required: Non | <u>^</u> | | lulos have | hoon passade | | | |
| rrerequisites | MA-INF 1213 | | 0 | | - | | | |
| | Analysis | | eu Aigoin | mins and | 1 IODADIIISUC | | | |
| | Teaching forma | | | 1. / | XX 71-11-[1-] | CP | | |
| E (| | at G | roup size | h/week | Workload[h] | | | |
| Format | Lecture | | 60 20 | $\frac{2}{2}$ | 30 T / 45 S | 2.5 | | |
| | Exercises | | 30 | | 30 T / 75 S | 3.5 | | |
| | T = face-to-fa | ce teaching; | S = indep | endent st | udy | | | |
| | Oral exam (graded) | | | | | | | |
| Exam achievements | Oral exam | | | | (gra | .ded) | | |
| Exam achievements Study achievements | Oral exam Successful exer | rcise particij | oation | | (gra (not gra | | | |
| | | rcise particij | pation | | (8 | | | |

| Module | Parameteriz | zed Comp | exity | | | | | | | |
|--------------------|--|--|--------------|------------|-------------------|----------|--|--|--|--|
| MA-INF 1211 | | | | | | | | | | |
| Workload | Credit points | Duration | Frequer | ncy | | | | | | |
| 270 h | 9 CP | 1 semester | every y | ear | | | | | | |
| Module | Prof. Dr. Stef | an Kratsch | | | | | | | | |
| coordinator | | | | | | | | | | |
| Lecturer(s) | Prof. Dr. Stef | an Kratsch | | | | | | | | |
| Classification | Programme | | Mode | Seme | ster | | | | | |
| Classification | M. Sc. Compu | ter Science | Optional | 1., 2. | or 3. | | | | | |
| Technical skills | A fundamenta | l understand | ing of the | differen | ce in complexity | у | | | | |
| | among NP-cor | nplete proble | ems that is | s reveale | ed by taking the |) | | | | |
| | perspective of | parameteriz | ed comple | xity. Lea | arning to employ | y a | | | | |
| | rich toolbox of | f techniques | for upper | and lowe | er bounds on th | e | | | | |
| | complexity of | parameterize | ed problem | ns. | | | | | | |
| Soft skills | • social compe | • social competence: solving exercise tasks in teams, presenting | | | | | | | | |
| | solutions | solutions | | | | | | | | |
| | • methodical competence: analysis, abstraction, proofs | | | | | | | | | |
| | • individual co | • individual competence: learning, reading scientific | | | | | | | | |
| | papers/book c | papers/book chapters, abstraction | | | | | | | | |
| Contents | • Parameteriz | ed problems | | | | | | | | |
| | • Algorithmic | techniques: | bounded s | earch tr | ees, kernelizatio | on, | | | | |
| | treewidth, iter | ative compre | ession, colo | or coding | g, algebraic | | | | | |
| | algorithms, etc | 2. | | | | | | | | |
| | • Methods for | establishing | intractab | ility: par | rameterized | | | | | |
| | reductions, ha | rdness under | • ETH/SE | TH, low | er bounds for | | | | | |
| | kernelization | | | | | | | | | |
| Prerequisites | none | | | | | | | | | |
| | Teaching form | at Gro | oup size | h/week | Workload[h] | CP | | | | |
| Format | Lecture | | 60 | 4 | 60 T / 105 S | 5.5 | | | | |
| | Exercises | | 30 | 2 | 30 T / 75 S | 3.5 | | | | |
| | T = face-to-fa | ce teaching; | S = indep | endent s | study | | | | | |
| Exam achievements | Oral exam | | | | (gra | ided) | | | | |
| Study achievements | Successful exe | rcise particip | oation | | (not gra | | | | | |
| Forms of media | | | | | | | | | | |
| | • Downey/Fel | lows: Fundar | mentals of | Parame | terized Comple | xity | | | | |
| Literature | (2013) | | | | | | | | | |
| | • Cygan et al. | : Parameteri | zed Algor | ithms $(2$ | 015) | | | | | |

| Module MA-INF 1212 | Seminar Pa | Seminar Parameterized Complexity | | | | | | |
|-----------------------|--------------------------|---|-----------|----------------------|----------|--------------|------|--|
| Workload | Credit points | Duration | Freq | uenc | ey | | | |
| 120 h | 4 CP | 1 semest | er ever | y ye | ar | | | |
| Module | Prof. Dr. Stef | an Kratsch | | | | | | |
| coordinator | | | | | | | | |
| Lecturer(s) | Prof. Dr. Stefan Kratsch | | | | | | | |
| Classification | Programme | Mode | | Semest | ter | | | |
| Classification | M. Sc. Compu | ter Science | e Optic | nal | 2. | | | |
| Technical skills | Ability to und | Ability to understand new research results presented in original | | | | | | |
| | scientific papers. | | | | | | | |
| Soft skills | Ability to pres | Ability to present and to critically discuss these results in the | | | | | | |
| | framework of t | the corresp | onding a | rea. | | | | |
| Contents | Current confer | rence and j | ournal p | aper | s from p | arameterized | | |
| | complexity. | | | | | | | |
| Prerequisites | none | | | | | | | |
| Format | Teaching form | at | Group siz | e | h/week | Workload[h] | CP | |
| rormat | Seminar | | 10 | | 2 | 30 T / 90 S | 4 | |
| | T = face-to-fa | ce teaching | S = in | lepe | ndent st | udy | | |
| Exam achievements | Oral presentat | tion, writte | n report | | | (gra | ded) | |
| Study achievements | none | | | | | (not gra | ded) | |
| Forms of media | | | | | | | | |
| Literature | | | | | | | | |

| Module MA-INF 1213 | Randomized | Randomized Algorithms and Probabilistic Analysis | | | | | | | |
|-----------------------|------------------------|--|-------------|-------------|---------------------------------|-------|--|--|--|
| Workload | Credit points | Duration | Freque | ency | | | | | |
| 270 h | 9 CP | 1 semester | - | - | | | | | |
| Module | Prof. Dr. Heil | ko Röglin | I | | | | | | |
| coordinator | | | | | | | | | |
| Lecturer(s) | Prof. Dr. Heil | ko Röglin | | | | | | | |
| Classification | Programme | | Mode | Seme | ster | | | | |
| Classification | M. Sc. Compu | | Optiona | | | | | | |
| Technical skills | 0 | | | - | the probabilistic | | | | |
| | | | rell as for | the desig | n and analysis | of | | | |
| | randomized al | - | | | | | | | |
| Soft skills | | en presentat | on of sol | utions and | d methods, abst | tract | | | |
| | thinking | 1 | | 1 1 | | | | | |
| Contents | design and and | alysis of rand | lomized a | algorithms | 5 | | | | |
| | · · | • complexity classes | | | | | | | |
| | | • Markov chains and random walks | | | | | | | |
| | • tail inequalit | | | | | | | | |
| | • probabilistic | method | | | | | | | |
| | smoothed and | average-cas | e analysis | 3 | | | | | |
| | • simplex algo | rithm | | | | | | | |
| | \bullet local search | algorithms | | | | | | | |
| | • clustering al | 0 | | | | | | | |
| | • combinatoria | - | - | ems | | | | | |
| | • multi-object | - | | | | | | | |
| Prerequisites | - | | 0 | | e been passed: | | | | |
| | MA-INF 1210 | | - | | | | | | |
| | Teaching form | at Gr | oup size | h/week | Workload[h] | CP | | | |
| Format | Lecture | | 60 | 4 | 60 T / 105 S | 5.5 | | | |
| | Exercises | | 30 | 2 | $30 \ {\rm T}$ / $75 \ {\rm S}$ | 3.5 | | | |
| | T = face-to-fa | ce teaching; | S = inde | pendent s | ° | | | | |
| Exam achievements | Oral exam | | | | (= | .ded) | | | |
| Study achievements | Successful exe | rcise particip | ation | | (not gra | ded) | | | |
| Forms of media | - | | | | | | | | |
| | • lecture notes | | | | | | | | |
| Literature | • research arti | | 1 | 1 4 1 • • • | | | | | |
| | • Motwani, Ra | - | | - | | | | | |
| | • Mitzenmach | er, Uptal: P | obability | and Con | nputing | | | | |

| Module MA-INF 1214 | Computatio | nal Comp | lexity | | | | | | | |
|-----------------------|---|--|-----------|-------------|-------------------------|------|--|--|--|--|
| Workload | Credit points | Duration | Freque | nau | | | | | | |
| 270 h | 9 CP | 1 semester | _ | 2 years | | | | | | |
| Module | Prof. Dr. Stefa | | every | 2 years | | | | | | |
| | FIOL DL. Stela | in Matsch | | | | | | | | |
| coordinator | Prof. Dr. Stefa | | | | | | | | | |
| Lecturer(s) | | an Kratsch | | | | | | | | |
| Classification | Programme M. S.a. Comput | tor Science | Mode | al 1., 2. | | | | | | |
| Technical skills | M. Sc. Comput A fundamental | | Optiona | , | | | | | | |
| Technical skills | regarding | understand | ing of co | mputatio | nai complexity | | | | | |
| | • models of con | mputation s | ich as Tu | uring mad | hines and Boole | ean | | | | |
| | circuits, | | | | | | | | | |
| | • different type | es of comput | ation suc | ch as non | determinism or | | | | | |
| | randomization, | | | | | | | | | |
| | · · | complexity classes, | | | | | | | | |
| | • relation of time | relation of time and space complexity, and | | | | | | | | |
| | • fundamental | proof strate | gies such | as diago | nalization and | | | | | |
| | simulation. | | | | | | | | | |
| Soft skills | • social competence: solving exercise tasks in teams, present | | | | | | | | | |
| | solutions | | | | | | | | | |
| | • methodical c | - | | | | | | | | |
| | • individual co | mpetence: le | earning, | reading so | cientific | | | | | |
| | papers/book cl | napters, abst | raction | | | | | | | |
| Contents | • Turing mach | | | | | | | | | |
| | • NP and NP-0 | - | 3 | | | | | | | |
| | • Diagonalizati | ion | | | | | | | | |
| | • Space comple | | | | | | | | | |
| | • The polynom | - | 7 | | | | | | | |
| | • Boolean circu | | | | | | | | | |
| | • Randomized | - | 1 | | | | | | | |
| | • Interactive p | | | | | | | | | |
| | • PCP Theorem | m | | | | | | | | |
| Prerequisites | none | | | | | | | | | |
| | Teaching forma | t Gro | oup size | h/week | Workload[h] | CP | | | | |
| Format | Lecture | | 60 | 4 | 60 T / 105 S | 5.5 | | | | |
| | Exercises | | 30 | 2 | $30 { m T} / 75 { m S}$ | 3.5 | | | | |
| | T = face-to-face | ce teaching; | S = inde | pendent s | study | | | | | |
| Exam achievements | Oral exam | | | | (gra | ded) | | | | |
| Study achievements | Successful exer | cise particip | ation | | (not gra | ded) | | | | |
| Forms of media | | | | | | | | | | |
| Titonotung | • Arora/Barak | : Computat | ional Cor | mplexity: | A Modern | | | | | |
| Literature | Approach (200 | 9) | | | | | | | | |

| Module | Introduction | Introduction to Computational Topology | | | | | | |
|--------------------|------------------|--|------------|-----------|--------------|-------|--|--|
| MA-INF 1215 | | | | | | | | |
| Workload | Credit points | Duration | Frequer | ncy | | | | |
| 180 h | 6 CP | 1 semester | every y | ear | | | | |
| Module | Prof. Dr. Rolf | Prof. Dr. Rolf Klein | | | | | | |
| coordinator | | | | | | | | |
| Lecturer(s) | Prof. Dr. Rolf | Klein, PD I | Dr. Elmar | Langetep | be | | | |
| Classification | Programme | | Mode | Semest | ter | | | |
| Classification | M. Sc. Compu | ter Science | Optional | 2. or 4 | ł. | | | |
| Technical skills | understanding | understanding of basic tools and techniques for the analysis of | | | | | | |
| | geometric shap | geometric shapes by topological methods | | | | | | |
| Soft skills | oral and writte | oral and written presentation of solutions and methods, abstract | | | | | | |
| | thinking | | | | | | | |
| Contents | basic tools of c | computation | al topolog | у | | | | |
| | • surfaces | | | | | | | |
| | • simplicial con | mplexes | | | | | | |
| | • Morse functi | * | | | | | | |
| | • persistent ho | omology | | | | | | |
| Prerequisites | none | | | | | | | |
| | Teaching forma | at Gi | oup size | h/week | Workload[h] | CP | | |
| Format | Lecture | | 60 | 2 | 30 T / 45 S | 2.5 | | |
| | Exercises | | 30 | 2 | 30 T / 75 S | 3.5 | | |
| | T = face-to-face | ce teaching; | S = indep | endent st | udy | | | |
| Exam achievements | Oral exam | | | | (gra | ided) | | |
| Study achievements | Successful exer | cise particip | ation | | (not gra | ded) | | |
| Forms of media | | | | | | | | |
| | • Edelsbrunne: | r/Harer: Co | nputation | al Topolo | ogy: An | | | |
| Literature | Introduction | | | | | | | |
| | • Rote/Vegter: | : Computati | onal Topo | logy: An | Introduction | | | |

| Module | Fine-Grained Analysis of Algorithms | | | | | | | | |
|----------------------------------|--|---|------------------------|-------------|-------------------|------|--|--|--|
| MA-INF 1216 | r me-Grame | a Analysis | o or Alg | 01101111 | 5 | | | | |
| Workload | Credit points | Duration | Freque | ncv | | | | | |
| 270 h | 9 CP | 1 semester | - | 2 years | | | | | |
| Module | Prof. Dr. Stefa | | J | J | | | | | |
| coordinator | | | | | | | | | |
| Lecturer(s) | Prof. Dr. Stefa | Prof. Dr. Stefan Kratsch | | | | | | | |
| | Programme | | Mode | Seme | ster | | | | |
| Classification | M. Sc. Compu | ter Science | Optiona | 1 2., 3. | or 4. | | | | |
| Technical skills | - | The main focus of the lecture lies on proving optimality of | | | | | | | |
| | | algorithms for several well-known polynomial-time solvable | | | | | | | |
| | problems. Res | ults of this ty | ype typic | ally requi | ire complexity | | | | |
| | assumptions su | assumptions such as SETH, stating that Satisfiability cannot be | | | | | | | |
| | solved significa | antly faster the | han in O | $(2^n), or$ | the 3-SUM | | | | |
| | conjecture, the | at 3-SUM car | not be s | olved in t | truly subquadra | tic | | | |
| | time. | | | | | | | | |
| | Beyond learning | Beyond learning to use such conjectures to prove lower bounds, | | | | | | | |
| | we will also di | we will also discuss algorithmic techniques for getting the | | | | | | | |
| | (conditionally) |) best possibl | e running | g times. | | | | | |
| | Further topics | Further topics of interest are communication complexity and | | | | | | | |
| | - | | | | gorithms. These | | | | |
| | | · · | | | conditional lowe | | | | |
| | | | • • | | y assumptions. | | | | |
| | such, the requi | — | | | | | | | |
| Soft skills | • social compe | etence: solvin | g exercis | e tasks ir | teams and | | | | |
| | discussing scie | ntific papers | | | | | | | |
| | • methodical of | competence: a | analysis, | abstracti | on, proofs | | | | |
| | • individual co | ompetence: le | earning, i | reading so | cientific | | | | |
| | papers/book c | | | | | | | | |
| Contents | - | | | | ounds for algorit | | | | |
| | | - | | | e 3-SUM conjec | | | | |
| | • Algorithms v | whose runnin | g time m | atches th | e lower bounds | | | | |
| | Optionally: | | | | | | | | |
| | • Communicat | tion complexi | ty | | | | | | |
| | • Query comp | - | 0 | d sorting | algorithms | | | | |
| Prerequisites | none | - | | | _ | | | | |
| | Teaching forma | at Gro | up size | h/week | Workload[h] | CP | | | |
| Format | Lecture | | 60 | 4 | 60 T / 105 S | 5.5 | | | |
| | Exercises | | 30 | 2 | 30 T / 75 S | 3.5 | | | |
| | T = face-to-fa | ce teaching; S | S = inder | pendent s | study | | | | |
| Exam achievements | Oral exam | | | | | ded) | | | |
| | Successful exercise participation (graded) | | | | | | | | |
| Study achievements | Successful exer | rcise participa | ation | | (not gra | ded) | | | |
| Study achievementsForms of media | Successful exer | rcise participa | ation | | (not gra | ded) | | | |

| Module MA-INF 1301 | Algorithmic | Game Th | eory a | nd the I | nternet | | | | |
|-----------------------|--|----------------|------------------|-------------|--------------------------|-------|--|--|--|
| Workload | Credit reinte | Duration | Encour | | | | | | |
| 270 h | Credit points 9 CP | 1 semester | Freque | 2 years | | | | | |
| | Prof. Dr. Mar | | - | 2 years | | | | | |
| Module coordinator | FIOL DL. Mai | ek Karpinski | | | | | | | |
| | Prof. Dr. Mar | al. Vanningli | Drof I |)n Nonho | nt Dluma | | | | |
| Lecturer(s) | Programme | ek Karpinski | $\frac{1}{Mode}$ | Semes | | | | | |
| Classification | M. Sc. Compu | ter Science | Option | | | | | | |
| Technical skills | The goal is to provide basic techniques and methods related to the Game Theory for analyzing modern Internet-based communication networks and for designing algorithms for the underlying problems of transmission control, resource allocation, mechanism design, market equilibria, combinatorial auctions, and the network cost allocation | | | | | | | | |
| Soft skills | | | | ods, critic | al discussion of | | | | |
| | applied metho | | | | | | | | |
| Contents | The most defining characteristic of the Internet is that it was not designed by a single central entity, but emerged from the complex interactions of many individual entities or economic agents, such as network operators, service providers, designers, users, etc. We aim at providing basic framework and basic techniques for analyzing and designing algorithms for the following Internet-related problems and contexts: game theoretic problems connected to the Internet and other decentralized networks, resource allocation, mechanism design, Nash and market equilibria, network design. We will address new broadly applicable and unifying techniques that have emerged recently in the above areas and discuss new | | | | | | | | |
| Prerequisites | Recommended | | uesign 0. | | ant algorithms. | • | | | |
| - | Introductory k | | foundati | ons of alg | orithms and | | | | |
| | complexity the | - | | 0 | | | | | |
| | Teaching forma | - | up size | h/week | Workload[h] | CP | | | |
| Format | Lecture | | <u>60</u> | 4 | 60 T / 105 S | 5.5 | | | |
| | Exercises | | 30 | 2 | 30 T [′] / 75 S | 3.5 | | | |
| | T = face-to-fa | ce teaching. | S - inde | nendent s | | I | | | |
| Exam achievements | Written exam | ee teaching, | 5 — mac | pendent | • | ided) | | | |
| Study achievements | Successful exer | rcise narticin | ation | | (not gra | , | | | |
| Forms of media | Succession exel | one particip | | | (1100 g1a | acuj | | | |
| I OT IIIS OF IIICUIA | • D P Rertse | kas A Nedi | AE | Ozdaolar | Convex Analys | sis | | | |
| Literature | D. P. Bertsekas, A. Nedic, A. E. Ozdaglar: Convex Analysis and Optimization, Athena, 2003 M. Karpinski, W. Rytter: Fast Parallel Algorithms for Graph Matching Problems, Oxford Univ. Press, 1998 D. M. Kreps: A Course in Microeconomic Theory, Princeton Univ. Press, 1990 N. Nisan, T. Roughgarden, E. Tardos, V.V. Vazirani (ed.): Algorithmic Game Theory, Cambridge Univ. Press, 2007 M. J. Osborne, A. Rubinstein: A Course in Game Theory, | | | | | | | | |

| Module MA-INF 1302 | Advanced T | Copics in A | lgorith | mics | | | | | |
|-----------------------|--|--|-----------|------------|-------------------|-------|--|--|--|
| Workload | Credit points | Duration | Freque | ency | | | | | |
| 270 h | 9 CP | 1 semester | at leas | t every 2 | years | | | | |
| Module | Prof. Dr. Mar | ek Karpinski | | | | | | | |
| coordinator | | | | | | | | | |
| $extrm{Lecturer(s)}$ | Prof. Dr. Marek Karpinski, Prof. Dr. Norbert Blum, Prof. Dr. Joachim von zur Gathen, Prof. Dr. Rolf Klein | | | | | | | | |
| Classification | Programme | | Mode | Seme | ster | | | | |
| Classification | M. Sc. Computer Science Optional 2. or 3. | | | | | | | | |
| Technical skills | Introduction to research | Introduction to current advanced research topics in algorithmic research | | | | | | | |
| Soft skills | Presentation o | Presentation of solutions and methods, critical discussion of | | | | | | | |
| | ~ ~ | applied methods and techniques | | | | | | | |
| Contents | The topic will be announced before the start of the relevant | | | | | | | | |
| | semester. | | | | | | | | |
| Prerequisites | Recommended | - | | | | | | | |
| | Introductory k complexity the | | | ons of alg | orithms and | | | | |
| | Teaching forma | at Gro | up size | h/week | Workload[h] | CP | | | |
| Format | Lecture | | 60 | 4 | 60 T / 105 S | 5.5 | | | |
| | Exercises | | 30 | 2 | 30 T / 75 S | 3.5 | | | |
| | T = face-to-fa | ce teaching; | S = indep | pendent s | study | | | | |
| Exam achievements | Written exam | | | | (gra | ided) | | | |
| Study achievements | Successful exer | rcise particip | ation | | (not gra | ded) | | | |
| Forms of media | | | | | | | | | |
| | | - | | | ter to semester, | | | | |
| Literature | | | will be a | nnounceo | d before the star | rt of | | | |
| | the resp. seme | ster. | | | | | | | |

| Module | Selected To | Selected Topics in Algorithmics | | | | | | |
|--------------------|--|---|----------------------|------------|-----------|-------------------|-------|--|
| MA-INF 1303 | | | | 1 | | | | |
| Workload | Credit points | Duration | L | Frequer | icy | | | |
| 180 h | 6 CP | 1 semes | ter | at least | every 2 g | years | | |
| Module | Prof. Dr. Nor | bert Blum | L | | | | | |
| coordinator | | | | | | | | |
| Lecturer(s) | Prof. Dr. Nor | Prof. Dr. Norbert Blum, Prof. Dr. Rolf Klein, | | | | | | |
| | Prof. Dr. Mar | ek Karpin | ski | | | | | |
| | Programme | | | Mode | Semest | ter | | |
| Classification | M. Sc. Computer Science Optional 2. or 3. | | | | 3. | | | |
| Technical skills | Introduction t | o current | adva | anced res | earch top | oics in algorithm | mic | |
| | research | research | | | | | | |
| Soft skills | Presentation of | Presentation of own and others' solutions and methods, critical | | | | | | |
| | discussion of a | discussion of applied methods, techniques and solutions. | | | | | | |
| Contents | The topic will | be annou | ncec | l before t | he start | of the resp. | | |
| | semester. | | | | | | | |
| Prerequisites | none | | | | | | | |
| | Teaching form | at | Gro | oup size | h/week | Workload[h] | CP | |
| Format | Lecture | | | 60 | 2 | 30 T / 45 S | 2.5 | |
| | Exercises | | | 30 | 2 | 30 T / 75 S | 3.5 | |
| | T = face-to-fa | ce teachin | g; S | = indep | endent st | udy | | |
| Exam achievements | Written exam | | | | | (gra | ded) | |
| Study achievements | Successful exe | rcise parti | cipa | tion | | (not gra | ded) | |
| Forms of media | | | | | | | | |
| | Depending on the topics varying from semester to semester, the | | | | | | | |
| Literature | relevant resear | ch literatu | ure v | will be an | nnounced | before the sta | rt of | |
| | the resp. seme | ester. | | | | | | |

| Module MA-INF 1304 | Seminar Ge | eometric | : Di | stance | Problen | ıs | |
|-----------------------|--|------------|--------|-----------|-------------------|-------------|-------|
| Workload | Credit points | Duratio | n | Freque | ncy | | |
| 120 h | 4 CP | 1 seme | ster | every y | ear | | |
| Module | Prof. Dr. Rolf | Klein | | | | | |
| coordinator | | | | | | | |
| Lecturer(s) | Prof. Dr. Rolf Klein, Dr. Elmar Langetepe | | | | | | |
| Classification | Programme | | | Mode | Semest | ter | |
| Classification | M. Sc. Compu | ter Scien | ce | Optional | $1 \mid 2., 3.$ a | or 4. | |
| Technical skills | To Independently study problems at research level, based on | | | | | | |
| | research publications, to prepare a concise summary, to | | | | | | |
| | present the summary in a scientific talk, to lead a critical | | | | | | |
| | discussion | | | | | | |
| | with other sen | ninar par | ticipa | ants. | | | |
| Soft skills | | | | | | | |
| Contents | Current topics | in Comp | outat | ional Ge | ometry. | | |
| Prerequisites | Recommended | : | | | | | |
| | BA-INF 114 – | Grundla | gen o | der algor | ithmische | n Geometrie | |
| Format | Teaching form | at | Gro | oup size | h/week | Workload[h] | CP |
| rormat | Seminar | | | 10 | 2 | 30 T / 90 S | 4 |
| | T = face-to-fa | ce teachi | ng; S | = indep | endent st | udy | |
| Exam achievements | Oral presentat | ion, writ | ten r | eport | | (gra | .ded) |
| Study achievements | none | | | | | (not gra | ded) |
| Forms of media | Multimedia pr | ojector, ł | olack | board. | | | |
| Literature | The relevant l | iterature | will | be annou | inced. | | |

| Module | Graduate Seminar Chip Design | | | | | | |
|--------------------|--|---|------------------------|------------------------|------------|------------------|-------|
| MA-INF 1305 | | | | 1 | | | |
| Workload | Credit points | | | | | | |
| 180 h | 6 CP | 1 seme | ester | every | year | | |
| Module | Prof. Dr. Jens | s Vygen | | | | | |
| coordinator | | | | | | | |
| Lecturer(s) | All lecturers o | f Discret | e Ma | themati | cs | | |
| Classification | Programme | | | Mode | Seme | ster | |
| Classification | M. Sc. Compu | ter Scier | nce | Optiona | al 3. | | |
| Technical skills | Competence to | o underst | tand | new the | oretical r | esults and pract | tical |
| | solutions in V | solutions in VLSI design and related applications, as well as | | | | | |
| | presentation o | presentation of such results | | | | | |
| Soft skills | Ability to read | Ability to read and understand research papers, abstract | | | | | |
| | thinking, prese | thinking, presentation of mathematical results in a talk | | | | | |
| Contents | Current topics | in chip | desig | n and re | elated app | olications | |
| Prerequisites | Required: At] | least 1 of | the | followin | g: | | |
| | MA-INF 1102 | – Combi | inato | rial Opt | imization | | |
| | MA-INF 1202 | – Chip I | Desig | n | | | |
| | Teaching form | at | Gro | up size | h/week | Workload[h] | CP |
| Format | Seminar | | | 10 | 4 | 60 T / 120 S | 6 |
| | T = face-to-fa | ce teachi | ng; S | s = inde | pendent s | study | |
| Exam achievements | Oral presentat | ion, writ | ten r | eport | | (gra | ded) |
| Study achievements | none | | | | | (not gra | ded) |
| Forms of media | | | | | | | |
| Titonotuno | The topics and the relevant literature will be announced towards | | | | | | |
| Literature | the end of the | previous | s sem | ester | | | |

| Module MA-INF 1306 | Seminar Co | mbinatori | al and G | eometr | ic Optimiza | tion | |
|-----------------------|-----------------|--|-------------|------------|------------------|-------|--|
| Workload | Credit points | Duration Frequency | | | | | |
| 120 h | 4 CP | 1 semester | every y | ear | | | |
| Module | Prof. Dr. Mar | Prof. Dr. Marek Karpinski | | | | | |
| coordinator | | | | | | | |
| Lecturer(s) | Prof. Dr. Mar | ek Karpinsk | , Prof. Dr | . Norber | t Blum, | | |
| | Prof. Dr. Rolf | Klein | | | | | |
| | Programme | | Mode | Semest | ter | | |
| Classification | M. Sc. Compu | ter Science | Optional | 3. | 3. | | |
| Technical skills | Presentation of | f selected to | pics in the | above an | rea | | |
| Soft skills | Ability to perf | orm individu | al literatu | ire search | , critical readi | ng, | |
| | understanding | understanding, and clear didactic presentation | | | | | |
| Contents | Current topics | in combinat | orial and | geometrie | c optimization | | |
| | based on lates | t research lit | erature | | | | |
| Prerequisites | none | | | | | | |
| Format | Teaching form | at G | oup size | h/week | Workload[h] | CP | |
| Format | Seminar | | 10 | 2 | 30 T / 90 S | 4 | |
| | T = face-to-fa | ce teaching; | S = indep | endent st | udy | | |
| Exam achievements | Oral presentat | ion, written | report | | (gra | .ded) | |
| Study achievements | none | | | | (not gra | ded) | |
| Forms of media | | | | | | | |
| Literature | The relevant l | iterature will | be annou | nced in t | ime. | | |

| Module MA-INF 1307 | Seminar Ad | lvanced A | gorithms | 5 | | |
|-----------------------|-----------------|-----------------|-----------------|-------------|------------------|------|
| Workload | Credit points | Duration | Frequen | cv | | |
| 120 h | 4 CP | 1 semester | - | • | | |
| Module | Prof. Dr. Mar | | | | | |
| coordinator | | I I | | | | |
| Lecturer(s) | Prof. Dr. Mar | ek Karpinsk | i, Prof. Dr | Norber | t Blum, | |
| | Prof. Dr. Rolf | - | | | , | |
| | Programme | | Mode | Semest | ter | |
| Classification | M. Sc. Compu | ter Science | Optional | 3. | | |
| Technical skills | | | vanced top | oics in alg | gorithm design | and |
| Soft skills | various applica | | allitoratu | no goonch | , critical readi | na |
| Soft skills | understanding | | | | , | ng, |
| Contents | 8 | , | - | | newest resear | ah |
| Contents | literature | ics in algorit. | ini design | based on | l newest resear | CII |
| Prerequisites | none | | | | | |
| D | Teaching form | at G | oup size | h/week | Workload[h] | CP |
| Format | Seminar | | 10 | 2 | 30 T / 90 S | 4 |
| | T = face-to-fa | ce teaching; | S = independent | endent st | udy | |
| Exam achievements | Oral presentat | tion, written | report | | (gra | ded) |
| Study achievements | none | | | | (not gra | ded) |
| Forms of media | | | | | | |
| Literature | The relevant l | iterature wil | be annou | nced in t | ime. | |

| Module MA-INF 1308 | Lab Algorit | Lab Algorithms for Chip Design | | | | | |
|-----------------------|-----------------------------------|---|----------|----------|----------|--|-------|
| Workload | Credit points | Duration | Fr | equenc | ey | | |
| 270 h | 9 CP | 1 semest | er ev | ery yea | ar | | |
| Module | Prof. Dr. Jens Vygen | | | | | | |
| coordinator | | | | | | | |
| Lecturer(s) | All lecturers of | f Discrete | Mather | matics | | | |
| Classification | Programme | | Mo | | Seme | ster | |
| | M. Sc. Compu | | - | tional | 3. | | |
| Technical skills | - | - | 0 | | | SI design, efficie | ent |
| | handling of ve | | | , testir | ng, doc | umentation. | |
| | Advanced soft | | <u> </u> | | | | |
| Soft skills | Efficient imple | | | - | 0 | , | |
| | 0, | | | tion pr | roblem | in VLSI design, | , |
| | documentation | | | | | | |
| Contents | | A currently challenging problem will be chosen each semester. | | | | | |
| | <u>^</u> | sk will be | explain | ied in a | a meeti | ng in the previo | ous |
| | semester. | | | | | | |
| Prerequisites | Required: At l | | | 0 | | | |
| | MA-INF 1102 | | | Optim | lization | | |
| | MA-INF 1202 | - | | | . , , | \sim \cdot \cdot \cdot \cdot | |
| | MA-INF 1205 | | | | | * | |
| | MA-INF 1208 | | | | | - | CD |
| Format | $\frac{\text{Teaching forma}}{1}$ | at (| troup s | ize h | /week | Workload[h] | CP |
| | Lab | | 8 | | 4 | 60 T / 210 S | 9 |
| | T = face-to-fa | | | | ndent s | - | |
| Exam achievements | Oral presentat | ion, writte | n repo | rt | | (0) | ded) |
| Study achievements | none | | | | | (not gra | ded) |
| Forms of media | | | | | | | |
| Literature | The topics and the end of the | | | | will be | announced tow | vards |

| Module | | Lab Efficient Algorithms for Selected Problems: | | | | |
|--------------------|------------------|--|-------------|-------------|------------------|-------|
| MA-INF 1309 | Design, Ana | alysis and | l Implen | nentatio | n | |
| Workload | Credit points | redit points Duration Frequency | | | | |
| 270 h | 9 CP | 1 semest | er at lea | st every y | ear | |
| Module | Prof. Dr. Mar | ek Karpins | ki | | | |
| coordinator | | | | | | |
| Lecturer(s) | Prof. Dr. Mar | ek Karpins | ki, Prof. I | Dr. Norbe | rt Blum, | |
| | Prof. Dr. Rolf | Klein, Pro | f. Dr. He | iko Röglin | L | |
| Classification | Programme | | Mode | Seme | ster | |
| Classification | M. Sc. Compu | ter Science | Option | al 3. | | |
| Technical skills | Ability to desi | gn, analyze | and impl | ement effi | cient algorithm | s for |
| | selected comp | selected computational problems. | | | | |
| Soft skills | ability to work | ability to work on advanced algorithmic implementation | | | | |
| | projects, to we | ork in smal | l teams, cl | ear didact | tic presentation | and |
| | critical discuss | sion of resu | lts | | | |
| Contents | Design of effic | ient exact a | and approx | ximate alg | orithms and da | ta |
| | structures for | selected co | mputation | al probler. | ns. | |
| Prerequisites | none | | | | | |
| Format | Teaching form | at G | roup size | h/week | Workload[h] | CP |
| rormat | Lab | | 8 | 4 | 60 T / 210 S | 9 |
| | T = face-to-fa | ce teaching | ; S = inde | ependent s | study | |
| Exam achievements | Oral presentat | tion, writte | n report | | (gra | ded) |
| Study achievements | none | | | | (not gra | ded) |
| Forms of media | | | | | | |
| Literature | The relevant l | iterature w | ill be anno | ounced in | time. | |

| Module | The Art of | Cryptogra | phy | | | | | |
|--------------------|---|--|------------|-----------------|---------------|-------|--|--|
| MA-INF 1312 | | | | | | | | |
| Workload | Credit points | Duration | Freque | \mathbf{ency} | | | | |
| 270 h | 9 CP | 1 semester | every | year | | | | |
| Module | Prof. Dr. Joachim von zur Gathen | | | | | | | |
| coordinator | | | | | | | | |
| Lecturer(s) | Prof. Dr. Joac | chim von zur | Gathen, | Dr. Mich | nael Nüsken | | | |
| Classification | Programme | | Mode | Seme | ster | | | |
| Classification | M. Sc. Computer Science Optional 2. | | | | | | | |
| Technical skills | Insights into t | nsights into the theoretical foundations behind security | | | | | | |
| | concerns and n | concerns and measures, and of the interplay between computing | | | | | | |
| | power, and security requirements. Mastery of advanced | | | | | | | |
| | techniques for | cryptosystem | ns and ci | yptanaly | sis. | | | |
| Soft skills | Oral presentat | Oral presentation (in tutorial groups), written presentation (of | | | | | | |
| | exercise solution | ons), team c | ollaborati | ion in sol | ving homework | | | |
| | problems, criti | cal assessme | nt | | | | | |
| Contents | Possible topics | s are | | | | | | |
| | • pseudorando | mness and z | ero-know | ledge. | | | | |
| | • security redu | | | | | | | |
| | • lattices. | , | | | | | | |
| Prerequisites | Recommended | : | | | | | | |
| • | MA-INF 1103 | – Cryptogra | phy | | | | | |
| | Teaching forma | at Gr | oup size | h/week | Workload[h] | CP | | |
| Format | Lecture | | 60 | 4 | 60 T / 105 S | 5.5 | | |
| | Exercises | | 30 | 2 | 30 T / 75 S | 3.5 | | |
| | T = face-to-fa | ce teaching; | S = inde | pendent s | study | | | |
| Exam achievements | Written exam | | | | (gra | ided) | | |
| Study achievements | Successful exe | rcise particip | ation | | (not gra | ded) | | |
| Forms of media | | | | | | | | |
| Literature | Varying | | | | | | | |

| Module | Topics in T | heoretical | Crypto | graphy | | | | |
|--------------------|--|---|------------|------------|---------------------|------|--|--|
| MA-INF 1313 | | | | | | | | |
| Workload | Credit points | Duration | Freque | ency | | | | |
| 270 h | 9 CP | 1 semester | 0.0 | | | | | |
| Module | Prof. Dr. Joac | chim von zur | Gathen | | | | | |
| coordinator | | | | | | | | |
| Lecturer(s) | Prof. Dr. Joac | Prof. Dr. Joachim von zur Gathen, Dr. Michael Nüsken | | | | | | |
| Classification | Programme | rogramme Mode Semester | | | ster | | | |
| Classification | M. Sc. Compu | M. Sc. Computer Science Optional 3. | | | | | | |
| Technical skills | Gain deeper u | nderstanding | g in a spe | ecial area | of cryptography | 7 | | |
| | close to curren | close to current research. | | | | | | |
| Soft skills | Oral presentation (in tutorial groups), written presentation (of | | | | | | | |
| | exercise solution | exercise solutions), team collaboration in solving homework | | | | | | |
| | problems, critical assessment. | | | | | | | |
| Contents | One varying, a | One varying, advanced topic related to current research in | | | | | | |
| | theoretical cry | ptography, e | .g. | | | | | |
| | • elliptic curve | <i>v</i> · <i>·</i> · | hy, or | | | | | |
| | • quantum cry | ptography | | | | | | |
| Prerequisites | Required: | | | | | | | |
| | MA-INF 1103 | - Cryptogra | phy | | | | | |
| | and one furthe | er course in o | ryptogra | phy like 7 | The Art of | | | |
| | Cryptography | | ° 2 0 | | | | | |
| | Teaching forma | at Gr | oup size | h/week | Workload[h] | CP | | |
| Format | Lecture | | 60 | 4 | 60 T / 105 S | 5.5 | | |
| | Exercises | | 30 | 2 | $30~{\rm T}$ / 75 S | 3.5 | | |
| | T = face-to-fa | ce teaching; | S = inde | pendent s | study | | | |
| Exam achievements | Written exam | | | | (gra | ded) | | |
| Study achievements | Successful exer | rcise particip | ation | | (not gra | ded) | | |
| Forms of media | | | | | | | | |
| Literature | Research artic | les | | | | | | |

| Module MA-INF 1314 | Online Mot | ion Planni | ng | | | |
|-----------------------|---|------------------------------|-----------------|--------------------------|--------------------|------|
| Workload | Credit points | Duration | Freque | ncy | | |
| 270 h | 9 CP | CP 1 semester every year | | | | |
| Module | Prof. Dr. Rolf Klein | | | | | |
| coordinator | | | | | | |
| Lecturer(s) | Prof. Dr. Rolf | Klein, PD I | Dr. Elmar | · Langete | epe | |
| Classification | Programme M. Sc. Compu | ter Science | Mode Optiona | Seme 1 1., 2., | ster , 3. or 4. | |
| Technical skills | To acquire fur online motion | | owledge o | on topics | and methods in | 1 |
| Soft skills | | | | | | |
| Contents | Search and ex | ploration in 1 | ınknown | environn | nents | |
| | (e.g., graphs, cellular environmwents, polygons, strets), online algorithms, competitive analysis, competitive complexity,functional optimization, shortest watchman route, tethered robots, marker algorithms, spiral search, approximation of optimal search paths. | | | | | |
| Prerequisites | Recommended | : | | | | |
| | BA-INF 114 – | Grundlagen | der algor | rithmisch | en Geometrie | |
| | Teaching form | at Gro | oup size | h/week | Workload[h] | CP |
| Format | Lecture | | 60 | 4 | 60 T / 105 S | 5.5 |
| | Exercises | | 30 | 2 | 30 T / 75 S | 3.5 |
| | T = face-to-fa | ce teaching; | S = indeptils | pendent s | study | |
| Exam achievements | Oral exam | | | | (gra | ded) |
| Study achievements | Successful exe | rcise particip | ation | | (not gra | ded) |
| Forms of media | | Java applets of geometry lab | | | | |
| Literature | Scientific resea | arch articles | will be ree | commend | led in the lectur | e. |

| Module MA-INF 1315 | Lab Compu | Lab Computational Geometry | | | | | |
|-----------------------|-----------------|--|-----------|------------|------------------|-------|--|
| Workload | Credit points | Duration | Freque | ency | | | |
| 270 h | 9 CP | 1 semeste | - | v | | | |
| Module | Prof. Dr. Rolf | Prof. Dr. Rolf Klein | | | | | |
| coordinator | | | | | | | |
| Lecturer(s) | Prof. Dr. Rolf | f Klein, PD | Dr. Elma | r Langete | epe | | |
| Classification | Programme | | Mode | Seme | ster | | |
| Classification | M. Sc. Compu | ter Science | Optiona | al 2. | | | |
| Technical skills | Ability to desi | gn, analyze, | impleme | nt and do | cument efficien | t | |
| | algorithms for | selected pro | oblems in | computat | tional geometry. | | |
| Soft skills | Ability to prop | Ability to properly present, defend and discuss design and | | | | | |
| | implementatio | n decisions, | to docun | nent softw | are according to | 0 | |
| | given rules and | d to collabo | ate with | other stu | dents in small | | |
| | groups. | | | | | | |
| Contents | Various proble | ems in comp | utational | geometry | | | |
| Prerequisites | none | | | | | | |
| Format | Teaching form | at Gr | oup size | h/week | Workload[h] | CP | |
| Tormat | Lab | | 8 | 4 | 60 T / 210 S | 9 | |
| | T = face-to-fa | ce teaching; | S = inde | pendent s | study | | |
| Exam achievements | Oral presentat | tion, written | report | | (gra | ded) | |
| Study achievements | none | | | | (not gra | .ded) | |
| Forms of media | | | | | | | |
| Literature | The relevant l | iterature wi | l be anno | ounced in | time. | | |

| Module | Lab Parame | eterized C | omplexi | ty | | | |
|--------------------|------------------|--------------------------|---------------|------------------------|-------------------|------|--|
| MA-INF 1317 | | | | | | | |
| Workload | Credit points | Duration | Freque | \mathbf{ncy} | | | |
| 270 h | 9 CP | 1 semeste | er every year | | | | |
| Module | Prof. Dr. Stef | Prof. Dr. Stefan Kratsch | | | | | |
| coordinator | | | | | | | |
| Lecturer(s) | Prof. Dr. Stef | an Kratsch | | | | | |
| Classification | Programme | | Mode | Seme | ster | | |
| Classification | M. Sc. Compu | ter Science | Optiona | $1 \mid 2. \text{ or}$ | 3. | | |
| Technical skills | The ability to | turn theore | tical result | ts from p | arameterized | | |
| | complexity int | o functionin | ig code. E | ngineerin | g, testing, and | | |
| | evaluation of t | he achieved | performat | nce. | | | |
| Soft skills | Managing pro | jects in sma | ll teams or | ver a long | ger period of tin | ne. | |
| | Presentation a | nd discussion | on of obtai | ned resul | lts. | | |
| Contents | Implementatio | on of algorit | nms from | paramete | erized complexit | y, | |
| | i.e., both fixed | -parameter | tractable a | algorithn | ns as well as | | |
| | kernelization a | lgorithms. | Testing an | d engine | ering of the | | |
| | obtained code | | | | | | |
| | Concrete topic | s are subje | t to chang | ge. | | | |
| Prerequisites | none | | | | | | |
| Format | Teaching form | at Gi | oup size | h/week | Workload[h] | CP | |
| rormat | Lab | | 8 | 4 | 60 T / 210 S | 9 | |
| | T = face-to-fa | ce teaching | S = indep | pendent s | study | | |
| Exam achievements | Oral presentat | tion, written | report | | (gra | ded) | |
| Study achievements | none | | | | (not gra | ded) | |
| Forms of media | | | | | | | |
| Literature | | | | | | | |

| Module | Theoretical | Aspects | s of | Intrud | er Seard | ch | |
|--------------------|------------------|---|-------|------------|------------|------------------|------|
| MA-INF 1318 | | | | | | | |
| Workload | Credit points | Duration | | Frequer | icy | | |
| 180 h | 6 CP | 1 semest | ter | every y | ear | | |
| Module | PD Dr. Elmar | Langetep | e | | | | |
| coordinator | | | | | | | |
| Lecturer(s) | PD Dr. Elmar | Langetep | e | | | | |
| Classification | Programme | | | Mode | Semest | er | |
| Classification | M. Sc. Compu | ter Scienc | e | Optional | 1. | | |
| Technical skills | To acquire fun | Idamental | kno | wledge o | n topics a | and methods in | 1 |
| | theoretical and | theoretical and algorithmic aspects of intruder search in | | | | | |
| | | geometric and discrete environments; | | | | | |
| Soft skills | | | | | , | | |
| Contents | Intruder/Evad | ler search i | in ge | eometric | and discr | ete environme | nts, |
| | Fire-Fighter p | roblem, Fi | ire C | Control o | n graphs | and in the plat | ne, |
| | Man-and-Lion | problem, | Two | -Guards | problem, | , Search Game | s, |
| | Mobile and im | mobile hie | ders, | Patrolli | ng algorit | thms. | |
| Prerequisites | none | | | | | | |
| | Teaching form | at | Gro | up size | h/week | Workload[h] | CP |
| Format | Lecture | | | 60 | 2 | 30 T / 45 S | 2.5 |
| | Exercises | | | 30 | 2 | 30 T / 75 S | 3.5 |
| | T = face-to-fa | ce teachin | g; S | = indep | endent st | udy | |
| Exam achievements | Oral exam | | | | | (gra | ded) |
| Study achievements | Successful exe | rcise parti | cipa | tion | | (not gra | ded) |
| Forms of media | | | | | | | |
| Literature | Scientific resea | arch article | es w | ill be rec | ommende | ed in the lectur | ·e. |

2 Graphics, Vision, Audio

| MA-INF 211 | 1 L2E2 | 6 CP | Foundations of Graphics | 37 |
|------------|---------------|-------------------|--|----|
| MA-INF 211 | 3 L2E2 | 6 CP | Foundations of Audio Signal Processing | 38 |
| MA-INF 220 | 1 L4E2 | 9 CP | Computer Vision | 39 |
| MA-INF 220 | 2 L4E2 | 9 CP | Computer Animation | 40 |
| MA-INF 220 | 3 L4E2 | $9 \mathrm{CP}$ | Selected Topics in Signal Processing | 41 |
| MA-INF 220 | 4 L2E2 | 6 CP | Rendering Techniques I | 42 |
| MA-INF 220 | 5 L2E2 | 6 CP | Geometry Processing I | 43 |
| MA-INF 220 | 6 Sem2 | 4 CP | Seminar Vision | 44 |
| MA-INF 220 | 7 Sem2 | 4 CP | Seminar Graphics | 45 |
| MA-INF 220 | 8 Sem2 | 4 CP | Seminar Audio | 46 |
| MA-INF 220 | 9 L4E2 | $9 \mathrm{CP}$ | Advanced Topics in Computer Graphics I | 47 |
| MA-INF 221 | 0 Sem2 | 4 CP | Seminar Computer Animation | 48 |
| MA-INF 221 | | | Selected Topics in Signal Processing | 49 |
| MA-INF 221 | 3 L3E1 | 6 CP | Computer Vision II | 50 |
| MA-INF 221 | 4 L2E2 | 6 CP | Computational Photography | 51 |
| MA-INF 221 | 5 Sem2 | 4 CP | Seminar Digital Material Appearance | 52 |
| MA-INF 221 | 6 Lab4 | 9 CP | Lab Visual Computing | 53 |
| MA-INF 221 | 7 L2E2 | 6 CP | Markov Random Fields for Vision and Graphics | 54 |
| MA-INF 221 | 8 L2E2 | 6 CP | Video Analytics | 55 |
| MA-INF 221 | | | 0 2 | |
| MA-INF 222 | 0 Lab4 | $9 \mathrm{CP}$ | Lab Visualization and Medical Image Analysis | |
| MA-INF 222 | 1 Sem2 | 4 CP | 1 0 | |
| MA-INF 230 | 1 L2E2 | 6 CP | Advanced Topics in Computer Vision | 59 |
| MA-INF 230 | 2 L2E2 | 6 CP | Physics-based Modelling | |
| MA-INF 230 | 4 L2E2 | 6 CP | Rendering Techniques II | 61 |
| MA-INF 230 | | | Geometry Processing II | |
| MA-INF 230 | 6 L2E2 | 6 CP | Virtual Reality | 63 |
| MA-INF 230 | 7 Lab4 | 9 CP | Lab Vision | 64 |
| MA-INF 230 | | | Lab Graphics | |
| | | | Lab Audio | |
| MA-INF 231 | 0 L4E2 | | Advanced Topics in Computer Graphics II | |
| MA-INF 231 | 1 Lab4 | $9 \ \mathrm{CP}$ | Lab Computer Animation | |
| MA-INF 231 | | | Image Acquisition and Analysis in Neuroscience | |
| MA-INF 231 | 3 L2E2 | 6 CP | Deep Learning for Visual Recognition | 70 |

| Module MA-INF 2111 | Foundations of Graphics | | | | | | | |
|-----------------------|--|--|--------------|---------------------------|------------------|------|--|--|
| Workload | Credit points | Duration | Freque | ncv | | | | |
| 180 h | 6 CP | 1 semeste | 1 0 | | | | | |
| Module | Prof. Dr. Reinhard Klein | | | | | | | |
| coordinator | | | | | | | | |
| Lecturer(s) | Prof. Dr. Reinhard Klein, Prof. Dr. Andreas Weber, | | | | | | | |
| | Prof. Dr. Mat | | | | , | | | |
| | Programme | | Mode | Semest | ter | | | |
| Classification | M. Sc. Compu | ter Science | Optional | $1 \mid 1. \text{ or } 2$ | 2. | | | |
| Technical skills | Knowledge of | Knowledge of basic mathematical techniques commonly used in | | | | | | |
| | Graphics with | Graphics with a strong emphasis on their application to real | | | | | | |
| | world problem | world problems. | | | | | | |
| Soft skills | Research abilit | Research abilities, information retrieval abilities, collaboration | | | | | | |
| | abilities, self n | nanagement | , creativity | r. | | | | |
| Contents | Affine and pro | jective tran | sformation | s with ap | plications to in | nage | | |
| | formation (rig | id body mo | tion, cinem | atic chair | ns); | | | |
| | Parametric cu modelling; | rves and su | faces with | applicati | ons to 3D | | | |
| | Ordinary different based modelling | _ | tions with | applicatio | ons to physical | | | |
| Prerequisites | Required: Nor | ne of the fol | lowing mod | lules have | e been passed: | | | |
| | MA-INF 2101 | – Foundati | ons of Graj | phics, Vis | ion and Audio | | | |
| | Teaching forma | at C | roup size | h/week | Workload[h] | CP | | |
| Format | Lecture | | 60 | 2 | 30 T / 45 S | 2.5 | | |
| | Exercises | | 30 | 2 | 30 T / 75 S | 3.5 | | |
| | T = face-to-fa | ce teaching | S = indep | endent st | udy | | | |
| Exam achievements | Written exam | | | | (gra | ded) | | |
| Study achievements | Successful exe | rcise partici | pation | | (not gra | ded) | | |
| Forms of media | | | | | | | | |
| Literature | | | | | | | | |

| | Foundations of Audio Signal Processing | | | | | | | | | |
|---|---|---|-------------|-------------|-------------------|--|--|--|--|--|
| Module MA-INF 2113 | Foundations | s of Audio | Signal I | Processi | ng | | | | | |
| | | | - | | | | | | | |
| Workload | Credit points | Duration | Frequer | - | | | | | | |
| 180 h | 6 CP | 1 semester | ÷·•=J J | ear | | | | | | |
| Module | apl. Prof. Dr. | Frank Kurt | h | | | | | | | |
| coordinator | | | | | | | | | | |
| Lecturer(s) | apl. Prof. Dr. Frank Kurth, Prof. Dr. Michael Clausen | | | | | | | | | |
| Classification | Programme | | Mode | Semest | ter | | | | | |
| | M. Sc. Compu | | Optional | | | | | | | |
| Technical skills | • Introduction to basic concepts of analog and digital signal | | | | | | | | | |
| | processing; | | | | | | | | | |
| | • Applications | • Applications in the field of Audio Signal Processing; | | | | | | | | |
| | • Signal Proces | 0 0 | , | | | | | | | |
| | · · | • Implementing basic Signal Processing Algorithms | | | | | | | | |
| Soft skills | Solving basic S | Solving basic Signal Processing Problems; Implementing Signal | | | | | | | | |
| | Processing Alg | orithms usir | ng state-of | -the-art s | oftware | | | | | |
| | frameworks; | | 0 | | | | | | | |
| | Capability to a | analyze; Tim | e manage | ment; Pre | esentation skills | 5; | | | | |
| | Discussing own | n solutions a | nd solutio | ns of othe | ers, and workin | ıg in | | | | |
| | groups. | | | | | - | | | | |
| Contents | Theoretical int | roduction to | o analog a | nd digital | Signal Process | sing; | | | | |
| | Fourier Transfe | orms; Analog | g to digita | l Convers | ion; Digital Fil | ters; | | | | |
| | Audio Signal P | Processing A | pplication | s: Filter b | oanks: Window | ed | | | | |
| | Fourier Transfe | 0 | | , |) | | | | | |
| Prerequisites | none | , 0 | | 0 | | | | | | |
| _ | Teaching forma | t G | roup size | h/week | Workload[h] | CP | | | | |
| Format | Lecture | | 60 | 2 | 30 T / 45 S | 2.5 | | | | |
| | Exercises | | 30 | 2 | 30 T / 75 S | 3.5 | | | | |
| | T = face-to-face | ce teaching; | S = indep | endent st | udy | - | | | | |
| | | | | | | | | | | |
| Exam achievements | Oral exam | | | | (gra | Successful exercise participation (graded) | | | | |
| Exam achievements Study achievements | | cise particip | oation | | (8 | / | | | | |
| | | | | | (8 | / | | | | |

| Module | Computer V | Vision | | | | | |
|--------------------|---|--|--------------|------------|--------------------|-------|--|
| MA-INF 2201 | | | | | | | |
| Workload | Credit points | Duration | Freque | ncy | | | |
| 270 h | 9 CP | 1 semester | r every year | | | | |
| Module | Prof. Dr. Juergen Gall | | | | | | |
| coordinator | | | | | | | |
| Lecturer(s) | Prof. Dr. Juergen Gall | | | | | | |
| Classification | Programme | | Mode | Seme | ster | | |
| Classification | M. Sc. Computer Science Optional 1. or 2. | | | | | | |
| Technical skills | Students will I | Students will learn about various mathematical methods and | | | | | |
| | their applicati | their applications to computer vision problems. | | | | | |
| Soft skills | Productive wo | Productive work in small teams, development and realization of | | | | | |
| | individual approaches and solutions, critical reflection of | | | | | | |
| | competing me | , | 0 | - | | | |
| Contents | The class will | The class will cover a number of mathematical methods and | | | | | |
| | their applicati | ons in comp | ter visio | n. For ex | ample, linear fil | ters, | |
| | edges, derivati | ves, Hough t | ransform | , segment | tation, graph cu | .ts, | |
| | mean shift, ac | tive contours | , level set | ts, MRFs | , expectation | | |
| | , | 0 | | · - | oral filtering, a | | |
| | ~ ~ | ý – | , 1 | , | tracking, camera | ' | |
| | ' | , , | | , | pose estimation | , | |
| | articulated po | se estimatior | , deform | able mesł | nes, RGBD visio | on. | |
| Prerequisites | Recommended | | | | | | |
| | | | lgebra, a | nalysis, p | probability theory | ry, | |
| | C++ program | _ | | | 1 | | |
| | Teaching form | at Gro | oup size | h/week | Workload[h] | CP | |
| Format | Lecture | | 60 | 4 | 60 T / 105 S | 5.5 | |
| | Exercises | | 30 | 2 | 30 T / 75 S | 3.5 | |
| | T = face-to-fa | ce teaching; | S = indep | pendent s | study | | |
| Exam achievements | Written exam | | | | (gra | ded) | |
| Study achievements | Successful exe | rcise particip | ation | | (not gra | ded) | |
| Forms of media | | | | | | | |
| | • R. Hartley, A | A. Zisserman | : Multipl | e View G | eometry in | | |
| Literature | Computer Vis | ion | | | | | |
| Literature | • R. Szeliski: | Computer V | ision: Alg | orithms a | and Application | IS | |
| | • S. Prince: C | omputer Vis | ion: Mod | els, Leari | ning, and Infere | nce | |

| Module | Computer A | Animation | | | | | | |
|--------------------|--|--|--------------|-----------|------------------|-------|--|--|
| MA-INF 2202 | | | | | | | | |
| Workload | Credit points | Duration | Freque | ncy | | | | |
| 270 h | 9 CP | 1 semester | r every year | | | | | |
| Module | Prof. Dr. And | reas Weber | | | | | | |
| coordinator | | | | | | | | |
| Lecturer(s) | Prof. Dr. And | Prof. Dr. Andreas Weber | | | | | | |
| Classification | Programme | | Mode | Seme | ster | | | |
| Classification | M. Sc. Computer Science Optional 2. | | | | | | | |
| Technical skills | Students will I | earn fundam | ental par | adigms u | used in compute | r | | |
| | animation. Th | animation. They will learn to use mathematical models of | | | | | | |
| | motions to come up with algorithmic solutions of problems of | | | | | | | |
| | the synthesis of motions of virtual characters. | | | | | | | |
| Soft skills | Social competences (work in groups), communicative skills | | | | | | | |
| | (written and oral presentation) | | | | | | | |
| Contents | | Fundamentals of computer animation; kinematics; | | | | | | |
| | - | | | capturing | ; motion editing | g; | | |
| | motion synthe | sis; facial an | imations | | | | | |
| Prerequisites | Recommended | - | | | | | | |
| | MA-INF 2111 | | | - | I | | | |
| | Teaching form | at Gro | oup size | h/week | Workload[h] | CP | | |
| Format | Lecture | | 60 | 4 | 60 T / 105 S | 5.5 | | |
| | Exercises | | 30 | 2 | 30 T / 75 S | 3.5 | | |
| | T = face-to-fa | ce teaching; | S = indep | pendent s | study | | | |
| Exam achievements | Written exam | | | | (gra | ided) | | |
| Study achievements | Successful exe | rcise particip | ation | | (not gra | ded) | | |
| Forms of media | | | | | | | | |
| | • Dietmar Jac | · - | | , | 0 | | | |
| | Methoden der | - | , | | | | | |
| | • Rick Parent: | Computer A | Animatio | n: Algori | thms and | | | |
| Literature | Techniques, | | | | | | | |
| | Morgan Kaufr | nan Publishe | ers 2002 | | | | | |
| | • Frederic I. P | arke , Keith | Waters: | Compute | er Facial Anima | tion. | | |
| | A K Peters, L | td. 1996 | | | | | | |

| Module | Selected To | pics in Sig | nal Pro | ocessing | | | |
|--------------------|---|-----------------|-----------------|--------------|---------------------|------|--|
| MA-INF 2203 | | | | | | | |
| Workload | Credit points | Duration | Freque | - | | | |
| 270 h | 9 CP | 1 semester | every | year | | | |
| Module | apl. Prof. Dr. | Frank Kurth | L | | | | |
| coordinator | | | | | | | |
| | apl. Prof. Dr. | Frank Kurth | | Dr. Micha | ael Clausen | | |
| Classification | Programme | | Mode | Seme | ster | | |
| | M. Sc. Compu | | Optiona | | | | |
| Technical skills | Learning adva | | | | - | | |
| | techniques in o | digital signal | processi | ng. Study | v examples from t | the | |
| | field of digital | audio signal | processi | ng with a | focus on music | | |
| | audio. Develop | p skills for an | alysing a | audio sign | als and designing | g | |
| | audio features | for selected a | applicati | on scenar | ios. Mathematica | al | |
| | modelling of si | ignal processi | ng probl | ems in pr | actical application | ons. | |
| | Design and im | plementation | of corre | sponding | algorithms and | | |
| | data structures solving those problems. Efficiency issues. | | | | | | |
| Soft skills | Capability to analyze. Time management. Strength of purpose. | | | | | | |
| | Discussing own solutions and solutions of others. | | | | | | |
| Contents | Advanced tech | niques for fil | ter desig | n, design | and extraction o | of | |
| | features descri | bing multime | dia sign | als, efficie | ent DSP algorithr | ms, | |
| | general concep | ots for conten | t-based a | analysis o | f multimedia | | |
| | signals. Select | ed signal pro | cessing a | pplication | ns, for example | | |
| | content-based | music analys | is, signa | l compres | sion, denoising, | | |
| | source separat | ion. | | | | | |
| Prerequisites | none | | | | | | |
| | Teaching forma | at Gro | up size | h/week | Workload[h] | CP | |
| Format | Lecture | | 60 | 4 | 60 T / 105 S | 5.5 | |
| | Exercises | | 30 | 2 | 30 T / 75 S | 3.5 | |
| | T = face-to-fa | ce teaching: S | $\delta = inde$ | pendent s | study | | |
| Exam achievements | Written exam | 8, | | <u>r</u> | (grad | led) | |
| Study achievements | Successful exer | rcise participa | ation | | (not grad | | |
| Forms of media | | 1 1 | | | (0 | / | |
| | • Lecture scrip | ot and selecte | d resear | ch publica | ations | | |
| | | | | | | | |
| | • Hayes: Statistical Digital Signal Processing and Modelling, John Wiley, 1996 | | | | | | |
| Literature | Proakis, Manolakis: Digital Signal Processing, Prentice Hall, | | | | | | |
| | | | | | | | |
| | 1996 | 0 | 0 | | 0, | | |
| | , | | 0 | | | | |

| Module MA-INF 2204 | Rendering 7 | Fechniqu | es I | | | | | | |
|-----------------------|---|--|-------------------------|---------|------------|-----------------|------------|--|--|
| Workload | Credit points | Duration | D ₂ - | aner | | | | | |
| 180 h | 6 CP | 1 semest | | equeno | - | | | | |
| Module | Prof. Dr. Reir | | | ery ye | ai | | | | |
| coordinator | | maru Men | L | | | | | | |
| Lecturer(s) | Prof. Dr. Reir | hard Kleir |) | | | | | | |
| Lecturer (5) | Programme | | | | | | | | |
| Classification | 0 | Mode Semester M. Sc. Computer Science Optional 2. | | | | | | | |
| Technical skills | Analytical for | | - | | | image synthe | sis | | |
| | and knowledge | | | | | | | | |
| | of photorealist | ic image d | ata. Kn | nowled | dge of the | e major algor | | | |
| | for the simulat volume data se | - | | | | | sic | | |
| | algorithms. | | | | | | | | |
| Soft skills | Analytical pro | | | | | - | | | |
| | solution of pra | - | | | | | | | |
| | presentation o | | - | | - | | | | |
| | self-dependent | | research | h, col | laboratic | on abilities, | | | |
| <u> </u> | self-manageme | | ha. ma | dela | forthad | legenintian of | | | |
| Contents | Topics among others will be: models for the description | | | | | | | | |
| | optical material properties and light sources; transport, volume | | | | | | | | |
| | visualization and rendering equation; algorithms and techniques for the solution of the volume visualization and rendering | | | | | | | | |
| | for the solution of the volume visualization and rendering equation; advanced methods for photorealistic image generation | | | | | | | | |
| | in real-time applications like 3D games. In addition, results from | | | | | | | | |
| | state of the ar | - | | - | | antion, resards | | | |
| Prerequisites | Recommended | | | 1 | | | | | |
| - | Algorithms an | d data stru | ictures, | basic | e knowled | dge on | | | |
| | multidimension | nal analysi | s und li | near a | algebra, | basic knowled | lge in | | |
| | stochastics and | d statistics | , numer | rical a | nalysis a | and numerical | | | |
| | linear algebra, | C++ | | | | | | | |
| | Teaching forma | at | Group s | size | h/week | Workload[h] | CP | | |
| Format | Lecture | | 60 | | 2 | 30 T / 45 S | 2.5 | | |
| | Exercises | | 30 | | 2 | 30 T / 75 S | 3.5 | | |
| | T = face-to-fa | ce teaching | ; S = in | ndepe | endent st | udy | | | |
| Exam achievements | Oral exam | | | | | (gr | aded) | | |
| Study achievements | Successful exe | rcise partic | ipation | | | (not gr | aded) | | |
| Forms of media | | | | | | | | | |
| | • L. Szirmay-Kalos: Monte-Carlo Methods in Global Illumination, Institute of Computer Graphics, Vienna University | | | | | | | | |
| | of Technology, Vienna. | | | | | | | | |
| | URL: citeseer.ist.psu.edu/szirmay-kalos00montecarlo.html, 1999/ | | | | | | | | |
| Literature | , | יי ות | 1, | A 1 | 1.01 | | , . | | |
| Liveravare | • P. Dutre, K. Bala, P. Bekaert: Advanced Global Illumination, | | | | | | | | |
| | 2nd ed., B&T, 2006 M. Pharr, G. Humphreys: Physically Based Rendering, | | | | | | | | |
| | • M. Pharr, G Elsevier, 2004 | . mumpure | уз. ГШУ | sicall | iy Dased | nendering, | | | |
| | , | Lehtinen | P-P SI | oan· | Precomp | uted Badianc | e | | |
| | • J. Kautz, J. Lehtinen, PP. Sloan: Precomputed Radiance Transfer: Theory and Practice, Siggraph Course Notes, 2005 | | | | | | | | |
| | | Jiy and I I | acuice, r | JISSIE | ipii Ooul | 10165, 200 | 0 | | |

| Module | Geometry P | Processi | ng] | [| | | | | |
|--------------------|---|---|-----------|--|-------------|-------------------|------|--|--|
| MA-INF 2205 | | | | | | | | | |
| Workload | Credit points | Duration | 1 | Freque | ncy | | | | |
| 180 h | 6 CP | 1 semes | | every y | - | | | | |
| Module | Prof. Dr. Reinhard Klein | | | | | | | | |
| coordinator | | | | | | | | | |
| Lecturer(s) | Prof. Dr. Reinhard Klein | | | | | | | | |
| | Programme | | | Mode | Semes | ter | | | |
| Classification | M. Sc. Compu | ter Scien | ce | Optiona | 1 2. | | | | |
| Technical skills | Analytical form | nulation of | of pr | oblems 1 | elated to | geometry | | | |
| | processing and | knowled | ge of | f techniq | ues and a | lgorithms to | | | |
| | optimize, proce | ess and st | ore | geometr | y data. E | specially, learn | ing | | |
| | of techniques t | o generat | e hig | ghly deta | ailed three | e-dimensional | | | |
| | digital models | of real of | oject | s and to | implement | nt current | | | |
| | geometry proce | 0 0 | | | | | | | |
| Soft skills | | Analytical problem description, creativity, self-dependent solution of practical problems in the area of mesh processing, | | | | | | | |
| | - | - | | | | | s, | | |
| | presentation of solution strategies and implementations, | | | | | | | | |
| | - | self-dependent literature research, collaboration abilities, | | | | | | | |
| | self-manageme | | | | 0 1 | | | | |
| Contents | Topics among other will be: Methods for the generation of polygonal meshes (Laser scanning, registration and integration | | | | | | | | |
| | | | | | - | - | on | | |
| | - | | · · | .), Point based representations, es, Efficient mesh data structures and | | | | | |
| | | - | , | | | | ia | | |
| | mesh compress Mesh decimati | · – | | | - | = - | | | |
| | coarse-to-fine u | | | , | | - | | | |
| | addition result | | | | | | | | |
| Prerequisites | Recommended: | | <i></i> c | | researen | will be presen | icu. | | |
| Troroquisitos | Algorithms and | | ncti | ires or k | nowledge | of basic discre | te | | |
| | differential geo | | | | - | | | | |
| | und linear alge | | | - | | - | | | |
| | linear algebra, | | | | v | | | | |
| | Teaching forma | 1 | Gro | oup size | h/week | Workload[h] | CP | | |
| Format | Lecture | | | 60 | 2 | 30 T / 45 S | 2.5 | | |
| | Exercises | | | 30 | 2 | 30 T / 75 S | 3.5 | | |
| | T = face-to-face teaching; $S = $ independent study | | | | | | | | |
| Exam achievements | Oral exam | | 0/ | 1 | | - | ded) | | |
| Study achievements | Successful exer | cise parti | cipa | tion | | (not gra | | | |
| Forms of media | | - | • | | | | / | | |
| | • R. Scopigno, | C. Andu | jar, | M. Goes | ele, H. Le | ensch: 3D Data | l | | |
| | Acquistion, Eu | | | | | | | | |
| | • E. Grinspun, | , M. Desb | run | (organiz | ers): Disc | erete Differentia | al | | |
| Literature | Geometry: An | Applied | Intro | oduction | , Siggrapl | h Course Notes | з, | | |
| | 2006 | | | | | | | | |
| | • M. Botsch, N | - | | | - | Based on Triar | ngle | | |
| | Meshes, Siggra | ph Cours | e No | otes, 200 | 6 | | | | |

| Module | Seminar Vision | | | | | | |
|--------------------|--------------------------------|--|---------------|------------|------------------|------|--|
| MA-INF 2206 | | 1 | | | | | |
| Workload | Credit points | | | | | | |
| 120 h | 4 CP 1 semester every semester | | | | | | |
| Module | Prof. Dr. Juergen Gall | | | | | | |
| coordinator | | | | | | | |
| Lecturer(s) | Prof. Dr. Juer | rgen Gall | | | | | |
| Classification | Programme | | Mode Semester | | ter | | |
| Classification | M. Sc. Compu | Optional | 2. or 3 | 8. | | | |
| Technical skills | Ability to und | Ability to understand new research results presented in original | | | | | |
| | scientific pape | rs. | | | | | |
| Soft skills | Ability to pres | sent and to o | eritically d | iscuss the | se results in th | ne | |
| | framework of | the correspo | nding area | | | | |
| Contents | Current confer | ence and jo | urnal pape | ers. | | | |
| Prerequisites | Required: | | | | | | |
| | MA-INF 2201 | - Computer | · Vision | | | | |
| Format | Teaching form | at G | roup size | h/week | Workload[h] | CP | |
| rormat | Seminar | | 10 | 2 | 30 T / 90 S | 4 | |
| | T = face-to-fa | ce teaching; | S = indep | endent st | udy | | |
| Exam achievements | Oral presentat | tion, written | report | | (gra | ded) | |
| Study achievements | none | | | | (not gra | ded) | |
| Forms of media | | | | | | | |
| Literature | | | | | | | |

| Module | Seminar Graphics | | | | | | |
|--------------------|--------------------------|---|-----------|---------------------------|-----------------|-------|--|
| MA-INF 2207 | | | | | | | |
| Workload | Credit points | Duration | Freque | ncy | | | |
| 120 h | 4 CP | | | | | | |
| Module | Prof. Dr. Reinhard Klein | | | | | | |
| coordinator | | | | | | | |
| Lecturer(s) | Prof. Dr. Reinhard Klein | | | | | | |
| Classification | Programme | | Mode | Semest | Semester | | |
| Classification | M. Sc. Compu | ter Science | Optiona | $1 \mid 2. \text{ or } 3$ | 3. | | |
| Technical skills | Ability to und | Ability to understand new research results presented in original | | | | | |
| | scientific pape | scientific papers. | | | | | |
| Soft skills | | Ability to present and to critically discuss these results in the | | | | | |
| | framework of | | | | | | |
| Contents | Current confer | _ | - | | | | |
| | Recommended | 0 | umai pape | 218. | | | |
| Prerequisites | | - | (]4:]: | 1 | | | |
| | | 0 | | lensional | analysis and li | near | |
| | algebra, basic | | / | | | | |
| | Basic knowled | ge in Comp | uter Grap | hics | | | |
| Format | Teaching form | at C | roup size | h/week | Workload[h] | CP | |
| roimat | Seminar | | 10 | 2 | 30 T / 90 S | 4 | |
| | T = face-to-fa | ce teaching | S = indep | pendent st | Judy | | |
| Exam achievements | Oral presentat | ion, writter | ı report | | (gra | ded) | |
| Study achievements | none | | | | (not gra | .ded) | |
| Forms of media | | | | | | | |
| Literature | | | | | | | |

| Module MA-INF 2208 | Seminar Audio | | | | | |
|-----------------------|---|---------------|--------------|------------|-------------------|-------|
| Workload | Credit points | Duration | Frequer | icv | | |
| 120 h | 4 CP | | | | | |
| Module | apl. Prof. Dr. Frank Kurth | | | | | |
| coordinator | 1 | | | | | |
| Lecturer(s) | apl. Prof. Dr. Frank Kurth, Dr. Michael Clausen | | | | | |
| Classification | Programme | | Mode | Semest | ter | |
| Classification | M. Sc. Computer Science Optional 2. | | | | | |
| Technical skills | Ability to und | erstand new | research r | esults pre | esented in origi | inal |
| | scientific pape | rs. | | | | |
| Soft skills | Ability to pres | sent and to c | ritically di | iscuss the | ese results in th | ne |
| | framework of | the correspo | nding area | | | |
| Contents | Current confer | rence and jou | ırnal pape | rs. | | |
| Prerequisites | none | | | | | |
| D (| Teaching form | at G | oup size | h/week | Workload[h] | CP |
| Format | Seminar | | 10 | 2 | 30 T / 90 S | 4 |
| | T = face-to-fa | ce teaching; | S = indep | endent st | udy | |
| Exam achievements | Oral presentat | tion, written | report | | (gra | .ded) |
| Study achievements | none | | | | (not gra | .ded) |
| Forms of media | | | | | | |
| Literature | | | | | | |

| Module | Advanced Topics in Computer Graphics I | | | | | | | | | |
|---|--|---|--|--|--|--|--|--|--|--|
| MA-INF 2209 | _ | - | - | | | | | | | |
| Workload | Credit points Durati | on Frequen | cy | | | | | | | |
| 270 h | 9 CP 1 seme | r | | | | | | | | |
| Module | Prof. Dr. Reinhard Klein | | | | | | | | | |
| coordinator | | | | | | | | | | |
| Lecturer(s) | Prof. Dr. Reinhard Klein | | | | | | | | | |
| Classification | Programme | | | | | | | | | |
| | M. Sc. Computer Science | - I | or 3. | | | | | | | |
| Technical skills | - | | l to geometry processing and | | | | | | | |
| | | rendering. Knowledge of techniques and algorithms to optimize, process, | | | | | | | | |
| | analyze and store geometry and reflectance data as well as knowledge of the major algorithms for the simulation of light distributions in 3D-scences and | | | | | | | | | |
| | | - | ntation of the basic algorithms. | | | | | | | |
| Soft skills | | | | | | | | | | |
| Soft Skills | _ | Based on the knowledge and skills acquired students should be able to | | | | | | | | |
| | | scientific literatu | re in the area of geometry | | | | | | | |
| | processing and rendering | turo concorning | a given problem in geometry | | | | | | | |
| | | | a given problem in geometry iew of the current state of the art | | | | | | | |
| | | | rocessing or rendering with | | | | | | | |
| | researchers from different | | | | | | | | | |
| | | | nd work in a team to solve a mes | | | | | | | |
| | processing or rendering problem | | | | | | | | | |
| | • and should have acquired key-competences like motivation to deliver results, flexibility, scientific integrity, ability to adapt to changes and ability | | | | | | | | | |
| | | | | | | | | | | |
| | to communicate | | | | | | | | | |
| Contents | Topics among other will be: | | | | | | | | | |
| | • methods for the generat | ion of polygonal | meshes from point clouds | | | | | | | |
| | • efficient mesh data struc | tures and mesh | compression | | | | | | | |
| | • mesh optimization techr | iques: denoising | , smoothing, decimation, | | | | | | | |
| | refinement | | | | | | | | | |
| | • mesh editing techniques | | | | | | | | | |
| | • optical material propert | | rces | | | | | | | |
| | • light transport and rend | | on of the rendering equation | | | | | | | |
| | • advanced methods for p | | on of the rendering equation | | | | | | | |
| | | | | | | | | | | |
| D | In addition, results from s | tate of the art re | esearch will be presented. | | | | | | | |
| Prerequisites | Required: | ton manhing da | te structures multidimensional | | | | | | | |
| | Basic knowledge in computer graphics, data structures, multidimensional | | | | | | | | | |
| | | analysis und linear algebra, numerical analysis and numerical linear algebra, | | | | | | | | |
| | analysis und linear algebra | | | | | | | | | |
| | analysis und linear algebra C++ | a, numerical ana | lysis and numerical linear algebra | | | | | | | |
| Format | analysis und linear algebra C++ Teaching format | a, numerical ana Group size | lysis and numerical linear algebra h/week Workload[h] Cl | | | | | | | |
| Format | analysis und linear algebra C++ | a, numerical ana | lysis and numerical linear algebra | | | | | | | |
| Format | analysis und linear algebra C++ Teaching format Lecture Exercises | a, numerical ana Group size 60 30 | h/week Workload[h] Cl 4 60 T / 105 S 5.3 2 30 T / 75 S 3.3 | | | | | | | |
| | analysis und linear algebra C++ Teaching format Lecture Exercises T = face-to-face teaching; | a, numerical ana Group size 60 30 S = independent | h/weekWorkload[h]Cl4 $60 \text{ T} / 105 \text{ S}$ 5.1 2 $30 \text{ T} / 75 \text{ S}$ 3.1 at study 5.1 | | | | | | | |
| Exam achievements | analysis und linear algebra C++ Teaching format Lecture Exercises T = face-to-face teaching; Oral presentation, written | a, numerical ana Group size 60 30 S = independent report | lysis and numerical linear algebra h/week Workload[h] Cl 4 60 T / 105 S 5. 2 30 T / 75 S 3. at study (graded | | | | | | | |
| Exam achievements Study achievements | analysis und linear algebra C++ Teaching format Lecture Exercises T = face-to-face teaching; | a, numerical ana Group size 60 30 S = independent report | h/weekWorkload[h]Cl4 $60 \text{ T} / 105 \text{ S}$ 5.1 2 $30 \text{ T} / 75 \text{ S}$ 3.1 at study 5.1 | | | | | | | |
| Exam achievements | analysis und linear algebra C++ Teaching format Lecture Exercises T = face-to-face teaching; Oral presentation, written Successful exercise partici | a, numerical ana Group size 60 30 S = independer report pation | lysis and numerical linear algebra h/week Workload[h] Cl 4 60 T / 105 S 5. 2 30 T / 75 S 3. at study (graded (not graded | | | | | | | |
| Exam achievements Study achievements | analysis und linear algebra C++ Teaching format Lecture Exercises T = face-to-face teaching; Oral presentation, written Successful exercise partici | a, numerical ana Group size 60 30 S = independer report pation M. Pauly, P. All: | lysis and numerical linear algebra h/week Workload[h] Cl 4 60 T / 105 S 5 2 30 T / 75 S 3 at study (graded (not graded iez, B. Levy, Polygon Mesh | | | | | | | |
| Exam achievements Study achievements | analysis und linear algebra C++ Teaching format Lecture Exercises T = face-to-face teaching; Oral presentation, written Successful exercise particities M. Botsch, L. Kobbelt, Processing, A K Peters (7) | A, numerical ana Group size 60 30 S = independer report pation M. Pauly, P. Alli . Oktober 2010) | lysis and numerical linear algebra h/week Workload[h] Cl 4 60 T / 105 S 5 2 30 T / 75 S 3 at study (graded (not graded iez, B. Levy, Polygon Mesh | | | | | | | |
| Exam achievements Study achievements | analysis und linear algebra C++ Teaching format Lecture Exercises T = face-to-face teaching; Oral presentation, written Successful exercise particities M. Botsch, L. Kobbelt, Processing, A K Peters (7) | A, numerical ana Group size 60 30 S = independer report pation M. Pauly, P. Alli . Oktober 2010) | lysis and numerical linear algebra h/week Workload[h] Cl 4 60 T / 105 S 5 2 30 T / 75 S 3 nt study (graded (not graded iez, B. Levy, Polygon Mesh | | | | | | | |
| Exam achievements Study achievements | analysis und linear algebra C++ Teaching format Lecture Exercises T = face-to-face teaching; Oral presentation, written Successful exercise particities M. Botsch, L. Kobbelt, Processing, A K Peters (7 M. Gross, HP. Pfister, F 2007) | A, numerical ana Group size 60 30 S = independer report pation M. Pauly, P. All: . Oktober 2010) coint-Based Grap | lysis and numerical linear algebra h/week Workload[h] Cl 4 60 T / 105 S 5 2 30 T / 75 S 3 nt study (graded (not graded iez, B. Levy, Polygon Mesh | | | | | | | |
| Exam achievements Study achievements | analysis und linear algebra C++ Teaching format Lecture Exercises T = face-to-face teaching; Oral presentation, written Successful exercise particities M. Botsch, L. Kobbelt, Processing, A K Peters (7 M. Gross, HP. Pfister, F 2007) R. Scopigno, C. Anduja: Eurographics Tutorial, 200 | a, numerical ana Group size 60 30 S = independer report pation M. Pauly, P. All: Oktober 2010) coint-Based Grap cr, M. Goesele, H 02 | lysis and numerical linear algebra h/week Workload[h] Cl 4 60 T / 105 S 5. 2 30 T / 75 S 3. at study (graded (not graded iez, B. Levy, Polygon Mesh bhics, Morgan Kaufmann (21. Jun . Lensch: 3D Data Acquistion, | | | | | | | |
| Exam achievements Study achievements Forms of media | analysis und linear algebra C++ Teaching format Lecture Exercises T = face-to-face teaching; Oral presentation, written Successful exercise partici M. Botsch, L. Kobbelt, Processing, A K Peters (7 M. Gross, HP. Pfister, F 2007) R. Scopigno, C. Anduja; Eurographics Tutorial, 200 E. Grinspun, M. Desbru | A, numerical ana Group size 60 30 S = independer report pation M. Pauly, P. All: Oktober 2010) coint-Based Grap r, M. Goesele, H 02 n (organizers): I | lysis and numerical linear algebra h/week Workload[h] Cl 4 60 T / 105 S 5. 2 30 T / 75 S 3. at study (graded (not graded iez, B. Levy, Polygon Mesh bhics, Morgan Kaufmann (21. Jur . Lensch: 3D Data Acquistion, Discrete Differential Geometry: A | | | | | | | |
| Exam achievements Study achievements | analysis und linear algebra C++ Teaching format Lecture Exercises T = face-to-face teaching; Oral presentation, written Successful exercise partici • M. Botsch, L. Kobbelt, Processing, A K Peters (7 • M. Gross, HP. Pfister, F 2007) • R. Scopigno, C. Anduja: Eurographics Tutorial, 200 • E. Grinspun, M. Desbru Applied Introduction, Sigg | A, numerical ana Group size 60 30 S = independer report pation M. Pauly, P. All: Oktober 2010) coint-Based Grap c, M. Goesele, H D2 n (organizers): I graph Course No | lysis and numerical linear algebra h/week Workload[h] Cl 4 60 T / 105 S 5. 2 30 T / 75 S 3. at study (graded (not graded (not graded iez, B. Levy, Polygon Mesh bhics, Morgan Kaufmann (21. Jur . Lensch: 3D Data Acquistion, Discrete Differential Geometry: A otes, 2006 | | | | | | | |
| Exam achievements Study achievements Forms of media | analysis und linear algebra C++ Teaching format Lecture Exercises T = face-to-face teaching; Oral presentation, written Successful exercise partici M. Botsch, L. Kobbelt, Processing, A K Peters (7 M. Gross, HP. Pfister, F 2007) R. Scopigno, C. Anduja: Eurographics Tutorial, 200 E. Grinspun, M. Desbru Applied Introduction, Sigg L. Szirmay-Kalos: Mont | A, numerical ana Group size 60 30 S = independer report pation M. Pauly, P. All: Oktober 2010) oint-Based Grap r, M. Goesele, H 02 n (organizers): I graph Course No e-Carlo Methods | lysis and numerical linear algebra h/week Workload[h] Cl 4 60 T / 105 S 5. 2 30 T / 75 S 3. at study (graded (not graded (not graded (not graded (not graded) bhics, Morgan Kaufmann (21. Jur . Lensch: 3D Data Acquistion, Discrete Differential Geometry: A otes, 2006 s in Global Illumination, Institute | | | | | | | |
| Exam achievements Study achievements Forms of media | analysis und linear algebra C++ Teaching format Lecture Exercises T = face-to-face teaching; Oral presentation, written Successful exercise partici • M. Botsch, L. Kobbelt, Processing, A K Peters (7 • M. Gross, HP. Pfister, F 2007) • R. Scopigno, C. Anduja: Eurographics Tutorial, 200 • E. Grinspun, M. Desbru Applied Introduction, Sigg • L. Szirmay-Kalos: Mont of Computer Graphics, Vi | A, numerical ana Group size 60 30 S = independer report pation M. Pauly, P. All. Oktober 2010) oint-Based Grap r, M. Goesele, H 02 n (organizers): I graph Course No e-Carlo Methods enna University | lysis and numerical linear algebra h/week Workload[h] Cl 4 60 T / 105 S 5.1 2 30 T / 75 S 3.1 at study (graded (not graded (not gr | | | | | | | |
| Exam achievements Study achievements Forms of media | analysis und linear algebra C++ Teaching format Lecture Exercises T = face-to-face teaching; Oral presentation, written Successful exercise partici • M. Botsch, L. Kobbelt, Processing, A K Peters (7 • M. Gross, HP. Pfister, F 2007) • R. Scopigno, C. Anduja: Eurographics Tutorial, 200 • E. Grinspun, M. Desbru Applied Introduction, Sigg • L. Szirmay-Kalos: Mont of Computer Graphics, Vi citeseer.ist.psu.edu/szirma | A, numerical ana Group size 60 30 S = independer report pation M. Pauly, P. All Oktober 2010) oint-Based Grap r, M. Goesele, H 02 n (organizers): I graph Course No e-Carlo Methods enna University y-kalos00monted | lysis and numerical linear algebra h/week Workload[h] Cl 4 60 T / 105 S 5. 2 30 T / 75 S 3. at study (graded (not graded (not graded (not graded (not graded) iez, B. Levy, Polygon Mesh bhics, Morgan Kaufmann (21. Jur . Lensch: 3D Data Acquistion, Discrete Differential Geometry: A otes, 2006 s in Global Illumination, Institute of Technology, Vienna. URL: carlo.html, 1999/ | | | | | | | |
| Exam achievements Study achievements Forms of media | analysis und linear algebra C++ Teaching format Lecture Exercises T = face-to-face teaching; Oral presentation, written Successful exercise partici M. Botsch, L. Kobbelt, Processing, A K Peters (7 M. Gross, HP. Pfister, F 2007) R. Scopigno, C. Anduja: Eurographics Tutorial, 200 E. Grinspun, M. Desbru Applied Introduction, Sigg L. Szirmay-Kalos: Mont of Computer Graphics, Vi citeseer.ist.psu.edu/szirma P. Dutre, K. Bala, P. Be | A, numerical ana Group size 60 30 S = independer report pation M. Pauly, P. All Oktober 2010) oint-Based Grap r, M. Goesele, H 02 n (organizers): I graph Course No e-Carlo Methods enna University y-kalos00monted | lysis and numerical linear algebra h/week Workload[h] Cl 4 60 T / 105 S 5.1 2 30 T / 75 S 3.1 at study (graded (not graded (not gr | | | | | | | |
| Exam achievements Study achievements Forms of media | analysis und linear algebra C++ Teaching format Lecture Exercises T = face-to-face teaching; Oral presentation, written Successful exercise partici • M. Botsch, L. Kobbelt, Processing, A K Peters (7 • M. Gross, HP. Pfister, F 2007) • R. Scopigno, C. Anduja: Eurographics Tutorial, 200 • E. Grinspun, M. Desbru Applied Introduction, Sigg • L. Szirmay-Kalos: Mont of Computer Graphics, Vi citeseer.ist.psu.edu/szirma • P. Dutre, K. Bala, P. Be B&T, 2006 | A, numerical ana Group size 60 30 S = independer report pation M. Pauly, P. All: Oktober 2010) ioint-Based Grap r, M. Goesele, H 02 n (organizers): I graph Course No e-Carlo Methods enna University y-kalos00monted scart: Advanced | h/week Workload[h] Cl 4 60 T / 105 S 5.1 2 30 T / 75 S 3.1 at study (graded (not graded (not | | | | | | | |
| Exam achievements Study achievements Forms of media | analysis und linear algebra C++ Teaching format Lecture Exercises T = face-to-face teaching; Oral presentation, written Successful exercise partici • M. Botsch, L. Kobbelt, Processing, A K Peters (7 • M. Gross, HP. Pfister, F 2007) • R. Scopigno, C. Anduja: Eurographics Tutorial, 200 • E. Grinspun, M. Desbru Applied Introduction, Sigg • L. Szirmay-Kalos: Mont of Computer Graphics, Vi citeseer.ist.psu.edu/szirma • P. Dutre, K. Bala, P. Be B&T, 2006 | A, numerical ana Group size 60 30 S = independer report pation M. Pauly, P. All: Oktober 2010) coint-Based Grap r, M. Goesele, H 02 n (organizers): I graph Course No e-Carlo Methods enna University y-kalos00montee skaert: Advanceo s: Physically Ba | lysis and numerical linear algebra h/week Workload[h] Cl 4 60 T / 105 S 5. 2 30 T / 75 S 3. at study (graded (not graded (not graded (not graded (not graded) iez, B. Levy, Polygon Mesh bhics, Morgan Kaufmann (21. Jur . Lensch: 3D Data Acquistion, Discrete Differential Geometry: A otes, 2006 s in Global Illumination, Institute of Technology, Vienna. URL: carlo.html, 1999/ | | | | | | | |

| Module | Seminar Computer Animation | | | | | | |
|--------------------|----------------------------|--|--------------|------------|-------------------|-------|--|
| MA-INF 2210 | | | | | | | |
| Workload | Credit points | Duration | Freque | ncy | | | |
| 120 h | 4 CP | | | | | | |
| Module | Prof. Dr. And | Prof. Dr. Andreas Weber | | | | | |
| coordinator | | | | | | | |
| Lecturer(s) | Prof. Dr. And | Prof. Dr. Andreas Weber | | | | | |
| Classification | Programme | | Mode | Semest | ter | | |
| Classification | M. Sc. Compu | ter Science | Optional | l 2. | | | |
| Technical skills | Ability to und | Ability to understand new research results presented in original | | | | | |
| | scientific pape | scientific papers. | | | | | |
| Soft skills | Ability to pres | sent and to | eritically d | iscuss the | ese results in th | ne | |
| | framework of | the correspo | nding area | | | | |
| Contents | Current confer | rence and jo | urnal pape | ers. | | | |
| Prerequisites | Recommended | : At least 1 | of the follo | owing: | | | |
| | MA-INF 2202 | - Compute | r Animatic | n | | | |
| | MA-INF 2311 | – Lab Com | puter Anir | nation | | | |
| Format | Teaching form | at G | roup size | h/week | Workload[h] | CP | |
| Format | Seminar | | 10 | 2 | 30 T / 90 S | 4 | |
| | T = face-to-fa | ce teaching; | S = indep | endent st | Judy | | |
| Exam achievements | Oral presentat | tion, written | report | | (gra | ded) | |
| Study achievements | none | | | | (not gra | ided) | |
| Forms of media | | | | | | | |
| Literature | | | | | | | |

| | Calastal Th | | | · · · · · · · · · · · · · · · · · · · | | | |
|--------------------|-----------------|------------------------------------|-------------|---------------------------------------|------------------|-------|--|
| Module | Selected To | pics in Sig | gnal Pro | cessing | | | |
| MA-INF 2212 | | | | | | | |
| Workload | Credit points | Duration | Freque | • | | | |
| 180 h | 6 CP | 1 semester | 00 | rear | | | |
| Module | apl. Prof. Dr. | Frank Kurt | h | | | | |
| coordinator | | | | | | | |
| Lecturer(s) | apl. Prof. Dr. | Frank Kurt | h, Prof. D | r. Michae | el Clausen | | |
| Classification | Programme | | Mode | Semest | ter | | |
| Classification | M. Sc. Compu | | Optional | | | | |
| Technical skills | • Introduction | into selecte | d topics of | f digital s | ignal processin | g; | |
| | • Applications | in the field | of Audio | Signal Pro | ocessing; | | |
| | • Methods of . | Automatic F | attern Re | $\operatorname{cognition}$ | | | |
| Soft skills | Audio Signal I | Processing A | pplication | s; Extend | led programmi | ng | |
| | $_{ m skills}$ | kills | | | | | |
| | for signal proc | or signal processing applications; | | | | | |
| | Capability to a | analyze; Tin | ne manage | ment; Pre | esentation skill | s; | |
| | Discussing own | n solutions a | nd solutio | ons of othe | ers, and workir | ng in | |
| | groups. | | | | , | 0 | |
| Contents | The lecture is | presented in | modular | form, who | ere each modul | le | |
| | is motivated fr | om the app | ication sid | le. The p | resented topics | are: | |
| | Windowed Fou | irier transfo | rms; Audio | o Identific | ations; Audio | | |
| | Matching; Sigi | nal Classifica | ation; Hide | den Marke | ov Models; | | |
| | Support Vecto | | , | | , | | |
| Prerequisites | Required: Non | | owing mod | dules have | e been passed: | | |
| • | MA-INF 2203 | | 0 | | - | | |
| | Teaching forma | at G | roup size | h/week | Workload[h] | CP | |
| Format | Lecture | | 60 | 2 | 30 T / 45 S | 2.5 | |
| | Exercises | | 30 | 2 | 30 T / 75 S | 3.5 | |
| | T = face-to-fa | ce teaching; | S = indep | pendent st | udy | | |
| Exam achievements | Oral exam | | | | (gra | ded) | |
| Study achievements | Successful exe | rcise particij | oation | | (not gra | ded) | |
| Forms of media | Slides, Blackb | pard, White | ooard | | | | |
| Literature | | | | | | | |
| L | i | | | | | | |

| Module | Computer V | Vision II | [| | | | |
|--------------------|--|--|---------|------------|----------------------------|--------------|------|
| MA-INF 2213 | | | | - | | | |
| Workload | Credit points | Duration | | Frequer | | | |
| 180 h | 6 CP | 1 semester every year | | | | | |
| Module | Prof. Dr. Juer | gen Gall | | | | | |
| coordinator | | | | | | | |
| Lecturer(s) | Prof. Dr. Juer | gen Gall | | | | | |
| Classification | Programme | | | /lode | Semest | | |
| | M. Sc. Compu | | | Optional | | | |
| Technical skills | Students will l | earn abou | it var | ious lea | rning me | thods and | |
| | their applicati | their applications to computer vision problems. | | | | | |
| Soft skills | | Productive work in small teams, development and realization of | | | | | n of |
| | individual app | individual approaches and solutions, critical reflection of | | | | | |
| | competing methods, discussion in groups. | | | | | | |
| Contents | The class will | The class will cover a number of learning methods and | | | | | |
| | their applicati | ons in con | npute | er vision | . For exa | mple, linear | |
| | methods for cl | | · · | | | _ / | |
| | forests, neural | | | 0 | , | 0, | |
| | neighbors, Ga | | , | , 1 | ° 1 | , | |
| | learning, imag | * | | , | | | |
| | recognition, po | | , | | | , | |
| Prerequisites | Required: | |) | | <i>J J J J J J J J J J</i> | 0 | |
| | MA-INF 2201 | – Compu | ter V | ision | | | |
| | Teaching form | at | Grou | ıp size | h/week | Workload[h] | CP |
| Format | Lecture | | 6 | 30 | 3 | 45 T / 45 S | 3 |
| | Exercises | | ŝ | 30 | 1 | 15 T / 75 S | 3 |
| | T = face-to-fa | ce teachin | ng; S = | = indep | endent st | udy | |
| Exam achievements | Oral exam | | | | | (gra | ded) |
| Study achievements | Successful exe | rcise parti | cipati | ion | | (not gra | ded) |
| Forms of media | | | | | | | |
| Literature | | | | | | | |

| Module MA-INF 2214 | Computatio | onal Photo | graphy | | | |
|-----------------------|---|---|--------------------------------------|------------------------|-----------------------------------|------|
| Workload | Credit points | Duration | Frequer | ncy | | |
| 180 h | 6 CP | 1 semester | every y | ear | | |
| Module | Prof. Dr. Mat | thias Hullin | | | | |
| coordinator | | | | | | |
| Lecturer(s) | | | | | | |
| Classification | Programme M. Sc. Compu | ter Science | Mode Optional | Semest 2. or 3 | | |
| Technical skills | inverse problem Image alignment representation | Foundations in optics and image sensors. Signal processing and nverse problems in imaging. Color spaces and perception. mage alignment and blending. High-dimensional epresentations of light transport (light fields, reflectance fields, effectance distributions). Computational illumination. | | | | |
| Soft skills | to implementto propose ato follow good | Students learn to read and understand current literature in the field to implement standard computational photography techniques to propose and implement solutions to a given problem to follow good scientific practice by planning, documenting and communicating their work | | | | |
| Contents | Topics: • Image sensor • Optics • Panoramas • Light fields • Signal proce • Color, perce • Reflectance f | ssing and inv ption and HI | DR - | | es | |
| Prerequisites | Required: Basic knowled multidimension and numerical | ge in comput nal analysis linear algebr | er graphi ind linear ca, C++ c | cs, data s algebra, | tructures, numerical ana AB | - |
| | Teaching forma | at Gr | oup size | h/week | Workload[h] | CP |
| Format | Lecture | | 60 | 2 | 30 T / 45 S | 2.5 |
| | Exercises $T = face-to-fa$ | ce teaching: | 30 $ $ $S = indep$ | 2 endent st | 30 T / 75 S udy | 3.5 |
| Exam achievements | Oral exam | | F | | | ded) |
| Study achievements | Successful exe | rcise particip | ation | | (not gra | |
| Forms of media | | rP | | | (814 | |
| 2 STHID OF HIGHIG | | | | | | |

| Module MA-INF 2215 | Seminar Digital Material Appearance | | | | | |
|-----------------------|--|--|-------------|------------|-------------------|-------|
| Workload | Credit points | Duration | Freque | ncy | | |
| 120 h | 4 CP 1 semester every year | | | | | |
| Module | Prof. Dr. Matthias Hullin | | | | | |
| coordinator | | | | | | |
| Lecturer(s) | | | | | | |
| Classification | Programme | | Mode | Semest | ter | |
| Classification | M. Sc. Compu | ter Science | Optional | l 2. | | |
| Technical skills | Ability to und | Ability to understand new research results | | | | |
| | presented in o | presented in original scientific papers. | | | | |
| Soft skills | Ability to pres | Ability to present and to critically discuss | | | | |
| | these results in | n the frame | vork of the | e correspo | nding | |
| | area. | amon and in | | | | |
| Contents | Current confer | rence and jo | urnai pape | ers | | |
| Prerequisites | none | | • | 1 / 1 | XX7 11 101 | CD |
| Format | $\frac{\text{Teaching forms}}{\alpha}$ | at G | roup size | h/week | Workload[h] | CP |
| | Seminar | | 10 | 2 | 30 T / 90 S | 4 |
| | T = face-to-fa | ce teaching; | S = indep | endent st | udy | |
| Exam achievements | Oral presentat | tion, written | report | | (gra | ded) |
| Study achievements | none | | | | (not gra | ided) |
| Forms of media | | | | | | |
| Literature | | | | | | |

| Module | Lab Visual | Computing | or S | | | | |
|--------------------|------------------|---|------------|------------|-------------------|-------|--|
| MA-INF 2216 | | | | | | | |
| Workload | Credit points | Duration | Freque | ency | | | |
| 270 h | 9 CP | 1 semester | every 2 | every year | | | |
| Module | Jun-Prof. Dr. | Angela Yao | | | | | |
| coordinator | | | | | | | |
| Lecturer(s) | Jun-Prof. Dr. | Angela Yao | | | | | |
| Classification | Programme | | Mode | Seme | ster | | |
| Classification | M. Sc. Compu | | Optiona | | , 3. or 4. | | |
| Technical skills | The students | The students will carry out a practical task (project) in the | | | | | |
| | context of con | context of computer vision, including test and documentation of | | | | | |
| | the implement | ed software/ | system. | | | | |
| Soft skills | Ability to prop | Ability to properly present and defend | | | | | |
| | design decision | design decisions, to prepare readable documentation of software; | | | | | |
| | skills in constr | skills in constructively collaborating with others in small teams | | | | | |
| | over a longer p | period of tim | e; ability | to classif | fy ones own res | ults | |
| | into the state- | of-the-art of | the resp. | area | | | |
| Contents | | * | | | s and application | ons. | |
| | You will get a | | | | * 0 | | |
| | | | | • | s. At the end of | the | |
| | semester, you | | | | | | |
| | | | a report | describi | ng the method | and | |
| | experimental of | outcomes. | | | | | |
| Prerequisites | none | | | | 1 | 1 | |
| Format | Teaching form | at Gro | oup size | h/week | Workload[h] | CP | |
| lormat | Lab | | 8 | 4 | 60 T / 210 S | 9 | |
| | T = face-to-fa | 8, | | pendent s | • | | |
| Exam achievements | Oral presentat | tion, written | report | | | ided) | |
| Study achievements | none | | | | (not gra | ided) | |
| Forms of media | | | | | | | |
| Literature | | | | | | | |

| Module MA-INF 2217 | Markov Ra | ndom Fiel | ds for V | ision an | d Graphics | |
|-----------------------|---------------------------------|----------------|-------------------------|-------------|------------------|-----------------------|
| Workload | Credit points | Duration | Frequer | | | |
| 180 h | 6 CP | 1 semeste | Frequency every year | | | |
| Module | JunProf. Dr. | | 00 | eai | | |
| coordinator | $\operatorname{Jun-1}$ 101. D1. | Aligela 1a |) | | | |
| | | | | | | |
| Lecturer(s) | D | | 3.4 1 | G | | |
| Classification | Programme | ton Colonco | Mode | Semest | | |
| T | M. Sc. Compu | | Optional | | 3. or 4. | |
| Technical skills | | | | e | narkov random | L |
| | fields and stud | | • | | processing, | |
| | computer visio | | | | | |
| Soft skills | | | , | - | and realization | n of |
| | individual app | | , | | effection of | |
| | competing me | | _ | - | | |
| Contents | This course ad | | - | | | |
| | | | | | and graphics. | We |
| | will cover adva | anced topics | in inferen | ce and lea | arning such as | |
| | loopy belief pr | | | * 0/0 | - | |
| | move-making | algorithms, | dual decon | nposition | and structured | l |
| | learning. App | lications dise | cussed will | include l | ow and mid-lev | vel |
| | vision and gra | phics concep | ots such as | optical fl | low and stereo | |
| | depth, super-r | esolution, su | perpixels, | texture s | ynthesis, | |
| | segmentation a | as well as hi | gher-level | concepts | such as semant | ic |
| | segmentation a | and object d | etection. | | | |
| Prerequisites | Recommended | : | | | | |
| | It is recommen | nded but no | required | to have ta | aken Probabilis | stic |
| | Graphical Mo | dels as a pre | -requisite | for this co | ourse. Those w | ho |
| | have not taker | n Probabilist | ic Graphic | al Model | s should be | |
| | comfortable w | ith concepts | in probab | ility theo | ry and | |
| | optimization. | - | - | Ū | | |
| | Teaching form | at G | roup size | h/week | Workload[h] | CP |
| Format | Lecture | | 60 | 2 | 30 T / 45 S | 2.5 |
| | Exercises | | 30 | 2 | 30 T / 75 S | 3.5 |
| | T = face-to-fa | ce teaching. | I | endent et | , | I |
| Exam achievements | 1 = 1ace-to-1a Written exam | to toaching, | 5 — muep | | - | ded) |
| Study achievements | Successful exe | rcise partici | nation | | (not gra | , |
| Forms of media | Successiui exe. | rense partitel | 7401011 | | | ucuj |
| Literature | No required to | ext supplem | ental readi | ings will k | be given in clas | s |
| Literature | rio required te | z, supplem | cinai reau | | St given in clas | · |

| Module MA-INF 2218 | Video Anal | ytics | | | | | |
|-----------------------|---|--|------------|------------|------------------|-------|--|
| Workload | Credit points | Duration | Frequen | icy | | | |
| 180 h | 6 CP | 1 semester | at least | every 2 g | years | | |
| Module | Prof. Dr. Jürg | gen Gall | | | | | |
| coordinator | | | | | | | |
| Lecturer(s) | Prof. Dr. Jürg | Prof. Dr. Jürgen Gall | | | | | |
| Classification | Programme Mode Semester M. So. Computer Science Optional 2, 2, or 4 | | | | | | |
| Technical skills | - | M. Sc. Computer Science Optional 2., 3. or 4. Students will learn advanced techniques for analyzing video data. | | | | | |
| Soft skills | | Productive work in small teams, development and realization of | | | | | |
| | | a state-of-the-art system for video analysis. | | | | | |
| Contents | The class will | The class will discuss state-of-the-art methods for several tasks | | | | | |
| | of video analys | sis. For exan | ple, video | clip class | sification, temp | ooral | |
| | video segment | ation, spatio | temporal | action de | etection, video | | |
| | context, spatic | o-temporal m | odeling of | humans | and objects, | | |
| | anticipation, a segmentation. | ffordance, vi | deo summ | arization | , semantic vide | eo | |
| Prerequisites | Required: | | | | | | |
| | MA-INF 2201 | - Computer | Vision | | | | |
| | Teaching form | at G | oup size | h/week | Workload[h] | CP | |
| Format | Lecture | | 60 | 2 | 30 T / 45 S | 2.5 | |
| | Exercises | | 30 | 2 | 30 T / 75 S | 3.5 | |
| | T = face-to-fa | ce teaching; | S = indep | endent st | Judy | | |
| Exam achievements | Oral exam | | | | (gra | .ded) | |
| Study achievements | Successful exe | rcise particip | ation | | (not gra | ded) | |
| Forms of media | | | | | | | |
| Literature | | | | | | | |

| Module | Seminar Vi | sualizatior | and Me | edical In | mage Analys | sis | |
|--------------------|----------------------------|--|--------------|--------------|-----------------|-------|--|
| MA-INF 2219 | | | | | | | |
| Workload | Credit points | Duration | on Frequency | | | | |
| 120 h | 4 CP 1 semester every year | | | | | | |
| Module | JunProf. Dr. | JunProf. Dr. Thomas Schultz | | | | | |
| coordinator | | | | | | | |
| Lecturer(s) | JunProf. Dr. | Thomas Sc | hultz | | | | |
| Classification | Programme | | Mode | Semest | ter | | |
| Classification | M. Sc. Compu | ter Science | Optional | 2. | | | |
| Technical skills | Ability to und | Ability to understand new research results presented in original | | | | | |
| | scientific pape | scientific papers. | | | | | |
| Soft skills | Ability to pres | Ability to present and to critically discuss scientific results in the | | | | | |
| | context of the | current stat | e of the ar | t. Ability | to perform an | 1 | |
| | independent se | earch for rele | evant scien | tific litera | ature. | | |
| Contents | Current confer | ence and jo | ırnal pape | rs | | | |
| Prerequisites | Recommended | : | | | | | |
| | MA-INF 2312 | – Image Ac | quisition a | nd Analy | sis in Neurosci | ence | |
| Format | Teaching form | at G | roup size | h/week | Workload[h] | CP | |
| rormat | Seminar | | 10 | 2 | 30 T / 90 S | 4 | |
| | T = face-to-fa | ce teaching; | S = indep | endent st | Judy | | |
| Exam achievements | Oral presentat | tion, written | report | | (gra | ded) | |
| Study achievements | none | | | | (not gra | .ded) | |
| Forms of media | | | | | | | |
| Literature | | | | | | | |

| Module MA-INF 2220 | Lab Visuali | zation and | l Medica | al Imag | e Analysis | |
|-----------------------|---|--|-------------|-----------|------------------|-------|
| Workload | Credit points | Duration | Freque | nau | | |
| 270 h | 9 CP | 1 semester | - | • | | |
| Module | 9 CP 1 semester every year JunProf. Dr. Thomas Schultz | | | | | |
| coordinator | Jun1 101. D1. | 1 nomas Sc | nunz | | | |
| | Jup Prof Dr | Thomas Sa | hultz | | | |
| Lecturer(s) | Programme | JunProf. Dr. Thomas Schultz Programme Mode Semester | | | | |
| Classification | 0 | ton Colongo | | | ster | |
| T | M. Sc. Compu | | - | | (| |
| Technical skills | | The students will carry out a practical task (project) in the | | | | |
| | | context of data visualization and visual analytics or medical mage analysis, including test and documentation of the | | | | |
| | | , 0 | | ocumenta | ation of the | |
| | implemented s | , , | | | | |
| Soft skills | Ability to prop | | | 0 | , | |
| | prepare readab | | | , | | |
| | 0 | | 0 | | nall teams over | |
| | longer period o | of time; abili | ty to clas | sify ones | own results into | o the |
| | state-of-the-ar | t of the resp | . area | | | |
| Contents | | | | | | |
| Prerequisites | Recommended | : | | | | |
| | MA-INF 2312 | – Image Ac | quisition a | and Anal | ysis in Neurosci | ence |
| Format | Teaching forma | at Gr | oup size | h/week | Workload[h] | CP |
| Format | Lab | | 8 | 4 | 60 T / 210 S | 9 |
| | T = face-to-fa | ce teaching; | S = indep | pendent s | study | |
| Exam achievements | Oral presentat | tion, written | report | | (gra | ded) |
| Study achievements | none | | | | (not gra | ided) |
| Forms of media | | | | | | |
| Literature | | | | | | |
| | | | | | | |

| Module | Seminar Vis | Seminar Visual Computing | | | | |
|--------------------|-----------------|--|--------------|-----------|------------------|------|
| MA-INF 2221 | | | 1 | | | |
| Workload | Credit points | Duration | Frequency | | | |
| 120 h | 4 CP | 4 CP 1 semester every year | | | | |
| Module | Jun-Prof. Dr. | Angela Yao | | | | |
| coordinator | | | | | | |
| Lecturer(s) | Jun-Prof. Dr. | Angela Yao | | | | |
| Classification | Programme | | Mode | Semest | ter | |
| Classification | M. Sc. Compu | ter Science | Optional | 2. | | |
| Technical skills | Ability to und | Ability to understand new research results presented in original | | | | |
| | scientific pape | scientific papers. | | | | |
| Soft skills | Ability to pres | sent and to c | ritically di | scuss the | se results in th | ne |
| | framework of t | the correspon | nding area | | | |
| Contents | Current confer | ence and jou | ırnal pape | rs | | |
| Prerequisites | none | | | | | |
| Format | Teaching form | at G | oup size | h/week | Workload[h] | CP |
| rormat | Seminar | | 10 | 2 | 30 T / 90 S | 4 |
| | T = face-to-fa | ce teaching; | S = indep | endent st | udy | |
| Exam achievements | Oral presentat | ion, written | report | | (gra | ded) |
| Study achievements | none | | | | (not gra | ded) |
| Forms of media | | | | | | |
| Literature | | | | | | |

| Module | Advanced T | opics in (| Advanced Topics in Computer Vision | | | | |
|--------------------|--|--|------------------------------------|------------|-----------------|------|--|
| MA-INF 2301 | | | | | | | |
| Workload | Credit points | Duration | Freque | ncy | | | |
| 180 h | 6 CP | 1 semeste | r every y | ear | | | |
| Module | NN | NN | | | | | |
| coordinator | | | | | | | |
| Lecturer(s) | | | | | | | |
| Classification | Programme | | Mode | Semest | ter | | |
| Classification | M. Sc. Compu | ter Science | Optiona | l 3. | | | |
| Technical skills | Advanced com | Advanced computer vision methods | | | | | |
| Soft skills | Productive wo | Productive work in small teams, development and realization of | | | | | |
| | individual app | individual approaches and solutions, critical reflection of | | | | | |
| | competing me | competing methods, discussion in groups. | | | | | |
| Contents | The class focuses on advanced topics in the fields of computer | | | | | | |
| | vision and ima | ige processi | ng. In part | icular, it | will make stud | ents | |
| | familiar with r | ecent devel | opments in | compute | r vision resear | ch. | |
| Prerequisites | Recommended | : | | | | | |
| | MA-INF 2201 | - Compute | r Vision | | | | |
| | Teaching forma | at C | roup size | h/week | Workload[h] | CP | |
| Format | Lecture | | 60 | 2 | 30 T / 45 S | 2.5 | |
| | Exercises | | 30 | 2 | 30 T / 75 S | 3.5 | |
| | T = face-to-fa | ce teaching | S = indep | endent st | Judy | | |
| Exam achievements | Written exam | | | | (gra | ded) | |
| Study achievements | Successful exe | rcise partici | pation | | (not gra | ded) | |
| Forms of media | | | | | | | |
| Literature | Latest topic-re announced in a | | | | ature will be | | |

| Module MA-INF 2302 | Physics-bas | ed Modell | ing | | | |
|-----------------------|---|--|------------------------------|-------------------------|----------------------------|-------|
| Workload | Credit points | Duration | Frequer | ncy | | |
| 180 h | 6 CP | 1 semester | ester at least every 2 years | | | |
| Module | Prof. Dr. And | reas Weber | 1 | | | |
| coordinator | | | | | | |
| Lecturer(s) | Prof. Dr. And | reas Weber | | | | |
| Classification | Programme M. Sc. Compu | ter Science | Mode Optional | Semest 3. | ter | |
| Technical skills | Students learn | tudents learn the fundamental techniques of physics-based | | | | |
| | students shall models. Know | nodelling for computer graphics and computer animation. The students shall be able to choose appropriate mathematical nodels. Knowing the algorithmic techniques and algorithmic ssues, they shall be able to come up with software solutions for specific problems | | | | |
| Soft skills | · · | Social competences (work in groups), communicative skills | | | | |
| | (written and o | ` | · · · | , | | |
| Contents | Initial value p | roblems; par | cicle simul | ation; rigi | id body simula | tion; |
| | multi-body-sys modelling; hai | , | | / | ons response; on synthesis | cloth |
| Prerequisites | Recommended | | | | U | |
| | MA-INF 2111 – ??? | | 0 | phics | | |
| | Teaching forma | at G | oup size | h/week | Workload[h] | CP |
| Format | Lecture | | 60 | 2 | 30 T / 45 S | 2.5 |
| | Exercises | | 30 | 2 | 30 T / 75 S | 3.5 |
| | T = face-to-fa | ce teaching; | S = indep | endent st | udy | |
| Exam achievements | Oral exam | | | | (0 | ded) |
| Study achievements | Successful exer | rcise particip | ation | | (not gra | ded) |
| Forms of media | | | | | | |
| Literature | Dietmar Jac Methoden der David M. Bo Advanced co | Computeration Computeration Computeration Computeration Computer Computer Computer Computeration Com | imation, S s for Game | Springer 2 e Develop | 2006 bers, O'Reilly | |

| | n ı • | тт | | | | |
|----------------------------|---|---|--|---|--|--|
| Rendering | lechnique | S 11 | | | | |
| Credit points | Duration | Frequer | ncy | | | |
| 6 CP 1 semester every year | | | | | | |
| Prof. Dr. Reinhard Klein | | | | | | |
| | | | | | | |
| Prof. Dr. Rein | hard Klein | | | | | |
| Programme | Programme Mode Semester | | | | | |
| M. Sc. Compu | M. Sc. Computer Science Optional 3. | | | | | |
| Analytical form | nulation of | problems r | elated to | image based | | |
| rendering and | knowledge of | of advance | d techniq | ues in the field | of | |
| rendering. Kno | owledge of r | nethods an | d models | for the acquis | ition | |
| and description | n of light so | urces and | optical m | aterial propert | ies | |
| for Computer | Graphics ap | plications. | Knowled | lge of methods | and | |
| | - | | - | 0 | | |
| 0 | - | · · | · · · | Self-depender | nt | |
| <u> </u> | | | | | | |
| ° * | - | , | | - | | |
| - | - | | | 0 | | |
| 0 | | | | | | |
| - | - | | - | | | |
| | research, collaboration abilities, self-management | | | | | |
| | | | | - | | |
| | | | - | 0 | | |
| 8, 8 | | | 0 | d scene modell | ing | |
| = - | | mai photog | graphy | | | |
| | | tures has | c knowled | dre on | | |
| - | | | | - | re in | |
| | e | | | | | |
| | 5020150105, 1 | | 11a1y 515 al | na numericar n | incar | |
| <u> </u> | at G | roup size | h/week | Workload[h] | CP | |
| | | _ | ' | | 2.5 | |
| | | | 2 | / | 3.5 | |
| | ce teaching. | S = indep | endent st | 1 , | I | |
| | ce teaching, | | | | ded) | |
| | rcise partici | pation | | (= | , | |
| | tonoo partitoij | | | (1100 814 | (aca) | |
| • H.P.A. Lense | ch. M. Goes | ele (organi | zers): Re | alistic Materia | ls in | |
| | , | · · · · | , | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | · - / | | | | | |
| , | - | , | | tational | | |
| | | | | | | |
| | Credit points 6 CP Prof. Dr. Rein Prof. Dr. Rein Programme M. Sc. Computer rendering and rendering. Known and description for Computer models for the rendering tech implementation Analytical pro- solution of pra- rendering and strategies and research, collal Topics among modelling tech rendering; digi and rendering; Recommended Algorithms an multidimension stochastic and algebra, C++ Teaching formation Lecture Exercises T = face-to-fa Oral exam Successful exercises T = face-to-fa Oral exam Successful exercises N. Hoffman Games, Siggra • R. Raskar, J | Credit points 6 CPDuration 1 semester 6 CP1 semesterProf. Dr. Reinhard KleinProf. Dr. Reinhard KleinProgrammeM. Sc. Computer ScienceAnalytical formulation of prendering and knowledge of mand description of light some for Computer Graphics appendels for the acquisition rendering techniques and complementation of the baseAnalytical problem description of predering and digital phote strategies and implementation of the baseAnalytical problem description of predering and digital phote strategies and implementation abite to the strategies and implementation and rendering; computation abite to the description of predering and digital photographic strategies and statistics, malgebra, C++Teaching formatGAlgorithms and data struct multidimensional analysisstochastic and statistics, malgebra, C++Teaching formatGLectureExercisesT = face-to-face teaching;Oral examSuccessful exercise particiption• H.P.A. Lensch, M. GoeseComputer Graphics, Siggraph Course M• R. Raskar, J. Tumblin (organizer):Games, Siggraph Course M• R. Raskar, J. Tumblin (organizer): | 6 CP1 semesterevery yrProf. Dr. Reinhard KleinProf. Dr. Reinhard KleinProf. Dr. Reinhard KleinProgrammeModeM. Sc. Computer ScienceOptionalAnalytical formulation of problems rrendering and knowledge of advancedrendering. Knowledge of methods anand description of light sources andfor Computer Graphics applications.models for the acquisition and description, creatsolution of practical problem description, creatsolution of practical problems in therendering and digital photography pstrategies and implementations, self-research, collaboration abilities, self-Topics among others will be: advancedmodelling techniques; algorithms andrendering; digital photography for inand rendering; computational photography for inand rendering; computational analysis und linearstochastic and statistics, numerical aalgebra, C++Teaching formatGroup sizeLecture60Exercises30T = face-to-face teaching; S = indepOral examSuccessful exercise participation• H.P.A. Lensch, M. Goesele (organize)• P. Debevec, E. Reinhard (organize)• N. Hoffman (organizer): PhysicallyGames, Siggraph Course Notes, 2006• R. Raskar, J. Tumblin (organizers) | Credit points 6 CPDuration 1 semesterFrequency every yearProf. Dr. Reinhard Kleinevery yearProf. Dr. Reinhard KleinProgrammeModeSemest SemestM. Sc. Computer ScienceOptional3.Analytical formulation of problems related to rendering and knowledge of advanced technique rendering. Knowledge of methods and models and description of light sources and optical methods for the acquisition and description of ir rendering techniques and digital photography, implementation of the basic algorithms.Analytical problem description, creativity, self- solution of practical problems in the area of in rendering and digital photography, presentation strategies and implementations, self-dependent research, collaboration abilities, self-managem Topics among others will be: advanced mater modelling techniques; algorithms and technique rendering; digital photography for image bases and rendering; computational photography for image bases and renderi | Credit points 6 CPDuration 1 semesterFrequency every yearProf. Dr. Reinhard KleinProf. Dr. Reinhard KleinProf. Dr. Reinhard KleinProgramme M. Sc. Computer ScienceMode OptionalAnalytical formulation of problems related to image based rendering and knowledge of advanced techniques in the field rendering. Knowledge of methods and models for the acquisi and description of light sources and optical material propert for Computer Graphics applications. Knowledge of methods models for the acquisition and description of image based rendering techniques and digital photography. Self-dependent solution of practical problems in the area of image based rendering and digital photography, presentation of solution strategies and implementations, self-dependent literature research, collaboration abilities, self-managementTopics among others will be: advanced material acquisition modeling techniques; algorithms and techniques of image based rendering; digital photography for image based scene modell and rendering; computational photographyRecommended: Algorithms and data structures, basic knowledge on multidimensional analysis und linear algebra, basic knowledgi stochastic and statistics, numerical analysis and numerical li algebra, C++Teac-to-face teaching; S = independent study Oral examOral exam(gra Successful exercise participation(not gra Successful exercise participation(not gra Successful exercise participation(not gra Successful exercise participation(not gra Successful exercise participation, Siggraph Course Notes, 2005• H.P.A. Lensch, M. Goesele (organizers): Realistic Materia Computer Graphics, Siggraph C | |

| Module | Geometry F | Processin | r TT | | | | | |
|--------------------|--|---|---------------|------------|------------------|-------|--|--|
| MA-INF 2305 | | | | | | | | |
| Workload | Credit points | Duration | Freque | ncy | | | | |
| 180 h | 6 CP | 1 semeste | er every y | vear | | | | |
| Module | Prof. Dr. Reinhard Klein | | | | | | | |
| coordinator | | | | | | | | |
| Lecturer(s) | Prof. Dr. Rein | hard Klein | | | | | | |
| Classification | Programme | | Mode | Semes | ter | | | |
| Classification | - | M. Sc. Computer Science Optional 3. | | | | | | |
| Technical skills | | Analytical formulation of problems related to geometry | | | | | | |
| | . 0, | processing, shape analysis and shape retrieval as well as | | | | | | |
| | - | | - | | ques from these | е | | |
| | fields. Self-dep | | | | - | | | |
| Soft skills | Analytical pro | | | | | | | |
| | solution of pra | - | | | 0 | | | |
| | rendering and | | | | | | | |
| | strategies and | - | | - | | | | |
| Contents | research, collab | | | | ne field of geom | otru | | |
| Contents | | | | - | cent developme | • | | |
| | in the area of s | | 0 | | - | | | |
| | others will be | shape anai | bib and bin | spe reurie | van. ropies ani | 0118 | | |
| | Parameteriza | tion of any | 6.000 | | | | | |
| | Parameteriza Shape segme | | | ailarity | | | | |
| | Shape segme Shape classif | | - | - | evel | | | |
| | Shape classifi Shape spaces | | | | evar | | | |
| Prerequisites | Recommended | | tiour snape | anarysis | | | | |
| 1 Toroquisitos | Algorithms an | | ctures, bas | ic knowle | dge on | | | |
| | - | | | | basic knowledg | ge in | | |
| | stochastic and | statistics, | numerical a | analysis a | nd numerical li | near | | |
| | algebra, C++ | | | | | | | |
| | Teaching forma | at (| Froup size | h/week | Workload[h] | CP | | |
| Format | Lecture | | 60 | 2 | 30 T / 45 S | 2.5 | | |
| | Exercises | | 30 | 2 | 30 T / 75 S | 3.5 | | |
| | T = face-to-face | ce teaching | S = indep | oendent st | tudy | | | |
| Exam achievements | Oral exam | | | | (gra | ded) | | |
| Study achievements | Successful exer | rcise partic | pation | | (not gra | ded) | | |
| Forms of media | | | | | | | | |
| | • T. Funkhous | | | | | | | |
| | Analysis of 3D-Models, Siggraph Course Notes, 2004 | | | | | | | |
| | • L. Dryden, F | | a, Statistica | al Shape . | Analysis, John | | | |
| Literature | Wiley & Sons, | | | | | | | |
| | • H. Krim, Jr, | | , | | - | | | |
| | | - | | | Engineering and | 1 | | |
| | Technology), Birkhäuser Boston, 2006 | | | | | | | |

| Module | Virtual Rea | lity | | | | | | |
|--------------------|--|----------------------|-------------|------------|--------------------|------|--|--|
| MA-INF 2306 | | v | | | | | | |
| Workload | Credit points | Duration | Frequen | cy | | | | |
| 180 h | 6 CP | 1 semester | every ye | ear | | | | |
| Module | Prof. Dr. Reinhard Klein | | | | | | | |
| coordinator | | | | | | | | |
| Lecturer(s) | Prof. Dr. Rein | hard Klein | | | | | | |
| | Programme | | Mode | Semest | ter | | | |
| Classification | M. Sc. Compu | ter Science | Optional | 3. | | | | |
| Technical skills | Basic knowledg | | - | e compo | nents of curren | nt | | |
| | VR-Systems, E | Broad knowle | dge of tra | cking-, co | ollision detection | on- | | |
| | and real-time r | | 0 | U , | | | | |
| | integrate hapti | | | - | | | | |
| | with emphasis | | | | | | | |
| | components of | - | - | , | · · | | | |
| Soft skills | Analytical pro | blem descrip | tion, creat | ivity, sel | f-dependent | | | |
| | solution of pra | | | | | | | |
| | presentation of | f solution str | ategies an | d implem | nentations, | | | |
| | self-dependent | literature re | search, col | laboratio | on abilities, | | | |
| | - | self-management | | | | | | |
| Contents | Scene Graphs, | Stereo Seein | g (HW, S | W), Trac | king (HW, SW | 7), | | |
| | Acceleration T | echniques (L | OD; Culli | ng), Coll | ision detection | , | | |
| | Haptics, Sound | l, Special effe | ects (GPU | -Program | nming) | | | |
| Prerequisites | Recommended: | : | | | | | | |
| | Mathematical | background | (multidim | ensional | analysis and lii | near | | |
| | algebra, founda | ations of nur | nerical me | thods), g | ood knowledge | e of | | |
| | the foundation | s of compute | er graphics | 5 | | | | |
| | Teaching forma | at Gr | oup size | h/week | Workload[h] | CP | | |
| Format | Lecture | | 60 | 2 | 30 T / 45 S | 2.5 | | |
| | Exercises | | 30 | 2 | 30 T / 75 S | 3.5 | | |
| | T = face-to-face | ce teaching; | S = indep | endent st | Judy | | | |
| Exam achievements | Oral exam | | | | (gra | ded) | | |
| Study achievements | Successful exer | cise particip | ation | | (not gra | ded) | | |
| Forms of media | | | | | | | | |
| | • K. Stanney (| ed.): Handb | ook of Vir | tual Env | ironments. | | | |
| | Lawrence Erlbaum Associates, 2002 | | | | | | | |
| | • W. Sherman, A. Craig: Understanding Virtual Reality. | | | | | | | |
| Litonature | Morgan Kaufn | nan, 2002 | | | | | | |
| Literature | • D. Pape: Co | mmodity-Ba | sed Projec | tion VR, | , Siggraph Cou | rse | | |
| | Notes, 2006 | | | | | | | |
| | • N. Tatarchuk | κ (organizer) | : Advance | d Real-T | ime Rendering | in | | |
| | ğD Graphics a | nd Games, S | iggraph C | ourse No | otes, 2006 | | | |

| Module | Lab Vision | | | | | | | |
|--------------------|------------------------|--|---------|-----------|--------------------|------------------|------|--|
| MA-INF 2307 | | | | | | | | |
| Workload | Credit points | Duratio | n | Frequency | | | | |
| 270 h | 9 CP | 1 seme | ster | every a | semester | | | |
| Module | Prof. Dr. Juergen Gall | | | | | | | |
| coordinator | | | | | | | | |
| Lecturer(s) | Prof. Dr. Juer | gen Gall | | | | | | |
| Classification | Programme | | ľ | Mode | Seme | ster | | |
| Classification | M. Sc. Compu | ter Scien | nce (| Optiona | al $2. \text{ or}$ | 2. or 3. | | |
| Technical skills | The students v | will carry | r out a | a practi | ical task (| (project) in the | | |
| | context of RG | B-D cam | eras. | | | | | |
| Soft skills | Ability to prop | perly pres | sent a | nd defe | end design | n decisions, to | | |
| | prepare readab | prepare readable documentation of software; skills in | | | | | | |
| | | constructively collaborating with others in small teams over a | | | | | | |
| | e. | | 0 | | | own results into | | |
| | state-of-the-ar | , | | | U | | | |
| Contents | RGBD camera | as: resear | ch top | pics and | d applicat | ions | | |
| Prerequisites | Required: | | | | | | | |
| | MA-INF 2201 | - Compu | uter V | ision | | | | |
| | Good $C++$ pr | ogrammi | ng ski | ills | | | | |
| Format | Teaching form | at | Grou | p size | h/week | Workload[h] | CP | |
| Format | Lab | | 8 | 8 | 4 | 60 T / 210 S | 9 | |
| | T = face-to-fa | ce teachi | ng; S | = inde | pendent s | study | | |
| Exam achievements | Oral presentat | tion, writ | ten re | port | | (0 | ded) | |
| Study achievements | none | | | | | (not gra | ded) | |
| Forms of media | | | | | | | | |
| | , | , | | , | , | Konolige. Consu | ımer | |
| Literature | Depth Camera | as for Con | mpute | er Visio | n: Resear | ch Topics and | | |
| | Applications | | | | | | | |

| Module MA-INF 2308 | Lab Graphics | | | | | | |
|-----------------------|------------------|------------------------------|-------------|----------------|-------------------|-------|--|
| Workload | Credit points | Duration | Freque | ency | | | |
| 270 h | 9 CP | 1 semester | - | every semester | | | |
| Module | Prof. Dr. Rein | hard Klein | | | | | |
| coordinator | | | | | | | |
| Lecturer(s) | Prof. Dr. Rein | nhard Klein | | | | | |
| Classification | Programme | | Mode | Seme | ster | | |
| Classification | M. Sc. Compu | ter Science | Optiona | al 3. | | | |
| Technical skills | The students v | will carry ou | t a pract | ical task (| (project) in the | | |
| | context of | | | | | | |
| | geometry proc | essing, rend | ering, scie | entific vis | ualization or hu | man | |
| | | 0, | 0, | | umentation of t | | |
| | - | implemented software/system. | | | | | |
| Soft skills | Ability to prop | perly presen | and defe | end design | n decisions, to | | |
| | prepare | | | | | | |
| | readable docu | mentation o | f software | e: skills in | constructively | | |
| | | | | , | r a longer period | d of | |
| | time; ability to | o classify on | es own re | sults into | the state-of-the | e-art | |
| | of the resp. ar | ea | | | | | |
| Contents | Varying selected | ed topics clo | se to cur | rent resea | rch in the area | of | |
| | geometry proc | essing, rend | ering, scie | entific vis | ualization or hu | man | |
| | computer inter | raction. | | | | | |
| Prerequisites | none | | | | | | |
| Format | Teaching forma | at Gr | oup size | h/week | Workload[h] | CP | |
| Format | Lab | | 8 | 4 | 60 T / 210 S | 9 | |
| | T = face-to-fa | ce teaching; | S = inde | ependent s | study | | |
| Exam achievements | Oral presentat | ion, written | report | | (gra | ded) | |
| Study achievements | none | | | | (not gra | ded) | |
| Forms of media | | | | | | | |
| Literature | | | | | | | |

| Module | Lab Audio | | | | | |
|--------------------|---------------------------------|-------------------------|--------------|-------------|------------------------------------|-------------------------|
| MA-INF 2309 | | | | | | |
| Workload | Credit points | Duration | Freque | ency | | |
| 270 h | 9 CP | 1 semester | every g | year | | |
| Module | apl. Prof. Dr. | Frank Kurth | 1 | | | |
| coordinator | | | | | | |
| Lecturer(s) | apl. Prof. Dr. | Frank Kurth | n, Prof. I | Dr. Micha | ael Clausen | |
| Classification | Programme | Programme Mode Semester | | | | |
| Classification | M. Sc. Compu | ter Science | Optiona | al 3. | | |
| Technical skills | The students v | will carry out | a practi | ical task (| (project) in the | |
| | context of | | | | | |
| | audio and mus | sic processing | , includi | ng test ar | nd documentatio | on of |
| | the implement | | ., | 0 | | |
| | software/syste | m. | | | | |
| Soft skills | Ability to prop | perly present | and defe | end design | n decisions, to | |
| | prepare | | | | | |
| | readable docur collaborating | mentation of | software | ; skills in | constructively | |
| | 0 | small teams | over a lo | nger perio | od of time; abili | ty to |
| | | | | ••• | , | e l |
| | e | wn results in | to the sta | ate-oi-the | e-art of the resp | • |
| Q + + | area. | | | | | |
| Contents | | | | | | |
| Prerequisites | none | 4 | • | 1 / 1 | 337 11 101 | |
| Format | Teaching formation | at Gro | up size 8 | h/week 4 | Workload[h] 60 T / 210 S | $\frac{\mathbf{CP}}{9}$ |
| | | ee tee chinge (| I | | , | 9 |
| | T = face-to-fa | | | pendent s | | dod) |
| Exam achievements | Oral presentat | ion, written | report | | (0 | $\frac{ded}{ded}$ |
| Study achievements | none | | | | (not gra | ueu) |
| Forms of media | | | | | | |
| Literature | | | | | | |

| Module | Advanced Topics in | n Compute | er Graph | nics II | | | | |
|-----------------------|--|---|--------------------------------------|--------------------------------------|----------------------|--|--|--|
| MA-INF 2310 | | | | | | | | |
| Workload 270 h | Credit pointsDuratio9 CP1 semes | - | | | | | | |
| Module coordinator | Prof. Dr. Reinhard Klein | | | | | | | |
| Lecturer(s) | | | | | | | | |
| | Programme | Mode | Semester | | | | | |
| Classification | M. Sc. Computer Science | M. Sc. Computer Science Optional 3. | | | | | | |
| Technical skills | On completion students s | hould be able | to | | | | | |
| | world problems and design in these areasapply methods of shape problems | • apply methods of shape segmentation and shape similarity to novel problems | | | | | | |
| | • design novel shape retri | | | | | | | |
| | • apply basic concepts of | statistical sha | ape analysis | and shape space | es to | | | |
| | real world applications | diamatria cali | hation alm | with man to come | | | | |
| | • apply geometric and rabased acquisition systems | | bration algo | oritimis to came. | ra | | | |
| | select and apply light source and optical material models for computer graphics applications | | | | | | | |
| | incorporate basic image b | incorporate basic image based algorithms into rendering applications | | | | | | |
| | | - | | | | | | |
| | description, creativity, sel presentation of solution s | • and should have acquired soft skills like analytical problem description, creativity, self-dependent solution of practical problems, presentation of solution strategies and implementations, self-dependen literature research, collaboration abilities, self-management. | | | | | | |
| Soft skills | | | | | | | | |
| Contents | Topics among others will | be: | | | | | | |
| | This class is focussed on a digital appearance proces developments in the area acquistion and modeling | sing. Student of shape anal | s will get fa ysis, shape | miliar with rece retrieval, mater | ent | | | |
| | Parameterization of sur Shape segmentation and Shape classification and | d shape simila | | | | | | |
| | Shape classification and Shape spaces and statis | | | | | | | |
| | Optical material acquis | | | niques | | | | |
| | • Algorithms and techniq | | | | | | | |
| | • Digital photography for | image based | | | ring | | | |
| | • Basic computational ph | otography | | | | | | |
| Prerequisites | none | | | | | | | |
| - | Teaching format | Group size | h/week | Workload[h] | CP | | | |
| Format | Lecture Exercises | $\frac{60}{30}$ | $\begin{vmatrix} 4\\2 \end{vmatrix}$ | 60 T / 105 S 30 T / 75 S | $5.5 \\ 3.5$ | | | |
| | T = face-to-face teaching | S = independent | dent study | | | | | |
| Exam achievements | Oral exam | , 1 | | (gra | aded) | | | |
| Study achievements | Successful exercise partic | pation | | (not gra | , | | | |
| Forms of media | - | | | <u>, 0</u> | / | | | |
| Literature | | | | | | | | |

| Module | Lab Computer Animation | | | | | | |
|--------------------|-------------------------|---------------|---------------------|------------|--------------------|-------|--|
| MA-INF 2311 | _ | | | | | | |
| Workload | Credit points | Duration | Freque | Frequency | | | |
| 270 h | 9 CP | 1 semester | at least every year | | | | |
| Module | Prof. Dr. Andreas Weber | | | | | | |
| coordinator | | | | | | | |
| Lecturer(s) | Prof. Dr. And | reas Weber | | | | | |
| Classification | Programme | | Mode | Seme | ster | | |
| Classification | M. Sc. Compu | | Optiona | | | | |
| Technical skills | | will carry ou | t a practio | cal task (| (project) in the | | |
| | context of | context of | | | | | |
| | - | | - | and docu | mentation of th | ne | |
| | implemented s | , . | | <u> </u> | | | |
| Soft skills | Ability to prop | perly present | and defe | nd desigi | n decisions, to | | |
| | prepare | | | | | | |
| | | mentation of | software; | skills in | constructively | | |
| | collaborating | | | | | | |
| | with others in | small teams | over a lor | iger perio | od of time; abili | ty to | |
| | classify ones o | wn results in | to the sta | te-of-the | -art of the resp | | |
| | area | | | | 1 1 | C | |
| Contents | | - | se to curr | ent resea | rch in the area | of | |
| | computer anim | | C + 1 C 11 | • | | | |
| Prerequisites | Recommended | | | 0 | | | |
| | MA-INF 2202 | - | | | | | |
| | MA-INF 2302 | | | _ | XX7 1 1 101 | CD | |
| Format | Teaching formation | at Gro | oup size | h/week | Workload[h] | CP | |
| | | | 8 | 4 | 60 T / 210 S | 9 | |
| | T = face-to-fa | | | pendent s | | | |
| Exam achievements | Oral presentat | tion, written | report | | (0 | ded) | |
| Study achievements | none | | | | (not gra | .ded) | |
| Forms of media | | | | | | | |
| Literature | | | | | | | |

| M. deele | Image Acqu | visition and | Apoly | ia in N | nuroscionco | | | |
|-----------------------|---|--|------------|-------------|-------------------|-------|--|--|
| Module MA-INF 2312 | image Acqu | lisition and | Analys | 515 III ING | euroscience | | | |
| Workload | Credit points | Duration | Frequer | NGV | | | | |
| 180 h | 6 CP | 1 semester | - | - | voars | | | |
| Module | 6 CP 1 semester at least every 2 years JunProf. Dr. Thomas Schultz | | | | | | | |
| coordinator | Jun1 101. D1. | 1 nonias Sci. | lultz | | | | | |
| Lecturer(s) | JunProf. Dr. Thomas Schultz | | | | | | | |
| Lecturer(s) | | 1 nomas Sci | Mode | Samaad | ton | | | |
| Classification | 0 | ProgrammeModeSemesterM. Sc. Computer ScienceOptional14 | | | | | | |
| Technical skills | - | | | | nd analysis | | | |
| Technical skills | | Students will learn about image acquisition and analysis pipelines which are used in neuroscience. They will understand | | | | | | |
| | | | | | emoval, image | | | |
| | registration an | - | | | · – | | | |
| | machine learni | - | | | | | | |
| | | | - | | | | | |
| | | rom Magnetic Resonance Imaging and on mathematical models or functional and diffusion MRI data. | | | | | | |
| Soft skills | Productive wo | | | | nt solution of | | | |
| | practical probl | | | - | | g. | | |
| | presentation of | | | | <u> </u> | 0/ | | |
| | management, | | | | | | | |
| | complex exper | | | | | | | |
| Contents | | | | nation ar | nd analysis pip | eline | | |
| | that is typicall | ly used in bic | medical s | tudies, fr | om image | | | |
| | acquisition to | image proces | sing and a | statistical | l analysis. | | | |
| Prerequisites | Recommended | : | | | | | | |
| | Mathematical | background | (calculus, | linear alg | gebra, statistics | 5); | | |
| | imperative pro | ogramming. | | | | | | |
| | Teaching forma | at Gr | oup size | h/week | Workload[h] | CP | | |
| Format | Lecture | | 60 | 3 | 45 T / 45 S | 3 | | |
| | Exercises | | 30 | 1 | 15 T / 75 S | 3 | | |
| | T = face-to-fa | ce teaching; S | S = indep | endent st | udy | | | |
| Exam achievements | Oral exam | | | | (gra | ded) | | |
| Study achievements | Successful exer | rcise particip | ation | | (not gra | ded) | | |
| Forms of media | | | | | | , | | |
| | • B. Preim, C. | . Botha: Visu | al Comp | uting for | Medicine: The | ory, | | |
| | Algorithms, and Applications. Morgan Kaufmann, 2014 | | | | | | | |
| | • R.A. Poldrad | ck, J.A. Mum | ford, T.E | . Nichols | : Handbook of | | | |
| Literature | Functional MF | RI Data Anal | ysis. Can | ıbridge U | niversity Press | , | | |
| | 2011 | | | | | | | |
| | • D.K. Jones: | | | | l, and | | | |
| | Applications, Oxford University Press, 2011 | | | | | | | |

| Module | Deep Learn | ing for Vis | sual Rec | ognition | 1 | | |
|--------------------|---|--|-------------|-------------|-------------------------------|--------|--|
| MA-INF 2313 | | D | | | | | |
| Workload | Credit points | Duration | Frequer | - | | | |
| 180 h | 6 CP | 1 semester | every y | ear | | | |
| Module | JunProf. Dr. | Angela Yao | | | | | |
| coordinator | | | | | | | |
| Lecturer(s) | | | | | | | |
| Classification | Programme Mode Semester | | | | | | |
| | M. Sc. Compu | | Optional | | $\frac{3. \text{ or } 4.}{1}$ | 1 | |
| Technical skills | | | | 0 | eural networks | | |
| | study various AI. | applications | in comput | er vision | and other topi | cs in | |
| Soft skills | Productive wo | Productive work in small teams, development and realization of | | | | | |
| | individual app | individual approaches and solutions, critical reflection of | | | | | |
| | competing me | competing methods, discussion in groups. | | | | | |
| Contents | Deep learning | has taken ov | er the ma | chine lear | rning communi | ity | |
| | by storm, with | by storm, with success both in research and commercially. Deep | | | | | |
| | learning is app | olicable over a | a range of | fields such | ch as computer | 2 | |
| | vision, speech | recognition, | natural la | nguage p | rocessing, robo | otics, | |
| | etc. This cour | se will introd | uce the fu | indament | als of neural | | |
| | networks and | then progress | s to state- | of-the-art | convolutional | and | |
| | recurrent neur | al networks a | as well as | their use | in applications | s for | |
| | visual recognit | tion. Student | s will get | a chance | to learn how t | 0 | |
| | implement and | d train their o | own netwo | ork for vis | sual recognition | n | |
| | tasks such as o | object recogn | ition, ima | ge segme | ntation and | | |
| | caption genera | ation. | | | | | |
| Prerequisites | Recommended | : | | | | | |
| | Students are r | ecommended | to have a | ı basic kn | owledge in | | |
| | probability an | d statistics a | nd linear | algebra a | s well as | | |
| | proficiency in | programming | g (python | or Matla | b or $C++$). | | |
| | | | | | | | |
| | Teaching form | at Gr | oup size | h/week | Workload[h] | CP | |
| Format | Lecture | | 60 | 2 | 30 T / 45 S | 2.5 | |
| | Exercises | | 30 | 2 | 30 T / 75 S | 3.5 | |
| | T = face-to-fa | ce teaching; | I | | , , | I | |
| Exam achievements | Oral exam | | | | (gra | ded) | |
| Study achievements | Successful exe | rcise particip | ation | | (not gra | ded) | |
| Forms of media | | | | | | | |
| | No required text. Supplemental readings will be provided in the | | | | | | |
| Literature | lecture. | | | | | 0110 | |

3 Information and Communication Management

| MA-INF 3104 | L2E2 | 6 CP | Intelligent Analysis of Data Streams | . 72 |
|----------------------------|-----------------------|------------------|--|------|
| MA-INF 3105 | L2E2 | 6 CP | Principles of Distributed Systems | . 73 |
| MA-INF 3106 | L2E2 | 6 CP | Privacy in Ubiquitous Computing | . 74 |
| MA-INF 3201 | L2E2 | 6 CP | Network Security | . 75 |
| MA-INF 3202 | L2E2 | 6 CP | Mobile Communication | . 76 |
| MA-INF 3203 | L4E2 | 9 CP | Intelligent Information Systems | . 77 |
| MA-INF 3207 | L2E2 | 6 CP | Advanced Logic Programming | . 78 |
| MA-INF 3209 | $\mathrm{Sem}2$ | 4 CP | Seminar Selected Topics in Communication | |
| | | | Management | . 79 |
| MA-INF 3210 | $\mathrm{Sem}2$ | 4 CP | Seminar Intelligent Information Systems | . 80 |
| MA-INF 3213 | L2E2 | 6 CP | Advanced Topics in Information Systems | . 81 |
| MA-INF 3214 | Sem2 | 4 CP | Seminar Selected Topics in Information Management | |
| MA-INF 3215 | Sem2 | 4 CP | Seminar Selected Topics in Malware Analysis and | |
| | | | Computer/Network Security | . 83 |
| MA-INF 3216 | Sem2 | 4 CP | Seminar Sensor Data Fusion | |
| MA-INF 3218 | | | | |
| MA-INF 3219 | | | Lab Model-Driven Software Engineering | |
| MA-INF 3222 | | | eSecurity | |
| MA-INF 3227 | | | Seminar Anonymity and Privacy on the Internet | |
| | | | Foundations of Information Systems Security | |
| MA-INF 3229 | | 9 CP | Lab IT-Security | |
| | | | Enterprise Information Systems | |
| | | | Seminar Enterprise Information Systems | |
| | | | Lab Enterprise Information Systems | |
| MA-INF 3233 | | | Advanced Sensor Data Fusion in Distributed Systems . | |
| MA-INF 3234 | | | Lab Mobile Sensing Systems | |
| | | | Usable Security and Privacy | |
| | | | IT Security | |
| MA-INF 3237 | | | | |
| MA-INF 3237 MA-INF 3238 | | | | |
| | | | Seminar Natural Language Processing | |
| | | | Lab Natural Language Processing | |
| | | | Lab Distributed Machine Learning | |
| | | | | |
| | | | Temporal Information Systems | |
| MA-INF 3305 | | | Lab Communication and Communicating Devices | |
| | | | Lab Information Systems | |
| MA-INF 3309 | | | Lab Malware Analysis | 106 |
| MA-INF 3310 | L2E2 | 6 CP | | 107 |
| MA INT 0011 | 1 4 1 2 9 | | Applications | |
| MA-INF 3311 | | | Topics in Applied Cryptography | |
| MA-INF 3312 | | 9 CP | Lab Sensor Data Fusion | |
| MA-INF 3313 | | 9 CP | Lab Intelligent Information Systems | |
| MA-INF 3314 | | | Advanced Topics in Information Systems Security | |
| MA-INF 3315 | | | Seminar Advanced Information Systems Security | |
| | Lab4 | 9 CP | Lab Techniques in Information Systems Security | |
| MA-INF 3317 | | | Seminar Selected Topics in IT Security | |
| MA-INF 3318 | | | Seminar Verification of Complex Systems | |
| MA-INF 3319 | | $9 \mathrm{CP}$ | Lab Usable Security and Privacy | |
| MA-INF 3320 | | $9 \mathrm{CP}$ | Lab Security in Distributed Systems | |
| MA-INF 3321 | $\operatorname{Sem}2$ | 4 CP | Seminar Usable Security and Privacy | 118 |

| Module MA-INF 3104 | Intelligent Analysis of Data Streams | | | | | | | |
|-----------------------|--------------------------------------|----------------------------------|---------------|-----------|-----------|-------------|------|--|
| Workload | Credit points | Credit points Duration Frequency | | | | | | |
| 180 h | 6 CP | 1 seme | ster | every y | ear | | | |
| Module | PD Dr. Andre | eas Behre | nd | 1 | | | | |
| coordinator | | | | | | | | |
| Lecturer(s) | PD Dr. Andre | eas Behre | nd | | | | | |
| Classification | Programme | | | Mode | Semest | ter | | |
| Classification | M. Sc. Compu | M. Sc. Computer Science | | | l 1. | 1. | | |
| Technical skills | | | | | | | | |
| Soft skills | | | | | | | | |
| Contents | | | | | | | | |
| Prerequisites | none | | | | | | | |
| | Teaching form | at | \mathbf{Gr} | oup size | h/week | Workload[h] | CP | |
| Format | Lecture | | | 60 | 2 | 30 T / 45 S | 2.5 | |
| | Exercises | | | 30 | 2 | 30 T / 75 S | 3.5 | |
| | T = face-to-fa | ce teachi | ng; \$ | S = indep | endent st | udy | | |
| Exam achievements | Oral exam | | | | | (gra | ded) | |
| Study achievements | Successful exe | rcise part | icip | ation | | (not gra | ded) | |
| Forms of media | | | | | | | | |
| Literature | | | | | | | | |

| Module MA-INF 3105 | Principles o | f Distribu | ted Syst | ems | | | |
|-----------------------|---|---|---|--|--|--|--|
| Workload | Credit points | Duration | Freque | ncv | | | |
| 180 h | 6 CP | 1 semester | - | - | | | |
| Module | Prof. Dr. Pete | | | | | | |
| coordinator | 11011 211 1 000 | | | | | | |
| Lecturer(s) | Dr. Markus E | sch | | | | | |
| Lecturer (3) | Programme | 5011 | Mode | Semes | tor | | |
| Classification | M. Sc. Compu | ter Science | Optional | | | | |
| Technical skills | The students l | | - | , | | | |
| | computer syste includes archit fault tolerance for synchroniza Moreover conce networks as se | computer systems and learn to apply them in practice. This includes architectures of distributed systems, key concepts like fault tolerance and consistency as well as important algorithms for synchronization, distributed mutual exclusion, election etc. Moreover concepts of structured and unstructured overlay networks as self-organization, overlay routing, modeling of complex random networks etc. will be taught. | | | | | |
| Soft skills | Theoretical ex understanding exercises stude own and other that need to b teamwork, tim | Theoretical exercises are given in order to support in-depth understanding of the lecture topics. In the course of these exercises students learn to present their results and discuss their own and others' solutions. In the course of practical assignments that need to be solved in small teams the students learn teamwork, time management, targeted organization of practical work as well as presentation and discussion of their solutions. | | | | | |
| Contents | Physical close Distributed for Distributed for Election in consistency Structured and | Architectures of distributed systems Physical clock synchronization and logical clocks Distributed termination Distributed mutual exclusion Election in distributed systems Fault tolerance of distributed systems Consistency in distributed systems Structured and unstructured overlays Distributed hash tables | | | | | |
| Prerequisites | • Overlay rout Recommended BA-INF 101 "I Bachelor-level Technology | ing Kommunika knowledge o | tion in Ve of Data Co | rteilten Sy ommunica | ystemen", or tion and Intern | net | |
| - | Teaching forma | at G | roup size | h/week | Workload[h] | CP | |
| Format | Lecture Exercises | | $\frac{60}{30}$ | $\frac{2}{2}$ | 30 T / 45 S 30 T / 75 S | $\begin{array}{ c c c c c c c c c c c c c c c c c c c$ | |
| | | - | | | | 0.0 | |
| | T = face-to-fa | ce teaching; | S = indep | endent st | - | | |
| Exam achievements | Oral exam | | | | (= | ded) | |
| Study achievements | Successful exer | cise particij | pation | | (not gra | ded) | |
| Forms of media | | | | | | | |
| Literature | Scientific artic Tanenbaum, v Paradigms (2n (Eds.): Peer-te Barrat, Barthe Complex Netw | an Steen: D d Edition), p-Peer Syste elemy, Vespi | istributed Prentice H ms and Aj gnani, Dyr | Systems: [all, 2007; pplication namical P | Principles and Steinmetz, Wo s, Springer, 20 Processes on | ehrle | |

| Module | Privacy in U | Ubiquitou | s Compu | iting | | | |
|--------------------|--|---|-------------|-----------|---------------------------------|--------|--|
| MA-INF 3106 | v | 1 | 1 | 0 | | | |
| Workload | Credit points | Duration | Freque | ncy | | | |
| 180 h | 6 CP | 1 semeste | r every y | ear | | | |
| Module | JunProf. Dr. | Delphine (| hristin | | | | |
| coordinator | | | | | | | |
| Lecturer(s) | JunProf. Dr. | Delphine (| Christin | | | | |
| | Programme | | Mode | Semes | ter | | |
| Classification | M. Sc. Compu | M. Sc. Computer Science Optional 1., 2. or 3. | | | | | |
| Technical skills | Students gain | Students gain knowledge about key concepts of privacy | | | | | |
| | (including lega | (including legal and economical aspects) and field of ubiquitous | | | | | |
| | computing. Tl | hey are able | to identify | y threats | to privacy in g | iven | |
| | application sce | enarios. The | y learn fu | ndamenta | l techniques to |) | |
| | - | protect users' privacy. Relying on this background, they are able | | | | | |
| | | to understand and analyze cutting-edge solutions. | | | | | |
| Soft skills | | Written and oral communicative skills, critical thinking and | | | | | |
| | - | problem solving skills, teamwork, and time management | | | | | |
| Contents | Introduction t | * ° | - | - | 0, x 0 | | |
| | | threats, privacy-enhancing systems in selected scenarios, usable | | | | | |
| | privacy | | | | | | |
| Prerequisites | Recommended | | | | | | |
| | MA-INF 3202 | | | | 1 | | |
| | Teaching forma | at G | roup size | h/week | Workload[h] | CP | |
| Format | Lecture | | 60 | 2 | 30 T / 45 S | 2.5 | |
| | Exercises | | 30 | 2 | 30 T / 75 S | 3.5 | |
| | T = face-to-fa | ce teaching; | S = indep | endent st | tudy | | |
| Exam achievements | Oral exam | | | | (gra | ided) | |
| Study achievements | Successful exer | rcise partici | pation | | (not gra | ded) | |
| Forms of media | | | | | | | |
| | John Krumm, 2009 | Ubiquitous | Computin | g Fundan | nentals, Crc Pr | · Inc, | |
| | Alessandro Ac Digital Privacy Pubn, 2007 | | | | Lambrinoudal cactices, Auerb | | |
| Literature | Mireille Hildel Madelin, Digit Personal Data | al Enlighter | nment Year | , | , | | |
| | Jan Camenisch Privacy and Id | | | | | | |
| | Additional resolucture | earch literat | ure will be | e annound | ced during the | | |

| Module MA-INF 3201 | Network Se | curity | | | | | | |
|-----------------------|--|--|----------------|---------------------------|------------------|-------|--|--|
| Workload | Credit points | Duration | Freque | ncy | | | | |
| 180 h | 6 CP 1 semester every year | | | | | | | |
| Module | Prof. Dr. Pete | er Martini | | | | | | |
| coordinator | | | | | | | | |
| Lecturer(s) | Prof. Dr. Pete | Prof. Dr. Peter Martini, Dr. Jens Tölle | | | | | | |
| | Programme | , | Mode | Semes | ter | | | |
| Classification | M. Sc. Compu | ter Science | Optional | $1 \mid 2. \text{ or } 3$ | 3. | | | |
| Technical skills | The students l | earn fundar | nental con | cepts of n | etwork security | y. | | |
| | | This includes risks and vulnerabilities of today's computer | | | | | | |
| | | networks, concepts to increase the level of security in these | | | | | | |
| | networks, and | - | | | e e | | | |
| | | techniques, their applications and their weaknesses. | | | | | | |
| Soft skills | Theoretical ex | Theoretical exercises to support in-depth understanding of | | | | | | |
| | | ecture topics and to stimulate discussions, practical exercises in | | | | | | |
| | teamwork to s | eamwork to support time management, targeted organisation of | | | | | | |
| | practical work and critical discussion of own and others' results | | | | | | | |
| Contents | Threats and attack scenarios, organizational aspects, technical | | | | | | | |
| | aspects: securi | ing networks | s using diff | erent fire | wall concepts, | IDS | | |
| | and IPS (intru | sion detecti | on systems | s and intr | usion prevention | on | | |
| | systems), secu | rity protoco | ls for diffe | rent prote | ocol layers, | | | |
| | integrity prote | ction: hash | functions | and their | weaknesses, | | | |
| | certificates, pr | ivacy protec | tion, encry | vption. | | | | |
| Prerequisites | Recommended | : | | | | | | |
| | Bachelor level | knowledge of | of basics of | f commun | ication system | s | | |
| | (e.g. BA-INF | 101 "Komm | unikation i | in Verteil | ten Systemen" | | | |
| | (German Bach | elor Progra | mme Infor | matik, Er | nglish lecture s | lides | | |
| | available) and | /or MA-INF | $3105 - P_{1}$ | rinciples o | of Distributed | | | |
| | Systems | | | | | | | |
| | Teaching forma | at G | roup size | h/week | Workload[h] | CP | | |
| Format | Lecture | | 60 | 2 | 30 T / 45 S | 2.5 | | |
| | Exercises | | 30 | 2 | 30 T / 75 S | 3.5 | | |
| | T = face-to-face | ce teaching; | S = indep | endent st | udy | | | |
| Exam achievements | Oral exam | | | | = | ded) | | |
| Study achievements | Successful exer | rcise partici | oation | | (not gra | ded) | | |
| Forms of media | | | · | | × – | , | | |
| Literature | Christoph B Spektrum Aka Matt Bishop Wesley | demischer V | Verlag | | | | | |

| | Mahila Can | | | | | | |
|--------------------|--|--|-------------|-------------|------------------|-------|--|
| Module | Mobile Communication | | | | | | |
| MA-INF 3202 | | | D | | | | |
| Workload | Credit points | Duration | Frequer | - | | | |
| 180 h | 6 CP 1 semester every year Prof. Dr. Peter Martini | | | | | | |
| Module | Prof. Dr. Pete | er Martini | | | | | |
| coordinator | | | 36 | | | | |
| Lecturer(s) | Prof. Dr. Peter Martini, Dr. Matthias Frank | | | | | | |
| Classification | Programme | ~ . | Mode | Semest | | | |
| | M. Sc. Compu | | Optional | | | | |
| Technical skills | Knowledge about key concepts of mobile communication | | | | | | |
| | including mobility management (both technology independent | | | | | | |
| | | and technology dependent), knowledge about wireless | | | | | |
| | technologies a | | | - | | | |
| | and/or other r | | | - | | ssess | |
| | scenarios with | | | | - | | |
| | - | understanding of communication paradigms of wireless/mobile | | | | | |
| | - | systems and network elements, productive work in small groups, | | | | | |
| | | strengthening skills on presentation and discussion of solutions | | | | | |
| | | to current challenges | | | | | |
| Soft skills | | Theoretical exercises to support in-depth understanding of | | | | | |
| | lecture topics | | | / - | | | |
| | teamwork to s | | - | . – | - | | |
| | practical work | | | | | | |
| Contents | Mobility Management in the Internet, Wireless Communication | | | | | | |
| | Basics, Wirele | | 0 | 0 / | , | | |
| | Communicatio | | | data cor | nmunication), | | |
| | Ad-hoc and Se | | ks. | | | | |
| Prerequisites | Recommended | | | | | | |
| | Bachelor level | 0 | | | e | S | |
| | (e.g. BA-INF | | | | e | | |
| | | | | | nglish lecture s | lides | |
| | available) and | /or MA-INF | 3105 - Pr | inciples of | of Distributed | | |
| | Systems | | | | 1 | | |
| | Teaching forma | at G | oup size | h/week | Workload[h] | CP | |
| Format | Lecture | | 60 | 2 | 30 T / 45 S | 2.5 | |
| | Exercises | | 30 | 2 | 30 T / 75 S | 3.5 | |
| | T = face-to-fa | ce teaching; | S = indep | endent st | Judy | | |
| Exam achievements | Oral exam | | | | (gra | ided) | |
| Study achievements | Successful exe | rcise particip | ation | | (not gra | ded) | |
| Forms of media | | | | | | | |
| | • Jochen Schil | ler: Mobile (| Communic | ations, A | ddison-Wesley | , | |
| | • Jochen Schiller: Mobile Communications, Addison-Wesley, 2003 | | | | | | |
| T : | • William Stallings: Wireless Communications and Networking, | | | | | | |
| Literature | Prentice Hall, 2002 | | | | | | |
| | • Further up-t | o-date litera | ture will b | e annour | nced in due cou | ırse | |
| | before the beg | | | | | | |
| | | | | | | | |

| Module | Intelligent I | nformatio | n Svste | ms | | | | |
|--------------------|--|---|---------------------|---------------------------------------|-------------------------|-------|--|--|
| MA-INF 3203 | | | | | | | | |
| Workload | Credit points | Duration | Freque | ency | | | | |
| 270 h | 9 CP | 1 semester | semester every year | | | | | |
| Module | Prof. Dr. Rain | Prof. Dr. Rainer Manthey | | | | | | |
| coordinator | | | | | | | | |
| Lecturer(s) | Prof. Dr. Rain | ner Manthey | | | | | | |
| Classification | Programme | | Mode | Seme | ster | | | |
| | M. Sc. Compu | | Optiona | | | | | |
| Technical skills | | - | - | 0 | nt of derived da | | | |
| | | <i>u</i> 1 | | e | evelopment and | | | |
| | | pplication modeling. They are able to understand and classify | | | | | | |
| | | he state-of-the-art in research in deductive databases. | | | | | | |
| Soft skills | | Communicative skills (oral/written presentation, "defending" | | | | | | |
| | , , | - | | 0 | nt, self-organisat | , | | |
| | • / / | cial skills (co | nstructiv | e discussi | on, sharing wor | ·k in | | |
| | small teams) | | | | | | | |
| Contents | e e | | | · · · · · · · · · · · · · · · · · · · | ws); efficient qu | v | | |
| | | | , | sed chang | ge management; | ; IS | | |
| | design for rule | | cations | | | | | |
| Prerequisites | Recommended | | | | | | | |
| | | ge of the fou | ndations | of SQL, | predicate logic a | and | | |
| | set theory | | | | 1 | | | |
| | Teaching forma | at Gr | oup size | h/week | Workload[h] | CP | | |
| Format | Lecture | | 60 | 4 | 60 T / 105 S | 5.5 | | |
| | Exercises | | 30 | 2 | $30 { m T} / 75 { m S}$ | 3.5 | | |
| | T = face-to-fa | ce teaching; | S = inde | pendent s | study | | | |
| Exam achievements | Written exam | | | | (gra | ded) | | |
| Study achievements | Successful exer | rcise particip | ation | | (not gra | ded) | | |
| Forms of media | | | | | | | | |
| | • C. Zaniolo, S. Ceri et al.: Advanced Database Systems, | | | | | | | |
| Literature | Morgan Kaufn | , | , | , | | | | |
| | • E. Bertino, C | | | Intelligen | t Database | | | |
| | Systems, Addi | son Wesley, | 2001 | | | | | |

| Module | Advanced L | ogic Prog | ramming | | | | |
|--------------------|--|---|------------------|---------------|------------------|-------|--|
| MA-INF 3207 | | | | | | | |
| Workload | Credit points | Duration | Frequen | cy | | | |
| 180 h | 6 CP | 1 semester | ester every year | | | | |
| Module | Dr. Günter K | niesel | | | | | |
| coordinator | | | | | | | |
| Lecturer(s) | Dr. Günter K | Dr. Günter Kniesel, JunProf. Dr. Janis Voigtländer | | | | | |
| Classification | Programme | | Mode | Semes | ter | | |
| Classification | M. Sc. Compu | M. Sc. Computer Science Optional 2. or 3. | | | | | |
| Technical skills | Ability to mas | Ability to master advanced logic programing techniques and to | | | | | |
| | write clean but highly efficient Prolog programs using these | | | | | | |
| | techniques; co | techniques; competence in problem solving using the declarative | | | | | |
| | paradigm; con | paradigm; competence in using the non-logical features of | | | | | |
| | Prolog; | | | | | | |
| Soft skills | Skills in writte | Skills in written and oral presentation of the solutions to | | | | | |
| | programming | programming assignments, collaboration with other students in | | | | | |
| | small teams | small teams | | | | | |
| Contents | Quick refresh | · · · | 0 | | 0 | | |
| | development e | , | 0, | | 0 | | |
| | backtracking a | and the cut, | context arg | guments, | difference lists | з, | |
| | data structure | | | | | g, | |
| | meta-interpret | . – | | - | | | |
| | meta-interpret | ers, efficient | Prolog pro | grammi | ng, logic progra | am | |
| | analysis. | | | | | | |
| Prerequisites | Recommended | | | | | | |
| | Good knowled | _ | ndations o | f Logic I | | | |
| | Teaching form | at Gi | roup size | h/week | Workload[h] | CP | |
| Format | Lecture | | 60 | 2 | 30 T / 45 S | 2.5 | |
| | Exercises | | 30 | 2 | 30 T / 75 S | 3.5 | |
| | T = face-to-fa | ce teaching; | S = independent | endent st | Judy | | |
| Exam achievements | Oral exam | | | | (gra | ided) | |
| Study achievements | Successful exe | rcise particip | ation | | (not gra | ded) | |
| Forms of media | | | | | | | |
| | W. Clocksin, O | C. Mellish: P | rogrammin | $\log in Pro$ | olog, Springer. | | |
| Literature | • L. Sterling, 1 Press. | E. Shapiro (e | d.): The A | rt of Pro | olog (2nd ed.) | MIT | |
| | Richard O'Keefe: The Craft of Prolog, MIT Press. | | | | | | |
| | | | | | 000. | | |

| Module | Seminar Se | Seminar Selected Topics in Communication | | | | | |
|--------------------|--|---|------------|------------|-----------------|-------|--|
| MA-INF 3209 | Managemer | Management | | | | | |
| Workload | Credit points | Duration | Frequency | | | | |
| 120 h | 4 CP | 1 semester | at least | every ye | ar | | |
| Module | Prof. Dr. Pete | Prof. Dr. Peter Martini | | | | | |
| coordinator | | | | | | | |
| Lecturer(s) | Prof. Dr. Pete | er Martini, F | rof. Dr. M | fichael M | leier | | |
| Classification | Programme | | Mode | Semest | ter | | |
| Classification | M. Sc. Compu | ter Science | Optional | 2. or 3 | 8. | | |
| Technical skills | Ability to und | Ability to understand new research results presented in original | | | | | |
| | scientific pape | rs. | | | | | |
| Soft skills | Ability to pres | Ability to present and to critically discuss these results in the | | | | | |
| | framework of t | framework of the corresponding area. | | | | | |
| Contents | | rence and jo | ırnal pape | rs, curren | nt standardizat | ion | |
| | drafts | | | | | | |
| Prerequisites | Required: | | | | | | |
| | Successful com | * | | | 0 | s: | |
| | Principles of I | | | | / ' | | |
| | | | | nmunicati | ion (MA-INF3: | 202), | |
| | IT Security (N | | | | | | |
| Format | Teaching form | at G | roup size | h/week | Workload[h] | CP | |
| 1 of mat | Seminar | | 10 | 2 | 30 T / 90 S | 4 | |
| | T = face-to-fa | ce teaching; | S = indep | endent st | Judy | | |
| Exam achievements | Oral presentat | tion, written | report | | (gra | ded) | |
| Study achievements | none | | | | (not gra | .ded) | |
| Forms of media | | | | | | | |
| Literature | The relevant literature will be announced towards the end of the | | | | | | |
| | previous seme | ster | | | | | |

| Module | Seminar Int | elligent In | formati | on Syste | ems | | | |
|--------------------|--|---|-------------|---------------------------|----------------|-------|--|--|
| MA-INF 3210 | | | | | | | | |
| Workload | Credit points | Duration | Freque | ncy | | | | |
| 120 h | 4 CP | 4 CP 1 semester at least every year | | | | | | |
| Module | Prof. Dr. Rain | Prof. Dr. Rainer Manthey | | | | | | |
| coordinator | | | | | | | | |
| Lecturer(s) | Prof. Dr. Rain | ner Manthey | | | | | | |
| Classification | Programme | | Mode | Semes | Semester | | | |
| Classification | M. Sc. Compu | ter Science | Optional | $1 \mid 2. \text{ or } 3$ | 3. | | | |
| Technical skills | Ability to acqu | Ability to acquire and evaluate advanced scientific literature; | | | | | | |
| | skills in didact | skills in didactic preparation as well as oral presentation of | | | | | | |
| | complex matters and latest research results; ability to evaluate | | | | | | | |
| | and discuss pr | and discuss presentations of fellow students, and to | | | | | | |
| | constructively | deal with cr | itical feed | back of o | thers | | | |
| Soft skills | | | | | | | | |
| Contents | Varying select | ed topics in | intelligent | informat | ion systems ba | sed | | |
| | on modern res | earch literat | ure | | | | | |
| Prerequisites | none | | | | | | | |
| Format | Teaching form | at G | roup size | h/week | Workload[h] | CP | | |
| rormat | Seminar | | 10 | 2 | 30 T / 90 S | 4 | | |
| | T = face-to-fa | ce teaching; | S = indep | endent st | Judy | - | | |
| Exam achievements | Oral presentat | tion, written | report | | (gra | ded) | | |
| Study achievements | none | | | | (not gra | ided) | | |
| Forms of media | | | | | | | | |
| Literature | The relevant liprevious seme | | l be annou | inced tow | ards the end o | f the | | |

| | Advanced T | onica in | Informat | ion Sust | oma | | | |
|-----------------------|-------------------|---|------------------|-------------|-----------------|------|--|--|
| Module MA-INF 3213 | Advanced T | opics in | mormat | ion syst | ems | | | |
| Workload | Credit points | Duration | Freque | nov | | | | |
| 180 h | 6 CP | 1 semest | - | - | | | | |
| Module | JunProf. Dr. | | | | | | | |
| coordinator | Jun1 101. D1. | Alexanue | | 2 | | | | |
| Lecturer(s) | Jup Prof Dr | JunProf. Dr. Alexander Markowetz | | | | | | |
| Lecturer(s) | Programme | Alexalide | Mode | Semes | ton | | | |
| Classification | M. Sc. Compu | ter Science | | | | | | |
| Technical skills | An in-depth u | | ~ | | | Δ | | |
| Technical skills | - | | 0 | - | 0 | | | |
| | | command of the concepts and terminologies, in order to discuss and compare the various systems, algorithms and approaches. | | | | | | |
| | - | | . , | 0 | | | | |
| | - | The ability to implement the presented systems and algorithms. The ability to dissect (i) the logic of arguments and (ii) | | | | | | |
| | experimental s | | - | - | · · · | | | |
| Soft skills | Oral discussi | | | | | | | |
| Soft Skills | • Written pres | - | | | and cutorials. | | | |
| | • Team collabo | | | | nd practical | | | |
| | problems. | | sorving the | netical al | la practical | | | |
| | • Critical asses | ssment of l | iterature s | vstems al | gorithms and | | | |
| | approaches. | | iterature, 5 | ystems, a | goritinis and | | | |
| Contents | | In depth coverage of a selected topic in Information Systems, in | | | | | | |
| | particular focu | 0 | - | | e | , | | |
| | algorithms. Ex | - | - | - | | | | |
| | Systems, Inform | - | • • | | | | | |
| | Management o | | , | 0 | - | / | | |
| Prerequisites | Required: | | , | | | | | |
| _ | A thorough un | derstandir | ng of Datab | ase Mana | gement System | ıs, | | |
| | such as laid ou | | | | | | | |
| | Solid skills in a | | | | | | | |
| | Algorithms, su | ch as sum | marized by | the intro | ductory book o | f | | |
| | Cormen et al. | | | | | | | |
| | | | | | | | | |
| | Teaching forma | at | Group size | h/week | Workload[h] | CP | | |
| Format | Lecture | | 60 | 2 | 30 T / 45 S | 2.5 | | |
| | Exercises | | 30 | 2 | 30 T / 75 S | 3.5 | | |
| | T = face-to-face | ce teaching | | I | | I | | |
| Exam achievements | Written exam | | $s, b = mde_{1}$ | Jonuenti Bi | | ded) | | |
| Study achievements | Successful exer | rcise nartic | ination | | (not gra | | | |
| Forms of media | | Lose partic | 1Paulon | | (not gra | ucuj | | |
| FOLIDS OF ITIEUTA | Recent scientif | ic nublicat | ions and a | plected ch | anters of advar | nced | | |
| Literature | | ic publicat | ions, and s | sieuteu ch | apters of auval | iceu | | |
| | textbooks. | | | | | | | |

| Module MA-INF 3214 | Seminar Selected Topics in Information Management | | | | | | |
|-----------------------|--|------------------------------------|------|-----------|------------|------------------|-------|
| Workload | Credit points Duration Frequency | | | | | | |
| 120 h | 4 CP . | 1 semest | er | every y | - | | |
| Module | JunProf. Dr. | Alexander | r Ma | arkowetz | Z | | |
| coordinator | | | | | | | |
| Lecturer(s) | JunProf. Dr. | Alexander | r Ma | arkowetz | 3 | | |
| Classification | Programme Mode Semester | | | | | | |
| Classification | M. Sc. Compu | M. Sc. Computer Science Optional | | 2. | 2. | | |
| Technical skills | | | | | | | |
| Soft skills | Ability to pres | sent and to | crit | cically d | iscuss the | se results in th | ne |
| | framework of t | the corresp | ond | ing area | | | |
| Contents | Current confer | ence and j | ourr | nal pape | rs. | | |
| Prerequisites | none | | | | | | |
| Format | Teaching forma | at | Groi | up size | h/week | Workload[h] | CP |
| rormat | Seminar | | | 10 | 2 | 30 T / 90 S | 4 |
| | T = face-to-fa | ce teaching | s; S | = indep | endent st | udy | |
| Exam achievements | Oral presentat | ion, writte | n re | port | | (gra | .ded) |
| Study achievements | none (not graded) | | | | | | |
| Forms of media | | | | | | | |
| Literature | | | | | | | |

| Module | Seminar Selected Topics in Malware Analysis and | | | | | | |
|--------------------|--|---|-------------|-----------|-----------------|-------|--|
| MA-INF 3215 | Computer/ | Network S | ecurity | | | | |
| Workload | Credit points | Duration | Frequer | ncy | | | |
| 120 h | 4 CP | 1 semester | at least | every ye | ar | | |
| Module | Prof. Dr. Peter Martini | | | | | | |
| coordinator | | | | | | | |
| Lecturer(s) | Prof. Dr. Pete | er Martini, F | rof. Dr. M | Iichael M | leier | | |
| Classification | Programme | | Mode | Semest | ter | | |
| Classification | M. Sc. Compu | | Optional | | | | |
| Technical skills | Ability to und | Ability to understand new research results presented in original | | | | | |
| | scientific pape | scientific papers. | | | | | |
| Soft skills | Ability to pres | Ability to present and to critically discuss these results in the | | | | | |
| | framework of the corresponding area. | | | | | | |
| Contents | Current conference and journal papers, current standardization | | | | | | |
| | drafts - with a | specific top | ic focus or | Malware | - Analysis | | |
| | Computer and | * * | | | s rinaryons, | | |
| Prerequisites | Required: | | J | | | | |
| • | Successful con | npletion of a | least one | of the fo | llowing lecture | es: | |
| | Principles of I | Distributed S | ystems (M | [A-INF31 | 05), Network | | |
| | Security (MA- | INF3201), N | Iobile Con | nmunicati | ion (MA-INF3 | 202), | |
| | IT Security (N | IA-INF3236 |) | | | | |
| | Recommended | : | | | | | |
| | | | | | | | |
| | Teaching forma | at G | roup size | h/week | Workload[h] | CP | |
| Format | Seminar | | 10 | 2 | 30 T / 90 S | 4 | |
| | T = face-to-fa | ce teaching; | S = indep | endent st | udy | | |
| Exam achievements | Oral presentat | tion, written | report | | (gra | ided) | |
| Study achievements | none | | | | (not gra | ided) | |
| Forms of media | | | | | | | |
| Literature | | | | | | | |

| Seminar Sensor Data Fusion | | | | | | | |
|---|---|---|---|--|--|--|--|
| | 1 | | | | | | |
| Credit points | Duration | Frequency | | | | | |
| 4 CP | 1 semeste | every y | ear | | | | |
| P.D. Dr. Wolfgang Koch | | | | | | | |
| | | | | | | | |
| P.D. Dr. Wolf | gang Koch | | | | | | |
| Programme Mode Semester | | | | | | | |
| M. Sc. Compu | I. Sc. Computer Science C | | | | | | |
| Ability to und | Ability to understand new research results presented in original | | | | | | |
| scientific pape | scientific papers. | | | | | | |
| Ability to pres | sent and to o | critically d | iscuss the | ese results in th | ne | | |
| framework of | framework of the corresponding area. | | | | | | |
| Current confer | rence and jo | urnal pape | rs | | | | |
| none | | | | | | | |
| Teaching form | at G | roup size | h/week | Workload[h] | CP | | |
| Seminar | | 10 | 2 | 30 T / 90 S | 4 | | |
| T = face-to-fa | ce teaching; | S = indep | endent st | udy | | | |
| Oral presentat | tion, written | report | | (gra | ded) | | |
| none | | | | (not gra | ded) | | |
| | | | | | | | |
| The relevant literature will be announced at the beginning of the | | | | | | | |
| seminar. | | | | _ | | | |
| | Credit points4 CPP.D. Dr. WolfProgrammeM. Sc. ComputAbility to undscientific papeAbility to pressframework of framework of framewor | Credit points 4 CPDuration 1 semester4 CP1 semesterP.D. Dr. Wolfgang KochP.D. Dr. Wolfgang KochProgramme M. Sc. Computer ScienceAbility to understand new scientific papers.Ability to understand new scientific papers.Ability to present and to o framework of the corresponence Current conference and jour noneTeaching formatG G SeminarT = face-to-face teaching; Oral presentation, written noneThe relevant literature will | Credit points 4 CPDuration 1 semesterFrequence every yes4 CP1 semesterevery yesP.D. Dr. Wolfgang KochProgrammeModeP.D. Dr. Wolfgang KochModeModeM. Sc. Computer ScienceOptionalAbility to understand new research r scientific papers.OptionalAbility to present and to critically dif framework of the corresponding areaCurrent conference and journal papeCurrent conference and journal papenoneTeaching formatGroup sizeSeminar10T = face-to-face teaching; S = indepOral presentation, written reportnoneThe relevant literature will be annou | Credit points 4 CPDuration 1 semesterFrequency every year4 CP1 semesterevery yearP.D. Dr. Wolfgang KochProgramme ModeModeProgramme M. Sc. Computer ScienceMode OptionalSemess 2.Ability to understand new research results prescientific papers.Ability to present and to critically discuss the framework of the corresponding area.Current conference and journal papers noneGroup size 10h/weekSeminar102T = face-to-face teaching; S = independent st Oral presentation, written report noneThe relevant literature will be announced at t | Credit pointsDurationFrequency4 CP1 semesterevery yearP.D. Dr. Wolfgang Kochevery yearP.D. Dr. Wolfgang KochProgrammeModeSemesterM. Sc. Computer ScienceOptional2.Ability to understand new research results presented in origiscientific papers.Ability to present and to critically discuss these results in the framework of the corresponding area.Current conference and journal papersnoneTeaching formatGroup sizeh/weekWorkload[h]Seminar10230 T / 90 ST = face-to-face teaching; S = independent studyOral presentation, written report(gramone)The relevant literature will be announced at the beginning or | | |

| Module | Seminar Mo | odel-Driv | ven Softw | vare Engi | ineering | |
|--------------------|--|---|--|---|---|--|
| MA-INF 3218 | | | | | | |
| Workload 120 h | Credit points 4 CP | Duration 1 semeste | r overv v | | | |
| Module | Dr. Günter Kni | | r every y | ear | | |
| coordinator | DI. Guittei Kiii | .6561 | | | | |
| Lecturer(s) | Dr. Günter Kni | esel | | | | |
| Classification | Programme | | Mode | Semester | | |
| Classification | M. Sc. Comput | | Optional | 2. | | |
| Technical skills | On successful co | ompletion o | f this modu | le, students | should be able to: | |
| | software develop • Describe the of driven developm | oment common fea nent approa tability of a riate tools f | tures and p ches model driv or model dr | eculiarities en approacl iven develoj | n and traditional of different model h for a given project pment tasks | |
| Soft skills | On successful co | | | | should have | |
| | refined their sci | - | | | | |
| | should be able t | | ing and proc | 0110001011 011 | | |
| | | | . J L | | • <i>t</i> | |
| | Mine for profound knowledge about a given subject Distill and communicate the summary of a computer science orally Evaluate the scientific integrity of a written summary Use modern presentation software | | | | | |
| Contents | Inhalte | | | | | |
| | Model driven so | oftware deve | lopment co | ncepts, tools | s and methods. | |
| | In particular: | In particular: | | | | |
| | Models, meta-models and meta-meta-models (General, I EMOF, ECORE) Text to model, model to model, model to text transform Imperative versus declarative model transformation Model-driven versus other software development approa Best practice and research issues in model based develop | | | | | |
| Prerequisites | Recommended | | | | | |
| | MA-INF 3207 – | Advanced | Logic Progr | amming | | |
| D | Teaching forma | at | Group size | h/week | Workload[h] CP | |
| Format | Seminar | | 10 | 2 | 30 T / 90 S 4 | |
| | T = face-to-face | e teaching: S | S = independent | ident study | · · · · | |
| Exam achievements | Oral presentatio | 0, | - | | (graded) | |
| Study achievements | none | | - | | (not graded) | |
| Forms of media | • Web page: ht | tps://sewiki | .iai.uni-bon | n.de/teachi | ng/seminars/start | |
| | • Slides (Power) | - , , | | | | |
| Literature | Management". ' • "Model-Driver Book, Volker G | n Software I Thomas Sta n Software I ruhn (Eds), kel: Model | hl, Markus Developmen ISBN 978-3 Driven Arc | Voelter, Wi t". Sami Be 3-540-25613 | gy, Engineering, iley 2006. eydeda , Matthias -7, Springer 2005 applying MDA to | |

| Module | Lab Model-Driven Software Engineering | | | | |
|--------------------|--|--|--|--|--|
| MA-INF 3219 | Lab Model-Driven Software Engineering | | | | |
| Workload | Credit points Duration Frequency | | | | |
| 270 h | 9 CP 1 semester every year | | | | |
| Module | Dr. Günter Kniesel | | | | |
| coordinator | | | | | |
| Lecturer(s) | Dr. Günter Kniesel | | | | |
| Classification | Programme Mode Semester | | | | |
| | M. Sc. Computer Science Optional 2. | | | | |
| Technical skills | On successful completion of this module, students should be able to: | | | | |
| | Describe the process of model driven software development (MDSD) and support this description with personal experiences Connect model driven software development guidelines to concrete practical examples Be able to use one or several concrete MDSD tools and techniques and explain their use to others | | | | |
| Soft skills | Students should be able to: | | | | |
| | Run a software project based on MDSD tools, techniques and methods Establish and iteratively evolve a project plan Collaborate in a team Estimate the required time and other resources for given tasks Manage a software development project with time constraints | | | | |
| Contents | Model driven software development methods are the key to a new level | | | | |
| | of | | | | |
| | automation and tool integration in software development. Students will | | | | |
| | learn how MDSE concepts, tools an methods boost the development of | | | | |
| | general purpose and domain specific languages, leverage software quality | | | | |
| | analysis tools and foster automated software improvement. | | | | |
| Prerequisites | Required: MA-INF 3218 – Seminar Model-Driven Software Engineering | | | | |
| | The seminar lays the conceptual foundations for the work in the lab. | | | | |
| | Teaching format Group size h/week Workload[h] CP | | | | |
| Format | $\begin{array}{c c c c c c c c c c c c c c c c c c c $ | | | | |
| | T = face-to-face teaching; $S = $ independent study | | | | |
| Exam achievements | Oral presentation, written report (graded) | | | | |
| Study achievements | none (not graded) | | | | |
| Forms of media | • Web page: https://sewiki.iai.uni-bonn.de/teaching/labs/start | | | | |
| | • Slides (Powerpoint/PDF) | | | | |
| | • Wiki as a shared knowledge base | | | | |
| | • Task Tracking System (Electronical or Physical) | | | | |
| | • Shared repository for source code and development documents | | | | |
| | • Mailing list | | | | |
| | • "Model-Driven Software Development: Technology, Engineering, Management", Thomas Stahl, Markus Voelter, Wiley 2006 | | | | |
| | Management". Thomas Stahl, Markus Voelter, Wiley 2006."Model-Driven Software Development". Sami Beydeda , Matthias | | | | |
| Literature | Book, Volker Gruhn (Eds), ISBN 978-3-540-25613-7, Springer 2005David S. Frankel: Model Driven Architecture: Applying MDA to | | | | |
| | Enterprise Computing, John Wiley Modellgetriebene Softwareentwicklung, Techniken, Engineering, Management. dPunkt, 2005 | | | | |

| Module | eSecurity | | | | | |
|--------------------|---|----------------|------------|-------------|---------------------------|-------|
| MA-INF 3222 | - | | | | | |
| Workload | Credit points | Duration | Freque | ency | | |
| 270 h | 9 CP | 1 semester | every | year | | |
| Module | Prof. Dr. Joac | him von zur | Gathen | | | |
| coordinator | | | | | | |
| Lecturer(s) | Prof. Dr. Joac | chim von zur | Gathen, | Dr. Mich | nael Nüsken | |
| Classification | Programme | | Mode | Seme | ster | |
| Classification | M. Sc. Compu | ter Science | Optiona | al 2. | | |
| Technical skills | Understanding | g of security | concerns | and meas | sures, and of the | е |
| | interplay betw | een computi | ng power | and secu | rity requiremen | ts in |
| | | | | · - | cular internet-b | ased |
| | ones. Mastery | | - | | e design of | |
| | cryptosystems | <u>^</u> | ° * | • | | |
| Soft skills | Oral presentat | ion (in tuto | ial group | s), writte | n presentation | (of |
| | | , , | | ion in solv | ving homework | |
| | problems, criti | | | | | |
| Contents | First focus: se | | | | - | |
| | Furthermore: | at least one | real world | d applicat | tion, for exampl | e |
| | • electronic he | alth cards, | | | | |
| | \bullet electronic ele | ections, or | | | | |
| | • electronic pa | ssports. | | | | |
| Prerequisites | Required: | | | | | |
| | MA-INF 1103 | - Cryptogra | phy | | | |
| | Teaching forma | at Gr | oup size | h/week | Workload[h] | CP |
| Format | Lecture | | 60 | 4 | 60 T / 105 S | 5.5 |
| | Exercises | | 30 | 2 | $30~{ m T}$ / $75~{ m S}$ | 3.5 |
| | T = face-to-fa | ce teaching; | S = inde | pendent s | study | |
| Exam achievements | Written exam | | | | (9) | ded) |
| Study achievements | Successful exer | rcise particip | ation | | (not gra | ded) |
| Forms of media | | | | | | |
| | Varying according to the selected topic | | | | | |

| Module MA-INF 3227 | Seminar An | onymity a | nd Priva | acy on t | the Internet | |
|-----------------------|-----------------|---------------|-----------------|------------|------------------|------|
| Workload | Credit points | Duration | Frequen | cy | | |
| 120 h | 4 CP | 1 semester | every ye | ear | | |
| Module | Prof. Dr. Björ | n Scheuerma | inn | | | |
| coordinator | | | | | | |
| Lecturer(s) | Prof. Dr. Björ | rn Scheuerma | nn | | | |
| Classification | Programme | | Mode | Semest | ter | |
| Classification | M. Sc. Compu | ter Science | Optional | 2. | | |
| Technical skills | Ability to und | erstand new | research re | esults pro | esented in origi | inal |
| | scientific pape | rs. | | | | |
| Soft skills | Ability to pres | sent and to c | ritically di | scuss the | se results in th | ne |
| | framework of t | the correspon | nding area. | | | |
| Contents | Current confer | rence and jou | ırnal papeı | s. | | |
| Prerequisites | none | | | | | |
| Format | Teaching forma | at G | oup size | h/week | Workload[h] | CP |
| ronnat | Seminar | | 10 | 2 | 30 T / 90 S | 4 |
| | T = face-to-fa | ce teaching; | S = independent | endent st | Judy | |
| Exam achievements | Oral presentat | ion, written | report | | (gra | ded) |
| Study achievements | none | | | | (not gra | ded) |
| Forms of media | | | | | | |
| Literature | | | | | | |

| Module | Foundations | s of Inform | nation S | ystems | Security | | |
|--------------------|-----------------|----------------------------------|--------------|------------|-----------------|--------|--|
| MA-INF 3228 | | | | | | | |
| Workload | Credit points | Credit points Duration Frequency | | | | | |
| 180 h | 6 CP | 1 semester | every y | ear | | | |
| Module | PD Dr. Adria | n Spalka | | | | | |
| coordinator | | | | | | | |
| Lecturer(s) | PD Dr. Adria | n Spalka | | | | | |
| Classification | Programme | | Mode | Semest | ter | | |
| Classification | M. Sc. Compu | ter Science | Optional | 1. | | | |
| Technical skills | | | | | | | |
| Soft skills | | | | | | | |
| Contents | The security o | f networked | informatio | on system | s depends on f | our | |
| | factors: auther | nticity, avail | ability, cor | fidentiali | ty and integrit | y. | |
| | This lecture ex | xamines thei | r theoretic | al founda | ations and prac | etical | |
| | implementatio | n. Along the | e historical | l developr | ment, the empl | nasis | |
| | is put on mode | ern informat | ion systen | ns, such a | s those in the | | |
| | cloud. | | | | | | |
| Prerequisites | none | | | | | | |
| | Teaching forma | at G | roup size | h/week | Workload[h] | CP | |
| Format | Lecture | | 60 | 2 | 30 T / 45 S | 2.5 | |
| | Exercises | | 30 | 2 | 30 T / 75 S | 3.5 | |
| | T = face-to-fa | ce teaching; | S = indep | endent st | udy | | |
| Exam achievements | Written exam | | | | (gra | ded) | |
| Study achievements | Successful exe | rcise particij | ation | | (not gra | ded) | |
| Forms of media | Most content | will be hand | written o | n the boa | rd with the | | |
| | supplement of | a few slides | There are | e no hand | louts. | | |
| Literature | A text-book of | n cryptograp | hy is advi | sable. | | | |

| Module | Lab IT-Security | | | | | | |
|--------------------|-----------------|----------------------------------|-------------|------------|------------------|-------|--|
| MA-INF 3229 | | | | | | | |
| Workload | Credit points | Credit points Duration Frequency | | | | | |
| 270 h | 9 CP | 9 CP 1 semester every semester | | | | | |
| Module | Prof. Dr. Mich | Prof. Dr. Michael Meier | | | | | |
| coordinator | | | | | | | |
| Lecturer(s) | Prof. Dr. Mich | hael Meier | | | | | |
| Classification | Programme | | Mode | Seme | ster | | |
| Classification | M. Sc. Compu | ter Science | Optiona | 1 2. or | 3. | | |
| Technical skills | The students | will carry ou | t a practi | cal task (| (project) in the | | |
| | context of IT | Security, inc | uding tes | t and do | cumentation of | the | |
| | implemented s | oftware/syst | em. | | | | |
| Soft skills | Ability to prop | perly present | and defe | nd desig | n decisions, to | | |
| | prepare readal | ole documen | tation of s | software; | skills in | | |
| | constructively | collaboratin | g with ot | hers in sr | nall teams over | a | |
| | longer period | of time; abili | ty to clas | sify ones | own results into | o the | |
| | state-of-the-ar | t of the resp | area | | | | |
| Contents | | | | | | | |
| Prerequisites | none | | | | | | |
| Format | Teaching form | at Gr | oup size | h/week | Workload[h] | CP | |
| Format | Lab | | 8 | 4 | 60 T / 210 S | 9 | |
| | T = face-to-fa | ce teaching; | S = indep | pendent s | study | | |
| Exam achievements | Oral presentat | tion, written | report | | (gra | .ded) | |
| Study achievements | none | | | | (not gra | ded) | |
| Forms of media | | | | | | | |
| Literature | | | | | | | |

| Module MA-INF 3230 | Enterprise l | Informatio | n Syster | ns | | |
|-----------------------|--|-------------------------------------|--------------|------------|------------------|-------|
| Workload | Credit points | Duration | Frequen | cy | | |
| 180 h | 6 CP | 1 semester | every ye | ear | | |
| Module | Prof. Dr. Söre | en Auer | | | | |
| coordinator | | | | | | |
| Lecturer(s) | Prof. Dr. Söre | en Auer | | | | |
| | Programme | | Mode | Semest | er | |
| Classification | M. Sc. Compu | M. Sc. Computer Science Optional 1. | | | | |
| Technical skills | Students acqui | ire knowledg | e in the de | esign, dev | elopment and | use |
| | of information | systems in c | ompanies | and organ | nizations in gen | neral |
| | but also in onl | ine commun | ities, and i | nter-ente | rprise value ch | ains. |
| Soft skills | | | | | | |
| Contents | • Information | systems in t | he enterpr | ise, in pa | rticular Enterp | orise |
| | Resource Plan | ning (ERP), | Customer | Relation | ship Managen | nent |
| | (CRM), Suppl | y Chain Ma | nagement | (SCM), d | ata warehouse | / |
| | business intelli | igence, e-con | nmerce, ge | ographic | information | |
| | systems. | | | | | |
| | • technologies | for the impl | ementation | n of mode | ern information | 1 |
| | systems and in | nformation s | ystem envi | ronments | : in particular | , |
| | service-oriente | d informatio | n system a | architectu | res, workflow | |
| | management (| BPEL), sem | antic-base | d data in | tegration, busi | ness |
| | process manag | gement, | | | | |
| | • Information | systems for | the proces | sing of B | ig Data in | |
| | particular tran | nsactions (O) | LTP) and a | analytica | l information | |
| | systems (OLA | P) for decisi | on support | . Data V | Varehousing an | nd |
| | Data Mining. | | | | | |
| Prerequisites | none | | | | | |
| | Teaching forma | at G | roup size | h/week | Workload[h] | CP |
| Format | Lecture | | 60 | 2 | 30 T / 45 S | 2.5 |
| | Exercises | | 30 | 2 | 30 T / 75 S | 3.5 |
| | T = face-to-fa | ce teaching: | S = indep | endent st | udy | |
| Exam achievements | Written exam | 0) | T | | | ded) |
| Exam admevements | Successful exercise participation (graded) | | | | | |
| Study achievements | | rcise particip | ation | | (not gra | ded) |
| | | rcise particip | oation | | (not gra | ded) |

| Module MA-INF 3231 | Seminar En | Seminar Enterprise Information Systems | | | |
|-----------------------|----------------------------|--|--------------|-------------|---------------------|
| Workload | Credit points | Duration | Freque | ncy | |
| 120 h | 4 CP | 1 semeste | r every y | vear | |
| Module | Prof. Dr. Söre | en Auer | I | | |
| coordinator | | | | | |
| Lecturer(s) | Prof. Dr. Söre | en Auer | | | |
| Classification | Programme | | Mode | Semest | ter |
| Classification | M. Sc. Compu | ter Science | Optiona | $1 \mid 2.$ | |
| Technical skills | Ability to und | erstand nev | v research : | results pre | esented in original |
| | scientific pape | rs and tech | nologies in | the area of | of Enterprise |
| | Information S ₂ | ystems. | | | |
| Soft skills | Ability to pres | sent and to | critically d | iscuss the | ese results in the |
| | framework of t | the correspo | onding area | ι. | |
| Contents | Recent confere | ence and jo | ırnal papeı | S | |
| | Technologies s | uch as ERI | , CRM, SO | CM, datab | base and data |
| | warehousing s | ystems | | , | |
| Prerequisites | none | - | | | |
| Format | Teaching form | at (| roup size | h/week | Workload[h] CP |
| Format | Seminar | | 10 | 2 | 30 T / 90 S 4 |
| | T = face-to-fa | ce teaching | S = indep | bendent st | udy |
| Exam achievements | Oral presentat | tion, written | report | | (graded) |
| Study achievements | none | | | | (not graded) |
| Forms of media | | | | | |
| Literature | | | | | |

| Module MA-INF 3232 | Lab Enterp | rise Infor | mation | Systems | 5 | | |
|-----------------------|-----------------|----------------------------------|-------------|-------------|------------------|----------|--|
| Workload | Credit points | Credit points Duration Frequency | | | | | |
| 270 h | 9 CP | 1 semeste | r every | year | | | |
| Module | Prof. Dr. Söre | en Auer | ¥ | | | | |
| coordinator | | | | | | | |
| Lecturer(s) | Prof. Dr. Söre | en Auer | | | | | |
| Classification | Programme | | Mode | Seme | ster | | |
| Classification | M. Sc. Compu | ter Science | Option | al 2. | | | |
| Technical skills | The students v | will carry o | it a pract | ical task | (project) in the | | |
| | context of Ent | erprise Info | rmation S | Systems, i | ncluding test ar | nd | |
| | documentation | n of the imp | lemented | software/ | 'system. | | |
| Soft skills | Ability to prop | perly preser | t and def | end design | n decisions, to | | |
| | prepare readab | ole docume | ntation of | software; | skills in | | |
| | constructively | collaborati | ng with o | thers in si | mall teams over | a | |
| | longer period | of time; abi | lity to cla | ssify own | results into the |) | |
| | state-of-the-ar | t in the are | a of | | | | |
| Contents | | | | | | | |
| Prerequisites | none | | | | | | |
| | Teaching form | at G | oup size | h/week | Workload[h] | CP | |
| Format | Lab | | 8 | 4 | 60 T / 210 S | 9 | |
| | T = face-to-fa | ce teaching | S = inde | ependent s | study | | |
| Exam achievements | Oral presentat | tion, written | report | | (gra | aded) | |
| Study achievements | none | | | | (not gra | aded) | |
| Forms of media | | | | | | | |
| Literature | | | | | | | |

| Module | Advanced S | ensor Dat | a Fusion | in Dist | ributed | |
|--------------------|---|---------------|--------------|---------------|-----------------------------------|-------------------|
| MA-INF 3233 | Systems | | | | | |
| Workload | Credit points | Duration | Frequen | cy | | |
| 180 h | 6 CP | | | | | |
| Module | PD Dr. Wolfga | ang Koch | | | | |
| coordinator | , i i i i i i i i i i i i i i i i i i i | 0 | | | | |
| Lecturer(s) | Dr. Felix Gova | ers | | | | |
| | Programme | | Mode | Semest | ter | |
| Classification | M. Sc. Compu | ter Science | Optional | 2. | | |
| Technical skills | For challenging | g state estim | ation task | s, algorit | hms which enh | ance |
| | the situational | awareness b | y fusing so | ensor info | ormation are | |
| | inevitable. Nov | | | | - | |
| | performance of | | | | | |
| | some challenge | | | | - | |
| | sensor registra | | | | | |
| | estimation erro | — | | | | |
| | limited bandwi | | | - | | - |
| | at the sensor s | | | | — | |
| | Once recieved to reconstruct | | · · · · | , · | | |
| | to a achieve a | 0 | | | , 0 | 162 |
| | Among these a | | | | | |
| | formula, the Fe | | | | - | |
| | distributed Ka | | | | | |
| Soft skills | Mathematical | | | _ | | |
| | mathematical | | - | | | |
| Contents | tracklet fusion | , the Bar-Sh | alom-Cam | po formu | la, the Federat | ed |
| | Kalman Filter, | , naive fusio | n, the distr | ributed K | Kalman filter an | nd |
| | the least squar | , | | | e Densities, | |
| | Decorrlated fu | · • | - | | | |
| Prerequisites | Recommended | | | 0 | _ | |
| | BA-INF 137 – | 0 | | | | |
| | MA-INF 3310 | | on to Sens | or Data . | Fusion - Metho | ods |
| | and Applicatio | | • | 1 / 1 | XX7 11 1011 | CD |
| | Teaching forma | it G | roup size | h/week | Workload[h] 30 T / 45 S | CP |
| Format | Lecture Exercises | | 60 30 | $\frac{2}{2}$ | 30 T / 45 S 30 T / 75 S | $2.5 \\ 3.5$ |
| | | | I | | , | 0.0 |
| - | T = face-to-face | ce teaching; | S = indep | endent st | | 1 1\ |
| Exam achievements | Oral exam | ···· ··· | - 4: | | (8 | $\frac{ded}{ded}$ |
| Study achievements | Successful exer | cise particip | ation | | (not gra | aea) |
| Forms of media | Power Point W. Koch: "Tra | cking and Q | ansor Date | Fusion | Methodologia | <u>_</u>] |
| | Framework and | - | | | _ | al |
| Literature | | | | | | |
| | D. Hall, CY. | | | | | Jata |
| | Fusion for Net | work-Centri | c Operatio | ns^{-}, CRC | Press, 2014. | |

| Module | Lab Mobile | Sensing Sy | stems | | | | | |
|--------------------|--|---|------------------------|-------------|------------------------------------|----------|--|--|
| MA-INF 3234 | | 0.1 | | | | | | |
| Workload | Credit points | Credit points Duration Frequency | | | | | | |
| 270 h | 9 CP 1 semester every year | | | | | | | |
| Module | JunProf. Dr. | Delphine Ch | ristin | | | | | |
| coordinator | | | | | | | | |
| Lecturer(s) | JunProf. Dr. | JunProf. Dr. Delphine Christin | | | | | | |
| Classification | Programme | Programme Mode Semester | | | | | | |
| Classification | _ | M. Sc. Computer Science Optional 2. or 3. | | | | | | |
| Technical skills | The students v | 0 | - | - | | | | |
| | | | | | ile sensing syst | | | |
| | | ramming mol | oile devi | ces and the | he correspondi | ng | | |
| | infrastructure. | | | | | | | |
| Soft skills | Organized in s | | | | | | | |
| | - | - | | • | l analyze the de | - | | |
| | - | 0 | | | is analysis. Th | | | |
| | - | | - | | ill be document | lea in | | |
| Contorta | a written repo | <u> </u> | | | | | | |
| Contents | Mobile sensing | | 0 | - | es as a new sensors, such as | | | |
| | - | | | | ers, are used to | | | |
| | capture contex | - · · | | | | , | | |
| | - | | | | of this lab, the | | | |
| | | | | _ | challenging rese | | | |
| | field by addres | - | | | indironging rose | aron | | |
| | _ | - | | | ong | | | |
| | New mobile Beputation 1 | 0 | | ~ ~ | ous contribution | าย | | |
| | • Incentive sch | | | | | 15 | | |
| | • Usable priva | | uruge u | 00110 | | | | |
| Prerequisites | Recommended | - | | | | | | |
| • | MA-INF 3202 | – Mobile Cor | nmunica | ation | | | | |
| | Teaching forma | at Gro | up size | h/week | Workload[h] | CP | | |
| Format | Lab | | 8 | h/week 4 | Workload[h] 60 T / 210 S | 9 | | |
| | T = face-to-fa | ce teaching: S | $\delta = ind\epsilon$ | pendent s | study | | | |
| Exam achievements | Oral presentat | | | r | | aded) | | |
| Study achievements | none | , | 1 | | (not gra | , | | |
| Forms of media | | | | | | , | | |
| | Burke, J., Estr | rin, D., Hanse | en, M., 1 | Parker, A. | , Ramanathan | , N., | | |
| | Reddy, S., Sriv | | | | | , , , | | |
| | Proceedings of | the 1st Wor | kshop or | n World- S | Sensor-Web | | | |
| | (WSW), pp. 1 | -5. | | | | | | |
| | Campbell, A., | Eisenman, S. | , Lane, | N., Miluz | zo, E., Peterson | n, R., | | |
| | | | | | eedings of the | | | |
| | | | - | | - | | | |
| Literature | Annual International Wireless Internet Conference (WICON), pp. 18–31. | | | | | | | |
| | Campbell, A., Eisenman, S., Lane, N., Miluzzo, E., Peterson, R., | | | | | | | |
| | | | | | Eisenman, S., A | | | |
| | G., 2008. The | | | | | , | | |
| | Computing 12 | | | 0, | 0 | | | |
| | - 0 | | Kanho | S Hol | llick, M., A sur | VOV | | |
| | | | | | oplications, Jou | | | |
| | - ° | - | ÷ . | | 1, 2011, 1928-19 | | | |
| | | | | | | | | |

| Module | Usable Securi | ity and P | rivacy | | | |
|--------------------|--|---------------|---|-------------|-----------------|-------------------|
| MA-INF 3235 | | | 1 | | | |
| Workload | - | Duration | Freque | - | | |
| 180 h | 6 CP 1 semester every year | | | | | |
| Module | Prof. Dr. Matth | ew Smith | | | | |
| coordinator | | <u> </u> | | | | |
| Lecturer(s) | Prof. Dr. Matth | ew Smith | | | | |
| Classification | Programme M. So. Compute | " Science | Mode | Semest | er | |
| Technical skills | M. Sc. Compute Students will be | | $\frac{\text{Optiona}}{\text{th usabil}}$ | | ma of IT soour | |
| Technical skills | and privacy med | | | ° 1 | | 16у |
| | usability of IT se | , | | | | a |
| | able to design an | - | | | | 5 |
| Soft skills | Working with a | | | studies. | | |
| Soft Skills | Communicatio | | crature | | | |
| | • Team working | | | | | |
| Contents | The lecture on U | | rity and | Privacy de | eals with many | J |
| | aspects of human | | 0 | • | ° | |
| | and privacy. The | | | e | | |
| | security and priv | | | | | |
| | international res | - | | | | |
| | • Evaluation of u | ısability iss | ues of ex | isting sec | urity & privacy | v |
| | models or techno | - | 405 01 01 | insting see | | , |
| | • Design and evaluation of new usable security & privacy | | | | | |
| | technology | | | | | |
| | • Impact of orga | nizational j | oolicy on | security a | and privacy | |
| | interaction | - | , v | v | 1 U | |
| | • Lessons learned | d from desig | gning, de | ploying, r | nanaging or | |
| | evaluating securi | ity & privad | ey techno | logies | | |
| | • Foundations of | | | | | |
| | • Methodology f | or usable se | ecurity & | privacy r | esearch | |
| | • Ethical, psycho | 0 / | 0 | and econ | omic aspects o | of |
| | security & privad | cy technolog | gies | | | |
| Prerequisites | Required: | a | | | _ | |
| | Knowledge about IT Security is advantageous but not | | | | | |
| | mandatory. | | | | | |
| | Recommended: A | | | owing: | | |
| | BA-INF 138 – I | | | | | |
| | BA-INF 136 – R | | | | | |
| | MA-INF 1103 - | | - | | | |
| | MA-INF 3229 - | | v | | | ab |
| Democrat | Teaching format | Gro | oup size | h/week | Workload[h] | CP |
| Format | Lecture Exercises | | 60 20 | 2 | 30 T / 45 S | 2.5 |
| | | | 30 | 2 | 30 T / 75 S | 3.5 |
| | Die Übung wird | | | | , | |
| | T = face-to-face | teaching; S | b = indep | endent st | ē | 1 1 |
| Exam achievements | Written exam | | | | · = | $\frac{ded}{ded}$ |
| Study achievements | Successful exerci | se participa | ation | | (not gra | ded) |
| Forms of media | | | | | | |
| Literature | | | | | | |

| Module | IT Security | IT Security | | | | | | |
|--------------------|--|---|------------|------------|-----------------------------------|-------|--|--|
| MA-INF 3236 | | | | | | | | |
| Workload | Credit points | Duration | Frequer | ncy | | | | |
| 180 h | 6 CP | 1 semester | every year | | | | | |
| Module | Prof. Dr. Mic | hael Meier | | | | | | |
| coordinator | | | | | | | | |
| Lecturer(s) | Prof. Dr. Micl | hael Meier | | | | | | |
| Classification | Programme | | Mode | Semest | ter | | | |
| Classification | M. Sc. Compu | | Optional | | | | | |
| Technical skills | | Students are introduced to selected active research fields of IT | | | | | | |
| | · · · | security and gain deep knowledge of the research literature. | | | | | | |
| | | Students learn selected aspects of IT security. This includes | | | | | | |
| | risks and vuln | | - | | | s | | |
| | - | vell as concepts to increase the level of IT security, their | | | | | | |
| | applications and | | | .1 1 | 11 0 | | | |
| Soft skills | | Theoretical exercises to support in-depth understanding of lecture topics and to stimulate discussions, practical exercises in | | | | | | |
| | - | | | , - | | | | |
| | teamwork to s | * * | 0 | , 0 | 0 | | | |
| <u> </u> | practical work | | discussion | t of own a | and others' rest | ults. | | |
| Contents | • security three | | | | · · · · · · · · · · · · · · · · · | | | |
| | • advanced ne | | - | - | security, netw | OFK | | |
| | attack detection • cryptograph | | | n maing | | | | |
| | • building aut | | | | | | | |
| | • advanced ho | | 1110y | | | | | |
| | • security patt | e | | | | | | |
| | • privacy and | | ation | | | | | |
| Prerequisites | Required: | F = = = = = | | | | | | |
| 1 | Fundamental l | knowledge in | the follow | ving areas | s: operating | | | |
| | systems, netwo | - | | 0 | 1 0 | | | |
| | Teaching form | | oup size | h/week | Workload[h] | CP | | |
| Format | Lecture | | 60 | 2 | 30 T / 45 S | 2.5 | | |
| | Exercises | | 30 | 2 | 30 T / 75 S | 3.5 | | |
| | T = face-to-fa | ce teaching: | S = indep | endent st | udy | | | |
| Exam achievements | Written exam | - 01 | r | | ě | ded) | | |
| Study achievements | Successful exercise participation (not graded) | | | | | | | |
| | Successiul exe | (not graded) | | | | | | |
| Forms of media | Successful exe | | | | (1100 gra | / | | |

| Module MA-INF 3237 | Seminar Deep Learning | | | | | |
|-----------------------|----------------------------------|--|--------------|-----------|-------------------|------|
| Workload | Credit points Duration Frequency | | | | | |
| 120 h | 4 CP | 1 semester | - | v | | |
| Module | Prof. Dr. Jens | s Lehmann | 00 | | | |
| coordinator | | | | | | |
| Lecturer(s) | Prof. Dr. Jens | Prof. Dr. Jens Lehmann | | | | |
| Classification | Programme | | Mode | Semest | ter | |
| Classification | M. Sc. Compu | ter Science | Optional | 2. | | |
| Technical skills | Ability to und | Ability to understand new research results presented in original | | | | |
| | scientific pape | rs. | | | | |
| Soft skills | Ability to pres | sent and to c | ritically di | scuss the | ese results in th | ne |
| | framework of t | the correspon | nding area | | | |
| Contents | Current confer | rence and jou | ırnal pape | rs | | |
| Prerequisites | none | | | | | |
| Format | Teaching form | at G | oup size | h/week | Workload[h] | CP |
| rormat | Seminar | | 10 | 2 | 30 T / 90 S | 4 |
| | T = face-to-fa | ce teaching; | S = indep | endent st | Judy | |
| Exam achievements | Oral presentat | ion, written | report | | (gra | ded) |
| Study achievements | none | | | | (not gra | ded) |
| Forms of media | | | | | | |
| Literature | | | | | | |

| Module MA-INF 3238 | Seminar Predictive Analysis | | | | | |
|-----------------------|-----------------------------|--|--------------|-----------|------------------|------|
| Workload | Credit points | Credit points Duration Frequency | | | | |
| 120 h | 4 CP | 1 semester | - | v | | |
| Module | Prof. Dr. Jens | s Lehmann | | | | |
| coordinator | | | | | | |
| Lecturer(s) | Prof. Dr. Jens | Prof. Dr. Jens Lehmann | | | | |
| Classification | Programme | | Mode | Semest | ter | |
| Classification | M. Sc. Compu | ter Science | Optional | 2. | | |
| Technical skills | Ability to und | Ability to understand new research results presented in original | | | | |
| | scientific pape | scientific papers. | | | | |
| Soft skills | Ability to pres | sent and to c | ritically di | scuss the | se results in th | ne |
| | framework of t | the correspon | nding area | • | | |
| Contents | Current confer | rence and jou | ırnal pape | rs | | |
| Prerequisites | none | | | | | |
| Format | Teaching form | at G | oup size | h/week | Workload[h] | CP |
| rormat | Seminar | | 10 | 2 | 30 T / 90 S | 4 |
| | T = face-to-fa | ce teaching; | S = indep | endent st | udy | |
| Exam achievements | Oral presentat | tion, written | report | | (gra | ded) |
| Study achievements | none | | | | (not gra | ded) |
| Forms of media | | | | | | |
| Literature | | | | | | |

| Module MA-INF 3239 | Seminar Natural Language Processing | | | | | |
|-----------------------|-------------------------------------|--|-----------------|-----------|------------------|------|
| Workload | Credit points | Credit points Duration Frequency | | | | |
| 120 h | 4 CP | 1 semester | every ye | ear | | |
| Module | Prof. Dr. Jens | s Lehmann | | | | |
| coordinator | | | | | | |
| Lecturer(s) | Prof. Dr. Jens | Prof. Dr. Jens Lehmann | | | | |
| Classification | Programme | | Mode | Semest | ter | |
| Classification | M. Sc. Compu | ter Science | Optional | 2. | | |
| Technical skills | Ability to und | Ability to understand new research results presented in original | | | | |
| | scientific pape | scientific papers. | | | | |
| Soft skills | Ability to pres | sent and to c | ritically di | scuss the | se results in th | ne |
| | framework of | the correspon | nding area. | | | |
| Contents | Current confer | rence and jou | ırnal papeı | s | | |
| Prerequisites | none | | | | | |
| Format | Teaching form | at G | oup size | h/week | Workload[h] | CP |
| rormat | Seminar | | 10 | 2 | 30 T / 90 S | 4 |
| | T = face-to-fa | ce teaching; | S = independent | endent st | udy | |
| Exam achievements | Oral presentat | tion, written | report | | (gra | ded) |
| Study achievements | none | | | | (not gra | ded) |
| Forms of media | | | | | | |
| Literature | | | | | | |

| Module MA-INF 3240 | Lab Natural Language Processing | | | | | | |
|-----------------------|---------------------------------|---|------------|------------|------------------|-------|--|
| Workload | Credit points | Duration | Frequency | | | | |
| 270 h | 9 CP | 9 CP 1 semester every year | | | | | |
| Module | Prof. Dr. Jens | Prof. Dr. Jens Lehmann | | | | | |
| coordinator | | | | | | | |
| Lecturer(s) | Prof. Dr. Jens | s Lehmann | | | | | |
| Classification | Programme | | Mode | Seme | ster | | |
| Classification | M. Sc. Compu | ter Science | Optiona | al 2. | | | |
| Technical skills | The students | The students will carry out a practical task (project) in the | | | | | |
| | context of xxx | context of xxxxx, including test and documentation of the | | | | | |
| | implemented software/system. | | | | | | |
| Soft skills | Ability to prop | perly present | and defe | end design | n decisions, to | | |
| | prepare readal | ole documen | tation of | software; | skills in | | |
| | constructively | collaboratin | g with ot | hers in sr | nall teams over | a | |
| | longer period | of time; abili | ty to clas | sify ones | own results into | o the | |
| | state-of-the-ar | t of the resp | . area | | | | |
| Contents | | | | | | | |
| Prerequisites | none | | | | | | |
| Format | Teaching form | at Gr | oup size | h/week | Workload[h] | CP | |
| rormat | Lab | | 8 | 4 | 60 T / 210 S | 9 | |
| | T = face-to-fa | ce teaching; | S = inde | pendent s | study | | |
| Exam achievements | Oral presentat | tion, written | report | | (gra | ided) | |
| Study achievements | none | | | | (not gra | ided) | |
| Forms of media | | | | | | | |
| Literature | | | | | | | |

| Module MA-INF 3241 | Lab Distributed Machine Learning | | | | | | |
|-----------------------|---|---|------------------|-------------|------------------|-------|--|
| Workload | Credit points | Duration | ration Frequency | | | | |
| 270 h | 9 CP 1 semester every year | | | | | | |
| Module | Prof. Dr. Jens | Prof. Dr. Jens Lehmann | | | | | |
| coordinator | | | | | | | |
| Lecturer(s) | Prof. Dr. Jens | s Lehmann | | | | | |
| Classification | Programme | | Mode | Seme | ster | | |
| Classification | M. Sc. Compu | ter Science | Option | al 2. | | | |
| Technical skills | The students | The students will carry out a practical task (project) in the | | | | | |
| | context of xxxxx, including test and documentation of the | | | | | | |
| | implemented software/system. | | | | | | |
| Soft skills | Ability to prop | perly preser | t and def | end design | n decisions, to | | |
| | prepare readal | ole documer | tation of | software; | skills in | | |
| | constructively | collaborati | ng with ot | thers in sr | nall teams over | a | |
| | longer period | of time; abi | ity to clas | ssify ones | own results into | o the | |
| | state-of-the-ar | t of the resp | o. area | | | | |
| Contents | | | | | | | |
| Prerequisites | none | | | | | | |
| Format | Teaching form | at G | oup size | h/week | Workload[h] | CP | |
| rormat | Lab | | 8 | 4 | 60 T / 210 S | 9 | |
| | T = face-to-fa | ce teaching | S = inde | ependent s | study | | |
| Exam achievements | Oral presentat | tion, writter | report | | (gra | ded) | |
| Study achievements | none | | | | (not gra | ided) | |
| Forms of media | | | | | | | |
| Literature | | | | | | | |

| Module MA-INF 3302 | Temporal Information Systems | | | | | | | |
|-----------------------|------------------------------|--|-------------|-----------|-------------|------|--|--|
| Workload | Credit points | Duration | n Frequency | | | | | |
| 180 h | 6 CP | 1 semester | every y | ear | | | | |
| Module | Prof. Dr. Rainer Manthey | | | | | | | |
| coordinator | | | | | | | | |
| Lecturer(s) | Prof. Dr. Rain | ner Manthey | | | | | | |
| Classification | Programme | | Mode | Semest | ter | | | |
| Classification | M. Sc. Compu | ter Science | Optional | 2. or 3 | 3. | | | |
| Technical skills | | | | | | | | |
| Soft skills | solutions), self | Communicative skills (oral/written presentation, "defending" solutions), self-competence (time management, self-organisation, creativity), social skills (constructive discussion, sharing work in small teams) | | | | | | |
| Contents | | | | | | | | |
| Prerequisites | none | | | | | | | |
| | Teaching form | at G | oup size | h/week | Workload[h] | CP | | |
| Format | Lecture | | 60 | 2 | 30 T / 45 S | 2.5 | | |
| | Exercises | | 30 | 2 | 30 T / 75 S | 3.5 | | |
| | T = face-to-fa | ce teaching; | S = indep | endent st | Judy | | | |
| Exam achievements | Written exam | | | | (gra | ded) | | |
| Study achievements | Successful exe | rcise particip | ation | | (not gra | ded) | | |
| Forms of media | | | | | | | | |
| Literature | | | | | | | | |

| Module MA-INF 3304 | Lab Commu | Lab Communication and Communicating Devices | | | | | |
|-----------------------|--|---|----------------|-----------|------------------|-------------------------|--|
| Workload | Credit points | Duration | Frequer | ncy | | | |
| 270 h | 9 CP | 1 semester | every semester | | | | |
| Module | Prof. Dr. Pete | er Martini | - 4 | | | | |
| coordinator | | | | | | | |
| Lecturer(s) | Prof. Dr. Pete | Prof. Dr. Peter Martini, Prof. Dr. Michael Meier | | | | | |
| Classification | Programme | | Mode | Seme | ster | | |
| Classification | M. Sc. Compu | ter Science | Optional | l 2. or | 3. | | |
| Technical skills | The students v | The students will carry out a practical task (project) in the | | | | | |
| | context of com | | | 0 | | | |
| | documentation | | | , | - | | |
| Soft skills | | Work in small teams and cooperate with other teams in a group; | | | | | |
| | • | ability to make design decisions in a practical task; present and | | | | | |
| | | discuss (interim and final) results in the team/group and to | | | | | |
| | | other students; prepare written documentation of the work | | | | | |
| | | carried out | | | | | |
| Contents | Selected topics | | | | | | |
| | communication | e , | | 0, | obile | | |
| | communication | n and commu | inicating | devices. | | | |
| Prerequisites | Required: | 1 | 1 (| C (1) C | 11 • 1 4 | | |
| | | • | | | ollowing lecture | s: | |
| | Principles of D | | | | , · | 202) | |
| | IT Security (MA- | , · · | oblie Con | imunica | tion (MA-INF3 | 202), | |
| | Teaching forma | | up size | h/week | Workload[h] | CP | |
| Format | Lab | | 8 | 4 | 60 T / 210 S | $\frac{\mathbf{OI}}{9}$ | |
| | | | Ŭ I | | , , | | |
| D | T = face-to-fa | | | endent s | | 1 1) | |
| Exam achievements | Oral presentat | ion, written | report | | (0 | ded) | |
| Study achievements | none | | | | (not gra | laea) | |
| Forms of media | The relation 1 | t on o t | b | mand t | manda the seri | f the | |
| Literature | The relevant literature will be announced towards the end of the | | | | | | |
| | previous semester. | | | | | | |

| Module MA-INF 3305 | Lab Inform | ation Sys | tems | | | | | |
|-----------------------|------------------------------|---|------------|-------------|------------------|-------|--|--|
| Workload | Credit points | Duration | Frequ | ency | | | | |
| 270 h | 9 CP | 1 semeste | | | | | | |
| Module | Prof. Dr. Rain | | | | | | | |
| coordinator | | | | | | | | |
| Lecturer(s) | Prof. Dr. Rain | ner Manthe | y, Dr. The | omas Bod | e | | | |
| | Programme | | Mode | Seme | | | | |
| Classification | M. Sc. Compu | ter Science | Option | al 2. or | 3. | | | |
| Technical skills | The students | The students will carry out a practical task (project) in the | | | | | | |
| | context of info | context of information systems, including test and | | | | | | |
| | documentation | documentation of the implemented software/system. | | | | | | |
| Soft skills | Ability to prop | Ability to properly present and defend design decisions, to | | | | | | |
| | prepare readal | ole docume | ntation of | software; | skills in | | | |
| | constructively | collaborati | ng with of | thers in sr | nall teams over | a | | |
| | longer period | of time; abi | ity to cla | ssify ones | own results into | o the | | |
| | state-of-the-ar | t of the res | o. area | | | | | |
| Contents | | - | | | rch in the area | of | | |
| | database- and | information | n systems | | | | | |
| Prerequisites | none | | | | | | | |
| Format | Teaching form | at G | oup size | h/week | Workload[h] | CP | | |
| roimat | Lab | | 8 | 4 | 60 T / 210 S | 9 | | |
| | T = face-to-fa | ce teaching | S = inde | ependent s | study | | | |
| Exam achievements | Oral presentat | tion, written | ı report | | (gra | ded) | | |
| Study achievements | none | | | | (not gra | ided) | | |
| Forms of media | | | | | | | | |
| Literature | The relevant liprevious seme | | ll be anno | ounced to | wards the end o | f the | | |

| Module | Lab Malwar | re Analysis | 2 | | | | | |
|--------------------|--|---|-----------|----------------|-------------------|-------|--|--|
| MA-INF 3309 | Lab Marwar | C Analysis | 5 | | | | | |
| Workload | Credit points | Duration | Freque | nev | | | | |
| 270 h | 9 CP | 1 semester | _ | every semester | | | | |
| | Prof. Dr. Pete | | every | every semester | | | | |
| Module | Prol. Dr. Pete | 1 IOI. DI. I Eter Martini | | | | | | |
| coordinator | | | (D | NT 1 1 1 | τ. | | | |
| Lecturer(s) | Prof. Dr. Pete | er Martini, P | | | | | | |
| Classification | Programme | ~ . | Mode | Seme | ster | | | |
| | M. Sc. Compu | | Optiona | | | | | |
| Technical skills | The students v | The students will carry out a practical task (project) in the | | | | | | |
| | context of com | munication | systems v | with a spo | ecific topic focu | s on | | |
| | | Malware Analysis and Computer/Network Security, including | | | | | | |
| | test and documentation of the implemented software/system. | | | | | | | |
| Soft skills | | Work in small teams and cooperate with other teams in a group; | | | | | | |
| 2010 511115 | | ability to make design decisions in a practical task; present and | | | | | | |
| | e | 0 | | - | n/group and to | | | |
| | other students | , | | | , 0 * | | | |
| | carried out | , prepare wi | uten doe | | on or the work | | | |
| Contents | Selected topics | s close to cur | rent rese | arch in th | ne area of | | | |
| Contents | - | | | | | | | |
| | communication | | alware a | nalysis, co | omputer and | | | |
| | network securi | ty. | | | | | | |
| Prerequisites | Required: | | | | | | | |
| | | * | | | ollowing lecture | s: | | |
| | Principles of E | | | | · · · | | | |
| | Security (MA- | INF3201), M | lobile Co | mmunica | tion (MA-INF3 | 202), | | |
| | IT Security (N | (A-INF3236) | | | | | | |
| Format | Teaching forma | at Gro | oup size | h/week | Workload[h] | CP | | |
| Format | Lab | | 8 | 4 | 60 T / 210 S | 9 | | |
| | T = face-to-fa | ce teaching; | S = inde | pendent s | study | | | |
| Exam achievements | Oral presentat | ion, written | report | | (gra | ded) | | |
| Study achievements | none | | | | (not gra | ded) | | |
| Forms of media | | | | | | | | |
| | | | | | | | | |

| Module | Introductio | n to Senso | r Data l | Fusion - | Methods a | nd | | |
|--------------------|-------------------------------|--|-----------------|------------|-------------------|----------|--|--|
| MA-INF 3310 | Application | Applications | | | | | | |
| Workload | Credit points | Duration | Frequency | | | | | |
| 180 h | 6 CP | 1 semester | ster every year | | | | | |
| Module | P.D. Dr. Wolf | gang Koch | I. | | | | | |
| coordinator | | | | | | | | |
| Lecturer(s) | P.D. Dr. Wolf | gang Koch | | | | | | |
| Classification | Programme | | Mode | Semest | ter | | | |
| | M. Sc. Compu | | Optional | | | | | |
| Technical skills | | All participants shall get known to the basic theory of sensor data fusion. The lecture starts with preliminaries on how to | | | | | | |
| | handle uncerta | ain data and | knowledg | e within a | analytical calcu | ılus. | | |
| | Then, the fund | damental and | l well-kno | wn Kalma | an filter is deri | ved. | | |
| | Based on this | tracking sche | eme, furth | er approa | aches to a wide |) | | |
| | - | - | | | lgorithms will | be | | |
| | motivated by | - | 0 0 | - | × • , | | | |
| | | industrial cooperations, and impressions of current | | | | | | |
| | demonstration hardware. | | | | | | | |
| | | Because of inherent practical issues, every sensor measures | | | | | | |
| | | - | | | e shows how to | | | |
| | | | ē | ~ ~ | ion of theoretic | cal | | |
| | tools such as I | - | | | | | | |
| | _ | | | | ions, maneuver | ing | | |
| Soft skills | phases, and m Mathematical | | - | | ation of | | | |
| Soft Skills | mathematical | | - | | | | | |
| Contents | Gaussian prob | | | e | an filter | | | |
| Contents | - | • | e . | , | ble Model Filte | r | | |
| | Retrodiction, | | | | | -, | | |
| Prerequisites | none | | 10110 4 1 01 | | , , | | | |
| | Teaching form | at Gr | oup size | h/week | Workload[h] | CP | | |
| Format | Lecture | | 60 | 2 | 30 T / 45 S | 2.5 | | |
| | Exercises | | 30 | 2 | 30 T / 75 S | 3.5 | | |
| | T = face-to-fa | ce teaching: | S = index | endent st | udv | 1 | | |
| Exam achievements | Oral exam | 6, | - ··· I | | | ded) | | |
| Study achievements | Successful exe | rcise particip | ation | | (not gra | | | |
| Forms of media | | . 1 | | | <u>, 5</u> | / | | |
| | W. Koch: "Tra | acking and Se | ensor Dat | a Fusion: | Methodologica | al | | |
| | Framework an | - | | | - | | | |
| Literature | | | | | s to Tracking | and | | |
| | Navigation", V | | - | | | ~1114 | | |
| L | | , ney morse | 200 | . . | | | | |

| Module | Topics in Applied Cryptography | | | | | | | |
|--------------------|--|--|------------|------------|-----------------|------|--|--|
| MA-INF 3311 | | | | | | | | |
| Workload | Credit points | Duration | Freque | ency | | | | |
| 270 h | 9 CP | 1 semester | 00 | | | | | |
| Module | Prof. Dr. Joachim von zur Gathen | | | | | | | |
| coordinator | | | | | | | | |
| Lecturer(s) | Prof. Dr. Joachim von zur Gathen, Dr. Michael Nüsken | | | | | | | |
| Classification | Programme Mo | | | | Semester | | | |
| | M. Sc. Compu | | Optiona | | | | | |
| Technical skills | Gain deeper u | nderstanding | g in a spe | cial area | of cryptography | 7 | | |
| | close to current research. | | | | | | | |
| Soft skills | Oral presentation (in tutorial groups), written presentation (of | | | | | | | |
| | exercise solutions), team collaboration in solving homework | | | | | | | |
| | problems, critical assessment. | | | | | | | |
| Contents | ° 0, | One varying, advanced topic related to current research in | | | | | | |
| | applied crypto | graphy, e.g. | | | | | | |
| | • mobile secur | ity, or | | | | | | |
| | \bullet design and a | nalysis of ha | sh functi | ons. | | | | |
| Prerequisites | Required: | | | | | | | |
| | MA-INF 1103 | - Cryptogra | phy | | | | | |
| | and one furthe | er course in o | ryptogra | phy like 7 | The Art of | | | |
| | Cryptography | | • • • • | | | | | |
| | Teaching form | at Gr | oup size | h/week | Workload[h] | CP | | |
| Format | Lecture | | 60 | 4 | 60 T / 105 S | 5.5 | | |
| | Exercises | | 30 | 2 | 30 T / 75 S | 3.5 | | |
| | T = face-to-fa | ce teaching; | S = indep | pendent s | study | | | |
| Exam achievements | Written exam | | | | (gra | ded) | | |
| Study achievements | Successful exer | rcise particip | ation | | (not gra | ded) | | |
| Forms of media | | | | | | | | |
| Literature | | | | | | | | |

| Module MA-INF 3312 | Lab Sensor | Lab Sensor Data Fusion | | | | | | |
|-----------------------|---|--|-----------|------------|-----------------|-------|--|--|
| Warkload | Cuedit peinte | Credit points Duration Frequency | | | | | | |
| | 9 CP | | | | | | | |
| 270 h | | | | | | | | |
| Module | P.D. Dr. Wolf | P.D. Dr. Wolfgang Koch | | | | | | |
| coordinator | | | | | | | | |
| Lecturer(s) | P.D. Dr. Wolf | gang Koch | | | | | | |
| Classification | Programme | Programme Mode Semester | | | | | | |
| Classification | M. Sc. Compu | ter Science | Option | al 3. | | | | |
| Technical skills | The students | The students will work together on a data fusion project using | | | | | | |
| | various sensor hardware. Latest algorithms for fusing | | | | | | | |
| | information from several nodes will be implemented. | | | | | | | |
| Soft skills | The students s | The students shall work together in a team. Everyone is | | | | | | |
| | | | 0 | | of a main goal. | | | |
| | - | · · | | | software interf | aces. | | |
| Contents | Varying select | ed topics on | sensor da | ata fusion | | | | |
| Prerequisites | none | | | | | | | |
| Format | Teaching form | at Gr | oup size | h/week | Workload[h] | CP | | |
| Format | Lab | | 8 | 4 | 60 T / 210 S | 9 | | |
| | T = face-to-fa | ce teaching; | S = inde | pendent s | study | - | | |
| Exam achievements | Oral presentat | tion, written | report | | (gra | ided) | | |
| Study achievements | none | | | | (not gra | ided) | | |
| Forms of media | | | | | | | | |
| T :4 4 | The relevant li | iterature wil | be anno | unced at | the beginning o | f the | | |
| Literature | lab. | | | | | | | |

| Module MA-INF 3313 | Lab Intellig | Lab Intelligent Information Systems | | | | | | |
|-----------------------|----------------|-------------------------------------|-----------|------|---------|--------------|------|--|
| Workload | Credit points | Credit points Duration Frequency | | | | | | |
| 270 h | 9 CP | O CP 1 semester every year | | | | | | |
| Module | Prof. Dr. Rain | her Manthe | y | | | | | |
| coordinator | | | | | | | | |
| Lecturer(s) | Prof. Dr. Rain | ner Manthe | у | | | | | |
| Classification | Programme | Programme Mode Semester | | | | | | |
| Classification | M. Sc. Compu | Optio | nal | 3. | 3. | | | |
| Technical skills | | | I | | | | | |
| Soft skills | | | | | | | | |
| Contents | | | | | | | | |
| Prerequisites | none | | | | | | | |
| Format | Teaching form | at G | roup size | h | /week | Workload[h] | CP | |
| Format | Lab | | 8 | | 4 | 60 T / 210 S | 9 | |
| | T = face-to-fa | ce teaching | ; S = inc | lepe | ndent s | study | | |
| Exam achievements | Oral presentat | ion, written | n report | | | (gra | ded) | |
| Study achievements | none | | | | | (not gra | ded) | |
| Forms of media | | | | | | | | |
| Literature | | | | | | | | |

| Module | Advanced T | Copics in I | nformati | on Syst | ems Securit | у | | |
|--------------------|-----------------|---|-------------|------------|-----------------|---------------------|--|--|
| MA-INF 3314 | | | | | | | | |
| Workload | Credit points | Credit points Duration Frequency | | | | | | |
| 180 h | 6 CP | 6 CP 1 semester every year | | | | | | |
| Module | PD Dr. Adria | PD Dr. Adrian Spalka | | | | | | |
| coordinator | | | | | | | | |
| Lecturer(s) | PD Dr. Adria | n Spalka | | | | | | |
| Classification | Programme | Programme Mode Semester | | | | | | |
| Classification | M. Sc. Compu | ter Science | Optional | l 1. | | | | |
| Technical skills | | | | · | | | | |
| Soft skills | | | | | | | | |
| Contents | The content of | The content of the lecture focuses on state-of-the-art findings | | | | | | |
| | and techniques | s, and on pr | esent threa | ats and se | curity problem | ns. | | |
| | Current examp | ples are: an | axiomatic | view of a | uthentication v | with | | |
| | application to | user-centric | environme | ents and l | key manageme | nt | | |
| | for cloud-appli | ications. | | | | | | |
| Prerequisites | none | | | | | | | |
| | Teaching forma | at G | roup size | h/week | Workload[h] | CP | | |
| Format | Lecture | | 60 | 2 | 30 T / 45 S | 2.5 | | |
| | Exercises | | 30 | 2 | 30 T / 75 S | 3.5 | | |
| | T = face-to-fa | ce teaching; | S = indep | endent st | udy | | | |
| Exam achievements | Oral exam | | | | (gra | ded) | | |
| Study achievements | Successful exe | rcise partici | pation | | (not gra | ded) | | |
| Forms of media | Most content | will be hand | -written o | n the boa | rd with the | | | |
| | supplement of | a few slides | . There ar | e no hanc | louts. | | | |
| Literature | A text-book of | n cryptogra | phy is advi | sable. | | | | |

| Module MA-INF 3315 | Seminar Ad | Seminar Advanced Information Systems Security | | | | | | |
|-----------------------|------------------|---|-----------|------|----------|-------------|-------|--|
| Workload | Credit points | Credit points Duration Frequency | | | | | | |
| 120 h | 4 CP . | | | | | | | |
| Module | PD Dr. Adria | n Spalka | | U | | | | |
| coordinator | | | | | | | | |
| Lecturer(s) | PD Dr. Adria | n Spalka | | | | | | |
| Classification | Programme | Programme Mode Semester | | | | | | |
| Classification | M. Sc. Compu | e Optic | nal | 2. | | | | |
| Technical skills | Ability to und | Ability to understand new research results | | | | | | |
| | presented in o | presented in original scientific papers. | | | | | | |
| Soft skills | Ability to pres | sent and to | criticall | dis | scuss | | | |
| | these results in | n the frame | work of | the | correspo | nding | | |
| | area. | | | | | | | |
| Contents | Current confer | rence and j | ournal p | per | s | | | |
| Prerequisites | none | | | | | | | |
| Format | Teaching form | at | Group siz | e | h/week | Workload[h] | CP | |
| Format | Seminar | | 10 | | 2 | 30 T / 90 S | 4 | |
| | T = face-to-fa | ce teaching | s; S = in | lepe | ndent st | udy | | |
| Exam achievements | Oral presentat | tion, writte | n report | | | (gra | ded) | |
| Study achievements | none | | | | | (not gra | ided) | |
| Forms of media | | | | | | | | |
| Literature | | | | | | | | |

| Module MA-INF 3316 | Lab Technic | Lab Techniques in Information Systems Security | | | | | |
|-----------------------|------------------|---|------------|------------|-------------------|-------|--|
| Workload | Credit points | Duration | Freque | 2011 | | | |
| 270 h | - | 9 CP 1 semester every year | | | | | |
| Module | | PD Dr. Adrian Spalka | | | | | |
| | FD DI. Auna | пэрака | | | | | |
| coordinator | | C 11 | | | | | |
| Lecturer(s) | PD Dr. Adria | n Spalka | | | | | |
| Classification | Programme | | Mode | Seme | ster | | |
| | M. Sc. Compu | | Optiona | | | | |
| Technical skills | The students v | The students will carry out a practical task | | | | | |
| | (project) in th | project) in the context of xxxxxx, including test and | | | | | |
| | documentation | documentation of the implemented | | | | | |
| | software/syste | m. | | | | | |
| Soft skills | Ability to prop | perly present | and defe | nd | | | |
| | design decisior | ns, to prepar | e readable | e docume | entation of softw | vare; | |
| | skills in constr | uctively coll | aborating | with oth | ners in small tea | ms | |
| | over a longer p | period of tim | e; ability | to classif | fy ones own rest | ılts | |
| | into the state- | of-the-art of | the resp. | area | | | |
| Contents | | | | | | | |
| Prerequisites | none | | | | | | |
| D (| Teaching form | at Gr | oup size | h/week | Workload[h] | CP | |
| Format | Lab | | 8 | 4 | 60 T / 210 S | 9 | |
| | T = face-to-fa | ce teaching; | S = indep | pendent s | study | | |
| Exam achievements | Oral presentat | tion, written | report | | (gra | ded) | |
| Study achievements | none | | | | (not gra | ded) | |
| Forms of media | | | | | | | |
| | | | | | | | |

| Module MA-INF 3317 | Seminar Sel | Seminar Selected Topics in IT Security | | | | | | | |
|-----------------------|-----------------|--|-----------------|-----------|------------------|-------|--|--|--|
| Workload | Credit points | Credit points Duration Frequency | | | | | | | |
| 120 h | 4 CP . | | | | | | | | |
| Module | Prof. Dr. Mic | hael Meier | | | | | | | |
| coordinator | | | | | | | | | |
| Lecturer(s) | Prof. Dr. Mic | hael Meier, I | Prof. Dr. F | eter Mai | rtini | | | | |
| Classification | Programme | Programme Mode Semester | | | | | | | |
| Classification | M. Sc. Compu | ter Science | 2. | | | | | | |
| Technical skills | Ability to und | Ability to understand new research results presented in original | | | | | | | |
| | scientific pape | rs. | | | | | | | |
| Soft skills | Ability to pres | sent and to c | ritically di | scuss the | se results in th | ne | | | |
| | framework of t | the correspon | nding area. | | | | | | |
| Contents | Current confer | rence and jou | ırnal papeı | s | | | | | |
| Prerequisites | none | | | | | | | | |
| Format | Teaching forma | at G | oup size | h/week | Workload[h] | CP | | | |
| romat | Seminar | | 10 | 2 | 30 T / 90 S | 4 | | | |
| | T = face-to-fa | ce teaching; | S = independent | endent st | Judy | | | | |
| Exam achievements | Oral presentat | ion, written | report | | (gra | ded) | | | |
| Study achievements | none | | | | (not gra | .ded) | | | |
| Forms of media | | | | | | | | | |
| Literature | | | | | | | | | |

| Module | Seminar Ve | rification | of Comp | lex Syst | tems | | |
|--------------------|--|---|--------------|-----------|-------------|--------|--|
| MA-INF 3318 | ~ | | - | | | | |
| Workload | Credit points | Duration | Frequen | - | | | |
| 120 h | 4 CP1 semesterat least every 2 yearsJunProf. Dr. Janis Voigtländer | | | | | | |
| Module | JunProf. Dr. | Janis Voigt | lander | | | | |
| coordinator | | | | | | | |
| Lecturer(s) | JunProf. Dr. | Janis Voigt | 1 | | | | |
| Classification | Programme | - | | | | | |
| | M. Sc. Compu | | Optional | | | | |
| Technical skills | Knowledge in | - | _ | | | | |
| | behaviour of c | × • | | | - | | |
| | mine for profo | | - | - | | icular | |
| | | acquiring and studying original literature. Understanding cientific publications, often written tersely. Distilling this into mutable presentations; determination of relevant vs. irrelevant naterial. Presenting research results to others, in writing and in oral presentations, and discussing them with an audience. Ability to discuss and evaluate presentations of fellow students, and to constructively deal with aritical feedback by others. | | | | | |
| | | | | | | | |
| | - | | | | | | |
| | | | | | | | |
| | - | | | | | | |
| | - | | | | | | |
| | | and to constructively deal with critical feedback by others. Communication skills (preparing and presenting talks, using | | | | | |
| Soft skills | | - | | - | | - | |
| | visual media, preparing a structured written document), so skills (motivating other students, ability to accept and form | | | | | | |
| | ` | - | | - | - | lulate | |
| | criticism), self competences (time management wi long-ranging deadlines, self-study, ability to analy | | | | | | |
| Contents | | | | | | , | |
| Contents | Techniques for analyzing the correctness of complex systems such as software. Theoretical foundations for such techniques | | | | | | |
| | such as software. Theoretical foundations for such techniques, as well as consideration of practical tools. Spectrum ranging from | | | | | | |
| | formal to semi-formal; positioning of techniques within this | | | | | | |
| | spectrum. Specific themes of interest include: | | | | | | |
| | | | | | | | |
| | • Specification formalisms and languages | | | | | | |
| | • Decision pro | | tion of a m | at and | | | |
| | Modelling de | | ties of a sy | stem | | | |
| | Model check Theorem pr | - | | | | | |
| | • Theorem proving • Static (flow) englycic electron interpretation | | | | | | |
| | Static (flow) analysis, abstract interpretation Code analysis using houristics | | | | | | |
| | Code analysis using heuristics Testing (approaches, frameworks, coverage criteria) | | | | | | |
| | • Runtime ver | | | - | , | | |
| | Applications | | | | itoring) | | |
| | | | | | | | |
| D | A selection of | topics will b | e made in | each sem | nester. | | |
| Prerequisites | none | . ~ | · · · | 1 / 1 | *** | 05 | |
| Format | Teaching forms | at G | roup size | h/week | Workload[h] | | |
| | Seminar | | 10 | 2 | 30 T / 90 S | 4 | |
| | T = face-to-fa | | | endent st | | | |
| Exam achievements | Oral presentat | tion, written | report | | , | aded) | |
| Study achievements | none | | | | (not gr | aded) | |
| Forms of media | | | | | | | |
| Literature | The relevant l | iterature wil | l be annou | nced in t | ime. | | |

| Module MA-INF 3319 | Lab Usable | Lab Usable Security and Privacy | | | | | |
|-----------------------|-----------------|---|------------|-----------|-----------------|------|--|
| Workload | Credit points | Duration | Freque | ncy | | | |
| 270 h | 9 CP | 9 CP 1 semester every year | | | | | |
| Module | Prof. Dr. Mat | Prof. Dr. Matthew Smith | | | | | |
| coordinator | | | | | | | |
| Lecturer(s) | Prof. Dr. Mat | thew Smith | | | | | |
| Classification | Programme | | Mode | Seme | ster | | |
| Classification | M. Sc. Compu | ter Science | Optiona | ıl 2. | | | |
| Technical skills | The students | The students will carry out a practical task (project) in the | | | | | |
| | context of usa | context of usable security and privacy, including user studies. | | | | | |
| Soft skills | Ability to crea | Ability to create and defend a scientific user study | | | | | |
| Contents | Students have | a great degr | ee of free | dom to c | hose their own | | |
| | topics within t | the context of | f human | aspects c | of security and | | |
| | privacy. | | | | | | |
| Prerequisites | Required: | | | | | | |
| | MA-INF 3235 | – Usable Se | curity and | d Privacy | - | | |
| Format | Teaching form | at Gro | oup size | h/week | Workload[h] | CP | |
| Tormat | Lab | | 8 | 4 | 60 T / 210 S | 9 | |
| | T = face-to-fa | ce teaching; | S = indep | pendent s | study | | |
| Exam achievements | Oral presentat | tion, written | report | | (gra | ded) | |
| Study achievements | none | | | | (not gra | ded) | |
| Forms of media | | | | | | | |
| Literature | | | | | | | |

| Module MA-INF 3320 | Lab Securit | y in Distri | buted S | Systems | | | |
|-----------------------|---|--|---------------|-------------|-----------------------------|----------------|--|
| Workload | Credit points | Duration | Freque | ency | | | |
| 270 h | 9 CP | 1 semester | every : | - | | | |
| Module | Prof. Dr. Mat | thew Smith | | <i>.</i> | | | |
| coordinator | | | | | | | |
| Lecturer(s) | Prof. Dr. Mat | thew Smith | | | | | |
| | Programme | | Mode | Seme | ster | | |
| Classification | M. Sc. Compu | ter Science | Optiona | al 2. | | | |
| Technical skills | The students v | will carry out | a practi | ical task (| project) in the | | |
| | | context of distributed security, including documentation of the implemented software/system. | | | | | |
| | Strong program | rong programming skills required. | | | | | |
| Soft skills | Ability to prop prepare readal constructively longer period of | Ability to properly present and defend design decisions, to prepare readable documentation of software; skills in constructively collaborating with others in small teams over a longer period of time; ability to classify ones own results into the state-of-the-art of the resp. area | | | | | |
| Contents | Security in dis | tributed syst | ems, incl | luding an | nongst others: | | |
| | Secure Mess App Security SSL/HTTPS API Security Machine Lea Passwords Intrusion Des Anomaly Des Security Vision | y S wrning for Sec etection Syste | | | | | |
| Prerequisites | none | | | | | | |
| Format | Teaching forma | at Gro | oup size 8 | h/week 4 | Workload[h] 60 T / 210 S | CP 9 | |
| | T = face-to-fa | ce teaching: | S = inde | pendent s | , | 1 | |
| Exam achievements | | | | r | • | ded) | |
| Study achievements | Oral presentation, written report(graded)none(not graded) | | | | | | |
| | none | | | | (not gra | ueu) | |
| Forms of media | none | | | | (not gra | iueu) | |

| Module MA-INF 3321 | Seminar Us | Seminar Usable Security and Privacy | | | | | | | |
|-----------------------|-----------------|--|-----------------|-----------|------------------|------|--|--|--|
| Workload | Credit points | Credit points Duration Frequency | | | | | | | |
| 120 h | 4 CP . | | | | | | | | |
| Module | Prof. Dr. Mat | thew Smith | | | | | | | |
| coordinator | | | | | | | | | |
| Lecturer(s) | Prof. Dr. Mat | thew Smith | | | | | | | |
| Classification | Programme | rogramme Mode Semester | | | | | | | |
| Classification | M. Sc. Compu | ter Science | Optional | 2. | | | | | |
| Technical skills | Ability to und | Ability to understand new research results presented in original | | | | | | | |
| | scientific pape | rs. | | | | | | | |
| Soft skills | Ability to pres | sent and to c | ritically di | scuss the | se results in th | ne | | | |
| | framework of t | the correspon | nding area. | | | | | | |
| Contents | Current confer | ence and jou | ırnal papeı | s | | | | | |
| Prerequisites | none | | | | | | | | |
| Format | Teaching form | at G | oup size | h/week | Workload[h] | CP | | | |
| ronnat | Seminar | | 10 | 2 | 30 T / 90 S | 4 | | | |
| | T = face-to-fa | ce teaching; | S = independent | endent st | Judy | | | | |
| Exam achievements | Oral presentat | ion, written | report | | (gra | ded) | | | |
| Study achievements | none | | | | (not gra | ded) | | | |
| Forms of media | | | | | | | | | |
| Literature | | | | | | | | | |

4 Intelligent Systems

| MA-INF 4111 | L2E2 | 6 CP | Intelligent Learning and Analysis Systems: Machine |
|--------------------|-----------------------|------------------|--|
| | | | Learning 120 |
| MA-INF 4112 | L2E2 | 6 CP | Intelligent Learning and Analysis Systems: Data Mining |
| | | | and Knowledge Discovery 121 |
| MA-INF 4113 | L2E2 | 6 CP | Cognitive Robotics 122 |
| MA-INF 4114 | L2E2 | 6 CP | Robot Learning 123 |
| MA-INF 4201 | L2E2 | 6 CP | Artificial Life 124 |
| MA-INF 4203 | L2E2 | 6 CP | Autonomous Mobile Systems 125 |
| MA-INF 4204 | L2E2 | 6 CP | Technical Neural Nets 126 |
| MA-INF 4206 | L2E2 | 6 CP | Selected Topics in Sensor Data Interpretation 127 |
| MA-INF 4207 | L2E2 | 6 CP | Dynamically Reconfigurable Systems 128 |
| MA-INF 4208 | $\operatorname{Sem}2$ | 4 CP | Seminar Vision Systems 129 |
| MA-INF 4209 | $\operatorname{Sem}2$ | 4 CP | Seminar Principles of Data Mining and Learning |
| | | | Algorithms 130 |
| | | | Seminar Advanced Topics in Technical Informatics 131 |
| MA-INF 4211 | | | 9 |
| MA-INF 4212 | L2E2 | 6 CP | Data Science and Big Data 133 |
| MA-INF 4213 | $\operatorname{Sem}2$ | 4 CP | Seminar Humanoid Robots 134 |
| MA-INF 4214 | Lab4 | $9 \mathrm{CP}$ | Lab Humanoid Robots 135 |
| MA-INF 4215 | L2E2 | 6 CP | Humanoid Robotics 136 |
| MA-INF 4216 | L2E2 | 6 CP | Data Mining and Machine Learning Methods in |
| | | | Bioinformatics 137 |
| MA-INF 4217 | $\operatorname{Sem}2$ | 4 CP | Seminar Machine Learning Methods in Systems |
| | | | Biology 138 |
| MA-INF 4218 | Lab4 | $9 \mathrm{CP}$ | Lab Modeling and Simulation 139 |
| | | | Advanced Learning Systems 140 |
| MA-INF 4303 | L2E2 | | Learning from Non-Standard Data 141 |
| MA-INF 4304 | Lab4 | | Lab Cognitive Robotics 142 |
| MA-INF 4306 | Lab4 | $9 \mathrm{CP}$ | Lab Development and Application of Data Mining and |
| | | | Learning Systems 143 |
| | | | Lab Field Programmable Gate Arrays 144 |
| MA-INF 4308 | Lab4 | | Lab Vision Systems 145 |
| MA-INF 4309 | Lab4 | $9 \mathrm{CP}$ | Lab Sensor Data Interpretation 146 |
| MA-INF 4310 | Lab4 | $9 \mathrm{CP}$ | Lab Mobile Robots 147 |
| MA-INF 4311 | | | Seminar Advanced Topics in Data Analysis 148 |
| MA-INF 4312 | L2E2 | | Semantic Data Web Technologies 149 |
| MA-INF 4313 | | 4 CP | Seminar Semantic Data Web Technologies 150 |
| MA-INF 4314 | | $9 \mathrm{CP}$ | Lab Semantic Data Web Technologies 151 |
| MA-INF 4315 | | | Probabilistic Graphical Models 152 |
| MA-INF 4316 | | | Knowledge Graph Analysis 153 |
| MA-INF 4317 | $\operatorname{Sem}2$ | 4 CP | Seminar Knowledge Graph Analysis 154 |

| Module | Intelligent L | earning | and Ana | lysis Sys | stems: Mach | nine | | |
|--------------------|---|---|-----------------|---------------|-----------------------------------|-------------------|--|--|
| MA-INF 4111 | Learning | | | | | | | |
| Workload | Credit points | Duration | _ | Frequency | | | | |
| 180 h | 6 CP 1 semester every year | | | | | | | |
| Module | Prof. Dr. Stefa | n Wrobel | | | | | | |
| coordinator | | | | | | | | |
| Lecturer(s) | Prof. Dr. Stefa | n Wrobel | | | | | | |
| Classification | Programme | rogrammeModeSemesterI. Sc. Computer ScienceOptional1. or 2. | | | | | | |
| Technical skills | This module is | | - | | | | | |
| Technical skills | students gain a | | - | - | | | | |
| | paradigms and | | - | | - | OV | | |
| | are used in dat | | 0 | | | ley | | |
| | behaviour (mac | ē | ' | - | · · | verv | | |
| | in databases). | | | | - | - | | |
| | predictive learn | | | | | | | |
| | teaches the mai | - | - | - | | | | |
| | | | - | | | | | |
| | end of the module, students will be capable of choosing appropriate methods and systems for particular predictive | | | | | | | |
| | learning applications and use them to arrive at convincing | | | | | | | |
| | results, and will know where to start whenever adaptation or | | | | | | | |
| | further development of algorithms and systems is necessary. | | | | | | | |
| | This module complements MA-INF 4112 and can be taken | | | | | | | |
| | before or after that module. | | | | | | | |
| Soft skills | Communicative | e skills (or | al and writ | ten preser | ntation of solut | ions, | | |
| | discussions in small teams), self competences (ability to accept | | | | | | | |
| | and formulate of | | - | | , | | | |
| Contents | Types of learning and analysis tasks, most important | | | | | | | |
| | non-parametric and parametric methods for supervised learning | | | | | | | |
| | (e.g., decision trees, rules, linear methods, neural networks, | | | | | | | |
| | neighbourhood methods, kernel methods, probabilistic | | | | | | | |
| | approaches), reinforcement learning, evaluation and learning | | | | | | | |
| D !! | theory. | | | | | | | |
| Prerequisites | Recommended: | o of probe | hility theo | m lincon | alcohna antifici | | | |
| | Prior knowledge of probability theory, linear algebra, artificial | | | | | | | |
| | intelligence, information systems and data bases Required : None of the following modules have been passed: | | | | | | | |
| | | | - | | - | | | |
| | MA-INF 4102 - | | Group size | h/week | | CP | | |
| Format | Teaching formation | | 60 | п/ weeк 2 | Workload[h] 30 T / 45 S | CP 2.5 | | |
| rormat | Exercises | | $\frac{00}{30}$ | $\frac{2}{2}$ | 30 T / 75 S | $\frac{2.5}{3.5}$ | | |
| | | 4 1. | | I | , | 0.0 | | |
| D | T = face-to-fac | e teaching | s; S = inde | pendent s | - | 1 1) | | |
| Exam achievements | Written exam | oigo <u>r</u> | ination | | (8 | $\frac{ded}{ded}$ | | |
| Study achievements | Successful exerc | | | 0.7 | (not gra | uaed) | | |
| Forms of media | Lectures, exerc | | | | | | | |
| T • | - Tom Mitchell | | 0, | | , | | | |
| Literature | - Ian Witten, E | libe Frank | , Data Mir | ning, Morg | gan Kauffmann | | | |
| | 2000 | | | | | | | |

| Module MA-INF 4112 | Intelligent I Mining and | | | | stems: Data | | | | |
|-----------------------|--|--|-------------|--------------------|-------------------|----------------------|--|--|--|
| Workload | Credit points | Duration | Frequen | | | | | | |
| 180 h | 6 CP | 1 semester | every ye | - | | | | | |
| Module | Prof. Dr. Stefa | | | | | | | | |
| coordinator | | | | | | | | | |
| Lecturer(s) | Prof. Dr. Wrobel | | | | | | | | |
| | Programme | | Mode | Semes | ter | | | | |
| Classification | M. Sc. Compu | M. Sc. Computer Science Optional 1. or 2. | | | | | | | |
| Technical skills | This module is | This module is one of two complementary modules in which | | | | | | | |
| | students gain a | students gain an understanding of the most important | | | | | | | |
| | paradigms and | | 0 | - | | ey | | | |
| | are used in dat | - | , | - | | | | | |
| | behaviour (ma | | | | - | - | | | |
| | in databases). | | | | | | | | |
| | pattern discover algorithms for | - | | | | | | | |
| | module, stude | • | | - | | une | | | |
| | methods and s | | - | 0 | | | | | |
| | applications and | • * | - | | v | nd | | | |
| | will know when | | | | | | | | |
| | development o | | | - | | | | | |
| | module comple | - | - | | - | e or | | | |
| | after that mod | | | | | | | | |
| Soft skills | Communicativ | e skills (oral | and writt | en preser | ntation of solut | ions, | | | |
| | discussions in a | small teams) | , self com | petences | (ability to acce | ept | | | |
| | and formulate | | - | | , | | | | |
| Contents | Types of learn | | · · · | | ° * , | | | | |
| | descriptive dat | - | | | | ps, | | | |
| | clustering, pre | | | | - 、 | + | | | |
| | warehouses, O multimedia da | , , 1 | • * | < - | , , | хі, | | | |
| Prerequisites | Recommended | | ve and vie | uai syste | | | | | |
| Terequisites | Prior knowledg | | lity theory | <i>v.</i> linear a | algebra, artifici | al | | | |
| | intelligence, in | | | | | | | | |
| | Required: Non | Ũ | | | | | | | |
| | MA-INF 4102 | | 0 | | - | | | | |
| | Teaching forma | | oup size | h/week | Workload[h] | CP | | | |
| Format | Lecture | | 60 | 2 | 30 T / 45 S | 2.5 | | | |
| | Exercises | | 30 | 2 | 30 T / 75 S | 3.5 | | | |
| | T = face-to- | ce teaching; | S = indep | endent st | udy | | | | |
| Exam achievements | Written exam | | | | (gra | ded) | | | |
| Study achievements | Successful exer | rcise particip | ation | | (not gra | ded) | | | |
| Forms of media | Lectures, exerc | cises, softwar | e package | | | | | | |
| | - Ian Witten, Eibe Frank, Data Mining, Morgan Kauffmann, | | | | | | | | |
| Literature | 2000 | | | | | | | | |
| | - Jiawei Han, I | Micheline Ka | mber, Dat | a Mining | g: Concepts an | d | | | |
| | Techniques, M | organ Kaufn | nann, 2000 |) | | | | | |

| Module | Cognitive F | Robotics | | | | | | |
|--------------------|--|---|------------|----------------|-----------------|-----------------------|--|--|
| MA-INF 4113 | 8 | | | | | | | |
| Workload | Credit points | Duration | Freque | ncy | | | | |
| 180 h | 6 CP | 1 semester | | | | | | |
| Module | Prof. Dr. Sven Behnke | | | | | | | |
| coordinator | | | | | | | | |
| Lecturer(s) | Prof. Dr. Sver | n Behnke | | | | | | |
| Classification | Programme | <u> </u> | | | | | | |
| | _ | M. Sc. Computer Science Optional 1. or 2. | | | | | | |
| Technical skills | This lecture is | | | e | | gent | | |
| | e e | systems track. The lecture covers cognitive capabilities of | | | | | | |
| | | robots, like self-localization, mapping, object perception, and | | | | | | |
| | action-plannin | action-planning in complex environments. | | | | | | |
| | This module c | This module complements MA-INF 4114 and can be taken | | | | | | |
| | | before or after that module. | | | | | | |
| Soft skills | | Communicative skills (oral and written presentation of solutions, | | | | | | |
| | discussions in small teams), self competences (ability to accept | | | | | | | |
| | | and formulate criticism, ability to analyze problems) | | | | | | |
| Contents | Probabilistic a | | | ``` | , s | | | |
| | Kalman Filter | , | | | , | els, | | |
| | self-localizatio | , ,, , | | ÷ , | | | | |
| | mapping and | | · · · · | | - | | | |
| | matching, pat | n planning, j | place- and | person re | ecognition, obj | ect | | |
| Prerequisites | recognition. Required: Nor | o of the fell | wing more | lulog hove | hoon pagadi | | | |
| Prerequisites | MA-INF 4101 | | - | | - | | | |
| | Teaching form | | roup size | h/week | Workload[h] | CP | | |
| Format | 1000000000000000000000000000000000000 | | 60 | 2 | 30 T / 45 S | 2.5 | | |
| | Exercises | | 30 | $\overline{2}$ | 30 T / 75 S | 3.5 | | |
| | T = face-to-fa | ce teaching. | S = inder | endent st | | I | | |
| Exam achievements | Written exam | | o maop | - ciriacino se | - | ided) | | |
| Study achievements | Successful exe | rcise partici | ation | | (not gra | , | | |
| Forms of media | | | | | (0 | / | | |
| | • S. Thrun, W. Burgard and D. Fox: Probabilistic Robotics. | | | | | | | |
| | MIT Press, 2005. | | | | | | | |
| T •4 | • B. Siciliano, O. Khatib (Eds.): Springer Handbook of | | | | | | | |
| Literature | Robotics, 2008 | 3. | | | | | | |
| | • R. Szeliski: | Computer V | ision: Alg | orithms a | nd Application | ns, | | |
| | Springer 2010. | | | | | | | |

| Module | Robot Lear | ning | | | | | | |
|--------------------|---|---|--|--|--|----------|--|--|
| MA-INF 4114 | | | | | | | | |
| Workload | Credit points | Duration | Freque | ncy | | | | |
| 180 h | 6 CP | CP 1 semester every year | | | | | | |
| Module | Prof. Dr. Sver | n Behnke | | | | | | |
| coordinator | | | | | | | | |
| Lecturer(s) | Prof. Dr. Sver | n Behnke, D | r. Nils Go | erke | | | | |
| Classification | Programme | | Mode | Semest | ter | | | |
| Classification | M. Sc. Compu | ter Science | Optional | $1 \mid 1. \text{ or } 2$ | 2. | | | |
| Technical skills | This lecture is | This lecture is one of two introductory lectures of the intelligent | | | | | | |
| | assist humans for machine lea | systems track. Creating autonomous robots that can learn to assist humans in situations of daily life is a fascinating challenge for machine learning. | | | | | | |
| | approach to ge robotics, such control, learnin | The lecture covers key ingredients for a general robot learning approach to get closer towards human-like performance in robotics, such as reinforcement learning, learning models for control, learning motor primitives, learning from demonstrations and imitation learning, and interactive learning. This module complements MA-INF 4113 and can be taken before or after that module. | | | | | | |
| | This module c | | | | | | | |
| | before or after | | | | | | | |
| Soft skills | Communicativ | e skills (ora | and writt | en presen | tation of solut | ions, | | |
| | discussions in a | small teams |) self.com | netences | (ability to acce | ont | | |
| | | | , , , , , , , , , , , , , , , , , , , | - | | P | | |
| ~ | and formulate | | - | | , | | | |
| Contents | Reinforcement programming, methods, funct differential dyn policy gradient imitation learn handling of ob | Monte Carl tion approxi- namic progr t methods, i ning, learnin | o methods mation, lie amming, p nverse reir | , tempora ear quadra eartially o forcemen | al-difference atic regulation bservable MDI t learning, | , Ps, | | |
| Prerequisites | none | | | | | | | |
| | Teaching forma | at G | roup size | h/week | Workload[h] | CP | | |
| Format | Lecture | | 60 | 2 | 30 T / 45 S | 2.5 | | |
| | Exercises | | 30 | 2 | 30 T / 75 S | 3.5 | | |
| | T = face-to-face | ce teaching; | S = indep | endent st | Judy | | | |
| Exam achievements | Oral exam | | | | (gra | ded) | | |
| Study achievements | Successful exer | cise partici | oation | | (not gra | ded) | | |
| Forms of media | | | | | | | | |
| Literature | R. Sutton an 1998. O. Sigaud an | | | | | ess, | | |
| | Interaction Lea | | · / | | - | | | |

| Module | Artificial Life | | | | | | | |
|--------------------|--|---|----------------------|---------------|----------------------------|--------------|--|--|
| MA-INF 4201 | | | | | | | | |
| Workload | Credit points | Duration | Frequen | cy | | | | |
| 180 h | 6 CP | 1 semester | every y | ear | | | | |
| Module | Prof. Dr. Sven Behnke | | | | | | | |
| coordinator | | | | | | | | |
| Lecturer(s) | Prof. Dr. Sver | n Behnke, Dr | . Nils Goe | erke | | | | |
| Classification | Programme | | Mode | Semest | ter | | | |
| Classification | M. Sc. Compu | M. Sc. Computer Science Optional 1., 2. or 3. | | | | | | |
| Technical skills | Detailed under | rstanding of t | the most i | mportant | t approaches a | nd | | |
| | principles of a | rtificial life. I | Knowledge | e and uno | derstanding of | the | | |
| | current state o | of research in | the field of | of artifici | al life | | | |
| Soft skills | Capability to i | - | | | | | | |
| | present and de | | | | | | | |
| | front of a grou | - | s. Critical | discussio | on of the result | s of | | |
| | the homework | | | | | | | |
| Contents | Foundations of | | , | | , | | | |
| | of Life"; mecha | | | - | , | s of | | |
| | nonlinear dyna | e e | , | | , | | | |
| | evolutionary n | | | , | | | | |
| | learning, artifi | | - | - | | | | |
| | self-organising | | - | - | , and swarm | | | |
| D | intelligence, pa | article swarm | optimiza | tion. | | | | |
| Prerequisites | none | · | • | 1 / 1 | XX7 11 1/11 | CD | | |
| E (| Teaching formation | at Gr | oup size | h/week | Workload[h] | CP | | |
| Format | Exercises | | 60 30 | $\frac{2}{2}$ | 30 T / 45 S 30 T / 75 S | $2.5 \\ 3.5$ | | |
| | | | I | | , , | 0.0 | | |
| | T = face-to-fa | ce teaching; S | S = indep | endent st | | | | |
| Exam achievements | Written exam | | | | (8 | ded) | | |
| Study achievements | Successful exer | | | | (not gra | | | |
| Forms of media | Pencil and pap | . – | | | | rcise | | |
| | group, implem | | mall prog | rams, use | e of simple | | | |
| | simulation too | | | A | | | | |
| | • Christoph A | | | | , | | | |
| | Electronic Lib | | | | | | | |
| | • Eric Bonabe | , | 0, 0 | | | | | |
| | Intelligence: F | | | - | | t | | |
| Literature | University Press, Santa Fe Institute Studies in the Science of | | | | | | | |
| | Complexity. • Andrzej Osy | ezka: Evolut | ionary AL | rorithms | for Single and | | | |
| | • Andrzej Osy Multicriteria I | | | | 0 | | | |
| | Soft Computin | | | | - | | | |
| | Heidelberg | 18, 1 11y 510a- V | 5110 <u>6</u> , 11 L | pringer- | Company | - <i>J</i> , | | |
| | mendemerg | | | | | | | |

| Module | Autonomou | s Mobile | Systems | | | | | | |
|--------------------|---|--|-----------------|---------------------------------------|--------------------|-------|--|--|--|
| MA-INF 4203 | | | | | | | | | |
| Workload | Credit points | Duration | Freque | ncy | | | | | |
| 180 h | 6 CP | 1 semeste | ster every year | | | | | | |
| Module | Prof. Dr. Sver | n Behnke | | | | | | | |
| coordinator | | | | | | | | | |
| Lecturer(s) | Dr. Dirk Schu | Dr. Dirk Schulz, Prof. Dr. Sven Behnke | | | | | | | |
| Classification | Programme | | Mode | Semes | ter | | | | |
| Classification | M. Sc. Computer Science Optional 2. | | | | | | | | |
| Technical skills | Profound know | vledge of de | velopment | and test | regarding strue | cture | | | |
| | and function c | of learning, a | utonomou | ıs, mobile | systems; | | | | |
| | Knowledge of | the comput | ational, m | athematic | al, and technic | al | | | |
| | requirements f | - | | - | | fic | | | |
| | | applications and for specific functional environments | | | | | | | |
| Soft skills | | The students will be capable to assess applications for | | | | | | | |
| | | autonomous mobile systems. They will be capable to identify | | | | | | | |
| | - | what part of the applications might be improved by using state | | | | | | | |
| | of the art developments. The student will learn how to plan and | | | | | | | | |
| | implement a s | | | | | | | | |
| Contents | Requirements | - | | | | | | | |
| | systems, e.g. f | - | | | | | | | |
| | SLAM-method | · – | - | - | | | | | |
| | methods for a | - | | arison of o | different learning | ng | | | |
| | paradigms for | | | | | | | | |
| Prerequisites | Recommended | | 0 | | | | | | |
| | MA-INF 4101 | - | | otor Syste | ems | | | | |
| | MA-INF 4113 | 1 | | | *** 11 1/11 | GD | | | |
| | Teaching form | at G | roup size | h/week | Workload[h] | CP | | | |
| Format | Lecture | | 60 20 | $\begin{vmatrix} 2\\ 0 \end{vmatrix}$ | 30 T / 45 S | 2.5 | | | |
| | Exercises | | 30 | 2 | 30 T / 75 S | 3.5 | | | |
| | T = face-to-fa | ce teaching; | S = indep | pendent st | | | | | |
| Exam achievements | Oral exam | | | | | ided) | | | |
| Study achievements | Successful exe | rcise partici | pation | | (not gra | .ded) | | | |
| Forms of media | | | | | | - | | | |
| | • J. Buchli: Mobile Robots: Moving Intelligence, Published by | | | | | | | | |
| | Advanced Rob | | | | 0 | | | | |
| Literature | | | | d, Dieter | Fox: Probabili | stic | | | |
| | Robotics, MIT | , | | | | | | | |
| | | et et al.: Pri | nciples of | Robot Me | otion, MIT-Pre | ess, | | | |
| | 2005 | | | | | | | | |

| | Technical N | Jours 1 Note | | | | | | |
|-----------------------|---|--|----------------|---------------|-----------------------------------|------------------|--|--|
| Module MA-INF 4204 | | leural mets | i | | | | | |
| Workload | Credit reinte | Duration | Theorem | | | | | |
| 180 h | Credit points 6 CP | Duration 1 semester | Freque | - | | | | |
| | 6 CP 1 semester every year Prof. Dr. Joachim K. Anlauf | | | | | | | |
| Module | Prol. Dr. Joad | min K. Ana | uı | | | | | |
| coordinator | Prof. Dr. Joachim K. Anlauf, Dr. Nils Goerke | | | | | | | |
| Lecturer(s) | | chim K. Ahla | · · | | | | | |
| Classification | Programme | | Mode | Semest | | | | |
| | - | M. Sc. Computer Science Optional 1., 2. or 3. Detailed knowledge of the most important neural network | | | | | | |
| Technical skills | | | | | | | | |
| | | approaches and learning algorithms and its fields of application. Knowledge and understanding of technical neural networks as | | | | | | |
| | | | 0 | | | | | |
| | Non-Von Neumann computer architectures similar to concepts of brain functions at different stages of development | | | | | | | |
| | | | - | | | | | |
| Soft skills | | The students will be capable to propose several paradigms from neural networks that are capable to solve a given task. They can | | | | | | |
| | | | - | 0 | ÷ | | | |
| | discuss the pro | | - | | 0 | | | |
| | - | will be capable to plan and implement a small project with state of the art neural network solutions. | | | | | | |
| | | | | · | the Handald | 4 | | |
| Contents | Multi-layer pe | | | | · – | iets, | | |
| | self organizing | | | - | ε, | | | |
| | learning vector | - | | | | | | |
| | back-propagat | | | | | g, | | |
| | support vector | , . | - | 0 | | | | |
| | Exemplary app | • | | | * * | , | | |
| | prediction, qua | | | | | mg, | | |
| | action plannin | | | - | | . . | | |
| | Implementatio | | | | | e: | | |
| D ''' | tools, simulato | ors, analog an | u uigitai | neurai na | Idware. | | | |
| Prerequisites | none | at Car | | 1. / | XX 71-11-[1] | CD | | |
| Format | Teaching formation | at Gr | oup size 60 | h/week 2 | Workload[h] 30 T / 45 S | CP 2.5 | | |
| rormat | Exercises | | 00 30 | $\frac{2}{2}$ | 30 T / 45 S 30 T / 75 S | | | |
| | | | 1 | | | 0.0 | | |
| | T = face-to-fa | ce teaching; S | S = indep | endent st | | | | |
| Exam achievements | Written exam | | | | (8 | ded) | | |
| Study achievements | Successful exe | rcise particip | ation | | (not gra | .ded) | | |
| Forms of media | | | | | | | | |
| | • Christopher | - | | | | | | |
| | Recognition, C | | sity Pres | s, ISBN-1 | 0: 0198538642 | , | | |
| Literature | ISBN-13: 978- | | | | D. D. | _ | | |
| | • Ian T. Nabn | - | - | | - | ion, | | |
| | Springer, ISBN | N-10: 185233^{2} | 4401, ISB | N-13: 978 | 3-1852334406 | | | |

| Module MA-INF 4206 | Selected To | pics in Se | nsor Dat | a Interj | pretation | | | |
|-----------------------|---|---|------------|-------------|------------------|-------|--|--|
| Workload | Credit points | Duration | Freque | ncy | | | | |
| 180 h | 6 CP | 1 semester every year | | | | | | |
| Module | PD Dr. Volker | PD Dr. Volker Steinhage | | | | | | |
| coordinator | | | | | | | | |
| Lecturer(s) | PD Dr. Volker | PD Dr. Volker Steinhage | | | | | | |
| Classification | Programme | | Mode | Semes | ter | | | |
| Classification | M. Sc. Compu | ter Science | Optional | 2. | | | | |
| Technical skills | Understanding | Inderstanding of important paradigms and methods of sensor | | | | | | |
| | data interpreta | lata interpretation and ability to implement systems for | | | | | | |
| | interpreting se | nterpreting sensor data | | | | | | |
| Soft skills | • Ability to co | Ability to cooparate in small groups on solving given tasksAbility to put a conceptual solution and its implemention | | | | | | |
| | • Ability to pu | | | | | | | |
| | down on paper | r | | | | | | |
| | • Ability to pr | • Ability to present and discuss a conceptual solution and its | | | | | | |
| | implemention | implemention in an oral presentation | | | | | | |
| Contents | Approaches to | Approaches to feature extraction and classification of sensor | | | | | | |
| | data with app | lications in s | cene analy | vsis, objec | ct detection and | d | | |
| | object tracking | у. Э | | | | | | |
| Prerequisites | Required: all o | | 0 | | | | | |
| | MA-INF 2201 | - | | | | | | |
| | BA-INF 131 – | Intelligente | Sehsysten | ne | | | | |
| | Module MA-II | NF 4206 "Sel | ected Top | ics in Ser | nsor Data | | | |
| | Interpretation | " requires kn | owledge a | nd skills i | in the foundati | ons | | |
| | of compuer vis | sion like give | n in the B | achelor n | nodule BA-INF | ` 131 | | |
| | - | - | r in Mast | er module | e MA-INF 2201 | L | | |
| | "Computer Vis | | | | | | | |
| | Teaching form | at G | oup size | h/week | Workload[h] | CP | | |
| Format | Lecture | | 60 | 2 | 30 T / 45 S | 2.5 | | |
| | Exercises | | 30 | 2 | 30 T / 75 S | 3.5 | | |
| | T = face-to-fa | ce teaching; | S = indep | endent st | tudy | | | |
| Exam achievements | Written exam | | | | | ded) | | |
| Study achievements | Successful exe | rcise particip | ation | | (not gra | ded) | | |
| Forms of media | | | | | | | | |
| | • Simon J.D. Prince: Computer Vision: Models, Learning, and | | | | | | | |
| | Inference. Cambridge University Press, 2012. | | | | | | | |
| Literature | • Richard Szel | - | | : Algorith | hms and | | | |
| | Applications. | Springer, 20 | LO. | | | | | |
| | • Selected up- | to-date publ | ications. | | | | | |

| Module MA-INF 4207 | Dynamically Reconfigurable Systems | | | | | | |
|-----------------------|------------------------------------|--|---------------|-------------|------------------|------|--|
| Workload | Credit points | Duration | Freque | nev | | | |
| 180 h | 6 CP | | | | vears | | |
| Module | Prof. Dr. Joachim K. Anlauf | | | | | | |
| coordinator | | | | | | | |
| Lecturer(s) | Prof. Dr. Joac | chim K. An | auf | | | | |
| | Programme | | Mode | Semest | ter | | |
| Classification | M. Sc. Compu | ter Science | Optiona | $1 \mid 2.$ | | | |
| Technical skills | Knowledge of | | ~ | | itectures, abili | ty | |
| | to select appro | to select appropriate FPGAs for a given application, overview of | | | | | |
| | programming | programming tools | | | | | |
| Soft skills | Communicativ | Communicative skills (oral and written presentation of | | | | | |
| | solutions), soc | ial skills (a | oility to sol | lve proble | ms in small tea | ams, | |
| | discussions of | solution co | ncepts) self | competer | nces (ability to | | |
| | accept and for | mulate crit | cism, abili | ty to anal | yze problems) | | |
| Contents | Architecture o | f FPGAs, (| Configurabl | e Logic B | locks, Wiring | | |
| | Ressources, Sp | ecial Block | s, Hardwar | e Descrip | tion Language | s, | |
| | Synthesis, Tec. | hnology Ma | pping, Pla | ce and Ro | oute, FPGA | | |
| | Computing, Pa | artial Reco | nfigurabilit | У | | | |
| Prerequisites | none | | | | | | |
| | Teaching forma | at (| roup size | h/week | Workload[h] | CP | |
| Format | Lecture | | 60 | 2 | 30 T / 45 S | 2.5 | |
| | Exercises | | 30 | 2 | 30 T / 75 S | 3.5 | |
| | T = face-to-fa | ce teaching | S = indep | oendent st | udy | | |
| Exam achievements | Oral exam | | | | (gra | ded) | |
| Study achievements | Successful exer | rcise partic | pation | | (not gra | ded) | |
| Forms of media | | | | | | | |
| Literature | Current resear | ch papers a | nd technic | al docum | entation | | |

| Module | Seminar Vision Systems | | | | | | | | |
|--------------------|--|--|--------------|-----------|-------------------|----------|--|--|--|
| MA-INF 4208 | | | | | | | | | |
| Workload | Credit points | Duration | Frequen | cy | | | | | |
| 120 h | 4 CP | 1 semester | every se | emester | | | | | |
| Module | Prof. Dr. Sven Behnke | | | | | | | | |
| coordinator | | | | | | | | | |
| Lecturer(s) | Prof. Dr. Sver | n Behnke, Pr | of. Dr. Jo | achim K | . Anlauf, | | | | |
| | Dr. Nils Goerl | Dr. Nils Goerke | | | | | | | |
| Classification | Programme | | Mode | Semes | | | | | |
| Classification | M. Sc. Compu | | Optional | | | | | | |
| Technical skills | Knowledge in | | | | | | | | |
| | | systems, such as image segmentation, feature extraction, and object recognition. | | | | | | | |
| | Ability to understand new research results presented in original scientific papers and to present them in a research talk as well | | | | | | | | |
| | | | | | | | | | |
| | in a seminar re | in a seminar report. | | | | | | | |
| Soft skills | Self-competences (time management, literature search, self-study), | | | | | | | | |
| | communication | n skills (prer | aration ar | d clear d | lidactic | | | | |
| | presentation of | | | | | 1 | | | |
| | writing of sem | | in, selentin | | son, structured | 1 | | | |
| | social skills (al examination of | - | | accept c | riticism, critica | al | | | |
| Contents | Current resear field of vision s applications. | | | | - | e | | | |
| Prerequisites | Recommended | : At least 1 | of the follo | wing: | | | | | |
| | MA-INF 4111 | - Intelligent | Learning | and Ana | lysis Systems: | | | | |
| | Machine Learr | ning | | | | | | | |
| | MA-INF 4204 | – Technical | Neural Ne | ts | | | | | |
| Format | Teaching forma | at G | oup size | h/week | Workload[h] | CP | | | |
| | Seminar | | 10 | 2 | 30 T / 90 S | 4 | | | |
| | T = face-to-fa | ce teaching; | S = indep | endent st | tudy | | | | |
| Exam achievements | Oral presentat | ion, written | report | | (gra | ided) | | | |
| Study achievements | none | | | | (not gra | ided) | | | |
| Forms of media | | | | | | | | | |
| | • R. Szeliski: Computer Vision: Algorithms and Applications, | | | | | | | | |
| | Springer 2010. | | | | | | | | |
| Literature | - | - | ecognition | and Ma | chine Learning | <i>,</i> | | | |
| | Springer 2006. | | C | | | | | | |
| | • D. A. Forsyth and J. Ponce: Computer Vision: A Modern | | | | | | | | |
| | Approach, Prentice Hall, 2003. | | | | | | | | |

| Module MA-INF 4209 | Seminar Pr Algorithms | Seminar Principles of Data Mining and Learning Algorithms | | | | | |
|-----------------------|--|--|--------------|---------------------------|---|--|--|
| Workload | Credit points | Duration | Freque | ncy | | | |
| 120 h | 4 CP | 1 semeste | r every g | every year | | | |
| Module | Prof. Dr. Stef | an Wrobel | · | | | | |
| coordinator | | | | | | | |
| Lecturer(s) | Prof. Dr. Stef | an Wrobel | | | | | |
| Classification | Programme | | Mode | Semes | ter | | |
| Classification | M. Sc. Compu | ter Science | Optiona | $1 \mid 2. \text{ or } 3$ | 3. | | |
| Technical skills | area of machin competence to it to others an auditorium. Le | Enhanced and in-depth knowledge in specialized topics in the area of machine learning and data mining, acquiring the competence to independently study scientific literature, present it to others and discuss it with a knowledgeable scientific auditorium. Learn how to scientifically present prior work by others, in writing and in presentations. | | | | | |
| Soft skills | Communicativ | e skills (pro | paring an | d presenti | ng talks, written | | |
| | - | ment with l | ong-rangin | g deadline | i), self competences es, ability to accept eativity). | | |
| Contents | Theoretical, st | | 0 | - | - | | |
| | mining and lea algorithms. Sp research. Fund | pecialized le | arning alg | orithms fr | om the frontier of | | |
| Prerequisites | Recommended | : At least 1 | of the fol | owing: | | | |
| | MA-INF 4111 Machine Learr MA-INF 4112 | ning | | · | | | |
| | Data Mining a | 0 | | · | iyala bystemia. | | |
| | Teaching forma | | roup size | h/week | Workload[h] CP | | |
| Format | Seminar | | 10 | 2 | 30 T / 90 S 4 | | |
| | T = face-to-fa | ce teaching | S = inder | - pendent st | tudy | | |
| Exam achievements | Oral presentat | | | | (graded) | | |
| Study achievements | none | , | ·r· · | | (not graded) | | |
| Forms of media | Scientific pape | ers and web | sites, inter | active pre | () | | |
| Literature | | iterature wi | / | | rards the end of the | | |

| Module MA-INF 4210 | Seminar Advanced Topics in Technical Informatics | | | | | | |
|-----------------------|--|---|-------|------------------------|---------------------------|-----------------|---------------------|
| Workload | Credit points | Credit points Duration Frequency | | | | | |
| 120 h | 4 CP | 1 semes | ter | at least | every 2 | years | |
| Module | Prof. Dr. Joac | chim K. A | nlaı | ıf | | | |
| coordinator | | | | | | | |
| Lecturer(s) | Prof. Dr. Joac | chim K. A | nlaı | ıf | | | |
| Classification | Programme | | | Mode | Semest | ter | |
| Classification | M. Sc. Compu | ter Sciene | ce | Optional | $1 \mid 2. \text{ or } 3$ | 3. | |
| Technical skills | Current Topic | s in Techr | nical | Informa | tics | | |
| Soft skills | Communicativ | Communicative skills (preparing and presenting talks, preparing | | | | | |
| | a structured w | ritten do | cum | ent), soc | ial skills (| ability to acce | pt |
| | and formulate | criticism, | dise | cussions | of current | content) self | |
| | competences (| time man | ager | nent wit | n long-ran | nging deadlines | з, |
| | understanding | | | - | _ | | |
| Contents | Current topics | s such as: | new | archited | tures of c | computers or | |
| | FPGAs (field | | | - | rays) or n | ew application | ns of |
| | dynamically re | econfigura | ble : | systems | | | |
| Prerequisites | none | | | | | | |
| Format | Teaching form | at | Gro | oup size | h/week | Workload[h] | CP |
| ronnat | Seminar | | | 10 | 2 | 30 T / 90 S | 4 |
| | T = face-to-fa | ce teachir | ıg; S | = indep | endent st | udy | |
| Exam achievements | Oral presentat | tion, writt | en r | eport | | (gra | ided) |
| Study achievements | none | | | | | (not gra | ided) |
| Forms of media | | | | | | | |
| Literature | Current resear | ch papers | | | | | |

| | Sominon Co | mitivo Do | hotica | | | | | |
|-----------------------|--|---|--------------|--------------|-------------------|------|--|--|
| Module MA-INF 4211 | Seminar Co | gintive no | DOUICS | | | | | |
| Workload | Credit points | Duration | Frequen | | | | | |
| 120 h | 4 CP | 1 semester | | | | | | |
| Module | Prof. Dr. Sver | | every se | | | | | |
| coordinator | | Dennike | | | | | | |
| Lecturer(s) | Prof Dr Sver | n Behnke Dr | Nils Goe | orko | | | | |
| Lecturer (s) | | Prof. Dr. Sven Behnke, Dr. Nils Goerke Programme Mode Semester | | | | | | |
| Classification | M. Sc. Compu | ter Science | mode | | | | | |
| Technical skills | | | | | | ice | | |
| Technical Skills | 0 | Knowledge in advanced topics in the area of cognitive robotics, such as robot perception, action planning, and robot learning. | | | | | | |
| | | | | | | | | |
| | Ability to understand new research results presented in original | | | | | | | |
| | scientific pape | scientific papers and to present them in a research talk as well as | | | | | | |
| | in a seminar r | in a seminar report. | | | | | | |
| Soft skills | Self-competen | Self-competences (time management, literature search, | | | | | | |
| | self-study), | | | | | | | |
| | communication | communication skills (preparation and clear didactic | | | | | | |
| | | (| | | sion, structured | 1 | | |
| | writing of sem | | , | | , | | | |
| | social skills (a | bility to form | ulate and | accent c | riticism, critica | 1 | | |
| | examination o | - | | accept o | | 01 | | |
| Contents | | | | ences and | journals in th | e | | |
| Contonio | field of cogniti | | | | • | | | |
| | applications. | | 0,01110,14 | 114441110110 | ar teeninques a | | | |
| Prerequisites | Recommended | : At least 1 d | of the follo | wing: | | | | |
| 1 | MA-INF 4113 | | | 0 | | | | |
| | MA-INF 4114 | 0 | | | | | | |
| | Teaching form | | oup size | h/week | Workload[h] | CP | | |
| Format | Seminar | | 10 | 2 | 30 T / 90 S | 4 | | |
| | T = face-to-fa | ce teaching. | S = indep | endent st | | ' | | |
| Exam achievements | Oral presentat | | | | | ded) | | |
| Study achievements | none | , | 1 | | (not gra | | | |
| Forms of media | | | | | (0 | / | | |
| | • S. Thrun, W. Burgard and D. Fox: Probabilistic Robotics. | | | | | | | |
| | MIT Press, 2005. | | | | | | | |
| Literature | • B. Siciliano, | | Eds.): Spr | inger Ha | ndbook of | | | |
| | Robotics, 2008 | | , . | 0 | | | | |
| | • Selected pap | | | | | | | |
| | | | | | | | | |

| Module | Data Science | and Big | Data | | | | | | |
|--------------------|---|---|------------|---------------|-------------------|--------|--|--|--|
| MA-INF 4212 | | | | | | | | | |
| Workload 180 h | - | Duration semester | Frequer | - | | | | | |
| Module | Prof. Dr. Stefan | | every ye | al | | | | | |
| coordinator | 1 IOI. DI. Stelali | WIODEI | | | | | | | |
| Lecturer(s) | Dr. Tamas Horva | th PD Dr | Michael N | lock | | | | | |
| | Programme | - | | Semester | | | | | |
| Classification | M. Sc. Computer | | Optional | 3. or 4. | | | | | |
| Technical skills | Participants acqu | | - | e of differen | nt aspects of big | r S | | | |
| | data analytics and | l systems, i | ncluding d | listributed | processing syste | ems | | | |
| | and big data data | | | | - | • • | | | |
| | structured and un | | | | | | | | |
| | computer because | | | | | es | | | |
| G (t. 1.11) | with such a high | | | | | | | | |
| Soft skills | | Communicative skills (oral and written presentation of solutions, | | | | | | | |
| | | liscussions in teams), self-competences (ability to accept and formulate riticism, ability to analyse, creativity in the context of an "open end" | | | | | | | |
| | | | | | | end" | | | |
| Contents | task), social skills | | | | | | | | |
| Contents | The module is off more specific issue | | year, each | time conce. | ntrating on one | or | | | |
| | | | 1. 1. | | | | | | |
| | - architectures and | | | | | | | | |
| | - distributed bate | h and strea | m processi | ng systems | , | | | | |
| | - non-standard da | tabases for | big data, | | | | | | |
| | - databases for str | ructured da | ta, | | | | | | |
| | - similarity search | , | | | | | | | |
| | - synopses for ma | ssive data, | | | | | | | |
| | - classical data m | ining tasks | for massiv | e data and | /or data stream | s, | | | |
| | - mining massive | graphs, | | | | | | | |
| | - applications. | | | | | | | | |
| Prerequisites | Recommended: | | - | | | | | | |
| | MA-INF 4111 – I | ntelligent L | earning an | d Analysis | Systems: Mach | ine | | | |
| | Learning | , 11 . , T | | 1 4 1 . | | | | | |
| | MA-INF 4112 – I | - | - | id Analysis | Systems: Data | | | | |
| | Mining and Know Teaching format | - | roup size | h/week | Workload[h] | CP | | | |
| Format | Lecture | G | 60 | 2 | 30 T / 45 S | 2.5 | | | |
| rormat | Exercises | | 30 | $\frac{2}{2}$ | 30 T / 75 S | 3.5 | | | |
| | | oo ching: S | | 1 | | 0.0 | | | |
| Exam achievements | T = face-to-face t Written exam | caching, 5 | – muepen | aciii siuuy | (or : | aded) | | | |
| Study achievements | Successful exercise | e participat | ion | | (not gra | / | | | |
| Forms of media | lectures, exercises | | | | (8 | | | | |
| | - N. Marz and J. | | | rinciples an | d best practices | s of | | | |
| | scalable realtime | data system | ns. Mannir | ng Pubn, 20 |)14. | | | | |
| | - T. White: Hadoop The Definitive Guide. O'REILLY, 2012. | | | | | | | | |
| | - A. Rajaraman a | - | | | | | | | |
| Literature | - | | | | | | | | |
| | Cambridge Unive | • | | . ~ | . . ~ | | | | |
| | - G. Cormode, M. Garofalakis, P.J. Haas, and C. Jermaine: Synopses | | | | | | | | |
| | for Massive Data: Samples, Histograms, Wavelets, Sketches. Foundations and Trends in Databases 4(1-3): 1-294 (2012). | | | | | | | | |

| MA-INF 4213 Credit points Duration Frequency Workload Credit points Duration Prequency 120 h 4 CP 1 semester every semester Module Prof. Dr. Maren Bennewitz every semester coordinator Lecturer(s) Prof. Dr. Maren Bennewitz Optional 2. Classification M. Sc. Computer Science Optional 2. Technical skills Knowledge in advanced topics in the area of humanoid robotics, such as environment perception, state estimation, navigation, or motion planning. Ability to understand new research results of scientific papers and to present them in a talk as well as in a self-written summary. Soft skills Self-competences (time management, literature search, self-study), communication skills (preparation of the talk, clear didactic presentation of techniques and experimental results). contails (ability to discussion, structured writing of summary), social skills (ability to afformulate and accept criticism, critical examination of algorithms and experimental results). Contents Current research papers from conferences and journals in the field of humanoid robotics covering fundamental techniques and applications. Prerequisites Recommended: At least 1 of the following: MA-INF 4113 – Cognitive Robotics MA-INF 4113 – Cognitive Robotics T = face-to-face teaching; S = independent study Exam achievements | Module | Seminar Hu | imanoid R | obots | | | | |
|---|------------------|--|----------------|---------------------------------------|-----------|------------------|-------|--|
| $\begin{array}{c c c c c c } 1 & \operatorname{semester} & \operatorname{every \ semester} & \\ \hline \mbox{Module} & \mbox{Prof. Dr. Marcn Bennewitz} & \\ \hline \mbox{Conditator} & \mbox{Prof. Dr. Marcn Bennewitz} & \\ \hline \mbox{Lecturer(s)} & \mbox{Prof. Dr. Marcn Bennewitz} & \\ \hline \mbox{Classification} & \mbox{Mode} & \mbox{Semester} & \\ \hline \mbox{Programme} & \mbox{Mode} & \mbox{Semester} & \\ \hline \mbox{Programme} & \mbox{Mode} & \mbox{Semestar} & \\ \hline \mbox{Programme} & \mbox{Mode} & \mbox{Semestar} & \\ \hline \mbox{Rescaled topics in the area of humanoid robotics, such as environment perception, state estimation, navigation, or motion planning. Ability to understand new research results of scientific papers and to present them in a talk as well as in a self-written summary. \\ \hline \mbox{Soft skills} & \mbox{Self-competences} (time management, literature search, self-study), \\ \hline \mbox{communication structured writing of summary), social skills (ability to order descenter) and experimental results, scientific discussion, structured writing of summary), social skills (ability to order descenter) applications. \\ \hline \mbox{formulate and accept criticism, critical examination of algorithms and experimental results). \\ \hline \mbox{Contents} & \mbox{Current research papers from conferences and journals in the field of humanoid robotics covering fundamental techniques and applications. \\ \hline \mbox{MA-INF 4113 - Cognitive Robotics} \\ \hline \mbox{MA-INF 4113 - Cognitive Robotics} \\ \hline \mbox{Format} & \mbox{ID a presentation, written report (graded) } \\ \hline \mbox{Format} & \mbox{ID a presentation, written report (graded) } \\ \hline \mbox{Forms of media} \\ \hline \mbox{Cond presentation, written report (graded) } \\ \hline \mbox{Forms of media} \\ \hline \mbox{ID a presentation, written report (graded) } \\ \hline \mbox{Forms of media} \\ \hline \mbox{ID a presentation, O. Khatib (Eds.): Springer Handbook of Robotics - (not graded) } \\ \hline ID a presentation, O. Khatib (Eds.): Motion Planning for later of later later of later of later later of l$ | | | | 00000 | | | | |
| $\begin{array}{c c c c c c } 1 & semester & every semester & \\ \hline \begin{tabular}{ c c c c } \hline \begin{tabular}{ c c c } \hline \begin{tabular}{ c c c c } \hline \begin{tabular}{ c c c } \hline \begin{tabular}{ c c c c } \hline \begin{tabular}{ c c c c c } \hline \begin{tabular}{ c c c c } \hline \begin{tabular}{ c c c c c } \hline \begin{tabular}{ c c c c c } \hline \begin{tabular}{ c c c c c c c } \hline \begin{tabular}{ c c c c c c c } \hline \begin{tabular}{ c c c c c c c } \hline \hline \begin{tabular}{ c c c c c c c c c c c } \hline \begin{tabular}{ c c c c c c c c c c c c c c c c c c c$ | Workload | Credit points | Duration | Frequen | cy | | | |
| coordinator Mode Semester Lecturer(s) Prof. Dr. Maren Bennewitz Mode Semester Classification M. Sc. Computer Science Optional 2. Technical skills Knowledge in advanced topics in the area of humanoid robotics, such as environment perception, state estimation, navigation, or motion planning. Ability to understand new research results of scientific papers and to present them in a talk as well as in a self-written summary. Soft skills Self-competences (time management, literature search, self-study), communication skills (preparation of the talk, clear didactic presentation of techniques and experimental results, scientific discussion, structured writing of summary), social skills (ability to formulate and accept criticism, critical examination of algorithms and experimental results). Contents Current research papers from conferences and journals in the field of humanoid robotics covering fundamental techniques and applications. Prerequisites Recommended: At least 1 of the following: MA-INF 4215 – Humanoid Robotics MA-INF 4215 – Humanoid Robotics MA-INF 4215 – Humanoid Robotics Format Image format Group size h/week Workload[h] CP Seminar Seminar 10 2 30 T / 90 S 4 T = face-to-face teaching; S = independent study Exam achievements Cord graded) A Study ac | 120 h | - | 1 semester | ster every semester | | | | |
| $\begin{tabular}{ c c c c c c } \hline $ $ $ $ $ $ $ $ $ $ $ $ $ $ $ $ $ $ $ | Module | Prof. Dr. Mar | en Bennewitz | Z | | | | |
| Classification Programme M. Sc. Computer Science Mode Optional Semester 2. Technical skills Knowledge in advanced topics in the area of humanoid robotics, such as environment perception, state estimation, navigation, or motion planning. Ability to understand new research results of scientific papers and to present them in a talk as well as in a self-written summary. Soft skills Self-competences (time management, literature search, self-study), communication skills (preparation of the talk, clear didactic presentation of techniques and experimental results, scientific discussion, structured writing of summary), social skills (ability to formulate and accept criticism, critical examination of algorithms and experimental results). Contents Current research papers from conferences and journals in the field of humanoid robotics covering fundamental techniques and applications. Prerequisites Recommended: At least 1 of the following: MA-INF 4215 – Humanoid Robotics MA-INF 4215 – Humanoid Robotics MA-INF 4113 – Cognitive Robotics Ma-INF 4113 – Cognitive Robotics T = face-to-face teaching; S = independent study Exam achievements Oral presentation, written report (graded) Study achievements none (not graded) Forms of media - S. Thrun, W. Burgard and D. Fox: Probabilistic Robotics. - B. Siciliano, O. Khatib (Eds.): Springer Handbook of Robotics - S. Thrun, W. Burgard and D. Fox: Orbabilistic Robo | coordinator | | | | | | | |
| $\begin{tabular}{ c c c c c c } \hline Classification & M. Sc. Computer Science & Optional & 2. \\ \hline Technical skills & Knowledge in advanced topics in the area of humanoid robotics, such as environment perception, state estimation, navigation, or motion planning. Ability to understand new research results of scientific papers and to present them in a talk as well as in a self-written summary. \\ \hline Soft skills & Self-competences (time management, literature search, self-study), communication skills (preparation of the talk, clear didactic presentation of techniques and experimental results, scientific discussion, structured writing of summary), social skills (ability to formulate and accept criticism, critical examination of algorithms and experimental results). \\ \hline Contents & Current research papers from conferences and journals in the field of humanoid robotics covering fundamental techniques and applications. \\ \hline Prerequisites & Recommended: At least 1 of the following: MA-INF 4215 - Humanoid Robotics MA-INF 4215 - Humanoid Robotics MA-INF 4113 - Cognitive Robotics MA-INF 411$ | Lecturer(s) | Prof. Dr. Mar | en Bennewitz | Z | | | | |
| M. Sc. Computer ScienceOptional2.Technical skillsKnowledge in advanced topics in the area of humanoid robotics, such as environment perception, state estimation, navigation, or motion planning. Ability to understand new research results of scientific papers and to present them in a talk as well as in a self-written summary.Soft skillsSelf-competences (time management, literature search, self-study), communication skills (preparation of the talk, clear didactic presentation of techniques and experimental results, scientific discussion, structured writing of summary), social skills (ability to formulate and accept criticism, critical examination of algorithms and experimental results).ContentsCurrent research papers from conferences and journals in the field of humanoid robotics covering fundamental techniques and applications.PrerequisitesRecommended: At least 1 of the following: MA-INF 4215 - Humanoid RoboticsMA-INF 4215 - Humanoid RoboticsMA-INF 4113 - Cognitive RoboticsFormatTeaching format SeminarGroup size h/weekMorkload[h]CP SeminarStudy achievementsOral presentation, written report (graded)Study achievementsoneone(not graded)Forms of media-Literature-B. Siciliano, O. Khatib (Eds.): Springer Handbook of Robotics - K. Harada, E. Yoshida, K. Yokoi (Eds.), Motion Planning for | Cleasification | Programme | | Mode | Semest | ter | | |
| $\begin{tabular}{lllllllllllllllllllllllllllllllllll$ | Classification | M. Sc. Compu | ter Science | Optional | 2. | | | |
| $\begin{tabular}{ l l l l l l l l l l l l l l l l l l l$ | Technical skills | 0 | - | | | | , | |
| $\begin{tabular}{ c c c c } eq:scientific papers and to present them in a talk as well as in a self-written summary. $$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$ | | | | , | | , 0 | , | |
| self-written summary.Soft skillsSelf-competences (time management, literature search, self-study), communication skills (preparation of the talk, clear didactic presentation of techniques and experimental results, scientific discussion, structured writing of summary), social skills (ability to formulate and accept criticism, critical examination of algorithms and experimental results).ContentsCurrent research papers from conferences and journals in the field of humanoid robotics covering fundamental techniques and applications.PrerequisitesRecommended: At least 1 of the following: MA-INF 4215 – Humanoid Robotics MA-INF 4215 – Gontive RoboticsFormatTeaching formatGroup sizeh/weekWorkload[h]CPSeminar10230 T / 90 S4T = face-to-face teaching; S = independent studyStudy achievementscont graded)Study achievementsone(not graded)Forms of mediaLiterature-S. Thrun, W. Burgard and D. Fox: Probabilistic Robotics. MIT Press-Literature-S. Siciliano, O. Khatib (Eds.): Springer Handbook of Robotics - K. Harada, E. Yoshida, K. Yokoi (Eds.), Motion Planning for | | - | 0 | | | | | |
| Soft skills Self-competences (time management, literature search, self-study), communication skills (preparation of the talk, clear didactic presentation of techniques and experimental results, scientific discussion, structured writing of summary), social skills (ability to formulate and accept criticism, critical examination of algorithms and experimental results). Contents Current research papers from conferences and journals in the field of humanoid robotics covering fundamental techniques and applications. Prerequisites Recommended: At least 1 of the following: MA-INF 4215 – Humanoid Robotics MA-INF 4215 – Humanoid Robotics MA-INF 4113 – Cognitive Robotics Format Teaching format Group size h/week Workload[h] CP Seminar 10 2 30 T / 90 S 4 T = face-to-face teaching; S = independent study Inone (not graded) Study achievements Oral presentation, written report (graded) MIT Press - S. Thrun, W. Burgard and D. Fox: Probabilistic Robotics. MIT Press - B. Siciliano, O. Khatib (Eds.): Springer Handbook of Robotics - K. Harada, E. Yoshida, K. Yokoi (Eds.), Motion Planning for | | scientific pape | rs and to pre | sent them | ın a talk | as well as in | a | |
| self-study),communication skills (preparation of the talk, clear didactic presentation of techniques and experimental results, scientific discussion, structured writing of summary), social skills (ability todiscussion, structured writing of summary), social skills (ability toformulate and accept criticism, critical examination of algorithms and experimental results).ContentsCurrent research papers from conferences and journals in the field of humanoid robotics covering fundamental techniques and applications.PrerequisitesRecommended: At least 1 of the following: MA-INF 4215 – Humanoid Robotics MA-INF 4215 – Humanoid RoboticsMA-INF 4215 – Humanoid RoboticsMA-INF 4215 – Humanoid RoboticsMA-INF 4113 – Cognitive RoboticsMA-INF 4113 – Cognitive RoboticsMaring formatGroup sizeh/weekWorkload[h]CPSeminar10230 T / 90 S4T = face-to-face teaching; S = independent studySeminar102Study achievementsOral presentation, written report(grad-to)Study achievementsOral presentation, written report(not grad-to)Study achievement | | | e | | | | | |
| Communication skills (preparation of the talk, clear didactic presentation of techniques and experimental results, scientific discussion, structured writing of summary), social skills (ability toformulate and accept criticism, critical examination of algorithms and experimental results).formulate and accept criticism, critical examination of algorithms and experimental results).ContentsCurrent research papers from conferences and journals in the field of humanoid robotics covering fundamental techniques and applications.PrerequisitesRecommended: At least 1 of the following: MA-INF 4215 - Humanoid Robotics MA-INF 4113 - Cognitive RoboticsMA-INF 4113 - Cognitive RoboticsMorkload[h]CP Seminar10230 T / 90 S4T = face-to-face teaching; S = independent studyStudy achievementsOral presentation, written report0ral presentation, written report(not graded)Forms of media- S. Thrun, W. Burgard and D. Fox: Probabilistic Robotics. MIT PressLiterature- B. Siciliano, O. Khatib (Eds.): Springer Haubook of Robotics. | Soft skills | - | ces (time mai | nagement, | literatur | e search, | | |
| Presentation of techniques and experimental results, scientific discussion, structured writing of summary), social skills (ability toformulate and accept criticism, critical examination of algorithms and experimental results).formulate and accept criticism, critical examination of algorithms and experimental results).ContentsCurrent research papers from conferences and journals in the field of humanoid robotics covering fundamental techniques and applications.PrerequisitesRecommended: At least 1 of the following: MA-INF 4215 – Humanoid Robotics MA-INF 4113 – Cognitive RoboticsFormatTeaching formatGroup sizeh/weekWorkload[h]CP SeminarSeminar10230 T / 90 S4T = face-to-face teaching; S = independent study(not graded)Study achievementsOral presentation, writter report(not graded)Forms of media S. Thrun, W. Burgard and D. Fox: Probabilistic Robotics. MIT PressLiterature- S. Sciliano, O. Khatib (Eds.): Springer Hatbook of Robotics. S. K. Harada, E. Yoshida, K. Yokoi (Eds.), Motion Planning for | | 0,,, | | | | | | |
| Interval witing of summary), social skills (ability to formulate and accept criticism, critical examination of algorithms and experimental results).ContentsCurrent research papers from conferences and journals in the field of humanoid robotics covering fundamental techniques and applications.PrerequisitesRecommended: At least 1 of the following: MA-INF 4215 – Humanoid Robotics MA-INF 4113 – Cognitive RoboticsFormatTeaching formatGroup sizeh/weekWorkload[h]CP SeminarFormatTeaching formatGroup sizeh/weekWorkload[h]CP (graded)Study achievementsOral presentation, written report(graded)Study achievementsnone(not graded)Forms of mediaLiterature-S. Thrun, W. Burgard and D. Fox: Probabilistic Robotics. MIT PressLiterature-S. S. Thrun, K. Surgard and D. Koki (Eds.); Springer Hardbook of Robotics - K. Harada, E. Yoshida, K. Yokoi (Eds.), Motion Planning for | | communication | n skills (prep | aration of | the talk, | clear didactic | ; | |
| to formulate and accept criticism, critical examination of algorithms and experimental results). Contents Current research papers from conferences and journals in the field of humanoid robotics covering fundamental techniques and applications. Prerequisites Recommended: At least 1 of the following: MA-INF 4215 – Humanoid Robotics MA-INF 4113 – Cognitive Robotics Format Teaching format Seminar Group size h/week Workload[h] CP Study achievements Oral presentation, written report (graded) Study achievements none (not graded) Forms of media - S. Thrun, W. Burgard and D. Fox: Probabilistic Robotics. MIT Press MIT Press Literature - B. Siciliano, O. Khatib (Eds.): Springer Handbook of Robotics K. Harada, E. Yoshida, K. Yokoi (Eds.), Motion Planning for | | presentation o | f techniques a | and experi | imental r | esults, scientif | ìc | |
| to formulate and accept criticism, critical examination of algorithms and experimental results). Contents Current research papers from conferences and journals in the field of humanoid robotics covering fundamental techniques and applications. Prerequisites Recommended: At least 1 of the following: MA-INF 4215 – Humanoid Robotics MA-INF 4113 – Cognitive Robotics Format Teaching format Seminar Group size h/week Workload[h] CP Study achievements Oral presentation, written report (graded) Study achievements none (not graded) Forms of media - S. Thrun, W. Burgard and D. Fox: Probabilistic Robotics. MIT Press MIT Press Literature - B. Siciliano, O. Khatib (Eds.): Springer Handbook of Robotics K. Harada, E. Yoshida, K. Yokoi (Eds.), Motion Planning for | | discussion, structured writing of summary), social skills (ability | | | | | | |
| algorithms and experimental results).ContentsCurrent research papers from conferences and journals in the field of humanoid robotics covering fundamental techniques and applications.PrerequisitesRecommended: At least 1 of the following: MA-INF 4215 – Humanoid Robotics MA-INF 4113 – Cognitive RoboticsMA-INF 40113 – Cognitive RoboticsSeminar102Study achievementsOral presentation, writer report(gradedee)Sonr run W. Burgard and D. Fox: Probabilisti | | | | | | | | |
| algorithms and experimental results).ContentsCurrent research papers from conferences and journals in the field of humanoid robotics covering fundamental techniques and applications.PrerequisitesRecommended: At least 1 of the following: MA-INF 4215 – Humanoid Robotics MA-INF 4113 – Cognitive RoboticsMA-INF 40113 – Cognitive RoboticsSeminar102Study achievementsOral presentation, writer report(gradedee)Sonr run W. Burgard and D. Fox: Probabilisti | | formulate and | accept critic | ism. critic | al examir | nation of | | |
| Contents Current research papers from conferences and journals in the field of humanoid robotics covering fundamental techniques and applications. Prerequisites Recommended: At least 1 of the following: MA-INF 4215 – Humanoid Robotics MA-INF 4113 – Cognitive Robotics Verkload[h] CP Format Teaching format Group size h/week Workload[h] CP Format T = face-to-face teaching; S = independent study Graded) Oral presentation, written report (graded) Study achievements Oral presentation, written report (not graded) Forms of media - S. Thrun, W. Burgard and D. Fox: Probabilistic Robotics. MIT Press Literature - B. Siciliano, O. Khatib (Eds.): Springer Handbook of Robotics - S. | | | - | | | | | |
| applications.PrerequisitesRecommended: At least 1 of the following: MA-INF 4215 – Humanoid Robotics MA-INF 4113 – Cognitive RoboticsFormatTeaching formatGroup sizeh/weekWorkload[h]CPFormatTeaching formatGroup sizein/weekWorkload[h]CPFormatTeaching formatGroup sizein/weekWorkload[h]CPFormatTeaching formatGroup sizein/weekWorkload[h]CPFormatTeaching formatGroup sizein/weekWorkload[h]CPSeminar10230 T / 90 S4T= face-to-face teaching; S = independent study(graded)Study achievementsOral presentation, written report(graded)Study achievementsnone(not graded)Forms of mediaIS. Thrun, W. Burgard and D. Fox: Probabilistic Robotics. MIT Press-Literature-B. Siciliano, O. Khatib (Eds.): Springer Handbook of Robotics - K. Harada, E. Yoshida, K. Yokoi (Eds.), Motion Planning for | Contents | Current resear | ch papers fro | om confere | nces and | journals in th | ne | |
| PrerequisitesRecommended: At least 1 of the following: MA-INF 4215 – Humanoid Robotics MA-INF 4215 – Humanoid Robotics MA-INF 4113 – Cognitive RoboticsFormatTeaching formatGroup sizeh/weekWorkload[h]CPFormatTeaching formatGroup sizein/weekWorkload[h]CPFormatTeaching formatGroup sizein/weekWorkload[h]CPFormatTeaching formatGroup sizein/weekWorkload[h]CPFormatTeaching formatGroup sizein/weekWorkload[h]CPSeminar10230 T / 90 S4T= face-to-face teaching; S = independent study(graded)Study achievementsOral presentation, written report(graded)Study achievementsOne(not graded)Forms of media-S. Thrun, W. Burgard and D. Fox: Probabilistic Robotics.MIT Press-B. Siciliano, O. Khatib (Eds.): Springer Handbook of RoboticsLiterature-B. Siciliano, O. Khatib (Eds.): Springer Handbook of Robotics | | field of human | oid robotics | covering fu | undamen | tal techniques | and | |
| MA-INF 4215 – Humanoid Robotics MA-INF 4113 – Cognitive RoboticsMA-INF 4113 – Cognitive RoboticsTeaching formatGroup sizeh/weekWorkload[h]CPSeminar10230 T / 90 S4T = face-to-face teaching; S = independent studyTfor a dette aching; S = independent studyExam achievementsOral presentation, written report(graded)Study achievementsnone(not graded)MIT Press- S. Thrun, W. Burgard and D. Fox: Probabilistic Robotics. MIT PressInterature- B. Siciliano, O. Khatib (Eds.): Springer Handbook of Robotics - K. Harada, E. Yoshida, K. Yokoi (Eds.), Motion Planning for | | | | | | | | |
| MA-INF 4113 – Cognity RoboticsFormatGroup sizekokekWorkload[h]CPSeminar10230 T / 90 S4T = face-to-face teachiry; S = independent studyTface-to-face teachiry; S = independent studyKam achievementsOral presentation, writher report(graded)Study achievementsOral presentation, writher report(graded)Forms of media-(not graded)MIT Press- S. Thrun, W. Burgard and D. Fox: Probabilistic Robotics.MIT Press B. Siciliano, O. Khatib (Eds.): Springer Handbook of Robotics- K. Harada, E. Yoshid, K. Yokoi (Eds.), Motion Planning for | Prerequisites | | | | wing: | | | |
| FormatTeaching formatGroup sizeh/weekWorkload[h]CPSeminar10230 T / 90 S4T = face-to-face teaching; S = independent studyExam achievementsOral presentation, written report(graded)Study achievementsnone(not graded)Forms of media- S. Thrun, W. Burgard and D. Fox: Probabilistic Robotics.MIT Press- B. Siciliano, O. Khatib (Eds.): Springer Handbook of Robotics- K. Harada, E. Yoshida, K. Yokoi (Eds.), Motion Planning for | | | | | | | | |
| FormatSeminar10230 T / 90 S4T = face-to-face teaching; S = independent studyExam achievementsOral presentation, written report(graded)Study achievementsnone(not graded)Forms of media- S. Thrun, W. Burgard and D. Fox: Probabilistic Robotics. MIT PressLiterature- B. Siciliano, O. Khatib (Eds.): Springer Handbook of Robotics - K. Harada, E. Yoshida, K. Yokoi (Eds.), Motion Planning for | | | | | | | | |
| T = face-to-face teaching; S = independent study Exam achievements Oral presentation, written report (graded) Study achievements none (not graded) Forms of media - S. Thrun, W. Burgard and D. Fox: Probabilistic Robotics. MIT Press Literature - B. Siciliano, O. Khatib (Eds.): Springer Handbook of Robotics - K. Harada, E. Yoshida, K. Yokoi (Eds.), Motion Planning for | Format | | at Gr | _ | , | | | |
| Exam achievementsOral presentation, written report(graded)Study achievementsnone(not graded)Forms of media S. Thrun, W. Burgard and D. Fox: Probabilistic Robotics. MIT Press-Literature- B. Siciliano, O. Khatib (Eds.): Springer Handbook of Robotics - K. Harada, E. Yoshida, K. Yokoi (Eds.), Motion Planning for | | | | 1 | | 1 / | 4 | |
| Study achievements none (not graded) Forms of media - < | | | | | endent st | - | > | |
| Forms of media - S. Thrun, W. Burgard and D. Fox: Probabilistic Robotics. MIT Press - B. Siciliano, O. Khatib (Eds.): Springer Handbook of Robotics Literature - K. Harada, E. Yoshida, K. Yokoi (Eds.), Motion Planning for | | Oral presentat | ion, written | report | | | | |
| - S. Thrun, W. Burgard and D. Fox: Probabilistic Robotics. MIT Press - B. Siciliano, O. Khatib (Eds.): Springer Handbook of Robotics - K. Harada, E. Yoshida, K. Yokoi (Eds.), Motion Planning for | - | none | | | | (not gra | aded) | |
| MIT Press - B. Siciliano, O. Khatib (Eds.): Springer Handbook of Robotics - K. Harada, E. Yoshida, K. Yokoi (Eds.), Motion Planning for | Forms of media | | | | <u> </u> | · · · D l · · | | |
| Literature - K. Harada, E. Yoshida, K. Yokoi (Eds.), Motion Planning for | | , 0 | | | | | | |
| - K. Harada, E. Yoshida, K. Yokoi (Eds.), Motion Planning for | . | - B. Siciliano, | O. Khatib (E | Eds.): Spri | nger Har | ndbook of Rob | otics | |
| | Literature | , | , | · · · · · · · · · · · · · · · · · · · | Eds.), Mo | tion Planning | for | |
| - Selected papers. | | - Selected pap | ers. | | | | | |

| Module MA-INF 4214 | Lab Human | oid Robot | s | | | | | | |
|--------------------------------------|---|--|------------|-------------|---|---------------|--|--|--|
| Workload | Credit points | Duration | Freque | ency | | | | | |
| 270 h | 9 CP | 1 semester | - | semester | | | | | |
| Module | Prof. Dr. Mar | | | bonnester | | | | | |
| coordinator | | | | | | | | | |
| Lecturer(s) | Prof. Dr. Mar | en Bennewit | Z | | | | | | |
| Lecturer(5) | Programme | en Dennewie | Mode | Seme | ster | | | | |
| Classification | M. Sc. Compu | ter Science | Option | | 5001 | | | | |
| Technical skills | - | | - | | in the design a | nd | | | |
| | - | | - | 0 | on, environmen | | | | |
| | - | | | | ing techniques | | | | |
| | humanoid robo | ots In small | groups | the partic | cipants analyze | я | | | |
| | problem, realiz | | · · | - | * v | a | | | |
| | evaluation. | | and per | | xperimentai | | | | |
| Soft skills | | ces (time ma | nagemen | it, goal-or | iented work, ab | ility | | | |
| | to | • | | | | | | | |
| | analyze proble | ms theoretic | ally and | to find pr | actical solution | s), | | | |
| | communication | communication skills (collaboration in small teams, oral and | | | | | | | |
| | written | | | | oran and | - | | | |
| | presentation of | f solutions c | ritical ex | raminatio | a of | | | | |
| | implementation | | initial ex | ammation | 1 01 | | | | |
| Contents | Robot middley | | perceptie | on state (| estimation | | | | |
| | environment | (1000); | percepti | on, state (| ,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,, | | | | |
| | | newigntion | and me | tion plan | ning for human | oid | | | |
| | robots. | s, navigation | , and me | mon pian | ning for human | loid | | | |
| Prerequisites | Recommended | • At least 1 (| of the fol | lowing | | | | | |
| Terequisites | MA-INF 4215 | | | | | | | | |
| | MA-INF 4113 | | | | | | | | |
| | Teaching forma | - | oup size | h/week | Workload[h] | CP | | | |
| Format | Lab | | 8 | 4 | 60 T / 210 S | 9 | | | |
| | | a top ching | | – | , | | | | |
| Exam achievements | T = face-to-factorial Oral presentat | | | pendent s | - | dod) | | | |
| | none | ion, written | report | | (gra (not gra | $\frac{1}{1}$ | | | |
| Study achievements Forms of media | none | | | | | ideu) | | | |
| Forms of media | - S Thrun W | Burgard an | d D Fox | c Probab | ilistic Robotics | | | | |
| | - S. Thrun, W. Burgard and D. Fox: Probabilistic Robotics. MIT Press | | | | | | | | |
| | - B. Siciliano, O. Khatib (Eds.): Springer Handbook of Robotics | | | | | | | | |
| Literature | - K. Harada, E. Yoshida, K. Yokoi (Eds.), Motion Planning for | | | | | | | | |
| Literature | | E. Yoshida, K | | (Eds.), M | otion Planning | for | | | |

| Module | Humanoid | Robotics | | | | | | |
|--------------------|---|---|---------------------------------------|---------------|------------------|-------|--|--|
| MA-INF 4215 | | | | | | | | |
| Workload | Credit points | Duration | Frequer | ncy | | | | |
| 180 h | 6 CP | 1 semester | every y | ear | | | | |
| Module | Prof. Dr. Mar | en Bennewit | Z | | | | | |
| coordinator | | | | | | | | |
| Lecturer(s) | Prof. Dr. Mar | en Bennewit | Z | | | | | |
| Classification | Programme | | Mode | Semest | ter | | | |
| Classification | M. Sc. Compu | ter Science | Optional | l 2. | | | | |
| Technical skills | This lecture co | overs technic | ues for hu | manoid r | obots such as | | | |
| | perception, na | vigation, mo | tion plann | ning, gras | ping, and hum | an | | |
| | motion analys | is. | | | | | | |
| Soft skills | Communicativ | ve skills (oral | and writt | en presen | ntation of solut | ions, | | |
| | discussions in | discussions in small teams), ability to analyze problems. | | | | | | |
| Contents | Self-calibration | n with least | squares, 3 | D environ | iment | | | |
| | representation | representation, | | | | | | |
| | self-localization with particle filters and improved proposals, | | | | | | | |
| | footstep plann | ung whole-h | odv motic | n plannir | ng with rapidly | | | |
| | exploring | ling, whole b | ouy mone | ii piaiiii | ig with rapidly | | | |
| | random trees, | grasping, ac | tive perce | otion, hur | man motion | | | |
| | analysis, | 81 aspine, ac | ine percej | p 01011, 1141 | | | | |
| | activity recogn | nition, statis | ical testin | g, paper | writing. | | | |
| Prerequisites | Recommended | | | 0/1 1 | 0 | | | |
| 1 | MA-INF 4113 | | Robotics | | | | | |
| | Teaching form | | oup size | h/week | Workload[h] | CP | | |
| Format | Lecture | | 60 | 2 | 30 T / 45 S | 2.5 | | |
| | Exercises | | 30 | 2 | 30 T / 75 S | 3.5 | | |
| | T = face-to-fa | ce teaching; | S = indep | endent st | udy | 1 | | |
| Exam achievements | Oral exam | | | | - | ded) | | |
| Study achievements | Successful exe | rcise particip | ation | | (not gra | ded) | | |
| Forms of media | | | | | | | | |
| | • S. Thrun, W | V. Burgard a | nd D. Fox: | Probabi | listic Robotics | | | |
| | MIT Press, 2005. | | | | | | | |
| . | • B. Siciliano, O. Khatib (Eds.): Springer Handbook of Robotics | | | | | | | |
| Literature | | | | | otion Planning | | | |
| | Humanoid Ro | , | · · · · · · · · · · · · · · · · · · · | | 0 | | | |
| | • Selected rese | | | | | | | |

| Module | Data Mining | | hine Le | arning I | Methods in | | |
|--------------------|--|-------------|-------------|--------------|------------------|------|--|
| MA-INF 4216 | Bioinformatio | | | | | | |
| Workload | | Duration | Frequer | - | | | |
| 180 h | | semester | every y | ear | | | |
| Module | Dr. Holger Fröh | lich | | | | | |
| coordinator | Dr. Holger Fräh | liah | | | | | |
| Lecturer(s) | Dr. Holger Fröh | licn | Mode | C | | | |
| Classification | Programme M. Sc. Compute | er Science | Optional | Semest 2. | ter | | |
| Technical skills | - understanding machine learning | | edge of fu | ndamenta | al data mining | and | |
| | - understanding | of their ap | plication | in bioinfo | rmatics | | |
| Soft skills | - communication exercises | : oral and | written p | resentatio | on of solutions | to | |
| | - self-competence to formulate pos | ě | e | e applicat | ion problems a | nd | |
| | - practical skills: | ability to | practicall | y implem | ent solutions | | |
| | - social skills: we | orking in a | small tea | m with o | ther students | | |
| Contents | - Introduction: Data Mining and Machine Learning in Bioinformatics | | | | | | |
| | - Introduction to models, Bayesian | | hypothe | sis tests, | (generalized) li | near | |
| | - Clustering algo | orithms | | | | | |
| | - Hidden Markov | v Models | | | | | |
| | - Support Vector | r Machines | | | | | |
| | For all algorithm | ns the spec | ific contex | t in bioir | formatics is | | |
| | discussed (e.g | - | | | | | |
| Prerequisites | none | | 1 | | ~ / | | |
| | Teaching format | Gr | oup size | h/week | Workload[h] | CP | |
| Format | Lecture | | 60 | 2 | 30 T / 45 S | 2.5 | |
| | Exercises | | 30 | 2 | 30 T / 75 S | 3.5 | |
| | T = face-to-face | teaching; | S = indep | endent st | udy | | |
| Exam achievements | Written exam | · · · · · | | | (gra | ded) | |
| Study achievements | Successful exerci | se particip | ation | | (not gra | ded) | |
| Forms of media | | | | | | | |
| | T. Hastie, R. Tibshirani, J. Friedman, The Elements of Statistical Learning, Springer, 2008 | | | | | | |
| Literature | S.Boslaugh, P. Watters, Statistics in a Nutshell, O'Reilly, 2008 | | | | | | |
| | N. Jones, P. Pev Algorithms, MIT | | | on to Bioi | nformatics | | |

| Module MA-INF 4217 | Seminar Ma Biology | achine Le | arning M | ethods | in Systems | |
|-----------------------|---|--|---------------|-------------|-----------------|-------|
| Workload | Credit points | Duration | Frequen | icy | | |
| 120 h | 4 CP | 1 semeste | r every ye | ear | | |
| Module | Dr. Holger Fré | öhlich | | | | |
| coordinator | | | | | | |
| Lecturer(s) | Dr. Holger Frö | öhlich | | | | |
| Classification | Programme | | Mode | Semes | ter | |
| Classification | M. Sc. Compu | ter Science | Optional | 2. | | |
| Technical skills | - understandin biology | ig and know | ledge of cu | rrent con | cepts in syster | ns |
| | | - understanding and knowledge of involved computational methods, specifically from the field of Machine Learning | | | | |
| Soft skills | - communicati | - communication: oral scientific presentation of a defined topic | | | | |
| | - | - self-competences: ability to read, understand and analyze scientific publications | | | | |
| | - social skills: students and t | - | iscuss a scie | entific top | pic with other | |
| Contents | Conference and | d journal p | apers coveri | ing the a | reas: | |
| | - Introduction | to Systems | Biology | | | |
| | - Overview ab | out differen | t modeling | concepts | and philosoph | ies |
| | - Machine Lea Models, Dynai data integratic | nic Bayesia | ~ ~ | | - | nous |
| Prerequisites | Recommended | | | | | |
| L L | MA-INF 4216 | | ing and Ma | achine Le | earning Method | ds in |
| | Bioinformatics | | 0 | | C | |
| | Teaching forma | at C | roup size | h/week | Workload[h] | CP |
| Format | Seminar | | 10 | 2 | 30 T / 90 S | 4 |
| | T = face-to-fa | ce teaching | S = indep | endent st | tudy | |
| Exam achievements | Oral presentat | ion, writter | report | | (gra | ided) |
| Study achievements | none | | | | (not gra | ided) |
| Forms of media | powerpoint | powerpoint | | | | |
| Literature | selected journa | al and confe | rence pape | rs | | |

| Module MA-INF 4218 | Lab Modeli | ng and | Sim | ulatio | 1 | | |
|-----------------------|--|--|------------------------|-----------|-----------|-------------------------------------|----------------------|
| Workload | Credit points | Duratio | on | Freque | ency | | |
| 270 h | 9 CP | 1 seme | ester | every ; | year | | |
| Module | Prof. Dr. And | reas We | ber | 1 | | | |
| coordinator | | | | | | | |
| Lecturer(s) | Prof. Dr. And | reas We | ber, F | Prof. Dr | . Holger | Fröhlich | |
| | Programme | | | Mode | Seme | ster | |
| Classification | M. Sc. Compu | ter Scier | nce | Optiona | al 2. | | |
| Technical skills | - ability to des | scribe a s | syster | n via a : | model | | |
| | ability to cor its results ability to implicit to implit to implicit to implicit to imp | | | | | lize and interpre | et |
| | MATLAB, R | - | | - | 0 | | |
| Soft skills | - ability to cor | - ability to communicate effectively in order to implement learned methods together with a team of other students | | | | | |
| | decisions | - ability to present and explain results and to defend design decisions | | | | | |
| Contents | Simulation and example, in sy - Boolean Net - ODEs | stems bi | | - | 0 | that arise, for ing approaches a | are: |
| Prerequisites | Recommended | : | | | | | |
| | Biology | | ar Ma | achine I | earning l | Methods in Syst | ems |
| Format | Teaching forma | at | Grou | up size | h/week | Workload[h] | \mathbf{CP} |
| Format | Lab | | | 8 | 4 | 60 T / 210 S | 9 |
| | T = face-to-fa | ce teachi | ing; S | s = inde | pendent s | study | |
| Exam achievements | Oral presentat | | | | | (grae | ded) |
| Study achievements | none | , | | - | | (not grad | |
| Forms of media | powerpoint | | | | | | / |
| | | Introduc | tion | to Syste | ms Biolog | gy, CRC Press, 2 | 2007 |
| Literature | | & J.A. I | Rhode | Ū | | Models in Biolo | |

| | A | · · · · · · · · · · · · · · · · · · · | | | | | | | | |
|-----------------------|-----------------|---------------------------------------|-----------------|------------|----------------------------|-------|--|--|--|--|
| Module MA-INF 4302 | Advanced L | earning Sy | stems | | | | | | | |
| Workload | Credit points | Duration | Freque | ncy | | | | | | |
| 180 h | 6 CP | 1 semester | ster every year | | | | | | | |
| Module | Prof. Dr. Stef | | 00 | | | | | | | |
| coordinator | | | | | | | | | | |
| Lecturer(s) | Prof. Dr. Stef | an Wrobel. D | r. Thom | as Gärtne | er | | | | | |
| | Programme | , | Mode | Semes | | | | | | |
| Classification | M. Sc. Compu | ter Science | Optional | | | | | | | |
| Technical skills | Participants sp | | - | | | ne | | | | |
| | particular clas | | - | - | - | | | | | |
| | necessary know | 0 | 0 | , , | - | | | | | |
| | construct their | • | | | | o the | | | | |
| | research fronti | | | , | U I | | | | | |
| Soft skills | In group work | , students acc | quire the | necessary | social and | | | | | |
| | communication | n skills for eff | ective tea | um work a | and project | | | | | |
| | planning, and | learn how to | present s | oftware p | projects to othe | ers. | | | | |
| Contents | The module is | offered every | year, ea | ch time c | oncentrating o | n | | | | |
| | one or more sp | pecific algorit | hm classe | s, e.g. | | | | | | |
| | • kernel machi | kernel machines | | | | | | | | |
| | | neural networks | | | | | | | | |
| | • probabilistic | | al learnin | g approa | ches | | | | | |
| | • logic-based l | | | 0 - FF | | | | | | |
| | - | • reinforcement learning | | | | | | | | |
| Prerequisites | Recommended | <u>_</u> | llowing: | | | | | | | |
| - | MA-INF 4111 | | 0 | and Ana | lysis Systems: | | | | | |
| | Machine Learn | ning | _ | | | | | | | |
| | MA-INF 4112 | – Intelligent | Learning | and Ana | lysis Systems: | | | | | |
| | Data Mining a | and Knowledg | ge Discov | ery | | | | | | |
| | | | | | | | | | | |
| | Teaching form | at Gr | oup size | h/week | Workload[h] | CP | | | | |
| Format | Lecture | | 60 | 2 | 30 T / 45 S 30 T / 75 S | 2.5 | | | | |
| | Exercises | | 30 | 2 | 30 T / 75 S | 3.5 | | | | |
| | T = face-to-fa | ce teaching; S | S = indep | endent st | tudy | | | | | |
| Exam achievements | Written exam | | 1 | | | aded) | | | | |
| Study achievements | Successful exer | rcise participa | ation | | (not gra | , | | | | |
| Forms of media | lectures, exerc | | | | | , | | | | |
| | • B. Schoelkor | | - | ng with K | ernels, The M | IT | | | | |
| | Press, 2002, C | | | 0 | , | | | | | |
| | • John Shawe- | Taylor, Nello | Christia | nini, Keri | nel Methods fo | or | | | | |
| | Pattern Analy | sis, CUP, 200 | 94 | | | | | | | |
| T •4 | • Christopher | Bishop, Patt | ern Recog | gnition an | nd Machine | | | | | |
| Literature | Learning, The | University of | f Edinbur | gh, 2006 | | | | | | |
| | • David MacK | ay, Informati | on Theor | y, Inferen | nce, and Learn | ing | | | | |
| | Algorithms, 20 |)03 | | | | | | | | |
| | • Richard Duc | la, Peter Har | t, David | Stork, Pa | ttern | | | | | |
| | Classification, | John Wiley | and Sons | 2001 | | | | | | |

| Module | Learning fro | m Non-S | Standard | Data | | | | | |
|--------------------|-------------------------------------|---|---------------|---------------|-----------------------------------|-------------------|--|--|--|
| MA-INF 4303 | | | | | | | | | |
| Workload | Credit points | Duration | Freque | ncy | | | | | |
| 180 h | | 1 semeste | er every y | vear | | | | | |
| Module | Prof. Dr. Stefa | n Wrobel | | | | | | | |
| coordinator | | | | | | | | | |
| Lecturer(s) | Prof. Dr. Stefa | n Wrobel, | Dr. Tamas | s Horvath | | | | | |
| Classification | Programme | | Mode | Semest | | | | | |
| | M. Sc. Comput | | - | | | | | | |
| Technical skills | Participants de | - | 0 | | 0 0 | h | | | |
| | respect to one p | | | - | | | | | |
| | non-tabular dat | , | | 0 | 0.0 | ant | | | |
| | in many applica | | ° 1 | | ° 1 | ~ | | | |
| | specialized algo pre- and postpr | | | 0 | | 0 | | | |
| | pre- and postpr participants in | 0 | * | | 1 0 | | | | |
| | necessary social | | | | _ | 0110 | | | |
| | | | | | | re | | | |
| | | ork and project planning, and learn how to present software ojects to others. | | | | | | | |
| Soft skills | * * | ommunicative skills (oral and written presentation of solutions, | | | | | | | |
| | | scussions in teams), self-competences (ability to accept and | | | | | | | |
| | formulate critic | rmulate criticism, ability to analyse, creativity in the context | | | | | | | |
| | of an "open end | of an "open end" task) | | | | | | | |
| Contents | The module wi | ll offered e | very year, | concentra | ting on one | | | | |
| | particular non-s | standard d | ata type e | ach time, | including: Tex | t | | | |
| | Mining, Multim | | U, 1 | 0 | Learning from | | | | |
| | structured data | | | g | | | | | |
| Prerequisites | Recommended: | | 0 | | | | | | |
| | MA-INF 4111 - | - | t Learning | and Ana | lysis Systems: | | | | |
| | Machine Learni | 0 | t Taamaina | and Ana | lucia Customa | | | | |
| | MA-INF 4112 - Data Mining ar | - | - | | iysis Systems: | | | | |
| | Data Mining a | iu miowie | uge Discov | ery | | | | | |
| | Teaching format | + (| Froup size | h/week | Workload[h] | CP | | | |
| Format | Lecture | | 60 | 2 | Workload[h] 30 T / 45 S | 2.5 | | | |
| roimat | Exercises | | 30 | $\frac{2}{2}$ | 30 T / 75 S | $\frac{2.5}{3.5}$ | | | |
| | | e teo china | | I | | 0.0 | | | |
| Exam achievements | T = face-to-fac Written exam | e teaching | $s = mae_{f}$ | bendent st | | ided) | | | |
| Study achievements | Successful exerc | ciso partici | nation | | (gra (not gra | | | | |
| Forms of media | lectures, exercis | 1 | | | (1100 g10 | ucu) | | | |
| | Gennady And | | - | | ploratory Ana | lvsis | | | |
| | of Spatial and | , | | , | * 0 | 1,010 | | | |
| | • Diane J. Cool | - | · – | | | | | | |
| | Wiley & Sons, | | |) 0 | , , , , , , , , , , | | | | |
| Literature | • Saso Dzerosk | | vrac, Relat | tional Dat | a Mining, | | | | |
| | Springer, 2001 | | | | 3, | | | | |
| | • Sholom M. W | /eiss, Nitin | Indurkhya | a, Tong Zł | nang, Fred J. | | | | |
| | Damerau, Text | Mining. H | Predictive N | Methods for | or Analyzing | | | | |
| | Unstructured In | nformation | , Springer, | 2004 | | | | | |

| Module | Lab Cognit | ive Roboti | cs | | | | | |
|--------------------|---|--|--|-------------------|------------------------------------|----------------|--|--|
| MA-INF 4304 | 0 | | | | | | | |
| Workload | Credit points | Duration | Freque | ency | | | | |
| 270 h | 9 CP | 1 semester | every | semester | | | | |
| Module | Prof. Dr. Sver | n Behnke | | | | | | |
| coordinator | | | | | | | | |
| Lecturer(s) | Prof. Dr. Sver | n Behnke | | | | | | |
| Classification | Programme | | Mode | Seme | ster | | | |
| | M. Sc. Compu | | Optiona | | - | | | |
| Technical skills | Participants a | | - | | - | | | |
| | 0 | 0 | - | | of perception a | ind | | |
| | control algorit | hms for com | plex robo | otic syster | ns. | | | |
| | In a small gro | up, they ana | lyze a pr | oblem, rea | alize a | | | |
| | state-of-the-ar | , , | | - | | | | |
| Soft skills | - | · · · · · · · · · · · · · · · · · · · | 0 | , 0 | iented work, ab | ility | | |
| | to analyze pro | blems and to | o find pra | actical solu | utions), | | | |
| | communication | communication skills (Work together in small teams, oral and | | | | | | |
| | written presen | written presentation of solutions, critical examination of | | | | | | |
| | implementations) | | | | | | | |
| Contents | Robot middley | · · · · · · · · · · · · · · · · · · · | | | | | | |
| | mapping (SLA | | | - | | | | |
| | , | 0 | | 0 | on, person dete | | | |
| | | | | | ning and contro | и, | | |
| D | mobile manipu | | | | on. | | | |
| Prerequisites | Recommended | | | 0 | | | | |
| | MA-INF 4113 | 0 | | | | | | |
| | MA-INF 4114 | | oup size | h /mal | Worldood[b] | CP | | |
| Format | Teaching forms Lab | | 8 | h/week 4 | Workload[h] 60 T / 210 S | $\frac{CP}{9}$ | | |
| | | . 1. | с I | _ | , , | 5 | | |
| D | T = face-to-fa | = : | | pendent s | | 1 1) | | |
| Exam achievements | Oral presentat | ion, written | report | | (8 | ided) | | |
| Study achievements | none | | | | (not gra | (aea | | |
| Forms of media | • S. Thrup W | Dungand | d D For | . Drohoh | iliatia Dobatiaa | | | |
| | | | urgard and D. Fox: Probabilistic Robotics. | | | | | |
| Literature | MIT Press, 2005.B. Siciliano, O. Khatib (Eds.): Springer Handbook of | | | | | | | |
| Literature | Robotics, 2008 | · · · · · · · · · · · · · · · · · · · | Las.). DI | , <u>8</u> 01 116 | | | | |
| | • Selected rese | | | | | | | |
| | - 50100100 1050 | aron papers | | | | | | |

| MA-INF 4306 and Learning Systems It is the second system is the second system. The second system is the second syst | Module | Lab Develo | pment a | nd 🛛 | Applic | cation o | f Data Minir | າຍ | |
|--|-------------------|-----------------|-------------|----------|----------|-------------|-----------------------------|-------|--|
| 270 h 9 CP 1 semester every year Module coordinator Prof. Dr. Stefan Wrobel Lecturer(s) Prof. Dr. Stefan Wrobel Classification Programme M. Sc. Computer Science Mode Optional Semester 3. Technical skills Students will acquire in-depth knowledge in the construction and development of intelligent learning systems for machine learning and data mining. They learn how to work with existing state-of-the-art systems and apply them to application problems, usually extending them for the requirements of their particular task. Soft skills Communicative skills (appropriate oral presentation and written documentation of project results), social skills (ability to work in teams), self-competences (time management, aiming at long-range goals under limited ressources, ability to work under pressure, ability to accept/formulate ciriticsm) Contents Data storage and process models of data analysis. Common open source frameworks for the construction of data analysis systems, specialized statistical packages. Pre-processing tools. Mathematical libraries for numerical computation. Search and optimization methods. User interfaces and visualization for analysis systems. Data analysis algorithms for embedded and distributed systems. Data analysis algorithms for embedded and distributed systems. Data analysis systems: Machine Learning MA-INF 4111 – Intelligent Learning and Analysis Systems: Machine Learning MA-INF 4112 – Intelligent Learning and Analysis Systems: Data Mining and Knowledge Discovery Format Group size Independent study Morekoded[h] CP | | | | | I I | | | 0 | |
| Module coordinator Prof. Dr. Stefan Wrobel Lecturer(s) Prof. Dr. Stefan Wrobel Classification Programme M. Sc. Computer Science Mode Optional Semester Technical skills Students will acquire in-depth knowledge in the construction and development of intelligent learning systems for machine learning and data mining. They learn how to work with existing state-of-the-art systems and apply them to application problems, usually extending them for the requirements of their particular task. Soft skills Communicative skills (appropriate oral presentation and written documentation of project results), social skills (ability to work in teams), self-competences (time management, aiming at long-range goals under limited ressources, ability to work under pressure, ability to accept/formulate ciriticsm) Contents Data storage and process models of data analysis. Common open source frameworks for the construction of data analysis systems, specialized statistical packages. Pre-processing tools. Mathematical libraries for numerical computation. Search and optimization methods. User interfaces and visualization for analysis systems. Data analysis algorithms for embedded and distributed systems. Ubiquitous discovery systems: Machine Learning MA-INF 4111 – Intelligent Learning and Analysis Systems: Machine Learning MA-INF 4112 – Intelligent Learning and Analysis Systems: Data Mining and Knowledge Discovery Format Teaching format Lab Group size N/week Workload[h] CP Forms of media Computer Software, Documentation, Research Papers. (not graded) 9 | Workload | Credit points | Duration | | Freque | ency | | | |
| coordinator Mode Semester Lecturer(s) Prof. Dr. Stefan Wrobel Mode Semester Classification Students will acquire in-depth knowledge in the construction and development of intelligent learning systems for machine learning and data mining. They learn how to work with existing state-of-the-art systems and apply them to application problems, usually extending them for the requirements of their particular task. Soft skills Communicative skills (appropriate oral presentation and written documentation of project results), social skills (ability to work in teams), self-competences (time management, aiming at long-range goals under limited ressources, ability to work under pressure, ability to accept/formulate ciriticsm) Contents Data storage and process models of data analysis. Common open source frameworks for the construction of data analysis systems, specialized statistical packages. Pre-processing tools. Mathematical libraries for numerical computation. Search and optimization methods. User interfaces and visualization for analysis systems. Data analysis algorithms for embedded and distributed systems. Ubiquitous discovery systems: Prerequisites Recommended: At least 1 of the following: MA-INF 4111 – Intelligent Learning and Analysis Systems: Data Mining and Knowledge Discovery Format Teaching format Group size h/week Workload[h] CP Lab 8 4 60 T / 210 S 9 9 T = face-to-face teaching; S = indep | 270 h | 9 CP | 1 semest | ter | every | year | | | |
| Lecturer(s) Prof. Dr. Stefan Wrobel Classification Programme M. Sc. Computer Science Mode Optional Semester Technical skills Students will acquire in-depth knowledge in the construction and development of intelligent learning systems for machine learning and data mining. They learn how to work with existing state-of-the-art systems and apply them to application problems, usually extending them for the requirements of their particular task. Soft skills Communicative skills (appropriate oral presentation and written documentation of project results), social skills (ability to work in teams), self-competences (time management, aiming at long-range goals under limited ressources, ability to work under pressure, ability to accept/formulate ciriticsm) Contents Data storage and process models of data analysis. Common open source frameworks for the construction of data analysis systems. Specialized statistical packages. Pre-processing tools. Mathematical libraries for numerical computation. Search and optimization methods. User interfaces and visualization for analysis systems. Ubiquitous discovery systems. Prerequisites Recommended: At least 1 of the following: MA-INF 4112 – Intelligent Learning and Analysis Systems: Machine Learning MA-INF 4112 – Intelligent Learning and Analysis Systems: Data Mining and Knowledge Discovery Format Teaching format Lab Group size N/week Workload[h] CP Format Teaching format Cong presentation, written report (graded) 9 7 | Module | Prof. Dr. Stef | an Wrobel | | | | | | |
| Classification Programme M. Sc. Computer Science Mode Optional Semester 3. Technical skills Students will acquire in-depth knowledge in the construction and development of intelligent learning systems for machine learning and data mining. They learn how to work with existing state-of-the-art systems and apply them to application problems, usually extending them for the requirements of their particular task. Soft skills Communicative skills (appropriate oral presentation and written documentation of project results), social skills (ability to work in teams), self-competences (time management, aiming at long-range goals under limited ressources, ability to work under pressure, ability to accept/formulate ciriticsm) Contents Data storage and process models of data analysis systems, specialized statistical packages. Pre-processing tools. Mathematical libraries for numerical computation. Search and optimization methods. User interfaces and visualization for analysis systems. Data analysis algorithms for embedded and distributed systems. Ubiquitous discovery systems. Prerequisites Recommended: At least 1 of the following: MA-INF 4111 – Intelligent Learning and Analysis Systems: Data Mining and Knowledge Discovery Format Teaching format Lab Group size N/week Morkload[h] CP Oral presentation, written report (graded) Study achievements Oral presentation, written report (not graded) Forms of media | coordinator | | | | | | | | |
| Classification M. Sc. Computer Science Optional 3. Technical skills Students will acquire in-depth knowledge in the construction and development of intelligent learning systems for machine learning and data mining. They learn how to work with existing state-of-the-art systems and apply them to application problems, usually extending them for the requirements of their particular task. Soft skills Communicative skills (appropriate oral presentation and written documentation of project results), social skills (ability to work in teams), self-competences (time management, aiming at long-range goals under limited ressources, ability to work under pressure, ability to accept/formulate ciriticsm) Contents Data storage and process models of data analysis. Common open source frameworks for the construction of data analysis systems, specialized statistical packages. Pre-processing tools. Mathematical libraries for numerical computation. Search and optimization methods. User interfaces and visualization for analysis systems. Data analysis algorithms for embedded and distributed systems. Ubiquitous discovery systems: Machine Learning MA-INF 4111 – Intelligent Learning and Analysis Systems: Data Mining and Knowledge Discovery Format Teaching format Group size h/week Workload[h] CP Iab 8 4 60 T / 210 S 9 7 = face-to-face teaching; S = independent study Exam achievements Oral presentation, written report (praded) Forms of media | Lecturer(s) | Prof. Dr. Stef | an Wrobel | | | | | | |
| M. Sc. Computer Science Optional 3. Technical skills Students will acquire in-depth knowledge in the construction and development of intelligent learning systems for machine learning and data mining. They learn how to work with existing state-of-the-art systems and apply them to application problems, usually extending them for the requirements of their particular task. Soft skills Communicative skills (appropriate oral presentation and written documentation of project results), social skills (ability to work in teams), self-competences (time management, aiming at long-range goals under limited ressources, ability to work under pressure, ability to accept/formulate ciriticsm) Contents Data storage and process models of data analysis. Common open source frameworks for the construction of data analysis systems, specialized statistical packages. Pre-processing tools. Mathematical libraries for numerical computation. Search and optimization methods. User interfaces and visualization for analysis systems. Data analysis algorithms for embedded and distributed systems. Ubiquitous discovery systems. Prerequisites Recommended: At least 1 of the following: MA-INF 4111 – Intelligent Learning and Analysis Systems: Data Mining and Knowledge Discovery Format Teaching format Lab Group size h/week Workload[h] CP P Face-to-face teaching; S = independent study T = face-to-face teaching; S = independent study 9 T = face-to-face teaching; S = independent study Exam achievements Oral presentation, written report (not graded) Forms of media | Classification | Programme | | I | Mode | Seme | ster | | |
| and development of intelligent learning systems for machine learning and data mining. They learn how to work with existing state-of-the-art systems and apply them to application problems, usually extending them for the requirements of their particular task. Soft skills Communicative skills (appropriate oral presentation and written documentation of project results), social skills (ability to work in teams), self-competences (time management, aiming at long-range goals under limited ressources, ability to work under pressure, ability to accept/formulate ciriticsm) Contents Data storage and process models of data analysis. Common open source frameworks for the construction of data analysis systems, specialized statistical packages. Pre-processing tools. Mathematical libraries for numerical computation. Search and optimization methods. User interfaces and visualization for analysis systems. Data analysis algorithms for embedded and distributed systems. Ubiquitous discovery systems: Ma-INF 4111 – Intelligent Learning and Analysis Systems: Machine Learning MA-INF 4112 – Intelligent Learning and Analysis Systems: Data Mining and Knowledge Discovery Taaking format Group size h/week Workload[h] </td <th>Classification</th> <td>M. Sc. Compu</td> <td>ter Scienc</td> <td>e (</td> <td>Optiona</td> <td>al 3.</td> <td></td> <td></td> | Classification | M. Sc. Compu | ter Scienc | e (| Optiona | al 3. | | | |
| learning and data mining. They learn how to work with existing state-of-the-art systems and apply them to application problems, usually extending them for the requirements of their particular task. Soft skills Communicative skills (appropriate oral presentation and written documentation of project results), social skills (ability to work in teams), self-competences (time management, aiming at long-range goals under limited ressources, ability to work under pressure, ability to accept/formulate ciriticsm) Contents Data storage and process models of data analysis. Common open source frameworks for the construction of data analysis systems, specialized statistical packages. Pre-processing tools. Mathematical libraries for numerical computation. Search and optimization methods. User interfaces and visualization for analysis systems. Data analysis algorithms for embedded and distributed systems. Ubiquitous discovery systems. Prerequisites Recommended: At least 1 of the following: MA-INF 4111 – Intelligent Learning and Analysis Systems: Data Mining and Knowledge Discovery Format Teaching format Group size h/week Workload[h] CP Lab Lab 8 4 60 T / 210 S 9 T = face-to-face teaching; S = independent study 9 1 = Study achievements Oral presentation, written report (graded) Forms of media Computer Software, Documentation, Research Papers. | Technical skills | Students will a | acquire in- | dept | h know | vledge in t | the construction | 1 | |
| state-of-the-art systems and apply them to application problems, usually extending them for the requirements of their particular task.Soft skillsCommunicative skills (appropriate oral presentation and written documentation of project results), social skills (ability to work in teams), self-competences (time management, aiming at long-range goals under limited ressources, ability to work under pressure, ability to accept/formulate ciriticsm)ContentsData storage and process models of data analysis. Common open source frameworks for the construction of data analysis systems, specialized statistical packages. Pre-processing tools. Mathematical libraries for numerical computation. Search and optimization methods. User interfaces and visualization for analysis systems. Data analysis algorithms for embedded and distributed systems. Ubiquitous discovery systems.PrerequisitesRecommended: At least 1 of the following: MA-INF 4111 – Intelligent Learning and Analysis Systems: Machine Learning MA-INF 4112 – Intelligent Learning and Analysis Systems: Data Mining and Knowledge DiscoveryFormatTeaching format LabGroup size (graded)Exam achievementsOral presentation, written report(graded)Study achievementsnone (not graded)(not graded)Forms of mediaComputer Software, Documentation, Research Papers.The relevant literature will be announced towards the end of the | | - | | - | | | | | |
| problems, usually extending them for the requirements of their particular task.Soft skillsCommunicative skills (appropriate oral presentation and written documentation of project results), social skills (ability to work in teams), self-competences (time management, aiming at long-range goals under limited ressources, ability to work under pressure, ability to accept/formulate ciriticsm)ContentsData storage and process models of data analysis. Common open source frameworks for the construction of data analysis systems, specialized statistical packages. Pre-processing tools. Mathematical libraries for numerical computation. Search and optimization methods. User interfaces and visualization for analysis systems. Data analysis algorithms for embedded and distributed systems. Ubiquitous discovery systems.PrerequisitesRecommended: At least 1 of the following: MA-INF 4111 – Intelligent Learning and Analysis Systems: Machine Learning MA-INF 4112 – Intelligent Learning and Analysis Systems: Data Mining and Knowledge DiscoveryFormatTeaching format LabGroup size (mot project project)FormatTeaching format (graded) T = face-to-face teaching; S = independent studyExam achievementsOral presentation, written report (not graded)Forms of mediaComputer Software, Documentation, Research Papers. | | 0 | | <u> </u> | ē | | | sting | |
| Soft skillsCommunicative skills (appropriate oral presentation and written documentation of project results), social skills (ability to work in teams), self-competences (time management, aiming at long-range goals under limited ressources, ability to work under pressure, ability to accept/formulate ciriticsm)ContentsData storage and process models of data analysis. Common open source frameworks for the construction of data analysis systems, specialized statistical packages. Pre-processing tools. Mathematical libraries for numerical computation. Search and optimization methods. User interfaces and visualization for analysis systems. Data analysis algorithms for embedded and distributed systems. Ubiquitous discovery systems.PrerequisitesRecommended: At least 1 of the following: MA-INF 4111 – Intelligent Learning and Analysis Systems: Data Mining and Knowledge DiscoveryFormatTeaching format LabGroup size N (Group size h/weekWorkload[h] CP (graded)FormatTeaching format LabGroup size (not graded)Forms of mediaOral presentation, written report(graded)Forms of mediaComputer Software, Documentation, Research Papers. | | | - | | | | | | |
| Soft skills Communicative skills (appropriate oral presentation and written documentation of project results), social skills (ability to work in teams), self-competences (time management, aiming at long-range goals under limited ressources, ability to work under pressure, ability to accept/formulate ciriticsm) Contents Data storage and process models of data analysis. Common open source frameworks for the construction of data analysis systems, specialized statistical packages. Pre-processing tools. Mathematical libraries for numerical computation. Search and optimization methods. User interfaces and visualization for analysis systems. Data analysis algorithms for embedded and distributed systems. Ubiquitous discovery systems. Prerequisites Recommended: At least 1 of the following: MA-INF 4111 – Intelligent Learning and Analysis Systems: Data Mining and Knowledge Discovery Format Teaching format Group size h/week Workload[h] CP Format Teaching format Group size h/week Workload[h] CP Format Teaching format Group size h/week Workload[h] CP Forms of media Oral presentation, written report (graded) 9 T face-to-face teaching; S = independent study 9 Forms of media Computer Software, Documentation, Research Papers. The relevant literature will be announced towards the end of the | | | - | ling | them for | or the req | uirements of th | eir | |
| documentation of project results), social skills (ability to work in teams), self-competences (time management, aiming at long-range goals under limited ressources, ability to work under pressure, ability to accept/formulate ciriticsm)ContentsData storage and process models of data analysis. Common open source frameworks for the construction of data analysis systems, specialized statistical packages. Pre-processing tools. Mathematical libraries for numerical computation. Search and optimization methods. User interfaces and visualization for analysis systems. Data analysis algorithms for embedded and distributed systems. Ubiquitous discovery systems.PrerequisitesRecommended: At least 1 of the following: MA-INF 4111 – Intelligent Learning and Analysis Systems: Machine Learning MA-INF 4112 – Intelligent Learning and Analysis Systems: Data Mining and Knowledge DiscoveryVorkload[h] CPCPFormatTeaching format LabGroup size 8h/week 4Workload[h]CPExam achievementsOral presentation, written report(graded)Study achievementsnone(not graded)Forms of mediaComputer Software, Documentation, Research Papers.LiteratureThe relevant literature will be announced towards the end of the | | * | | | | | | | |
| teams), self-competences (time management, aiming at long-range goals under limited ressources, ability to work under pressure, ability to accept/formulate ciriticsm)ContentsData storage and process models of data analysis. Common open source frameworks for the construction of data analysis systems, specialized statistical packages. Pre-processing tools. Mathematical libraries for numerical computation. Search and optimization methods. User interfaces and visualization for analysis systems. Data analysis algorithms for embedded and distributed systems. Ubiquitous discovery systems.PrerequisitesRecommended: At least 1 of the following: MA-INF 4111 – Intelligent Learning and Analysis Systems: Data Mining and Knowledge DiscoveryFormatTeaching format LabGroup size 8h/week 4Workload[h]CPFormatTeaching format LabGroup size 8h/weekWorkload[h]CPStudy achievementsOral presentation, written report(graded)Study achievementsnone Computer Software, Documentation, Research Papers.LiteratureThe relevant literature will be announced towards the end of the | Soft skills | | | | | | | | |
| $\begin{tabular}{ c c c c c c c } \hline long-range goals under limited ressources, ability to work under pressure, ability to accept/formulate ciriticsm) \hline \hline \hline \begin{tabular}{lllllllllllllllllllllllllllllllllll$ | | | | | | | | | |
| $\begin{tabular}{ c c c c c c } \hline pressure, ability to accept/formulate ciriticsm) \hline \end{tabular} $ | | | - | · · | | | 0 | 1 | |
| ContentsData storage and process models of data analysis. Common open source frameworks for the construction of data analysis systems, specialized statistical packages. Pre-processing tools. Mathematical libraries for numerical computation. Search and optimization methods. User interfaces and visualization for analysis systems. Data analysis algorithms for embedded and distributed systems. Ubiquitous discovery systems.PrerequisitesRecommended: At least 1 of the following: MA-INF 4111 – Intelligent Learning and Analysis Systems: Machine Learning MA-INF 4112 – Intelligent Learning and Analysis Systems: Data Mining and Knowledge DiscoveryVorkload[h]CPFormatTeaching format LabGroup size 8h/week 4Workload[h]CPFormatTeaching format (graded)Group size 8h/week 9Workload[h]CPFormatTeaching format (graded)Group size 8h/week 9Workload[h]CPFormatTeaching format (graded)Group size 8h/week 9Workload[h]CPFormatTeaching format (graded)Group size 8h/week 9Workload[h]CPFormatTeaching format (graded)Group size 8h/week 9Workload[h]CPFormatTeaching format (graded)Group size 9h/week 9Workload[h]CPFormatTeaching format (graded)Group size 9h/week 9Molographic 9Group size 9The relevant literatureSecond size 9Group size 9h/week 9Workload]Group size 9 | | | | | | , | e e | lder | |
| open source frameworks for the construction of data analysis systems, specialized statistical packages. Pre-processing tools. Mathematical libraries for numerical computation. Search and optimization methods. User interfaces and visualization for analysis systems. Data analysis algorithms for embedded and distributed systems. Ubiquitous discovery systems.PrerequisitesRecommended: At least 1 of the following: MA-INF 4111 – Intelligent Learning and Analysis Systems: Machine Learning MA-INF 4112 – Intelligent Learning and Analysis Systems: Data Mining and Knowledge DiscoveryVorkload[h]CPFormatTeaching format | | | · , , | | | | | | |
| systems, specialized statistical packages. Pre-processing tools. Mathematical libraries for numerical computation. Search and optimization methods. User interfaces and visualization for analysis systems. Data analysis algorithms for embedded and distributed systems. Ubiquitous discovery systems.PrerequisitesRecommended: At least 1 of the following: MA-INF 4111 – Intelligent Learning and Analysis Systems: Data Mining and Knowledge DiscoveryFormatTeaching format LabGroup size 8h/week 4Workload[h]CPFormatTeaching format CalabGroup size 8h/week 4Workload[h]CPTeaching formatGroup size 9Teaching format 9Group size 9h/week 9Workload[h]CPComputer Software, Documentation, Research Papers.The relevant literature will be announced towards the end of the <th>Contents</th> <th>0</th> <th>-</th> <th></th> <th></th> <th></th> <th>•</th> <th></th> | Contents | 0 | - | | | | • | | |
| Mathematical libraries for numerical computation. Search and optimization methods. User interfaces and visualization for analysis systems. Data analysis algorithms for embedded and distributed systems. Ubiquitous discovery systems.PrerequisitesRecommended: At least 1 of the following: MA-INF 4111 – Intelligent Learning and Analysis Systems: Machine Learning MA-INF 4112 – Intelligent Learning and Analysis Systems: Data Mining and Knowledge DiscoveryFormatTeaching format LabGroup size 8h/week 4Workload[h]CP CP 100 T / 210 SFormatTeaching format Coral presentation, written report(graded)Study achievementsOral presentation, written report(graded)Forms of mediaComputer Software, Documentation, Research Papers.The relevant literature will be announced towards the end of the | | - | | | | | • | | |
| optimization methods. User interfaces and visualization for analysis systems. Data analysis algorithms for embedded and distributed systems. Ubiquitous discovery systems.PrerequisitesRecommended: At least 1 of the following: MA-INF 4111 – Intelligent Learning and Analysis Systems: Machine Learning MA-INF 4112 – Intelligent Learning and Analysis Systems: Data Mining and Knowledge DiscoveryFormatTeaching format LabGroup size 8h/week 4Workload[h]CPFormatTeaching format LabGroup size 8h/weekWorkload[h]CPFormatTeaching format LabGroup size 8Howe size 9Go T / 210 S9FormatThe relevant literature will be announced towards the end of theHowe size 9 | | | | | | | | | |
| analysis systems. Data analysis algorithms for embedded and distributed systems. Ubiquitous discovery systems.PrerequisitesRecommended: At least 1 of the following: MA-INF 4111 – Intelligent Learning and Analysis Systems: Machine Learning MA-INF 4112 – Intelligent Learning and Analysis Systems: Data Mining and Knowledge DiscoveryFormatTeaching format LabGroup size 8h/week 4Workload[h]CPFormatTeaching format LabGroup size 8h/weekWorkload[h]CPFormatTeaching format 1Group size 9h/weekWorkload[h]CPFormatTeaching format 1Group size 9H/weekTeaching format | | | | | | - | | na | |
| $\begin{tabular}{ c c c c c c c c c c c c c c c c c c c$ | | - | | | | | | d | |
| Prerequisites Recommended: At least 1 of the following: MA-INF 4111 – Intelligent Learning and Analysis Systems: Machine Learning MA-INF 4112 – Intelligent Learning and Analysis Systems: Data Mining and Knowledge Discovery Format Teaching format Lab Group size h/week Workload[h] CP Format Teaching format Lab Group size h/week Workload[h] CP Study achievements Oral presentation, written report (graded) Study achievements none (not graded) Forms of media Computer Software, Documentation, Research Papers. Literature The relevant literature will be announced towards the end of the | | | | - | - | | | u | |
| $\begin{tabular}{ c c c c c c c c c c c c c c c c c c c$ | Prerequisites | - | | - | | | 5001115. | | |
| $\begin{tabular}{ c c c c c c } \hline Machine Learning & Machine Learning & MA-INF 4112 - Intelligent Learning and Analysis Systems: Data Mining and Knowledge Discovery \\\hline \hline Data Mining and Knowledge Discovery \\\hline \hline Teaching format & Group size & h/week & Workload[h] & CP & \\\hline Lab & 8 & 4 & 60 & T & 210 & S & 9 & \\\hline T & = face-to-face teaching; S & = independent study \\\hline Exam achievements & Oral presentation, written report & (graded) & \\\hline Study achievements & none & (not graded) & \\\hline Forms of media & Computer Software, Documentation, Research Papers. \\\hline Literature & The relevant literature will be announced towards the end of the \\\hline \end{tabular}$ | 1 Terequisites | | | | | 0 | alvsis Systems [.] | | |
| $\begin{tabular}{ c c c c c c c c c c c c c c c c c c c$ | | | 0 | | | 5 | | | |
| Data Mining and Knowledge DiscoveryFormatTeaching formatGroup sizeh/weekWorkload[h]CPLab8460 T / 210 S9T = face-to-face teaching; S = independent studyExam achievementsOral presentation, written report(graded)Study achievementsnone(not graded)Forms of mediaComputer Software, Documentation, Research Papers.LiteratureThe relevant literature will be announced towards the end of the | | | 0 | ent L | earning | r and Ana | alvsis Systems: | | |
| FormatTeaching formatGroup sizeh/weekWorkload[h]CPLab8460 T / 210 S9T = face-to-face teaching; S = independent studyExam achievementsOral presentation, written report(graded)Study achievementsnone(not graded)Forms of mediaComputer Software, Documentation, Research Papers.LiteratureThe relevant literature will be announced towards the end of the | | | | | | | | | |
| FormatLab8460 T / 210 S9T = face-to-face teaching; S = independent studyExam achievementsOral presentation, written report(graded)Study achievementsnone(not graded)Forms of mediaComputer Software, Documentation, Research Papers.LiteratureThe relevant literature will be announced towards the end of the | | | I | | | U | Workload[h] | CP | |
| T = face-to-face teaching; S = independent study Exam achievements Oral presentation, written report (graded) Study achievements none (not graded) Forms of media Computer Software, Documentation, Research Papers. Literature The relevant literature will be announced towards the end of the | Format | | | 8 | 8 | 4 | | 9 | |
| Exam achievementsOral presentation, written report(graded)Study achievementsnone(not graded)Forms of mediaComputer Software, Documentation, Research Papers.LiteratureThe relevant literature will be announced towards the end of the | | T – face-to-fa | ce teachin | o S | — inde | nendent s | , | I | |
| Study achievements none (not graded) Forms of media Computer Software, Documentation, Research Papers. Literature The relevant literature will be announced towards the end of the | Exam achievements | | | 0, | | r on a on t | | ded) | |
| Forms of mediaComputer Software, Documentation, Research Papers.LiteratureThe relevant literature will be announced towards the end of the | | - | | | L or o | | (0 | / | |
| Literature The relevant literature will be announced towards the end of the | | | tware. Doc | cume | entatior | n. Researc | · · · | | |
| Literature | | - | , | | | , | - | f the | |
| | Literature | | | - ~ | | | | . = - | |

| Module MA-INF 4307 | Lab Field P | Lab Field Programmable Gate Arrays | | | | | |
|-----------------------|---------------------------------------|--|-------------|------------------------|-----------------|----------|--|
| Workload | Credit points | Duration | Frequ | ency | | | |
| 270 h | 9 CP | 1 semest | er at lea | at least every 2 years | | | |
| Module | Prof. Dr. Joac | chim K. Ai | nlauf | | | | |
| coordinator | | | | | | | |
| Lecturer(s) | Prof. Dr. Joac | chim K. Ai | nlauf | | | | |
| Classification | Programme | | Mode | Seme | ster | | |
| Classification | M. Sc. Compu | ter Scienc | e Option | al $ $ 2. or | 3. | | |
| Technical skills | Development a | and simula | tion of dig | ital circuit | ts in VHDL and | 1 | |
| | SystemC, expe | erience wit | h synthesiz | able subs | ets, knowledge | of | |
| | the design pat | h from the | e idea to a | realized c | ircuit implemen | ted | |
| | in an FPGA (| n an FPGA (field programmable gate array) | | | | | |
| Soft skills | Communicativ | Communicative skills (oral and written presentation of results), | | | | | |
| | · · · · · · · · · · · · · · · · · · · | social skills (ability to cooperate in small teams, discussions of | | | | | |
| | solution conce | pts) self co | ompetences | (ability t | to accept and | | |
| | formulate criti | cism, abili | ty to analy | ze and fir | nd practical | | |
| | solutions to pr | $\operatorname{coblems})$ | | | | | |
| Contents | | | . / | | , and Synthesis | <i>,</i> | |
| | SystemC for H | Iardware I | Description | , Simulati | on, and Synthes | sis, | |
| | Synthesizable | , | est of Imp | ementatio | ons on FPGA | | |
| | Evaluation Bo | ards | | | | | |
| Prerequisites | Recommended | : | | | | | |
| | MA-INF 4207 | – Dynami | cally Reco | nfigurable | Systems | | |
| Format | Teaching forma | at C | Froup size | h/week | Workload[h] | CP | |
| rormat | Lab | | 8 | 4 | 60 T / 210 S | 9 | |
| | T = face-to-fa | ce teaching | g; S = inde | ependent s | study | | |
| Exam achievements | Oral presentat | ion, writte | en report | | (gra | ided) | |
| Study achievements | none | | | | (not gra | ided) | |
| Forms of media | | | | | | | |
| Literature | Technical docu | umentation | 1 | | | | |

| Module MA-INF 4308 | Lab Vision | Systems | | | | | | |
|-----------------------|---|--|------------|----------------|------------------|-----------------------------------|--|--|
| Workload | Credit points | Duration | Freque | encv | | | | |
| 270 h | 9 CP | 1 semeste | | every semester | | | | |
| Module | Prof. Dr. Sven Behnke | | | | | | | |
| coordinator | 11011 211 510 | | | | | | | |
| Lecturer(s) | Dr. Nils Goerke | | | | | | | |
| | Programme | | Mode | Seme | ster | | | |
| Classification | M. Sc. Compu | ter Science | Option | | 3001 | | | |
| Technical skills | | Students will acquire knowledge of the design and | | | | | | |
| reennear skins | | implementation of parallel algorithms on GPUs. They will apply | | | | | | |
| | these techniqu | - | 0 | | • | ippiy | | |
| | algorithms for | | | | - | | | |
| Soft skills | | | - | | | ility | | |
| Soft Skills | - | Self-competences (time management, goal-oriented work, ability to analyze problems and to find practical solutions), | | | | | | |
| | ° * | | - | | , , | nd | | |
| | | communication skills (Work together in small teams, oral and written presentation of solutions, critical examination of | | | | | | |
| | implementations) | | | | | | | |
| Contents | _ | / | mnutati | one with (| GPUs (CUDA). | | | |
| Contents | Classification | | | | | • | | |
| | support-vector | · · | | | · · · | | | |
| | linear-discrimi | | | | | | | |
| | handling. Qua | - | - | | - | | | |
| | algorithms for | - | | | - | | | |
| Prerequisites | Recommended | | | | 011. | | | |
| Trerequisites | | | | 0 | alysis Systems: | | | |
| | Machine Learn | - | Loui IIII, | 5 and min | aryono oyotemis. | | | |
| | MA-INF 4204 | 0 | Neural N | lets | | | | |
| | Teaching form | I | oup size | h/week | Workload[h] | CP | | |
| Format | Lab | | 8 | 4 | 60 T / 210 S | 9 | | |
| | | | | | , , | | | |
| | T = face-to-fa | | | pendent s | | 11) | | |
| Exam achievements | Oral presentat | tion, written | report | | (0 | $\frac{\text{aded}}{\text{aded}}$ | | |
| Study achievements | none | | | | (not gra | aded) | | |
| Forms of media | - D C 1.1. | <u></u> | · | | 1 A 1 | | | |
| | | - | ision: Al | gorithms a | and Application | ns, | | |
| T.4 4 | Springer 2010. | |) | 111 and 111 | abina I' | | | |
| Literature | | • | tecognitio | on and Ma | achine Learning | 5, | | |
| | Springer 2006. | | | | | | | |
| | • NVidia CUDA Programming Guide, Version 4.0, 2011. | | | | | | | |

| Module | Lab Sensor | Data Inte | rpretati | on | | | |
|--------------------|--|--|-------------|------------|-------------------|-------|--|
| MA-INF 4309 | | | | | | | |
| Workload | Credit points Duration Frequency | | | | | | |
| 270 h | 9 CP | 1 semester | at leas | t every 2 | years | | |
| Module | PD. Dr. Volke | PD. Dr. Volker Steinhage | | | | | |
| coordinator | | | | | | | |
| Lecturer(s) | PD. Dr. Volke | er Steinhage | | | | | |
| Classification | Programme | | Mode | Seme | ster | | |
| Classification | M. Sc. Compu | ter Science | Optiona | 1 2. or | 3. | | |
| Technical skills | Competence to | o implement | algorithm | ns for sen | sor data | | |
| | interpretation, efficient handling and testing, documentation. | | | | | | |
| Soft skills | Efficient imple | Efficient implementation of complex algorithms, abstract | | | | | |
| | thinking, documentation of source code. | | | | | | |
| Contents | Varying select | ed up-to-dat | e topics o | n sensor | data interpreta | tion | |
| Prerequisites | Required: all o | of the follow: | ng: | | | | |
| | MA-INF 2201 | - Computer | Vision | | | | |
| | MA-INF 4206 | – Selected 7 | Copics in S | Sensor Da | ata Interpretatio | on | |
| Format | Teaching form | at Gr | oup size | h/week | Workload[h] | CP | |
| rormat | Lab | | 8 | 4 | 60 T / 210 S | 9 | |
| | T = face-to-fa | ce teaching; | S = indep | pendent s | study | | |
| Exam achievements | Oral presentat | tion, written | report | | (gra | ded) | |
| Study achievements | none | | | | (not gra | ided) | |
| Forms of media | | | | | | | |
| Literature | Relevant litera | ture will be | anounced | l at start | of the lab. | | |

| Module MA-INF 4310 | Lab Mobile | Robots | | | | | | |
|-------------------------|--|--|---|------------|-------------------|-------|--|--|
| WA-INF 4510 Workload | | D | The second | | | | | |
| 270 h | Credit points 9 CP | Duration 1 semeste | Frequency r at least every year | | | | | |
| Module | Prof. Dr. Sven Behnke | | | | | | | |
| coordinator | | I Dennke | | | | | | |
| | Drof Dr. Svon Bohnko Dr. Nils Coorko | | | | | | | |
| Lecturer(s) | Programme | Prof. Dr. Sven Behnke, Dr. Nils Goerke Programme Mode Semester | | | | | | |
| Classification | | Mode Semister M. Sc. Computer Science Optional 2. or 3. | | | | | | |
| Technical skills | ~ | | - | | | ce in | | |
| Teennear skins | Participants acquire basic knowledge and practical experience in the design and implementation of control algorithms for simple | | | | | | | |
| | | structured robotic systems using real mobile robots. | | | | | | |
| | | ě | 0 | | ill be identified | and | | |
| | implemented i | - | | 100000 | | and | | |
| Soft skills | - | | - | t, goal-or | iented work, ab | ility | | |
| | to analyze pro | · · · · · · · · · · · · · · · · · · · | 0 | , 0 | , | U | | |
| | communication | n skills (Wo | ·k togeth | er in smal | ll teams, oral ar | hd | | |
| | | | - | | | iu. | | |
| | written presentation of solutions, critical examination of implementations) | | | | | | | |
| Contents | * | / | \overline{OS} rob | ot simulat | ion tools, basic | | | |
| Contents | capabilities for | · – | | | | | | |
| | architecture, n | | | | , | | | |
| | · · · · · | · · | - | 0, | .M), visual base | ed | | |
| | object detection | | | - (|)) | | | |
| Prerequisites | Recommended | | | | | | | |
| | BA-INF 132 – | Grundlager | der Rob | otik | | | | |
| | BA-INF 131 – | Intelligente | Sehsyste | me | | | | |
| | MA-INF 1314 | – Online M | otion Pla | nning | | | | |
| | MA-INF 2201 | - | | | | | | |
| | MA-INF 4113 | - | | 3 | | | | |
| | MA-INF 4114 | | 0 | | | | | |
| | MA-INF 4203 | | | | | | | |
| Format | Teaching forma | at Gr | oup size | h/week | Workload[h] | CP | | |
| | Lab | | 8 | 4 | 60 T / 210 S | 9 | | |
| | T = face-to-fa | = : | | ependent s | study | | | |
| Exam achievements | Oral presentat | ion, written | report | | (= | ided) | | |
| Study achievements | none | | | | (not gra | aded) | | |
| Forms of media | | | , | | ol middleware, | | | |
| | - | | | | ionstration of re | | | |
| | | | , | presentati | ion and written | | | |
| | report of appr | | | | | | | |
| | | - | nd D. Fo | x: Probat | oilistic Robotics | • | | |
| | MIT Press, 20 | | a. Marin | m Intallim | man Dublished | h | | |
| Titonotoro | • J. Buchli: M Advanced Rob | | | | ence, Published | БУ | | |
| Literature | • B. Siciliano, | • | | | 0 | | | |
| | | | Eus.). B | miger 11 | IU AUUUUU | | | |
| | Robotics, 2008.Additional State-of-the-art publications. | | | | | | | |
| | | | er public | | | | | |

| Module MA-INF 4311 | Seminar Advanced Topics in Data Analysis | | | | | | |
|-----------------------|--|----------------------------------|--------------|------------|-------------|------|--|
| Workload | Credit points | Credit points Duration Frequency | | | | | |
| 120 h | 4 CP | | | | | | |
| Module | Prof. Dr. Söre | en Auer | | | | | |
| coordinator | | | | | | | |
| Lecturer(s) | | | | | | | |
| Classification | Programme | | Mode | Semes | ter | | |
| Classification | M. Sc. Compu | ter Science | Optiona | 1 2. | | | |
| Technical skills | Ability to und | erstand ne | v research | results | | | |
| | presented in original scientific papers. | | | | | | |
| Soft skills | Ability to pres | sent and to | critically d | iscuss | | | |
| | these results in | n the frame | work of the | e correspo | nding | | |
| | area. | | | | | | |
| Contents | Current confer | rence and j | ournal pap | ers | | | |
| Prerequisites | none | | | | | | |
| Format | Teaching form | at | Group size | h/week | Workload[h] | CP | |
| Format | Seminar | | 10 | 2 | 30 T / 90 S | 4 | |
| | T = face-to-fa | ce teaching | ; S = indep | bendent st | udy | | |
| Exam achievements | Oral presentat | tion, writte | 1 report | | (gra | ded) | |
| Study achievements | none | | | | (not gra | ded) | |
| Forms of media | | | | | | | |
| Literature | | | | | | | |

| Module | Semantic Data Web Technologies | | | | | | | |
|---|---|--|-------------|---|------------------|----------------------|--|--|
| MA-INF 4312 | | | | | | | | |
| Workload | Credit points | Duration | Frequency | | | | | |
| 180 h | 6 CP | 1 semester | every year | | | | | |
| Module | Prof. Dr. Sören Auer | | | | | | | |
| coordinator | | | | | | | | |
| Lecturer(s) | Prof. Dr. Söre | Prof. Dr. Sören Auer, Dr. Christoph Lange | | | | | | |
| Classification | Programme | | Mode | Semest | ter | | | |
| Classification | M. Sc. Compu | | Optiona | | | | | |
| Technical skills | The goal of th | The goal of this lecture is to impart knowledge on the | | | | | | |
| | fundamentals, | technologies | s and appl | ications o | f the Semantic | | | |
| | Web and infor | mation retri | leval. As p | oart of the | e lecture the ba | sic | | |
| | concepts and s | standards fo | r semantic | technolog | gies are explair | ned. | | |
| Soft skills | | | | | | | | |
| Contents | As part of the | | | | | | | |
| | technologies h | ave been de | veloped for | r machine | -readable exch | ange | | |
| | of data, inform | nation and k | nowledge | on the We | eb. These | | | |
| | standards and | technologie | s are incre | asingly be | eing used in | | | |
| | applications as | nd have alre | ady led to | a number | r of exciting | | | |
| | projects (e.g. 1 | DBpedia, se | mantic wil | ki or comi | mercial | | | |
| | applications su | ich as schen | na.org, Op | enCalais, | or Google's | | | |
| | Freebase). The | e module pr | ovides a th | neoreticall | y grounded an | d | | |
| | practically ori | ented introd | uction to t | this area. | The topics | | | |
| | discussed with | in the lectur | re include: | | | | | |
| | • RDF syntax | and data m | odel | | | | | |
| | • RDF Schema | | | s of RDF | (\mathbf{S}) | | | |
| | ontologies in | | | | | | | |
| | - | | | | , query langua | നലട | | |
| | • Linked Data | | | | | gus | | |
| | • Semantic tex | | | ~ ~ | | | | |
| Prerequisites | none | tt anarysis a | | | le var bysterns | | | |
| 1 TOTOQUISITOS | Teaching form | at C | roup size | h/week | Workload[h] | CP | | |
| Format | Lecture | | 60 | 2 | 30 T / 45 S | 2.5 | | |
| 2 02 may | Exercises | | 30 | 2 | 30 T / 75 S | 3.5 | | |
| | | ce teaching: | | l | , , | 0.0 | | |
| | T = face-to-face teaching; $S = $ independent study | | | | | | | |
| Exam achievements | Written exam | | | Written exam Successful exercise participation | | | | |
| Exam achievements | Written exam Successful exe | rcise partici | oation | | (= | ded) | | |
| Exam achievements Study achievements Forms of media | | rcise particij | pation | | (gra (not gra | , | | |

| Module | Seminar Se | Seminar Semantic Data Web Technologies | | | | | |
|--------------------|------------------|--|----------------|------------|----------------|-------|--|
| MA-INF 4313 | | | | | | | |
| Workload | Credit points | Duration | Frequer | Frequency | | | |
| 120 h | 4 CP | 1 semeste | r every y | ear | | | |
| Module | Prof. Dr. Söre | en Auer | | | | | |
| coordinator | | | | | | | |
| Lecturer(s) | Prof. Dr. Chr. | istoph Lang | e | | | | |
| Classification | Programme | | Mode | Semest | ter | | |
| Classification | M. Sc. Compu | ter Science | Optional | 2. | | | |
| Technical skills | Through the s | eminar, stu | dents will l | earn to w | ork with tools | and | |
| | technologies of | f the Seman | tic Web as | well as a | ssess their | | |
| | capabilities for | capabilities for given problems. They will gain the ability to | | | | | |
| | understand ne | understand new research results presented in original scientific | | | | | |
| | papers. | papers. | | | | | |
| Soft skills | Ability to pres | sent and to | critically di | iscuss tec | hnologies and | | |
| | research result | ts in the frame | nework of | Semantic | Web technolog | gies. | |
| Contents | • technologies | such as trip | ole stores, li | ink discov | very framework | xs, | |
| | NLP pipelines | | | | | | |
| | • recent confer | rence and jo | urnal pape | rs | | | |
| Prerequisites | none | | | | | | |
| Format | Teaching form | at G | roup size | h/week | Workload[h] | CP | |
| rormat | Seminar | | 10 | 2 | 30 T / 90 S | 4 | |
| | T = face-to-fa | ce teaching | S = indep | endent st | udy | | |
| Exam achievements | Oral presentat | tion, writter | report | | (gra | ded) | |
| Study achievements | none | | | | (not gra | ded) | |
| Forms of media | | | | | | | |
| Literature | | | | | | | |

| Module | Lab Semantic Data Web Technologies | | | | | | |
|--------------------|------------------------------------|--|------------|-------------|------------------|-------|--|
| MA-INF 4314 | | | | | | | |
| Workload | Credit points | Duration | Freque | ency | | | |
| 270 h | 9 CP | 1 semester | every | year | | | |
| Module | Prof. Dr. Sören Auer | | | | | | |
| coordinator | | | | | | | |
| Lecturer(s) | Prof. Dr. Söre | en Auer, Dr. | Christop | h Lange | | | |
| Classification | Programme | | Mode | Seme | ster | | |
| Classification | M. Sc. Compu | ter Science | Optiona | al 2. | | | |
| Technical skills | The students v | will carry ou | t a pract | ical task (| (project) in the | | |
| | context of Sem | context of Semantic Web technologies, including test and | | | | | |
| | documentation | documentation of the implemented software/system. | | | | | |
| Soft skills | Ability to prop | perly presen | and defe | end design | n decisions, to | | |
| | prepare readal | ole documen | tation of | software; | skills in | | |
| | constructively | collaboratin | g with ot | thers in sr | nall teams over | a | |
| | longer period | of time; abil | ty to clas | ssify own | results with reg | gard | |
| | to the state-of | -the-art | | | | | |
| Contents | | | | | | | |
| Prerequisites | none | | | | | | |
| Format | Teaching form | at Gr | oup size | h/week | Workload[h] | CP | |
| Format | Lab | | 8 | 4 | 60 T / 210 S | 9 | |
| | T = face-to-fa | ce teaching; | S = inde | pendent s | study | | |
| Exam achievements | Oral presentat | tion, written | report | | (gra | ided) | |
| Study achievements | none | | | | (not gra | ided) | |
| Forms of media | | | | | | | |
| Literature | | | | | | | |

| Module MA-INF 4315 | Probabilistic Graphical Models | | | | | | | |
|-----------------------|--------------------------------|---|------------------|------------|------------------|------|--|--|
| Workload | Credit points | Duration | Freque | ncy | | | | |
| 180 h | 6 CP | 1 semeste | ester every year | | | | | |
| Module | JunProf. Dr. | Angela Ya | | | | | | |
| coordinator | | | | | | | | |
| Lecturer(s) | | | | | | | | |
| | Programme | | Mode | Semes | ter | | | |
| Classification | M. Sc. Compu | M. Sc. Computer Science Optional 1., 2., 3. or 4. | | | | | | |
| Technical skills | Students will I | be introduce | d to the th | neory of p | orobabilistic | | | |
| | graphical mod | els and stud | y various a | applicatio | ons of such mod | lels | | |
| | in image proce | essing, comp | uter vision | and othe | er topics in AI. | | | |
| Soft skills | Productive wo | rk in small | eams, dev | elopment | and realization | n of | | |
| | individual app | roaches and | solutions, | critical r | eflection of | | | |
| | competing me | thods, discu | ssion in gr | oups. | | | | |
| Contents | This course in | This course introduces probabilistic graphical models and their | | | | | | |
| | use in solving | problems in | computer | vision an | d machine | | | |
| | learning. Grap | ohical model | s offer a p | robabilist | ic framework fo | or | | |
| | modelling and | making dec | isions in c | omplex so | cenarios with | | | |
| | limited and no | oisy data. W | e will cove | r topics s | uch as Markov | and | | |
| | Bayesian netw | orks, param | eter learni | ng, and in | nference | | | |
| | techniques. Th | ne theory wi | ll be demo | nstrated | in computer vi | sion | | |
| | applications su | ich as huma | n pose esti | imation, o | object tracking | , | | |
| | image de-noisi | ng and sem | antic segm | entation. | | | | |
| Prerequisites | Recommended | | | | | | | |
| | - | 0 | | - | follow the cou | rse. | | |
| | Exercises will | | ory and pr | ogrammiı | ng (Matlab / | | | |
| | Python) based | | | | 1 | | | |
| | Teaching forma | at G | roup size | h/week | Workload[h] | CP | | |
| Format | Lecture | | 60 | 2 | 30 T / 45 S | 2.5 | | |
| | Exercises | | 30 | 2 | 30 T / 75 S | 3.5 | | |
| | T = face-to-fa | ce teaching; | S = indep | endent st | udy | | | |
| Exam achievements | Written exam | | | | (gra | ded) | | |
| Study achievements | Successful exer | rcise partici | oation | | (not gra | ded) | | |
| Forms of media | | | | | | | | |
| Litopoturo | David Barber, | Bayesian R | easoning a | nd Mach | ine Learning | | | |
| Literature | Koller & Fried | man, Proba | bilistic Gr | aphical M | Iodels | | | |

| Module MA-INF 4316 | Knowledge Graph Analysis | | | | | | | |
|-----------------------|--------------------------|----------------------------------|----------------------|-----------|-----------|-------------|------|--|
| Workload | Credit points | Credit points Duration Frequency | | | | | | |
| 180 h | 6 CP | 1 semes | ter | every y | ear | | | |
| Module | Prof. Dr. Jens | s Lehmanr | 1 | | | | | |
| coordinator | | | | | | | | |
| Lecturer(s) | Prof. Dr. Jens | s Lehmanr | 1 | | | | | |
| Classification | Programme | Programme | | | Semest | ter | | |
| Classification | M. Sc. Compu | M. Sc. Computer Science | | Optional | l 1. | 1. | | |
| Technical skills | | | | | | | | |
| Soft skills | | | | | | | | |
| Contents | | | | | | | | |
| Prerequisites | none | | | | | - | | |
| | Teaching form | at | \mathbf{Gr} | oup size | h/week | Workload[h] | CP | |
| Format | Lecture | | | 60 | 2 | 30 T / 45 S | 2.5 | |
| | Exercises | | | 30 | 2 | 30 T / 75 S | 3.5 | |
| | T = face-to-fa | ce teachin | ıg; S | S = indep | endent st | udy | | |
| Exam achievements | Oral exam | | | | | (gra | ded) | |
| Study achievements | Successful exe | rcise parti | cipa | ation | | (not gra | ded) | |
| Forms of media | | | | | | | | |
| Literature | | | | | | | | |

| Module MA-INF 4317 | Seminar Knowledge Graph Analysis | | | | | | |
|-----------------------|----------------------------------|--|-----------------|-------------|-----------------------------------|-------------------------|--|
| Workload | Credit points | Credit points Duration Frequency | | | | | |
| 120 h | 4 CP | 1 semester | every y | ear | | | |
| Module | Prof. Dr. Jens | s Lehmann | | | | | |
| coordinator | | | | | | | |
| Lecturer(s) | Prof. Dr. Jens | s Lehmann | | | | | |
| Classification | Programme | | Mode | Semest | ter | | |
| Classification | M. Sc. Compu | ter Science | Optional | l 2. | | | |
| Technical skills | Ability to und | erstand new | research r | results | | | |
| | presented in o | presented in original scientific papers. | | | | | |
| Soft skills | Ability to pres | Ability to present and to critically discuss | | | | | |
| | these results in | n the framew | vork of the | e correspo | nding | | |
| Contents | area. Current confei | conco and io | urnal nano | vrc | | | |
| | none | lence and jo | iinai pape | 18 | | | |
| Prerequisites | | | noun sino | h /mal | Wanhlood[h] | CP | |
| Format | Teaching forms Seminar | at G | roup size 10 | h/week 2 | Workload[h] 30 T / 90 S | $\frac{\mathbf{CP}}{4}$ | |
| | | | I | | , | 4 | |
| | T = face-to-fa | | | endent st | | | |
| Exam achievements | Oral presentat | ion, written | report | | (gra | ded) | |
| Study achievements | none | | | | (not gra | ded) | |
| Forms of media | | | | | | | |
| Literature | | | | | | | |

5 Master Thesis

| MA-INF 0401 | $30 \ \mathrm{CP}$ | Master Thesis | 156 |
|------------------|--------------------|----------------|-----|
| MA-INF 0402 Sem2 | 2 CP | Master Seminar | 157 |

| Module MA-INF 0401 | Master Thesis | | | | | | | |
|-----------------------|--|--|---------------|------------|------------------|--------|--|--|
| Workload | Credit points | Duration | Freque | ncv | | | | |
| 900 h | 30 CP | 1 semeste | - | emester | | | | |
| Module | | | | | | | | |
| coordinator | | | | | | | | |
| Lecturer(s) | All lecturers o | f computer | science | | | | | |
| | Programme | mester | | | | | | |
| Classification | M. Sc. Computer Scier | | Compul | sory 4. | | | | |
| Technical skills | Ability to solv | e a well-dei | ined, signi | ficant res | earch problem | | | |
| | under supervis | sion, but in | principle i | ndepende | ently | | | |
| Soft skills | Ability to writ | Ability to write a scientific documentation of considerable length | | | | | | |
| | according to e | stablished s | cientific pr | inciples o | of form and styl | le, in | | |
| | - | ecting solid | knowledge | about th | e state-of-the-a | art in | | |
| | the field | | | | | | | |
| Contents | - | - | | - | of the areas of | | | |
| | computer scier | nce represen | nted in the | curriculu | ım | | | |
| Prerequisites | none | | | | | | | |
| | Teaching forma | at (| Group size | h/week | | CP | | |
| | Independent | | | | 900 S | 30 | | |
| Format | preparation of | | | | | | | |
| | scientific thesis | | | | | | | |
| | individual coa | ching | | | | | | |
| | T = face-to-fa | ce teaching | S = indeption | pendent s | tudy | | | |
| Exam achievements | Master Thesis | | | | (0 | aded) | | |
| Study achievements | none | | | | (not gra | aded) | | |
| Forms of media | | | | | | | | |
| Literature | Individual bibliographic research required for identifying | | | | | | | |
| Littlituit | relevant literature (depending on the topic of the thesis) | | | | | | | |

| Module | Master Seminar | | | | | | | | |
|--------------------|---|----------|----------------------|-----------|------|-----|--------------|------|--|
| MA-INF 0402 | | | | | | | | | |
| Workload | Credit points | Duration | ı | Frequency | | | | | |
| 60 h | 2 CP | 1 semes | ester every semester | | | | | | |
| Module | | | | | | | | | |
| coordinator | | | | | | | | | |
| Lecturer(s) | All lecturers of computer science | | | | | | | | |
| Classification | Programme | | | Mode S | | Sen | Semester | | |
| | M. Sc. Computer Scien | | | Compuls | sory | 4. | | | |
| Technical skills | Ability to document and defend the results of the thesis work in | | | | | | | | |
| | a scientifically appropriate style, taking into consideration the | | | | | | | | |
| | state-of-the-art in research in the resp. area | | | | | | | | |
| Soft skills | | | | | | | | | |
| Contents | Topic, scientific context, and results of the master thesis | | | | | | | | |
| Prerequisites | none | | | | | | | | |
| Format | Teaching format | | Gr | oup size | h/we | eek | Workload[h] | CP | |
| | Seminar | | | | 2 | | 30 T / 30 S | 2 | |
| | T = face-to-face teaching; S = independent study | | | | | | | | |
| Exam achievements | Oral presentation of final results (graded | | | | | | | ded) | |
| Study achievements | none | | | | | | (not graded) | | |
| Forms of media | | | | | | | | | |
| Literature | Individual bibliographic research required for identifying | | | | | | | | |
| | relevant literature (depending on the topic of the thesis) | | | | | | | | |