April 12, 2021

#### **Courses in the Summer Term 2021**



UNIVERSITÄT DES SAARLANDES

# AG Prof. Dr. Weickert



UNIVERSITÄT DES SAARLANDES

Mathematical Image Analysis Group — www.mia.uni-saarland.de



2

3

#### **Image Processing and Computer Vision** three teaching awards **Type:** core class, 4h+2h, 9 ECTS Lecturer: Prof. Joachim Weickert transformations, image enhancement, motion, stereo, object recognition Scope: frame 2 frame 1 motion field Example: Motion Analysis in Videos **Extra Benefit:** enables you to write a bachelor thesis in our group

Requirements: undergraduate mathematics, proficiency in English

Virtual Lectures: Tuesday and Friday, 10:15–12:00 (starting April 13)
 https://www.mia.uni-saarland.de/Teaching/ipcv21.shtml

#### **Image Compression**

#### two computer science teaching awards (2017, 2019)

- ◆ Lecturer: Dr. Pascal Peter
  ◆ Type: advanced class, 4h+2h, 9 ECTS
- Requirements: undergraduate mathematics, proficiency in English
- Virtual Lectures: Mon 12-14 c.t. & Wed 14-16 c.t. (starting April 14) https://www.mia.uni-saarland.de/Teaching/ic21.shtml
- Scope: from basics of information theory to state-of-the-art image compression
   classics (JPEG, PNG, ...) and novel codecs (BPG, inpainting-/CNN-based)







reconstruction



Example: Inpainting-based Image Compression

3

#### Numerical Algorithms for Visual Computing

- Lecturer: Dr. Matthias Augustin
- **Type:** advanced class, 3h+1h, 6 ECTS

• **Requirements:** undergraduate mathematics, proficiency in English

- Virtual Lectures: Tue 8:30-10:00 & Thu 12:15-14:00 (starting April 13) https://www.mia.uni-saarland.de/Teaching/navc21.shtml
- Scope: mathematical background and numerical aspects of
  - iterative solution methods for systems of linear equations
  - finite difference methods for partial differential equations

2

# Prof. Dr. Jilles Vreeken



UNIVERSITÄT DES SAARLANDES

# TADA!

## **Topics in Algorithmic Data Analysis**





#### The Ultimate Guide to Surviving your PhD and Beyond

Thursdays in June, 16:00—17:00, 0 ECTS

# Prof. Dr. Isabel Valera



UNIVERSITÄT DES SAARLANDES

#### Machine Learning – Prof. Isabel Valera

How much? 2 lectures and 1 tutorial per week, 9 credits

- When? Lectures on Mon. 14-16 h & Wed. 16–18 h (starts 19<sup>th</sup> April) Tutorials on Thu. 12–14 h (TBC, starts 22<sup>nd</sup> April)
- **What?** Theoretical Foundations of Machine Learning:
  - Probability theory
  - Bayesian decision theory
  - Linear classification and regression
  - Model selection and evaluation
  - Convex Optimization
  - Kernel methods

• Societal Impact of Machine Learning SIC Saarland Informatics

- Unsupervised learning (Clustering, Dimensionality Reduction)
- Deep Learning

#### More information and registration: <a href="https://cms.sic.saarland/pml/">https://cms.sic.saarland/pml/</a>

**Contact & questions to:** <u>ml-course-team@lists.saarland-informatics-campus.de</u>

## Dr. Ben Stock



UNIVERSITÄT DES SAARLANDES



- Highly practical lecture on Web Security
  - Client-Side Issues (XSS, CSRF, ...), Server-Side Issues (SQL Injections, Command Injections, ...), Infrastructure Security (TLS, ...)
- Accompanied by several practical tasks
  - Attack/Defense Challenges and Jeopardy Challenges
- Inverted-ish classroom
  - lecture videos each week, Q/A session with quizzes Friday 10-12
  - bonus material: complete script for all content of the lecture
- High effort, high reward course
  - Overall assessment thus far: 1.31, 1.3, 1.24, 1.33
     Overall requirements thus far: 2.45, 2.51, 2.54, 2.09 (wtf?!)
- All information through https://cms.cispa.saarland/websec21

# Prof. Dr. Christoph Sorge



UNIVERSITÄT DES SAARLANDES

#### **IT Forensics**

 From
 0000-0010:
 54
 72
 61
 6e-73
 61
 63
 74-69
 6f
 6e
 20-62
 65
 67
 69

 0000-0020:
 6e
 3a
 20
 32-30
 31
 33
 2d-30
 31
 2d
 30-31
 54
 30
 30

 0000-0030:
 3a
 30
 3a-30
 30
 5a
 20-20
 54
 72
 61-6e
 73
 61
 63

 0000-0040:
 74
 69
 6f
 6e-20
 49
 44
 3a-20
 35
 34
 37-31
 32
 33
 36

 0000-0050:
 39
 38
 35
 34-36
 35
 38
 37-20
 20
 43
 61-72
 64
 20
 6e

 0000-0060:
 75
 6d
 62
 65-72
 3a
 20
 34-34
 34
 34
 35-35
 35
 36



to

- How to find and secure evidence in computer systems, and how to present evidence in court?
- Some exemplary topics:
  - Statistics and the prosecutor's fallacy
  - Collection of persistent data
  - File system analysis
  - Investigator as an expert witness
- Time: Lecture Tuesday, 10-12, Tutorials TBA
- Contact:
  - www.legalinf.de lehrstuhl.sorge@uni-saarland.de

# Prof. Dr. Gert Smolka



UNIVERSITÄT DES SAARLANDES

#### Introduction to Computational Logic Prof. Gert Smolka



Core Course, 9 CP Wednesdays 12.15-13.45 and Fridays 14.15-15.45 via Zoom

- Programming language for developing computational and mathematical theories
- Interactively construct mathematical models and proofs using the Coq theorem prover
- · Computational type theory, a foundational language different from set theory
- Case studies (numbers, lists, compilation, regular exp. matching, proof systems)
- Foundational issues and engineering issues
- Intuitionistic proofs, computer-verified proofs, general inductive definitions
- Important for programming languages, system verification, automated reasoning, mathematics
- Course well-suited for online teaching (comprehensive lecture notes, feedback through interactive prover)
- · Visit course page via Gert Smolka's homepage to register and learn more

# Prof. Dr. Philipp Slusallek



UNIVERSITÄT DES SAARLANDES

#### Lecture: Realistic Image Synthesis Philipp Slusallek, Karol Myszkowski, Gurprit Singh

ggraph 2020

- Starts April 12th, 10 **Topics:** 
  - Realistic Rendering
  - Lighting Simulation
  - Monte-Carlo Methods
  - Sampling-Techniques
  - HW-based Techniques
  - High-Dynamic Range Imaging
  - Animation & Perception
- **Organization:** 
  - Lectures, assignments, oral exam
- Schedule (online via Zoom):
  - Mon 10-12h & Thu 8:30-10h





See: https://graphics.cg.uni-saarland.de/ courses/ Contact: slusallek@cs.uni-saarland.de





Saarland Informatics

relMSE, time

5.46 (base), 195s

5.46  $(1.00 \times)$ , 195s 5.43  $(0.99 \times)$ , 220s

# Prof. Dr. Sven Rahmann



UNIVERSITÄT DES SAARLANDES

#### New at UdS CS and ZBI: Prof. Sven Rahmann

- Research topic: Algorithmic Bioinformatics
- Bioinformatics Master Courses
  - Algorithms for Sequence Analysis
  - Seminar on Algorithms and Data Structures
  - Python Programming (Winter?)
- BSc and MSc Theses
- Website (needs update):

https://www.rahmannlab.de/



#### Special lecture: Algorithms for Sequence Analysis

- Exact and approximate pattern matching
- Full-text inverted index data structures
   (suffix trees / arrays); applications to biosequences
- Text compression and succinct indexing
- Pairwise and multiple sequence alignment
- Combinatorial and probabilistic models for patterns
- DNA/peptide motif search and discovery
- Alignment-free methods, *k*-mers and hashing
- More information and registration:
   <u>https://www.rahmannlab.de/</u>  $\rightarrow$  Lehre  $\rightarrow$  Algorithms...
- Summer 2021: 4V+2Ü, 9 ECTS
- Tue 12:30-14:00, Thu 08:30-10:00, Exercises TBD



# Dr. Anand Narayanan



UNIVERSITÄT DES SAARLANDES

#### Algebraic Coding Theory

How to transmit information over noise?







How to conduct an interactive protocol amidst noise? ...or.... How to play blindfold chess when your friends are screaming?



Wednesdays 14-16 hr. Instructor: Anand Narayanan (CISPA) Advanced lecture, 6CP

 Warning: May contain mathematics; arithmetic, algebra, geometry, discrete

 probability and graph theory.
 https://cms.cispa.saarland/algebraic\_coding

# Prof. Dr. Martina Maggio



UNIVERSITÄT DES SAARLANDES

#### Systems: Embedded, Cyber-Physical, Real-Time

#### Embedded Systems, 9 credits

- \* Models of the physical environment
- \* Control and computation
- \* Implementation

http://cms.sic.saarland/es21/
maggio@cs.uni-saarland.de





# Prof. Dr. Wolfgang Maaß



UNIVERSITÄT DES SAARLANDES



#### Data Science (6CP)



Univ.-Prof. Dr.-Ing. Wolfgang Maaß

Professor für Wirtschaftsinformatik

Fakultät für Empirische Humanwissenschaften und Wirtschaftswissenschaft

Professor für Informatik (kooptiert) Fakultät für Mathematik und Informatik

Wissenschaftlicher Direktor Deutsches Forschungszentrum für Künstliche Intelligenz (DFKI)









"A data scientist is someone who knows more statistics than a computer scientist and more computer science than a statistician."

– Josh Blumenstock



Lecture (via zoom): Fri 11:45 - 13:45 Registration: https://lms.sulb.uni-saarland.de/moodle/course/view.php?id=4679

# Prof. Dr. Jana Köhler



UNIVERSITÄT DES SAARLANDES





## **Artificial Intelligence 2021**

#### Monday 4-6pm and Thursday 4-6pm

Register at https://cms.sic.saarland/ai\_21



#### Prof. Jörg Hoffmann

http://fai.cs.uni-saarland.de/hoffmann/ hoffmann@cs.uni-saarland.de



#### Prof. Jana Koehler

https://jana-koehler.dfki.de/ jana.koehler@dfki.de

- General introduction into the field of Artificial Intelligence (AI), its history, key assumptions, paradigms, concepts, and fundamental methods
- Learn and apply techniques developed in the fields of intelligent agents, search algorithms and game playing, knowledge representation, logical reasoning and deduction, planning, constraint reasoning, machine learning, and reasoning under uncertainty
- With the knowledge acquired in this course, students are well-prepared to successfully attend the many special lectures on AI offered at UdS or to write their Bachelor or Master thesis in the field of AI
- □ New in 2021: Alden chatbot supports students when working on assignment cheats

# Prof. Dr. Dietrich Klakow



UNIVERSITÄT DES SAARLANDES



#### Digital Signal Processing Lecture V2Ü, 6CP

S

Dietrich.Klakow@lsv.uni-saarland.de

#### **Topics**

- 1. Introduction
- 2. Signal Representations
- 3. Microphone Arrays
- 4. Filtering and Smoothing
- 5. Feature Extraction from Speech Signals
- 6. Musical Genre Classification
- 7. Speaker Recognition
- 8. KL-Transform and Linear Discriminant Analysis
- 9. Linear Predictive Coding
- 10. Wiener Filter
- 11. Spectral Subtraction
- 12. Kalman-Filter

#### Lecture:

- Monday 10:15-11:45
- Location: MS Teams
- Starts: Monday April 17th
- Tutorials: one group by arrangement (doodle)
- Register by April 14<sup>rd</sup> 23:59 on course home page







#### Statistical Natural Language Processing Lecture V2Ü2, 6CP



Dietrich.Klakow@lsv.uni-saarland.de

#### Topics

- 1. Natural Language as a Sequence of Symbols
- 2. Basics of Language Modeling
- 3. Entropy
- 4. Backing-Off Language Modeling
- 5. Text Classification
- 6. Word Sense Disambiguation
- 7. Information Retrieval
- 8. Topic Detection and Tracking
- 9. Part-Of-Speech Tagging
- 10. Named Entity Tagging
- 11. Machine Translation

#### Lecture:

- Friday 8:30-10:00
- Location: MS Teams
- Starts: April 23rd
- Tutorials: by arrangement (doodle)
- Register on course home page by 16<sup>th</sup>, 23:59









#### Software Project: Representation Learning with Deep Learning



#### adavody@lsv.uni-saarland.de

The learning objectives are:

- Reading papers on recent advances in deep learning related topics.
- Implementing an (ideally novel) idea and getting hands-on experience.
- Working as a group to create a software.

#### Topics:

- Natural Language Processing related topics.
- Few-shot learning.
- Transfer Learning.

#### Lecture:

 Major parts of the software project will be done in the summer break as a 5 weeks block course.

 During the coming semester the effort will be about 3h per week for preparing the project and planing it.

- Register by April 14th, 23:59, email: adavody@lsv.uni-saarland.de

# Dr. Andreas Karrenbauer



UNIVERSITÄT DES SAARLANDES

#### Optimization

#### Core lecture: 9 credit points

- two lectures per week (Wednesdays + Thursdays 14-16)
- one tutorial per week (Mondays 16-18)
- theoretical course with (optional) practical exercises
- https://bit.ly/3a08lic

#### (integer/linear) Optimization is not only a key topic in theoretical CS



 $\min c^T x$ s.t. Ax = b $x \ge 0$ 





#### [online]

# Prof. Dr. Holger Hermanns





UNIVERSITÄT DES ARLANDES



## System Design

- Orbit Dynamics
- Launchers, Spacecrafts, Satellites, Space Stations
- System Architecture, System Components



## Communication

- Transmission and **Encoding Basics**
- Delay Tolerant Networking, Routing, Congestion, **Contact Plans**
- Interplanetary Internet and beyond



# - Space Informatics Juan Fraire, Holger Hermanns

## **Planning and Operation**

- Power, Memory, Space, Time
- Telerobotics vs. Autonomy vs. Human-Operated
- Task Graphs, Priced Timed Automata
- Optimisation DP, LP, ILP, MILP, ...
- SAT and OMT

## **Applications and Challenges**

- LEO vs. GEO Satellites
- Space Missions
- Exploration, Observation, Communication, Tourism
- Space Debris





**Advanced Lecture** Vertiefungsvorlesung

What?

- **6 CP**
- Thu 14-16 weekly otherwise online



dcms.cs.uni-saarland.de/spain21/



## **Blocks** I **Philosophical Tool Box**

- What are your **moral** intuitions?
- What is **right and** wrong?
- How to write a proper argument?
- What are **Codes of** Ethics, where do you find them, and how may they help you?

. .

**Contemporary Topics** 

**Block II** 

- What is wrong with filter bubbles and echo chambers?
- What problems are there with machine learning?
- What about surveillance and whistle blowing?

...



# Ethics for Nerds Kevin Baum, Sarah Sterz, Holger Hermanns

5	Block III Oncomming & Sci-Fi Topics	Organiz
	<ul> <li>How should machines behave towards</li> </ul>	Advanced Vertiefung
	numans:	• 6 CP
2	Is it possible to built thinking machines?	short vide lectures
	<ul> <li>Would a super- intelligence be dangerous?</li> </ul>	<ul> <li>grading th (or re-exa</li> </ul>
	•••	<ul> <li>exam adm through a and group</li> </ul>



### zation

## **Date and Time**

**Lecture** gsvorlesung

eos instead of

hough **exam** m) and essay

nission ssignments p work

a self-paced online course



dcms.cs.uni-saarland.de/ethics\_21/

# Prof. Dr. Thorsten Herfet



UNIVERSITÄT DES SAARLANDES





#### **COURSES SUMMER TERM 2021**

- 1. Audio/Visual Communication and Networks (5G New Radio)
  - 4L2T, Start April 13<sup>th</sup> (tutorials start Wednesday Apr. 21<sup>st</sup>) Tuesday 12:15–13:45 and Wednesday 8:30–10:00
  - Implementation:
    - <u>eBook "5G NR"</u> available to all students!
    - Background theory via <u>interactive manuscript</u>
    - Quizzes & Tutorials via (UdS)-Moodle
    - (Partially Inverted) Lecture via (UdS)-Teams
  - 5G New Radio (you'll finally understand how it works ⓒ)
    - Wireless transmission (propagation, link budgets)
    - Multiple access (T-/F-/C-/S-DMA)
    - (Massive-) MIMO
  - Contact: <u>herfet@cs.uni-saarland.de</u>







1





- 2. Hands on Networking (HON)
  - 2L2T, Start August 2<sup>nd</sup>, Block-Course until August 27<sup>th</sup> Each Day 08:30–15:00 (August 2<sup>nd</sup>-13<sup>th</sup>) Practical Project Work (individual, August 14<sup>th</sup>-27<sup>th</sup>)
  - Implementation (YET TO BE DECIDED!):
    - Admission Test: We, July 21<sup>st</sup>, 2021, 16:00st
    - Slides available via web!
    - Tutorials via <u>(UdS)-Moodle</u>
    - (Partially Inverted) Lecture via (UdS)-Teams
  - Networking Practice
    - Wired and Wireless (Physical and Link)
    - Network addressing (IPv4 and IPv6)
    - Transport Protocols
    - Network Management and Debugging
  - Contact: <u>herfet@cs.uni-saarland.de</u>



SIC Saarland Informatics Campus





2

# Prof. Dr. Anja Feldmann



UNIVERSITÄT DES SAARLANDES

## Data Networks

#### Anja Feldmann, Oliver Gasser, Devashish Gosain & Savvas Zannettou

Summer semester 2021



We will dive deep into network architectures, protocols, and technologies.

- Self-contained, downloadable video lectures
- Interactive live Q&A with lecturers
- Engaging exercises and tutorials

Contact: inet-teaching@lists.mpi-inf.mpg.de



1969

UTAH

# Dr. Nico Döttling, Prof. Dr. Antoine Joux, Prof. Dr. Cas Cremers



UNIVERSITÄT DES SAARLANDES



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## RYPTOGRAPHY

Lecturers: Nico Döttling, Antoine Joux, Cas Cremers https://cms.cispa.saarland/crypto21/

# Prof. Dr. Markus Bläser



UNIVERSITÄT DES SAARLANDES

#### Complexity Theory (core lecture)

- Monday 10:15–12:00
- Wednesday 8:15–10:00
- starts April 14
- Complexity theory is the science of classifying problems with respect to their usage of resources
- Flagship question:  $P \stackrel{?}{=} NP$
- "Grundzüge der Theoretischen Informatik" (Introduction to Computability and Complexity) or equivalent highly recommended
- Web: cms.sic.saarland/cct21/
- Contact: Markus Bläser mblaeser@cs.uni-saarland.de

#### COMPLEXITY THEORY

average student

#### The End.

#### **Enjoy your studies**

#### **@ Saarland Informatics Campus**

## **@ Saarland University**

& stay safe!