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Courses in summer term 2021



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AGProf. Dr. Weickert



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Image Processing and Computer Vision

three teaching awards

Lecturer: Prof. Joachim Weickert

Type: core class, 4h+2h, 9 ECTS

Scope: transformations, image enhancement, motion, stereo, object recognition

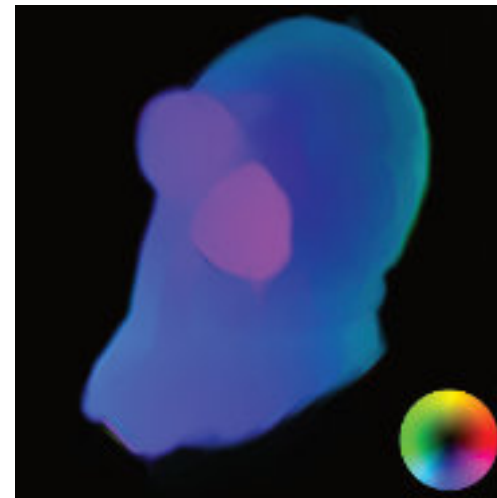
frame 1



frame 2



motion



Example: Motion Analysis in Videos

Extra Benefit: enables you to write a bachelor thesis in our group

Requirements: undergraduatemathematics, proficiency in English

Virtual Lectures: Tuesday and Friday, 10:15{12:00 (starting April 13)

<https://www.mia.uni-saarland.de/Teaching/ipcv21.shtml>

1

2

3

Image Compression

two computer science teaching awards (2017, 2019)

Lecturer: Dr. Pascal Peter

Type: advanced class, 4h+2h, 9 ECTS

Requirements: undergraduatemathematics, 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)

original



stored data



reconstruction



Example: Inpainting-based Image Compression

1

2

3

Numerical Algorithms for Visual Computing

Lecturer: Dr. Matthias Augustin

Type: advanced class, 3h+1h, 6 ECTS

Requirements: undergraduatemathematics, 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

1

2

3

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Prof. Dr. Jilles Vreeken



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TADA!

Topics in Algorithmic Data Analysis

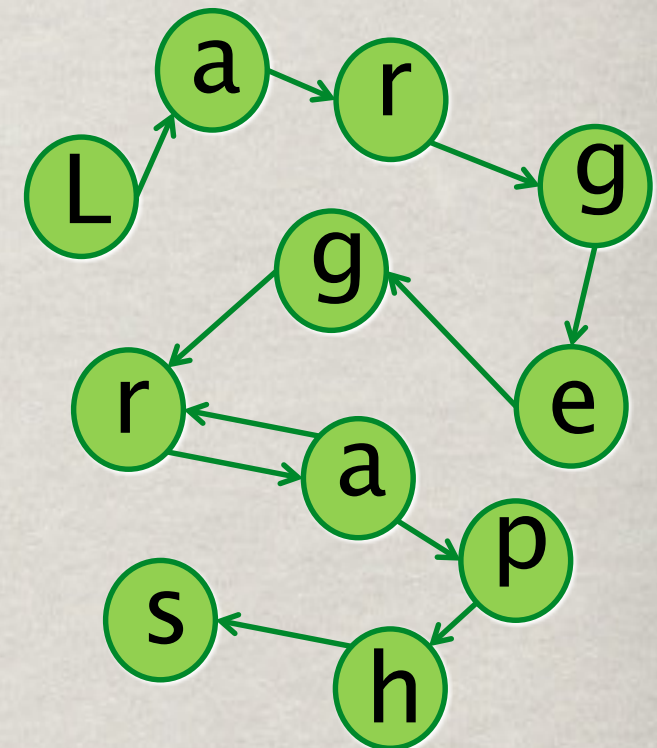
Who

Prof. Dr. Jilles Vreeken

What

Interpretable
Models

Causality



How much

2 hours of lectures per week, 6 credits

When

Thursdays 10–12 o'clock

Where

eda.mmci.uni-saarland.de/edu/tada21

DON'T PANIC

The Ultimate Guide to Surviving
your PhD and Beyond

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

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Prof. Dr. Isabel Valera



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Machine Learning– Prof. Isabel Valera

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

When? Lectures on Mon. 14–16h & Wed. 16–18 h (starts 19th April)
Tutorials on Thu. 12–14 h (TBC, starts 22nd 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
- Unsupervised learning (Clustering, Dimensionality Reduction)
- Deep Learning

More information and registration: <https://cms.sic.saarland/pml/>

Contact & questions to: ml-course-team@lists.saarland-informatics-campus.de

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Dr. Ben Stock



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- 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>

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Prof. Dr. Christoph Sorge



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IT Forensics



to

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 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 35 36
```

- 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

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Prof. Dr. Gert Smolka



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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

```
Definition nat_rec (p: N → Type) :  
  p 0 →  
  (∀ n, p n → p (S n)) →  
  ∀ n, p n  
:=  
  λ e1 e2 ⇒ fix f n :=  
    match n with  
    | 0 ⇒ e1  
    | S n' ⇒ e2 n' (f n')  
  end.
```

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Prof. Dr. Philipp Slusallek



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Lecture: Realistic Image Synthesis

Philipp Slusallek, Karol Myszkowski, Gurprit Singh

- **Topics:**

- ☐ Realistic Rendering
- ☐ Lighting Simulation
- ☐ Monte-Carlo Methods
- ☐ Sampling-Techniques
- ☐ HW-based Techniques
- ☐ High-DynamicRange Imaging
- ☐ Animation & Perception

- **Organization:**

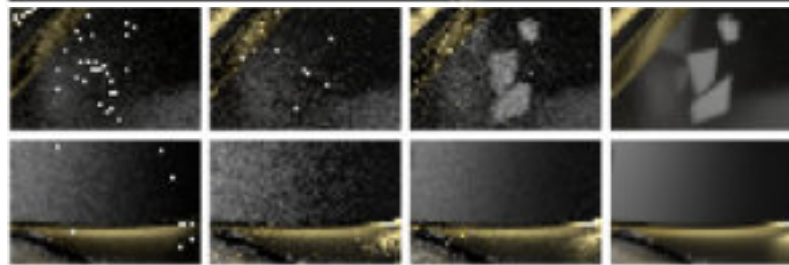
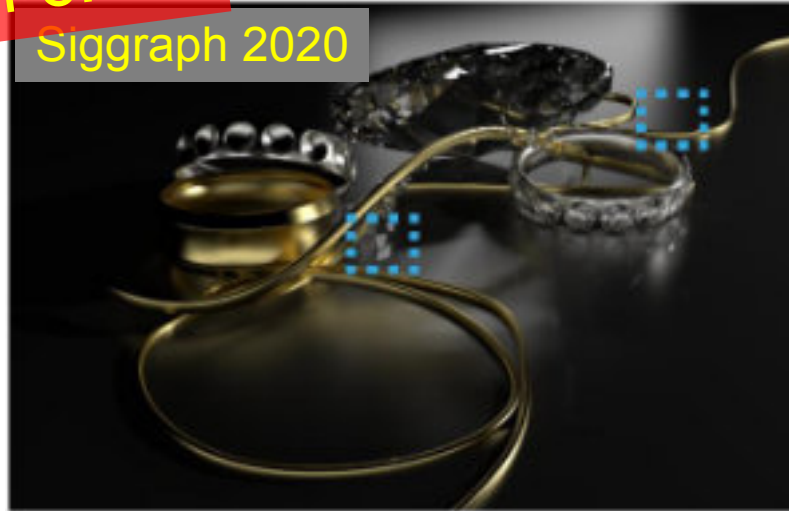
- ☐ Lectures, assignments, oral exam

- **Schedule (online via Zoom):**

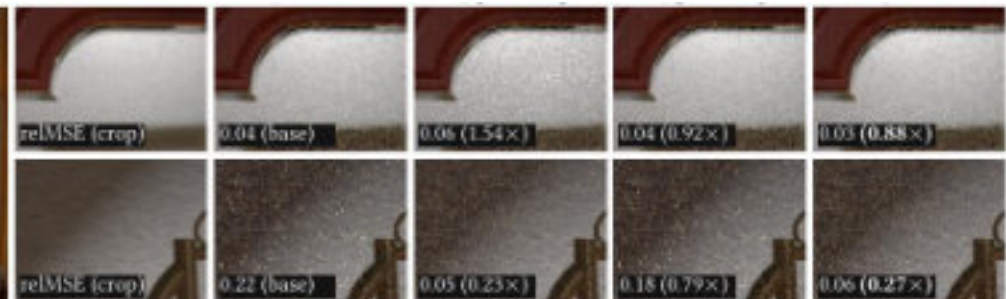
- ☐ Mon 10–12h & Thu 8:30–10h

Starts April 12th, 10h c.t.!!!

Siggraph 2020



LIVINGROOM



Siggraph 2012



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

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Prof. Dr. Sven Rahmann



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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:
<https://www.rahmannlab.de/> → Lehre → Algorithms...
- Summer 2021: 4V+2Ü, 9 ECTS
- Tue 12:30-14:00, Thu 08:30-10:00, Exercises TBD

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a	n a \$ b a	n
a	n a n a \$	b
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n	a \$ b a n	a
n	a n a \$ b	a

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Dr. Anand Narayanan

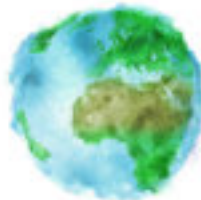


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Algebraic Coding Theory

How to transmit information over noise?



Complexity theory applications: How to write a proof that can be verified by reading a few bits?



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



Wednesdays 14–16hr.
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

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Prof. Dr. Martina Maggio

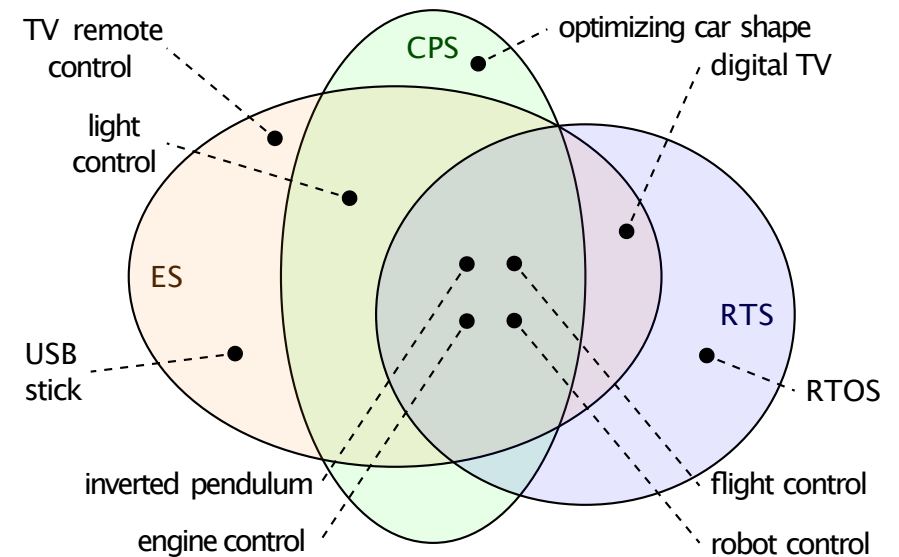


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Embedded Systems, 9 credits

- § Models of the physical environment
- § Control and computation
- § Implementation



Continuous-Time Models

State-space System Model: **Linear** Time-Invariant

$$\ddot{x}(t) = \frac{dx}{dt}, \text{first derivative of } x(t)$$

$$\begin{aligned} \dot{x}(t) &= f(x(t), u(t), t) \\ y(t) &= h(x(t), u(t), t) \end{aligned}$$

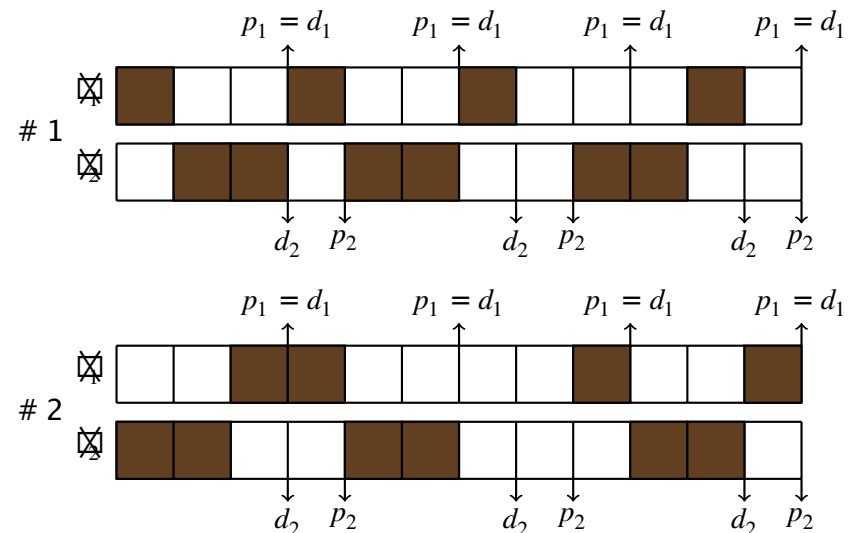
$f: \mathbb{R}^n \times \mathbb{R}^p \times \mathbb{R} \rightarrow \mathbb{R}^n$, **and f is linear**
states $\times$ inputs $\times$ time $\rightarrow$ states derivatives

$h: \mathbb{R}^n \times \mathbb{R}^p \times \mathbb{R} \rightarrow \mathbb{R}^q$, **and h is linear**
states $\times$ inputs $\times$ time $\rightarrow$ output

A function f is **linear** when it preserves vector addition and scalar multiplication:
 $f(x + y) = f(x) + f(y)$
 $f(\alpha \cdot x) = \alpha \cdot f(x)$

Scheduling

Scheduling Example



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Prof. Dr. Wolfgang Maaß



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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

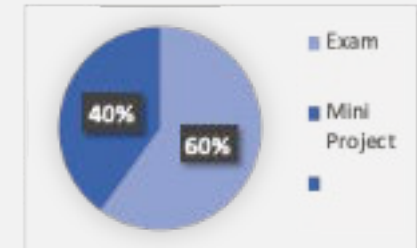
Lecture topics



What you will learn

- Asking the right question.
- Choosing the right model for the problem.
- Concepts in data science.
- Applying algorithms in practice and manipulating data sets.
- Visualizing data analysis results and transforming them into business models.

Course structure



Lecturer: Univ.-Prof. Dr.-Ing. Wolfgang Maaß
Contact person: Maxx Richard Rahman
(m.rahman@iss.uni-saarland.de)

Lecture (via zoom): Fri 11:45 –13:45

Registration: <https://lms.sulb.uni-saarland.de/moodle/course/view.php?id=4679>

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Prof. Dr. Jana Köhler



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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

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Prof. Dr. Dietrich Klakow



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Digital Signal Processing

Lecture V2Ü, 6CP

Dietrich.Klakow@lsv.uni-saarland.de

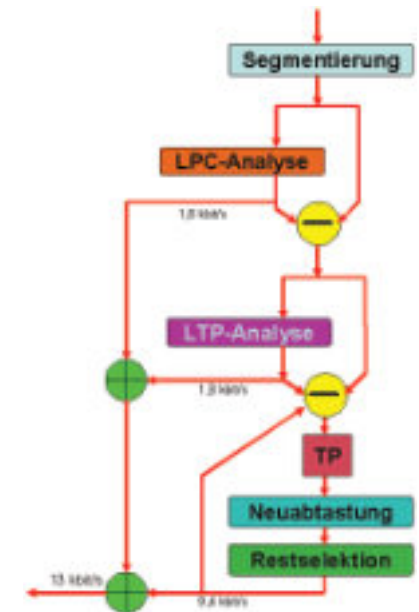
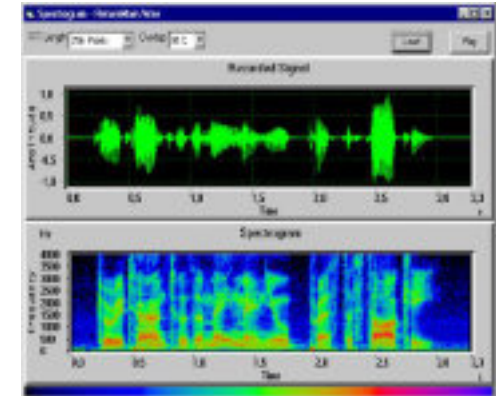


Topics

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 14rd 23:59 on course home page





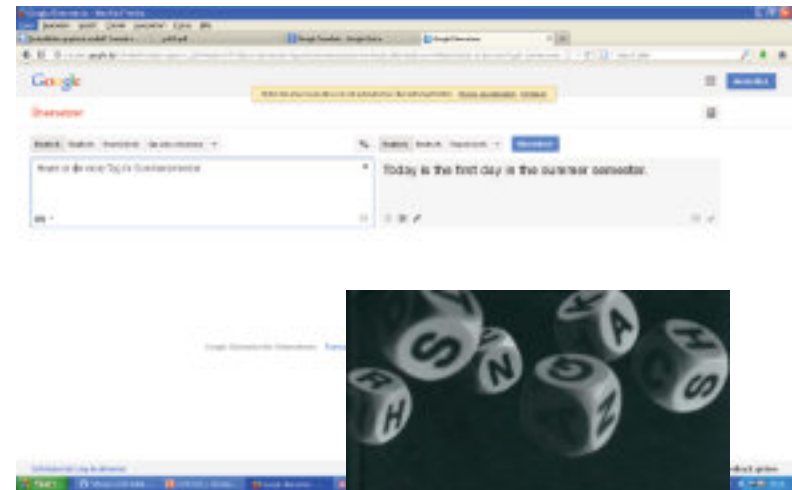
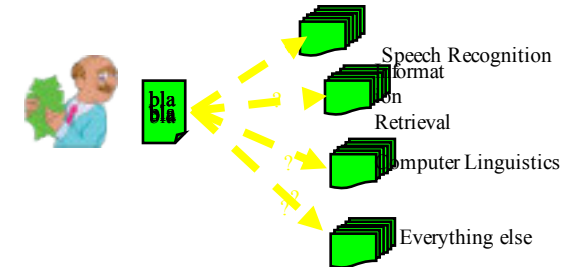
Statistical Natural Language Processing

Lecture V2Ü2, 6CP

Dietrich.Klakow@lsv.uni-saarland.de

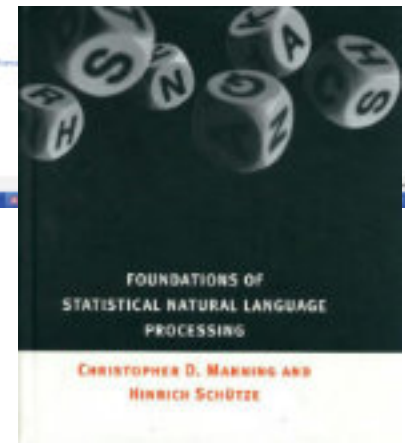
Topics

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 16th, 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

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Dr. Andreas Karrenbauer



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Optimization

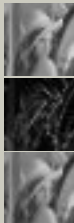
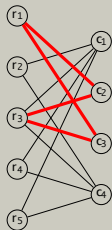
Core lecture: 9 credit points

[online]

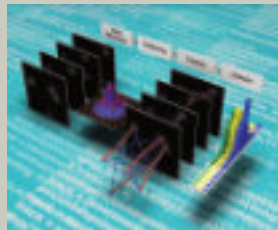
- two lectures per week (Wednesdays + Thursdays 14–16)
- one tutorial per week (Mondays 16–18)
- theoretical course with (optional) practical exercises
- <https://bit.ly/3a08lic>



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



$$\begin{aligned} \min \quad & c^T x \\ \text{s.t.} \quad & Ax = b \\ & x \geq 0 \end{aligned}$$



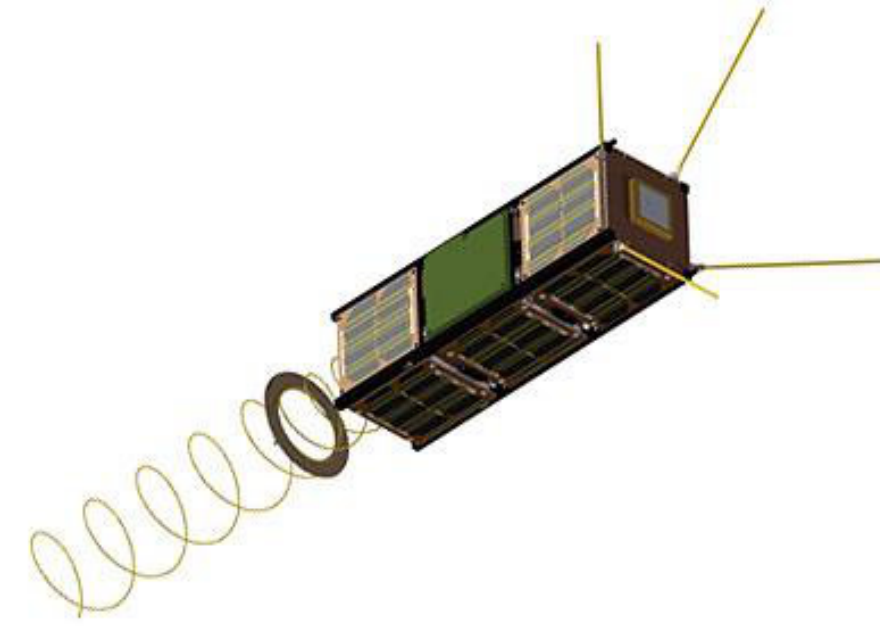
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Prof. Dr. Holger Hermanns



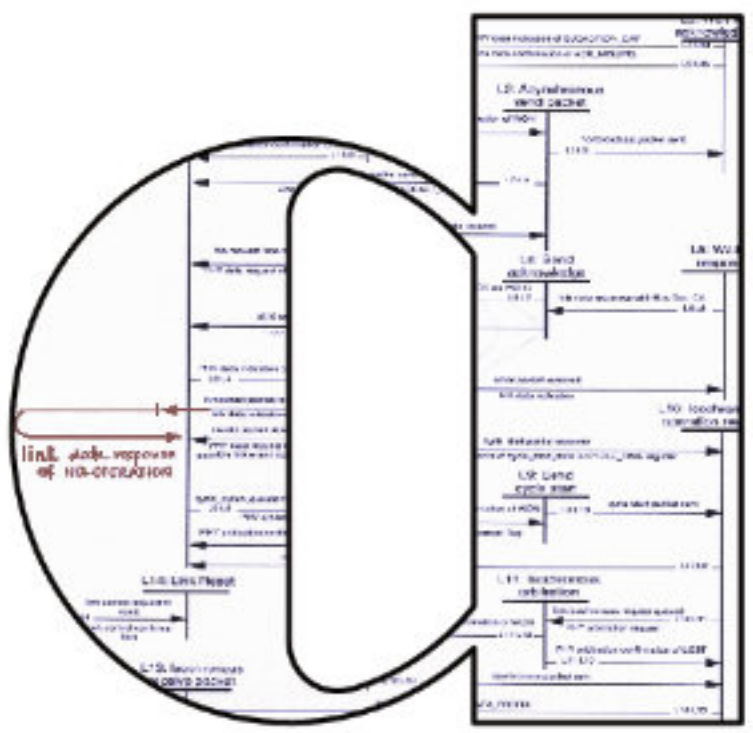
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Space Informatics

Juan Fraire, Holger Hermanns



System Design

Communication

Planning and Operation

Applications and Challenges

What?

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

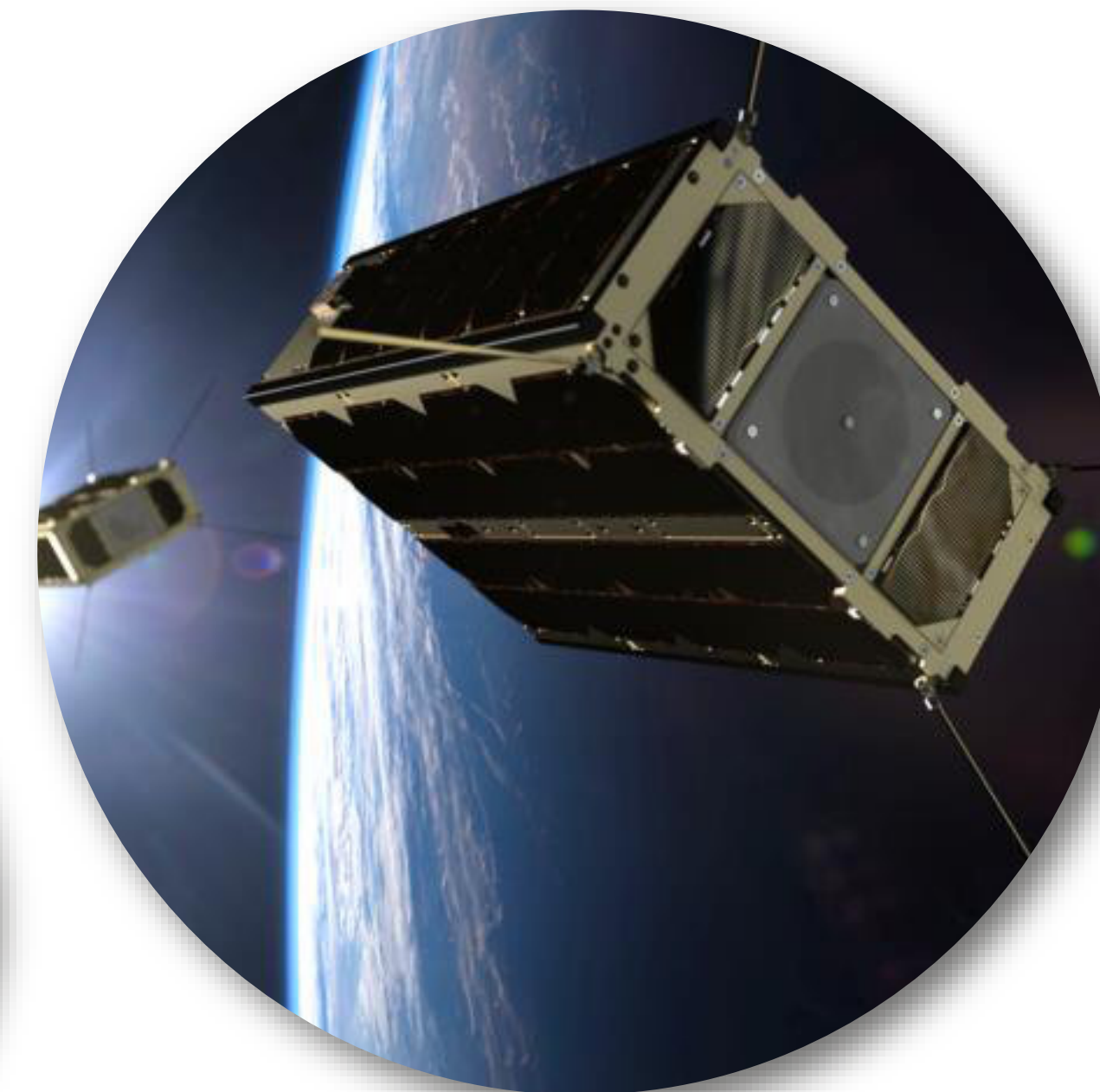
- Transmission and Encoding Basics
- Delay Tolerant Networking, Routing, Congestion, Contact Plans
- Interplanetary Internet and beyond



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



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



- **Advanced Lecture**
Vertiefungsvorlesung
- **6 CP**
- **Thu 14–16 weekly**
otherwise online

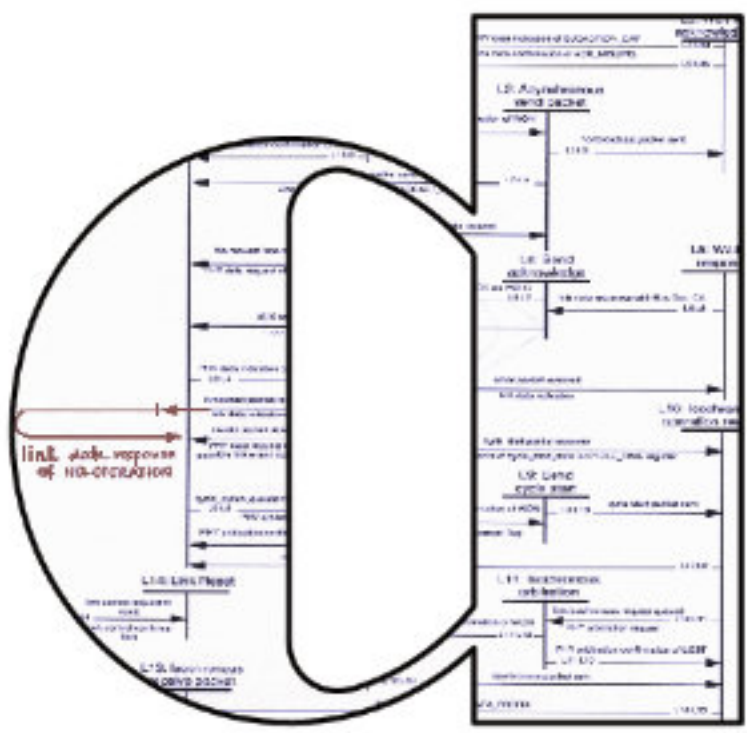


Interested?



Ethics for Nerds

Kevin Baum, Sarah Sterz, Holger Hermanns



Blocks I Philosophical ToolBox

- 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?
- ..

Block II Contemporary Topics

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

Block III Oncoming & Sci-Fi Topics

- How should **machines** **behave** towards humans?
- Is it possible to build **thinking machines**?
- Would a **super-intelligence** be dangerous?
- ...

Organization

- **Advanced Lecture**
Vertiefungsvorlesung
- **6 CP**
- **short videos** instead of lectures
- grading through **exam** (or re-exam) and **essay**
- exam admission through assignments and group work

Date and Time

a self-paced
online course



Interested?



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Prof. Dr. Thorsten Herfet



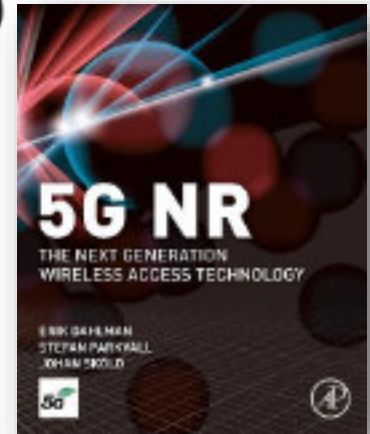
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COURSES SUMMER TERM 2021

1. Audio/Visual Communication and Networks (5G New Radio)

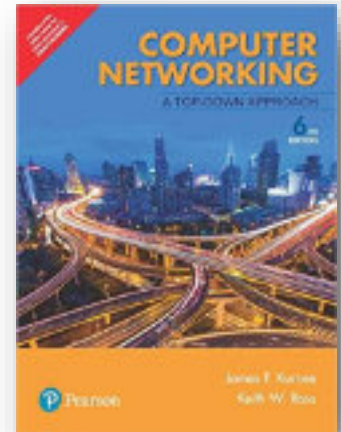
- **4L2T, Start April 13th** (tutorials start Wednesday Apr. 21st)
Tuesday 12:15–13:45 and Wednesday 8:30–10:00
- **Implementation:**
 - **eBook “5G NR”** available to all students!
 - **Background theory** via [interactive manuscript](#)
 - **Quizzes & Tutorials** via [\(UdS\)-Moodle](#)
 - **(Partially 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:** herfet@cs.uni-saarland.de



COURSES SUMMER TERM 2021

2. Hands on Networking (HON)

- **2L2T, Start August 2nd, Block-Course until August 27th**
Each Day 08:30–15:00 (August 2nd-13th)
Practical Project Work (individual, August 14th-27th)
- **Implementation (YET TO BE DECIDED!):**
 - **Admission Test: We, July 21st, 2021, 16:00st**
 - **Slides available via web!**
 - **Tutorials via (UdS)-Moodle**
 - **(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: herfet@cs.uni-saarland.de**



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Dr. Themistoklis Gouleakis



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Geometric algorithms with limited resources

Lecturers:

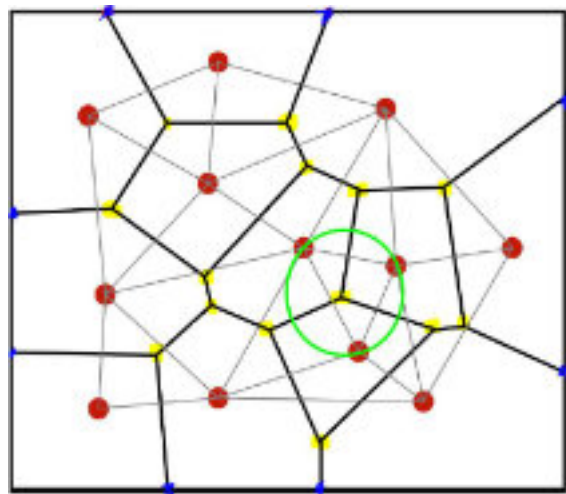
Themistoklis Gouleakis and Sándor Kisfaludi-Bak

Teaching assistant:

Hannaneh Akrami

Topics:

- Geometric algorithms in sub-linear time
- Property Testing for geometric properties
- Learning algorithms
- Streaming algorithms



Join our mailing list: <https://lists.mpi-inf.mpg.de/listinfo/geoalgor>

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Prof. Dr. Anja Feldmann



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Data Networks

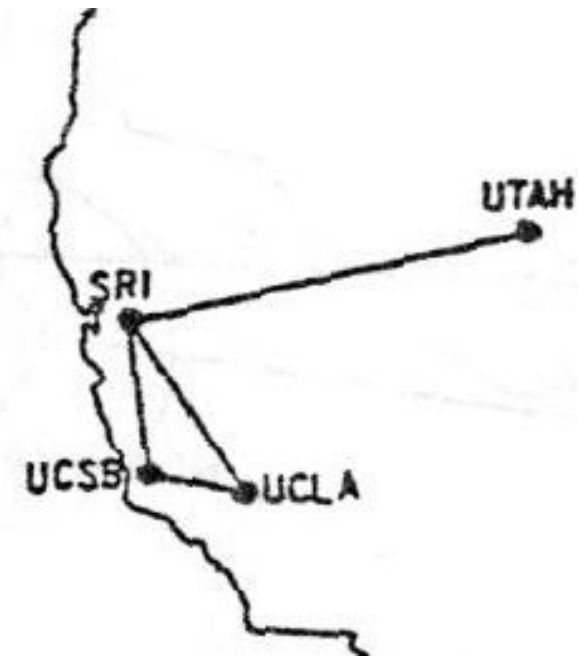
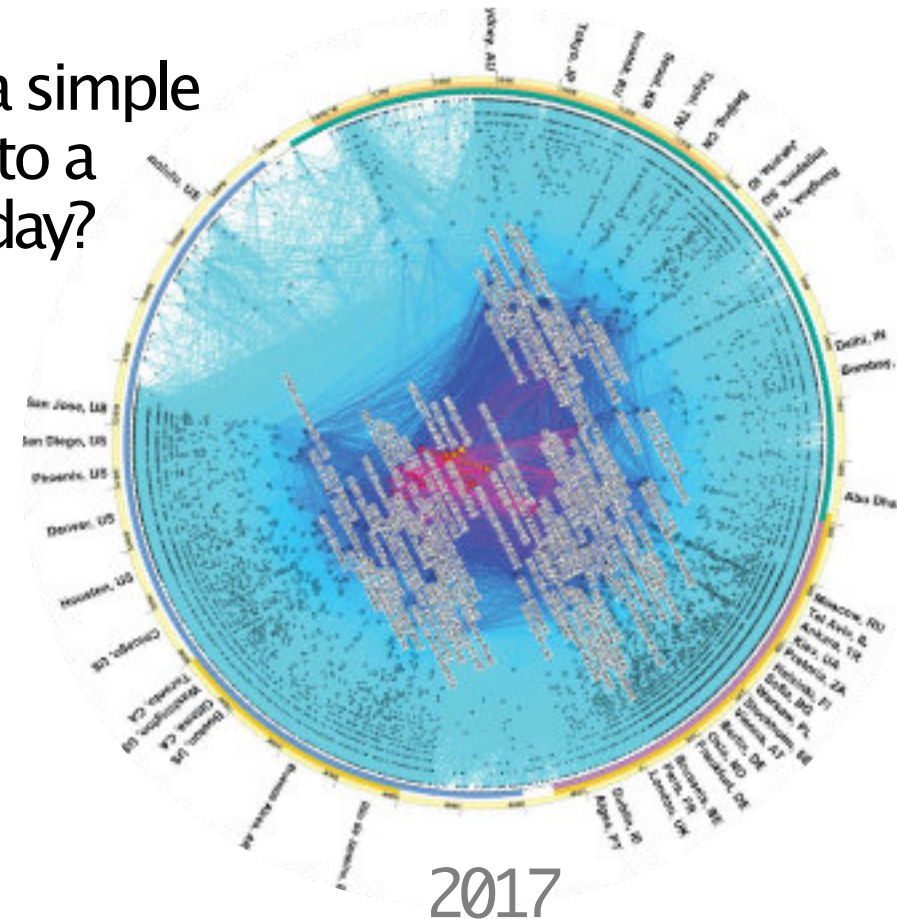
Anja Feldmann, Oliver Gasser, Devashish Gosain & Sawas Zannettou

Summer semester 2021

What enabled the **Internet** to evolve from a simple network of a few hosts in its early days to a complex network of **billions of hosts** today?

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

- Self-contained, **downloadablevideo** lectures
- Interactive **live Q&A** with lecturers
- **Engagingexercises** and tutorials



1969

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

2017

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



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CISPA

HELMHOLTZ CENTER FOR
INFORMATION SECURITY

CRYPTOGRAPHY

Lecturers: Nico Döttling, Antoine Joux, Cas Cremers

<https://cms.cispa.saarland/crypto21/>

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Prof. Dr. MarkusBläser



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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
- | ~~was soll das?~~
- | Contact: Markus Bläser



COMPLEXITY THEORY

average student