# BSc & MSc
# Computational Science and Engineering (CSE)

## Annual Report 2022/2023

# BSc & MSc CSE

BSc & MSc Computational Science and Engineering

## Annual Report
## 2022 / 2023

### August 2022 to July 2023

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# Teaching in BSc and MSc CSE 1

# Teaching in Computational Science and Engineering

The beginning of the academic year 2022/23 brought distressing news for the students enrolled in the BSc and MSc CSE: Prof. Petros Koumoutsakos, who for several years had been in charge of CSE core courses on high performace computing, had left ETH just before the semester start and with little notice.

Fortunatelly the Department of Mechanical Engineering could find and fund a very short-term replacement in Prof. Sergio Martin and Prof. Jens Walther, who did an excellent job in teaching the two core courses on high performace computing. However, this was just a one-time arrangment and these lectures cannot be continued.

This incident highlighted the vulnerability of the CSE curriculum to sudden cancellation of courses. As a consequence, a revision of the curriculum revision has been launched. Instead of two blocks of core courses, the students will have to choose three core courses from a list that currently consists of the fall semester lectures *Software Engineering* and *Design of High Performance Computing* and of the spring semester lectures *Introduction to Machine Learning* and *HPC Lab for CSE*.

Now the good news: In the winter examination session 2023, 83.3% of the 40 participating students passed the first Basisprüfungsblock, 91.3% of the 46 participating students passed the exam block *G1* and 80.9% of the 47 participating students passed the block *G2*. The core lecture *Design of Parallel and High-Performance Computing* was chosen by 11 students, all of them passed. The lecture *High Performance Computing for Science and Engineering I* was chosen by 33 students, 97% of them passed. Popular lectures among the BSc CSE students in Fall 2021 were: *Information Systems for Engineers* (15), *Dynamic Programming and Optimal Control* (11), *Introduction to Computational Physics* (10). *Image Analysis and Computer Vision* (8), *Probabilistic Artificial Intelligence* (8) and *Time Series Analysis* (8). In the *Case Studies Seminar* in Autumn 2020 a number of 56 BSc CSE and 41 MSc CSE students participated with success. The lecture *Probabilistic Artificial Intelligence* in Autumn 2022 was very poular among the MSc CSE students (33). Also popular were *Computer Graphics* (7), *Robot Dynamics* (7) and *Image Analysis and Computer Vision* (6). 12 students of MSc CSE attended and passed the additional requirement *High Performance Computing for Science and Engineering*.

In the summer examination session 2023, 84.4% of the 45 participating students passed the second Basisprüfungsblock, 85.7% of the 42 participants passed the exam *G3* and 77.2% of the 58 participants (from which 8 were repeating) passed the block *G4*, which still seems to be the most difficult exam block of the curriculum. All 19 students attending *High-Performance Computing Lab for CSE* passed and all 25 participating students passed *High Performance Computing for Science and Engineering II*. The core lectures *Introduction to Machine Learning* (30) and *Software Engineering* (20) also had 100% success rate. The *Case Studies Seminar* in Spring 2023 was succcesfully attended by 45 BSc CSE and 33 MSc students. Popular lectures among the MSc CSE students in Spring 2022 were: *Deep Learning in Scientific Computing* (37), *Advanced Systems Lab* (9), *Computational Statistics* (9), *Recursive Estimation* (12) and *Introduction to Machine Learning* (7).

In each of the two semesters of the accademic year 2021/22, grades were awarded to MSc CSE students in about 90 scientific lectures and seminars across all the ETH departments.

Grades CSE BSc

Credit Points CSE BSc

Grades CSE MSc



Credit Points CSE MSc
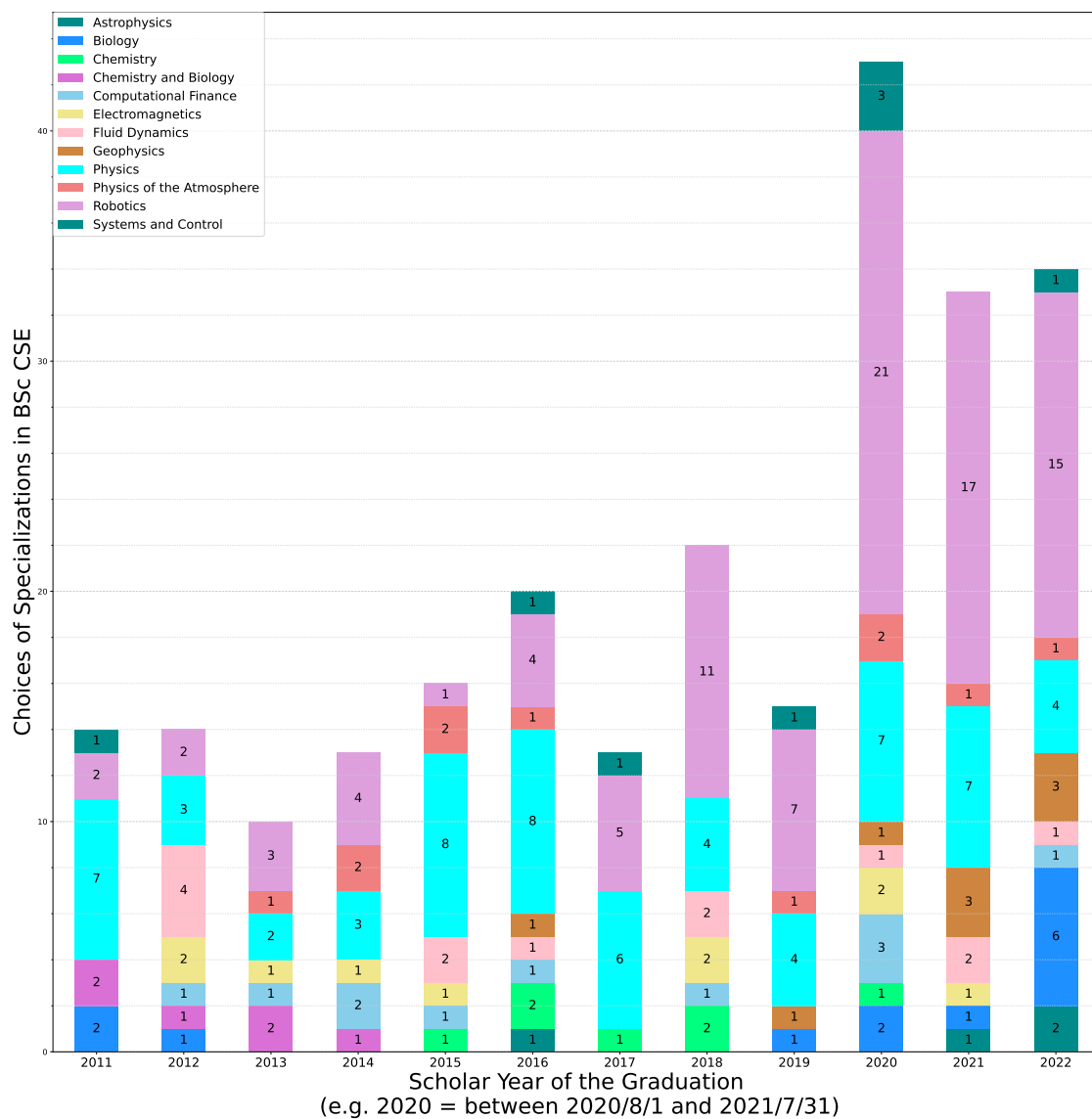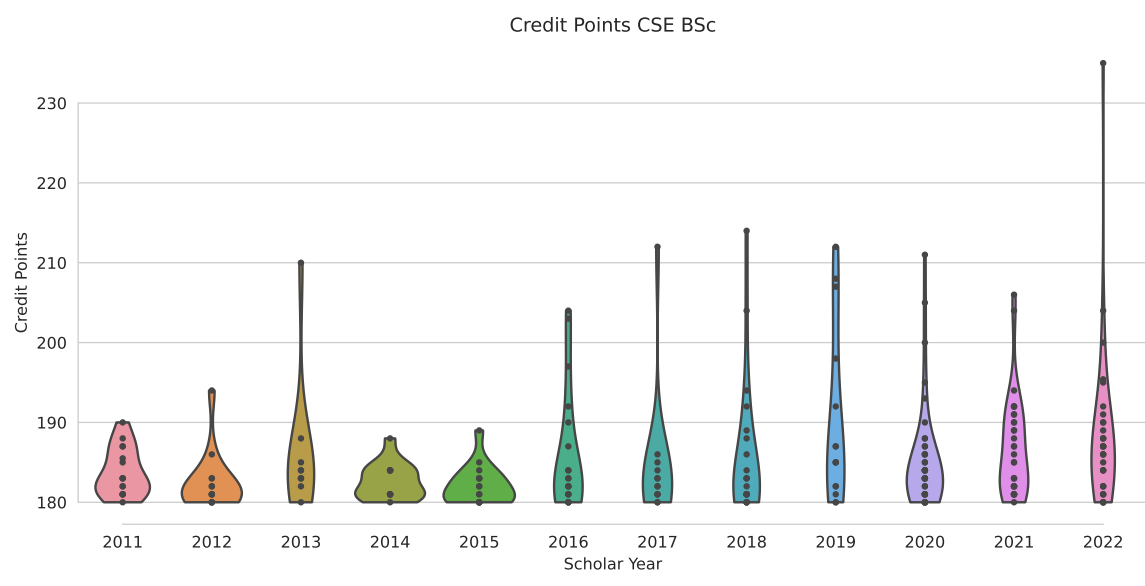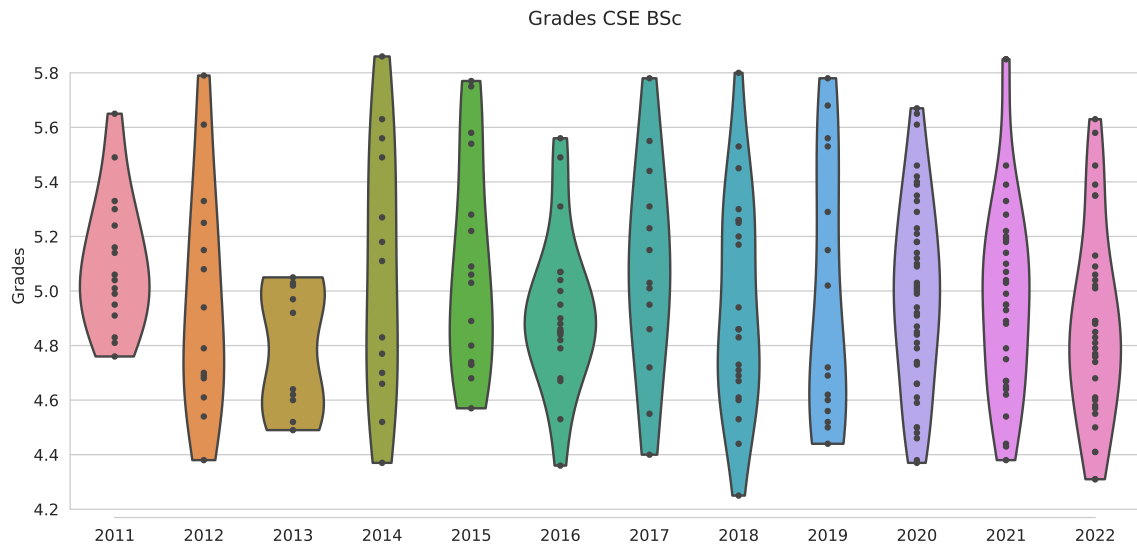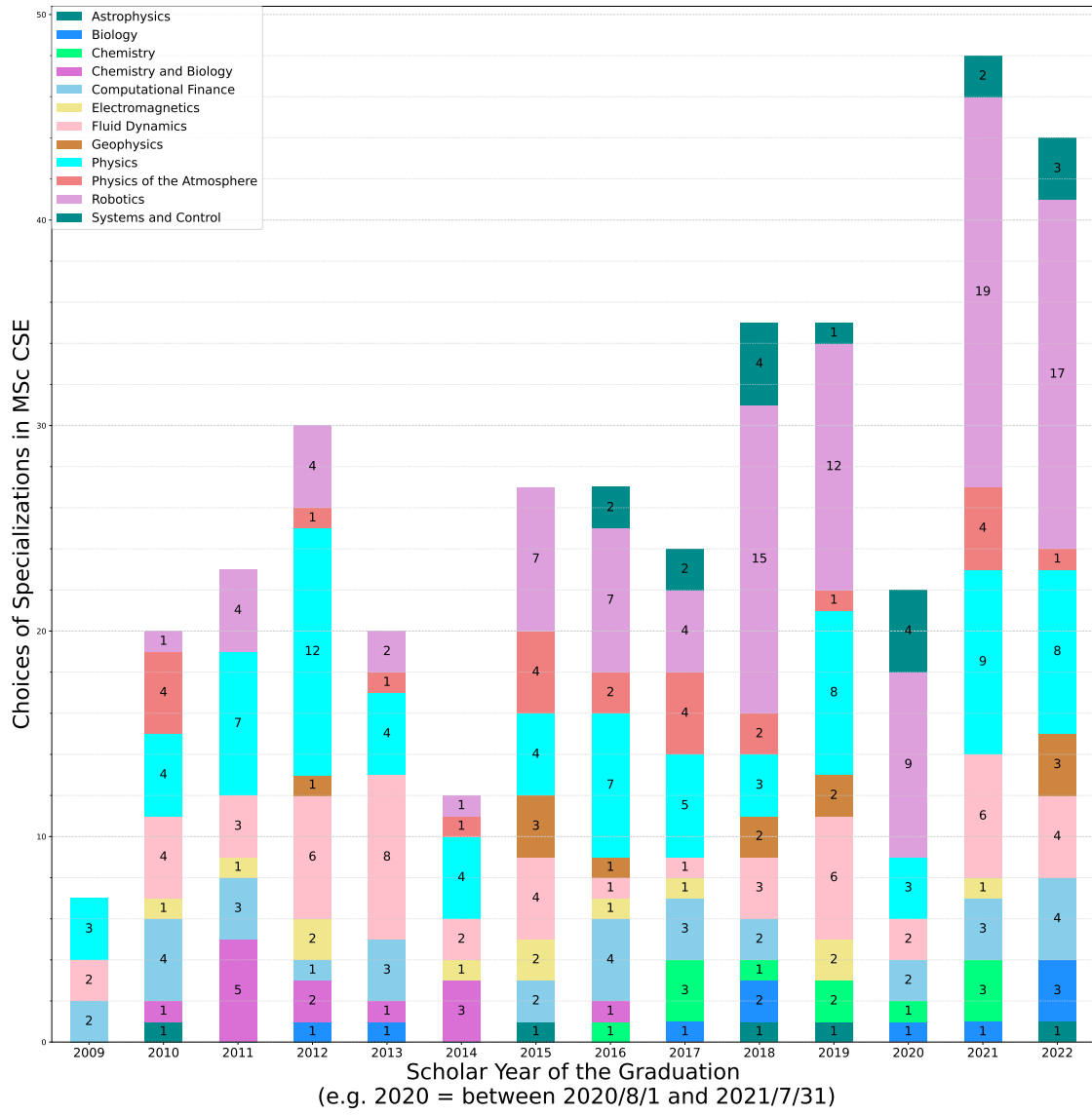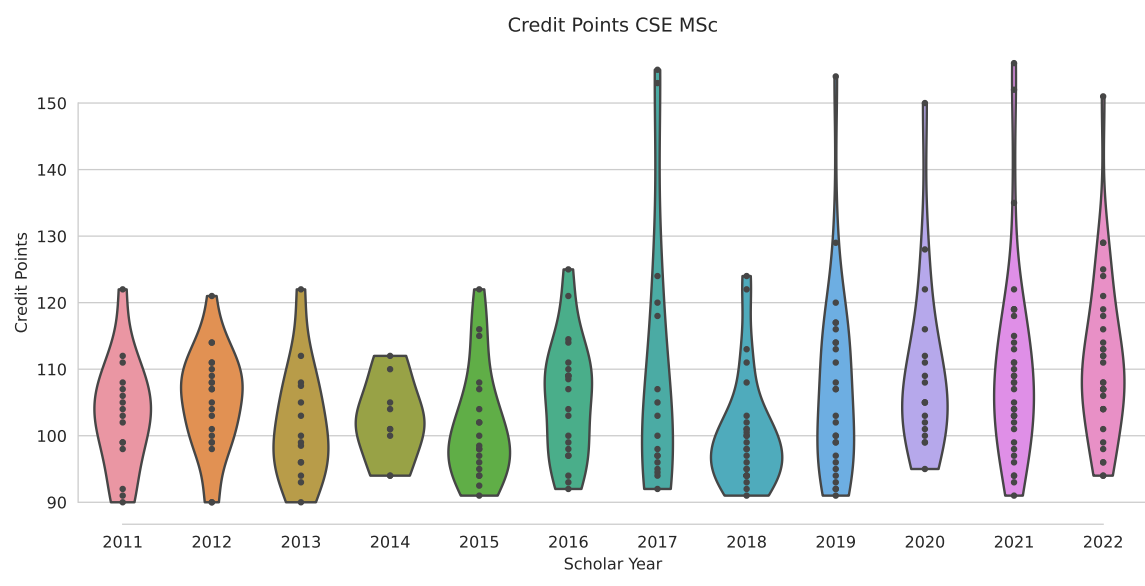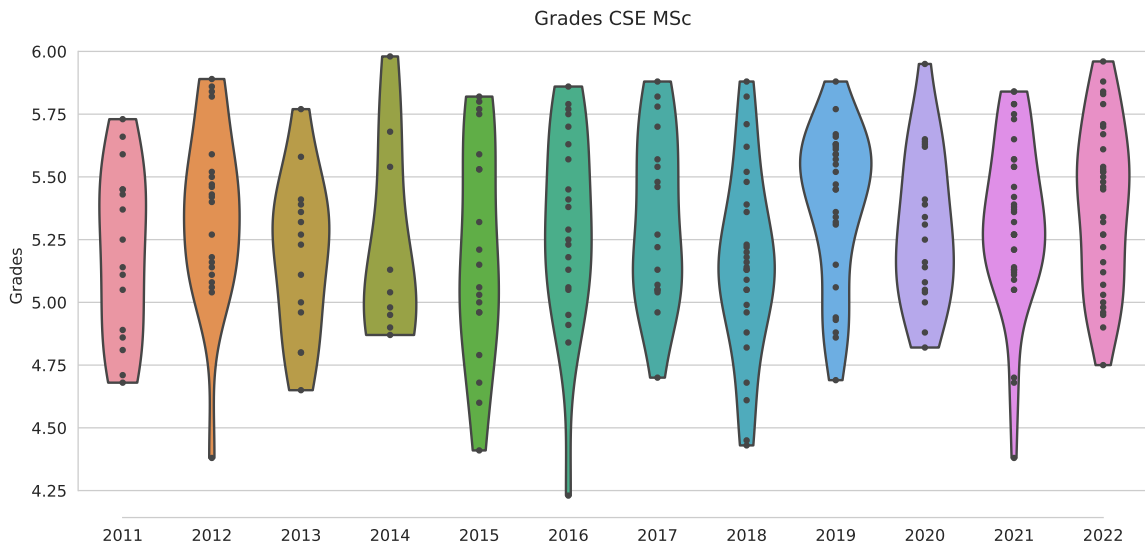
# CSE Students and Theses 2

In September 2022, 39 new students started their CSE Bachelor studies in the first semester. A total of 32 students registered their begin of MSc CSE: 15 BSc CSE students entered the MSc CSE as a consecutive curriculum, while 17 students came from outside.

The total number of CSE students enrolled in Fall Term 2022 was 343 (headcount): 218 in the BSc program and 125 in the MSc program.
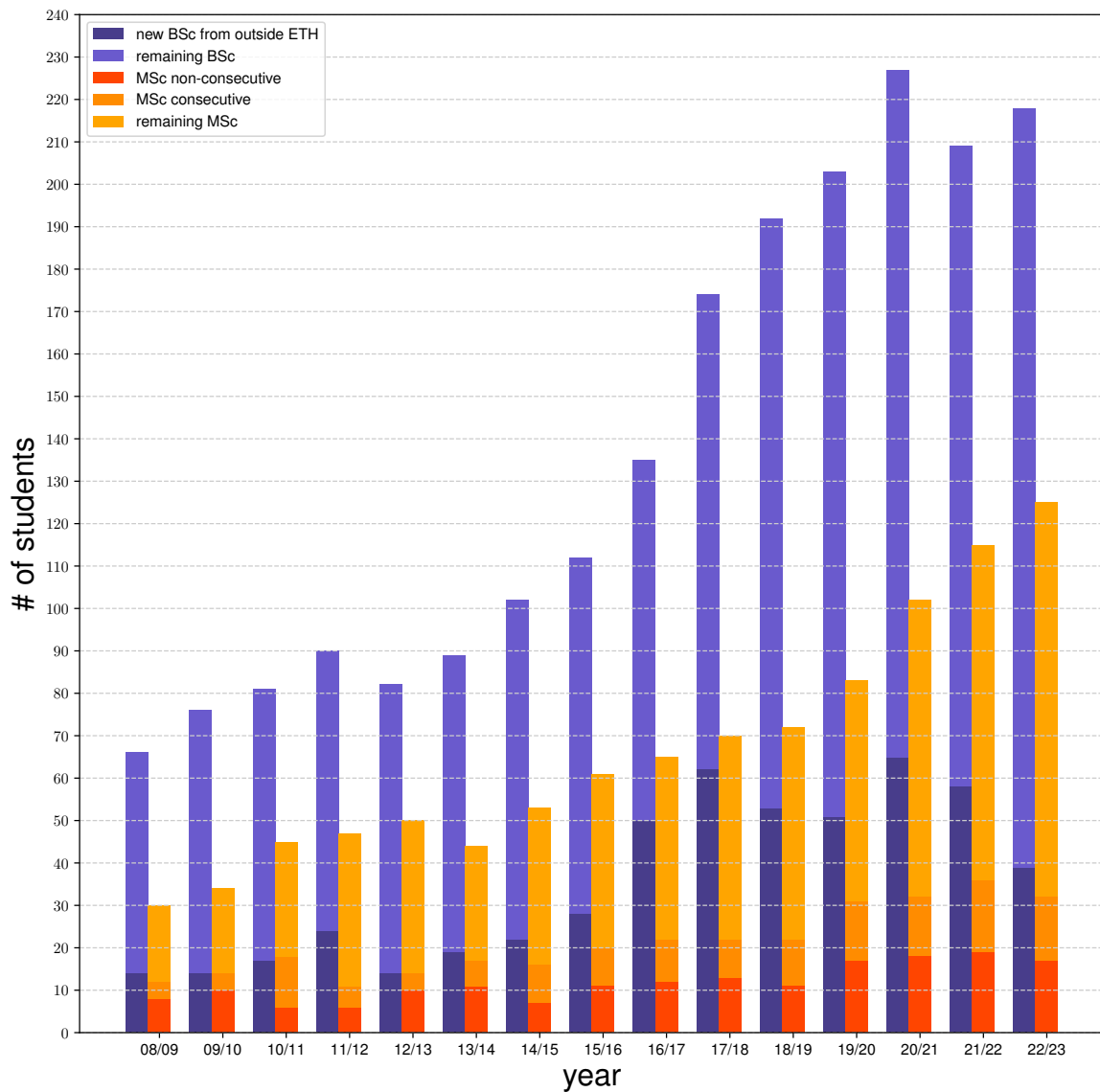


Number of CSE students in the curriculum; dark = number of new students

In the past academic year 78 students have successfully finished a CSE curriculum, 34 Bachelor students and 44 Master students, and have received a CSE degree, some with very good grades. In the following list we give the name of the student, the title of the Bachelor/Master/Term thesis and the name and the department of the advisor. In summer 2023 `Philipp Lindenberger` was awarded the **Willi Studer Preis** 2023 for the best CSE Master Diploma in the past academic year.
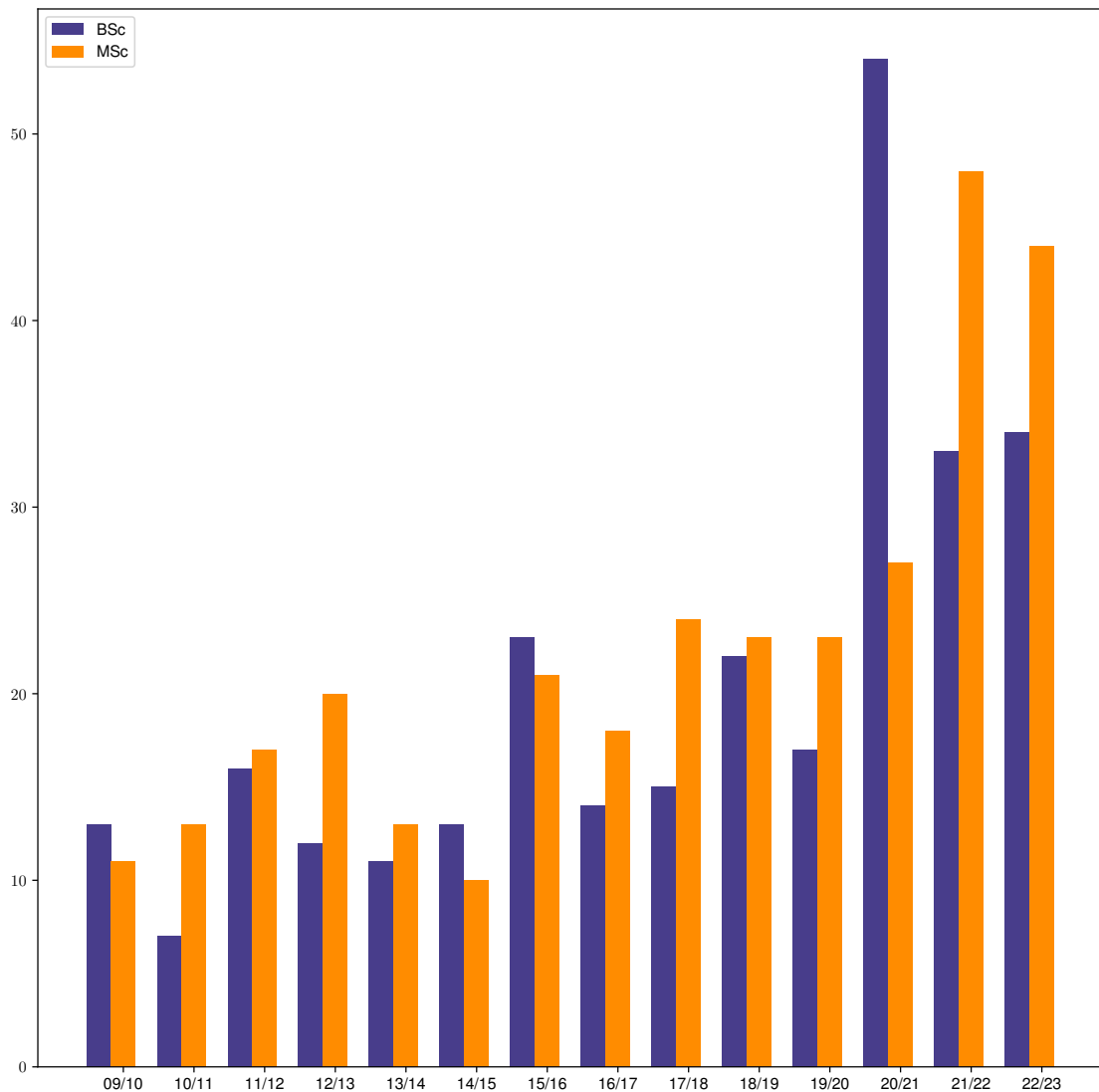


Number of CSE graduates
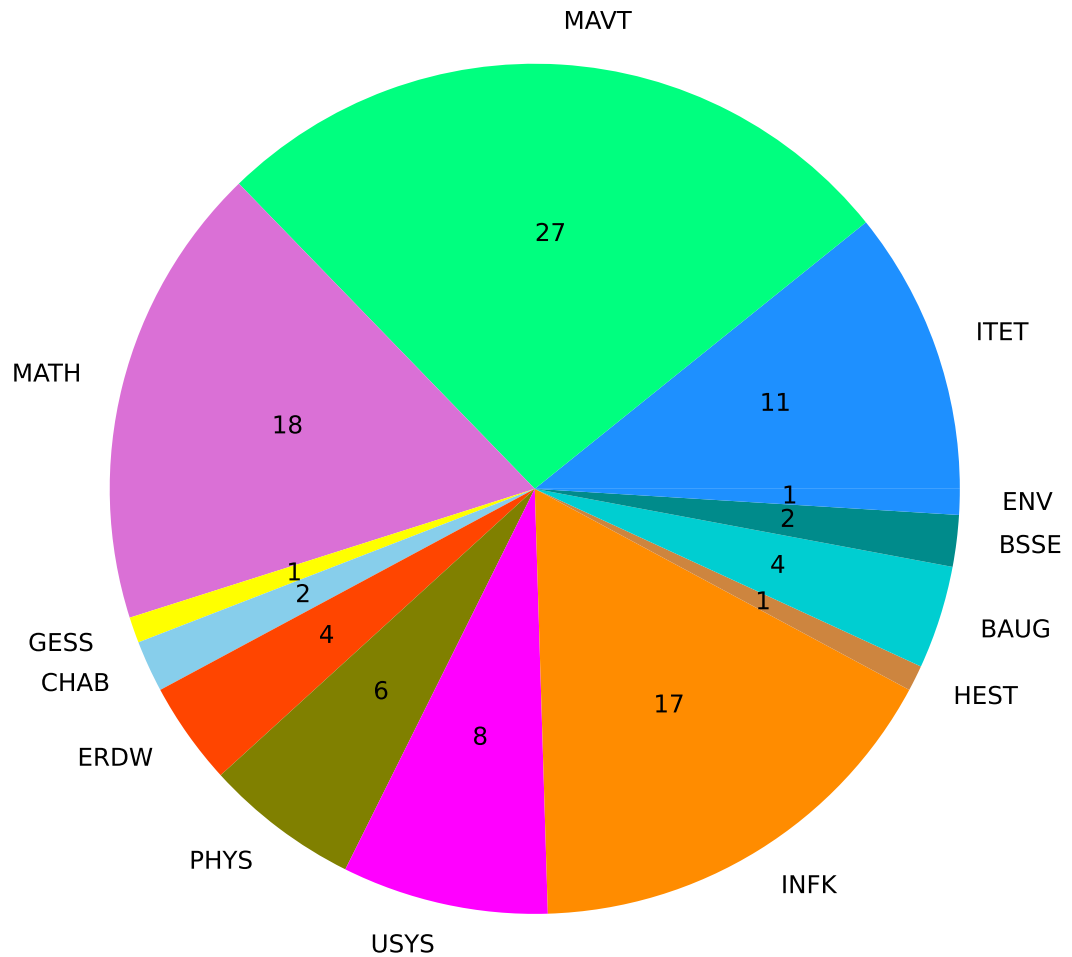
In the academic year 2022-2023 there were written a total of 102 semester, BSc and MSc theses in CSE. The diagram above shows that the supervision of these works is spread over 13 departments of ETH, while some of them seem to attract more students than others. The most popular departments this year were D-MAVT with 27 theses, D-MATH with 18 theses and D-INFK with 17 theses. On the following pages we mention the authoring students, the titles of the theses and the corresponding official supervisors from various departments at ETH.

## BSc-Arbeiten

Simon Felix Bolt
*Analysis and Implementation of SFCW Radar for Through-Wall-Sensing*
(Jasmin Smajic, D-ITET)

Paolo Bottoni
*Tracking Space Extensions using SLAM*
(Andreas Kunz, D-MAVT)

Noé Attilio Canevascini
*Modeling Collective Patterns: Behavioral Rules and Multi-Agent Reinforcement Learning*
(Petros Koumoutsakos, D-MAVT)

Ondrej Cernin
*Comparison of Parallel Paradigms and High Performance Computing Libraries*
(Roger Käppeli, D-MATH)

Shengdi Chen
*Mastering Tetris with Reinforcement-Learning*
(Joachim Buhmann, D-ITET)

Nicholas Robert Engel
*A Parallel Implementation of Stochastic Gradient Descent for Stress Minimization*
(Ulrik Gerd Brandes, D-GESS)

Paul Fischill
*Cost-effective variants of the transcorrelated DMRG method*
(Markus Reiher, D-CHAB)

Julius Gruber
*A taxonomy of General Adverserial Networks and Variational Auto Encoder based time series data generation algorithm for forecasting financial asset returns*
(Peter Bühlmann, D-MATH)

Maximilian James Raymond Guidi
*Multi-Agent Reinforcement Learning for Subgrid Scale Modeling*
(Petros Koumoutsakos, D-MAVT)

Zuzanna Herud
*Implementation and testing of an accelerated pseudo-transient iterative solver into StagYY, a widely-used 3D spherical mantle convection simulation code*
(Paul James Tackley, D-ERDW)

Faveo Hörold
*Formation of Earth's primoridal atmosphere*
(Judit Szulagyi, D-PHYS)

Elisa Hoskovec
*Implementation and Assessment of Tail-Artifact Removal Algorithms in Optical Coherence Tomography Angiography*
(Daniel Razansky, D-ITET)

Ciril Humbel
*Tree-Based Regression Method for Streaming Data*
(Patrick Jenny, D-MAVT)

Severin Andrey Thomas Klapproth
*The Langevin Approach to Discretize the Collision Operator*
(Andreas Adelmann, D-MATH)

Benjamin Stefan Krummenacher
*A deep learning approach on classifying physical processes of ice crystal habits*
(Ulrike Lohmann, D-USYS)

Nicola Saverio Lo Russo
*Simulations of different electoral systems based on a SmartVote data set*
(Roger Wattenhofer, D-INFK)

Jonas Luther
*Compressible Navier Stokes solver with adaptive local time stepping*
(Patrick Jenny, D-MAVT)

Marianna Angela Giovanna Marzetta
*An automated registration approach for multi-stack time-lapsed imaging using high-resolution peripheral quantitative computed tomography*
(Ralph Müller, D-HEST)

Gioele Molinari
*Physics informed deep learning for multi-parameter phase-field fracture problems*
(Laura de Lorenzis, D-MAVT)

Stanislaw Janusz Piasecki
*Fast Computation Of Weighted Transitive Closure*
(Markus Püschel, D-INFK)

Josua Rieder
*Constructing Generators of Cohomology Classes on Surfaces*
(Ralf Hiptmair, D-MATH)

Tim Sauter
*Neural Variance Reduction for Stochastic Differential Equations*
(Christoph Schwab, D-MATH)

Michael Vollenweider
*Benchmarking Framework for Gene Regulatory Network Inference Methods*
(Magali Champion, D-MATH)

Luca Wolfart
*Interpretable Prediction of Comorbidities and Fractures in Type 2 Diabetes Mellitus Patients*
(Ekaterina Krymova, D-INFK)

Dana Laura Zimmermann
*Using Julia for Geophysical Numerical Modelling*
(Taras Gerya, D-ERDW)

## MSc-Arbeiten

Christophe Kwame Amevor
*A Differentiable Model of Cell Intercalation*
(Stelian Coros, D-INFK)

Luca Adrian Blum
*DeepMetalign: Catalyzing deep learning-based metagenomic profiling*
(Onur Mutlu, D-ITET)

Sean Alexander Bone
*Monte Carlo Tree Search for Coordinated Multi-Robot Exploration*
(Margarita Chli, D-MAVT)

Ge Cao
*Differentiable Ferrofluid Simulations and Optimizations*
(Markus Gross, D-INFK)

Yutong Chao
*Learning Two-Player Zero-Sum Markov Game with a Single Sample Path*
(Niao He, D-INFK)

Tiancheng Chen
*Towards distributed sparse tensor computations in graph neural networks*
(Torsten Hoefler, D-INFK)

Yilu Chen
*Constraining basal sliding of glaciers in the Swiss Alps by inverse modeling*
(Ludovic Räss, D-BAUG)

Han Yao Choong
*Quantum Annealing for Single Image Super-Resolution*
(Luc Van Gool, D-ITET)

Aurelio Lino Dolfini
*Probabilistic Energy-Based Models for Vertebrae Reconstruction*
(Ender Konukoglu, D-ITET)

Léonard Raphaël Marie Equer
*Multi-Scale Message Passing Neural PDE Solvers*
(Siddhartha Mishra, D-MATH)

Sebastian Heinekamp
*Dynamical Model Simulating Quantum States in Crystalline Ion Beams*
(Andreas Adelmann, D-PHYS)

Dominik Helmreich
*Graph Neural Network Reinforcement Learning for Electric Autonomous Mobility on Demand Systems*
(Emilio Frazzoli, D-MAVT)

Chia-I Hu
*Graph Neural Network-Based Mesh Generation for Computational Fluid Dynamics using Genetic Algorithms*
(Eleni Chatzi, D-BAUG)

Beat Peter Hubmann
*Hydrology of Planetesimals*
(Taras Gerya, D-ERDW)

Lukas Joss
*Porting of a two-moment cloud scheme module of a numerical weather and climate model to GPU*
(Ulrike Lohmann, D-USYS)

Mirlan Karimov
*PreNeRF: Interactive Preprocessing via Multi-Modal Prompting for Distraction-Free and Selective NeRFs*
(Marc Pollefeys, D-INFK)

Benjamin Langer
*Enabling Local Haplotype Reconstruction for Related Samples*
(Niko Beerenwinkel, D-BSSE)

Fabian Patrick Lyck
*Visual Aircraft Positioning from Orthographic Imagery*
(Roland Siegwart, D-MAVT)

Laurens Richard Lueg
*Approximate Bayesian Inference for Continual Learning of Dynamical Systems*
(Rainer Andreas Krause, D-INFK)

Christian Timo Mitsch
*Simulation of Wearable System via Empirical Actuator Model*
(Stelian Coros, D-INFK)

Xiaohe Niu
*Rethinking Sparse Tensor Storage: Incremental Formats as a Path Towards Maximizing Tensor-Vector Multiplication Efficiency*
(Olaf Schenk, D-MATH)

Safira Leandra Liora Piasko
*Discontinuous finite element methods for Large Eddy Simulation (LES) of incompressible flows*
(Christoph Schär, D-ENV)

Georg Richard Pollak
*Deep Learning for Korali*
(Petros Koumoutsakos, D-MAVT)

Maxime Raafat
*3D Consistent Implicit Generative Models of Human Appearance*
(Siyu Tang, D-INFK)

Ning Ren
*Sensitivity-Guided Shape Reconstruction*
(Ralf Hiptmair, D-MATH)

Manuel Schneider
*Autonomy-Enabling Infrastructure, A Comparison of Infrastructure Placements on Swiss Roads*
(Andrea Censi, D-MAVT)

Athina Sotiropoulou
*Lipschitz Analysis of the Molecular Graph Encoder*
(Gisbert Helmut Schneider, D-MAVT)

Daniel Luca Stalder
*Sub-representative elementary volume homogenization of flow in porous media with embedded fractures*
(Patrick Jenny, D-MAVT)

Michal Grzegorz Sudwoj
*Bayesian inference for 4D spatio-temporal models using Integrated nested Laplacian approximations*
(Olaf Schenk, D-MATH)

Kalman Szenes
*Tensor Computations on GPUs: From Dense Contractions to Sparse Decompositions*
(Torsten Hoefler, D-INFK)

Martin Carl Christian Tschechne
*Multiview Enhancement for Generating Atlases - Deep Image-Based Sanssouci*
(Markus Gross, D-INFK)

## Semester-Arbeiten

Giacomo Aloisi
*Accelerating finite differences solvers for acoustic wave propagation on GPUs with Julia*
(Andreas Fichtner, D-ERDW)

Thomas Baumann
*Diffusion Models for Probabilistic Programming*
(Fernando Perez Cruz, D-INFK)

Paolo Claudio Bottoni
*Characterizing regional energy demand in Swiss municipalities*
(Russell MCKenna, D-MAVT)

Claudio Cannizzaro
*Scientific Visualisation of High-resolution Climate Simulations*
(Christoph Schär, D-USYS)

Ge Cao
*Augmented BEM for Acoustic Transmission*
(Ralf Hiptmair, D-MATH)

Shengdi Chen
*An Empirical Study of Primal Wasserstein Imitation-Learning in Goal-Conditioned Reinforcement-Learning*
(Joachim Buhmann, D-INFK)

Yilu Chen
*Implementing the Ice Phase of a Two-moment microphysics scheme of ICON in GT4Py*
(Christoph Schär, D-USYS)

Yilu CHEN
*ODE Parameter Identification with Neural Networks*
(Vasile Gradinaru, D-MATH)

Tobia Claglüna
*A Study on Hierarchical Inference for Semantic Segmentation*
(Konrad Schindler, D-BAUG)

Severin Marc Fritschi
*Application of Gauss-Newton Optimization for Variational Data Assimilation*
(Patrick Jenny, D-MAVT)

Gao Junpeng
*Deep Learning of Residual Physics For Soft Robot Simulation*
(Robert Katzschmann, D-MAVT)

Christoph Michael Grötzbach
*Mimic-Me: Learning from Demonstration using Task Parameterised Gaussian Mixture Models*
(Stelian Coros, D-INFK)

Damian Robin Heer
*HPC Implementations of Visualisation of Wavefunctions in Quantum Mechanics*
(Vasile Gradinaru, D-MATH)

Zuzanna Herud
*Simulating Long-Range Obstacle Detection for Trains*
(Roland Siegwart, D-MAVT)

Alain Philippe Hügli
*Improving the Efficiency of Spin-Mapping Methods*
(Jeremy Oliver Richardson, D-CHAB)

Raphael Tobias Husistein
*Phonon Motion in Crystalline Beams*
(Andreas Adelmann, D-PHYS)

Sina Klampt
*Efficient Numerical Methods in Shallow Water Dynamics*
(Johann Wernli, D-USYS)

Leonard Peter Knirsch
*Probabilistic physics-constrained postprocessing using deep neural networks*
(Johann Heinrich Wernli, D-USYS)

Bjarne Kölle
*Numerical Simulation of Droplet Deformation in a Microfluidic Channel*
(Outi Supponen, D-MAVT)

Benjamin Stefan Krummenacher
*Generic Camera Models for SLAM*
(Roland Siegwart, D-MAVT)

Francesco La Commare
*Multi-Agent Reinforcement Learning for Mixed Collaborative-Competitive Environments*
(Roger Wattenhofer, D-ITET)

Yining Li
*The application of Quantum Computing in Financial Portfolio Optimization Problems*
(Patrick Cheridito, D-MATH)

Stephan Lichtenstein
*From 3D Scans to Meshes Suitable for Mobile Device Tracking*
(Marco Hutter, D-MAVT)

Levi Evan Lingsch
*A Vandermonde Neural Operator: Extending the Fourier Neural Operator to Nonequis-paced Distributions*
(Robert Katschmann, D-MAVT)

Josefine Leuenberger
*Spatial variations of snow stability and corresponding avalanche danger levels*
(Jürg Schweizer, D-BAUG)

Stephanie Samantha Maier
*Accelerating lattice field theory using GPUs*
(Marina Krstic Marinkovic, D-PHYS)

Samuel Martin
*OpenACC port of Data Assimilation components in numerical weather prediction software*
(Oliver Fuhrer, D-USYS)

Florian Meer
*Surface Correspondence of Bladder Cancer Tissue Using an Autoencoder*
(Dagmar Iber, D-BSSE)

Jonas Patrik Mensch
*Interpolation of surface conditions in the pseudo-global warming downscaling approach*
(Christoph Schär, D-USYS)

Veronica Montanaro
*Improving Particle Communication in the Independent Parallel Particle Layer*
(Andreas Adelmann, D-PHYS)

Mariana Osorio Olvera
*Graph-Based Plate-Lattices*
(Dirk Mohr, D-MAVT)

Yang Pan
*Metric Entropy Limits on Recurrent Neural Network Learning of Lipschitz Fading Memory Systems*
(Helmut Bölcskei, D-ITET)

Vihang Sunil Puranik
*An Improved Flow and Transport Framework for Multiphase Flows in Embedded Discrete Fracture Model of Fractured Porous Media*
(Patrick Jenny, D-MAVT)

Diego Machain Rivera
*Learning-based Articulated Object Mapping with the HoloLens"*
(Roland Sigwart, D-MAVT)

Fabiano Sasselli
*Implementation and Validation of the Magnetized Poisson-Vlasov-Fokker-Planck Framework*
(Patrick Jenny, D-MAVT)

Manuel Schneider
*Differentiable Solvers for Deep Learning*
(Petros Koumoutsakos, D-MAVT)

Vsevolod Semenov
*Extraction of BOLD Signal Time Series from fMRI Data in Julia*
(Klaas Enno Stephan, D-ITET)

Timofey Shpakov
*nomaly Detection for Retinal Fundus Images*
(Julia Vogt, D-INFK)

Pascal Sommer
*Taking an Electoral Photograph with Neural Networks*
(Roger Wattenhofer, D-ITET)

Davide Staub
*Solving a coupled fluid-solid system with PINNs*
(Sid Mishra, D-MATH)

David Strassmans
*High-Order RKDG Schemes for Systems of Conservation Laws in MFEM*
(Roger Käppeli, D-MATH)

Michal Grzegorz Sudwoj
*A 3D Benchmark for R-INLA*
(Olaf Schenk, D-MATH)

Tobias Samuel Sugandi
*Investigations of Solar Race Car Design Concepts Using VSPAERO and OpenVSP*
(Patrick Jenny, D-MAVT)

Marc Constantin Wanner
*Detection in 1D NMR Spectroscopy with Detection Transformers'*
(Ender Konukoglu, D-ITET)

Manuel Louis Winkler
*Implementation of the Feshbach-Schur Method for the Fourier spectral discretizations of Schrödinger Operators*
(Vasile Gradinaru, D-MATH)

Robin Alexander Worreby
*Search for Topological Membranes*
(Sebastian Huber, D-PHYS)

# CSE Case Studies Seminar 3

The CSE Case Studies Seminar takes place each semester on Thursdays, 16 - 18 hours. Speakers from ETH, from other universities as well as from industry are invited to give a $2 \times 45$ minutes talk on an applied topic. The idea is to show the students a case study of an application problem containing the problem setting, the modelling, the mathematical approach and the simulation on a computer. In addition, such a case study should show what is going on in the field of CSE and what are the job perspectives for a CSE engineer. Apart these invited talks, each student has to give a 15 minutes presentation based either on one of the own projects or on a paper which can be proposed by the student or can be taken from a given list of possible interesting papers.

The titles of the invited talks during the past academic year are given in the two following lists.

## Case Studies Seminar HS22

29.09.22   Roger Barton
Swissloop Zurich
*Insight into Simulations at Swissloop*

13.10.22   Jeremy Richardson
Theoretical Molecular Quantum Dynamics, ETH Zurich
*Simulation of Quantum Effects in Molecules for Classical Cost*

20.10.22   Judit Szulagyi
Computational Astrophysics, ETH Zurich
*Computational Astrophysics*

01.12.22   Oliver Rietmann
Seminar for Applied Mathematics, ETH Zurich
*Quantum Dynamics with Wavepackets*

08.12.22   Jan Vermant
Soft Materials, ETH Zurich
*Thin Liquid Films: Where Capillarity, Hydrodynamics and Molecular Forces Meet*

# Case Studies Seminar FS23

23.02.23   Gonzalo Brito Gadeschi
NVIDIA Munich
*Portable Acceleration of HPC Applications Using Standard C++*

09.03.23   Ulrik Brandes
Social Networks, ETH Zurich
*Soccer Analytics*

16.03.23   Philip Zupancic
Accenture Zurich
*Quantum Machine Learning Applications in Industry*

04.05.23   Ana Klimovic
Computing Platforms, ETH Zurich
*Scalable Input Data Processing for Resource-Efficient Machine Learning*

01.06.23   Markus Bambach
Computational Manufacturing, ETH Zurich
*Simulation of Manufacturing Processes: Data-Driven, Physics-Based, or Both?*

# Student Talks in the Case Studies Seminar HS22

1. Paul Fischill (2022-10-06)
Paper Nr. 242: The Deep Ritz method: A deep learning-based numerical algorithm for solving variational problems

2. Jonas Luther (2022-10-06)
Thesis Bachelor: Compressible Navier Stokes solver with adaptive local time stepping

3. Tobia Simmler (2022-10-06)
Paper Nr. 338: Denoising Deep Monte Carlo Renderings

4. Paolo Bottoni (2022-10-06)
Thesis Bachelor: Tracking Space Extension using SLAM

5. Felix Vittori (2022-10-06)
Paper Nr. 240: Neural Ordinary Differential Equations

6. Stanislaw Piasecki (2022-10-06)
Thesis Bachelor: Fast Computation Of Weighted Transitive Closure

7. David Strassmann (2022-10-06)
Thesis Bachelor: Discontinuous Galerkin Limiters for Nonlinear Conservation Laws in MFEM

8. Joshua Aurand (2022-10-06)
Thesis Bachelor: Efficient Rendering of Implicit Mesh Representations for Neural Style Transfer

9. Claudio Cannizzaro (2022-10-06)
Thesis Semester: Scientific visualisation of high-resolution climate modelling

10. Simon Bolt (2022-10-06)
Thesis Bachelor: Analysis and Implementation of SFCW Radar for Through-Wall-Sensing

11. Davide Staub (2022-10-06)
Thesis Bachelor: Simulation of micron scale robots

12. Raphael Husistein (2022-10-27)
Paper Nr. 18: Cellular Automation Approach to Pedestrian Dynamics - Theory

13. Laurenz Keller (2022-10-27)
Paper Nr. 17: Simulating dynamical features of escape panic

14. David Jenny (2022-10-27)
Paper Nr. 8: Metapopulation dynamics

15. Liam Curtis (2022-10-27)
Paper Nr. 24: Evolution Dynamics of Biological Games

16. Jonah Baumann (2022-10-27)
Paper Nr. 124: Modeling epidemics using cellular automata

17. Adel Gavranovic (2022-10-27)
Paper Nr. 314: Price of Anarchy in Transportation Networks: Efficiency and Optimality Control

18. Defne Kurtulus (2022-10-27)
Paper Nr. 38: A simple rule for the evolution of cooperation on graphs and social networks

19. Ondrej Cernin (2022-10-27)
Paper Nr. 171: Slim Fly: A Cost Effective Low-Diameter Network Topology

20. Konstantin Ohlhorst (2022-10-27)
Paper Nr. 128: Self-regulatory information sharing in participatory social sensing

21. Nicholas Engel (2022-10-27)
Paper Nr. 30: Modelling the recent common ancestry of all living humans

22. Janine Baumann (2022-10-27)
Paper Nr. 23: Evolution in population dynamics

23. Tim Sauter (2022-10-27)
Paper Nr. 296: Interaction network analysis of the six game complexes in high-level volleyball through the use of Eigenvector Centrality

24. Roman Svoboda (2022-11-03)
Paper Nr. 123: Automatic Generation of Constructable Brick Sculptures

25. Daniel Schwarzenbach (2022-11-03)
Paper Nr. 246: Pixel2Mesh: Generating 3D Mesh Models from Single RGB Images

26. Sebastian Lochmann (2022-11-03)
Paper Nr. 45: reCAPTCHA: Human-Based Character Recognition via Web Security Measures

27. Marc Wanner (2022-11-03)
Own paper: Nicolas Carion, Francisco Massa, Gabriel Synnaeve, Nicolas Usunier, Alexander Kirillov, and Sergey Zagoruyko: End-to-End Object Detection with Trans-

formers, arXiv, 28 May 2020

28. Mingjie Li (2022-11-03)
Paper Nr. 292: Interactive Robotic Manipulation of Elastic Objects

29. Lukas Buehler (2022-11-03)
Paper Nr. 238: A Graph Signal Processing Perspective on Functional Brain Imaging

30. Florian Meer (2022-11-03)
Own paper: Yaoqing Yang, Chen Feng, Yiru Shen: FoldingNet: Point Cloud Auto-encoder via Deep Grid Deformation, Conference paper: 2018 IEEE/CVF Conference on Computer Vision and Pattern, June 2018

31. Enrico Miletto Granozio (2022-11-03)
Paper Nr. 137: Reciprocal n-Body Collision Avoidance

32. Florian Pauschitz (2022-11-03)
Thesis Bachelor: Inference of Capacity Constraints in Metabolic Networks from Data

33. Pavel Lenskii (2022-11-03)
Own paper: Chris Yu, Henrik Schumacher, Keenan Crane: Repulsive Curves, ACM Transactions on Graphics, Volume 40, Issue 2, Mai 2021

34. Anita Ochsner (2022-11-03)
Paper Nr. 54: A Coarse-to-Fine Strategy for Multiclass Shape Detection

35. Philip Pawlowsky (2022-11-03)
Own paper: Collins, A.M.; Brodie, K.L.; Bak, A.S.; Hesser, T.J.; Farthing, M.W.; Lee, J.; Long, J.W.: Bathymetric Inversion and Uncertainty Estimation from Synthetic Surf-Zone Imagery with Machine Learning, Remote Sens. 2020, 12(20)

36. Rafael Steiner (2022-11-03)
Paper Nr. 103: Fast parallel construction of highquality bounding volume hierarchies

37. Sebastian Heckers (2022-11-03)
Paper Nr. 156: Online Generation of Collision-Free Trajectories for Quadrotor Flight in Unknown Cluttered Environments

38. Tobias Christ (2022-11-03)
Paper Nr. 321: A New Parallel Algorithm for Minimum Spanning Tree(MST)

39. Octave Arevian (2022-11-03)
Paper Nr. 131: Deep G-Buffers for Stable Global Illumination Approximation

40. Bogdan Dubinin (2022-11-03)
Paper Nr. 82: Gaze Correction for Home Video Conferencing

41. Timofey Shpakov (2022-11-10)
Paper Nr. 289: Recurrent Models of Visual Attention

42. Niall Siegenheim (2022-11-10)
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47. Peiyuan Xie (2022-11-10)
Paper Nr. 172: Model-Driven Choice of Numerical Methods for the Solution of the Linear Advection Equation

48. Bob Schreiner (2022-11-10)
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49. Vsevolod Semenov (2022-11-10)
Paper Nr. 153: Transitional Markov Chain Monte Carlo Method for Bayesian Model Updating, Model Class Selection, and Model Averaging

50. Dingran Feng (2022-11-10)
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Paper Nr. 233: A general reinforcement learning algorithm that masters chess, shogi, and Go through self-play

54. Robin Sieber (2022-11-17)
Paper Nr. 315: Image Based Geo-Localization in the Alps

55. Aaron Menzi (2022-11-17)
Paper Nr. 89: A material point method for snow simulation

56. Michael Klein (2022-11-17)
Paper Nr. 161: Current Challenges for Numerical Weather Prediction in Complex Terrain: Topography Representation and Parameterizations

57. Thibault Meier (2022-11-17)
Paper Nr. 28: Quantification of modeling uncertainties in a large ensemble of climate change simulations

58. Michele Mina (2022-11-17)
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Paper Nr. 78: Solar Flares as Cascades of Reconnecting Magnetic Loops

60. Caterina Croci (2022-11-17)
Paper Nr. 175: Detection, tracking and event localization of jet stream features in 4-D atmospheric data

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67. Mike Schmid (2022-11-24)
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68. Ciril Humbel (2022-11-24)
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69. Livio Ziltener (2022-11-24)
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70. Ryan Ammann (2022-11-24)
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73. Stephanie Maier (2022-11-24)
Paper Nr. 138: Using Noise to Speed up Markov Chain Monte Carlo Estimation

74. Ioan Gorea (2022-11-24)
Paper Nr. 2: Optimization by Simulated Annealing

75. Kourosh Shariat (2022-11-24)

Paper Nr. 223: Methods for interpreting and understanding deep neural networks

76. Jan Zwahlen (2022-11-24)
Paper Nr. 265: DeepBach: a Steerable Model for Bach Chorales Generation

77. Wenkai Xuan (2022-12-15)
Paper Nr. 96: A Bit-String Model for Biological Aging

78. Junpeng Gao (2022-12-15)
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79. Fabian Kistler (2022-12-15)
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80. Ielizaveta Polupanova (2022-12-15)
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81. Jingjing Li (2022-12-15)
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83. Yang Pan (2022-12-15)
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84. Seraina Nebiker (2022-12-15)
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85. Flavia Taras (2022-12-15)
Paper Nr. 104: A whole-Cell Computational Model Predicts Phenotype from Genotype

86. Mael Macuglia (2022-12-15)
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88. Mingyuan Chi (2022-12-15)
Own paper: Bradley C. Edwards: DESIGN AND DEPLOYMENT OF A SPACE ELE-VATOR, Acta Astronautica

89. Marco Hummel (2022-12-22)
Paper Nr. 64: A New Vectorization Technique for Expression Templates in C++

90. You Wu (2022-12-22)
Paper Nr. 113: Julia: A Fresh Approach to Numerical Computing

91. Marcel Ferrari (2022-12-22)
Paper Nr. 152: Fast and Efficient Compression of Floating-Point Data

92. Damian Heer (2022-12-22)
Thesis Semester: HPC Implementations of Visualisation of Wavefunctions in Quantum Mechanics

93. Jens Nielsen (2022-12-22)
Paper Nr. 15: Programmable and autonomous computing machine made of biomelecules

94. Simeon Barbey (2022-12-22)
Paper Nr. 177: A fast SHAKE algorithm to solve distance constraint equations for small molecules in molecular dynamics simulations

95. Jonas Bachmann (2022-12-22)
Paper Nr. 41: A Cache-aware Algorithm for PDEs on Hierarchical Data Structures Based on Space-filling Curves

96. Christopher Lompa (2022-12-22)
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97. Blanca Fuentes Monjas (2022-12-22)
Paper Nr. 310: An Advection-Reflection Solver for Detail-Preserving Fluid Simulation

98. Max Stoll (2022-12-22)
Paper Nr. 262: Time-domain simulation of a guitar: Model and method

99. Guillaume Draznieks (2022-12-22)
Paper Nr. 198: On the low-rank approximation by the pivoted Cholesky decomposition

100. Severin Klapproth (2022-12-22)
Own paper: Linda Stoel, Jason Frank: The numerical solution of the Vlasov-Poisson-

## Student Talks in the Case Studies Seminar FS23

1. David Strassmann (2023-03-02)
Thesis Semester: High-Order RKDG Schemes for Systems of Conservation Laws in MFEM

2. Alexander Born (2023-03-02)
Paper Nr. 270: HellaSwag: Can a Machine *Really* Finish your Sentence?

3. Marco Solanki (2023-03-02)
Paper Nr. 71: Nineteen dubious ways to compute the exponential of a matrix

4. Paolo Bottoni (2023-03-02)
Thesis Semester: Characterizing regional energy demand in Swiss municipalities

5. Ciril Humbel (2023-03-02)
Thesis Bachelor: Tree-based Regression Method for Streaming Data

6. Jan Zwahlen (2023-03-02)
Paper Nr. 119: STELLA: A Domain-specific Tool for Structured Grid Methods in Weather and Climate Models

7. Caterina Croci (2023-03-02)
Own paper: Ying Chen, Jim Haywood, Yu Wang, Florent Malavelle, George Jordan, Daniel Partridge, Jonathan Fieldsend, Johannes De Leeuw, Anja Schmidt, Nayeong Cho, Lazaros Oreopoulos, Steven Platnick, Daniel Grosvenor , Paul Field, and Ulrike Lohmann: Machine learning reveals climate forcing from aerosols is dominated by increased cloud cover, Nature geoscience (2022-08)

8. Mael Macuglia (2023-03-02)
Own paper: Matus Telgarsky : Stochastic linear optimization never overfits with quadratically-bounded losses on general data, Conference on Learning Theory 2022

9. Rafael Steiner (2023-03-02)
Own paper: Nikita Rudin, David Hoeller, Philipp Reist, Marco Hutter: Learning to Walk in Minutes Using Massively Parallel Deep Reinforcement Learning, Conference on Robot Learning, 24 Sep 2021

10. Marcel Ferrari (2023-03-02)
Thesis Semester: Optimized Alltoall Algorithm for Low-Diameter Network Topologies

11. Defne Kurtulus (2023-03-02)
Paper Nr. 141: SoCo: A Social Network Aided Context-Aware Recommender

12. Timofey Shpakov (2023-03-02)

Own paper: Yilun Xu, Ziming Liu, Max Tegmark, Tommi Jaakkola: Poisson Flow Generative Models, NeurIPS 2022

13. Johan Calle Axius (2023-03-23)
Paper Nr. 150: Human-level control through deep reinforcement learning

14. Jonas Bachmann (2023-03-23)
Paper Nr. 1: Neural networks as tools to solve problems in physics and chemistry

15. Guillaume Draznieks (2023-03-23)
Own paper: Paul J. Blazek and Milo M. Lin: Explainable neural networks that simulate reasoning, Nature Computational Science

16. Dingran Feng (2023-03-23)
Own paper: Vadori, Nelson, Leo Ardon, Sumitra Ganesh, Thomas Spooner, Selim Amrouni, Jared Vann, Mengda Xu, Zeyu Zheng, Tucker Balch, and Manuela Veloso.: Towards Multi-Agent Reinforcement Learning driven Over-The-Counter Market Simulations, arXiv preprint 13.10.2022

17. David Jenny (2023-03-23)
Paper Nr. 35: Reducing the dimensionality of data with neural networks

18. Gioele Molinari (2023-03-23)
Own paper: Yannis Assael, Thea Sommerschield, Brendan Shillingford, Mahyar Bordbar, John Pavlopoulos, Marita Chatzipanagiotou, Ion Androutsopoulos, Jonathan Prag, Nando de Freitas: Restoring and attributing ancient texts using deep neural networks, Nature, Vol 603, 10 March 2022

19. Leonard Knirsch (2023-03-23)
Paper Nr. 135: Mastering the game of Go with deep neural networks and tree search

20. Ondrej Cernin (2023-03-23)
Paper Nr. 266: Large-Scale Image Retrieval with Attentive Deep Local Features

21. Luca Wolfart (2023-03-23)
Own paper: Ethan Pickering, Stephen Guth, George Em Karniadakis, Themistoklis P. Sapsis : Discovering and forecasting extreme events via active learning in neural operators, Nature Computational Science, 19th December 2022

22. Simeon Barbey (2023-03-30)
Paper Nr. 33: A fast triangle to triangle intersection test for collision detection

23. Fabian Kistler (2023-03-30)
Paper Nr. 147: Stochastic Superoptimization

24. Claudia Gubler (2023-03-30)

Paper Nr. 121: Multi-scale modeling and rendering of granular materials

25. Philip Pawlowsky (2023-03-30)
Own paper: M. Gargiani, A. Zanelli, D. Liao-McPherson, T. H. Summers and J. Lygeros: Dynamic Programming Through the Lens of Semismooth Newton-Type Methods, IEEE Control Systems Letters, vol. 6, pp. 2996-3001, 2022

26. Severin Fritschi (2023-03-30)
Thesis Semester: Application of Gauss-Newton Optimization for Variational Data Assimilation

27. Jens Nielsen (2023-03-30)
Paper Nr. 192: Single-pixel imaging via compressive sampling

28. Marianna Marzetta (2023-03-30)
Thesis Bachelor: An automated registration approach for multi-stack time-lapsed imaging using high-resolution peripheral quantitative computed tomography

29. Tobias Christ (2023-03-30)
Paper Nr. 102: Searching with iterated maps

30. Ielizaveta Polupanova (2023-03-30)
Paper Nr. 165: Phase-Based Frame Interpolation for Video

31. Octave Arevian (2023-03-30)
Paper Nr. 232: ADAM:A Method for Stochastic Optimization

32. Livio Ziltener (2023-03-30)
Paper Nr. 257: Image Inpainting for Irregular Holes Using Partial Convolutions

33. Alice Mazzoleni (2023-03-30)
Paper Nr. 105: Decoupling algorithms from schedules for easy optimization of image processing pipelines.

34. Luca Conconi (2023-04-06)
Paper Nr. 9: Chaotic Evolution of the Solar System

35. Mingjie Li (2023-04-06)
Paper Nr. 151: Unified Particle Physics for Real- Time Applications

36. Fabiano Sasselli (2023-04-06)
Thesis Semester: Implementation and validation of the magnetized Poisson-Vlasov-Fokker-Planck framework

37. Severin Nigg (2023-04-06)
Paper Nr. 188: A comparison of three high-precision quadrature schemes

38. Haitao Yu (2023-04-06)
Paper Nr. 108: Position based dynamics

39. Seraina Nebiker (2023-04-06)
Paper Nr. 3: A numerical method for solving partial differential equations on highly irregular evolving grids

40. Sophia Esser (2023-04-06)
Paper Nr. 122: Data-Driven Finite Elements for Geometry and Material Design

41. Shizheng Wen (2023-04-06)
Own paper: Han Gao, Matthew J Zahr, Jian-Xun Wang: Physics-informed graph neural Galerkin networks: A unified framework for solving PDE-governed forward and inverse problems, Computer Methods in Applied Mechanics and Engineering, 2022

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43. Tim Sauter (2023-04-06)
Paper Nr. 94: A Practical Guide to Wavelet Analysis

44. Francesco La Commare (2023-04-06)
Paper Nr. 268: Engineering Parallel Algorithms for Community Detection in Massive Networks

45. Sebastian Heckers (2023-04-20)
Paper Nr. 112: A Parallel Architecture for IISPH Fluids

46. Liam Curtis (2023-04-20)
Paper Nr. 166: Polynomial-Time Algorithms for Prime Factorization and Discrete Logarithms on a Quantum Computer

47. Robin Sieber (2023-04-20)
Own paper: Gargiani, Liao-McPherson, Zanelli, Lygeros: Inexact GMRES Policy Iteration for Large-Scale Markov Decision Processes, Arxiv Preprint (8. Nov. 2022), submitted to IFAC 2023

48. Nicholas Engel (2023-04-20)
Thesis Bachelor: A Parallel Implementation of Stochastic Gradient Descent for Stress Minimization

49. Nicola Lo Russo (2023-04-20)
Paper Nr. 91: A Computational Approach to Financial Option Pricing Using Quasi

Monte Carlo Methods via Variance Reduction Techniques

50. Lukas Buehler (2023-04-20)
Paper Nr. 230: A New Vectorization Technique for Expression Templates in C++

51. Simon Bolt (2023-04-20)
Paper Nr. 328: A new class of accurate, mesh-free hydrodynamic simulation methods

52. Thibault Meier (2023-04-20)
Paper Nr. 72: SPH based Shallow Water Simulation

53. Blanca Fuentes Monjas (2023-04-20)
Paper Nr. 269: High-order computational fluid dynamics simulations of a spinning golf ball

54. Bob Schreiner (2023-04-20)
Paper Nr. 5: Quantum Computation

55. Paul Fischill (2023-04-27)
Paper Nr. 87: Haptic Quantum Chemistry

56. Mike Schmid (2023-04-27)
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60. Sebastian Brovelli (2023-04-27)
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61. Max Stoll (2023-04-27)
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62. Felix Vittori (2023-04-27)
Own paper: Doris Danninger and Roland Pruckner and Laura Holzinger and Robert Koeppe and Martin Kaltenbrunner: MycelioTronics: Fungal mycelium skin for sustainable electronics, Science Advances 2022

63. Janine Baumann (2023-04-27)
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64. Ryan Ammann (2023-04-27)
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65. Wenkai Xuan (2023-04-27)
Paper Nr. 27: Emergence of cooperation and evolutionary stability in finite populations

66. Mingyuan Chi (2023-04-27)
Own paper: Hamacher, T and Bradshaw, AM: Fusion as a future power source: recent achievements and prospects, 18th world energy congress

67. Michael Klein (2023-05-11)
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68. Aaron Menzi (2023-05-11)
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70. Faveo Hoerold (2023-05-11)
Paper Nr. 291: Stateful Dataflow Multigraphs: A Data-Centric Model for Performance Portability on Heterogeneous Architectures

71. Jonah Baumann (2023-05-11)
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72. Sebastian Lochmann (2023-05-11)
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76. Bogdan Dubinin (2023-05-11)
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77. Jonas Luther (2023-05-11)
Paper Nr. 83: A New Line Integral Convolution Algorithm for Visualizing Time- Varying Flow Fields

78. Woojin Ban (2023-05-11)
Paper Nr. 325: Neural Networks and Principal Component Analysis: Learning from Examples Without Local Minima

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