M. Sc. Peter Súkeník

PHD STUDENT

I consider myself a highly enthusiastic and well-performing PhD student in the field of machine learning and deep learning. I have always had passion for solving challenging mathematical problems, creative activities, investigation of yet unknown concepts, as well as for trying to search for connections of concepts, which seem to be unrelated. I put emphasis on fulfilling all types of tasks with high precision. I usually become very passionate about things I am doing.

SKILLS & EXPERTISE

- **Education in applied mathematics on M.Sc. level**
- **Teaching**
- **Expert insight into:** neural collapse, randomized smoothing, multi-objective optimization, generalization bounds, sample complexity, sparse training & structured sparsity, multi-armed bandit

- **Languages:**
  - English (C1)
  - German (B1)
- **Coding:**
  - Python, Matlab, R
  - Torch, Numpy - advanced

EDUCATION

- **INSTITUTE OF SCIENCE AND TECHNOLOGY AUSTRIA**
  Sep 2021 - Present
  - **Field of PhD degree:** Theory of Deep Learning
  - **Supervisors:** Prof. Christoph Lampert, Prof. Marco Mondelli (co-supervision)
  - **External supervisors:** Prof. Mikhail Belkin, Prof. Nicolas Flammarion
  - **Research proposal title:** Implicit Bias of (S)GD Optimization on Training and Properties of Deep Neural Networks
  - **Research topics include:** (deep) neural collapse, implicit bias of SGD training, learning in the presence of spurious features, generalization bounds, data efficiency, multi-objective learning, sparse training
- **TECHNICAL UNIVERSITY OF MUNICH**
  Oct 2019 - Sep 2021
  - **Field of Master's degree:** Mathematics
  - **Final GPA: 1.098 - top 5% performance**
  - **Thesis title:** Improving Certifiable Robustness via Input-Dependent Randomized Smoothing (**later published at ICML 2022**)
  - **Thesis supervisor:** Prof. Stephan Günnemann
  - **Research project:** Active learning using sample-wise self-attention (a follow-up was **later published at NeurIPS 2022**)
- **COMENIUS UNIVERSITY IN BRATISLAVA (SLOVAKIA)**
  Sep 2016 - Jun 2019
  - **Field of Bachelor's degree:** Economical and financial mathematics
  - **Final GPA: 1.0 - #1 in the class**
  - **Thesis title:** Choice Decisions Problems - Multi Armed Bandit
  - **Thesis supervisor:** doc. RNDr. Katarína Janková, CSc.

PUBLICATIONS

Jacot, Arthur, **Súkeník Peter**, et. al. "Wide Neural Networks Trained with Weight Decay Provably Exhibit Neural Collapse." **ICLR 2025 oral**

Súkeník, Peter, Marco Mondelli, and Christoph H. Lampert. "Neural Collapse versus Low-rank Bias: Is Deep Neural Collapse Really Optimal?." **Advances in Neural Information Processing Systems 37 (2024)**

Daniel Beaglehole, **Súkeník, Peter**, Marco Mondelli, and Mikhail Belkin. "Average gradient outer product as a mechanism for deep neural collapse." **Advances in Neural Information Processing Systems 37 (2024)**

Súkeník, Peter, Marco Mondelli, and Christoph H. Lampert. "Deep Neural Collapse Is Provably Optimal for the Deep Unconstrained Features Model." **Advances in Neural Information Processing Systems 36 (2023) spotlight**

Kocsis, Peter, **Súkeník, Peter**, et. al. "The unreasonable effectiveness of fully-connected layers for low-data regimes." **Advances in Neural Information Processing Systems 35 (2022)**

Súkeník, Peter, and Christoph H. Lampert. "Generalization In Multi-Objective Machine Learning." **Neural Computing and Applications (2024)**

Súkeník, Peter, Aleksei Kuvshinov, and Stephan Günnemann. "Intriguing Properties of Input-Dependent Randomized Smoothing." **International Conference on Machine Learning. PMLR, 2022**

CONFERENCES

- NeurIPS 2024 (Canada)
- MALT 2024 (Spain)
- ICML 2024 (Austria)
- YiHD 2024 (Italy)
- ICLR 2024 (Austria)
- NeurIPS 2023 (USA)
- DeepMath 2023 (USA)
- NeurIPS 2022 (USA)
- ICML 2022 (USA)
- ICLR 2022 (USA)

INTERESTS & FURTHER SKILLS

- Sports
- Dancing
- Story writing
- Game design - created around 30 camp entertainment games of all sorts + 1 commercial escape room

AWARDS & ACHIEVEMENTS

- **International Mathematical Olympiad (IMO) 2016** - third prize (224th place)
- **European Union Science Olympiad 2014** - first prize (8th place, team)
- **International Mathematical Competition 2017, 2018, 2019** - third prize (3x) + Ivan the Confessor's fair play prize (2019)
- **Vojtech Jarník IMC 2017** - awarded
- **Vojtech Jarník IMC 2019** - 11th place + awarded
- **Physics olympiad 2016 (central round)** - 2nd place + special award for best experiment
- **Dean's prize for excellent bachelor's thesis 2019**
- **BAYHOST scholarship 2019-2021**
- **NeurIPS 2023 outstanding reviewer** - reviewed for the first time
- **ICML 2024 best reviewer award** - top 3% of reviewers

EXPERIENCE

- **Trojsten NGO, volunteer (2016-present)**

  Organizing online high-school mathematical contests for talented students. I have reviewed and scored around 500 of students' solutions. Moreover, I have organized and participated in 10 mathematical camps for winners, where I have lectured (together with other Trojsten actions) more than 100 hours of interesting and useful mathematical topics.
- **Mathematical Olympiad, reviewer (2017-present)**

  Correcting, and commentating hundreds of students' solutions from regional rounds to International Mathematical Olympiad team selections. Recently served as Slovak leader on MEMO 2023. I am a member of board of Slovak Mathematical Olympiad.
- **NeurIPS'23; ICML'24; ICLR'25 reviewer**