ZALAN FABIAN, POSTDOCTORAL RESEARCHER

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RESEARCH INTERESTS

- Multimodal foundation models - improving visual understanding, reasoning and reliability
- Diffusion models - inverse problems, controllable generation, mechanistic interpretability, efficient diffusion
- AI for science and health - biomedical and computational imaging, cryo-EM/ET, AI for Conservation
- Compute-efficient architectures for dense prediction - state space models for vision

ACTIVE PROJECTS

- **Multimodal models:** understanding the opportunities and fundamental limitations of multimodal foundation models, estimating model uncertainty, improving reliability and trustworthiness in the medical domain
- **Deep learning for cryo-ET:** developing accurate and efficient deep learning methods for a variety of tasks arising in cellular environments, including particle picking, protein classification and cell segmentation
- **Compute-efficient image restoration:** exploring selective state space models as a compute-efficient building block for vision tasks in imaging applications, focus on real-time applicability

RESEARCH EXPERIENCE

University of Southern California **Department of Electrical and Computer Engineering**
Postdoctoral Researcher *Jan 2024 to present*
- Advisor: Mahdi Soltanolkotabi
- Postdoc at USC AI Foundations for the Sciences Center
- Multimodal foundation models and compute-efficient architectures for science and healthcare

Microsoft **AI for Good Lab**
Research Intern *May 2023 to August 2023*
- Mentor: Zhongqi Miao,
- Developed a novel zero-shot algorithm for wildlife classification in camera trap images
- Implemented a novel technique for instruction tuning data generation using GPT-4
- Adapted vision-language foundation models to the application domain

IPAM (UCLA) **Computational Microscopy Long Program**
Visiting Graduate Researcher *September 2022 to December 2022*
- Focus on developing deep learning techniques for inverse problems arising in computational microscopy

Amazon **Alexa Perceptual Technologies**
Applied Scientist Intern *May 2022 to August 2022*
- Mentor: Rajath Kumar,
- Designed and implemented novel data augmentation techniques for speech spectrograms
- Implemented and tested semi-supervised learning techniques for wake word verification models

University of Southern California **Department of Electrical and Computer Engineering**
Research Assistant *Jan 2018 to Dec 2023*
- Advisor: Mahdi Soltanolkotabi
- Data and compute-efficient deep learning for science and healthcare

University of New Hampshire **Department of Electrical and Computer Engineering**
Research Assistant *Aug 2015 to May 2017*
- Advisor: Se Young Yoon
- Research assistant at UNH Robotics Lab
- Projects on intelligent robotic swarm control both in theory and practice

EDUCATION

- **PhD, Electrical Engineering**, University of Southern California, 2017 - 2023, December
  - Advisor: Mahdi Soltanolkotabi;
  - Focus: machine learning, deep learning, optimization, medical imaging
- **MSc, Electrical Engineering**, University of New Hampshire, 2017
  - Advisor: Se Young Yoon
- **BSc, Electrical Engineering**, Budapest University of Technology, 2014
  - Double degree program with Kyungpook National University, South Korea

SELECTED PREPRINTS AND PUBLICATIONS

1. M. S. Sepehri, **Z. Fabian**, M. Soltanolkotabi, and M. Soltanolkotabi, *MediConfusion: Can you trust your AI radiologist? Probing the reliability of multimodal medical foundation models*, 2024, preliminary work at NeurIPS 2024 Workshop on Advancements In Medical Foundation Models
2. S. Wiedemann, **Z. Fabian**, M. Soltanolkotabi, and R. Heckel, *ProPicker: Promptable Segmentation for Particle Picking in Cryogenic Electron Tomography*, 2024, preliminary work accepted at NeurIPS 2024 Workshop on Machine Learning in Structural Biology
3. **Z. Fabian**, B. Tinaz, and M. Soltanolkotabi, *Adapt and Diffuse: Sample-adaptive Reconstruction via Latent Diffusion Models*, 2024, ICML, [Spotlight]
4. **Z. Fabian**, B. Tınaz, and M. Soltanolkotabi, *DiracDiffusion: Denoising and Incremental Reconstruction with Assured Data-Consistency*, 2024, ICML
5. M. S. Sepehri, **Z. Fabian**, and M. Soltanolkotabi, *Serpent: Scalable and Efficient Image Restoration via Multi-scale Structured State Space Models*, 2024, preprint arXiv:2403.17902
6. Z. Miao, Y. Zhang, **Z. Fabian**, A.H. Celis, S. Beery, C. Li, Z. Liu, A. Gupta, M. Nasir, W. Li., J. Holmberg et al., *New frontiers in AI for biodiversity research and conservation with multimodal language models*, 2024, preprint EcoEvoRxiv
7. **Z. Fabian**, Z. Miao, C. Li, Y. Zhang, Z. Liu, A. Hernández, A. Montes-Rojas et al., *Multimodal Foundation Models for Zero-shot Animal Species Recognition in Camera Trap Images*, 2023, preprint arXiv:2311.01064
8. S. Babakniya **Z. Fabian**, C. He, M. Soltanolkotabi, and S. Avestimehr, *A Data-Free Approach to Mitigate Catastrophic Forgetting in Federated Class Incremental Learning for Vision Tasks*, 2023, NeurIPS
9. **Z. Fabian**, B. Tınaz, and M. Soltanolkotabi, *HUMUS-Net: Hybrid unrolled multi-scale network architecture for accelerated MRI reconstruction*, 2022, NeurIPS
10. **Z. Fabian**, R. Heckel and M. Soltanolkotabi, *Data Augmentation for Deep Learning Based Accelerated MRI Reconstruction with Limited Data*, 2021, ICML, [Spotlight]
11. **Z. Fabian**, J. Haldar, R. Leahy and M. Soltanolkotabi, *3D Phase Retrieval at Nano-Scale via Accelerated Wirtinger Flow*, 2020, EUSIPCO
12. S. M. M. Kalan, **Z. Fabian**, A. S. Avestimehr and M. Soltanolkotabi, *Minimax Lower Bounds for Transfer Learning with Linear and One-hidden Layer Neural Networks*, 2020, NeurIPS

AWARDS AND DISTINCTIONS

- William F. Ballhaus, Jr. Prize for Excellence in Graduate Engineering Research finalist, 2024
- Ming Hsieh Institute PhD Scholar 2021-2022
- Annenberg PhD Fellow, 2017-2021
- Distinguished BSc degree *summa cum laude*, 2014

TEACHING AND MENTORING EXPERIENCE

University of Southern California — **Department of Electrical and Computer Engineering**

Optimization for the Information and Data Sciences , *Teaching Assistant* — *Fall 2019*

University of New Hampshire — **Department of Electrical and Computer Engineering**

Computer Organizations, *Teaching Assistant* — *Fall 2016 - Spring 2017*

CONFERENCE REVIEW

- International Conference on Machine Learning (ICML 2021, 2022 - Outstanding Reviewer, 2023, 2024)
- International Conference on Learning Representations (ICLR 2020, 2021, 2022, 2023, 2024)
- Neural Information Processing Systems (NeurIPS 2020, 2021, 2022, 2023, 2024)
- Transactions on Machine Learning Research (starting from 2023)

OTHER SKILLS

Software Python, Pytorch, Tensorflow, Matlab, LaTeX

Languages English: fluent. Hungarian: native. German: basic.