Zachary Stoebner

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Overview

My research interests span **computational imaging** & **computer vision** and **machine learning** & **optimization**. Currently, I am working on provable learning methods for solving inverse problems, namely image reconstruction and system identification, in Fourier imaging systems with an emphasis on magnetic resonance imaging.

Education

University of Texas at Austin *Austin, TX*

PhD in Electrical & Computer Engineering *August 2022-Present*

- Advisor: Prof. Jon Tamir
- Graduate Coursework: Convex Optimization, Probability & Stochastic Processes, Computational MRI, Real Analysis, Advanced Computer Vision, Fourier Optics, Digital Signal Processing, Large-Scale Optimization

Vanderbilt University *Nashville, TN*

BS with Honors in Computer Science & Neuroscience, Minor in Applied Mathematics *May 2021*

MS in Computer Science *August 2022*

- Advisor: Prof. Ipek Oguz
- Thesis: A deep learning-enabled automatic segmentation system for surgical endoscopy
- Graduate Coursework: Statistical ML, Systems Theory, Computational Game Theory, Intelligent Systems & Robotics

Research Experience

In Progress

"Provable joint system identification and image reconstruction in Cartesian, Non-Cartesian, and low-field MRI using implicit neural point-spread functions", **Zachary A. Stoebner**, Jonathan I. Tamir.

"Non-Cartesian monotone operator learning with preconditioning for fast, memory-efficient, noise-robust compressed sensing MRI", **Zachary A. Stoebner**, Jonathan I. Tamir.

Conference

"Segmentation of kidney stones in endoscopic video feeds", **Zachary A. Stoebner**, Daiwei Lu, Seok Hee Hong, Nicholas L. Kavoussi, and Ipek Oguz. *SPIE Medical Imaging 2022: Image Processing* (2022).
[DOI][arXiv]

- Optimized a high-performing (>0.9 Dice, 0.8 Kappa) residual U-Net for video segmentation and deployed in live surgeries
- Built and annotated a novel dataset of endoscopic nephrolithotomy videos

Journal

"Comprehensive shape analysis of the cortex in Huntington's disease", **Zachary A. Stoebner**, Kilian Hett, Ilwoo Lyu, Hans Johnson, Jane S. Paulsen, Jeffrey Long, Ipek Oguz. *Human Brain Mapping* (2023).
[DOI][GitHub]

- Formulated a linear-mixed model to describe the cortex from the longitudinal PREDICT-HD dataset, using a novel index for gyrification, sulcal depth, and cortical thickness
- Discovered new areas of change associated with Huntington's disease and corroborated the degree of change associated with known areas

"Reducing malware analysis overhead with coverings", Michael Sandborn, **Zachary A. Stoebner**, Westley Weimer, Stephanie Forrest, Ryan Dougherty, Jules White, Kevin Leach. *IEEE-TDSC* (2023).
[DOI][GitHub]

- Developed a high-performing (>90% hit rate) deep multilabel CNN classifier that predicts which sandboxes will run a stealthy malware sample using its binary image
- Implemented scheduling algorithms to simulate the analysis framework's scalability given the classifier's predictions

Skills

Theory: Optimization, Deep Learning (Score-Based Diffusion, Neural Implicits, Deep Equilibrium, GANs), Fourier Analysis, Inverse Problems

Practice: Python (PyTorch, OpenCV), C++ & C (ITK / VTK, OpenCV, LLVM), ML Optimization & Workflow (Lightning, Comet), Visualization (PyPlot, Seaborn), MATLAB, R

Verbal: English (native), Portuguese (fluent), Spanish (advanced), French (basic)

Hobbies: tennis, trail running, backpacking, climbing, photography