Batu Ozturkler

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RESEARCH INTERESTS

My broad interests are efficient and robust deep learning for Medical/Computational Imaging, Computer Vision, and Natural Language Processing. I have been working on **diffusion models, in-context learning with Large Language Models, robustness under distribution shifts, memory-efficient learning, self-supervised learning, inverse problems, compressive sensing, and accelerated MRI reconstruction.**

EDUCATION

Stanford University Sep 2019 – Jan 2024
Ph.D. candidate in Electrical Engineering; GPA: 3.99/4.00 *Stanford, CA*
- Advisor: Prof. John Pauly and Prof. Mert Pilanci
- Graduation Date: 01/2024

Stanford University Sep 2019 – June 2021
Master of Science in Electrical Engineering; GPA: 3.99/4.00 *Stanford, CA*

Middle East Technical University (METU) Aug 2015 – June 2019
Bachelor of Science in Electrical Engineering; GPA: 3.96/4.00 *Ankara, Turkey*
Rank: **3/413**

EXPERIENCE

Applied Scientist 2 May 2024 – Present
Microsoft *Mountain View, CA*
- Developed and productionized multi-modal foundation model based computer vision applications
- Worked on minimizing human effort in using multi-modal foundation models through zero-shot/in-context/few-shot learning, optimizing human labelling, and providing semi-auto and auto-labelling experiences.
- Worked on utilizing zero-shot/in-context/few-shot learning and advanced finetuning techniques such as LoRA for multi-modal foundation models.

Postdoctoral Scholar March 2024 – May 2024
Research Assistant Sep 2019 – Jan 2024
Stanford University *Stanford, CA*
- Developed memory-efficient training techniques for high-dimensional MRI reconstruction with unrolled neural networks
- Developed a self-supervised learning based augmentation framework for MRI reconstruction that improves robustness to distribution shifts such as signal-to-noise ratio change and motion corruption
- Worked on equivalent convex formulations to non-convex neural networks to enable robustness, interpretability, and convergence guarantees

Research Intern Sep 2022 – April 2023
NVIDIA *Santa Clara, CA*
- Worked on improving the robustness of diffusion models under distribution shifts for MRI reconstruction using Stein's Unbiased Risk Estimator (SURE) under the supervision of Dr. Chao Liu and Prof. Jan Kautz
- Worked on improving the efficiency of diffusion models for MRI reconstruction using variational inference under the supervision of Dr. Morteza Mardani and Prof. Jan Kautz

Research Intern June 2022 – Aug 2022
Microsoft Research *Redmond, WA*
- Worked on identifying failure modes of in-context learning with Large Language Models (LLMs)
- Developed a probabilistic inference technique for LLMs to improve their reasoning capabilities and robustness to prompt design under the supervision of Dr. Nebojsa Jojic

Undergraduate Researcher June 2017 – Sep 2019
Imaging and Computational Neuroscience Laboratory (ICON Lab) at Bilkent University *Ankara, Turkey*

- Worked on active learning using Determinantal Point Processes for image reconstruction and synthesis in multi-contrast MRI with conditional GANs
- Evaluated task-related activations in fMRI, dynamic causal modelling to assess connectivity between brain regions
- Integrated motion-correction to a compressed sensing reconstruction method across coils and acquisitions and to simultaneous-multi-slice (SMS) acquisition for bSSFP imaging under the supervision of Prof. Tolga Cukur

Undergraduate Researcher March 2018 – June 2019

STAR Research Program, Middle East Technical University *Ankara, Turkey*
- Worked on deep-learning based high-quality microwave imaging under the supervision of Prof. Figen Oktem

Research Intern July 2018 – August 2018

Computer Vision Laboratory at ETH Zurich *Zurich, Switzerland*
- Compared beamforming and displacement tracking methods for imaging speed-of-sound with pulse-echo ultrasound under the supervision of Prof. Orcun Goksel
- Gave a poster presentation on this work at Amgen Scholars European Symposium, at Cambridge University, UK

Journal Publications

1. Oscanoa, J. A., Ong, F., Iyer, S.S., Li, Z., Sandino, C. M., **Ozturkler, B.M.**, Ennis, D.B., Pilanci, M., Vasanawala, S. Coil Sketching for Computationally-efficient MRI Iterative Reconstruction, **Magnetic Resonance in Medicine**, 2023; 1-19. doi: 10.1002/mrm.29883

2. Desai, A. D.*, **Ozturkler, B. M.***, Sandino, C. M., Boutin, R., Willis, M., Vasanawala, S., Hargreaves, B. A., Re, C. M., Pauly, J.M and Chaudhari, A. S. (* equal contribution) Noise2Recon: Enabling SNR-robust MRI reconstruction with semi-supervised and self-supervised learning, **Magnetic Resonance in Medicine**, 2023; 90(5): 2052-2070. doi: 10.1002/mrm.29759.

3. **Ozturkler, B. M.**, Sahiner, A., Ergen, T., Desai, A. D., Sandino, C. M., Vasanawala, S., Pauly, J.M, Mardani, M. and Pilanci, M. GLEAM: Greedy Learning for Large-Scale Accelerated MRI Reconstruction. preprint, (in submission, **IEEE Transactions in Medical Imaging**) [Online] Available: https://arxiv.org/abs/2207.08393, 2022

4. Tokgoz, S., Aydogdu, D., Ilhan, B., Sahin, Y., Bariseri, N., **Ozturkler, B.M.** and Çukur, T, 2020. Musical mirror-symmetrical movement tasks: comparison of rhythm versus melody-playing. **NeuroReport**, 31(7), pp.523-529.

Conference Publications and Workshop Proceedings

1. Sahiner, A., Ergen, T., **Ozturkler, B.M.**, Pauly, J., Mardani, M. and Pilanci, M. Scaling Convex Neural Networks with Burer-Monteiro Factorization. **ICLR 2024**. https://openreview.net/forum?id=ikmuHqugN7

2. **Ozturkler, B.M.**, Mardani, M., Vahdat, A., Kautz, J., Pauly, J. RED-diff: Regularization by Denoising Diffusion Process for MRI Reconstruction, **NeurIPS 2023 Workshop on Deep Learning and Inverse Problems** (Preliminary version presented at **MIDL 2023** (short paper). https://openreview.net/forum?id=NRGZmGbteB)

3. **Ozturkler, B.M.**, Liu, C., Eckart, B., Mardani, M. Song, J., Kautz, J. SMRD: SURE-based Robust MRI Reconstruction with Diffusion Models, **MICCAI 2023 (early accept, top 15% of all submissions)**

4. **Ozturkler, B.M.**, Malkin, N., Wang, Z. and Jojic, N. ThinkSum: Probabilistic reasoning over sets using large language models, **ACL 2023**. https://arxiv.org/abs/2210.01293

5. Gupta, A., **Ozturkler, B. M.**, Sahiner, A., Ergen, T., Desai, A. D., Vasanawala, S., Pauly, J.M, Mardani, M. and Pilanci, M. Greedy Learning for Memory-Efficient Self-Supervised MRI Reconstruction. **ISMRM 2023**

6. Desai, A.D., Gunel, B., **Ozturkler, B.M.**, Hargreaves, B.A., Gold,G., Vasanawala, S., Pauly, J.M., Ré, C. and Chaudhari, A.S. VORTEX-SS: Encoding Physics-Driven Data Priors for Robust Self-Supervised MRI Reconstruction. **ISMRM 2023**

7. Yurt, M., **Ozturkler, B.M.**, Setsompop, K., Vasanawala, S., Pauly, J.M., Chaudhari, A.S. Conditional Diffusion Models for Inverse MR Image Recovery, **oral presentation**. **ISMRM 2023**

8. Sahiner, A.*, Ergen, T.*, **Ozturkler, B.M.**, Bartan, B., Pauly, J., Mardani, M. and Pilanci, M. (* equal contribution) Hidden Convexity of Wasserstein GANs: Interpretable Generative Models with Closed-Form Solutions. **ICLR 2022**. https://arxiv.org/abs/2107.05680

9. Ergen, T.*, Sahiner, A.*, **Ozturkler, B. M.**, Pauly, J. , Mardani, M.,Pilanci, M. (* equal contribution), Demystifying Batch Normalization in ReLU Networks: Equivalent Convex Optimization Models and Implicit Regularization, **ICLR 2022**. https://arxiv.org/abs/2103.01499

10. Sahiner, A., Ergen, T., **Ozturkler, B.M.**, Pauly, J., Mardani, M. and Pilanci, M. Unraveling Attention via Convex Duality: Analysis and Interpretations of Vision Transformers. **ICML 2022**.

11. Van Veen, D., van der Sluijs, R., **Ozturkler, B. M.**, Desai, A.D., Bluethgen, C., Boutin, R.D., Willis, M.H., Wetzstein, G., Lindell, D., Vasanawala, S., Pauly, J., Chaudhari, A.S. Scale-Agnostic Super-Resolution in MRI using Feature-Based Coordinate Networks. **MIDL 2022** (short paper).

12. Yurt, M.*, **Ozturkler, B.M.***, Yesiloglu, R., Pauly, J.M., Setsompop, K., Chaudhari, A.S. Conditional Diffusion Models for Inverse MR Image Recovery, **ISBI 2022** (1-page abstract) (* equal contribution)

13. **Ozturkler, B.M.**, Sahiner, A., Ergen, T., Desai, A.D., Sandino, C. M., Vasanawala, S., Pauly, J., Mardani, M., Pilanci, M. Parallel Greedy Learning for Accelerating Cardiac Cine MRI, **ISMRM 2022**

14. Oscanoa, J. A., **Ozturkler, B.M.**, Iyer, S.S., Li, Z., Pilanci, M., Ennis, D.B., Vasanawala, S. Coil-sketched unrolled networks for computationally-efficient deep MRI reconstruction, **ISMRM 2022**

15. Beg, H.*, Gunel, B.*, **Ozturkler, B.M.***, Sandino, C. M., Pauly, J.M, Vasanawala, S.,Chaudhari, A.S.,Desai, A.D. (* equal contribution) Motion2Recon: A Motion-Robust Semi-Supervised Framework for MR Reconstruction, **ISMRM 2022**

16. Desai, A.D.*, Gunel, B.*, **Ozturkler, B.M.**, Beg, H., Vasanawala, S., Hargreaves, B.A., Ré, C., Pauly, J.M. and Chaudhari, A.S. (* equal contribution) VORTEX: Physics-Driven Data Augmentations for Consistency Training for Robust Accelerated MRI Reconstruction. **MIDL 2022 Best paper award.** https://arxiv.org/abs/2111.02549, 2021

17. **Ozturkler, B.M.**, Sahiner, A., Ergen, T., Desai, A.D., Pauly, J.M., Vasanawala, S., Mardani, M. and Pilanci, M. Greedy Learning for Large-Scale Neural MRI Reconstruction. **NeurIPS 2021 Workshop on Deep Learning and Inverse Problems**, **oral presentation.** https://openreview.net/forum?id=tKeEIFvmENy

18. **Ozturkler, B. M.**, Sahiner, A., Pilanci, M., Vasanawala, S., Pauly, J., Mardani, M. Scalable and Interpretable Neural MRI Reconstruction via Layer-Wise Training, **ISMRM 2021**

19. Desai, A.*, **Ozturkler, B. M.***, Sandino, C. S., Hargreaves, B., Pauly, J.*, Chaudhari, A.* (* equal contribution), Noise2Recon: A Semi-Supervised Framework for Joint MRI Reconstruction and Denoising using Limited Data **ISMRM 2021**. **Magna Cum Laude (Awarded to top 15% of all works)**

20. Sahiner, A., Mardani, M., **Ozturkler, B. M.**, Pilanci, M., Pauly, J. Convex Regularization Behind Neural Reconstruction, **ICLR 2021**. https://arxiv.org/abs/2012.05169

21. Rau, R., Ozkan, E., **Ozturkler, B. M.**, Gastli, L., Goksel, O., Displacement Estimation Methods for Speed-of-Sound Imaging in Pulse-Echo, **IEEE International Ultrasonics Symposium (IUS)**, Las Vegas, NV, USA, 2020, pp. 1-4, doi: 10.1109/IUS46767.2020.9251781.

Technical Skills

Languages: Python, MATLAB, R, C/C++
Deep Learning Libraries: PyTorch, TensorFlow, Keras, Jax
Other: Linux, Git, LaTeX, Weights & Biases, Docker, Google Cloud Platform, Microsoft Azure, Statistical Parametric Mapping (SPM), LABVIEW, Field-II, Key Creator, Lt Spice, Agilent Vee, Quartus 2, Verilog

Awards and Honours

National Science Foundation, Graduate Research Fellowship (NSF GRFP) 2021-Present
- Three years of financial support and a cost of education allowance to the institution.

Stanford University Electrical Engineering Departmental Fellowship 2019-2020
- Full tuition waiver & stipend during the first year of the Ph.D. program.

Bulent Kerim Altay Prize-METU 2016-2019
- Three times a winner of the Bulent Kerim Altay Prize, awarded to students with a GPA of 4.00/4.00 per semester.

AdimODTU undergraduate research project financial support 2019

- Awarded the AdimODTU undergraduate research project financial support for our work on deep-learning based high-quality microwave imaging.

Admitted to Amgen Scholars European Program 2018

- Full financial support for research internships at ETH Zurich for 20 students in Europe.

Ranked 197th nationally in the University Entrance Examination in Turkey 2015

- Among 2 million participants.

Professional Activities

- Reviewer:

  - IEEE Transactions on Medical Imaging
  - International Conference on Machine Learning (ICML)
  - Medical Image Computing and Computer Assisted Intervention (MICCAI)
  - Conference on Neural Information Processing Systems (NeurIPS)
  - International Conference on Learning Representations (ICLR)
  - Association for Computational Linguistics (ACL)

- Program Committee Member:

  - ICML Workshop on Knowledge and Logical Reasoning in the Era of Data-Driven Learning

- Talks:

  - Greedy Learning for Large-Scale Neural MRI Reconstruction, NeurIPS 2021 Workshop on Deep Learning and Inverse Problems

- Mentored undergraduate students with the Caltech Summer Undergraduate Research Fellowships (SURF) program (2021-Present)

Other Interests

- Published a news feature on COVID-19 testing in SIAM News:
Donoho, D., Lotfi, M., **Ozturkler, B. M.**, "The Mathematics of Mass Testing for COVID-19", SIAM News, July/August 2020. https://sinews.siam.org/Details-Page/the-mathematics-of-mass-testing-for-covid-19