

# Batu Ozturkler

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## RESEARCH INTERESTS

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My interests are efficient and robust deep learning for Medical/Computational Imaging, 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

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### Stanford University

Sep 2019 – present

*Ph.D. candidate in Electrical Engineering; GPA: 3.99/4.00*

*Stanford, CA*

- Advisor: Prof. John Pauly and Prof. Mert Pilanci
- Graduation Date: 12/2023

### 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

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### Research Assistant

Sep 2019 – Present

*Magnetic Resonance Systems Research Laboratory at Stanford University (MRSRL)*

*Stanford, CA*

- Developed memory-efficient learning techniques for high-dimensional compressed-sensing MRI reconstruction with unrolled neural networks
- Worked on equivalent convex formulations to non-convex neural networks to enable robustness, interpretability, and convergence guarantees
- Developed a semi-supervised physics-driven augmentation framework for MRI reconstruction that improves robustness to signal-to-noise ratio change and motion corruption during acquisition

### 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

### Research Intern

June 2022 – Aug. 2022

*Microsoft Research*

*Redmond, WA*

- Worked on identifying failure modes of in-context learning with Large Language Models (LLMs) such as GPT-3
- 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

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1. Oscanoa, J. A., Ong, F., Iyer, S.S., Li, Z., Sandino, C. M., **Ozturkler, B.M.**, Ennis, D.B., Pilanci, M., Vasanaawala, S. Coil Sketching for Computationally-efficient MRI Iterative Reconstruction (accepted, **Magnetic Resonance in Medicine**), 2023
2. Desai, A. D.\*, **Ozturkler, B. M.\***, Sandino, C. M., Vasanaawala, S., Hargreaves, B. A., Re, C. M., Pauly, J.M and Chaudhari, A. S. (\* equal contribution) Noise2Recon: A Semi-Supervised Framework for Joint MRI Reconstruction and Denoising, **Magnetic Resonance in Medicine**, 2023. <https://arxiv.org/abs/2110.00075>.
3. **Ozturkler, B. M.**, Sahiner, A., Ergen, T., Desai, A. D., Sandino, C. M., Vasanaawala, 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

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1. **Ozturkler, B.M.**, Mardani, M., Vahdat, A., Kautz, J., Pauly, J. RED-diff: Regularization by Denoising Diffusion Process for MRI Reconstruction, **MIDL 2023** (short paper). <https://openreview.net/forum?id=M1V498MXelq>
2. **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)
3. **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>
4. Sahiner, A., Ergen, T., **Ozturkler, B.M.**, Pauly, J., Mardani, M. and Pilanci, M. Scaling Convex Neural Networks with Burer-Monteiro Factorization. (in submission, 2023)
5. Gupta, A., **Ozturkler, B. M.**, Sahiner, A., Ergen, T., Desai, A. D., Vasanaawala, 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., Vasanaawala, 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., Vasanaawala, 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., Vasanaawala, 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., Vasanaawala, 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., Vasanaawala, 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.

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## TECHNICAL SKILLS

**Languages:** Python, MATLAB, R, C/C++

**Deep Learning Libraries:** PyTorch, TensorFlow, Jax

**Other:** Git,  $\LaTeX$ , Docker, Google Cloud Platform, Microsoft Azure, Statistical Parametric Mapping (SPM), LABVIEW, Field-II, Key Creator, Lt Spice, Agilent Vee, Quartus 2, Verilog

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## 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.
- Three times a winner of the Bulent Kerim Altay Prize-METU: Awarded to students with a GPA of 4.00/4.00 per semester
- 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
- Ranked 197<sup>th</sup> nationally in the University Entrance Examination in Turkey among 2 million participants

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## 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)
- 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

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- 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>