

Di An

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Research Interests

Inverse problems and sparse recovery; computational imaging; generative modeling (diffusion, flow matching, autoregressive); attention mechanisms in measurement space; emerging interest in physics-constrained latent dynamics and world models.

Education

Johns Hopkins University, Baltimore, MD 2023 – Present

Ph.D. in Electrical & Computer Engineering

Advisor: Prof. Trac D. Tran

Selected Coursework: Optimization in Data Science, Matrix Analysis, Random Matrix Theory, Probability Theory, Equivariant Machine Learning, Compressed Sensing, Wavelets

University of Southern California, Los Angeles, CA 2021 – 2023

M.S. in Electrical & Computer Engineering

Honor Student

Advisor: Prof. Justin P. Haldar

Xi'an Jiaotong University, Xi'an, China 2016 – 2020

B.S. in Automation

Publications

- C. Cheng, L. Song, **D. An**, Y. Xiao, X. Zhang, H. Sun, Y. Shan. “From Prediction to Perfection: Introducing Refinement to Autoregressive Image Generation.” *International Conference on Learning Representations (ICLR)*, 2026.
- **D. An**, D. Poppert, J. Li, M. Foster, T. D. Tran. “TRUST: Transformer-Driven U-Net for Sparse Target Recovery.” *Under review at ICLR*, 2026. arXiv:2506.01112.
- J. Li, **D. An**, M. Foster, T. D. Tran, *et al.* “A Minimally-Invasive Lensless Epi-Fluorescent Microendoscope Leveraging Learned Sensing.” *Under review at Optica*, 2025.
- **D. An**, D. Poppert, J. Li, J. Pham, B. Sun, M. Foster, T. D. Tran. “Region-of-Interest Sparse Reconstruction for Lensless Coded-Aperture Optical Imaging.” *59th Asilomar Conference on Signals, Systems, and Computers*, 2025, pp. 1517–1521.
- D. Poppert, **D. An**, T. D. Tran. “Attention Networks for Spotlight SAR Motion Compensation.” *59th Asilomar Conference on Signals, Systems, and Computers*, 2025.
- D. Poppert, **D. An**, E. D. Jansing, T. D. Tran. “Motion Compensation for Synthetic Aperture Radar with the Vision Transformer.” *IEEE International Geoscience and Remote Sensing Symposium (IGARSS)*, 2025.
- J. Wang, **D. An**, J. P. Haldar. “The ‘hidden noise’ problem in MR image reconstruction.” *Magnetic Resonance in Medicine*, vol. 92, no. 3, pp. 982–996, 2024. *Selected as MRM Highlights, 2025.*
- J. Wang, **D. An**, J. P. Haldar. “The problem of hidden noise in MR image reconstruction.” *Proc. International Society for Magnetic Resonance in Medicine (ISMRM)*, 2023.

Research Experience

Attention-Guided Sparse Recovery, Johns Hopkins University 2024 – Present

Graduate Research Assistant (Advisor: Prof. Trac D. Tran)

- Formulated an attention-guided sparse recovery framework: proved that self-attention computed on measurements y approximates attention on the underlying signal x under RIP-style conditions, yielding a bound on attention error; verified the result empirically across orthonormal, tall, fat, and locally structured sensing matrices.
- Designed **TRUST**, a hybrid ViT-encoder/U-Net-decoder with adaptive pooling and attention-guided skip connections that couples global support estimation with local detail refinement.
- Achieved consistent gains over U-Net, TransUNet, and Restormer across ImageNet-mask, FastMRI, and fiber microendoscope datasets; reduced hallucinations while maintaining competitive latency.

Lensless Epi-Fluorescent Microendoscopy, Johns Hopkins University Sep 2023 – Present

Graduate Research Assistant (Advisors: Prof. Trac D. Tran & Prof. Mark A. Foster)

- Developed calibration-free sparse recovery (ElasticNet for sensing-matrix estimation, OMP for reconstruction) for fluorescence imaging through coded-aperture optics.
- Designed learning-based reconstruction pipelines that achieve $\sim 10\times$ speedup over iterative baselines with higher image quality and fewer hallucinations.
- Extended the framework to region-of-interest reconstruction to enable real-time neuron imaging in deep-brain applications.

Refinement for Autoregressive Image Generation (TensorAR / AGR), Tencent, 2024 – Present
Shenzhen

Research Collaborator (with Cheng Cheng)

- Reformulated AR generation as a Markov process over *overlapping tensors* and derived the next-tensor factorization, enabling iterative refinement while preserving causal masking.
- Designed a *discrete tensor noising* scheme (token-wise schedules, padding-safe targets, ignored-loss masks) that eliminates copy-through leakage across overlaps; connected the mechanism to discrete diffusion via a weighted cross-entropy objective derived from categorical forward/posteriors.
- Ongoing work explores a bidirectional refiner attached to open-source AR backbones (VAR/MAR/HART-style), targeting near-training-free deployment for video extension.

Noise-Aware MRI Reconstruction, University of Southern California

May 2022 – May 2023

Research Assistant, Biomedical Imaging Group (Advisor: Prof. Justin P. Haldar)

- Revealed the **hidden-noise** pitfall: rSoS “reference” images bias full-reference metrics (RMSE/SSIM), leading to mis-ranked reconstructions and suboptimal tuning.
- Derived a **noncentral-chi error (NCE)** metric from the NCC negative log-likelihood with effective $(\tilde{L}, \tilde{\sigma})$ for non-prewhitened data; added a zero-point normalization for cross-scan comparability.
- Implemented parameter estimation from background (“noise-only”) regions and validated NCE against averaged/denoised clean targets vs. single-average noisy targets, improving hyperparameter selection over noisy RMSE/SSIM.

Teaching Experience

Teaching Assistant, EN.520.651 *Random Signal Analysis*, Johns Hopkins University Fall 2024, Fall 2025

- Led discussion sections, designed and graded problem sets and exams, and held weekly office hours for graduate students.

Technical Skills

Programming: Python (PyTorch, NumPy, SciPy), MATLAB, C/C++

Methods: Optimization, sparse recovery, signal processing, generative modeling, deep learning

Tools: Linux, Git, L^AT_EX, CUDA, multi-GPU training (DDP)