(Sonia) Minseo Kim

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RESEARCH INTEREST

I am broadly interested in imaging, such as image processing and computational imaging algorithms, medical imaging, optical imaging, astronomical imaging, etc.

EDUCATION

Stanford University Stanford, CA
M.S. in Electrical Engineering *Sept 2024 – April 2026*
GPA: 4.0/4.0

- **Depth area:** Signal Processing, Control and Optimization
- **Breadth area:** Physical Technology and Science
- **Course Highlights:** Modern Optics, Computational Imaging, Virtual Reality, Sensing for Autonomy

University of Michigan Ann Arbor, MI
B.S.E. in Electrical Engineering & B.S.E. in Data Science with Honors, Minor in Mathematics *Sept 2021 - May 2024*
Summa Cum Laude

- **Honors/Awards:** Admitted to College of Engineering Honors Program, all terms University Honors & Dean's List (GPA higher than 3.5), William J. Branstrom Freshman Prize (awarded to top 5% of freshman class - Fall 2021)
- **Course Highlights:** Matrix Methods for Signal Processing, Deep Learning, Computer Vision, Bayesian Statistics

WORK EXPERIENCE

Zoox, Inc. (Amazon's autonomous vehicle subsidiary) Foster City, CA
Digital Signal Processing Intern in Advanced Hardware Engineering Team *May 2024 – Aug 2024*

- Engineered multimodal AI models (PANN, AudioCLIP, ImageBind, etc.) to mine audio data based on text queries
- Developed an intuitive front-end search engine for a text-based audio mining system
- Preprocessed vehicle data with advanced DSP techniques, including filtering and noise suppression algorithms
- Implemented a fast and efficient decoder network for the UnO system, predicting future 3D occupancy using past LiDAR scans and a ResNet-processed 2D feature map

RESEARCH EXPERIENCE

Professor Gordon Wetzstein's Research Group Stanford, CA
Graduate Researcher in the Department of Electrical Engineering *Sept 2024 – Present*

- Developing advanced algorithms for more accurate and efficient posterior sampling method
- M.Kim, A.Levy, G.Wetzstein, "Dual Ascent Diffusion for Inverse Problems", under review, 2025. (Project website)
- Designed an interactive course assignment for EE 367: Computational Imaging (Winter 2025) on diffusion models for solving inverse problems with hands-on experimentation on posterior sampling methods and diverse applications

Professor Jeffrey A. Fessler's Research Group Ann Arbor, MI
Undergraduate Researcher in the Department of Electrical Engineering and Computer Science

Multiscale Wavelet Diffusion Model for Complex-valued Looping Star MRI Reconstruction *July 2024 – Present*

- Developing a Wavelet Score-based Generative Model (WSGM) to efficiently reconstruct undersampled MRI images by leveraging wavelet transforms across scales, improving time complexity with consistent time steps
- M.Kim, Z,Li, H.Xiang, and J.A.Fessler, "Multiscale Wavelet Diffusion Model for Complex-valued Looping Star MRI Reconstruction", in conference paper preparation to Neurips Workshop, 2025.

Deep Learning Models for Undersampled MRI (Honors capstone final report) *May 2023 – May 2024*

- Leveraged deep learning techniques by implementing a score-based diffusion model with diffusion posterior sampling to improve the reconstruction quality of undersampled MRI data (utilized fastMRI kspace dataset)
- Presented with a 30-minute mini symposium at the 2023 SIAM Great Lakes Conference
- Received an Honorable Mention Award at the 2024 Michigan Student Symposium for Interdisciplinary Statistical Sciences

Julia Software for Image Reconstruction *Dec 2021 – Apr 2023*

- Implemented 2D branchless distance-driven forward projection and backprojection algorithm for computed tomography (CT) reconstruction using the Julia language
- Implementation merged to the official JuliaImageRecon/Sinograms.jl package for public use (see documentation)
- Converted the code into PyTorch, now released as part of MIRTorch
- G.Wang, N.Shah, K.Zhu, T.Luo, N.Murthy, Z.Li, M.Kim, D.C.Noll, and J.A.Fessler, "MIRTorch: An Open Source PyTorch-based Differentiable Image Reconstruction Toolbox", under review at JOSS, 2024.

Professor Lia Corrales' Research Group Ann Arbor, MI

Undergraduate Researcher in the Department of Astronomy *Oct 2022 – May 2024*

- Designed the double interstellar dust scattering physics model and developed mathematical proofs to derive halo intensity using analytic and numerical methods
- Implemented the method in Astropy and applied the algorithm to data collected by the Chandra X-ray Observatory

COURSE PROJECT EXPERIENCE

EE 267: Virtual Reality (Final report) Spring 2025

- Adapted parallax attention architecture for consistent stereo image inpainting
- Trained on 48k stereo image pairs from Flickr1024 dataset and tested on 1k stereo image pairs from KITTI2012 dataset

PSYCH 221: Image Systems Engineering Fall 2024

- Developed digital twins of optical systems by comparing polynomial-based RTFs with MLPs for accurate ray mapping
- Generated ray data using Zemax and trained machine learning models to improve generalization in optical system simulations

EE 236A: Modern Optics Fall 2024

- Simulated JWST's Optical Telescope Element (OTE) in Zemax to analyze aberrations and optimize infrared imaging quality
- Modeled segmented mirrors and TMA architecture to evaluate imaging performance and stability

EECS 452: Digital Signal Processing Design Lab (Final report) Winter 2024

- Designed a low-cost embedded real-time motion capture system that can accurately localize and track points in 3D space
- Implemented Unscented Kalman Filter for 3D marker reconstruction and image processing algorithms to identify markers

EECS 442: Computer Vision Fall 2023

- Implemented deep learning architectures, Mask R-CNN and UNet, to deblend and classify galaxy, stars, and cosmic rays in simulated astronomical images
- Evaluated the network using test and validation data sets, and quantified the performance using precision-recall and AP

EECS 351: Digital Signal Processing and Analysis (Project website) Winter 2023

- Implemented algorithms for the noisy matrix completion (a.k.a. image inpainting) problem using optimization methods
- Low-rank matrix completion with pre-designed dictionaries and deep learning methods, e.g., diffusion models and GAN

EECS 281: Data Structures and Algorithms Winter 2023

- Graph search and route tracing using breadth first search and depth first search
- Silly SQL: simplified SQL implemented in C++ using hash tables
- Implemented optimization algorithms, e.g., Traveling Salesperson and Knapsack, using dynamic programming

SKILLS

Software skills: C, C++, Python (PyTorch, Astropy, scikit-learn), MATLAB, Julia, SQL, JavaScript, MongoDB, R, HTML, CSS, UNIX, CAD, Altium, Simulink, LTspice, VSCode, Git, LaTeX, Protobuf, Bazel, Zemax
Hardware skills: Circuit Design, Vector Network Analyzer, Oscilloscope, Logic Analyzer, Microcontrollers
Native/Bilingual Proficiency: English, Korean, Chinese