Bilal Ahmed

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RESEARCH INTERESTS

Generative models (diffusion: score-based, latent; flow models), emerging generative approaches such as Drifting models, multi-modal representation learning, computational imaging, and audio/speech modeling.

EDUCATION

Purdue University, PhD candidate — Aug. 2021 – Aug. 2026 (Expected)
Elmore Family School of Electrical and Computer Engineering. — GPA: 3.88/4.0
Advisor: Dr. Joseph G. Makin

University of Engineering & Technology Lahore — Aug. 2011 – Jun. 2015
B.Sc. in Electrical Engineering (Rank: 3/240) — GPA: 3.85/4.0

PROJECTS

Diffusion Prior for Neural Population Control in Auditory Cortex
Developing a diffusion-prior-based method for solving an inverse problem: generating optimal stimuli for neurons in the auditory cortex. Collaborating with a non-human primate lab to test synthetic stimuli in a closed-loop setup. Enables validation of auditory cortex encoding models and reveals neuronal tuning preferences.

Diffusion Prior for Solving Inverse Problems
Developed a restart sampling method for solving inverse problems with diffusion priors, demonstrated on image restoration tasks. The algorithm interleaves conditioned ODEs with intermittent restarts, benefiting from the low-discretization error of ODEs and the error contraction induced by stochasticity. Demonstrated faster convergence and higher-quality samples than state-of-the-art methods.

Modeling the Auditory Cortex Using Speech Recognition Models
Studied deep neural networks as candidate encoding models of the auditory cortex. Analyzed six models varying in architecture and training objectives, and demonstrated that task-optimized DNNs predict neural spiking activity more accurately than traditional spectro-temporal filters.

PUBLICATIONS/PREPRINTS

Solving Diffusion Inverse Problems with Restart Posterior Sampling
Bilal Ahmed, Joseph G. Makin
arXiv (submitted for review)

Deep Neural Networks Explain Spiking Activity in Auditory Cortex
Bilal Ahmed, Joshua D. Downer, Brian J. Malone, Joseph G. Makin
PLOS Computational Biology, 2025.

WORK EXPERIENCE

Research Assistant — Aug. 2025 – Present
Advisor: Dr. Joseph G. Makin
Purdue University

Teaching Assistant, Generative Models, (ECE 60131) — Aug. 2025 – Dec. 2025
Instructor: Dr. Joseph G. Makin
Purdue University

Teaching Assistant, Generative Models, (ECE 60131) Jan. 2024 – May 2024
Instructor: Dr. Joseph G. Makin
Purdue University

Instrumentation & Control Engineer Sep. 2015 – Jul. 2021
Manager: Majid Haneef
Fauji Fertilizer Company Limited, Pakistan

Research Intern Jul. 2014 – Sep. 2014
Manager: Dr. Waqar Mahmood
Al-Khawarizmi Institute of Comupter Science, UET Lahore, Pakistan

Skills

Tools	PyTorch, PyTorch Lightning, Python, MATLAB, C/C++, Linux, LaTeX, Pandas
Expertise	Diffusion & Flow Generative Models, ASR, TTS, Computational Imaging, Computer Vision, Neuroscience