Soham Mukherjee

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Work Experience

AI Research Scientist, *Cadence Design Systems – San Jose, CA* — Feb 2024 - Present
- Designed and deployed a sequence-to-sequence **Transformer** pipeline that automatically parsed raw Spectre and regression logs into structured summaries. The system replaced brittle regex scripts with learned representations, hitting over **90%** accuracy and saving hours of manual debug per project cycle.
- Fine-tuned a domain-adapted **LLM** to generate synthetic analog circuit netlists and design variants conditioned on performance targets. This synthetic data pipeline improved generalization on sparse design spaces.
- Set up scalable ML Ops pipelines to train and serve **GNNs** on hundreds of large analog circuit graphs (up to **300K** nodes each) using distributed GPUs. Built reusable experiment tracking, dataset versioning, and containerized deployments for fast iteration across architectures.
- Prototyped a **multimodal framework** that fuses graph embeddings, log embeddings, and state-space models into a unified predictor for circuit behavior. This approach links textual failure patterns to graph-structural anomalies in real time and makes debugging far more interpretable.

AI Research Intern, *IBM TJ Watson – Yorktown Heights, NY* — May 2022 - Aug 2022
- Graph generation with geometrical and topological constraints.

AI Engineering Intern, *Physna Inc. – Columbus, OH* — May 2021 - Aug 2021
- Deployed CNNs to predict 3D computer-aided design (CAD) models from 2D images.
- Automated segmentation and registration of point-cloud data obtained from scanning machine parts enabling efficient and accurate inspection.

Education

PhD Computer Science | **Purdue University** *(Awarded Scholarship)* — Aug 2020 - Dec 2023
Relevant Coursework : Machine Learning, Deep Learning, Gen AI

MS Computer Science | **Ohio State University** — Aug 2017 - Jul 2020

BE Electronics & Telecommunication | **Jadavpur University** *(Gold Medalist)* — Aug 2013 - Aug 2017

Skills

Languages: Python, C/C++ , Java

Framework: PyTorch, Pytorch-Geometric, Tensorflow, Keras, HuggingFace

Deep Learning & GenAI: GNN, Neural Operators, Contrastive Learning, Computer Vision, NLP, Attention Networks, Transformers, Diffusion Models, Large Language Model (LLM) finetuning & evaluations, Agentic AI, Multimodal Framework.

Selected Patents & Publications

1. Mukherjee, Soham, Karthikeyan Natesan Ramamurthy, and Payel Das. Generative Modeling with Topological Control. U.S. Patent P202203186US01, 2025 (Filed).

2. Hajij, Mustafa, et al. 'Topological Deep Learning: Going Beyond Graph Data'. arXiv Preprint arXiv:2206. 00606, 2023.

3. Mukherjee, Soham, Shreyas N. Samaga, et al. 'D-GRIL: End-to-End Topological Learning with 2-Parameter Persistence'. arXiv Preprint arXiv:2406. 07100, 2024.

4. Xin, Cheng, et al. 'GRIL: A 2-Parameter Persistence Based Vectorization for Machine Learning'. Proceedings of 2nd Annual Workshop on Topology, Algebra, and Geometry in Machine Learning (TAG-ML), vol. 221, 333, 2023, p. 313.

5. Zhang, Simon, et al. 'GEFL: Extended Filtration Learning for Graph Classification'. Learning on Graphs Conference, PMLR, 2022, pp. 16–11.

Full publication list is available on Google Scholar.

Projects

Agentic AI-Powered Workforce Assistants
- Developed autonomous AI agents that seamlessly integrate with employees' workflow tools (Slack, Jira, email, etc.) to autonomously manage routine tasks such as scheduling meetings, summarizing lengthy documents, organizing tasks, and proactively anticipating and resolving productivity bottlenecks.

Multi-Modal AI Chatbot for Health Insights
- Built a context-aware **multimodal chatbot using LLMs** and Pinecone retrieval to generate conversational answers from text and images. Designed an end-to-end chatbot with query reformulation, citation handling, and conversation memory.

Fine-Tuning Diffusion Models for Text-to-Image Generation
- Fine-tuned Stable Diffusion (SDXL) with **LoRA** on a custom dataset to improve image quality and prompt alignment.
- Evaluated performance using Inception and CLIP scores, boosting text-image coherence and visual fidelity.