# Soham Mukherjee

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## Work Experience

**Research Scientist**, Cadence Design Systems, Inc. – San Jose, CA — Feb 2024 – Present

- Integrated GNN-based models into ML pipelines to enable simulations for circuits with variable topologies.
- Proposed, implemented, and tested a novel Fourier Neural Operator model for circuit simulation.
- Prototyped Multimodal framework based models for predicting post-layout circuit behavior.

**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 2022 - Aug 2022

- 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

**Purdue University**, PhD in Computer Science — 2020 – 2024

**Thesis:** Unveiling patterns in data - harnessing computational topology for machine learning

**The Ohio State University**, Masters in Computer Science and Engineering — 2017 – 2020

**Jadavpur University**, Bachelor of Electronics & Telecommunication Engineering — 2013 – 2017

## Skills

**Languages:** Python, C/C++ , Java

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

**Deep Learning & GenAI:** Graph Neural Networks, Neural Operators, Contrastive Learning, Computer Vision, Natural Language Processing, Attention Networks, Transformers, Diffusion Models

## 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.
6. Dey, Tamal K., et al. 'Gene Expression Data Classification Using Topology and Machine Learning Models'. BMC Bioinformatics, vol. 22, no. Suppl 10, BioMed Central London, 2021, p. 627.
7. Mukherjee, Soham, Darren Wethington, et al. 'Determining Clinically Relevant Features in Cytometry Data Using Persistent Homology'. PLoS Computational Biology, vol. 18, no. 3, Public Library of Science San Francisco, CA USA, 2022, p. e1009931.
8. Mukherjee, Soham. 'Denoising with Discrete Morse Theory'. The Visual Computer, vol. 37, no. 9, Springer Berlin Heidelberg Berlin/Heidelberg, 2021, pp. 2883–2894.