Soham Mukherjee

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Education

Purdue University — West Lafayette, IN, USA
PhD. Student, Advisor: Tamal K .Dey — Aug 2020 –Aug 2023 (Expected)

The Ohio State University — Columbus, OH, USA
MS in CSE, GPA: 3.94/4.00 — Aug 2017 –Jul 2020

- Transferred to Purdue with Prof. Tamal K Dey

Jadavpur University — Kolkata, India
B.E. in ECE, GPA: 9.51/10.00 — Aug 2013 –Jul 2017

- Thesis: "FPGA Implementation of Stochastic Circuit"

Experience

Purdue University — West Lafayette, IN, USA
Graduate Research Assistant — Aug 2020 - Aug 2023 (Expected)

- TopGraph: A Topological Graph Neural Network Layer

IBM Research — Yorktown Heights, NY, USA
Research Intern — May 2022 - Aug 2022

- Graph generation with geometrical and topological constraints

Physna Inc. — Columbus, OH, USA
Engineering Intern — May 2021 - Aug 2021

- Predicting 3D CAD models from 2D images

The Ohio State University — Columbus, OH, USA
M.S. in Computer Science — Aug 2017 - Jul 2020

- Gene-expression classification using persistent cycles
- Denoising with Discrete Morse Theory

Georg-August Universität Göttingen — Göttingen, Germany
Summer Intern — May 2016 - Jul 2016

- Evaluation of Waspmote Cryptography

Jadavpur University — Kolkata, India
Undergraduate Researcher — Aug 2013 - Jul 2017

- FPGA Implementation of Stochastic Circuits

Publications

[1] S. Mukherjee, D. Wethington, T. K. Dey, and J. Das, "Determining clinically relevant features in cytometry data using persistent homology", *arXiv preprint arXiv:2203.06263*, 2022.

[2] S. Mukherjee, "Denoising with discrete morse theory", *The Visual Computer*, Jul. 2021, ISSN: 1432-2315.

Skills

- **Machine Learning:** Machine Learning on Graphs, Neural Networks
- **Data Analysis:** Topological Data Analysis, Morse Theory
- **Code:** C++, Python, Matlab
- **Skill Group:** PyTorch, PyTorch-Geometric, Tensorflow, Keras

Projects

TopGraph: A Topological Graph Neural Network Layer

In recent years, graph neural networks have shown great advantages in processing graph data and have been widely applied in many downstream fields. However, in practical applications, the acquisition of labeled data requires a large amount of resources and high cost. Therefore, how to improve the performance of the model with limited training data has always been the research focus. With the help of Persistent homology, a tool from computational topology we computed persistent diagrams of graphs and show that in scenarios where training data is limited our model, in general, performs better.

Denoising with Discrete Morse Theory

Denoising noisy datasets is a crucial task in this data-driven world. In this paper, we develop a persistence-guided discrete Morse theoretic denoising framework. We use our method to denoise point clouds and to extract surfaces from noisy volumes. In addition, we show that our method generally outperforms standard methods. Our paper is a synergy of classical noise removal techniques and topological data analysis.

Scholarships and Awards

- OSU CSE Departmental Fellowship 2017–2018
- University Bronze Medal 2017
- DAAD Scholarship 2016

Extracurricular Activities

- IEEE CodeCafe mentor 2021, 2022
  Mentor for beginner level Python course
- Joint President of Buckeye Bengalis 2019–2020
  Enhancing cultural diversity at OSU by introducing a glimpse of Bengali culture.