SOHAM MUKHERJEE

Ph.D. Candidate - Computer Science

CONTACT

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My Homepage

SKILLS

TDA	5+ yrs
Machine Learning	3+ yrs
Deep Learning	3+ yrs
ML on graphs	3+ yrs
Python	3+ yrs
C++	4+ yrs
Teaching	3+ yrs

EDUCATION

Ph. D. - Computer Science — **2020 - 2023**
Purdue University - West Lafayette, IN (USA)

Current Status: Submitting thesis titled "Computational topology and its applications in Deep Learning"

M. S. - Computer Science & Engineering — **2017 - 2020**
The Ohio State University - Columbus, OH (USA)

Passed with **3.71 CGPA**. Used computational topology and ML tools to analyze data and test hypotheses.

B. E. - Electronics & Telecommunication Engineering — **2013 - 2017**
Jadavpur University - Kolkata (India)

Passed with **9.51 CGPA**. Major project was FPGA implementation of stochastic circuits.

WORK EXPERIENCE

Research Intern — **May 22 - Aug 22**
IBM Research, Pleasantville (NY)

Partnered with research team to develop geometry constrained molecular graphs with generative graph models.

Engineering Intern — **May 21 - Aug 21**
Physna Inc., Columbus (OH)

Fine tuned and deployed state of the art ML models to predict 3D CAD models from 2D images.

PUBLICATIONS

A 2-parameter Persistence Layer for Learning — **2023**
OpenReview, 2023

GEFL: Extended Filtration Learning for Graph Classification — **2022**
PMLR (ISSN: 2640-3498) Vol 198, Issue 16, 2022

Determining clinically relevant features in cytometry data using persistent homology — **2022**
PCB (ISSN: 2883-2894) Vol 18, Issue 1-22, 2022

Denoising with discrete Morse theory — **2021**
TVC (ISSN: 2883-2894) Vol 37, Issue 9-11, 2021

Gene expression data classification using topology and machine learning models — **2020**
BMC Bioinformatics (ISSN: 1471-2105) Vol 22, Issue 10, 2021

ACHIEVEMENTS

Graduate

OSU CSE Departmental Fellowship
Received prestigious CSE departmental fellowship at the Ohio State University as a PhD student.

Undergraduate

University Bronze Medal
Received prestigious bronze medal from Jadavpur University for being 2nd in the ETCE department.

Scholarship

DAAD
Received DAAD scholarship during my 3rd year of undergrad to participate in research internship at Georg-August-Universität-Göttingen, Germany.

PROJECTS

Extended filtration learning for graph classification **2023**
Tool: Pytorch, Pytorch geometric

We introduce extended persistence, a tool from TDA, that incorporates global multiscale information into a supervised learning framework for graph classification.

A 2-parameter persistence layer for learning **2023**
Tool: Pytorch, Persistent Homology

To enrich representations of topological features into machine learning models, we introduce a novel vectorization on 2-parameter persistence modules called Generalized Rank Invariant Landscape.

Determining clinically relevant features in cytometry data using persistent homology **2022**
Tool: Python, Persistent Homology

Cytometry experiments yield high-dimensional point cloud data that is difficult to interpret manually. We use tools of TDA, namely persistent homology and xgboost classifier to find out structural differences in Covid-19 infected patients and healthy individuals.

A Jacobi-set based loss function for segmentation task **2021**
Tool: Pytorch

Segmentation of fine-scale structures in natural and bio-medical images are gaining importance with the development of high resolution electron microscopy images. The task still remains challenging as per-pixel accuracy is not only the metric of concern because of the imbalance in the dataset. In this project, a new loss function based on the Jacobi-sets are proposed.

Evaluation of Waspmote crypography **2016**
Tool: TinyOS

The scope of this project supported by DAAD was to benchmark the cryptography modules included in the Waspmote platform, port TinyOS crypto implementations to Waspmote, finally comparing the performance of both the implementations to the values given in the official Waspmote documentation.

EXTRACURRICULAR

- Elected president of **Buckeye-Bengalis**, a Bengali community in Columbus, OH, USA.
- Volunteered to mentor budding coders in **IEEE Code Café** in 2021, 2022 at Purdue University.