

Shrunal Pothagoni

Email: shrunal.pothagoni@gmail.com Mobile: 703-470-1144 Github: github.com/Shrunalp

EDUCATION

- **George Mason University** Fairfax, Virginia
Doctorate of Philosophy - Mathematics August 2022 - May 2026
- **George Mason University** Fairfax, Virginia
Bachelor of Science - Mathematics with honors August 2018 - May 2022

RESEARCH INTERESTS

- Research interests lie in the intersection of computational geometry and machine learning. Specifically, I am interested in the use of deep learning to study data that has interesting and rich geometric or topological structure.

SELECTED PUBLICATIONS

- **S. Pothagoni**, D. Miley, J. K. Mason, T. Berry, B. Schweinhart. "Deep Learning of Material Microstructure through Spectral Embedding Based Representations" (**In Review**)
- A. Krishna Vajjala, D. Meher, **S. Pothagoni**, Z. Zhu, and D. Rosenblum. "Vietoris-Rips Complex: A New Direction for Cross-Domain Cold-Start Recommendation." In Proceedings of the SIAM International Conference on Data Mining (SDM 2024), Houston, TX, U.S. 18th-20th April, 2024. (29.2% acceptance rate).

RESEARCH EXPERIENCE

- **George Mason University** August 2022 - Present
Graduate Research Assistant Fairfax, Virginia
 - (**Research Project**) **Persistent Convolution for Histopathology Image Classification**
 - * Used computation topology to process images of histopathology slides to synthesize the local geometry in the image.
 - * Implemented a deep CNN to detect cancerous tissue growth on TensorFlow.
 - * Achieved a performance increase of over 15% against pre-existing methods for histopathology classification.
 - * Utilized Python and Tensorflow for algorithm development, executing computations on the Nvidia A100 GPU.
 - (**Research Project**) **Vietoris-Rips Complex for Cross-Domain Cold-Start Recommendation**
 - * Used tools in computational geometry in conjunction with deep learning to transfer user preferences across domains for personalized recommendations in new user profiles.
 - * Achieved a performance increase of over 20% in extreme cold-start scenarios, surpassing leading methods.
 - * Employed 5-fold cross-validation for hyper-parameter tuning to improve model performance on unseen data.
- **NSF Collaborative Research: EAGER-ADAPT** January 2023 - Present
Research Assistant Davis, CA
 - (**Research Project**) **Charting the Space of Material Microstructures Using Deep Learning Models**
 - * Defined, implemented, and optimized a physically-motivated metric to evaluate the similarity of windows.
 - * Enriched micrographs with spatial data fields, augmenting the input to deep CNNs to predict material properties.
 - * Utilized Python and Tensorflow for training the deep CNN with a Nvidia A100 GPU for computational speedup.
 - * Achieved a performance increase of over 40% against existing methodologies for deep learning material micrographs.
- **Center for Mathematics and Artificial Intelligence - CMAI** May 2022 - August 2022
Research Intern Fairfax, Virginia
 - (**Research Project**) **Shape Optimization Using Machine Learning**
 - * Developed a theoretical framework for solving a class of PDEs for shape optimization based applications.
 - * Employed a Pytorch based wrapper known as Hessquik to train a DNN to find numerical solutions for the set of PDEs.
 - * Used the outputted gradient values of the DNN in conjunction with Armijo line search for shape optimization based applications.

MENTORING

- **Mason Experimental Geometry Lab** August 2022 - Present
Graduate Research Mentor Fairfax, Virginia
 - **Topology of Neural Networks**
 - * Studied the topological complexity of data by tuning the hyper-parameters of the neural network.
 - * Lead a team of undergraduate and graduate students in implementing neural network architectures, visualizing numerical results, and developing heuristics.
 - **Random 3D Polyforms**
 - * Applied the Metropolis-Hastings Algorithm using Rust to create polyforms for geometric data analysis.
 - * Used batch computing resource known as HOPPER for computational speed up with OpenHPC 2.X's SLURM for job scheduling and resource management.

SKILLS SUMMARY

- **Languages** Python, MatLab, Mathematica, R, C/C++, Rust, SQL, L^AT_EX
- **Frameworks** Scikit, PyTorch, Pandas, TensorFlow, Keras, NumPy, Sklearn, Qiskit
- **Platforms** Kaggle, Weights & Biases, Linux, Windows, TexMaker, Matlab, Jupyter Notebook, Microsoft Office