

Padma Ragaleena Tanikella

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Education

Pennsylvania State University

Ph.D. in Statistics, 3.77/4.0

State College, USA

August 2021 – present

National Institute of Science Education and Research (HBNI)

M.Sc. (5-year integrated) in Mathematics, [INSPIRE scholar](#) 🏆

Bhubaneswar, India

Master's Thesis: [Selected topics in Multivariate Statistical Analysis](#)

July 2021

Technical Skills

Ordinary and Stochastic Differential Equations

[Fourth-order Runge-Kutta method](#) MATLAB

- Disease models, Spatial diffusion models
- Euler-Maruyama method, Runge Kutta methods
- Ornstein-Uhlenbeck and geometric Brownian motion models
- Simulation and emulation approaches for SDE inference

Machine Learning

[Skin lesion image analysis](#) 🤖 📊

- Classification: CNN, bagging, boosting, random forest, SVM.
- Clustering: Autoencoder, k-means, hierarchical clustering, and Gaussian mixture models.
- Deep learning: LSTM, GAN, and Boltzmann machines.

Experimental Design

[Analyzing blood PSA levels in prostate cancer](#) 📊

- A/B testing and sample size planning using power analysis.
- Single and multi-factor studies: ANOVA, ANCOVA, complete block designs, and modeling factor effects.
- Specialized designs: nested designs, repeated measures, BIBD, and latin squares.

Bayesian Statistics

[Hands-on with NIMBLE, PyMC, and RStan](#) 🤖 📊

- Bayesian posterior inference.
- Monte Carlo methods: Metropolis-Hastings, Gibbs sampling, and Hamiltonian.
- Dirichlet and Gaussian process-based methods.
- Numerical Linear Algebra
- Majorization-Minimization algorithms.

Causal Inference

[Old Faithful geyser data analysis](#) 📊

- LiNGAM and bi-variate Additive Noise Models (ANM)
- Structural equation models
- Potential outcomes and directed acyclic graph frameworks.
- Propensity score methods

Survival Analysis

[Incorporating functional covariates in Cox PH model](#) 📊

- Cox proportional hazards model.
- Kaplan-Meier survival curves.
- Survival analysis with functional covariates.

Research Experience

Modified Mapper Algorithm for fMRI Data

joint work with Nicole Lazar.

- Mapper algorithm is a popular technique in topological data analysis (TDA) introduced by Singh, Memoli, and Carlsson in 2007.
- Our project aims to preserve tensor structure by overcoming traditional Mapper's vectorization limitation for fMRI data.
- Performance gains observed by recasting Mapper graph computation method as a changepoint detection problem.
- Modified Mapper algorithm implemented in Python, using `numpy`, `pandas`, `matplotlib`, `gudhi`, `ripser`, and `persim`.
- Investigating theory of mind and neuromatrix of pain in fMRI data using our modified Mapper algorithm.

Multi-Scale Spatial Texture Characterization in Earth Systems

joint work with Sam Baugh, Tushar Mittal, and Ben Roycraft.

- Developing an integrated TDA-Bayesian approach to understand the influence of rock's texture on fluid flow and mineral reactions.
- Using persistence diagrams and Bayesian mixtures to extract multi-scale features; predicting fluid flow in porous geological materials.
- Attain multi-scale resolution and statistical reliability for analyzing geometric and topological structures in mineral images.
- Implementing high-performance C++ wrapper using `Rcpp` to detect pixel-level topological patterns in multi-mineral rock formations.

Presentations & Workshops

Workshop on Computational Topology (ComPer 2025)

Poster presentation

Albany, USA

October 2025

The Geometric Realization of AATRN

IMSI Workshop celebrating 10 years of the Applied Algebraic Topology Research Network.

Chicago, USA

August 2025

Joint Statistical Meetings (JSM 2025)

Short course: "Bayesian Time Series Analysis and Forecasting" by Marco Ferreira

Nashville, USA

August 2025

C.R. Rao Prize Conference

Poster presentation: [Modified Mapper](#) 📊

State College, USA

May 2025

Geometry and Topology meet Data Analysis and Machine Learning (GTDAML23)

Poster presentation: [Persistent Homology Computation](#) 📊

Boston, USA

June 2023

Seminar on Stochastic Processes (IMS SSP 2023)

Tutorial: "High dimensional random landscapes: topological and dynamical complexity" by Gérard Ben Arous

Tucson, USA

March 2023