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HAWAI'I DATA SCIENCE

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Bayesian Topological Learning for Complex Data Analysis

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Abstract: Persistent homology is a tool in topological data analysis for learning about the geometrical/topological structures in data by detecting different dimensional holes and summarizing their appearance disappearance scales in persistence diagrams. However, quantifying the uncertainty present in these summaries is challenging. In this talk, I will present a Bayesian framework for persistent homology by relying on the theory of point processes. This Bayesian model provides an effective, flexible, and noise-resilient scheme to analyze and classify complex datasets. A closed form of the posterior distribution of persistence diagrams based on a family of conjugate priors will be provided. The goal is to introduce a supervised machine learning algorithm using Bayes factors on the space of persistence diagrams. This framework is applicable to a wide variety of datasets. I will present an application to filament networks data classification of plant cells.

Bio: Farzana Nasrin graduated from Texas Tech University with a Ph.D. in Applied Mathematics in August 2018. Her research interests span algebraic topology, differential geometry, statistics, and machine learning. Currently, she is holding an assistant professor position at UH Manoa in the Department of Mathematics. Before coming to UHM, she was working as a postdoctoral research associate funded by the ARO in mathematical data science at UTK. She has been working on building novel learning tools that rely on the shape peculiarities of data with application to biology, materials science, neuroscience, and ophthalmology. Her dissertation involves the development of analytical tools for smooth shape reconstruction from noisy data and visualization tools for utilizing information from advanced imaging devices.

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