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Computing Multidimensional Persistent Homology

Abstract

Persistent homology is a popular tool in topological data analysis for discerning the shape of complex data. Persistent homology produces easily-visualized algebraic invariants called barcodes, and it has been applied to data in areas such as computer graphics, biology, neuroscience, and signal processing. However, ordinary persistent homology is sensitive to outliers in the data. A variant called multidimensional persistent homology is robust in the presence of outliers, but is algebraically complicated and difficult to compute and visualize. Despite the relevance of multidimensional persistent homology for the analysis of noisy data, efficient tools for using multidimensional persistent homology were not available until recently. I will describe current work to efficiently compute and visualize multidimensional persistent homology. This work has resulted in new data structures and algorithms for computing families of barcodes, and has produced a new software program, the Rank Invariant Visualization and Exploration Tool (RIVET), for two-dimensional persistent homology.