

## **Persistent homology in topological data analysis**

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*Abstract:* Extracting meaningful information from large data can be difficult if one doesn't know what to look for. The relatively new area of Topological Data Analysis helps analyze point cloud data when one doesn't know what questions to ask about it, and offers advantages such as insensitivity to scale, ability to operate in higher dimensions, and most of all, provides information about the shape of data. How can a computer identify points on a circle as representing a circle? Persistent homology lets one observe how long certain topological features 'persist' in a filtration of a simplicial complex (a nested sequence of increasing subsets): to determine the features that best represent the underlying data. Presented is a demonstration in MATLAB of this analysis on artificial 3D spherical data, and preliminary results on real data from a large lake monitoring study.