Cleveland State University
College of Science

COLLOQUIUM

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Using Topology to Measure Dynamics of Time-Varying Systems

Friday September 18th at 3pm on Zoom

https://csuohio.zoom.us/j/91945126460

Bio: Prof. Ziegelmeier received her Ph.D. from Colorado State University in 2013 under the direction of Prof. Michael Kirby and Prof. Chris Peterson. Prof. Ziegelmeier works in the area of geometric and topological data analysis, a burgeoning field of mathematics at the intersection of many mathematical topics: geometry, topology, linear algebra, optimization, computing, and machine learning. This field investigates the structure and shape of large data sets. She is particularly interested in developing and applying tools from computational geometry and topology to a wide variety of data sets from hyperspectral imagery to biological aggregations. Professor Ziegelmeier teaches courses in calculus, linear and computational linear algebra, topology, and computational geometry.

Abstract: A time-varying collection of metric spaces as formed, for example, by a moving school of fish or flock of birds, can contain a vast amount of information. There is sometimes a need to simplify or summarize the dynamic behavior, and recently, topological tools have been applied to this purpose. One such method is a crocker plot, a 2-dimensional image that displays the (non-persistent but varying with scale) topological information at all times simultaneously. We use this method to perform exploratory data analysis and investigate parameter recovery via machine learning in the collective motion model of D'Orsogna et al. (2006). Then, we use it to choose between unbiased correlated random walk models of Nilsen et al. (2013) that describe motion tracking experiments on pea aphids. Finally, we discuss an extension of the crocker plot that is persistent and equivalent to the information in a persistence diagram at each point in time, and hence, inherits the nice stability properties of persistent homology.