

Topological Data Analysis for Functional Magnetic Resonance Imaging Data

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Topological data analysis (TDA) is a relatively new approach for the analysis of high-dimensional, complex-structured data. Functional magnetic resonance imaging (fMRI) is one source of such data. fMRI, which provides a window into the working human brain, yields high-dimensional, noisy data with complex temporal and spatial correlation structures. In this talk, I will first give an overview of fMRI data, highlighting some of the challenges for statistical analysis and how those challenges have traditionally been handled. A major drawback of many of the standard approaches is that they are "massively univariate," that is, they are performed at the level of the volume element, which has no physiological or scientific meaning. Such analysis paths furthermore induce a serious multiple testing problem. TDA is one modern attempt to move away from a data array perspective to fMRI analysis. The second part of the talk will give a gentle introduction to TDA, along with the results of initial attempts at application to fMRI data from a schizophrenia study.