

*Topological Data Analysis: An emerging tool for exploratory data analysis and its links to issues in probability and statistics*

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Abstract:

Topological Data Analysis (TDA) is a modern tool born in the realm of computational topology. Its objective is to explore structure contained in a cloud of data points, by addressing persistent homology. Roughly speaking, it deals with counting the number of “connected components”, “holes” and “cavities” at diverse scales. In this talk, a very brief introduction to the notion of persistent homology is given, with emphasis placed on particular functions of the data cloud that convey topological summaries (topological statistics). Examples will be shown of TDA analyses and the type of conclusions that are drawn from this technique. TDA addresses a problem that is inherently an inferential problem, so that probability (randomness in the data cloud and sampling distribution of statistics) and statistical inference (the evaluation of uncertainty in answering statistical questions) are directly relevant but have been loosely considered. Challenges in these two fields will be briefly outlined.