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EDITORIAL

Topological Data Analysis

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A growing portion of research in biology and biomedicine is characterized by the analysis of large, multidimensional data sets, ranging from genomic and transcriptomic data to clinical data sets from large patient cohorts. These data sets, and the phenomena characterized by them, require novel analysis methods, which, in turn, drives much mathematical, statistical, and computational research. One important strand of this research is the search for nonlinear dimension reduction methods. Another is topological data analysis (TDA), a method based on concepts from algebraic topology, that captures the geometric shape of high-dimensional data sets. TDA has been successfully applied to a range of data, from molecular to population-level data. And it has stimulated extensive research into its theoretical foundations as well as novel applications. A large number of workshops, conference presentations, and publications are witness to a broad interest in this methodology within the mathematical biology community.

In this issue, we publish two tutorial articles on topological data analysis, both based on presentations during the workshop "Topological, Geometric, and Statistical Techniques in Biological Data Analysis" at the Mathematical Biosciences Institute in 2016. Facundo Mémoli and Kritika Singhal provide "A primer on persistent homology of finite metric spaces," and Min Ho Cho, Amir Asiaee, and Sebastian Kurtek's article is entitled "Elastic statistical shape analysis of biological structures with case studies: a tutorial." The two articles together provide an introduction to the subject, with the necessary mathematical background and with extensive applications of the techniques. It is our hope that they will provide a useful introduction to the topic for the broader mathematical biology community. They also form the nucleus of a thematic collection of articles on the topic, and we invite the submission of articles on topological data analysis in all article categories, from research to educational and perspective articles. These will be collected together over the next 2 years into a virtual TDA theme issue. We look forward to seeing this data analysis technique grow in our field.

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