

Algebra/Topology Seminar

MIKE LESNICK

COMPUTATIONAL ASPECTS OF 2-PARAMETER PERSISTENT HOMOLOGY — PART 1

Thursday, October 25, 2018

1:15 p.m. in ES-143

ABSTRACT. In topological data analysis, one associates to the data a filtered topological space, whose structure we then examine using persistent homology. However, in many settings, a single filtered space is not a rich enough invariant to encode the interesting structure of the data. This motivates the study of multi-parameter persistence, which associates to the data a topological space simultaneously equipped with two or more filtrations. The homological invariants of these “multi-filtered spaces,” called persistence modules, are much richer than their 1-D counterparts, but also far more complicated. As such, adapting the usual 1-parameter persistent homology methodology for data analysis to the multi-parameter setting requires new ideas.

For the past several years, I have been working with Matthew Wright and several other collaborators on RIVET, a practical software tool for the visualization and analysis of 2-parameter persistent homology. One key new feature of RIVET is a fast (cubic time) algorithm for computing the minimal presentation of a 2-parameter persistence module. Perhaps surprisingly, the computational cost of the algorithm is similar in practice to that of the standard algorithm for computing 1-parameter persistent homology.

In this series of two talks, I’ll introduce 2-parameter persistent homology, RIVET, and our algorithm for computing minimal presentations.