Colloquium

UNIVERSITY OF NOTRE DAME
Department of Mathematics

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Tuesday, December 1, 2015
4:00 PM
117 Hayes-Healy Hall

Title: Limit theorems for the sum of persistence barcodes

Abstract:

The theory of persistent homology has recently been developed in the area of applied algebraic topology. The k-th persistent homology can distinguish between essential homological elements and topological noise by keeping track of the appearance and disappearance of k-dimensional holes formed by an object of interest. As an underlying probability law generating a random sample in R^d, we consider heavy tailed distributions, and we establish several limit theorems for the sum of bar lengths in a persistence barcode, a graphical descriptor of persistent homology, composed of a set of bars representing how long each hole lives. It then turns out that the growth rate of the sum of the bar lengths and the properties of limiting processes all depend on how far away the region of interest in R^d is from the core - the area in which random points are densely scattered and form a giant component of k-cycles. In particular, the region of interest gets close enough to a core, the limiting process constitutes a new class of Gaussian processes possessing complicated structure, due to the emergence of a giant component.