Spring 2019
Colloquium Series
February 22, 2019 at 3pm in Bell Hall 143

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Algebra for Geometric Data

With "Big Data" comes a surge of geometric data sets and data objects where shapes, images, videos, networks, and small samples in high dimension are common. One way to deal with such data is to summarize topologically: instead of asking for the support of a measure, for example, ask for the homology of the support. The talk will start with a general discussion of (mostly biological and medical) investigations that lend themselves to techniques based on geometry, including concrete datasets, underlying statistical questions, and relevant algebraic methods. The principles are exemplified by the primary focus of the talk: persistent homology with multiple parameters, which leads to algebraic structures taking their cue from graded polynomial rings and their modules. The motivations to be discussed come from two fundamental problems, one in evolutionary biology and one in statistics. They concern how discrete morphological features evolve – the dataset comprises images of fruit fly wing veins – and how to summarize the support of a probability distribution. The work under discussion touches ongoing projects with multiple groups of researchers, including David Houle (Biology, Florida State), Ashleigh Thomas (grad student, Duke Math), Surabhi Beriwal (undergrad, Duke Math), Sayan Mukherjee (Duke Stat and Math), Greg Malen (postdoc, Duke Math), and Andrew Nobel (UNC-Chapel Hill Stat).