Topological Barcode Fields and Data
Prof. Washington Mio
(Florida State University)

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Persistent homology is a powerful technique for probing and analyzing the organization of data with complex distributions and has been widely used in global data analysis across spatial scales. Much richer information about the geometry of data can be uncovered through local and regional topology; however, naive localization can be extremely sensitive to sampling and noise. In this talk, I will discuss an approach to local homology that is provably robust. Localization is achieved through kernel functions that highlight particular regions of the data landscape and local homology of a probability measure is encoded in barcodes (or persistence diagrams) that are stable with respect to the Wasserstein distance. Localization based on families of kernels leads to stable barcode fields that contain a wealth of information about the shape of data. I also will present an application to quantitative trait loci analysis of tomato leaf shape using data provided by collaborators at Danforth Plant Center. This will illustrate how barcode fields can help us discover associations between genotypes and complex phenotypes.