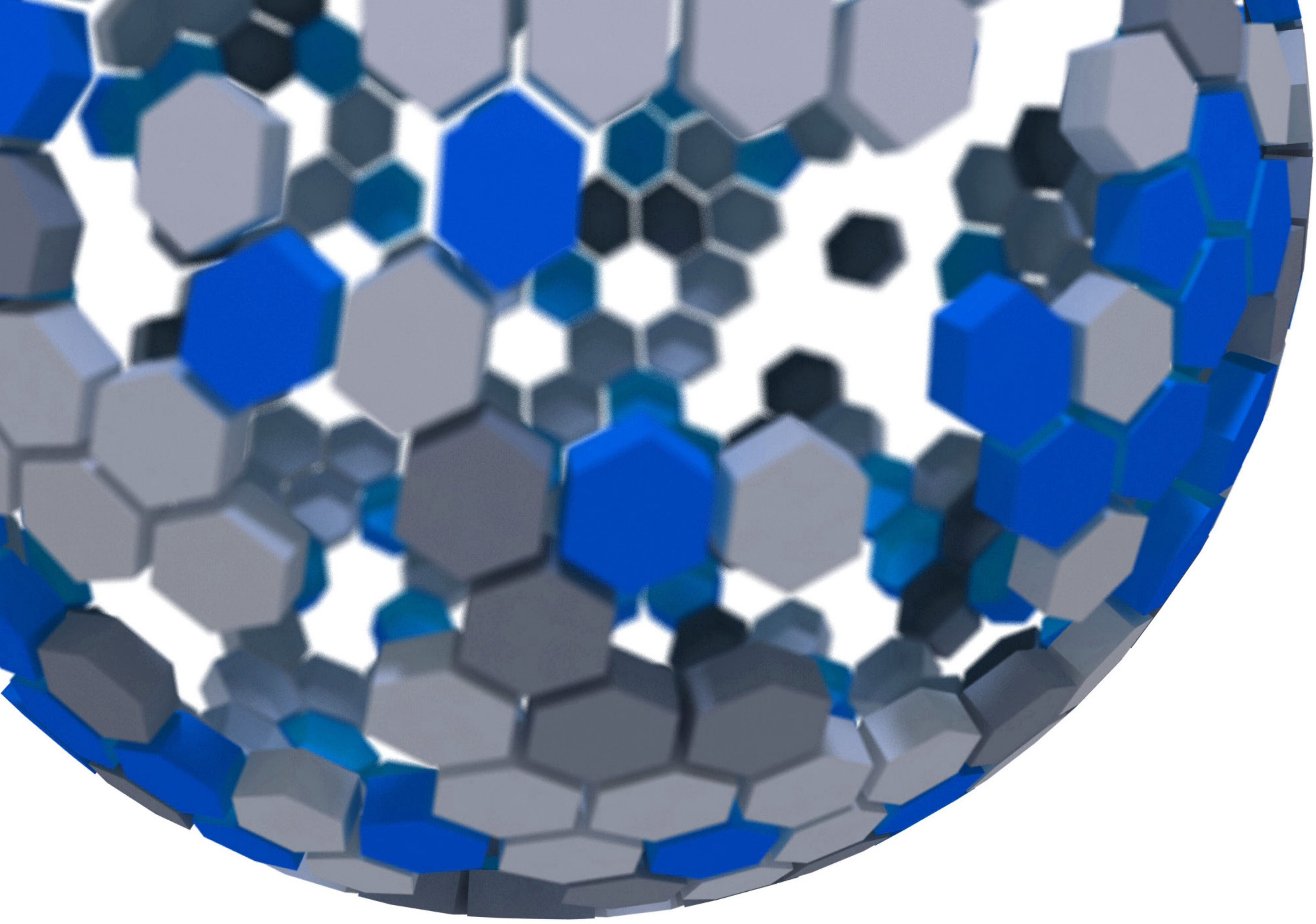

Spring 2013

G. Milton Wing Lecture Series

with **Mauro Maggioni**

Mathematics, Computer Science, and Electrical and Computer Engineering, Duke University

Geometry and Analysis of High-Dimensional Data

Wednesday, April 17 · 5–6 p.m.
Hutchison Hall, Hubbell Auditorium

I will introduce several high-dimensional data problems that arise in a variety of disciplines, from machine learning and computer vision to computational chemistry and network analysis. I will then discuss a common mathematical language and ideas to attack such problems—based on diffusion geometry, multiscale geometric analysis, and graph theory—that yield practical efficient algorithms for sifting through large data sets and learn properties of interest. Much of this mathematical language is at the intersection of analysis, probability, and geometry. I will emphasize the connections between apparently different problems and some of the key ideas in the geometric analysis of high-dimensional data that provide efficient ways of attacking these problems. This talk is directed to a wide audience of scientists.

Multiscale Methods for High-Dimensional Data and Graphs

Thursday, April 18 · 2–3 p.m.
Gavett Hall, Room 310

In this talk I will discuss in greater depth some of the ideas presented at a high level in the first talk. I will focus on the construction of multiscale transforms of high-dimensional point clouds, i.e., maps from high-dimensional data to low-dimensional sparse (or compressible) representations based on a geometric multiscale decomposition and coordinatization of the data. I will discuss the computational aspects of this construction, its application to the problem of dictionary learning, and its connections to a novel variation of the compressive sensing paradigm. I will then discuss extensions of this construction to classification and regression tasks, as well as to the problem of producing efficient estimators for probability measures in high dimensions that are concentrated near low-dimensional sets, drawing upon connections with optimal transportation problems in high dimensions. Finally, I will discuss how some of the above generalizes to studying multiscale structures in large graphs.

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