Stanford University
Department of Statistics

DEPARTMENTAL SEMINAR

*** Special Intersession Event ***

4:15pm, Tuesday, August 27, 2013
Sequoia Hall Room 200
Cookies served at 3:45pm, 1st floor Lounge.

Speaker: Samory Kpotufe, Toyota Technological Institute at Chicago

Title: Local adaptivity to smoothness and dimension in local nonparametric regression

Abstract:
Contemporary statistical procedures are making inroads into a diverse range of applications in the natural sciences and engineering. However it is difficult to use those procedures “off-the-shelf” because they have to be properly tuned to the particular application. Without proper tuning their prediction performance can suffer greatly. This is true in nonparametric regression (e.g., k-NN and kernel regression) where regression performance is particularly sensitive to how well the method is tuned to the unknown problem parameters.

In this talk, we will be presenting some adaptive regression procedures, i.e., procedures which self-tune to the unknown parameters of the problem at hand. We consider regression on a general metric space $X$ of unknown dimension, where the output $Y$ is given as $f(x)$ plus noise. We are interested in adaptivity at an input point $x$ in $X$ where the algorithm must self-tune to the unknown “local” parameters of the problem. The most important such parameters, defined over a neighborhood of $x$, are (1) the unknown smoothness of $f$, and (2) the unknown intrinsic dimension, both defined over a neighborhood of $x$. Existing results on adaptivity have typically treated these two problem parameters separately, resulting in methods that solve only part of the self-tuning problem. We will be presenting an approach for kernel regression which allows simultaneous adaption to smoothness and dimension locally at a point $x$.

The first part of the talk will serve to develop intuition around adapting to intrinsic dimension, using k-NN regression as an example. We will then show how to combine this intuition with earlier ideas developed by Lepski to obtain a fully locally adaptive kernel regressor. The main intuition relies on monitoring the various quantities that play into the bias-variance tradeoff achievable by a given regressor, and may generalize to other nonparametric methods.