STANFORD UNIVERSITY
DEPARTMENT OF STATISTICS

DEPARTMENTAL SEMINAR

4:15 p.m., Tuesday, December 6, 2005
Sequoia Hall Room 200
(Cookies at 3:45 in 1st Floor Lounge)

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Adaptive Parameter Space Exploration and Nonstationary Modeling Using Gaussian Process Trees

This work on adaptive non-stationary modeling was motivated by a problem in aeronautical computer modeling. Typically, a complete grid of input parameter configurations for computer simulations is needed to obtain even qualitative understanding of the simulation output. For large scale simulations, such sweeps can be prohibitively expensive. Thus there is a need for computationally inexpensive surrogate models that can be used in place of simulation to adaptively select new settings of input parameters and map the response with far fewer simulation runs. We provide a general methodology for modeling and adaptive sampling to greatly speed up parameter sweeps. Binary trees are used to recursively partition the input space, and Gaussian process models are fit within each partition. Trees facilitate non-stationarity and a Bayesian interpretation provides a measure of uncertainty in the sample space which can be used to guide future sampling. These methods are illustrated on several examples, including the motivating example involving computational fluid dynamics simulation of a NASA reentry vehicle.

This is joint work with Robert Gramacy and William Macready.