STANFORD UNIVERSITY

DEPARTMENT OF STATISTICS

DEPARTMENTAL SEMINAR

4:15 p.m., Thursday, August 3, 2006
Sequoia Hall Room 200
(Cookies at 3:45 in 1st Floor Lounge)

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Modern Statistical Methodology in Medical Image Analysis

Statistical analysis of medical image data may be aimed at predicting disease progression, separating the normal from the abnormal or aiding in the comprehension of a natural or pathological process. This talk will present a couple of important applications within this field, with an emphasis on methodology developed at Stanford University.

Clinically, the material is focused on brain morphometry – the measuring of shape and shape changes within the brain. A study is presented where the shape of the *corpus callosum* brain structure has been extracted from magnetic resonance images of a large number of patients. The shape data can be decomposed into a small set of interpretable template shapes using sparse principal component analysis. These templates may then be related to patient outcome data through the LASSO regression framework. The aim of the current analysis is to learn more about the relationship between localized brain tissue loss and the decline in e.g memory performance and motor skills. The more ambitious long-term goal is to predict and detect early stages of neurodegenerative diseases directly from image data. Examples of other applications include sparse modeling of functional magnetic resonance data (fMRI) and the statistical analysis of whole-brain deformation data, where the number of variables is in the order of millions.

Another task with several important applications in image analysis is the ordering of a set of observations according to the probability of each observation, given the entire data set. This can be implemented using a technique for one-class classification known as the support vector domain description. An efficient algorithm is presented and applied to medical shape data.