**The University of Chicago**
**Department of Statistics**

## Seminar Series

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## Statistical Analysis of Shapes of Curves and Surfaces

**MONDAY, November 27, 2006 at 4:00 PM**
**133 Eckhart Hall, 5734 S. University Avenue**
*Refreshments following the seminar in Eckhart 110.*

## ABSTRACT

We introduce a statistical framework for studying shapes of curves and surfaces with applications in 2D and 3D image analysis. The central idea is to isolate an appropriate space of desired curves, quotient out the action of certain shape-preserving transformations, and study the geometry of the resulting shape space. An important tool for comparing and analyzing shapes is to compute geodesics on shape spaces, under the chosen Riemannian metrics. I will show two methods — shooting and path-straightening — to compute geodesics on these spaces. Using geodesics, one can define and compute sample statistics, impose probability distributions, and study hypothesis testing involving shapes. As an example, I will present examples of generating Bayesian inferences from image data. The case of analyzing shapes of surfaces, e.g. facial surfaces, is much more difficult. Our approach is to represent a surface as an indexed collection of curves and to extend ideas from curve analysis to perform surface analysis. I will demonstrate this using a database of facial surfaces. This framework does not require landmarks, embedding of curves and surfaces in larger background spaces, or partial-differential equations.