The University of Chicago
Department of Statistics
Ph.D. Seminar

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"Estimating Deformations of Gaussian Random Fields"

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110 Eckhart Hall, 5734 S. University Avenue

ABSTRACT

The first part of this talk will present a new approach to the estimation of the deformation of an isotropic Gaussian random field on $\mathbb{R}^2$ based on dense observations of a single realization of the deformed random field. The use of deformations for modeling nonstationary processes has been applied in diverse fields from geophysics to image analysis. These models are natural extensions of stationary processes that are simple to understand but give rise to a diverse range of behavior. Even though these models seem a good choice when modeling nonstationary random fields they are generally difficult to work with because of the complex restrictions on the deformations like invertablility. This work establishes methodology using a general nonparametric representation of deformations that makes these models tractable. We present a complete methodological package—from model assumptions to algorithmic recovery of the deformation—for the class of nonstationary processes obtained by deforming isotropic Gaussian random fields.

This talk will also present a generalization of the Quadratic Variation Theorem for smooth processes in general dimension. This generalization is obtained by looking at sums of squared iterated directional increments of Gaussian processes. The quadratic variation results will be applied to the estimation of the parameters of a geometric anisotropic fractional Brownian surfaces. A fast algorithm is developed to simulate these processes and is used to compare different estimates of the geometric anisotropy.