



The University of Chicago

Department of Statistics

Seminar Series

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University of Washington

‘Wavelet Variance Analysis for Time Series and Random Fields

WEDNESDAY, February 14, 2007 at 4:00 PM

110 Eckhart Hall, 5734 S. University Avenue

Refreshments following the seminar in Eckhart 110.

ABSTRACT

Since their introduction to the statistical community in the pioneering work of Donoho, Johnston and co-workers in the 1990s, wavelets have had a substantial impact in signal and image processing, edge detection, nonparametric regression and inverse problems. In this talk, we focus on the wavelet variance, which decomposes the variance of a time series on a scale by scale basis, thus providing a scale-based analysis of variance. The wavelet variance has been applied to a variety of time series and is useful as an exploratory tool to identify important scales, to assess the exponent parameter of a power law process, to detect inhomogeneity and to estimate a time varying spectral density function. After a review of basic concepts, we propose methods for estimating the wavelet variance when the observed time series is ‘gappy’, i.e., is sampled at regular intervals, but certain observations are missing. We investigate properties of these estimators and discuss large sample inference. We illustrate our methodology using NOAA’s tropical atmospheric pressure data. We then extend the concept of the wavelet variance to handle random fields, and discuss estimation and large sample inference. We illustrate our methodology using images of clouds. We also briefly consider robust estimation of the wavelet variance in the presence of contaminated data. Finally we indicate some directions for future research on the wavelet variance, including analysis of categorical data, and wavelet cumulant analysis for higher order spectra.