



THE UNIVERSITY OF CHICAGO

Department of Statistics

DISSERTATION PROPOSAL

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Spectral Analysis of Random Field, Modeling Spatio-Temporal Data and Classification of Time Series

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Jones 304, 5747 S. Ellis Avenue

ABSTRACT

We consider three different problems in time series and random field. At first, we consider a general class of stationary random fields and study the asymptotic properties of different parametric and nonparametric spectral density estimators under an easily verifiable short-range dependence condition. We allow irregularly spaced data with minimal restriction on the index set and thus the theory developed here is applicable across a wide range of practical scenarios.

The second problem revolves around developing a spatio-temporal model with space-time interaction for air pollution data ($PM_{2.5}$), which enables one to provide forecasts and insights about the air quality. The proposed model uses a parametric space-time interaction component along with the spatial and temporal components in the mean structure, and introduces a random-effects component specified in the form of zero-mean spatio-temporal processes. For application, we analyze hourly air pollution data from Taiwan and China.

Finally, we consider a time series classification problem, which is still somewhat unexplored in literature. We are going to use pairwise differences of the nonparametric spectral density estimates to develop a hierarchical clustering algorithm. Future work includes exploring asymptotic theory for the above estimates and the consistency and rate of convergence of the algorithm. The method will finally be implemented on real life data obtained from medical fields.

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