THE UNIVERSITY OF CHICAGO

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DISSERTATION PRESENTATION AND DEFENSE

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Irregular Spaced Data, Spatio-Temporal Modeling and Clustering of Time Series

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ABSTRACT

In this thesis, three different problems in time series and random field have been discussed. First, for a general class of stationary random fields, we study the asymptotic properties of different parametric and nonparametric spectral density estimators under an easily verifiable short-range dependence condition. The theory developed here allows both regular and irregular spaced data with minimal restriction on the index set and thus 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, air pollution data from Taiwan have been analyzed.

The third problem in the thesis deals with a time series clustering problem. Using L^2 distance between nonparametric spectral density estimates, a hierarchical clustering algorithm has been developed. Simulation studies show that the power of the algorithm is very good for most scenarios. Especially, it shows much better performances for small samples. This algorithm can be extended to different practical setups and can be used on real life data obtained from various fields.

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