

Weak Separability Test for Spatial Functional Fields

Fang Yao

Peking University

E-mail: fyao@math.pku.edu.cn

Abstract: For spatially dependent functional data, a generalized Karhunen-Loeve expansion is commonly used to decompose data into an additive form of temporal components and spatially correlated coefficients. This structure provides a convenient tool to investigate the space-time interactions, but may not always hold for more complex spatial-functional data. In this paper, we introduce a concept of weak separability, and propose formal testing procedures to examine the validity of the general Karhunen-Loeve decomposition. Asymptotic distribution of the test statistic is studied to avoid using resampling procedures, e.g. bootstrap. Both parametric and nonparametric approaches are developed to estimate the asymptotic covariance, by constructing lagged covariance estimators. We demonstrate the efficacy of our methods via simulations under settings of grid and non-grid data, and illustrate their applications using two examples: Harvard forest data and China PM2.5 data.