Bayesian Analysis of Multidimensional Functional Data

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Abstract: Multi-dimensional functional data arises in numerous modern scientific experimental and ob- servational studies. In this lecture we focus on longitudinal functional data, a structured form of multidimensional functional data. Operating within a longitudinal functional framework we aim to capture low dimensional interpretable features. We propose a computationally efficient nonparametric Bayesian method to simultaneously smooth observed data, estimate conditional functional means and functional covariance surfaces. Statistical inference is based on Monte Carlo samples from the posterior measure through adaptive blocked Gibbs sampling. Several operative characteristics associated with the proposed modeling framework are assessed comparatively in a simulated environment. We illustrate the application of our work in two case studies. The first case study involves age-specific fertility collected over time for various countries. The second case study is an implicit learning experiment in children with Autism Spectrum Disorder (ASD).