MICHIGAN STATE UNIVERSITY
Department of Statistics and Probability

COLLOQUIUM

Xiongtao Dai
UC Davis

Principal Component Analysis for Functional Data on Riemannian Manifolds and Spheres

Thursday, February 8, 2018
10:20 AM - 11:10 AM
Refreshments 10:00 AM
C405 Wells Hall

Abstract

Functional data analysis on nonlinear manifolds has drawn recent interest. Sphere-valued functional data, which are encountered for example as movement trajectories on the surface of the earth, are an important special case. In this talk, we consider a principal component analysis for smooth Riemannian manifold-valued functional data, which respects the intrinsic geometry of the manifold. Riemannian functional principal component analysis (RFPCA) is carried out by first mapping the manifold-valued data through Riemannian logarithm maps to linear tangent spaces around the time-varying Frechet mean function, and then performing a classical multivariate functional principal component analysis. Representations of the sample functions and the eigenfunctions on the original manifold are then obtained with exponential maps. We derive a central limit theorem for the mean function, as well as root-n uniform convergence rates for other model components. Our applications include a novel framework for the analysis of longitudinal compositional data, achieved by mapping longitudinal compositional data to trajectories on the sphere, illustrated with longitudinal fruit fly behavior patterns. Riemannian functional principal component analysis is shown to be superior in terms of trajectory recovery and predictive power in comparison to an unrestricted method.

To request an interpreter or other accommodations for people with disabilities, please call the Department of Statistics and Probability at 517-355-9589.