COLLOQUIUM

MATHEMATICS AND STATISTICS
QUEEN'S UNIVERSITY

INTRINSIC RIEMANNIAN FUNCTIONAL DATA ANALYSIS

Abstract. Data of random paths on a Riemannian manifold is often encountered in real-world applications. Examples include trajectories of bird migration, the dynamics of brain functional connectivity, etc. To analyze such data, a framework of intrinsic Riemannian functional data analysis is developed, which provides a rigorous theoretical foundation for statistical analysis of random paths on a Riemannian manifold. The cornerstone of the framework is the Hilbert space of vector fields along a curve on the manifold, based on which principal component analysis and Karhunen-Loève expansion for Riemannian random paths are then established. The framework also features a proposal for proper comparison of vector fields along different curves, which paves the way for intrinsic asymptotic analysis of estimation procedures for Riemannian functional data analysis. Built on intrinsic geometric concepts such as vector field, Levi-Civita connection and parallel transport on Riemannian manifolds, the proposed framework embraces full generality of applications and proper handle of intrinsic geometric concepts. Based on the framework, functional linear regression models for Riemannian random paths are investigated, including estimation methods, asymptotic properties and an application to the study of brain functional connectivity.

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Zhenhua Lin obtained his Ph.D. in Statistics in 2017 from the University of Toronto. He recently joined the University of California, Davis, as a Postdoctoral Fellow. Dr. Lin research focuses on functional data analysis. Specifically, he works on locally sparse modelling for functional objects, adaptive representation of functional data, adaptive nonparametric functional regression, and application of manifold learning in functional data analysis. His interests also include the analysis of high-dimensional data and the analysis of data with complex structures (such as graphs, networks, matrices).

234 JEFFERY HALL
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