

Second Order Comparison of Gaussian Processes with Applications to DNA Shape Analysis

Victor M. Panaretos & David Kraus

*Institute of Mathematics
Ecole Polytechnique Fédérale de Lausanne*

Technical Report # 1/09, February 2009
Chair of Mathematical Statistics

Abstract

Given two samples of continuous zero-mean iid Gaussian processes on $[0, 1]$, we consider the problem of testing whether they share the same covariance structure or not. Our study is motivated by the problem of determining whether the mechanical properties of short strands of DNA are significantly affected by their base-pair sequence. The testing problem is seen to involve aspects of ill-posed inverse problems and a test based on a Karhunen-Loève approximation of the Hilbert-Schmidt distance of the empirical covariance operators is proposed and investigated. When applied to a dataset of DNA minicircles obtained through the electron microscope, our test suggests the existence of a sequence effect on DNA shape.

Keywords: *Covariance Operator; DNA Minicircles; Functional Data Analysis; Gaussian Processes; Hilbert-Schmidt Norm; Karhunen-Loève Expansion; Random Curves; Regularization; Two-Sample Testing.*