Functional Data Analysis

Chair: Duncan Murdoch (University of Western Ontario)
Organizer: Jiguo (Jack) Cao (University of Western Ontario)

DAVID CAMPBELL, Simon Fraser University

Inferring Nonlinear Differential Equation Models from Non-Parameteric Functional Estimators

Differential equation models are a type of functional regression model where the response is a (functional) derivative, and the covariates are the state functions. Parameters quantifying the relationship between derivative and states are typically easily interpretable, making this class of model appealing for understanding mechanisms and relationships. We outline an exploratory method for reverse engineering relationships based on non-parametric methods with the goal of proposing possible parametric nonlinear differential equation models. The method is based on linking kernel estimates of states and derivatives from data through generalized additive models to infer nonlinear relationships.

GILES HOOKER, Cornell University

Selecting the Domain of Integration in a Functional Linear Model

This talk examines the problem of determining which parts of a functional covariate may contribute to a functional linear model. Specifically, we consider the situation in which the coefficient of a functional linear model is known to be zero beyond some unknown point. This arises naturally in the functional convolution model in which a functional response is represented as a functional linear model of the short-term past of the covariate. We examine a change-point approach to detecting the range of integration to be used. The method is demonstrated on data from a vehicle emissions study.

JAMES O. RAMSAY, McGill University

Representing and Quantifying Complexity in Functional Observations and Parameters

Roughness-penalized functional data analyses, including smoothing, use a roughness penalty defined by a linear differential operator L to impose smoothness on functional parameter estimates. Finite element methods use the stiffness matrix for the same purpose. The matrix R, consisting of the possible inner products of basis functions transformed by L, defines the complexity of a functional parameter or functional data. The talk will show how the eigenanalysis of R can be used to quantify complexity in existing functions, stabilize functional estimates and show the consequences of choosing L, especially when it is determined by data-defined parameter values.