Nonlinear Methods for Samples of Densities and Functional Data

Hans-Georg Müller (University of California, Davis)

ABSTRACT:

Samples of random densities that are obtained in various applications present a challenge for functional data analysis since distributions do not live in a linear space, while prevailing methods such as functional linear principal component analysis are targeting objects in a Hilbert space. To describe variation in a sample of densities, we discuss a transformation approach, where probability densities are mapped to a linear function space through a continuous and invertible map. This transformation reduces the problem of defining modes of variation in density space to the simpler problem of defining such modes in a linear space. A second challenge is to find suitable regression models when the responses are random distributions or other random objects. To tackle this task, we generalize Frechet means to conditional Frechet means, which can be implemented in the form of global or local regression for Euclidean predictors. These methods are illustrated with examples from demography and brain imaging. The talk is based on joint work with Alexander Petersen.