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Random Objects: Functional Data in Nonlinear Subspaces and Fréchet Regression

Random Objects will be illustrated for three commonly encountered scenarios. A general characteristic of Random Objects is that one has an i.i.d. sample of these objects which lie in a metric space that often has additional properties. The goal is to quantify mean and variation in a sensible way. In the first scenario, functional data that lie on a smooth isometric manifold will be considered. This includes time-warped functional data, where manifold learning with Isomap is shown to provide interpretable data analysis. The second scenario concerns functional data that are density functions. A transformation to a Hilbert space, centered around the Wasserstein mean, then leads to sensible modes of variation. In a third scenario we consider random objects that belong to a more general metric space as responses in a regression model that features scalar or vector predictors. We present methods for global and local regression in this framework.