

# **Nonlinear Models for Functional Data**

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## **Abstract**

Functional data frequently exhibit nonlinearities; these have only more recently been systematically studied. One type of nonlinearity is due to time warping. This nonlinearity can be addressed with manifold learning methods, which will be exemplified with Isomap. The resulting manifold principal components often provide a low-dimensional and parsimonious representation for the functional data. A second example of nonlinear functional data are samples of density functions, which are encountered in various applications. For this situation, we discuss a transformation approach and discuss challenges such as the need to estimate the density functions from available data. In the course of an example in neuroimaging, we will also discuss various functional correlation measures.

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