

**Abstract:**

Functional data analysis is typically performed in two steps: first, functionally representing discrete observations, and then applying functional methods, such as the functional principal component analysis, to the so-represented data. While the initial choice of a functional representation may have a significant impact on the second phase of the analysis, this issue has not gained much attention in the past. Typically, a rather ad hoc choice of some standard basis such as Fourier, wavelets, splines, etc. is used for the data transforming purpose. To address this important problem, we present its mathematical formulation, demonstrate its importance, and propose a data-driven method of functionally representing observations. The method chooses an initial functional basis by an efficient placement of the knots. A simple machine learning style algorithm is utilized for the knot selection and recently introduced orthogonal spline bases - splinets - are eventually taken to represent the data. The benefits are illustrated by examples of analyses of sparse functional data.