

Projection-based testing in longitudinal functional data Salil Koner¹, Ana-Maria Staicu¹, So Young Park²

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Abstract:

In many modern applications, a dependent functional response is observed for each subject over repeated time, leading to longitudinal functional data. In this paper, we propose a novel statistical procedure to test whether the mean function varies over time. Our approach relies on reducing the dimension of the response using datadriven orthogonal projections and it employs a likelihood-based hypothesis testing. We investigate the methodology theoretically and discuss a computationally efficient implementation. The proposed test maintains the type I error rate, and exhibits adequate power to detect the departure from the null hypothesis in finite sample simulation studies. We apply our method to the longitudinal diffusion tensor imaging study of multiple sclerosis (MS) patients to formally assess whether the brain's health tissue, as summarized by fractional anisotropy (FA) profile, changes over time during the study period.

Keywords:

Longitudinal functional data analysis, Functional principal component analysis, Uniform convergence, Likelihood ratio test, Fractional Anisotropy, Multiple sclerosis.

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