Significance Tests in Functional Linear Models

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Abstract

In the recent decade, more and more attention has been paid to functional data analysis. A functional linear model (FLM) can be used to predict functional responses from a few time-independent predictor variables. The functional effects of the predictor variables can be easily estimated. We are interested in a general FLM testing problem which tests if a few linear combinations of the functional effects are statistically significant. In this presentation, we introduce and study an F-type test for this problem. The asymptotic power of the F-type test is derived and we found that under some regular conditions, the F-type test is root-n consistent. Moreover, we found that the null distribution of the F-type test can be well approximated by an F-distribution with their degrees of freedom depending on the underlying covariance structure. Methods for implementing the F-type test are described. Simulation studies are presented to compare the F-type test with the existing methods. Real data examples are used to motivate and illustrate the methodologies.

Key Words: F-type test, functional linear model, root-n consistency, χ^2-approximation, χ^2-type mixture.