

Zhang, Jin-Ting

Statistical inferences for linear models with functional responses. (English) Zbl 1236.62081
Stat. Sin. 21, No. 3, 1431-1451 (2011).

Summary: With modern technology development, functional responses are observed frequently in fields such as biology, meteorology, and ergonomics, among others. Consider statistical inferences for functional linear models in which the response functions depend on a few time-independent covariates, but the covariate effects are functions of time. Of interest is a test of a general linear hypothesis about the covariate effects. Existing test procedures include the L^2 -norm based test proposed by *J.-T. Zhang* and *J. Chen* [*Ann. Stat.* 35, No. 3, 1052–1079 (2007; [Zbl 1129.62029](#))] and the F -type test proposed by *Q. Shen* and *J. Faraway* [*Stat. Sin.* 14, No. 4, 1239–1257 (2004; [Zbl 1060.62075](#))], among others. However, the asymptotic powers of these testing procedures have not been studied, and the null distributions of the test statistics are approximated using a naive method.

We investigate the F -type test for the general linear hypothesis and derive its asymptotic power. We show that the F -type test is root- n consistent. In addition, we propose a bias-reduced method to approximate the null distribution of the F -type test. A simulation study demonstrates that the bias-reduced and the naive method perform similarly when the data are highly or moderately correlated, but the former outperforms the latter significantly when the data are nearly uncorrelated. The F -type test with the bias-reduced method is illustrated via applications to a functional data set collected in ergonomics.

MSC:

- [62J05](#) Linear regression; mixed models
- [62F03](#) Parametric hypothesis testing
- [62G10](#) Nonparametric hypothesis testing
- [62H15](#) Hypothesis testing in multivariate analysis
- [62E17](#) Approximations to statistical distributions (nonasymptotic)
- [65C60](#) Computational problems in statistics (MSC2010)

Cited in **6** Documents

Keywords:

functional data; functional hypothesis test; F -type test; Gaussian process; root- n consistency; χ^2 -type mixtures; χ^2 -approximation

Software:

faraway; R; SemiPar

Full Text: [DOI](#)