

New Tests for Equality of Several Covariance Functions for Functional Data

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Abstract: In this article, we propose two new tests for the equality of the covariance functions of several functional populations, namely, a quasi-GPF test and a quasi-Fmax test whose test statistics are obtained via globalizing a pointwise quasi-F-test statistic with integration and taking its supremum over some time interval of interest, respectively. Unlike several existing tests, they are scale-invariant in the sense that their test statistics will not change if we multiply each of the observed functions by any nonzero function of time. We derive the asymptotic random expressions of the two tests under the null hypothesis and show that under some mild conditions, the asymptotic null distribution of the quasi-GPF test is a chi-squared-type mixture whose distribution can be well approximated by a simple-scaled chi-squared distribution. We also propose a random permutation method for approximating the null distributions of the quasi-GPF and Fmax tests. The asymptotic distributions of the two tests under a local alternative are also investigated and the two tests are shown to be root-n consistent. A theoretical power comparison between the quasi-GPF test and the L2-norm-based test proposed in the literature is also given. Simulation studies are presented to demonstrate the finite-sample performance of the new tests against five existing tests. An illustrative example is also presented.