

Testing in matched-pairs functional data with missingness in one arm

Marléne Baumeister¹, Łukasz Smaga², Markus Pauly^{1,3}

¹*TU Dortmund University, Germany*

²*Adam Mickiewicz University in Poznań, Poland*

³*Research Center Trustworthy Data Science and Security, UA Ruhr,
Germany*

Abstract

We consider the matched-pairs testing problem for functional data when some observations from the second measurement are missing. Such incomplete designs arise, for example, in longitudinal medical studies when not all patients participate in a follow-up examination. Our motivating application concerns functional measurements collected from patients with multiple sclerosis at consecutive visits. We propose test statistics that use all available data without discarding incomplete pairs or imputing the missing functional observations. We establish the asymptotic properties of the proposed statistics. Since their null asymptotic distributions are complicated and depend on unknown parameters, direct asymptotic calibration is of limited practical use. We therefore develop parametric bootstrap procedures and show that the resulting tests are asymptotically valid and consistent. Their finite-sample performance is investigated through simulation studies, and the methodology is illustrated using the motivating medical data. The proposed approach provides uncertainty-aware inference for complex, incompletely observed functional data.

Keywords

Bootstrap method, Functional data, Missing data, Repeated measurements.

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