Hypothesis testing for Generalized Multivariate Analysis of Variance (GMANOVA) models under high-dimensional scenarios

Generalized Multivariate Analysis of Variance (GMANOVA) models which are especially useful for analysing longitudinal data with short to moderate time series, are an improvement over MANOVA models, as they allow modelling time-varying responses and allow for temporal ordering and temporal correlation to be incorporated in the model by incorporating a bilinear structure in the model. Like a MANOVA model, the prime objective of a GMANOVA model is comparison of means across multiple groups using hypothesis testing. GMANOVA models assume normality, same shape of mean profiles across the groups, and also assume that the sample size is greater than the number of time points in the model ($n>p$). However, often time in real life problems the number of time points in the model exceed the sample size ($n<p$), leading to high-dimensional scenarios, which in turn leads to a non-singular sample covariance matrix. Therefore, the existing tests available for the classical GMANOVA models, for testing the general linear hypothesis, are not appropriate for high-dimensional scenarios. We develop new test statistics for the GMANOVA model under high-dimensionality and assess its performance using extensive simulations. Empirical properties such as null and non-null distributions, power and level, are explored. Real Data illustration is also provided.

Keywords: GMANOVA models, high-dimensional scenario ($n<p$), Hypothesis testing, general linear hypotheses, empirical power and level