Title: Nonparametric models and methods for ANCOVA with dependent data
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Abstract:
A new, fully nonparametric model for nonlinear analysis of covariance is proposed. The model covers the theory for up to three covariates, in the general setting of dependent or longitudinal data, where the presence of repeated observations in a data set violates the assumption of independence, needed in the classical analysis of covariance model for factorial designs. The new model is completely nonparametric, so the response distributions are not restricted to any parametric or semiparametric model. The possibility of different shapes of covariate effect in different factor level combinations is allowed, and the effect can also be nonlinear. The model is based on smoothing techniques and so the use of kernels is suggested. The test statistics are based on averages over the covariate values of certain Nadaraya-Watson regression quantities, which asymptotically have, under their respective null hypotheses, a central chi-squared distribution. The hypotheses that are proposed and the testing procedures are invariant under monotone transformations of the response. Nonparametric hypotheses of no main effect, no interaction and no simple effect, which adjust for the covariate values, are defined through a decomposition of the conditional distribution functions of the response given the factor level combination and covariate values. Some small sample corrections are also provided, which are useful when the convergence of the test statistic to the central chi-squared distribution appears to be slow. Simulation results and data analysis for a real dataset are presented.