# A Low-rank Based Estimating and Testing Procedure for Matrix-covariate Regression

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## Abstract

Matrix-covariate is now frequently encountered in many biomedical researches. It is common to fit conventional statistical model by vectorizing the matrix-covariate. This strategy, however, results in a large number of parameters, while the available sample size is relatively small to have reliable analysis results. To test the significance of matrix-covariate, score test is widely used to overcome the curse of high-dimensionality by treating the coefficient of interest as a random vector. Although score test performs well in many situations, it cannot provide an estimate for the effect sizes of matrixcovariate. When the research interest focuses on the effect sizes, one still needs to fit a conventional regression model, and therefore faces the problem of high-dimensionality again. In this work, we overcome the problem of high-dimensionality by utilizing the inherent structure of matrix-covariates. The advantage is that estimation and hypothesis testing can be conducted simultaneously as in the conventional case, while the estimation efficiency and detection power can be largely improved due to a parsimonious parameterization. Our method is applied to test the significance of gene-gene interactions in the PSQI data, and is applied to test if electroencephalography is associated with the alcoholic status in the EEG data.