A surprisingly powerful methodology for analyzing correlated high dimensional data with factor models

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Multiple testing under dependence is a fundamental problem in high-dimensional statistical inference. We use a factor model to capture the dependence. Existing literature with factor models imposes joint normality on the data or requires tuning parameters to obtain robust inference. This paper looks at the problem differently by transposing approximate factor models. This allows heteroscedasticity and a more accurate estimation of the covariance matrix of idiosyncratic errors by projections. We construct factor-adjusted one-sample and two-sample test statistics of high-dimensional data. Extensive simulation studies demonstrate the favorable performance of the proposed method over state-of-the-art methods while controlling the false discovery rate, even for heavy-tailed data. The robustness and tuning parameter-free features make the proposed method attractive to practitioners.