Robust estimation in meta-regression analysis

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Abstract

Meta analysis provides a quantitative method for combining results from separate independent studies with the same problem and has been frequently used in different areas of scientific research. However existing estimation methods are sensitive to the presence of outliers in the data sets. In this paper we explore the robust estimation for the parameters in meta-regression, including the between-study variance and regression parameters. Huber's rho function is adopted to derive the formulae of robust maximum likelihood (ML) and restricted maximum likelihood (REML) estimation. The asymptotic properties of proposed robust estimators are established and the derivation allows the true parameter lying on the boundary of parameter space. Corresponding iterative algorithm of robust estimation is developed which is easy to implement in the software. The performance of the proposed methodology is assessed by Monte Carlo simulation studies, and our results show that the robust estimation methods outperform the conventional ML and $REML$ methods when outliers appear in the data set. Two real examples are used for illustrations.