Robust methods for one and two-way ANOVA

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Abstract

ANOVA is perhaps one of the most used statistical tools in applied statistics (Gelman, 2005).

All the branches of activity where experimentation is essential, do not dispense the use of this highly flexible technique that allows the users to understand the nature and to measure the magnitude of effects and interactions of a multitude of factors that naturally or artificially may contribute to the response output. Intense use of ANOVA is being recently required to analyze very large sets of data produced by computers and other technologies (data-mining, microarrays, weather prediction, credit card fraud detection, and others).

Appropriate application of the ANOVA relies on various assumptions underlying the model and if these assumptions are violated, which happens in many sets including the large data sets, the results may be misleading and do not serve to describe the reality. Unfortunately this fact is not mentioned or stressed in introductory statistics courses and the nature of the data is many times literally ignored by the user and ANOVA is applied naively, overlooking the structure of the data and the context of the problem that determine the validity of the model.

To control the effects of deviations from the model assumptions robust methods are required (Kulinskaya and Dollinge, 2007). After a short critical review of robust estimation and testing for ANOVA we concentrate on the one and two-way cases and introduce a simple robust approach. The robustness of these new tools is evaluated using Monte Carlo simulations under various distributions and in terms of different criteria. A real data set is examined to illustrate an application of the methods introduced.

Keywords

Robustness, ANOVA, Robust ANOVA.

References

Gelman, A. (2005). Analysis of variance - why is it more important than ever (with discussion). *Ann. Statist. 33*, 1–53.

Kulinskaya, E. and Dollinge, M.B. (2007). Robust weighted one-way ANOVA: Improved approximation and efficiency. *J. Statist. Plann. Inference 137*, 462–472.