

MULTIVARIATE MULTIPLE COMPARISONS WITH A CONTROL IN ELLIPTICAL POPULATIONS

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Abstract

The approximate upper percentile of Hotelling's T^2 -type statistic is derived in order to construct simultaneous confidence intervals for comparisons with a control under elliptical populations with unequal sample sizes. Accuracy and conservativeness of Bonferroni approximations are evaluated via a Monte Carlo simulation study. Finally, we explain the real data analysis using procedures derived in this paper.

Keywords: comparisons with a control, Bonferroni approximation and Monte Carlo simulation.

2010 Mathematics Subject Classification: 62H10, 60E05 and 65C05.

REFERENCES

- [1] F. Bretz, M. Posch, E. Glimm, F. Klingmueller, W. Maurer and K. Rohmeyer, *Graphical approaches for multiple comparison procedures using weighted Bonferroni, Simes, or parametric tests*, *Biometrical Journal* **53** (2011) No. 6, 894–913. doi:10.1002/bimj.201000239
- [2] T. Iwashita, *Asymptotic null and nonnull distribution of Hotelling's T^2 -statistic under the elliptical distribution*, *Journal of Statistical Planning and Inference* **61** (1997) 85–104. doi:10.1016/S0378-3758(96)00153-X

- [3] R.J. Muirhead, *Aspects of Multivariate Statistical Theory* (New York, Wiley, 1982). doi:10.1002/9780470316559
- [4] N. Okamoto, *A modified second order Bonferroni approximation in elliptical populations with unequal sample sizes*, SUT Journal of Mathematics **41** (2005) 205–225.
- [5] N. Okamoto and T. Seo, *Pairwise multiple comparisons of mean vectors under elliptical populations with unequal sample sizes*, Journal of the Japanese Society of Computational Statistics **17** (2004) 49–66.
- [6] T. Seo, *The effects of nonnormality on the upper percentiles of T_{\max}^2 statistic in elliptical distributions*, Journal of the Japan Statistical Society **32** (2002) 57–76.
- [7] T. Seo and M. Toyama, *On the estimation of kurtosis parameter in elliptical distributions*, Journal of the Japan Statistical Society **26** (1996) 59–68. doi:10.14490/jjss1995.26.59

Received 18 September 2013

Revised 18 November 2013