

CLASSIFIERS FOR DOUBLY MULTIVARIATE DATA

MIROSLAW KRZYŚKO, MICHAŁ SKORZYBUT

AND

WALDEMAR WOŁYŃSKI

Faculty of Mathematics and Computer Science
Adam Mickiewicz University of Poznań
Umultowska 87, 61–614 Poznań, Poland

e-mail: mkrzysko@amu.edu.pl
skorzmic@amu.edu.pl
wolynski@amu.edu.pl

Abstract

This paper proposes new classifiers under the assumption of multivariate normality for multivariate repeated measures data (doubly multivariate data) with Kronecker product covariance structures. These classifiers are especially useful when the number of observations is not large enough to estimate the covariance matrices, and thus the traditional classifiers fail. The quality of these new classifiers is examined on some real data. Computational schemes for maximum likelihood estimates of required class parameters, and the likelihood ratio test relating to the structure of the covariance matrices, are also given.

Keywords: classifiers, repeated measures data (doubly multivariate data), Kronecker product covariance structure, compound symmetry covariance structure, AR(1) covariance structure, maximum likelihood estimates, likelihood ratio tests.

2010 Mathematics Subject Classification: Primary: 62N30,
Secondary: 62H12.

REFERENCES

- [1] K.M. Abadir and J.R. Magnus, *Matrix Algebra* (Cambridge University Press, New York, 2005). doi:10.1017/CBO9780511810800

- [2] A.T. Galecki, *General class of covariance structures for two or more repeated factors in longitudinal data analysis*, Communications in Statistics – Theory and Methods **23** (1994) 3105–3119. doi:10.1080/03610929408831436
- [3] N.C. Giri, *Multivariate Statistical Analysis* (Marcel Dekker, Inc., New York, 1996).
- [4] D.N. Naik and S. Rao, *Analysis of multivariate repeated measures data with a Kronecker product structured covariance matrix*, J. Appl. Statist. **28** (2001) 91–105. doi:10.1080/02664760120011626
- [5] A. Roy and R. Khattree, *Discrimination and classification with repeated measures data under different covariance structures*, Communications in Statistics – Simulation and Computation **34** (2005a) 167–178. doi:10.1081/SAC-200047072
- [6] A. Roy and R. Khattree, *On discrimination and classification with multivariate repeated measures data*, Journal of Statistical Planning and Inference **134** (2005b) 462–485. doi:10.1016/j.jspi.2004.04.012
- [7] A. Roy and R. Khattree, *Classification rules for repeated measures data from biomedical research*, in: Computational methods in biomedical research, R. Khattree, D.N. Naik (Ed(s)), (Chapman and Hall/CRC, 2008) 323–370.
- [8] SAS Institute Inc., *SAS procedures guide, Version 6, Third Edition* (Cary, NC: SAS Institute Inc, 1990).
- [9] G.A.F. Seber, *Multivariate Observations* (Wiley, New York, 1984). doi:10.1002/9780470316641
- [10] S.M. Srivastava, T. von Rosen and D. von Rosen, *Models with a Kronecker product covariance structure: estimation and testing*, Math. Methods Stat. **17(4)** (2008) 357–370. doi:10.3103/S1066530708040066
- [11] A. Wald, *Tests of statistical hypotheses concerning several parameters when the number of observations is large*, Transactions of the American Mathematical Society **54** (1943) 426–483. doi:10.1090/S0002-9947-1943-0012401-3

Received 14 February 2011