Small nonparametric tolerance regions

Report 2000-011

Small nonparametric tolerance regions

A. Di Bucchianico, J.H.J. Einmahl,
and N.A. Mushkudiani

Eindhoven, April 2000
The Netherlands

EURANDOM
P.O. Box 513
5600 MB Eindhoven
The Netherlands

Secretariat: Laplace Building 1.09
Telephone: +31 40 247 8100
Telefax: +31 40 247 8190
Email: all@eurandom.tue.nl
WWW: http://www.eurandom.nl

ISSN 1389-2355

Small nonparametric tolerance regions*

A. Di Bucchianico† J.H.J. Einmahl‡ N.A. Mushkudiani§

Abstract

We present a new, natural way to construct nonparametric multivariate tolerance regions. Unlike the classical nonparametric tolerance intervals, where the endpoints are determined by beforehand chosen order statistics, we take the shortest interval, that contains a certain number of observations. We extend this idea to higher dimensions by replacing the class of intervals by a general class of indexing sets, which specializes to the classes of ellipsoids, hyperrectangles or convex sets. The asymptotic behaviour of our tolerance regions is derived using empirical process theory, in particular the concept of generalized quantiles. Finite sample properties of our tolerance regions are investigated through a simulation study. A real data example is also presented.

Key words and phrases. Nonparametric tolerance region, prediction region, empirical process, asymptotic normality, minimum volume set.

AMS 1991 subject classification. 62G15, 62G20, 62G30, 60F05.

---

*This report is a revision of COSOR memorandum 98-16, Eindhoven University of Technology. Research partially supported by European Union HCM grant ERB CHRX-CT 940693.

†EURANDOM and Eindhoven University of Technology, Department of Technology Management, Section Quality of Products and Processes, both P.O. Box 513, 5600 MB Eindhoven, the Netherlands, email: A.d.Bucchianico@tm.tue.nl

‡Corresponding author. EURANDOM and Eindhoven University of Technology, Department of Mathematics and Computing Science, both P.O. Box 513, 5600 MB Eindhoven, The Netherlands, email: j.h.j.einmahl@tue.nl

§Eindhoven University of Technology, Department of Mathematics and Computing Science, P.O. Box 513, 5600 MB Eindhoven, The Netherlands, email: anino@win.tue.nl