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Uniform convergence rates for the approximated halfspace and projection depth. (English)

For nonparametric statistical analysis of multidimensional data, a general concept that is used is data depth. Two types of depths, namely half-space depth and projection depth, are frequently used. Exact evaluation of data depth is often difficult. Hence the attention in this paper is on procedures to approximate the true depth. Statistical properties of these approximation procedures are studied in this paper. The conditions under which uniform convergence of the approximated depth to its true depth are explored and the convergence rates are evaluated. Under some regularity conditions, it is shown that uniform approximations of the depth are valid and convergence rates can be computed. Guidelines are provided to determine the number \(n\) of directions needed to achieve the desired precision. Two main theorems are established. Explicit and exact rates of convergence are established in a number of distributions including multivariate Gaussian. Explicit guidelines are given for the choice of \(n\), the random sample of directions, to achieve the desired quality of approximation. Situations, where uniform approximation cannot be achieved, are also discussed. Extensions of the concept of projection depth are also explored.

Reviewer: Arakaparampil M. Mathai (Montréal)

MSC:
62G20 Asymptotic properties of nonparametric inference
41A25 Rate of convergence, degree of approximation
41A29 Approximation with constraints
41A63 Multidimensional problems
62H11 Directional data; spatial statistics
62H12 Estimation in multivariate analysis

Keywords:
data analysis; high dimensional data; data depth; half-space depth; projection depth; approximation; uniform convergence

Full Text: DOI Euclid

References:


Edited by FIZ Karlsruhe, the European Mathematical Society and the Heidelberg Academy of Sciences and Humanities
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