UNIVERSITÄT SALZBURG

Fachbereich Mathematik
Hellbrunnerstraße 34
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Gastvortrag

Dienstag, 3. Juli 2018
14.00 Uhr
Seminarraum II

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Estimation of Parameters in Directional Distributions

Abstract:

Directional distributions are being used in atmospheric sciences (wind and storm directions), biology (spread of bacteria, cells in organisms) etc. There are situations where the data is cyclic in nature and so distribution on a circle is a better model. The two-parameter Langevin distribution has been widely used for analyzing directional data. We address the problem of estimating the mean direction in its Cartesian and angular forms. The equivariant point estimation is introduced under different transformation groups. The maximum likelihood estimator (MLE) is shown to satisfy many decision theoretic properties such as admissibility, minimaxity, the best equivariance and risk-unbiasedness under various loss functions. This unifies optimal properties of the MLE for a Langevin distribution. Next we consider some specific estimators such as M-estimators (sample mean direction and normalized spatial median), restricted M-estimators (maximum likelihood estimator (MLE), Watson estimator and L1-estimator) and R-estimators (spherical median and spherical Wilcoxon estimator) for the location of a rotationally symmetric distribution on the unit hypersphere. We obtain explicit expressions for asymptotic relative efficiencies and gross error sensitivities of various estimators for Langevin and mixture Langevin models. These are used to explore the trade-off between robustness and efficiency amongst various estimators.

In estimating parameters in Euclidean spaces, the action space is chosen to be the convex closure of the estimand space. We extend this concept to the estimation of circular parameters of distributions having support as a circle, torus or cylinder. The concepts of convexity, projection etc., are utilized on manifolds to develop sufficient conditions for inadmissibility of estimators for circular parameters. A complete class theorem for equivariant estimators under a compact group of transformations is derived. The results are shown to be applicable to various directional distributions. These provide improved estimators of circular parameters.

Eingeladen von: Arne Bathke