Department of Decision Sciences

Statistics Seminar

Weighted Likelihood estimation of multivariate location and scatter: model fitting, outlier detection and robust data reduction

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Abstract

Several multivariate techniques are based on the the assumption of multivariate normality and the use of the sample mean vector and covariance matrix. Contamination in the data may have dramatic effects on all those techniques based on classical multivariate estimation. On the contrary, the use of robust estimates of location and covariance leads to multivariate techniques that are resistant to contamination. Furthermore, robust methods provide effective tools to detect outliers, find unexpected structures in the data and explore the types of occurred departures from the assumed model. The weighted likelihood is a general methodology designed to provide robust inferences. Here, a novel approach to obtain weighted likelihood estimates of multivariate location and scatter is discussed. A weighting scheme is proposed that is based on the distribution of the Mahalanobis distances rather than the distribution of the data at the assumed model. This strategy allows to avoid the curse of dimensionality affecting non-parametric density estimation, that is involved in the construction of the weights through the Pearson residuals. Then, weighted likelihood based outlier detection rules and robust dimensionality reduction techniques, such as principal component analysis or linear discriminant analysis, are developed.

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