Effects of Numerical Errors on Sample Mahalanobis Distances


Yasuyuki Kobayashi

The numerical error of a sample Mahalanobis distance \( T_2 = y'S^{-1}y \) with sample covariance matrix \( S \) is investigated. It is found that in order to suppress the numerical error of \( T_2 \), the following conditions need to be satisfied. First, the reciprocal square root of the condition number of \( S \) should be larger than the relative error of calculating floating-point real-number variables. The second proposed condition is based on the relative error of the observed sample vector \( y \) in \( T_2 \). If the relative error of \( y \) is larger than the relative error of the real-number variables, the former governs the numerical error of \( T_2 \). Numerical experiments are conducted to show that the numerical error of \( T_2 \) can be suppressed if the two above-mentioned conditions are satisfied.

http://doi.org/10.1587/transinf.2015EDP7348