Conics and quadric surfaces fitting to correlated data

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Abstract

Fitting quadratic curves and quadric surfaces to given data points is a fundamental task in many fields like engineering, astronomy, physics, biology, quality control, image processing, etc. The classical approach for fitting is geometric fit based on minimization of geometric distances from observed data points to the fitted curve/surface. In the contribution, we focus on solving the problem of geometric fit to correlated data using the linear regression model with nonlinear constraints. The constraints are represented by the general equation of the certain curve/surface. In order to obtain approximate linear regression model, these nonlinear constraints are being linearized by the first-order Taylor expansion. The iterative estimation procedure provides locally best linear unbiased estimates of the unknown algebraic parameters of the considered curve/surface together with unbiased estimates of variance components. Consequently, estimates of geometric parameters, volume, surface area, etc. and their uncertainties can be determined.

Keywords

Geometric fitting. Least squares. Variance components. Accuracy. Conics. Quadric surfaces.

References

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