The Asymptotic Geometry of Stein Procedures

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Charles Stein (1956) showed that the usual unbiased estimator for the mean vector of an n-dimensional multivariate normal distribution is inadmissible under quadratic loss when n exceeds 2. Shocking at the time, his result was variously called counter-intuitive, paradoxical, and of no practical use. Such opinions ignored the powerful geometrical insights developed in the rest of his paper.

Described in this talk are Stein's asymptotic geometry for estimating a mean vector of high dimension under quadratic loss; the significance of orthogonal equivariance; implied asymptotic minimax properties of Stein estimators; and the limited importance of multivariate normality. Stein confidence sets and Stein predictors become intuitive through related geometry. Modern adaptive linear estimators, including data-based penalized least squares, are a practical extension of Stein shrinkage.