Semiparametric robust mean estimations based on the orderliness of distributions

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As one of the most fundamental problems in statistics, the robust location estimation has many prominent solutions, such as the symmetric trimmed mean, symmetric Winsorized mean, Hodges–Lehmann estimator, Huber M-estimator, and median of means. Recent studies suggest that their biases concerning the mean can be quite different in asymmetric distributions, but the underlying mechanisms remain largely unclear. This study establishes two forms of orderliness, similar to the mean-median-mode inequality, within a wide range of semiparametric distributions, particularly highlighting the unique role of γ-symmetric distributions.

semiparametric | mean-median-mode inequality | asymptotic | unimodal | Hodges–Lehmann estimator

Data Availability. Data for Figure **??** are given in SI Dataset S1. All codes have been deposited in GitHub.

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