Asymptotic second-order consistency for two-stage estimation methodologies and its applications

Makoto Aoshima · Kazuyoshi Yata

Abstract   We consider fixed-size estimation for a linear function of means from independent and normally distributed populations having unknown and respective variances. We construct a fixed-width confidence interval with required accuracy about the magnitude of the length and the confidence coefficient. We propose a two-stage estimation methodology having the asymptotic second-order consistency with the required accuracy. The key is the asymptotic second-order analysis about the risk function. We give a variety of asymptotic characteristics about the estimation methodology, such as asymptotic sample size and asymptotic Fisher-information. With the help of the asymptotic second-order analysis, we also explore a number of generalizations and extensions of the two-stage methodology to such as bounded risk point estimation, multiple comparisons among components between the populations, and power analysis in equivalence tests to plan the appropriate sample size for a study.

Keywords   Bounded risk · Confidence interval · Efficiency · Equivalence tests · Fisher information · Multiple comparisons · Sample size determination · Second-order consistency · Two-stage estimation