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Eliciting Von Neumann–Morgenstern utility from discrete choices with response error

We investigate the elicitation method for the Von Neumann–Morgenstern-type decision-maker (DM) from pairwise comparison data in the presence of response errors. We apply the maximum likelihood estimation (MLE) method to elicit the nominal utility, together with the variance of the response error, assuming a Gumbel distribution. Given the finite support of the pairwise comparison lotteries and a priori risk-aversion information on the DM, we reformulate the MLE as a convex programming problem and establish theoretical consistency guarantees. The proposed framework enables robust inference of latent utility functions from observed choice data. We derive statistical errors between the MLE parameters and the true parameters, and we establish the quantitative convergence of the MLE utility to the true utility in the sense of the Kolmogorov distance. We demonstrate that the optimization problem maximizing expected MLE utility is robust against the response error in a probabilistic sense. Numerical results validate the practicality of the MLE method in a portfolio selection application.

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