Statistical Analysis of Ordinal Pairwise Comparison Data

A Brief Description of Python Classes facilitating the Simulation Study

The project aims at investigating the asymptotic properties of the Maximum Likelihood Estimation (MLE) of both the global parameters θ (threshold parameter) and local parameters $\mathbf{u} = (u_1, u_2, ..., u_n)^T$, (latent scores measuring n subjects' skill) in the generalized Bradley-Terry (BT) models, where minorization-maximization (MM) algorithm is leveraged for computing the MLE.

To facilitate our simulation study examining the uniform consistency of the MLE, i.e.,

$$\|(\hat{\mathbf{u}} - \mathbf{u})/\mathbf{u}\|_\infty \to 0 \text{ and } |\theta - \hat{\theta}| \to 0 \text{ as } n \to \infty$$

and assumptions on data samples needed for ensuring the convergence of the MLE, we developed Python classes for MM algorithm and data generation. A general description and detailed explanation for usage were documented in a GitHub repository.

We assume that each pair has at most one comparison in our simulation study. The observed (and generated) data is organized in form of a matrix, with size $n \times n$, (n is the number of subjects of interest), whose ij-th entry indicates the comparison outcome between subject i and j.

As per the directive from my supervisor, the simulations will not be provided before the fully completion of theory construction and paper writing.