Bayesian Inference from Rank Data

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Modeling and analysis of rank data has received renewed interest in the era of big data, when recruited or volunteer assessors compare and rank objects to facilitate decision making in disparate areas, from politics to entertainment, from education to marketing. The Mallows rank model is among the most successful approaches, but for computational convenience its use has been limited to a particular form based on the Kendall distance. We develop computationally tractable methods for Bayesian inference in Mallows models with any right-invariant metric, allowing greatly extended flexibility. Our method allows inference on the consensus rankings of the considered items, also when based on data provided in the form of partial rankings, such as top-t or pairwise comparisons. If the assumption of an underlying common true ranking for all assessors is unrealistic, we can find by means of suitable clustering more homogeneous subgroups and consider consensus rankings within each. Our method allows making probabilistic predictions on the classification of assessors based on the ranking of some items, and on individual preferences based only on partial information. Finally, we construct a regression framework for ranks which vary over time. The performance of the approach is studied using several experimental and benchmark datasets, and on simulated data.

Keywords: Highly Structured Stochastic Systems; Incomplete Rankings; Mallows Model; Pairwise Comparisons; Preference Learning.