Learning Mixtures of Plackett-Luce Models from Structured Partial Orders
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Introduction:
□ Background
Restaurant

Plackett-Luce Model

Mixtures of Plackett-Luce Models

Identifiability
• Full rankings (Zhao et al. 16)
• Structured partial orders?

Contributions:
□ Modeling

Theoretical Contribution
• Nonidentifiability: given top-1 and l2-way orders, k-PL is not identifiable if \( k \leq (l_1 + l_2 - 1)/2 \).
• Identifiability: 2-PL over 4 or more alternatives are identifiable given: (i) top-3, (ii) top-2 and pairwise, (iii) 4-way, or (iv) choice over 2, 3, 4 alternatives.

Algorithmic Contribution: Generalized-Method-of-Moments
• First step:
• Second step:

Selection of events:
– top-2 and 2-way: all
– choice-2, 3, 4: groups of 4 alternatives with at least one overlapping alternative.

Results:

Synthetic data with the following settings:
• Full rankings (linear orders) available
• Only structured partial orders available

□ Algorithms
• Top-3: GMM with events of top-3 orders (Zhao et al. 2016)
• Top-2 and 2-way: GMM with events of ranked top-2 orders and pairwise comparisons (proposed)
• Choice: GMM with events of choice-2, 3, 4 orders

□ Results

Conclusions and Future Work:
□ We propose a class of models (k-PL-partial) that generate partial orders from k-PL; we prove theorems on (non)-identifiability of k-PL-partial under certain combinations of structures; we propose efficient GMM based algorithms to learn 2-PL-partial.

Interesting future directions include:
• Efficient algorithms for more general partial orders
• Theoretical and algorithmic results for 3 or more components
• Exploring mixtures of more general RUMs beyond PL

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Code available at https://github.com/zhaozb08/MixPL-SPO