Towards an Interactive Learn-to-Rank System for Economic Competitiveness Understanding

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Rankings and their pitfalls

- Rankings are a fundamental tool used to help people understand the relative merit of objects and to simplify decision making when the number of factors impacting choice is large.
- Examples: ranking countries or regions according to economic principles, ranking institutions such as colleges or hospitals, ranking search results for user queries.
- Ranking models are often hand-designed in ad hoc manner. May succumb to several shortcomings:
  - Depend heavily on expert opinion.
  - Formulation not always transparent.
  - May contain non-discoverable bias.

MyRanker Framework:
Plug and play system for interactive learn-to-rank

- Introduce an interactive paradigm for automatic learn-to-rank tools supporting exploration and understanding of rankings.
- Aid users in the creation of ranking models which reflect their intuition and value system, through the incorporation of learning-to-rank algorithms [1] into highly usable interfaces.
- Provide interlinked visual displays allowing users interact with ranking models to gain deeper insights.
- Demonstrate the power of interactive ranking analysis applied for economic competitiveness evaluation.

Use Case: MATTERS Analytics Dashboard

Massachusetts Technology, Talent, and Economic Reporting System

- Online public tool which measures the economic competitiveness of US states using open data [2].
- MATTERS consolidates over 50 publicly available socioeconomic datasets.
- Publish 4 rankings annually to measure economic competitiveness according to Talent, Tax Climate, Cost of Doing Business, and Quality of Life.
- RankRLS

Ranking Specification Tools

Manual Rank Builder Tool
Explicitly construct ranking formulas and adjust learned weightings

Pairwise Learn-to-Rank Tool
Indicate preferences amongst objects. Rankings are learned automatically.

Ranking Views: Compare, Explore, Interact

Multiple views allow users to inspect and compare rankings and their components.
(Shown clockwise from the top left)

- Table view: correlation analysis provided to understand the relationships between data and rankings.
- State Profile view: displays the metric values which make up a custom rankings for individual states.
- Timeline view: shows how data changes over time for a set of states.
- Choropleth Map view: allows users to compare the distribution of ranking values across states.

Evaluation

Preliminary evaluation of the pairwise Learn-to-Rank tool on the data in the MATTERS warehouse aims to answer key questions:

- How well can the ranking algorithm [3] learn an existing ranking?
- How much information is necessary to collect from users for a high quality ranking?

- Table 1: The impact of the number of training pairs of states used to predict the MATTERS Cost index using RankRLS.
- Table 2: The impact of the number of metrics used to predict the MATTERS Cost index using RankRLS.

[MATTERS was developed in collaboration with the Massachusetts High Tech Council who provided guidance and partial funding support. Student contributors to the project are listed at http://davis.wpi.edu/BER/PROJECTS/MATTERS.]

References: