Implementing fair rankings in retrieval systems

Ongoing and planned research projects

What is a fair ranking?

- Objects (documents, articles, persons, ...) are ranked by decreasing estimated utility for the users
- Unfair position bias: Top ranked objects, that belong to the same group, receive disproportionately high attention
- Goal: Groups of ranked objects should receive a "fair" share of the users' attention
- In-processing: Fairness constraints are applied during the estimation of the ranking function
- Post-processing: Constraints are applied afterwards to re-rank the systems output

Fair ranking example

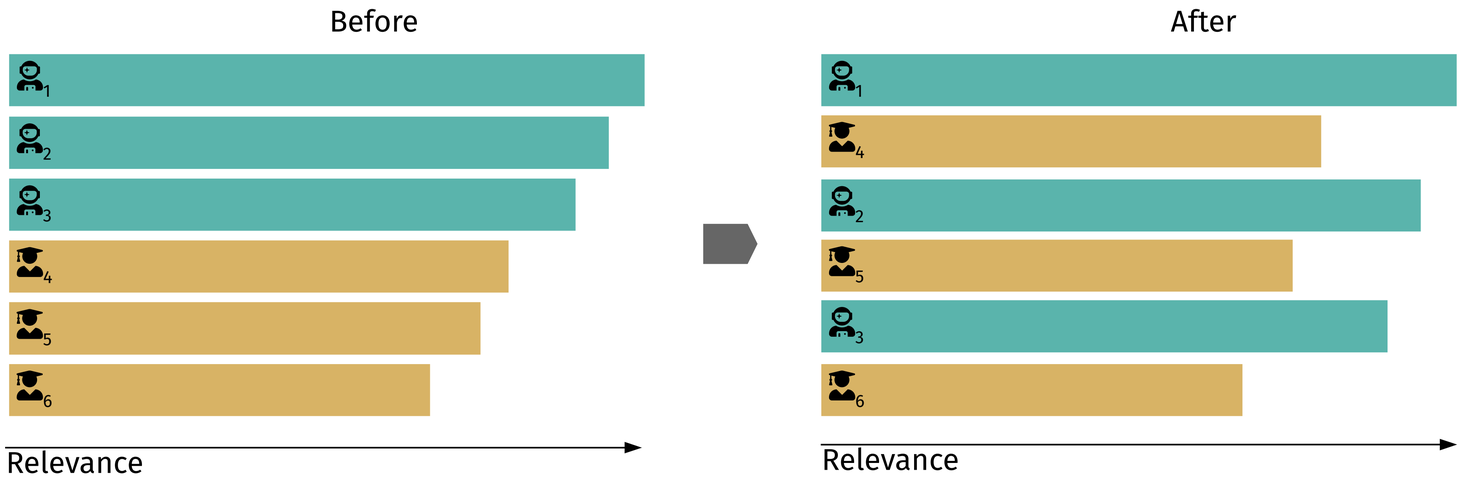

Fig 1: Applying post-processing fairness constraints to a ranking with two groups: , . After the post-processing, overall relevance decreased but attention for the objects in the second group increased.

P1: Query auto-completions

How to re-rank auto-completions such that topics are fairly distributed across the queries?

Data: Auto-completions for the names of German politicians

- Over 2000 names
- Google, Bing and DuckDuckGo
- Feb 2017 – today, two times a day

Methods: Post-processing fairness

- Clustering of auto-completions into topics
- Relevance scores from Google's autocomplete web API
- Auto-completions are re-ranked such that exposure of topics is proportional to relevance

Contributions

- Less biased auto-completions in critical search contexts, e.g. search about political candidates prior to elections

P2: News search

How to apply fair ranking to ensure a balanced representation of providers and opinions?

Data: German news research corpus

- Credibility Scores and meta-data on most popular online news-platforms (*Newsguard)*
- Online news data (*commoncrawl)*

Methods: Test collection and evaluation

- Event related auto-completions as query topics (see P1 and Fig. 2)
- Group definitions: news provider, political leaning, region, ...
- Systematic evaluation of different fair ranking implementations

Contributions

- Test collection to systematically study fair rankings in news search

P3: Academic search

How to fairly represent relevant authors from several, undisclosed group definitions?

Data: Semantic Scholar open research corpus

- Over 45 million published research papers
- Queries, group definitions and relevance estimates (*fair-trec* challenge)

Methods: Learning-to-fair-rank (Fig. 3)

- Starting point: DELTR algorithm
- Adaption for larger group sizes and different fairness criteria

Contributions

- Enhancement of existing learning-to-fair-rank procedures

Query auto-completions and news events

Fig 2: Auto-completions from Bing-Search for the query "trump" on July 10th, 2019. The highlighted completion references a news event that took place the day before.

System design for learning-to-fair-rank

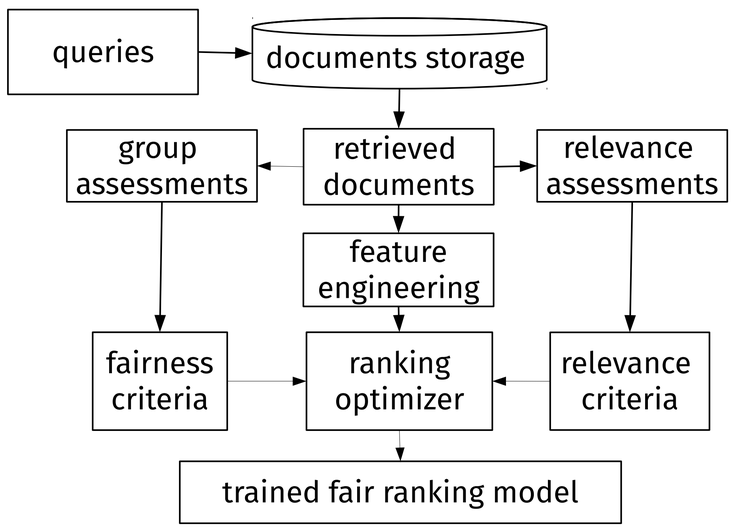

Fig 3: Schema of the modules, their relations and data input needed to train a learning-to-fair-rank retrieval system.

Related Concepts

Search engine bias

- Systematic and unfair exclusion, inclusion or prominence of ranked objects
- Measured as a systematic deviation from a fair or ideal ranking distribution

Ranking diversity in retrieval systems

- Provide the users with diverse and relevant information
- Fairness is concerned with the providers' side (e.g. providers of web content, scholarly or news articles) while diversity measures consider the users

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For further info, downloads and literature visit
ir.web.th-koeln.de/fairness

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DATA & KNOWLEDGE ENGINEERING

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