

Project Proposal – Examining and Debiasing Search Results in Political Domains

Track: Research Track

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Research Question

Can we usefully quantify political bias in web search results? Furthermore, can we reduce this bias while preserving relevance and user satisfaction?

Significance

The goal of this project is to explore the bias present in web searches and determine how to limit bias in results that may shift public perception on various topics. Search engines have immense influence over public discourse. Biased ranking of politically sensitive content can reinforce ideological echo chambers and distort users' perceptions of reality. Developing algorithms to identify and mitigate bias in search rankings is crucial for promoting a more balanced and informative web experience. This research could inform the design of fairer retrieval systems in news aggregators, academic platforms, and general-purpose web search engines.

Novelty

Many papers have discussed the nature of bias in search results and attempted to describe it in quantifiable terms. They tend to measure bias as it relates to a specific domain, such as politics or health information, and may further break down how bias can originate from different sources, which may mean examining user behavior and document content in addition to the results of information retrieval algorithms themselves. There is also a great deal of research that

examines bias in the sense of fairness, and which aims to describe how ranking algorithms that might be used to sort media, products, or people can be made less discriminatory.

Our approach is novel in that it makes use of existing datasets which label articles according to ideological affiliation. This data provides us with a clear, directly applicable metric with which to evaluate information retrieval methods.

Related Work:

Kulshrestha et al., "Quantifying Search Bias: Investigating Sources of Bias for Political Searches in Social Media" (2017)

<https://arxiv.org/abs/1704.01347>

Explores the distinction between bias from the data and bias from the search algorithm. Notes that differently phrased but similar queries can yield different biases.

Abbe Mowshowitz, Akira Kawaguchi, "Assessing bias in search engines" (2002)

<https://www.sciencedirect.com/science/article/pii/S0306457301000206?via%3Dihub>

Claims that bias can be difficult to evaluate, for the same reason that it can be difficult to authoritatively determine the relevance of a document to a query in the context of precision and recall. Proposes measuring bias from an "ideal distribution" created by collating results from several search engines.

Ryen White, "Beliefs and biases in web search" (2013)

<https://dl.acm.org/doi/abs/10.1145/2484028.2484053>

Explores the way in which bias can be a product of user behavior, in addition to bias produced by the search engine itself.

Biega et al., "Equity of Attention: Amortizing Individual Fairness in Rankings" (2018)

<https://arxiv.org/abs/1805.01788>

Discusses bias in the context of discrimination and fairness rather than in terms of ideology. Explores ways to improve the fairness of search results while maintaining relevance.

Approach

1. **Dataset:** Collect or use existing datasets containing political news articles labeled by ideological orientation (left, center, right).
2. **Baseline IR System:** Implement a standard search pipeline using BM25, embedding-based retrieval, or other IR techniques.
3. **Bias Quantification:** Develop a scoring method that can quantify the ideological skew of search ranking results (e.g., using left/right/center labels and computing entropy or

imbalance).

4. **Reranking Method:** Propose a reranking algorithm that balances relevance and ideological diversity (e.g., modified MMR, fairness constraints, or learning-to-rerank approaches).

Evaluation

We will evaluate the effectiveness of our approach along two axes:

- **Relevance:** Measured using standard IR metrics such as Precision@k, Recall@k, NDCG@k.
- **Bias/Diversity:** Using entropy of ideological labels, KL divergence from balanced distribution, and skew metrics from related works. This is to quantify how balanced or biased the search results are.

Timeline

- **April 5:** Collect and finalize datasets and research papers on ideological bias in web search results
- **April 12:** Literature review and background analysis on research papers
- **April 19:** Start implementing baseline IR systems
- **April 26:** Design and test bias quantification methods.
- **May 3:** Develop and test reranking algorithm techniques, start tuning.
- **May 10:** Run experiments, evaluate results
- **Final Week:** Write report, create presentation, finalize GitHub repo and results.

Task Division

- **Ronak Chaudhuri:** Coordinator. Lead baseline IR implementation.
- **Ronje Roy:** Dataset preparation, bias quantification, and evaluation metrics.
- **Alex Neibart:** Experimental tuning, visualization of results.