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Designing a bias-rating news recommendation system

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Abstract. Media bias can significantly influence public perception, often subconsciously shaping opinions. To understand and measure this bias, diverse methodologies have emerged. While models from social sciences offer in-depth evaluations, they involve intensive manual analysis. In contrast, computerized models provide speed but often lack depth. This research explores the synergy between these disciplines, aiming to create a robust bias detection tool that combines the meticulousness of social science models with the automation of computer science. Using this interdisciplinary approach, a system was developed to evaluate articles and instantly present a 'bias score' on the user interface. This score offers readers an immediate indication of potential news slant. The research also integrated web crawling techniques into the system, allowing it to identify and recommend alternative articles on analogous subjects. This innovative feature enriches readers' choices, equipping them with multiple narratives for an enriched understanding. In conclusion, this work bridges the gap between depth and speed in media bias detection, offering a novel tool that promotes informed readership. The contribution of this study lies in its interdisciplinary approach and the development of a system that fosters holistic media consumption.

Keywords: Bias-Rating, Recommendation System, Political polarization.

1. Introduction

In today's climate of pronounced political polarization, ensuring unobstructed access to news can seem like a daunting challenge in many regions. This makes it crucial for individuals to access impartial news, or at the very least, be cognizant of the biases present in their news sources. Addressing this issue requires an understanding of the root causes of media bias, which commonly stem from media ownership structures and the specific audiences they target.

Recent years have shed light on the profound influence of media bias [1]. Notable examples include the sway major outlets hold over public opinion during elections, perspectives on the Hong Kong protests, or views on the Taiwan issue. In the context of China, prominent news platforms are either owned by the party or maintain a specialized department named the CPC advisory council [2]. Such an environment invariably stifles the proliferation of diverse viewpoints. Compounding this challenge is the nature of traditional news recommendation algorithms. By catering primarily to users' existing preferences, these systems inadvertently foster confirmation bias or create "echo chambers" [3], culminating in narrowed worldviews and polarized perspectives.

This backdrop underscores the pressing need for a bias-rating news recommendation system. Such a system doesn't purport to be a sole arbiter of truth; rather, it offers a tool for users, empowering them to make informed decisions. It achieves this by presenting real-time data on potential biases within

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news sources. Should users wish to explore a topic from an alternate viewpoint, the system is equipped to retrieve relevant articles from its extensive repository. Initially, the intent was to leverage news articles from Chinese outlets, given their accessibility. However, the uniformity of perspectives within these sources posed significant constraints for the study [4]. Consequently, the analysis pivoted to evaluating major U.S. media establishments. The first step involved extracting URLs from a myriad of articles, categorizing them based on subject matter, followed by an assessment of their bias scores predicated on the criteria elaborated upon in subsequent sections. The remainder of this paper unfolds as follows: The subsequent section delves into the potential triggers for media bias and its defining traits. Section 3 provides an exhaustive overview of the bias-rating methodology. Section 4 unveils the outcomes of deploying the bias-rating system. Section 5 offers insights into feedback and challenges encountered during preliminary user interactions. Finally, Section 6 wraps up the discussion.

2. Media Bias

Understanding media bias and how they may arise in different stages of news production is crucial for coming up with the solution. Below is an illustration of the processes of producing news. As shown in Figure 1.

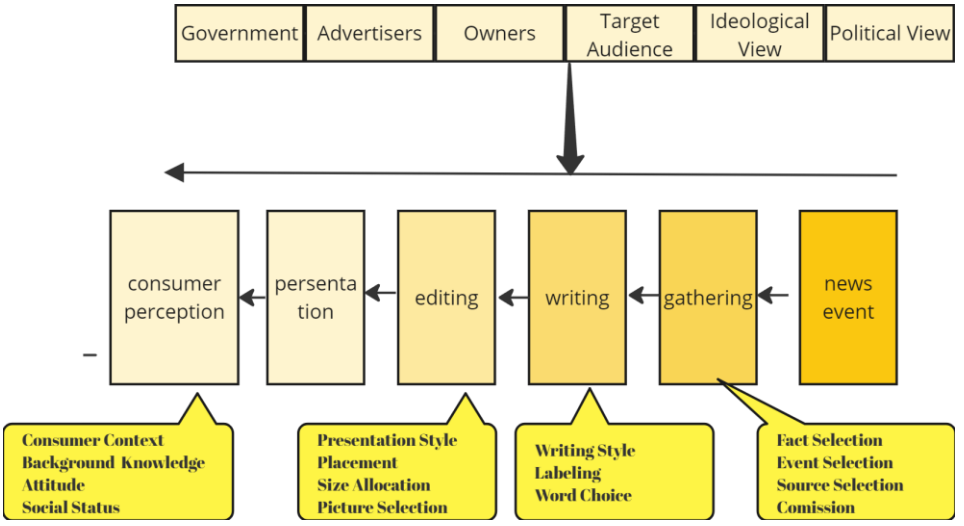

Figure 1. Structure diagram (Photo/Picture credit: Original).

As a preliminary research, this paper focuses mainly on writing style, i.e. labeling and word choice. When referring to a semantic concept, authors may label the concept based on its own knowledge and political stance and choose different words to represent it [5]. For example, in the Hong Kong protest, the government officials may refer to the protesters as “rioters” while Apple Daily may refer to them as the light of Hong Kong.

3. Bias-rating System

This section provides a deeper dive into the bias-rating method. As shown in Figure 2.

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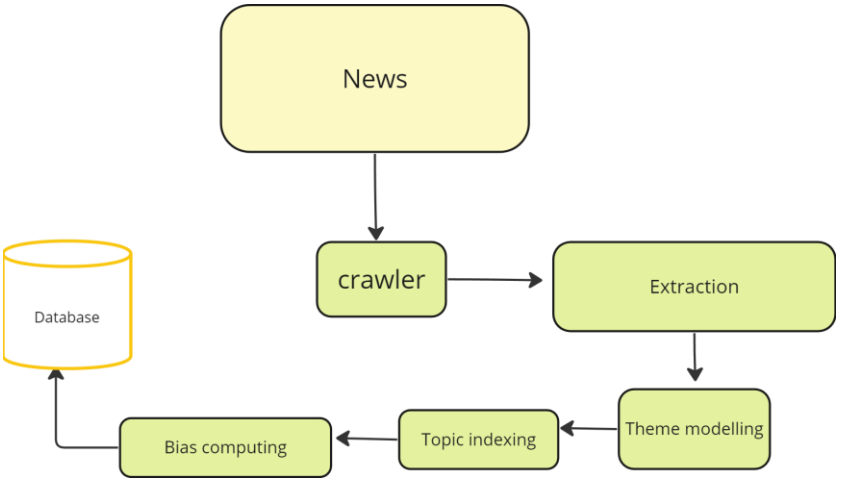

Figure 2. The bias-rating method (Photo/Picture credit: Original).

Initially, the primary focus was on political topics, given their propensity for bias compared to other subjects [6]. Take, for example, the topic of chip sanctions on China. News sources, including CNN, Fox News, NHK, China Daily, and The People's Daily, were chosen at random. Between September 1st and 10th, URLs of the most recent news content were crawled daily and parsed into robots for extracting the sitemap index. Subsequently, a language translator converted these articles into English to ensure precision in the analysis. A significant challenge arose when attempting to extract the title and text to enhance the recommendation speed by creating an index centered around specific topics. The bias-rating mechanism adopted the BASIL dataset, specifically, Bias Annotation Spans on the Informational Level, which encompasses manually annotated bias levels at both the sentence and article tiers [7]. In this context, BERT (Bidirectional Encoder Representations from Transformers) was utilized to delve into word embedding. This tactic is conventional in bias detection, where the pre-trained language model BERT is harnessed to extract low-level lexical features, thus determining the bias score of an article. The BASIL dataset incorporates 300 articles, distributed across 100 diverse topics, with three articles per event. These pieces were sourced from Fox News, Huffington Post, and New York Times, emblematic of right-leaning, left-leaning, and neutral perspectives, respectively. The dataset is compartmentalized into a training set, a test set, and a validation set. Afterward, the bias-rating model is honed using the training set and meticulously fine-tuned in line with the validation set. The efficacy of this model is subsequently assessed using metrics such as the F1-score, accuracy, and precision.

In this case, the system merge the right and left as biased, and neutral as unbiased. The bias-rating system adopts a scale from 1 to 5, whereas 1 represents the least biased and 5 represents the most biased. The algorithm is designed to round the bias score to whole number for real-life application. The system is designed to artificially compare and select the least biased among all of the articles it can gather and recommend the news to the user [8,9]. However, individual taste and selection can be catered to on the user end. As shown in Figure 3, the user may have a news that is rated as 1 but then they may consider the recommendation of narrow view and want to explore further into the topic. Therefore different perspectives can be shown by swiping left or right, where swiping left gives users left-leaning news and vice versa.

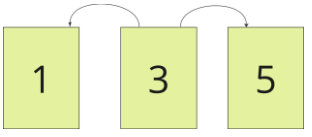

Figure 3. Diagram (Photo/Picture credit: Original).

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To test the system, various topics were selected from major news outlets from across the world and crawled for their URLs. The Bias-rating system is able to display the bias scores of individual articles and alert the users of potential bias.

4. Implementation Results

Due to the limited resources and the current political atmosphere, the experiment cannot be carried online. Therefore, to obtain as large a sample as I can, a WeChat group of 150 was founded, assembling my classmates and close friends. Two news topics were selected, the first was the 2019 Hong Kong Protest and the statistics was gathered between June 15th to June 25th, the second topic was more recent of the Fukushima wastewater releasing into the ocean and the statistics was collected from August 24th to September 2nd.The WeChat group was divided into two separate groups, with 75 members each. Team A was the control group in the experiment, during which they regularly consume the news on Chinese social media. Team B was the experimental group, they too had no access to foreign media and had access to the same news sources as team A. However, a plugin on their news browser notified them of the bias ratings of their news consumption. During the ten-day experiment, questionnaires were sent to the WeChat group at 9 p.m. and it would ask a series of questions to collect the group results. Users vote anonymously and the results are processed automatically and kept secret by the embedded function of voting analysis on WeChat till the end of the experiment.

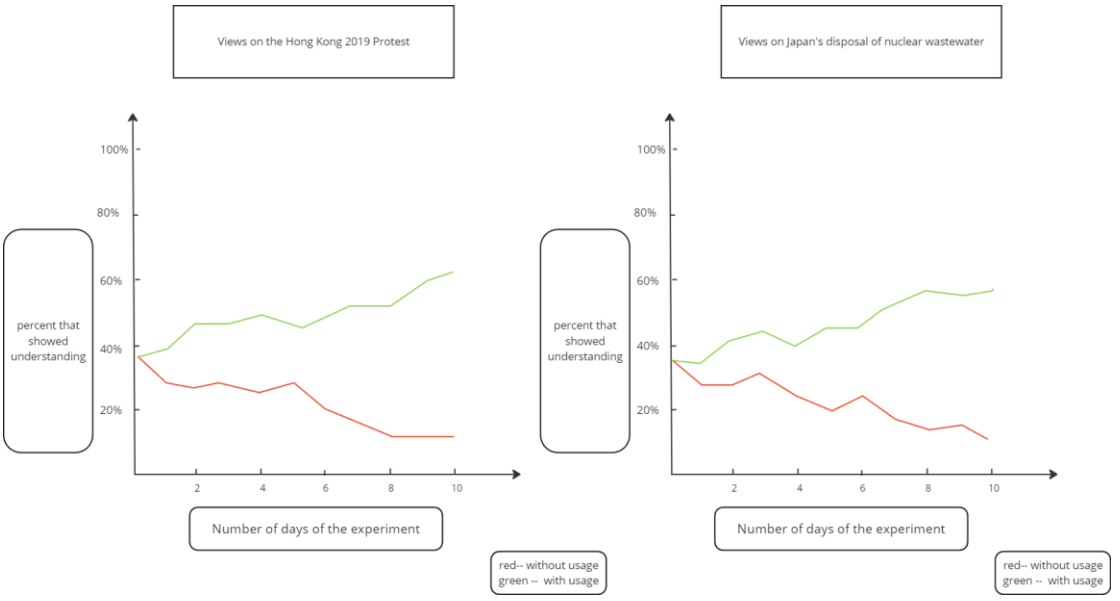

Figure 4. Structure diagram (Photo/Picture credit: Original).

Figure 4 shows the results of the two experiment where lines in red are without the plugin of the bias-rating system and the lines in green are subjects with the system. It can be seen from the chart that after merely ten days of the implementation, there is significant division in terms of the test subjects' inclination and acceptance of the topic discussed. Admittedly, the experiment is not at all rigorous for it only has a sample of 150 and they are not illustrative of the general population. However, there's no denying that the implementation of the news-recommendation system increased people's news-bias awareness and understanding and decreased extreme political views in the short-term [10,11]. This is especially important and proves that the bias-rating news recommendation system is still meaningful even when news in the database are biased to choose from.

5. Issues During the Try-out

As the bias-rating system is still a prototype, it has its flaws. This section congregates some of the most reported issues based on a follow up poll of team B.

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5.1. The Time Lapse

During real-life implementation, 41.2% of the members from experimental group report that the respond time for the news-bias rating system is more than 10 seconds. However, when the same procedure runs on English language news, the mean respond time is an acceptable 5.6 second. Although the rating time varies based on the length of the article and also the language used, further simulation and updates needs to be conducted to improve the model.

5.2. Bias-rating Flaws

55.8% of the test subjects reply that the bias-rating system does not necessarily points out the real bias score on some occasions. Further query exposes that the situation most likely occur when the news uses sarcasm or special way of writing. This reveals one of the weaknesses of word-based bias analysis. When using lexicon of positive/negative words marked with bias level, it is crucial to distinguish and analyze the bias level contextually [12,13]. This is because depending on the context of, words with positive/negative polarity may or may not convey bias. Conversely, generally neutral words can be used to convey a biased sentiment on a topic.

5.3. Plugin Interface

Across the 20 days of experiment in total, dozens of messages are sent by my classmates that the plugin sometimes has flashbacks which to anyone would be frustrating. Sadly, the problem is still waiting to be solved.

5.4. System Compatibility

The bias-rating system is designed to run on Android and Apple but seems to be not compatible with Huawei and some other mobile operating systems. As a result, some of the initial candidates for the experiment wasn't able to participate.

6. Conclusion

This paper introduces a novel system for rating bias in news recommendation platforms. This system extracts URLs from news websites and categorizes them based on various topics to construct a comprehensive database. The intention behind the bias-rating system is to offer Mainland users a reliable benchmark for assessing the veracity of information, thereby fostering their critical thinking skills. The design of this system represents a balanced approach, crafted to ensure its availability amidst the constraints of limited media freedom observed in certain nations.

Looking ahead, there are plans to refine the system further. Debugging is slated as a top priority, with the aim to subsequently introduce a more sophisticated model—designated as model 2.0—for assessing news bias. Integrating publicly accessible APIs that can distinguish between trustworthy news sources and fake news is also on the agenda. These APIs will play a pivotal role, either rewarding or penalizing the projected bias score. Moreover, enhancements to the sentiment analysis model are in the pipeline, with the goal of delivering a more comprehensive and nuanced understanding of news content.

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