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Escape from An Echo Chamber

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ABSTRACT

An echo chamber effect refers to the phenomena that online users revealed selective exposure and ideological segregation on political issues. Prior studies indicate the connection between the spread of misinformation and online echo chambers. In this paper, to help users escape from an echo chamber, we propose a novel news-analysis platform that provides a panoramic view of stances towards a particular event from different news media sources. Moreover, to help users better recognize the stances of news sources which published these news articles, we adopt a news stance classification model to categorize their stances into “agree”, “disagree”, “discuss”, or “unrelated” to a relevant claim for specified events with political stances. Finally, we proposed two ways showing the echo chamber effects: 1) visualizing the event and the associated pieces of news; and 2) visualizing the stance distribution of news from news sources of different political ideology. By making the echo chamber effect explicit, we expect online users will become exposed to more diverse perspectives toward a specific event. The demo video of our platform is available on youtube¹.

CCS CONCEPTS

• **Information systems** → *Web applications*.

KEYWORDS

Web Application, Social Media Bias, News Stance, Echo Chamber

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*Both authors contributed equally to this research.

¹<https://youtu.be/7jPJgRrK--8>

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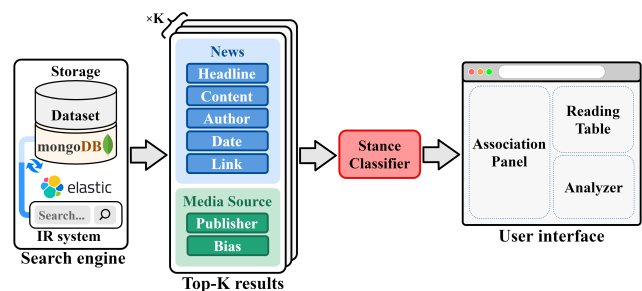


Figure 1: The news platform framework contains three major components: 1) a search engine, 2) a stance classifier, and 3) a user interface.

1 INTRODUCTION

Attribute to the advancement of the internet, retrieving information from the Internet becomes a daily habit. Sniffing out the business opportunity, commerce platforms attempt to attract users by developing recommender systems to feed the clients' possible interests. These business models also occur in the news platforms [5, 12]. More and more news sources publish news articles to tell the stories happening in the world. However, it isn't easy to always remain neutral and objective when composing news articles. Even more, some news sources attempt to spin control the information delivered to readers due to diverse purposes [8], or some news sources fabricate fake news that intent to mislead users [11, 13]. If the users are used to read news articles from specific sources that match their reading preferences or political leaning, they are easy to be exposed to some specific perspective without reaching the opposing views. The repeating information from one side would further reinforce the users' existing beliefs. This is usually referred as the echo chamber effect [3, 6, 7].

Noticing the echo chamber effect sets fire to the internet, we develop a novel news platform to break down the adverse impact. The news platform includes database collected from multiple news sources, e.g., a whole-year news in 2019 in our demo. Each news source has a source-level label that interprets its political orientation (i.e., media bias). We utilize a search engine that allows users to search news articles published by different news sources associated with the keyword (e.g., a particular event) in the news platform.

Moreover, to analyze how news sources with varied media biases react to a specific claim, we adopt a stance classification model to estimate each associated news article’s stance.

The proposed news platform has the potential to help users escape from echo chambers because 1) it retrieves news articles from multiple news sources, which provide rich information from different perspectives to the users [4]; 2) it visualizes the relation between media bias of the news sources and their stance for a claim, which makes users easier to exam their existing belief.

2 SYSTEM OVERVIEW

The proposed system provides several functions to facilitate news consumption. First, users can search for the news by topical keywords on demand. Second, search results are shown in a two dimensional space (association panel) according to their similarities. Third, users can click one of the results and the news article is immediately shown in the reading table. Forth, the analysis of media bias over news stance and the analysis of news stance over media bias for a set of news articles selected by a draggable rectangle are both provided in the reading table. Figure 1 shows the framework of the proposed news platform. The details of this platform and the provided functions are described in the following subsections.

2.1 Dataset

We utilize the NELA-GT-2019 dataset [9], which collected up to 260 news sources with 1.12 million news articles published within the whole year of 2019, to demonstrate the powerful functions of the proposed platform. The NELA-GT-2019 dataset provides the source-level media bias labeled from seven assessment sites². The media bias is categorized into one of “left bias”, “left center bias”, “right bias”, “right-center bias”, “least bias”, “questionable source”, “conspiracy pseudoscience”, “satire”, and “unlabeled” [9].

In this work, we are interested in illustrating how news sources with different political orientations react to an event’s claim by their published news articles. Therefore, we discarded news articles published by the news sources with media bias of “questionable source”, “conspiracy pseudoscience”, “satire”, and “unlabeled”. The statistics of the remaining data are shown in Table 1.

2.2 Search Engine

To enable users to search the news articles of a particular event, we integrate MongoDB³ with Elasticsearch⁴, where the MongoDB database handles the basic storing and retrieving function of the dataset, while Elasticsearch serves as the information retrieval system (IR system) that synchronizes with MongoDB to support the full-text query searching and ranking processes.

2.3 Stance Classifier

For the news articles retrieved by the search engine, we initially specify the headline of the top-ranked news as the claim of the event. Then a stance classification model [14] determines selected

Media bias category	# source	# article
Left bias	35	100,032
Left-center bias	45	258,037
Least biased	9	22,142
Right-center bias	17	81,911
Right bias	27	152,728

Table 1: The statistics of the dataset used in the proposed news platform.

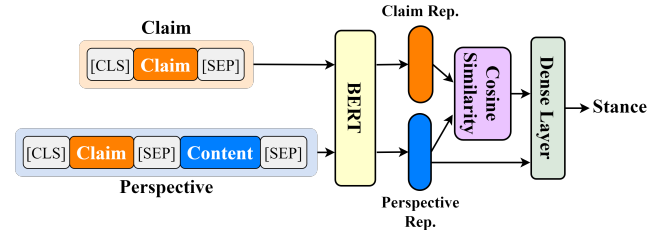


Figure 2: The architecture of the stance classifier.

Approach	Supporting			Opposing		
	Precision	Recall	F1	Precision	Recall	F1
LSTM	63.42	58.80	61.02	56.99	61.67	59.24
ESIM	64.38	61.32	62.81	58.53	61.67	60.06
MLP	64.53	60.98	62.71	58.50	62.14	60.26
WordAttn	64.43	63.43	63.93	59.40	60.45	59.92
LangFeat	63.74	75.05	68.94	64.75	51.77	57.53
BERT	79.05	84.64	81.75	81.14	74.65	77.76

Table 2: The performance comparison of the stance classifier (BERT) with different baseline models (the results are from the paper [14]).

news articles’ stance on this claim. We leverage BERT (Bidirectional Encoder Representations from Transformers) [2] to encode the representation of the claim and the news perspective, packed by the claim and the news content respectively. Then we use the cosine similarity to indicate the consistency between the claim representation and the perspective representation, which together with the latter in the next dense layer to divide the news stance for the former into 4 categories: “Agree”, “Disagree”, “Discuss” and “Unrelated”. These four stance categories are defined as:

- (1) Agrees: The news article agrees with the claim.
- (2) Disagrees: The news article disagrees with the claim.
- (3) Discusses: The news article discusses the same topic as the claim, but does not take a position.
- (4) Unrelated: The news article discusses a different topic than the claim.

The architecture of the stance classifier is shown in Figure 2.

We leverage the stance classifier that trained by an existing dataset—Perspectrum [1]—which contains claims and stances (“supporting” or “opposing” the claim)—to classify the stance of the news articles. The performance of the stance classifier and the baselines from the original paper [14] are listed in Table 2.

²Media Bias/Fact Check (MBFC), Pew Research Center, Wikipedia, OpenSources, Allsides, BuzzFeed News, and PolitiFact

³<https://www.mongodb.com/>

⁴<https://www.elastic.co/>

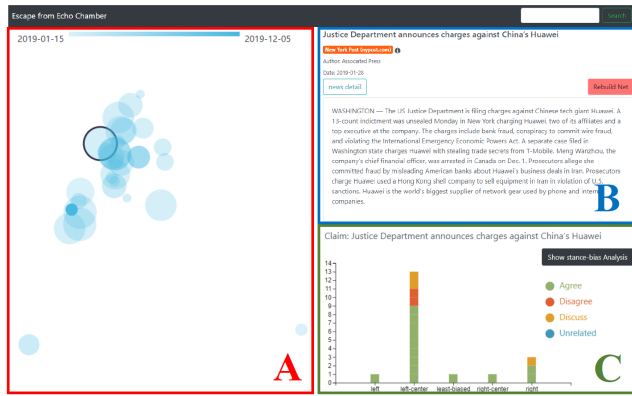


Figure 3: User interface of the news platform, which consists of three blocks: A) Association Panel, B) Reading Table, and C) Analyzer.



Figure 4: The reading table.

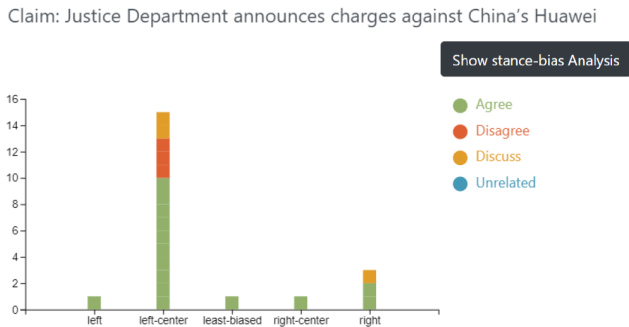


Figure 5: The bias-stance analysis, where the x-axis specifies the media biases, and y-axis presents the majority stance of the claim in each media bias category.

2.4 User Interface

Figure 3 illustrates the user interface (UI) of the platform. We provide a clean and simplified web UI consists of three blocks: A) an association panel, B) a reading table, and C) an analyzer. All blocks present different information to the users:

Association panel. We visualize the association of the news articles retrieved by the search engine on the association panel. Each

Claim: Justice Department announces charges against China's Huawei

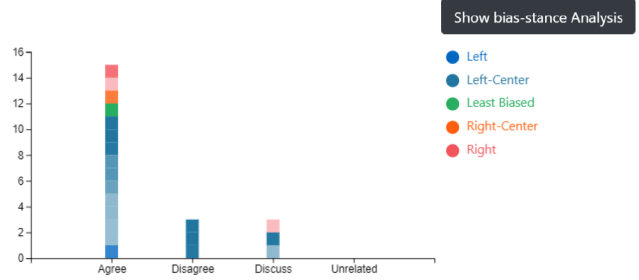


Figure 6: The stance-bias analysis, where the x-axis represents the stances, and y-axis shows the distribution of the sources of different political orientations with respect to different stances.

node on the panel represents one news article. To illustrate the similarity among the news, we first encode all retrieved news by the pretrained language model BERT [2], then project them onto a two-dimensional plane by leveraging principal component analysis (PCA) [10] to show the relative position of news articles on the panel—news articles are more similar if their positions on the association panel are closer. The color shade of the node shows up-to-dateness of the news—the darker the newer, while the size of the node indicates its popularity—the bigger the more often clicked. On the association panel, users can click on an arbitrary node, the selected news will present on the reading table; users can also draw a selection frame on multiple news articles for their further analysis of the interaction between the stance and media bias statistics.

Reading table. The reading table allows users to immediately access the selected news article on the association panel. It presents the news headline, news body, released date, a direct link to the original news page (by pressing the “news detail” button), and the news source (accompany with the media bias of the source shown in color: left oriented in red, left-center oriented in orange, least biased in green, right-center in cyan blue and right oriented in blue). Moreover, users can use the current selected news article’s headline, which could be more closely related to the event they are looking for or they are more interested in, as the query of the search engine to rebuild the association panel with the refreshing retrieved news by simply pressing on the “Rebuild Net” button. (see Figure 4).

Analyzer. The analyzer illustrates the perspectives of news sources with different political orientations (media biases) regarding to a specific claim. The claim is aligned to the selected news headline in the reading table, and users can easily manipulate the claim by selecting a piece of news article in the association panel. Users can select articles to generate statistics by drawing a selection frame with the left button of a mouse. Two display modes are provided: 1) bias-stance analysis, and 2) stance-bias analysis.

The bias-stance analysis visualizes the statistics with x-axis specified to the media bias, and y-axis presents the majority stance towards the claim in each media bias category. This analysis also shows which political oriented news source is more active in discussing the event, i.e., concerns more. Take the news shown in Figure 5 as an example, for the specified claim—“Justice Department

announces charges against China’s Huawei”, most of the news articles published by different political oriented news sources hold the same stance of “Agree” to the claim. Moreover, results show the news sources with “left-center” political orientation are more active on this topic than those in other categories.

On the other hand, the stance-bias analysis visualizes the statistics with x-axis represents the stance, and y-axis shows the distribution of the sources of different political orientations with respect to different stances. In this analysis, users can easily figure out which perspective dominates the claim. The example shown in Figure 5 indicates that “Agree” takes the major portion of the stances regarding the claim, and the claim is relatively reliable as news sources with different political agree on it.

3 CONCLUSION

We present a novel news platform, which aims to help users escape from the echo chamber by providing them news articles published by different news sources, and visualizing the interaction between media biases and news stances of the claim. The news platform involves news articles collected within the whole year of 2019, which is representative and close to the real world condition. By utilizing Elasticsearch as the search engine, users can retrieve the relevant news articles of the requested event published by up to 133 news sources. Additionally, all news sources in the database are annotated with a source-level label of their media bias showing the political orientation of the news source. A stance classification model plays the pivot part in the platform. We adopt BERT to encode the specified claim and the perspective shown by news content to predict each retrieved news article’s stance toward the claim. In the user interface, We display the distribution of stance-bias and bias-stance analysis to illustrate the distribution and the majority of the stance towards the claim in each media bias category. The bar chart also shows which politically oriented news source concerns the target event more. We believe the proposed platform is not only useful for general users but also can help journalists to easily gain the current media opinion from a holistic view. Our next step is to conduct user study on journalists in order to perfect this platform before opening it to the public.

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