Analysis and Comparison of Political Bias in News Aggregators

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ABSTRACT

News media is an extremely important source of information that keeps the public informed on current events and politics. Unfortunately, all news is biased. Different sources are slanted in different directions, and to varying degrees. News aggregators are websites that pick articles from various news outlets to ostensibly deliver a mixed bag of information from across the political spectrum. But news aggregators use algorithms to determine which articles are displayed, and as such, they can fall victim to biases in AI and machine learning. Three of the most well known news aggregator programs are Google News, Apple News, and Yahoo News. We would like to determine, through rigorous analysis of data collected from these sources, the extent of their biases. Some important questions to be analyzed include whether the three sources are biased (and how much, if they are), whether the rank of the articles plays a role in this bias evaluation, and whether there is a hollowing out effect that reduces the frequency of center articles and amplifies the proportion of extremes.

Keywords: Algorithmic Bias | News Media | News Aggregator | Statistics | Political Bias

I. INTRODUCTION

The transition of news from print to digital platforms in the last few decades has transformed the news industry and how people access news. With lower distribution costs and easy access, digital news has become widespread, with information that was previously controlled by traditional media becoming democratized. Along with this shift, which each passing decade, the number of sources available for consumers to choose from increases. Despite the proliferation of news sources to choose from, a majority of the U.S. public states that it is harder to be well-informed and determine which information is accurate.[2] News plays an important role in shaping public opinion about significant political and social issues. Most of what we know about current events in the world aside from first-hand experiences is shaped by how those events are reported in the news.[10] All news sources are biased to certain degrees, and it is impossible to avoid it due to the inherently biased nature of news reporting. The problem lies in the fact that many people don't know how to find reputable, neutral news sources among the many which are opinionated. News Aggregator sites consolidate information from different popular news sources into a single feed to make it easier for people to navigate. The aggregation process is entirely automatic, and algorithms regularly update their feed by sifting through the latest news articles on certain topics to determine their relevance from a variety of news sources. Some popular sites include Google News, Apple News, and Yahoo News which have accumulated audience sizes of hundreds of millions of active users.[4] Theoretically, the organization of news sources on the feed should result in the articles being evenly distributed on the political spectrum. But news aggregators use algorithms to determine which articles are displayed, and as such, they can fall victim to biases in AI and machine learning. They rank articles based on their perceived importance of them, however, importance is a variable factor that is based on individual opinion. Google has been accused of bias in their algorithms multiple times in the past and for favoring left leaning news sources; recently Google's CEO Sundar Pichai was called to testify in front of Congress.[9] In consideration of these accusations in Google's search algorithm, it is important to see if the same bias is reflected in their News Aggregation algorithms. We aim to investigate if there is bias in popular news aggregators to find out if the information we are accessing is reliable or not.

II. METHODOLOGY

A) Data Collection

To begin the study, our group needed data. As far as we could determine, there was no available free public data for search results in news aggregators. Thus, we had to collect our own data. To do so, we noted down the top 30 headlines in each of the three aggregators each day for 14 days. Along with the article itself, we also took note of the Media Bias/Fact Check and Interactive MB ratings for the article sources, the article date, the rank number, and whether the article was more than a day old. To do this accurately without reflecting the biases of the researchers, the data collection had to avoid article personalization. When not signed into an account, neither Google nor Yahoo news personalizes the "Top Headlines" section of their page. Apple News does, but based solely on view history in the app. That view history can be deleted each time data is collected, thereby avoiding personalization.

To get a more accurate view of the article biases, we also used a NLP (Natural Language Processing) algorithm from the Bipartisan Press to analyze the bias of each individual article, not just its source. The model has been trained on a large database of pre-categorised articles and can classify texts according to their degree of bias. According to previous research, the AI model can classify the bias of articles up to 96% accuracy with an average deviation of 7%.[1] The Bipartisan Press API returned values from -42 (most left biased) to 42 (most right biased), though most articles did not go beyond 20 in either direction.

B) Data Preprocessing

There were a few data preprocessing steps that we had to take. First, the MB/FC political slants were converted to numerical values, where a 1 was assigned to left, 2 to left-center, 3 to neutral, 4 to right-center, and 5 to right. To compare the Bipartisan Press on a similar scale, the bias values were assigned to numerical values from 1-5, where 1 and 5 fall on the left- and right-leaning spectrums, respectively. Bias values from -5 to 5 were deemed neutral and were thus assigned a 3. Publishers that didn't have a MB/FC slant were added to the neutral cohort, as most were small local publications of the type that tend to be least biased.

C) Hypotheses/Experiments

After completing the data preprocessing, we came up with 4 hypotheses to test. The z-test would be used for the first three hypotheses, and a p-value cutoff of 0.05 will help determine the statistical significance and whether or not to reject the null hypothesis.

1. Google News, Apple News, and Yahoo News are Left-Leaning.
2. Left-leaning articles show up higher on the list (lower average rank).
3. Articles that are older than a day old are more left leaning than the average article.
4. There is a hollowing out effect of the article biases (they show a bimodal distribution).

D) Hollowing Out Effect

The hollowing out effect has become a trend of the current political climate. It is characterized by the reduced frequency of center media and the proliferation of more left leaning or more right leaning media.

E) Model

As an extension to the research, our group created a model to predict whether an article is biased based on various factors. A logistic regression model was used to determine the accuracy of bias prediction based on a single factor at a time, while a Decision Tree classifier was used to test for maximum accuracy with all factors. An article

is considered “unbiased” for the purposes of this model if it has a Bipartisan Press bias value between -5 and 5, inclusive. All other values are considered “biased”.

III. RESULTS

A. Visualizations

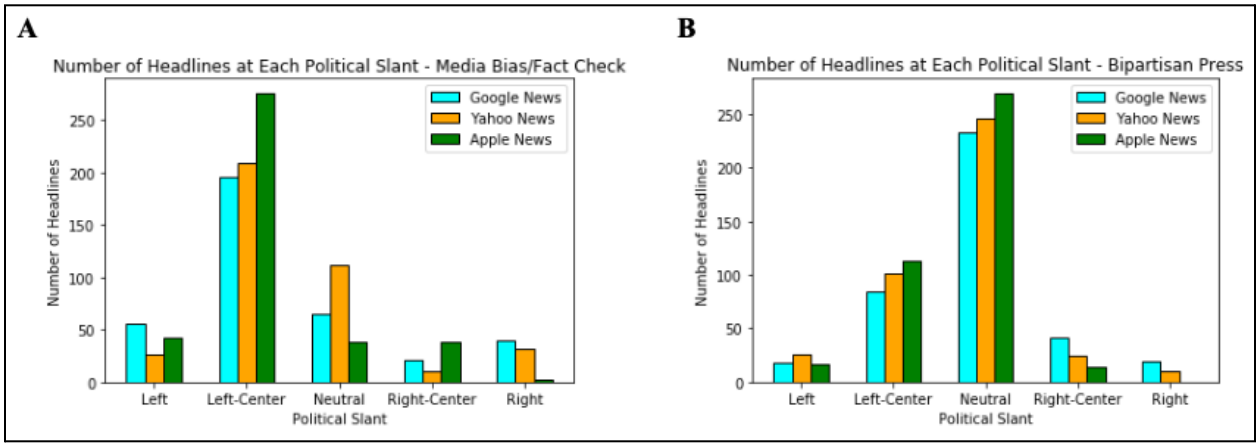

Fig. 1. Plots used to test out Hypothesis #1. **(A)** The distribution of political slants of the 3 news sources based on the Media Bias/Fact Check slants. These political slants look solely at the publisher of the articles. **(B)** The distribution of political slants based on the Bipartisan Press API values. These values are based on the text in each of the articles.

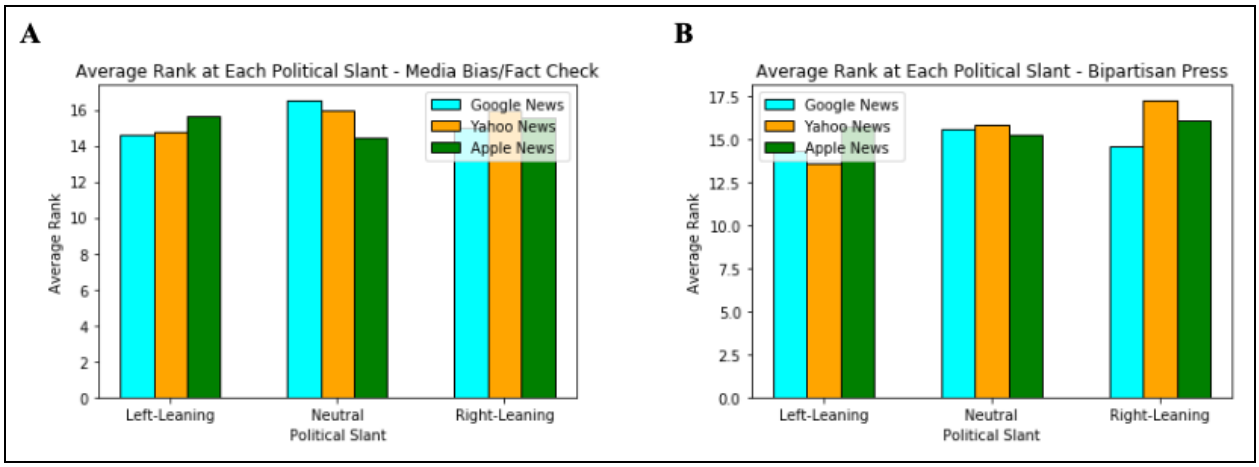

Fig. 2. Plots used to test out Hypothesis #2. **(A)** The average rank of the 3 news sources for left- or right-leaning articles based on the Media Bias/Fact Check slants. Lower ranks indicate that articles were shown higher up on the Headlines page. **(B)** The average rank of the 3 news sources for left- or right-leaning articles based on the Bipartisan Press API values.

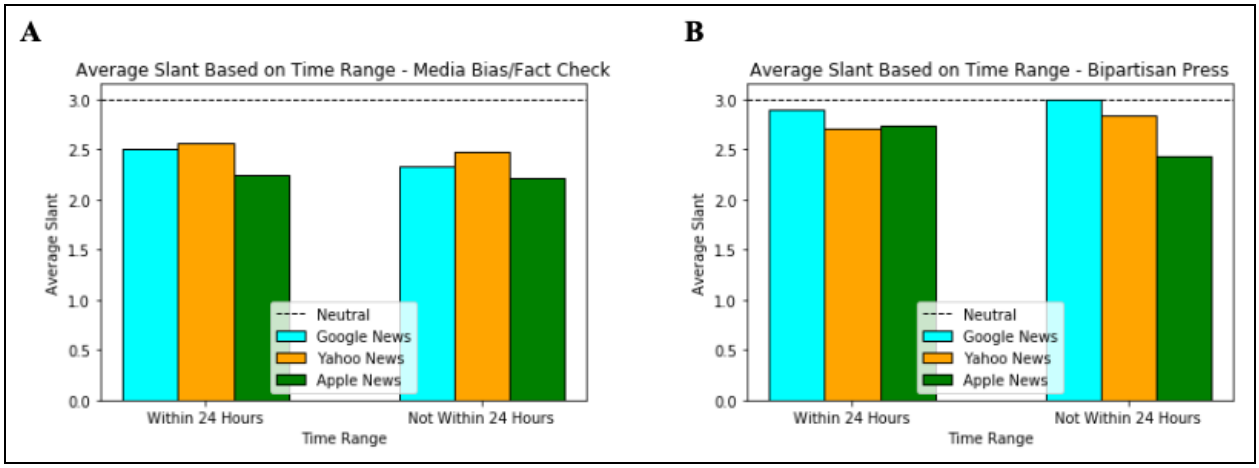

Fig. 3. Plots used to test out Hypothesis #3. **(A)** The average slant of the 3 news sources for articles within 24 hours and not within 24 hours of data collection based on the Media Bias/Fact Check slants. Political slant values under 3 indicate left-leaning articles. **(B)** The average slant of the 3 news sources for articles within 24 hours and not within 24 hours of data collection based on the Bipartisan Press API values.

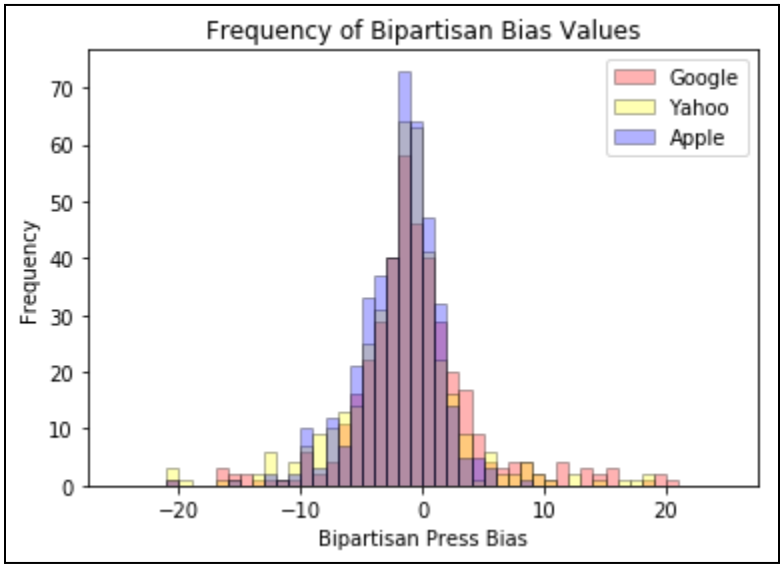

Fig. 4. Histogram used to test out Hypothesis #4. 51 bins of equal width were used in this histogram.

B. Statistical Test and Model Results

Table 1. Statistical Test Results for Hypothesis #1-3

News Media Source	P-value (Hyp. #1)	Left-Leaning Avg Rank	Right-Leaning Avg Rank	P-Value (Hyp. #2)	Within 24 Hours Avg Bias	Not Within 24 Hours Avg Bias	P-Value (Hyp. #3)
Google News	0.00669 *	14.30	14.58	0.346	-0.662	-0.118	0.361
Yahoo News	2.43×10^{-13} *	13.59	17.26	2.95×10^{-5} *	-1.90	-1.21	0.0176 *
Apple News	2.82×10^{-34} *	15.74	16.07	0.397	-1.72	-3.11	0.000751 *

* Statistically significant difference. Reject the null hypothesis.

Table 1 displays the results of the z-tests performed on the dataset. The first set of p-values represent the results of Hypothesis #1, comparing the Bipartisan Press biases of the 3 news sources to the expected neutral bias value of 0. The second set of p-values tests Hypothesis #2, whether left- or right-leaning articles have higher average ranks. The third, and final, set of p-values is for Hypothesis #3 and checks whether articles older than a day old are more left-leaning.

Table 2. Logistic Regression Results

Feature	Accuracy - Publisher (%)	Accuracy - Article (%)
Reliability_Range_Interactive_MB	78	84
Rank_Number	62	85
Within_24_hours_Cleaned	62	85
Audience_Interactive_MB	62	85

Table 2. The results of the logistic regression models used to test the accuracy of each of the 4 features independently in predicting the bias in both the publisher and the article.

Table 3. Decision Tree Results

Decision Tree max_depth	Accuracy - Publisher (%)	Accuracy - Article (%)
1	75	81
2	85	83
3	92	79
4	98	78
5	99	78

Table 3. The results of decision tree classifiers that used all 4 features to predict whether both a publisher and article are biased. The hyperparameter max_depth was varied in these trials.

C. Analysis

In Fig. 1A, it is clear that a majority of the articles for all 3 sources were left-leaning, according to the Media Bias/Fact Check slants. In Fig. 1B, the difference is slightly less, with most of the articles falling in the neutral category. This is likely due to the fact that the Bipartisan Press bias values are far more accurate since they analyze the actual article instead of the publisher. However, most of the non-neutral articles fall in the left-center category. To prove whether these differences are statistically significant, a set of z-tests was conducted to produce the first set of p-value results in Table 1. Since the p-values for Google, Yahoo, and Apple News are less than the p-value cutoff of 0.05, we can reject the null hypothesis that the news media sources display a collective set of neutral articles.

For the second hypothesis, Figs. 2A,B were generated to plot the correlation between the slant and average rank. Based on both Figs. 2A,B, there is a noticeable difference between the average rank of left- and right-leaning articles for Yahoo News but not for Google or Apple News. To check whether these results are statistically significant, a second set of z-tests was conducted in Table 1. We can only reject the null hypothesis for Yahoo News

since the p-value (0.00571) is lower than the cutoff. Google News and Apple News have a left-leaning average rank lower than their right-leaning average rank as well, but it is not shown here to be statistically significant.

Figs. 3A,B were plotted to visualize the average slants of articles that were or were not published within 24 hours of data collection. In Fig. 3A, the average Media Bias/Fact Check slant is lower for articles older than a day old for all 3 news sources, so those articles are more left-leaning. In contrast, Fig. 3B, which uses the average Bipartisan Press slants, shows that Google and Yahoo News articles that are older than a day old are actually more neutral, while older Apple News articles are more left-leaning. With no clear trend in the graphs, 3 more z-tests were conducted using the Bipartisan Press bias values to determine statistical significance. The null hypothesis can be rejected for Apple News; older articles are substantially more left-leaning. The null hypothesis can also be rejected for Yahoo News, in which older articles are substantially *less* left-leaning. The same is true for Google News, but to the degree to be statistically significant.

Fig. 4 shows the bias values plotted in a histogram for all 3 sources; there is clearly a single peak in the distribution. Thus, the hypothesis that there is a hollowing out effect (which can be demonstrated with a bimodal distribution) can be rejected.

The first logistic regression model in Table 2 predicts if a publisher is biased, while the second logistic regression model predicts if a specific article is biased. The 4 features are being used independently in the model, with Reliability_Range_Interactive_MB (Ad Fontes Media's reliability score for the source) having the highest accuracy of 78% for the publisher and a 3-way tie for the accuracy of 85% for specific articles.

The first decision tree classifier varies the max_depth to predict if a publisher is biased, while the second classifier predicts if a specific article is biased. As the max_depth of the classifier increases, the accuracy of the publisher-based model does as well, but it does not get any higher than 99% with max_depth values greater than 5. As the depth of the article-based classifier increases, the accuracy of the model does as well initially. However, after the depth of the classifier is greater than 2, the accuracy of the model decreases, an indication that the model started overfitting.

IV. DISCUSSION

Hypothesis #1 was tested and shown to be clearly true. Apple News, Google News, and Yahoo News all have algorithms that are biased left; thus, they select articles that have a mean bias left of center. The slant based on the article publisher had a higher distribution on the left than to the right. In comparison, the analysis based on the text in the articles themselves had a slight left bias, but were more neutral. So, the idea that news aggregators are unbiased because they incorporate news articles from various sources with articles of various slants on evenly distributed does not hold up to scrutiny. One potential explanation for this is that most news aggregators take articles from the popular news sources, most of which are slanted left. To remedy this, aggregator sites should take articles from a variety of sources and take into account which sources are more heavily slanted towards a particular political side as to not favor a particular side.

The experiment that tested Hypothesis #2 suggested that, generally speaking, left leaning articles are placed higher up on the webpage than right leaning articles - though only the data for Yahoo News is statistically significant. That means left leaning articles are the most visible to users, exacerbating the effect of the already significant bias of the aggregator. More data and testing is required to prove the same for Google and Apple news, though they do exhibit the same trend as Yahoo News in our data.

Hypothesis #3's experiment reveals substantive differences in the algorithms of the three aggregators. In Apple News, articles older than a day old are more left leaning than the average article. This means that left-wing articles are generally displayed for longer on the website, allowing exposure to more people. The opposite is true in Yahoo News; articles older than a day old are more neutral than the average article. Google News follows the same trend as Yahoo, but its data is not statistically significant.

Hypothesis #4 can be entirely rejected; there is no hollowing out effect since there is no trace of a bimodal distribution in the bias histogram. Thus, the data is clustered around one point (slightly left of neutral). The idea that

aggregators prioritize extreme perspectives while reducing the middle, as has been seen on other platforms, can be discarded.

The logistic regression model suggests that Interactive MB's reliability ranking for sources is the best predictor of source bias accuracy. Combining all factors, the decision tree model obtained a maximum of 99% source accuracy and 83% article accuracy. The model began to overfit the Bipartisan Press data at higher depths, reducing accuracy slightly. This proves that the most important factor in predicting whether it was biased or not was whether or not the source was considered a reliable one. In the future, news aggregators should take into consideration the reliability for popular news sources that they scrape articles from to determine the potential level of an article's bias before posting it. This can help reduce the amount of articles with a skewed bias and make the distribution more even on the political spectrum.

V. CONCLUSION

Ultimately, it is clear that Apple News, Google News, and Yahoo News are all left-leaning sites. Major news aggregators such as the ones tested have such large audiences that it is no surprise they play a big role in shaping the public's options. A few articles which are slanted to a certain bias on their own are not enough to change people's views, but as the number of articles stack up and a consistent trend is observable with a clear bias to them it is easy for people to be swayed. This is dangerous especially because most users of these sites are not even aware that they are being exposed to information that, taken as a whole, is slanted mildly but noticeably left.

In this study, our group used statistical tests to determine whether there was statistical significance in the political slants of articles from Google, Yahoo, and Apple News. We incorporated several different features in our analysis, such as the number of headlines in each political slant, the average rank of the articles, different grouped rank categories, and the time stamp during data collection. Our paper aims to provide additional information about the potential political bias in many popular news sources and inform users how their opinions may be influenced by the news they consume. Further study, with more data, is required to fully understand the degree of bias in these news aggregators, as well as its relationship with other article traits. Further testing is also needed to analyze the *change* in article bias over time; our 14 day study was not long enough for this.

VI. ACKNOWLEDGMENTS

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