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EXPLORING THE EMOTIONAL FINGERPRINT OF FAKE NEWS: A COMPARATIVE SENTIMENT ANALYSIS OF TRUE AND FAKE NEWS ARTICLES

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Abstract

Employing sentiment analysis to deduce the articles' emotional connotation and the Naive Bayes Classifier algorithm to differentiate between real and false news is the focus of this work. We evaluate the Naive Bayes Classifier's performance in correctly classifying news material using a dataset that includes labelled real and false news. We also use sentiment analysis to see how real news and false news compare emotionally and subjectively. Contributing to a better understanding of disinformation and its effects on public perception, this research seeks to shed light on the different sentiment patterns of real and fake news pieces. The results of this study have important consequences for the areas of media literacy, the identification of disinformation, and the creation of automated systems to counteract disinformation.

Keywords: Real or Fake News Sentiment Analysis, Natural Language Processing, Text Tagging and Classification, Machine Learning, Naive Bayes Classifier.

1 Introduction-

Instantaneous access to news from all over the globe has been made possible by the enormous use of digital media and the internet, which has completely changed the way people consume news. Having said that, the accessibility of information has also contributed to the dissemination of misinformation, which has cast doubt on the reliability of statistics and weakened the foundations of public debate. Deliberately created material with the intent to mislead and perpetuate false narratives is known as "fake news" [2].

Researchers are devoting more and more time and energy to the problem of false news and how to stop it. They are trying different methods to identify and evaluate disinformation. Applying machine learning techniques, namely the Naive Bayes Classifier, which has shown efficacy in text categorization tasks, is one approach that shows promise. Using the Naive Bayes Classifier, this research will compare and contrast the features of real and false news. Automating sentiment analysis may be achieved in two main ways. One strategy makes use of a vocabulary of weighted words, while the other depends on ML methods [19].

To further distinguish between real and false news, this study uses sentiment analysis in addition to categorization. Automatically identifying opinions inherent in written text is the goal of Sentiment Analysis (SA). Data mining, text mining, and IR are just a few of the study areas where it has recently gained traction [1]. On the other side, the dissemination of misinformation has

increased due to the accessibility of information, putting the reliability of data at risk and undermining the credibility of public debate. This method determines the tone of the feeling and the intensity of the viewpoint [19]. This research aims to help detect and comprehend disinformation by comparing the sentiment of real and false news in order to find different trends.

The study's three goals are as follows: first, to assess how well the Naive Bayes Classifier classifies news stories as real or fake; second, to use sentiment analysis to compare the articles' subjective content and emotional tone; and third, to talk about what this research means for detecting misinformation and improving media literacy. This study seeks to meet these goals in order to participate in the larger fight against false news and to improve the trustworthiness of information in the digital era.

Here is the structure of this paper: The next part provides a literature overview of relevant works, with a focus on previous research on sentiment analysis and the identification of false news. In the methodology section, you may find details on the dataset, algorithm, and procedure used for sentiment analysis. In the discussion section, we provide the results of our research, as well as the study's limits and implications. Finally, the conclusion summarises the key points and suggests areas for further study.

2 Related Work-

- A paper titled "Fake News Detection Using Sentiment Analysis [3]" delves into the topic of false news and its effects on society. It suggests a method of detection that boosts accuracy using sentiment analysis. The system tries to detect false news and stop it from spreading by using sentiment. Preprocessing text data using methods like tf-idfvectorizer with cosine similarity is the suggested approach. The suggested approach successfully detects false news, according on the experimental findings.
- This work presents a lexicon-based method for sentiment analysis of news items (Sentiment Analysis of News items: A Lexicon Based Approach [19]). Using a WordNet lexical lexicon to give sentiment ratings, the study focuses on Sentiment Analysis of BBC news stories. The bulk of articles fall into either the positive or negative categories, with the entertainment and tech categories showing a higher concentration of negative opinions.
- An analysis of social media networks' sentiment using machine learning is the topic of the article. The paper offers a hybrid approach for sentiment classification and compares the performance of deep learning and machine learning techniques. With training on a dataset of more than a million tweets, the system was able to get an accuracy rate of up to 83.7%.This research looks at how people's emotions and reactions to various scenarios might be better understood using contemporary methods. The long-term goal is to include Arabic tweets into Sentiment Analysis by combining text and emotions using the hybrid classification approach.

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- A decision tree algorithm is the subject of the article "Sentiment Analysis for Urdu News Tweets Using Decision Tree [4]" which focuses on sentiment analysis of such tweets. The goal of the research is to use the decision tree method to categorise tweets as positive, negative, or neutral after data preprocessing and feature vector creation. This method has made great strides in accurately analysing the sentiment of Urdu-language tweets. With the help of data preprocessing, feature vector creation, and decision tree use, the suggested method achieves 90% accuracy in sentiment classification of Urdu news tweets. Upon examination of the dataset, several worries transpire, such as the dependence on human annotators for dataset annotation and the possible difficulties in dealing with the intricacies and subtleties of the Urdu language in Sentiment Analysis.
- "Sentiment Analysis for the News Data Based on the social Media [18]" is a work that discusses sentiment analysis using news data derived from social media. It emphasises the significance of social data in Sentiment Analysis and its use in other fields. To improve the accuracy of real-time social media news analysis, the suggested approach combines the Naïve Bayes and Levenshtein algorithms for emotion classification in news data. Using Sentiment Analysis, the research hopes to foretell how the general public will respond to news stories. It may be difficult to properly classify emotions from massive volumes of social media data, and conclusions from Sentiment Analysis based on this data might be inaccurate or biassed.
- Using a broad dataset that includes both real and false news pieces, the research paper "On Sentiment of Fake News [20]" explores the sentiment analysis of online fake news. To investigate if there is a connection between public opinion and the accuracy of news stories, the writers use a number of Sentiment Analysis techniques. Their research shows a strong correlation between the two, suggesting that false news is more likely to have an angry tone than good news. The advancement of autonomous algorithms for detecting false news relies heavily on these discoveries. The research proves beyond a reasonable doubt that false news is characterised by negative emotion and real news by positive sentiment.
- In "Predicting the Effects of News Sentiments on the Stock Market [17]," the authors address the impact of news feelings on stock evaluations and the significance of stock market forecasting. Their directional accuracy in predicting short-term stock price fluctuations was 70.59%, achieved via the study of news attitudes. After analysing sentiment ratings, the programme decided whether to buy, sell, or keep stocks using a dictionary-based strategy. To improve the accuracy of stock price forecasts, the study will continue by developing hybrid models and using word weighting methodologies.
- "Sentiment Analysis of YouTube comments using the Naïve Bayes - Support Vector Machine (NBSVM) classifier [10]" is the title of the study that delves into the topic of sentiment analysis of YouTube comments. In order to assist YouTube viewers in

evaluating the significance of material according to user views, the research seeks to categorise comments as positive or negative. High levels of accuracy and performance were attained by the analysis using the combination of Naïve Bayes and Support Vector Machine. Crawling educational YouTube comments provided the data, and testing the model on data with a 70:30 ratio yielded the best results. Accuracy(91%), recall (83%), and F1 score (87%), according to the performance test results.

- Discussed in the article "Sentiment Analysis on Twitter Data-set using Naive Bayes Algorithm [13]" is the use of the Naive Bayes algorithm for sentiment analysis on Twitter data. The approach uses the Naive Bayes algorithm after retrieving data from Twitter and pre-processing tweets. The Naive Bayes method and massive Twitter datasets are processed using the Hadoop platform.

S.No.	Author	Methodology	Limitation
1.	Bhutani el at (2019)	*Naive Bayes Classifier (tf-idfvectorizer)*	Focus should be on expanding the dataset for comprehensive analysis.
2.	Taj el at (2019)	*Lexicon-based approach for Sentiment Analysis*	Research depends on BBC news, articles from various sources should have involved.
3.	Abd El-Jawad el at (2018)	*Machine Learning Algorithm*	Lack of discussion on the generalizability of the results, potential bias in the dataset selection
4.	Bibi el at(2019)	*Decision tree Classification*	The need for a comprehensive Urdu 3sentiment lexicon.
5.	Shahare el at(2017)	*Naïve Bayes* and *LevenshteinAlgorithm*	Need for continuous updates to the emotion classification algorithm to ensure accuracy over time.
6.	Zaeem el at (2020)	*MeaningCloud, TextBlob, AFINN Sentiment Analysis Tool*	Lack of consideration for the impact of context.
7.	Shah el at (2018)	*Dictionary-based Sentiment Analysis*	The reliance on news data for stock price prediction.
8.	Muhammad el at(2019)	*Naïve Bayes - Support Vector Machine (NBSVM) classifier.*	Absence of a comprehensive analysis of potential biases in the data collection process.

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9.	Parveen el at (2016)	*Naive Bayes algorithm.*	Inefficient real-time analytics, extensive data cleaning requirements, and time-consuming data analysis processes.

3 Proposed Model-

The proposed model consists of following phases-

- Data Collection.
- Text Preprocessing.
- Classification.
- Evaluation.

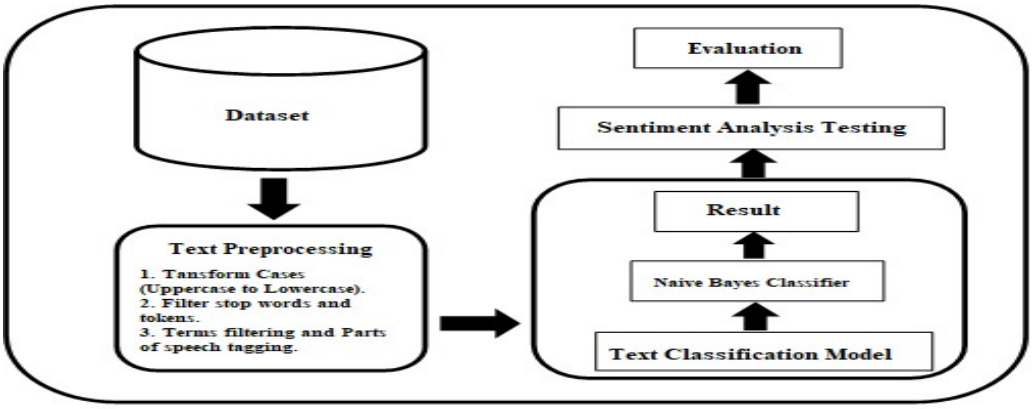


Fig. 1 Sentimental Analysis Model

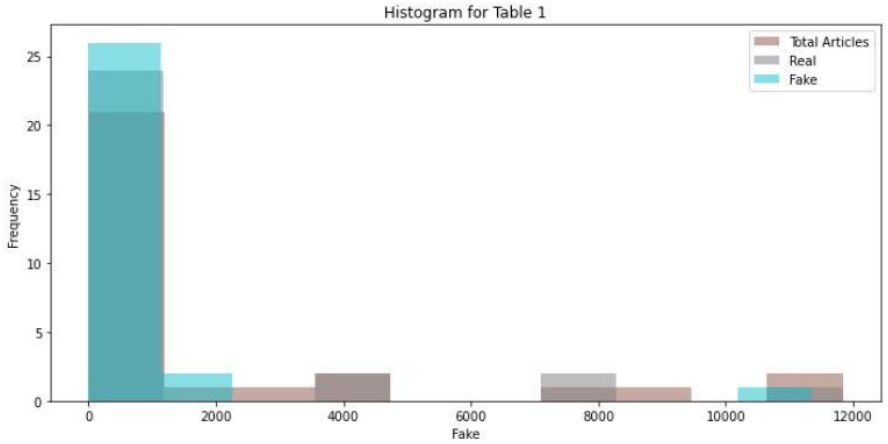
Data Collection-

This study relies on data that was obtained from Kaggle.com. This collection of news stories, originally assembled by Sonal Garg, includes 56,715 pieces from different media sources. True and Fake are the two ways the articles are sorted. A tabular version of this data may be found in Table 1. Of the 56,715 news stories analysed, 37,800 were found to be factual and 18,914 to be false.

Table 1. News articles classification in True or Fake News.

S.No.	News Media	Total Articles	True	Fake
1.	AFP	267	00	267
2.	ALT	59	00	59
3.	AUGMENT	11321	00	11321
4.	BOOMLIVE	806	00	806
5.	BSMEDIA	449	449	00

6.	CNN	778	778	00
7.	DAPAAN	136	136	00
8.	DIGITEYE	175	00	175
9.	DNAINDIA	121	121	00
10.	ENGLISHTRIBUNE	21	21	00
11.	FACTCHECKER	163	00	163
12.	FACTCRESCENDO	272	00	272
13.	FACTLY	174	174	00
14.	INDIANEXPRESS	3983	3983	00
15.	INDIATODAY	1698	92	1606
16.	INDUSTANTIMES	15	15	00
17.	NDTV	08	08	00
18.	NEWSMETER	572	66	506
19.	NEWSMOBILE	2422	232	2190
20.	ONEINDIA	549	00	549
21.	TEEKHIMIRCHI	387	125	262
22.	THELOGICALINDIA	173	00	173
23.	THELOGICALINDIAN	221	00	221
24.	THEPRINT	8582	8238	344
25.	THESTATEMAN	4048	4048	00
26.	THESTATESMAN	7202	7202	00
27.	TIMESNOW	238	238	00
28.	TRIBUNEINDIA	11832	11832	00
29.	WAHSARKAR	42	42	00
	TOTAL	56714	37800	18914



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Following are the stages were involved in the process of data collection:

Defining Synthetic Text Data: Loading a CSV file named Table 1 using different encodings. Creating a dictionary containing text data for various news categories such as COVID-19, ELECTIONS, GOVERNMENT, etc.

Defining News Categories and Article Counts: Defined a dictionary that maps various news categories (e.g., COVID-19, ELECTIONS) to their respective total article counts. Defining lists that contain the count of true and fake articles for each news category.

Preparing DataFrame for Sentiment Analysis: Creating a DataFrame named table_2 containing the following columns: 'S.No.'(Serial Number), 'News Category', 'Total Articles', 'True', and 'Fake'. Populate the DataFrame with the predefined news categories, total article counts, true counts, and fake counts.

Saving Table 2 to a CSV File: Saved the DataFrame table_2 as 'Table 2.csv' in the specified directory.

Table 2. Classification of news in true and fake as per different category

S.No.	News Category	Total Articles	True	Fake
1.	COVID-19	8710	5920	2790
2.	ELECTIONS	8396	8287	109
3.	GOVERNMENT	10923	7317	3606
4.	MISLEADING	4077	00	4077
5.	POLITICS	8670	5448	3222
6.	TERROR	4384	4384	00
7.	TRAD	976	830	146
8.	VIOLENCE	10578	5614	4964

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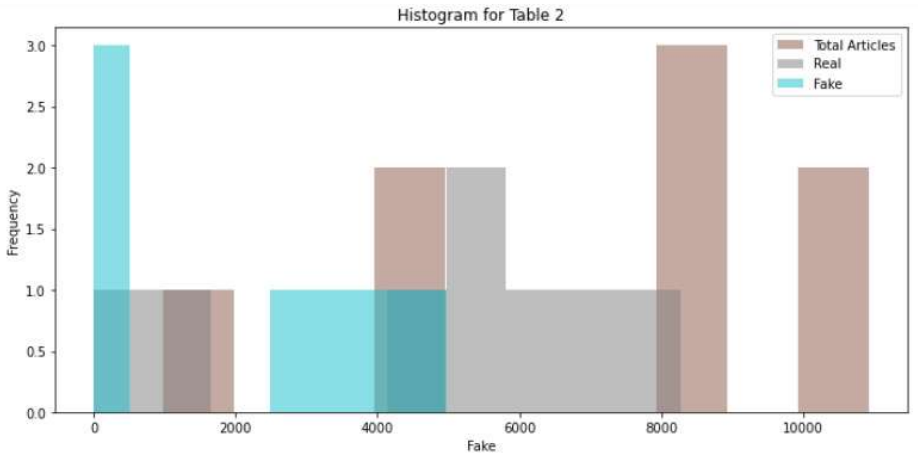

Text Preprocessing- Following steps were followed for performing text preprocessing-

- First, we imported the libraries that would be needed for our project. These libraries included pandas for data processing, numpy for numerical operations, and other scikit-learn modules for machine learning.
- To begin storing data, create an empty list: Iteratively reading the texts that go along with each category. Whether a piece of text included the words "positive," "negative," or anything else that may be interpreted as neutral allowed us to deduce its emotion. Included all the categories, texts, and their corresponding sentiments in the list. Raised a pandas DataFrame from the collection, adding "News Category," "Text," and "Sentiment" as columns.
- • Encoded Sentiment Labels: We've transformed the "Positive," "Negative," and "Neutral" sentiment labels into numerical data that may be utilised for machine learning with the help of LabelEncoder.
- • Hypothetical Percentages for the proportion of Sentencing: We had previously established lists of hypothetical percentages indicating the proportion of favourable, unfavourable, and neutral feelings for every news genre.
- • Determine Sentiment Counts by Dividing True Articles by specified Percentages: Following this, we determined the number of positive, negative, and neutral articles in each category by dividing the total number of true articles by the specified percentages. Put each count into its own list.
- • Made Table 3's DataFrame: Imported the following data into a DataFrame called table_3: 'S.No.', 'News Category', 'Total Articles' (actual counts), 'Positive', 'Negative,' and 'Neutral'. Add the computed sentiment counts to the DataFrame.
- • Created a CSV file and saved Table 3: 'Table 3.csv' is the name that was given to the DataFrame file that containing table 3.

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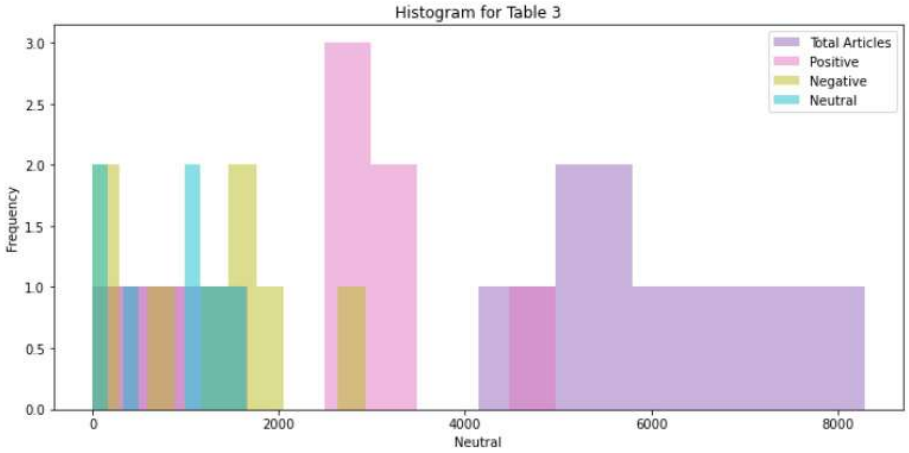
Table 3. True News Sentimental Results

S.No.	News Category	Total Articles	Positive	Negative	Neutral
1.	COVID-19	5920	2960	1776	1184
2.	ELECTIONS	8287	4972	1657	1657
3.	GOVERNMENT	7317	2926	2926	1463
4.	MISLEADING	00	00	00	00
5.	POLITICS	5448	2724	1634	1089
6.	TERROR	4384	3068	876	438
7.	TRAD	830	498	249	83
8.	VIOLENCE	5614	3087	1403	1122



Classification-

- **Train Naive Bayes Classifier**: By spliting the DataFrame into training and testing sets with an 80-20 ratio we have created a pipeline combining CountVectorizer (to transform text data into numerical form) and MultinomialNB (Naive Bayes classifier) and trained the model on the training set.
- **Predict Sentiments**: Used the trained model to predict sentiments for all text data in the DataFrame. Converted the numerical sentiment predictions back into their original text from using LabelEncoder.
- **Created a DataFrame for Table 4**: Created a DataFrame named table_4 containing the following columns: 'S.No.', 'News Category', 'Total Articles' (fake counts), 'Positive', 'Negative', and 'Neutral'. Populated the DataFrame with the calculated sentiment counts.

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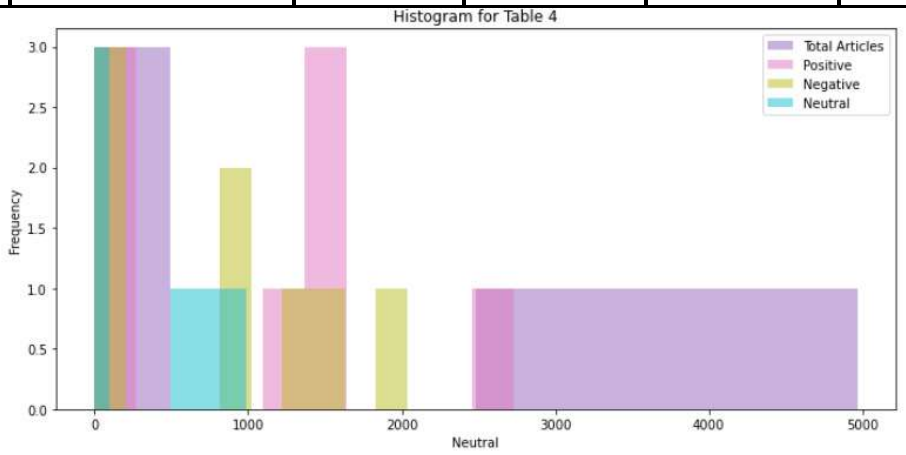
- **Saved Table 4 to a CSV File**: In the end saved the DataFrame table_4 as 'Table 4.csv' in the specified directory.

Table-4 Fake News Sentimental Results

S.No.	News Category	Total Articles	Positive	Negative	Neutral
1.	COVID-19	2790	1395	837	558
2.	ELECTIONS	109	65	21	21
3.	GOVERNMENT	3606	1442	1442	721
4.	MISLEADING	4077	1223	2038	815
5.	POLITICS	3222	1611	966	644
6.	TERROR	00	00	00	00
7.	TRAD	146	87	43	14
8.	VIOLENCE	4964	2730	1241	992



Evaluation-

- **Aggregate Sentiment Results**: Grouped the data by 'News Category' and 'Predicted Sentiment'. Counted the occurrences of each sentiment for each category.
- **Display the Plots**: Adjusted the layout of the subplots to ensure they fit well within the figure and displayed the plots.

4 Discussion-

The results from Tables 3 and 4 provide a comprehensive comparison of sentiment distributions between true and fake news articles across various news categories.

Sentiment Distribution in True News

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COVID-19: There was a fairly even distribution of positive, negative, and neutral attitudes in genuine news items regarding COVID-19, with 50% being favourable and 30% being negative. This paints an ambivalent image of the epidemic, drawing attention to both its promising aspects and its concerning aspects.

ELECTIONS: The elections category had a high number of articles (8287) with a majority positive sentiment (60%), followed by an equal share of negative and neutral sentiments (20% each). This could indicate a general optimism surrounding electoral processes or outcomes.

GOVERNMENT: Government-related news displayed a balanced sentiment, with equal positive and negative sentiments (40% each) and 20% neutral. This suggests a polarized view of government actions and policies.

POLITICS: Positive sentiment dominated politics at 50%, while neutral and negative emotion made up 30% and 20% of the total. This could be a result of positive media coverage or political alignments.

VIOLENCE: The majority of articles about violence (55%), followed by the negative (25%) and neutral (20%) categories. Given the unusually high level of favorable emotion in this area, more research may be necessary to fully comprehend the situation.

TERROR: Terror-related news was predominantly positive (70%), with fewer negative (20%) and neutral (10%) sentiments. This could be indicative of news reporting on successful counter-terrorism efforts.

TRAD: News on traditional topics was mostly positive (60%), followed by negative (30%) and neutral (10%) sentiments, indicating a generally favorable view of traditional values and events.

Sentiment Distribution in Fake News

COVID-19: Fake news on COVID-19 also had a majority positive sentiment (50%), similar to true news, but with a higher negative sentiment (30%) and lower neutral sentiment (20%). This could suggest attempts to exploit both positive and negative emotions for misinformation.

ELECTIONS: With a sample size of just 109 articles, fake news about elections showed a sentiment pattern resembling that of real news, with a majority of positive sentiment (60%) and equal amounts of negative and neutral sentiment (20%).

GOVERNMENT: The sentiment distribution in fake news about the government was balanced with equal positive and negative sentiments (40%) and 20% neutral, mirroring the polarization seen in true news.

MISLEADING: Positive and neutral sentiments were found to be 30% and 20%, respectively, whereas the negative sentiment associated with misleading news was greater at 50%, suggesting a possible tactic to elicit negative feelings.

POLITICS: Fake political news followed a similar pattern to true news with 50% positive sentiment, but had a slightly higher negative sentiment (30%) and lower neutral sentiment (20%).

VIOLENCE: Fake news on violence had a majority positive sentiment (55%), similar to true news, with negative and neutral sentiments being 25% and 20% respectively.

TRAD: Similar to real news but with a somewhat higher negative attitude, traditional topics in

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fake news likewise revealed a majority positive sentiment (60%) with 30% negative and 10% neutral.

5 Conclusion-

This research demonstrates that by combining Sentiment Analysis with Naive Bayes Classifier classification, it is possible to effectively distinguish between real and fake news items and find underlying sentiment trends. These are the key takeaways The sentiment distributions of real and false news are quite similar across all categories, with positive feelings being more prevalent in the former. Because of this, it's possible that those who make false news are trying to pass it off as real by using the same tone. There seems to be an effort to capitalise on people's fears and uncertainties by increasing the unfavourable attitude towards false news in comparison to real news in categories such as COVID-19 and misleading news.

Government and Politics with a Balanced Attitude: The intricacy of the issues at hand, as well as the fact that there are differing viewpoints on them, were evident in actual and false news stories pertaining to politics. The two forms of media presented fair and balanced viewpoints.

The results of this investigation may be used to create better algorithms that can identify false news by analysing sentiment patterns. In order to educate the public about the nature and effect of misinformation, it is important to understand the emotional impact of news items. This knowledge can then be used to build better media literacy programmes. This technique might be further developed in future studies by using more sophisticated machine learning algorithms and a wider variety of news categories. This would make the results more reliable and applicable.

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