ISSN (Online):3048-5088

International Journal of Advancement and Innovation in Technology and Research (IJAITR)

Volume 1, Issue 1, (Jan-Jun) 2024

MITHYA: Building a Machine Learning-Enabled Fake News Detection Model

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***Abstract*—Recent years have seen a significant increase in fake news, which is extremely concerning given the explosion of social media and how simple it is to distribute incorrect information. We describe a machine learning-based strategy for identifying bogus news in this study. We collected a large dataset of news articles labeled as either real or fake, and trained several classifiers using different machine-learning algorithms. We also employed text processing techniques, such as stemming and stop word removal, to extract meaningful features from the articles. Accuracy, precision, recalls, and F1 score were a few of the metrics we used it to evaluate the effectiveness of our classifier. Our best-performing classifier achieved an accuracy of over 90the test set, demonstrating the effectiveness of our approach. We also implemented a web application using Flask that allows users to input a news article and receive a prediction of whether it is real or fake. Overall, our results suggest that machine learning can be a powerful tool for detecting fake news and helping combat misinformation.**

***Index Terms*—Fake news, machine learning, classification, natural language processing, Flask, text processing, feature extraction, data prepossessing, and performance evaluation**

sectionIntroduction Misleading news that is reported as information is known as fake news. It is sometimes used to damage someone's or a company's identity or to generate income from promotion. False news was historically prevalent in the paper, but since the emergence of social media, notably the Facebook News Feed, it has become more widespread. Even during the election for president in 2016, several fake news stories regarding the candidates were widely disseminated on online social networks, which might have had a substantial impact on the outcome. Online social networks accounted for more than 41.8percent of the total of something like fake news data being intimidating as they attract more audience than normal. People use them because this can be an excellent marketing strategy. Therefore, the income generated could not be considered worthy of the potential danger. Machine learning methods were employed to automatically identify fake media articles in the interest of combating this problem. This paper presents a fake news detection model that utilizes machine learning and Flask. We collected a large dataset of news articles and labeled them as real or fake to train our model. To collect useful features from the text, we employed methods based on natural language processing. Then, we utilized different classification algorithms to build our system. Our model achieved high accuracy in detecting fake news, which was evaluated using various metrics. Additionally, we developed a web application using Flask to make the model easily accessible to users. This paper outlines the approach and methodology used to build our fake news detection model and discusses the results obtained, demonstrating the effectiveness of machine learning in detecting fake news. traffic during the election, greatly outpacing

ISSN (Online):3048-5088

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average data traffic shares of traditional Television, audio, major newspapers, and search engines on the internet, in accordance with a post-election statistical assessment. Fake news detection is becoming increasingly difficult because people who have ill intentions are writing fake pieces so convincingly that it is difficult to separate them from real news. What we have done is a simplistic approach that looks at the news headlines and tries to predict whether they may be fake or not.

I. Literature Review

Researchers have delved into a variety of facets of the legitimacy of online data from an NLP perspective. To evaluate the believability of a tweet in various contexts, [1] was using the time-dependent supervised approach based on the content of tweets. For a comparable early rumor detection challenge, [2] used LSTM. Another study [3] used convolutional neural networks to identify the mood in tweets and assess the veracity of a particular rumor. The development of a backpack autoencoder and its training on tokenized tweets were the main goals of a contribution [4] to the SemEval 2016 Twitter Stance Detection problem. An ensemble of models developed by a new team [5] produces a weighted sum that splits the difference between a deep convolutional neural network (CNN) and a gradient-boosted decision tree evenly. Despite the fact that this research seems to be comparable to ours, the creation of an ensemble of classifiers is where the differences lie. Similar work was done by a team [6] that combined various feature vectors and put them through with an NLP model. The Passive Aggressive algorithm is a span-based online learning algorithm for binary classification. It is also a soft margin-based algorithm that is robust to noise. It can be used in fake news detection [7] Term Frequency-Inverse Document Frequency is also a method for representing text in a format that can be easily processed by machine learning algorithms. Several classification algorithms were used to distinguish fake news from Real news like studies in [8] and [9], which was a further step to classify fake and real news. It is a numerical statistic that shows how important a word is to the news items in a news dataset. The meaning of a word's relevance is inversely related to the number of times it appears in the media database but is highly linked with the frequency with which it appears in the information.

II. Motivation

Social media facilitates the advent and sharing of statistics that make use of computer-mediated technologies. Those media have modified the way groups of people engage and communicate. They offer them low-value, easy to get admission and fast dissemination of records. The majority of humans nowadays are seeking and devouring information on social media in place of traditional information corporations. On one hand, social media has come to be an effective source of statistics and brings people together, but on the other hand, it also has a poor effect on society. check some examples right here: Facebook Inc.'s famous messaging service WhatsApp became a political marketing campaign platform at some stage in the Brazilian elections. false rumors, manipulated pix, decontextualized films, and audio jokes were used to market the campaign. These things went viral on the digital platform with no manipulation over their beginning or reach. In Sri Lanka, a national block on important social media and information websites including Facebook and Instagram was imposed after numerous terrorist assaults in 2019. Authorities claimed that "false information" started to circulate online. This highlights the challenges the most important major companies in the field confront in avoiding the dissemination of inaccurate data. Several occurrences demonstrate how "fake information" can propagate through social networks. News that is published on these networks might be of bad quality and include purposely false figures. The integrity of the facts is affected by this. How is each person able to differentiate between true and false information in the thousands of news articles that are posted publicly each day? So, among the major problems in our interconnected global digital world is plausible or fake news. Now, the study of fake data posted on social media has grown more widespread. This section addresses the significant

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challenge regarding how to defend yourselves from the spreading of disinformation via social media. Detecting fake news in social media faces numerous demanding situations. First, it is hard to gather faux information. Also, it is tough to manually flag fake information. on the grounds that they're deliberately written to mislead readers, it's tough to come across them based on message content material by myself. Additionally, Facebook, Whatsapp, and Twitter are closed messaging apps. incorrect information spread by means of trusted information outlets or their friends and circle of relatives individuals is consequently hard to classify as fake. As they are no longer enough to instruct the utility dataset, it is unclear how to verify the veracity of rising and time-sure messages. A few helpful study issues that require more investigation include substantial techniques to distinguish reliable clients, extract useful news aspects, and construct genuine information distribution systems. If we can't control the spread of false information, systemic trust will erode.There could be sizeable distrust among people. There will be nothing left that can be objectively used. It means the destruction of political and social coherence. We wanted to build some sort of web-based system that can fight this nightmare scenario. And we made some significant progress toward that goal.

III. PROBLEM DOMAIN

In this day and age, It is extremely difficult to determine whether the news is good or bad. we come across as real or not. There are very few options to check the authenticity and all of them are sophisticated and not accessible to the average person. There is an acute need for a web-based fact-checking platform that harnesses the power of Machine Learning to provide us with that opportunity. The growing net has led to a growth in the unfolding of fake information, which can have massive negative results on individuals and society as a whole. The problem of detecting fake news is challenging, as false information can be designed to look and sound like real news, making it difficult for humans to distinguish between the two. Therefore, there is a need for automated systems that can accurately detect fake news. In this context, we propose the development of a fake news detection model using machine learning and Flask to address this problem. The model will be trained on a large dataset of news articles labeled as real or fake and will use natural language processing and text processing techniques to extract meaningful features from the articles. The model will then be deployed as a web application using Flask, allowing users to input a news article and receive a prediction of whether it is real or fake.

IV. PROBLEM STATEMENT

MITHYA, our fake news detection model, is a powerful tool built using machine learning and Flask that aims to combat the spread of misinformation. With its sophisticated algorithms and natural language processing techniques, MITHYA is capable of accurately classifying news articles as real or fake, providing users with a reliable means of verifying the authenticity of the information they encounter. Whether you're a journalist, researcher, or concerned citizen, MITHYA can help you stay informed and separate fact from fiction. PROBLEM FORMULATION OR REPRESENTATION OR DESIGN Passive-aggressive classifiers, logistic regression, and LSTM can be used in fake news detection. Bi-directional LSTM was used to detect fake news. It had reasonably good accuracy but if the news was a bit more sophisticated, it would be difficult to achieve good accuracy. Because this model picks up the sensational/clickbaity words as part of fake news. For example, if a news title says, 'Donald Trump is the greatest president ever, the model will pick it up as fake news with reasonable accuracy. If the title is more nuanced and written in a sophisticated way, it'd be difficult to do so. We believe that our LSTM model is not enough by itself to detect fake news. That's why we included passive-aggressive classifiers when we compared passive news with reputable news sources, but the scope of the work is so vast that we couldn't do it with the resources available to us. Our model can act as a first step in detecting fake news. But more work is needed to call the model reliable enough.

V. SOLUTION METHODOLOGIES

There were several solution methodologies that were employed to develop the Mithya, fake news

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detection system using machine learning. Here are a few examples:

a) Get a sizable dataset of news articles that have been classified as either true or false. Data pre-processing involves taking out superfluous information from the data, such as HTML elements and URLs, including using text normalization methods, like stem and stop-words deletion.
b) Feature Extraction: Extract meaningful features from the preprocessed data using techniques such as bag-of-words or term frequency-inverse document frequency (TF-IDF).
c) Models Choice and Training: Choose one algorithm for machine learning, such as Naïve Bayes classifier, support vector machine, or Random Forests, to train it using the preprocessed data. To enhance the performance of the model, try exploring different hyperparameters.
d) Feature Selection: Identify the most relevant features for classification using techniques or mutual information.
e) Assessment of Performance: Use a variety of metrics, such as accuracy, precision, recall, and F1 score, to assess the model's performance. Cross-validate your model to make sure it is reliable.
f) Deployment: Implement the fake news detection system using a web application framework, such as Flask, to allow users to input news articles and receive predictions of their authenticity.
g) Continuous Improvement: Continuously update the model with new data and monitor its performance to ensure its accuracy and relevance. Consider incorporating additional features, such as sentiment analysis or social media data, to enhance the system's capabilities.

VI. DATASET DESCRIPTION

The dataset is simple. It contains the titles of the news, the body text, and a label field, which, if the news is authentic, shows REAL, and if inauthentic, shows FAKE. There are 3 main segments of the methodology:

1) The core Machine Learning model
2) The web interface.
3) The common platform that brings the model and the interface together.
4) The common platform that brings the model and the interface together.

VII. THE MACHINE LEARNING MODEL

There are two parts to the ML Model building. Machine Learning is a part of our life that can help us in predicting. We are using two types of models in this case.

Part 1: Passive-Aggressive Classifiers

The steps include:

1) **Data Loading:** We are loading a CSV file for the data sorting and training-testing part of the model. The CSV file is turned into an array for easier work purposes.
2) **Vectorization:** Vectorization is needed for determining the frequency of the words present in a passage. This is needed to determine which words are used often.
3) **Classifier:** Passive-aggressive algorithms are a family of great learning algorithms. They are similar to Perceptron because it does not require a reading scale. However, unlike Perceptron, they include parameter correction. Passive is used when the prediction is correct and there is no change in the model. But if there is any kind of change in the model, that is if the prediction is not correct then the aggressive part is called, which changes the model accordingly. The aggressive part of the model changes the model according to its wish on the backend.
4) **Model Building:** The model is built through the training and testing of the dataset, by ensuring that the training is done for 80% of the dataset and testing is done for the rest of the 20% of the dataset.

The training flow of the whole mode is shown in the Fig. 1 In the second part, we used LSTM. Here are the steps:

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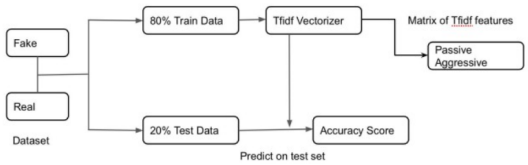

Fig. 1: Semantic Flow of our Fake News Detection Model

1) **Loading the Data:** For this step, it is the same as the passive-aggressive one.
2) **Scanning and Parsing:** Data is loaded from a CSV file. This consists of the body of selected news articles. It then contains a label field that indicates whether the news is real or fake. In this code block, we scan the CSV and clean the titles to filter out stop words and punctuation.
3) **Tokenization:** The tokenizer is used to assign indices to words, and filter out infrequent words. This allows us to generate sequences for our training and testing data.
4) **Embedding Matrix:** Apply the embedding matrix. An embedding matrix is used to extract the semantic information from the words in each title.
5) **Model Building:** Building the model and finding out the accuracy via the confusion matrix. The model is created using an Embedding layer, LSTM, Dropout, and Dense layers. We are going to run the data on 20 epochs. We observed that the LSTM model is vastly inaccurate in predicting the authenticity of the news. So we decided to show the output by running it through the Passive-aggressive classifier model.

THE WEB INTERFACE

This was the simplest part.

1) **HTML for building the basic skeleton:** HTML makes the structure of the web application and also there are some of the functions that can be achieved best with HTML only.
2) **CSS for design:** The CSS part is for designing only. Because it will give a more beautiful aspect to the website.
3) Flask acts as a common platform and takes the input with the pickle module and passes it to the machine learning model afterward the prediction is shown on the screen with the HTML and CSS website.
   a) Building functions for taking input.
   b) Passing input values through the ML model.
   c) Using the Pickle module for serializing and de-serializing the dataset.
   d) Providing output.

VIII. IMPLEMENTATION

The interface is what you see when you go to the web-based ML model. You are supposed to copy the news and paste it into the input box. Otherwise, it will show 'Looking Fake News'. That's how you can detect fake or real news via the interface. The model will give you the result. If the news seems authentic, the output will be 'Looking Real News'. Otherwise, it will show 'Looking Fake News'. That's how you can detect fake or real news via the interface.

When you paste the news on the input box and click 'Predict', the model will give you the result. If the news seems authentic, the output will be 'Looking Real News'.

IX. COMPARISON OF RESULTS

The passive-aggressive model produces 93% accuracy. When we input the news text on the interface, it correctly identifies the news most of the time. We tested this by using news from the Onion. The Onion is a satirical 'news' portal that posts fake funny news. When we pasted some of the news from the site on our web interface, those were correctly identified as fake. But when we wanted to test the news from BBC or New York Times, those were correctly identified as real. But the accuracy of the LSTM model was much lower, so we went with the passive-aggressive model to produce output on the interface.

X. CONCLUSION

Our project can ring the initial alert for fake news. The Model produces worse results if the article is written cleverly, without any sensationalization.

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This is a very complex problem but we tried to address it as much as we could. We believe the interface provides an easier way for the average person to check the authenticity of the news. Projects like this one with more advanced features should be integrated into social media to prevent the spread of fake news.

XI. Future Work

There are many future improvement aspects of this project. Introducing a cross-checking feature on the machine learning model so it compares the news inputs with reputable news sources is one way to go. It has to be online and done in real-time, which will be very challenging. Improving the model accuracy using bigger and better datasets, and integrating different machine learning algorithms is also something we hope to do in the future.

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