iJRASET
International Journal For Research in Applied Science and Engineering Technology



INTERNATIONAL JOURNAL FOR RESEARCH

IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY

Volume: 9 **Issue:** V **Month of publication:** May 2021

DOI: https://doi.org/10.22214/ijraset.2021.34700

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International Journal for Research in Applied Science & Engineering Technology (IJRASET)
ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor: 7.429
Volume 9 Issue V May 2021- Available at www.ijraset.com

Fake News Detection and Classification using Natural Language Processing

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Abstract: ***We can all agree that social media is a double-edged it has many advantages and also has many disadvantages. Everything begins with a piece of information be it correct or incorrect, one of them is spreading false information or Fake news. These days detecting fake news on social media has recently become an emerging research that is very challenging task for any organizational body. Fake news detection on social media has unique characteristics and challenges that make it extremely hard for it to be classified into fake or real. Apart from that the extensive spread of fake news can have a serious impact on society. Majorly fake news can break the standard balance of the way society works. It might get people into believing into false content that might cause serious harm to ones property. Fake news is usually spread by certain group of people in the society who have certain political connections or attempt to make free money out of one's hard earning. Most important thing is that fake news changes the way people think and they intend to doubt on each and every other news even if it is real. As we notice this is a major problem we have to help remove the negative effects caused by fake news both to public and the balance in natural mankind ecosystem. Our project aims at investigating the reasons, methodologies and algorithms for detecting fake news articles, creators and subjects from online social networks and evaluating the performance. We even try to implement the best algorithms to get the fastest performance needed which will boost the overall performance of the model.***
Keywords: Fake, Real, Logistic Regression, Tf-Idf Vectorizer, Test-Train split, and Passive Aggressive Classifier.

I. INTRODUCTION

The introduction of the internet and the rapid evolution of social media platforms such as Facebook and Twitter have outdated newspapers, magazines, articles etc which were the main source of valid information. The social media platforms are extremely powerful in their current state are and known for their ability to allow users to discuss and share ideas. But introduction of such platforms are also used in a negative way by certain people or organizations in the society commonly for monetary gain and in other cases for creating their own opinions, manipulating and misguiding peoples mindsets. This process is generally what we call spreading fake news which can be really dangerous and extremely harmful. There have been a large number of reports everyday regarding fake news. Many articles go hand to hand in seconds without knowing whether it is even real or fake. One such area affected by fake news is the public sectors, where a rumour can bring disastrous consequences and may bring the state to halt.

Normally we take decisions based on the type of news we hear. If we hear fake news then unknowingly we take wrong steps which might cost us. These characteristics can be used to identify the affects of fake news of humanity. Detecting fake news won't end the trauma of spreading them ,detecting fake news articles, identifying the fake news creators and subjects will actually be more important, which will help completely remove a large number of fake news from the roots. Basically when news is created all the information regarding author is also given, but in worst cases blind news gets forwarded hence we need to find and eradicate this from the starting stage itself. Even general public has a major role in spreading of news be it fake or real. People should not forward any news which they get to others without knowing whether it is real or fake. Our study signifies the nature of the news by its textual formation and content. It does so by comparing it with many articles which are real ones. By using those properties, we train a combination of different machine learning algorithms using various methods. We try to put the best solution possible and help to eradicate the problem as much as possible.

II. RELATED WORK

The probability of finding fake news online through various sources is sky-high in present era. As there are many technological changes currently happening in the society people were habituated to read news online rather than newspapers etc. But the one who reads the news online does not know whether the news is fake or real. A person in general assumes that whatever the news that is being read online is real. Fake news has a very bad effect on the society. Some of those impacts are as follows. People tend to accumulate matter regarding the news they read without knowing the certainty of it being real.

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ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor: 7.429
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If the news is eye-catchy then people tend to circulate it on social media. If the news is fake then unknowingly the person is responsible for spreading fake news online. As the number of users of social media is great, the effect of fake news would also be a great deal to deal with. To distinguish whether news is fake or real careful fact-checking and evidence collection are required. But in this busy world performing such activities is time consuming.

III. PROPOSED WORK

The proposed system helps in detecting the fake news. Fake news generation and circulation on social media has lead to a question among people about its credibility. So, the proposed system deals with the fake news detection problem as a credibility inference problem. Where the real ones will have a higher credibility while unauthentic ones will have a lower one instead. Logistic regression algorithm using machine learning is used in the proposed system. A classifier named as Passive aggressive classifier is used here. Passive means the classification is correct and aggressive means the classification may either contain miscalculations or it is wrong.
TFIDF vectorization is also involved in this process of detecting the fake news. Vectorization is the process of converting an algorithm from operating on a single value at a time to operating on a set of values (vector) at one time. Testing and Training the set is also done. The dataset used in the proposed system constitutes of four columns namely title, news, text, label (whether the news is fake or real).The proposed system not only helps in finding the fake news but also its origin from where it was generated.

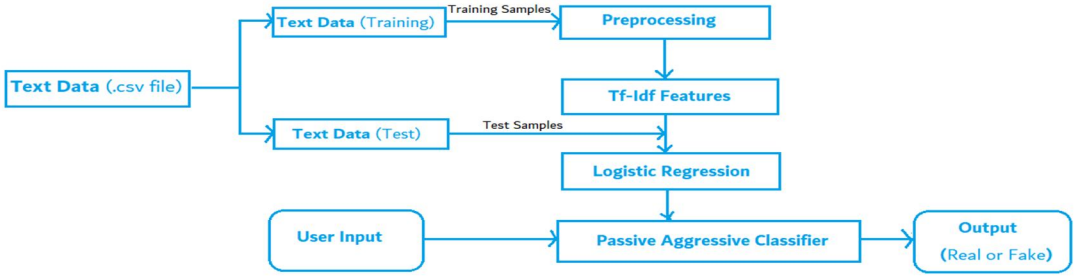


Figure 1: Architecture diagram of fake news detection

IV. IMPLEMENTATION

A. Preprocessing

Data preprocessing is a ,method that is used to convert the raw data into a useful and essential format. It is used to process and clean the input text data. The data here is collected from a .csv file. The .csv file consists of four columns. They are, news, title, text and labels i.e., fake or real. This file is preprocessed i.e., cleaned by replacing all the special characters except alphabets and numbers are replaced so as to retain the essential information.

B. Testing and Training

Training and Testing is a method to measure the accuracy of a model. It is called Train/Test because you split the data set into two sets: a training set and a testing set. The observations in the training set form the experience that the algorithm uses to learn. In supervised learning problems, each observation consists of an observed output variable and one or more observed input variables. [3]. If the test set does contain examples from the training set, it will be difficult to assess whether the algorithm has learned to generalize from the training set or has simply memorized it.
The train-test split procedure is appropriate when you have a very large dataset, a costly model to train, or require a good estimate of model performance quickly. We use the scikit-learn machine learning library to perform the train-test split procedure. The procedure involves taking a dataset and dividing it into two subsets.

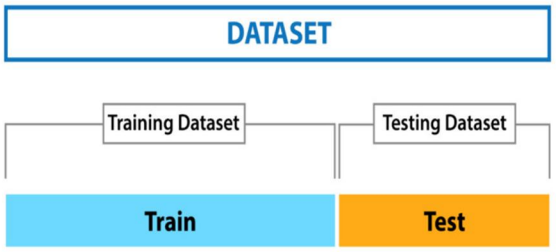


Figure 2

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The first subset is used to fit the model and is referred to as the training dataset. The second subset is not used to train the model; instead, the input element of the dataset is provided to the model, then predictions are made and compared to the expected values. This second dataset is referred to as the test dataset. After this we pass the training data to the Algorithm which we want to use and obtain the trained data or a model. Now we can pass the test data kept separately for this purpose and note the results.

C. Tf-Idf Vectorizer

Tf-Idf Vectorizer is used to transform the text strings to numerical representations and initialize a Passive Aggressive Classifier to fit the model. The accuracy score and confusion matrix which consists of tf-idf features tell us how well the model works. Terms one has to get habituated to in tf-idf vectorization process are term frequency and inverse document frequency.

Tf-Idf Vectorizer is an algorithm that is often used to convert text into meaningful representation of numbers. It is used to extract features from text strings based on occurrence.

We rate the prominence of the word based on the number of times the word got repeated. Higher the occurrence of the word greater the importance of the term. We can say that its occurrence is directly proportional to its significance. Number of times of repetition of the word divided by total number of words in a particular document.

Formula of Term frequency is

tf(w) = doc.count(w) / total words in the doc.

While calculating term-frequency, each word is given equal importance. There maybe words which have high occurrence across the documents and hence would contribute less in deriving the meaning of document. For example ‘a’, ‘the’ etc. are such kind of words which might be the reason for depreciation of the weights of more meaningful words. To reduce this effect, Idf is required. Idf is the acronym of inverse document frequency.

Formula of Inverse document frequency is

idf(w) = log(total_number_of_documents / number_of-documents_containing_word_w).

Tf-Idf is then calculated by considering a product of Tf and Idf. Words with higher significance get a higher tf-idf score.

Formula of *tf-idf(w) = tf(w) * idf(w).* [4]

D. Logistic Regression

Logistic regression is a statistical model that in its basic form uses a logistic function to model a binary dependent variable, although many more complex extensions exist. In regression analysis, logistic regression is estimating the parameters of a logistic model. Logistic regression is a technique borrowed by machine learning from the field of statistics. Logistic Regression was used in the biological sciences in early twentieth century. It was then used in many social science applications. Logistic Regression is used when the dependent variable (target) is categorical.

1) *Sigmod Function:* The logistic function, also called the sigmoid function was developed by statisticians to describe properties of population growth in ecology, rising quickly and maxing out at the carrying capacity of the environment. It’s an S-shaped curve that can take any real-valued number and map it into a value between 0 and 1, but never exactly at those limits. [5]

1 / (1 + e^-value)

Where e is the base of natural logarithms (Euler’s number) and value is the actual numerical value that you want to transform. Below is a plot of the numbers between -5 and 5 transformed into the range 0 and 1 using the logistic function.

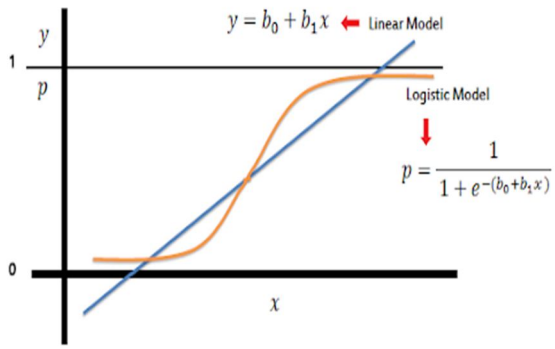


Figure 3

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E. Passive Aggressive Classifier

Passive-Aggressive classifier is an online learning algorithm where you train a system incrementally by feeding it instances sequentially, individually or in small groups. In online machine learning algorithms, the input data comes in sequential order and the machine learning model is updated step-by-step, as opposed to batch learning, where the entire training dataset is used at once. This is very useful for systems that receive data in a continuous stream. Passive aggressive classifier can be defined as follow:

Passive: If the prediction is correct, keep the model and do not make any changes. i.e., the data in the example is not enough to cause any changes in the model.

Aggressive: If the prediction is incorrect, make changes to the model. i.e., some change to the model may correct it. [6]

One of the most important parameter that is used in passive aggressive classifier is max_itr. It defines the maximum number of iterations the model makes over the training data. Using this classifier we classify if the given user input news article is real or fake.

V. RESULT AND ANALYSIS



Figure 4: Ouput screen of fake news dectection

Initially user gives the input in the text format as shown in the above figure 4. Then the tool receives it and when it is sent to the server then data preprocessing is performed on the .csv file. The dataset mainly consists of 4 columns namely news, title, text, labels(real/fake). After data preprocessing Test and Train split is done. Then tfidf vectorization takes place on the data. Tfidf is calculated by the product of tf(Term frequency) and idf(Inverse document frequency). Later Passive Aggressive classification takes place on the data. If the classifier results as passive then it means that the classification is correct. If the classifier results aggressive then it implies that the classification has miscalculation. In the end output is displayed on the screen saying whether the news is fake or real as follows.



Figure 5

If output is fake above screen as shown in figure 5 is displayed.

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Figure 6

If output is real above screen as shown in figure 6 is displayed.

VI. CONCLUSION AND FUTURE WORK

The task of classifying news manually requires in-depth knowledge of the domain and expertise to identify anomalies in the text. Hence, we used passive aggressive and TF-IDF Vectorizer which is efficient and effective way to obtain accurate results. The goal of this project is to comprehensively review, summarize, compare and evaluate the current research on fake news. After applying the above algorithms we can easily classify if the given user input article is real or fake.

Basing fake news detection only on supervised models on text have shown not to be enough in all the cases. In order to solve this problem, most of the research focus on additional information such as author information. The most successful approach would be automatic fact checking model, that is, compelling the model with some kind of knowledge base, the purpose of the model would then be to extract information for the text and verify the information in the database. The problem with this approach would be that the knowledge base would need to be constantly and manually update to stay up to date.

VII. ACKNOWLEDGMENT

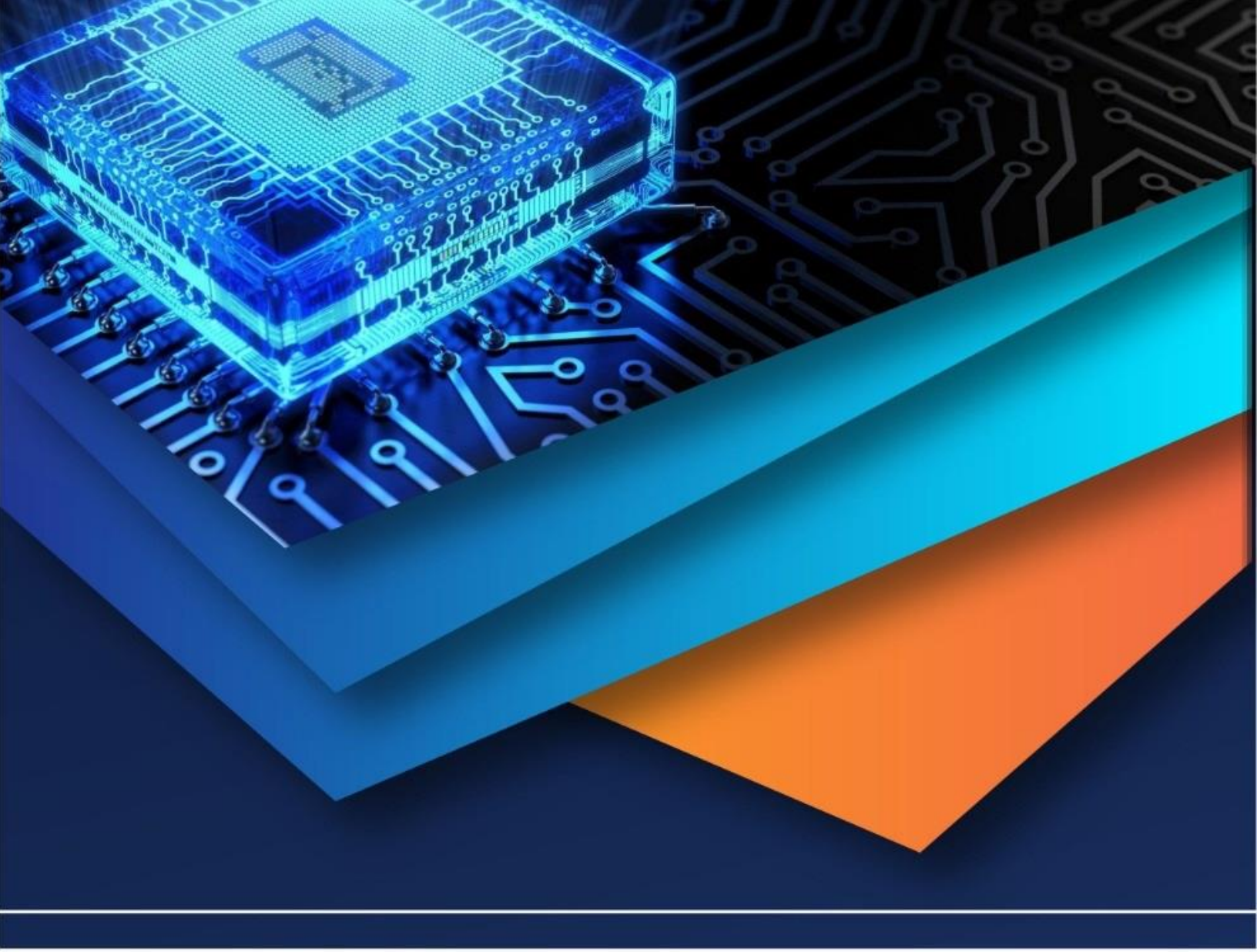
We take this opportunity to express our gratitude and respect to all the faculty members who have guided us in this project. We take privilege to extend our profound gratitude and sincere thanks to our guide Dr. Suwarna Gothane, Department of computer science and Engineering, CMR Technical Campus, who constantly supported us at every stage of the project and helped us in our difficult times to make the project a success.

We are thankful to HOD Dr. K Srujan Raju. Department of Computer Science and Engineering, CMR Technical Campus, for his immense support and encouragement. We also take this opportunity to thank Dr A Raji Reddy, Director CMR Technical Campus, for providing us an encouraging environment to work with.

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