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Fake News Detection using Passive Aggressive and TF-IDF Vectorizer

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Abstract: *The extensive spread of fake news can have a serious negative impact on individuals and society. It has brought down the authenticity of news ecosystem as it is even more widely spread on social media than most popular authentic news. It is one of the biggest problems which has the ability to change opinions and influence decisions and interrupts the way in which people responds to real news. Fake news has been incurring many problems to the individual and to our society. This paper reviews various Machine learning approaches in detection of fake and fabricated news and then I propose a method having high accuracy for the detection of the fake news.*

Keywords: Fake News, text classification, feature extraction, machine learning

1. INTRODUCTION

Fake news is news which are created intentionally to misguide the readers. It is a type of propaganda which is published in the form of genuine news. Fake news is spread through traditional news media and social media. Fake news are news articles that are "intentionally and verifiably false and could mislead readers". In the past years, especially in the 2016 US presidential election, coverage on fake news has alerted major media outlets and politicians. It is believed that fake news spread by social bots and populistic political websites and have influenced the election of Donald Trump as US president. In this project, it is aimed to produce a model that can accurately predict the likelihood that a given article is fake news.

2. OBJECTIVE

The major objectives of this project are:

- Taking the help of linguistic cues to develop a machine learning based model for accurately determining whether the given news is fake or authentic.
- To get high accuracy to determine a news is fake or true.

3. LITERATURE

Primarily, we take input in the form of a text data from the user and then the data is handled using the model build based on the count vectorizer or a TF-IDF vectorizer (word tallies how often they are used in other articles in our dataset).

Now the next step is to extract the most optimal features for count vectorizer or TFIDF-vectorizer, this is done by using a n-number of the most used words mainly removing the stop words which are common words such as "the", "if", and "when" and only using those words that appear at least a given number of times in a given text dataset.

Since this problem is a kind of text classification, Implementing Naive Bayes classifier and Passive Aggressive algorithm will be best as this is standard for text-based processing. The actual goal is in building a model which was the text transformation (Count Vectorizer vs TFIDF Vectorizer) and choosing which type of text to use.

Finally, we are obtaining the accuracy and printing the true and false positives and negatives using confusion matrix. Confusion matrix is nothing but a table used to describe the performance of classification model or classifier on set of data set.

We obtain the accuracy based on how well our classifiers are working and the data set is bet fit in it. Accuracy is calculated based on true and false positives and negatives.

$$\text{Accuracy} = TP+TN/\ TP+FP+TN+FN.$$

4. METHODOLOGY

The approach proposed for this project is:

- Data Collection
- Data Preprocessing
- Generating News Feature Vector
- Classification

❖ Data Collection

We have a dataset for fake news detection, we will use the required attributes of these datasets to train our model.

The dataset is being taken from Kaggle.com. The size of the dataset is 6335*4. It means that there are 6335 rows along with 4 columns. The name of the columns are 'URLs', 'Headline', 'Body' and 'Label'. The first column identifies the news, the second and third are the title and text, and the fourth column has labels denoting whether the news is REAL or FAKE.

❖ Data Preprocessing

Data preprocessing is done to convert the raw data into a required format. Data preprocessing can be done by various methods like data cleaning, data reduction, data integration etc. In this project, the datasets are collected from different resources which have different formats and attributes. Hence, the data can be duplicate and they may contain some attributes which are not useful. So, we convert the data into our required format with required attributes which are used to train our model.

❖ Generating News Feature Vector

A. COUNT VECTORIZER

Count Vectorizer is a representation of text that describes the occurrence of words within a document. It involves two things:

- A vocabulary of known words.
- A measure of the presence of known words.

B. TF-IDF VECTORIZER

TF-IDF is a statistical measure that evaluates how relevant a word is to a document in a collection of documents. This is done by multiplying two metrics: how many times a word appears in a document, and the inverse document frequency of the word across a set of documents.

❖ Classification

A. NAIVE BAYES CLASSIFIER

Naive Bayes are mostly used in natural language processing (NLP) problems. Naive Bayes predict the tag of a text. They calculate the probability of each tag for a given text and then output the tag with the highest one.

Classification technique based on Bayes' theorem with an assumption of independence among predictors

1. Convert data set into a frequency table.

2. Create likelihood table by finding probabilities.

3. Use Naive Bayesian equation to calculate posterior probability for each class.

➢ *USING TF-IDF VECTORIZER*

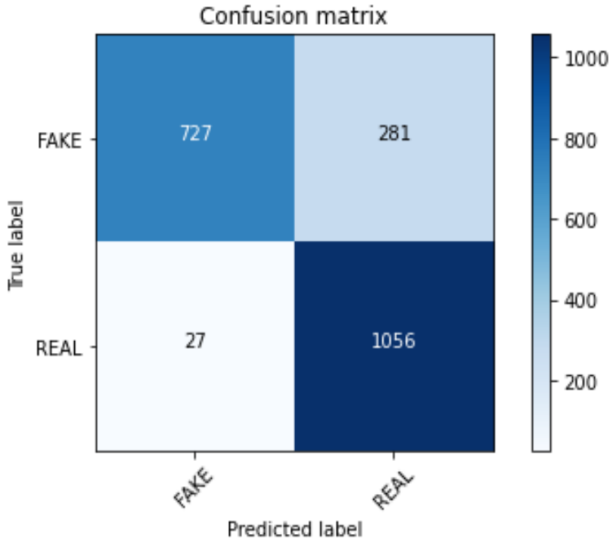

Fig1. *Confusion matrix for naive bayes using TF-IDF*

➢ *USING COUNT VECTORIZER*

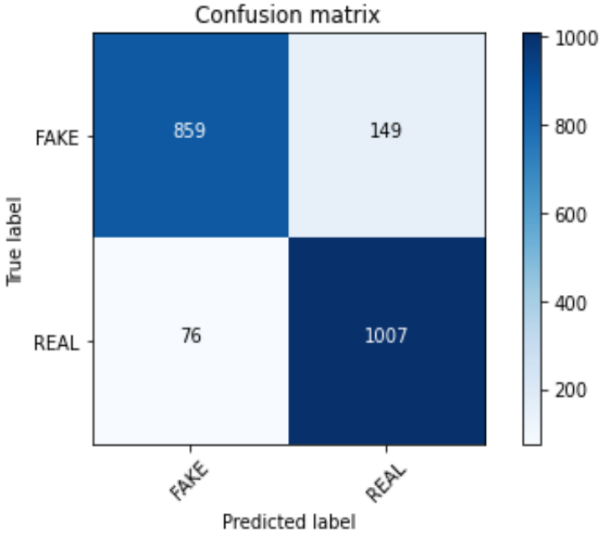

Fig2*. Confusion matrix for naive bayes using count vectorizer*

B. PASSIVE AGGRESSIVE CLASSIFIER

Passive Aggressive algorithm remains passive for a correct classification outcome, and turns aggressive in the event of a miscalculation. Its purpose is to make updates that correct the loss, causing very little in the norm of weight vector.

➢ *USING TF-IDF VECTORIZER*

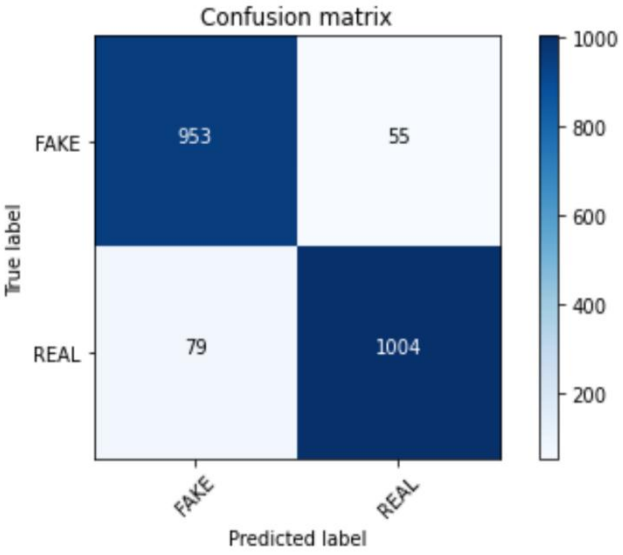

Fig3. *Confusion matrix for passive aggressive using TF-IDF*

➢ *USING COUNT VECTORIZER*

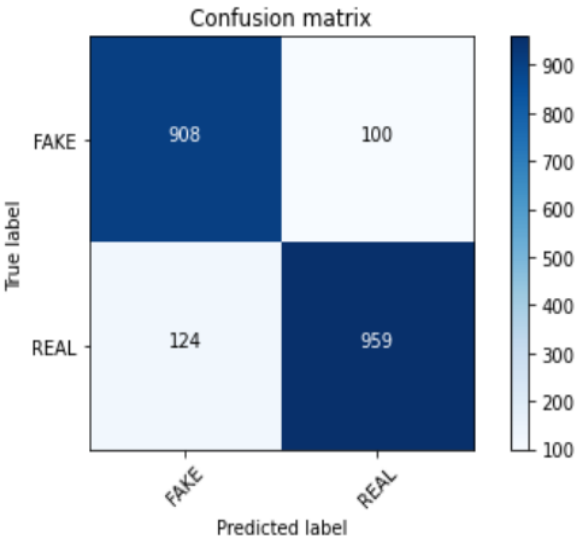

Fig4. *Confusion matrix for passive aggressive using count vectorizer*

5. RESULTS

The result show that Passive Aggressive have better performance than naive bayes on the dataset in the model. The same can be perceived from the classification report. Also, the training data is broadly based on US politics and economics news so it has been observed in our test cases, that the news statements related to US politics have been correctly classified and fake news was detected.

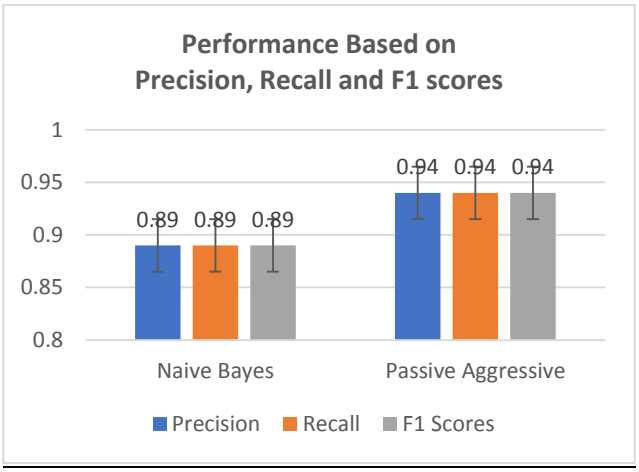

Fig5. *Classification Report*

6. CONCLUSION

Fake news detection based only on the content of the articles has been proven as an example of binary text classification. In the project implementation and the accompanying experiment, it was shown that the combination of TF-IDF and Passive Aggressive model shows the best performance and can detect over 9 out of 10 fake news articles correctly, thus being well suited for the text classification task. This paper concludes that using Passive Aggressive and TF-IDF vectorizer is efficient as we obtained 94% of accuracy from this model.

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