

PROJECT REPORT

Fake News Detection using Machine Learning

In partial fulfillment of the requirements for the degree of
B.Tech (Computer Science and Engineering)

Under the guidance of:

Mr. Pradeep Kamboj

Team Members:

Binthia Ahmed

D/18/CS/003

Mercyful Snaitang

D/19/CS/202



Department of Computer Science and Engineering

NORTH EASTERN REGIONAL INSTITUTE OF SCIENCE AND TECHNOLOGY

Deemed University, Under Section 3 of the UGC Act, 1956,
Ministry of Human Resource Development, Govt. of India, New Delhi
Nirjuli :: Arunachal Pradesh :: 791109

DECLARATION

We hereby declare that the project entitled "**Fake News Detection using Machine Learning**", submitted to the North Eastern Regional Institute of Science and Technology, Nirjuli; is a record of an original work done by us, *Miss Bintahia Ahmed* and *Mercyful Snaitang* under the abled guidance of our respected teacher and guide, *Mr. Pradeep Kamboj*. This report is submitted in partial fulfillment for the award of degree of Bachelors of Technology in Computer Science and Engineering. The results embodied in this thesis has not been submitted to any other University or Institute for the award of any degree or diploma.

Bintahia Ahmed

D/18/CS/003

Mercyful Snaitang

D/19/CS/202

CERTIFICATE

This is to certify that **Binthia Ahmed**(D/18/CS/003) and **Mercyful Snaitang**(D/19/CS/202), 4th year students of Computer Science and Engineering Department, North Eastern Regional Institute of Science and Technology; have successfully completed their Degree (Major) Project on ***“Fake News Detection using Machine Learning”*** under the guidance of **Mr. P. Kamboj**.

Mr. Pradeep Kamboj

(Associate Professor)

Project Guide

Mr. Aswini Kumar Patra

(Associate Professor)

Project Coordinator

Dr. Moirangthhem Marjit Singh

(Associate Professor)

Head of the Department

ACKNOWLEDGEMENT

We have made some really great efforts in completing this project. However this project wouldn't have been successful without the few persons whose efforts are worth mentioning. We would like to extend my deepest gratitude to all of them.

We are highly indebted to our Project Guide, Mr. P. Kamboj, for his guidance and constant supervision as well for providing necessary information regarding the project and also for his support in completing the project. His enthusiasm, patience, insightful comments, practical advice and unceasing ideas have helped us tremendously. His immense knowledge and profound experience in Data Analytics have helped us complete this project successfully.

We would like to express our sincere gratitude towards our Project Coordinator, Mr. A. K. Patra, for his kind cooperation and encouragement throughout the project. Without his constant support and guidance, this project would have been impossible.

Our heartfelt thanks to the Head of our Department, Computer Science and Engineering, Dr. M. M. Singh for giving us this opportunity to do a major degree project and gain knowledge from the researches and the experience, which would later be very helpful for our professional career.

We are also very thankful to the faculty members, staff members and the Department of CSE as a whole, who have directly or indirectly helped us getting this project done. We are also grateful to our parents for supporting and guiding us throughout.

Last but not the least, we extend our gratitude to all our friends, classmates and colleagues for being there for us and supporting us.

ABSTRACT

Fake news was a term used first in the 1890s when non true news reports or sensational reports were common in newspapers. These are basically just false reports that are presented to the public as news. Its basic aim to destroy the reputation of an individual, organization or any entity for advertising purposes or to gain money and fame by defaming another. Media plays a very important role in the fake news circulation.

Here, we try and create a Machine Learning model using the Jupyter Notebook. First, we visualize the two datasets that we have, "True" for the True News and "Fake" for the Fake News. We merge the two datasets by randomly mixing the data and create a single dataset. Then we pick up the title of any article in the dataset and try and predict if the news is fake or not.

We now use the BERT-fine tuning method and check the performance. The results give us 88% accuracy and high values of precision and recall. We then get the classification matrix.

By observing this classification problem, we can see that Passive Aggressive Classifier would be the best fit. By checking the accuracy we find that it gives us 94% accuracy.

As an extension of this project, we modify the project by removing BERT tokenizer and using Natural Processing Language packages and Multinomial Naïve Bayes classifier to optimize our model.

By observing the classification metrics we see that the model gives us as an accuracy of 95%.

TABLE OF CONTENTS

DECLARATION

CERTIFICATE

ACKNOWLEDGEMENT

ABSTRACT

1. INTRODUCTION

2. NEED OF THE PROJECT

3. PROJECT APPROACH

4. PROCEDURE :

a) DATABASE CREATION/COLLECTION

b) STUDY OF THE DATA BASE

c) GROUPING OF THE DATABASE

d) ALGORITHM CHOSEN

e) MACHINE LEARNING MODEL

5. EXTENSION AND MODIFICATION: OPTIMIZATION

6. CONCLUSION

7. FUTURE PROSPECTS

8. BIBLIOGRAPHY

INTRODUCTION

Data Analysis is essentially the practice of examining, cleaning, modifying and structuring data to get useful information, finding a conclusion and to support the choice making. In our project, we analyze the dataset consisting of different news reports telling us whether those are fake or true and create a model to predict if a given news title is fake or real.

The process of making a structure using a dataset is known as machine learning. It is nothing but the study of computer algorithms that automatically get updated with experience. It is a method of data analysis that robotizes systematic model building. It is just a subset of artificial intelligence (AI) which based on the idea that a piece of machine can learn from input data, look for patterns and make important decisions with tiniest human involvement.

AI is also known as machine intelligence in computer science, Machine demonstrates cleverness which is termed as machine intelligence, that is in disparity to the normal perception demonstrated by humans and animals. It points out the to the fact human cleverness are programmed into the machine so that they programmes acts as thinking like humans and reciprocate with their actions. The term is also applied to systems that show traits connected with a human mind such as learning and problem solving.

In our project, we have used machine learning using python in Jupyter notebook. Python is a high level general purpose programming language . This was first created and released in 1991 this language was created by Guido Van Rossum. Python's has the ability to read the code with its notable use of serious white space.

The jupyter notebook is an FOSS web application that allows us to make and send documents that contain live code, equations, visualizations and descriptive text. Jupyter notebook is maintained by the team of people at the project jupyter.

In this project, we use the various libraries provided to us by the Python Programming language such as: Pandas, Scikit-Learn, Matplotlib, Seaborn, Random, CSV, etc.

Pandas are the software library employed by Python and is written by the Python Programming Language for data employ and examination. It gives a data structures and is used for the functioning to shape the time series and numerical tables. Scikit-Learn is developed which helps with the different types of clustering, classification, and regression algorithms which also includes support-vector machines. Random forests, k-means, etc. Matplotlib is a library in the Python Programming Language for plotting different graphs and its numerical or Mathematics extension is the NumPy library. It provides us with an object oriented Application Programming Interface for implanting plots into applications using general-purpose Graphical User Interface toolkits. Seaborn is a Python library for making statistical graphs. It is built on top of matplotlib and very intimately combined with the pandas data structures.

Fake news was a term used first in the 1890s when non true news reports or sensational reports were common in newspapers. These are basically just false reports that are presented to the public as news. Its basic aim to destroy the reputation of an individual,

organization or any entity for advertising purposes or to gain money and fame by defaming another. Media plays a very important role in the fake news circulation.

NEED OF THE PROJECT

Fake news was a term used first in the 1890s when non true news reports or sensational reports were common in newspapers. These are basically just false reports that are presented to the public as news. Its basic aim to destroy the reputation of an individual, organization or any entity for advertising purposes or to gain money and fame by defaming another. Media plays a very important role in the fake news circulation.

Misleading news are the news which are basically categories to be Fake news's. In simple language these news lead people in wrong doing based on the news. With no verification the fakes news can create havoc in the society, they spread like wild fires and is shared without being verified. These are spread intentionally for political gains.

Fake News has been circulating since ages and this has a negative impact on the minds of the youth, individual and the society as a whole. Media outlets, looks for the avenues to attract viewers to their websites so that more revenue gets generated by online advertising revenue. That leads to requirement of fake news detection.

PROJECT APPROACH

We first load the two datasets containing the Fake and True News respectively. We then visualize them and merge them together randomly creating one single dataset. We visualize and explore this new dataset.

In order to perform this classification, we need some basic packages like matplotlib, seaborn, numpy, torch, torchvision, sklearn, transformers, pandas etc. Now, we want to create a model that takes the title of a news and tells us whether or not the news is fake.

Now we perform the BERT fine tuning. BERT is an extraordinary good model that performs classification. We take this model and fine tune it to perform our classification. This is done by splitting the data into training and validation set and then validation and testing set.

We perform all of the BERT procedure and then train and predict the model. Finally, we check the accuracy and visualize the classification matrix. The results give us 88% accuracy and high values of precision and recall.

Since BERT Fine Tuning is quite complex, we would like to try this another way.

Since our project is a classification problem, we need to use one of the classification algorithms out of many. By observing this classification problem, we can say that Passive Aggressive Classifier may be the best fit. For this we have to check the accuracy for the same.

We made two sets of data one for training and another one for testing and then test our model using the Passive Aggressive Classifier (PAC) to check its accuracy. The results show us that the PAC gives us 94.31% accuracy.

Finally, we observe that all the attributes of this problem are almost linearly separable and visualize the confusion matrix. So when a new news title is introduced, our model can accurately predict if the news is fake or not.

For the second part of our project, we would like to use another algorithm to train our model.

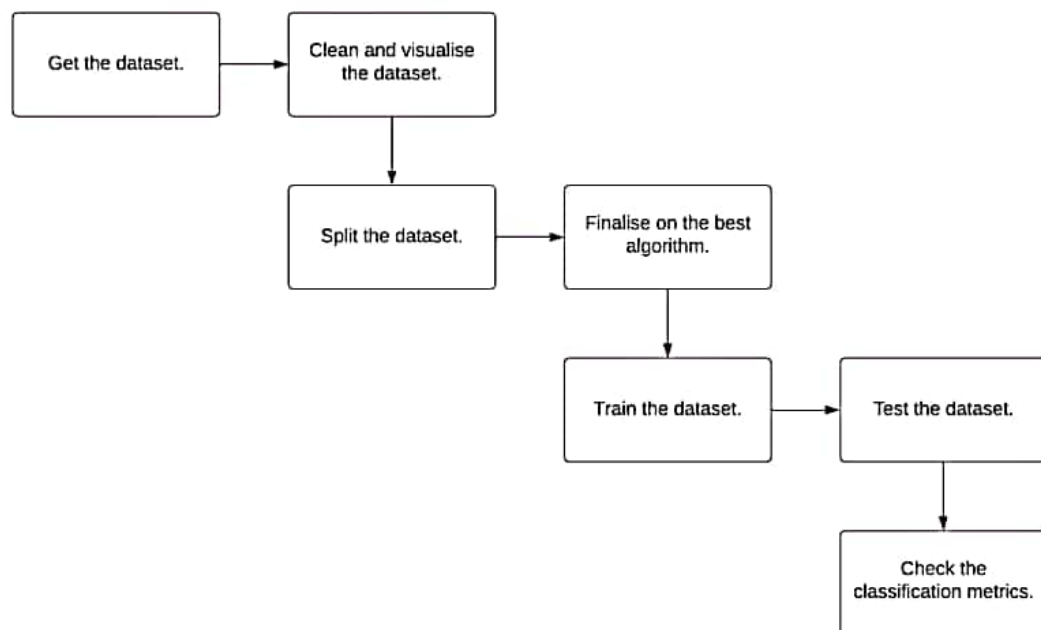
So we eliminate the BERT Tokenizer and PAC.

This time we combine the two datasets of True News and Fake News randomly and then clean the dataset. Cleaning the dataset means removing unwanted columns, lemmatizing the dataset and then removing the stopwords.

We then split the data and use Tfidfvectorizer to vectorize the data. This vectorization returns a sparse matrix. We then convert this sparse matrix into arrays.

The Multinomial Naïve Bayes Classifier is imported and the training dataset is fit into the model. After the dataset has been trained, we test the algorithm on our testing dataset. We do this by using the predict() method on our testing set.

Finally we check the accuracy score and the classification metrics of the trained model. We find that it is approximately 96%. This is quite a good score. Hence finally we save the model.



PROCEDURE

1. Importing the required packages:

2. Importing the dataset:

```
true_data = pd.read_csv('True.csv')
fake_data = pd.read_csv('Fake.csv')
```

```
In [7]: true_data.head()
```

```
Out[7]:
```

		title	text	subject	date
0	As U.S. budget fight looms, Republicans flip t...	WASHINGTON (Reuters) - The head of a conservat...	politicsNews	December 31, 2017	
1	U.S. military to accept transgender recruits o...	WASHINGTON (Reuters) - Transgender people wall...	politicsNews	December 29, 2017	
2	Senior U.S. Republican senator 'Let Mr. Muell...	WASHINGTON (Reuters) - The special counsel inv...	politicsNews	December 31, 2017	
3	FBI Russia probe helped by Australian diplomat...	WASHINGTON (Reuters) - Trump campaign adviser ...	politicsNews	December 30, 2017	
4	Trump wants Postal Service to charge 'much mor...	SEATTLE/WASHINGTON (Reuters) - President Donal...	politicsNews	December 29, 2017	

```
In [8]: fake_data.head()
```

```
Out[8]:
```

		title	text	subject	date
0	Donald Trump Sends Out Embarrassing New Year'...	Donald Trump just couldn't wish all Americans ...	News	December 31, 2017	
1	Drunk Bragging Trump Staffer Started Russian ...	House Intelligence Committee Chairman Devin Nu...	News	December 31, 2017	
2	Sheriff David Clarke Becomes An Internet Joke...	On Friday, it was revealed that former Milwauk...	News	December 30, 2017	
3	Trump Is So Obsessed He Even Has Obama's Name...	On Christmas day, Donald Trump announced that ...	News	December 29, 2017	
4	Pope Francis Just Called Out Donald Trump Dur...	Pope Francis used his annual Christmas Day mes...	News	December 25, 2017	

3. Merging and Cleaning the Dataset:

```
In [6]: true_data['Target']=['True']*len(true_data)
fake_data['Target']=['Fake']*len(fake_data)
```

```
In [7]: data=true_data.append(fake_data).sample(frac=1).reset_index().drop(columns=['index'])
```

```
In [8]: data['label']=pd.get_dummies(data.Target)['Fake']
```

```
In [9]: data.head()
```

```
Out[9]:
```

		title	text	subject	date	Target	label
0	DETROIT COP UNDER FIRE FOR FACEBOOK POST: 'The...	If this cop's comments were in lock-step with ...	left-news	Jul 11, 2016	Fake	1	
1	Obama, Republican leaders seek elusive common ...	WASHINGTON (Reuters) - U.S. President Barack O...	politicsNews	February 2, 2016	True	0	
2	Kremlin raps U.S.A for not issuing visas to U....	MOSCOW (Reuters) - The Kremlin on Friday accus...	worldnews	October 13, 2017	True	0	
3	Egyptian lawmaker to propose anti-gay bill as ...	CAIRO (Reuters) - An Egyptian lawmaker is intr...	worldnews	November 9, 2017	True	0	
4	FBI Arrest Cliven Bundy at Portland Airport - ...	Patrick Henningsen 21st Century WireCliven Bun...	US_News	February 11, 2016	Fake	1	

4. Training and Testing split:

4. Train-Validation split

```
In [10]: train_text, temp_text, train_labels, temp_labels = train_test_split(data['title'], data['label'],
                                                                              random_state=2018,
                                                                              test_size=0.3,
                                                                              stratify=data['Target'])
```

5. Validation-Test split

```
In [11]: val_text, test_text, val_labels, test_labels = train_test_split(temp_text, temp_labels,
                                                                           random_state=2018,
                                                                           test_size=0.5,
                                                                           stratify=temp_labels)
```

5. Training and Predicting using BERT Fine Tuning:

13. Train and predict

```
In [33]: best_valid_loss = float('inf')

# empty lists to store training and validation loss of each epoch
train_losses=[]
valid_losses=[]

#for each epoch
for epoch in range(epochs):

    print('\n Epoch {:} / {:}'.format(epoch + 1, epochs))

    #train model
    train_loss, _ = train()

    #evaluate model
    valid_loss, _ = evaluate()

    #save the best model
    if valid_loss < best_valid_loss:
        best_valid_loss = valid_loss
        torch.save(model.state_dict(), 'saved_weights.pt')

    # append training and validation loss
    train_losses.append(train_loss)
    valid_losses.append(valid_loss)

    print(f'\nTraining Loss: {train_loss:.3f}')
    print(f'\nValidation Loss: {valid_loss:.3f}')
```

```
Epoch 1 / 10
Batch 50 of 983.
Batch 100 of 983.
Batch 150 of 983.
Batch 200 of 983.
Batch 250 of 983.
Batch 300 of 983.
Batch 350 of 983.
Batch 400 of 983.
Batch 450 of 983.
Batch 500 of 983.
Batch 550 of 983.
Batch 600 of 983.
Batch 650 of 983.
Batch 700 of 983.
Batch 750 of 983.
Batch 800 of 983.
Batch 850 of 983.
```

6. Checking the performance and then the Confusion Matrix:

14. Checking the performance

```
In [36]: preds = np.argmax(preds, axis = 1)
print(classification_report(test_y, preds))
```

	precision	recall	f1-score	support
0	0.87	0.89	0.88	3213
1	0.90	0.88	0.89	3522
accuracy			0.88	6735
macro avg	0.88	0.88	0.88	6735
weighted avg	0.88	0.88	0.88	6735

```
In [39]: confusion_matrix(preds,test_y)
```

```
Out[39]: array([[2867, 438],
               [ 346, 3084]], dtype=int64)
```

7. Passive Aggressive Classifier-94.31%:

By observing this Classification Problem, it seems that Passive Aggressive Classifier would be the best fit. Let us check the Accuracy.

```
In [61]: target = data.Target
target.head
```

```
Out[61]: <bound method NDFrame.head of 0      True
1       True
2       Fake
3       True
4       True
...
44893   True
44894   True
44895   Fake
44896   Fake
44897   Fake
Name: Target, Length: 44898, dtype: object>
```

```
In [62]: x_train,x_test,y_train,y_test=train_test_split(data['title'], target, test_size=0.2, random_state=7)
```

```
In [63]: tfidf_vectorizer=TfidfVectorizer(stop_words='english', max_df=0.7)
tfidf_train=tfidf_vectorizer.fit_transform(x_train)
tfidf_test=tfidf_vectorizer.transform(x_test)
```

```
In [64]: pac=PassiveAggressiveClassifier(max_iter=50)
pac.fit(tfidf_train,y_train)
y_pred=pac.predict(tfidf_test)
score=accuracy_score(y_test,y_pred)
print(f'Accuracy: {round(score*100,2)}%')
```

Accuracy: 94.31%

```
In [69]: confusion_matrix(y_test,y_pred, labels=['Fake','True'])
```

```
Out[69]: array([[4427, 245],
               [ 266, 4042]], dtype=int64)
```


EXTENSION AND MODIFICATION: OPTIMIZATION

1. Importing the required packages.
2. Importing the datasets.
3. Concatenating both the datasets randomly.

	text	label
7082	(Reuters) - Britain's Sir Elton John will not ...	0
11597	James O Keefe has been at the forefront of new...	1
15780	Because nothing says justice for Freddie Gra...	1
300	(Reuters) - U.S. Senator Dick Durbin, the No. ...	0
20641	ANKARA (Reuters) - A Turkish court has ordered...	0
17094	CARACAS/PUERTO ORDAZ, Venezuela (Reuters) - Ve...	0
21897	Evil hiding under the banner of religion in ...	1
15170	BEIRUT (Reuters) - The Syrian Observatory for ...	0
1094	It s an old story: A demographic won t vote Re...	1
5551	TOKYO (Reuters) - Japanese Prime Minister Shin...	0
17718	BERLIN/PARIS (Reuters) - European countries ar...	0
19879	BEIRUT (Reuters) - The former al Qaeda branch ...	0
5770	(Reuters) - A federal judge in Florida on Wedn...	0
409	WASHINGTON (Reuters) - The guilty plea entered...	0
12953	Hillary spoke to a very small group of student...	1
16033	Former Navy SEAL and GOP Rep. Scott Taylor, R...	1
19453	NEW YORK (Reuters) - President Donald Trump sa...	0
13938	ABUJA (Reuters) - Nigeria s Atiku Abubakar, a ...	0
3719	WASHINGTON (Reuters) - Michael Flynn and other...	0
8876	WASHINGTON (Reuters) - U.S. House of Represent...	0

4. Cleaning the dataset.
5. Splitting the dataset.
6. Vectorizing the dataset and converting it to array.
7. Importing Multinomial Naïve Bayes algorithm.
8. Training the Dataset

9. Testing the Dataset

10. Observing the classification metrics.

```
print(classification_report(test_label , y_pred))
```

	precision	recall	f1-score	support
0	0.95	0.94	0.95	3344
1	0.95	0.96	0.95	3656
accuracy			0.95	7000
macro avg	0.95	0.95	0.95	7000
weighted avg	0.95	0.95	0.95	7000

```
y_pred_train = clf.predict(training_data)  
print(classification_report(train_label , y_pred_train))
```

	precision	recall	f1-score	support
0	0.96	0.96	0.96	13328
1	0.96	0.96	0.96	14672
accuracy			0.96	28000
macro avg	0.96	0.96	0.96	28000
weighted avg	0.96	0.96	0.96	28000

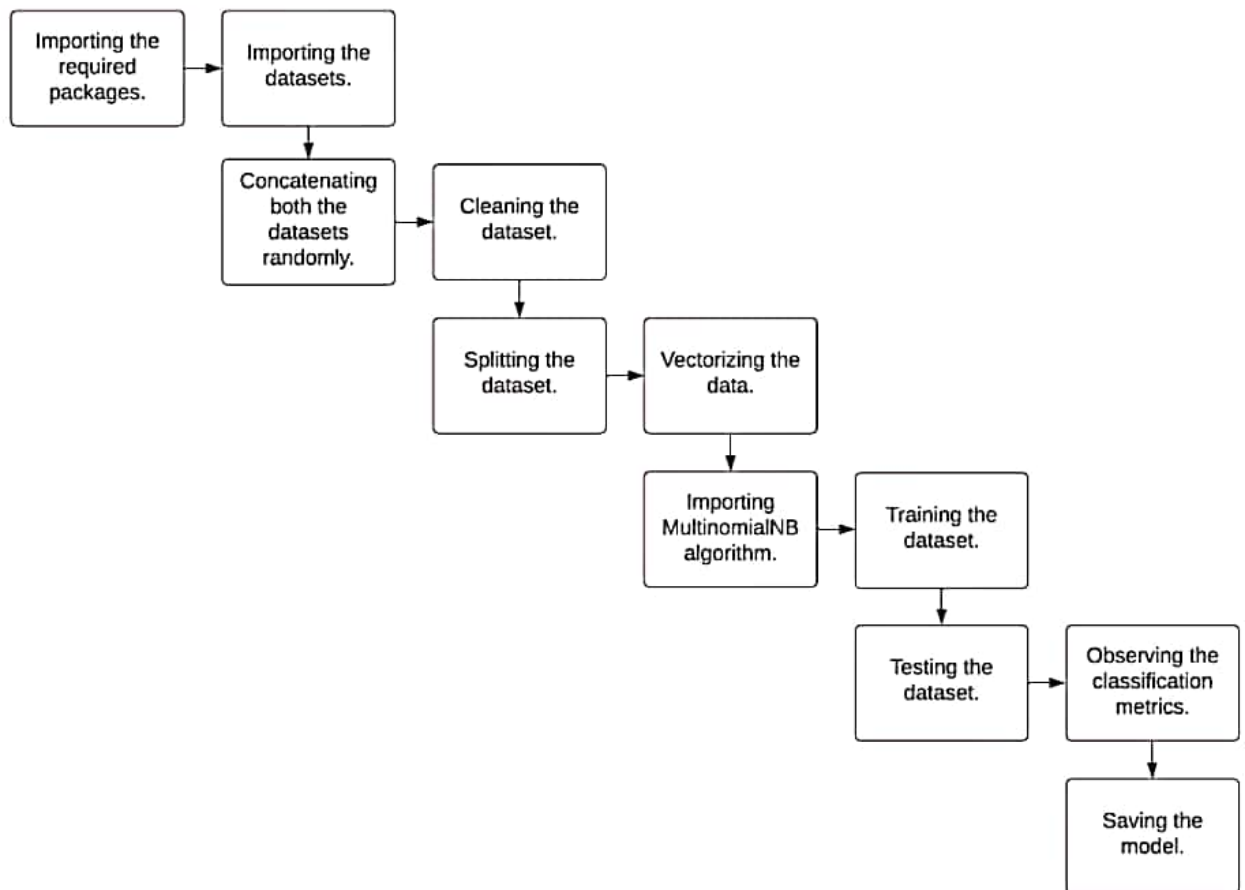
```
accuracy_score(train_label , y_pred_train)
```

0.96

```
accuracy_score(test_label , y_pred)
```

0.9484285714285714

11. Saving the model.



COMPARING BOTH THE MODELS THROUGH CONFUSION MATRIX

1. Confusion matrix for the first model:

```
: confusion_matrix(preds,test_y)  
:  
: array([[2867,  438],  
        [ 346, 3084]], dtype=int64)
```

Classification report:

	precision	recall	f1-score	support
0	0.87	0.89	0.88	3213
1	0.90	0.88	0.89	3522
accuracy			0.88	6735
macro avg	0.88	0.88	0.88	6735
weighted avg	0.88	0.88	0.88	6735

2. Confusion matrix for the second model:

```
: confusion_matrix(y_pred_train,train_label)  
:  
: array([[12798,  546],  
        [ 587, 14069]], dtype=int64)
```

Classification report:

	precision	recall	f1-score	support
0	0.96	0.96	0.96	13385
1	0.96	0.96	0.96	14615
accuracy			0.96	28000
macro avg	0.96	0.96	0.96	28000
weighted avg	0.96	0.96	0.96	28000

CONCLUSION

We have successfully created a machine learning model to predict whether a given news is Fake or Not given a sample of unknown type and its known title. We do this using the Passive Aggressive Classifier after finding out that this gives us 94.31%, which is quite good.

Machine Learning algorithms also have "The Passive-Aggressive algorithms" into their family. For large scale learning with massive data base Passive-Aggressive algorithms are generally used. This is one of the most powerful and '**online-learning algorithms**'.

With the upcoming data revolution, it is best to be equipped with the knowledge of machine learning and data analytics. Nowadays something or the other is always happening in every second of the ticking clock. By combining news with machine learning, we are creating the best possible combination to keep us updated and going.

FUTURE PROSPECTS

This model can further be modified and optimized with newer and better performing algorithms which are much more advanced.

Human type synthetic text are produced when we collaborate with Massive amounts of data. These human type synthetic text are nothing but the AI

May text-generating systems have joined the race and are becoming popular and smarter day by day. They basically use the NLP techniques for the text-generating system.

We modify and implement this further to generate awareness on fake academic submissions, abuse of government policies, detect misinformation, spam and phishing.

BIBLIOGRAPHY

1. <https://www.datasciencegraduateprograms.com/python/>
2. <https://www.analyticsvidhya.com/blog/2016/01/complete-tutorial-learn-data-science-python-scratch-2/>
3. <https://www.geeksforgeeks.org/introduction-machine-learning-using-python/>
4. <http://ivyproschoo.com/blog/2017/08/21/why-python-is-the-preferred-language-for-machine-learning/>
5. <https://www.slideshare.net/GautamSawant1/predicting-wine-quality-using-data-analytics>
6. <https://medium.com/themlblog/wine-quality-prediction-using-machine-learning-59c88a826789>
7. <https://www.investopedia.com/terms/d/data-analytics.asp>
8. <https://searchdatamanagement.techtarget.com/definition/data-analytics>
9. <https://expertsystem.com/machine-learning-definition/>
10. <https://www.geeksforgeeks.org/machine-learning/>
11. <http://lib3.dss.go.th/fulltext/Journal/J.Sci.Food%20and%20Agri/2005v85/no.2/2005v85no2p286-292pdf.pdf>
12. <https://pdfs.semanticscholar.org/8cdb/f1c699364433f0bf08209c9bf282167cf19b.pdf>
13. https://www.researchgate.net/publication/223495802_Tea_Quality_Prediction_Using_a_Tin_Oxide-based_Electronic_Nose_an_Artificial_Intelligence_Approach
14. <https://www.ijrte.org/wp-content/uploads/papers/v8i1s4/A11460681S419.pdf>
15. <https://www.tocklai.org/wp-content/uploads/2019/07/Tea-Tocklai-Brochure.pdf>
16. <http://www.currentscience.ac.in/Volumes/107/10/1757.pdf>

Fake News Detection

ORIGINALITY REPORT

6%

SIMILARITY INDEX

3%

INTERNET SOURCES

4%

PUBLICATIONS

4%

STUDENT PAPERS

PRIMARY SOURCES

1

Submitted to Mississippi State University

Student Paper

3%

2

Nirbhay Mishra, Amit Majumder, Dr. Pranati Rakshit. "Design and analysis of the epidemic novel corona virus", Journal of Physics: Conference Series, 2021

Publication

2%

3

Submitted to Bournemouth University

Student Paper

1%

Exclude quotes

Off

Exclude matches

< 10 words

Exclude bibliography

On