Fake News Detection Using Machine Learning in Python

A Minor Project Report submitted in the partial fulfilment of requirement of award of degree of Bachelor of Technology in Mining Engineering

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CERTIFICATE

This is to certify that the dissertation titled **"FAKE NEWS DETECTION USING MACHINE LEARNING IN PYTHON"** being submitted by Mr. Sri Sesha Sai Pavan Josyula (Roll No.: 511217002) to the Department of Mining Engineering, Indian Institute of Engineering Science and Technology, Shibpur, in partial fulfilment of requirements for award of degree of Bachelor of Technology in Mining Engineering is a record of bona fide work carried out by him under my supervision and guidance.

To the best of my knowledge, the matter embodied in this document has not been submitted anywhere else for award of any other degree or diploma.

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DECLARATION

I hereby declare that the technical report entitled **"FAKE NEWS DETECTION USING MACHINE LEARNING IN PYTHON"** submitted to the Indian Institute of Engineering Science and Technology, Shibpur in the partial fulfilment of the requirements of the award of the degree of Bachelor of Technology in Mining Engineering is a record of bona fide technical report carried out by me.

To the best of my knowledge, the matter embodied in this document has not been submitted anywhere else for award of any other degree or diploma.

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EXECUTIVE SUMMARY

Fake news is one of the current issues in the social media management. Every person having a smart phone today is following news through Google newsfeeds, Twitter, Facebook, Instagram or through any other website or app. Due to availability of smart apps like WhatsApp, Facebook, Telegram, the news items are being shared so rapidly just by a single click. It may not be possible for every person to classify whether the news item, he has read in Facebook, Twitter or any other social media, is genuine or duplicate. Especially, the illiterate or uneducated people may get deceived by the misleading headlines or fraudulent advertisements. I've made this model to detect the fake news in social media so that it can help at least few people from not getting deceived by cons. I utilized machine learning techniques in python programming to build this model. I'm glad to present my model which has prediction accuracy of 93-94%.

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CHAPTER 1

1. INTRODUCTION

Lot of things you read online especially in your social media feeds may appear to be true, often is not. Fake news is news, stories, or hoaxes created to deliberately misinform or deceive readers. Usually, these stories are created to influence people's views, push a political agenda or cause confusion and can often be a profitable business for online publishers. Fake news stories can deceive people by looking like trusted websites or using similar names and web addresses to reputable news organisations.

1.1. The Rise of Fake News

Fake news is not new however it has become a hot topic since 2015. Traditionally, we got our news from trusted sources, journalists and media outlets that are required to follow strict codes of practice. However, the internet has enabled a whole new way to publish, share and consume information and news with very little regulation or editorial standards.

Many people now get news from social media sites and networks and often it can be difficult to tell whether stories are credible or not. Information overload and a general lack of understanding about how the internet works by people have also contributed to an increase in fake news or hoax stories. Social media sites can play a big part in increasing the reach of these types of stories.

1.2. Types of Fake News

There are differing opinions when it comes to identifying types of fake news. However, when it comes to evaluating content online there are various types of fake or misleading news we need to be aware of.

1. Clickbait: These are the stories that are fabricated deliberately to gain more website visitors and increase advertising revenue for websites. Clickbait stories use sensational headlines to grab attention and drive click-throughs to the publisher website, normally at the expense of truth or accuracy.

2. Biased News: Many people are drawn to news or stories that confirm their own beliefs or biases and fake news can prey on these biases. Social media news feeds tend to display news and articles that they think we will like based on personalised searches.

3. Misleading Headlines: Stories that are not completely false can be distorted using misleading or sensationalist headlines. These types of news can spread quickly on social media sites where only headlines and small snippets of the full articles are displayed on the audience newsfeeds.

1.3.   Objective:

To detect the fake news in social newsfeeds with the aid of machine learning techniques in python by building a machine learning model accurately to classify a piece of news as REAL or FAKE.

CHAPTER 2

2. DETECTING FAKE NEWS USING MACHINE LEARNING

Before moving ahead of this project, I'd like to introduce some project related terms.

1) **Machine Learning:** The ability of machine to learn without being explicitly programmed is termed as Machine Learning. Machine Learning is the most popular technique of predicting the future or classifying information to help people in making necessary decisions. Machine Learning algorithms are trained over instances or examples through which they learn from past experiences and also analyze the historical data. Therefore, as it trains over the examples, again and again, it is able to identify patterns in order to make predictions about the future.

2) **Supervised Learning:** In Supervised Learning, the dataset on which we train our model is labeled. There is a clear and distinct mapping of input and output. Based on the example inputs, the model is able to get trained in the instances. An example of supervised learning is spam filtering. This project is also an example of this kind of learning.

3) **Unsupervised Learning:** In Unsupervised Learning, there is no labeled data. The algorithm identifies the patterns within the dataset and learns them. The algorithm groups the data into various clusters based on their density. Using it, one can perform visualization on high dimensional data.

4) **Numpy:** It's one of the libraries in Python programming which facilitates the user to create multi-dimensional arrays and also to perform higher mathematical operations.

5) **Scipy:** It's used for scientific computing and technical computing. It can modules for integration, optimization, linear algebra, etc. Besides Python, it's also written in C, C++, Fortran.

6) **Pandas:** It's one of the libraries in Python programming for data manipulation and analysis. It's a primary tool for data manipulation in Python. It's also written in C language.

7) **Scikit learn (sklearn):** It's an open-source machine learning library for Python programming. It offers various machine learning applications like regression, classification, clustering, etc.

8) **Pip:** It's the package installer for Python. It's used to manage and install software packages written in Python.

9) **Stop words:** These are the most common words in a language. For example, in English language, the words such as 'is', 'am', 'was', 'as', 'are', 'you', etc are considered as *stop words* and these words should not be considered for text data analysis or else it may give us different results.

10) **TF-IDF: TF means Term Frequency** and **IDF means Inverse Document Frequency**. It's used by search engines to better understand content which is undervalued. The number of occurrences of a term in a single document in a corpus is called 'Term Frequency', whereas the measure of how significant the term in the whole corpus (text dataset) is referred to as 'Inverse Document Frequency'. It's an information retrieval technique and a statistical measure used to determine how important a word is to a document in a corpus.

11) **TfidfVectorizer:** It converts a collection of raw documents to a matrix of TF-IDF features. It's a standard function provided in sklearn library.

12) **PassiveAggressiveClassifier:** Passive Aggressive algorithms are online learning algorithms. Such an algorithm remains passive for a correct classification outcome, and turns aggressive in the event of a miscalculation, updating and adjusting. Unlike most other algorithms, it does not converge. Its purpose is to make updates that correct the loss, causing very little change in the norm of the weight vector.

2.1. About this Project:

For this project, I utilized Jupyter Notebooks (which is a Python Integrated Development Environment (IDE)) provided in IBM Skills Network Labs. Using sklearn, we build a TfidfVectorizer on our dataset. Then, we intiliaze PassiveAggressiveClassifier and fit the model. In the end, the accuracy score and the confusion matrix tell us how well our model works.

2.2. The Dataset

The dataset is provided by DataFlair, one of the online data science training platforms. The dataset we used in this project is in .csv format. The shape of the dataset is 6335X4. The first column identifies the news, the second and the third are the title and the text, and the fourth column has labels denoting whether the news is REAL or FAKE.

2.3. Prerequisites

We have to install the following libraries to begin this project.

```
[1]: pip install numpy pandas sklearn

Requirement already satisfied: numpy in /home/jupyterlab/conda/envs/python/lib/python3.6/site-packages (1.16.2)
Requirement already satisfied: pandas in /home/jupyterlab/conda/envs/python/lib/python3.6/site-packages (0.25.3)
Collecting sklearn
  Downloading https://files.pythonhosted.org/packages/1e/7a/dbb3be0ce9bd5c8b7e3d87328e79063f8b263b2b1bfa4774cb1147bfcd3f/sklearn-
0.0.tar.gz
Requirement already satisfied: pytz>=2017.2 in /home/jupyterlab/conda/envs/python/lib/python3.6/site-packages (from pandas) (201
9.3)
Requirement already satisfied: python-dateutil>=2.6.1 in /home/jupyterlab/conda/envs/python/lib/python3.6/site-packages (from pan
das) (2.8.1)
Requirement already satisfied: scikit-learn in /home/jupyterlab/conda/envs/python/lib/python3.6/site-packages (from sklearn) (0.2
0.1)
Requirement already satisfied: six>=1.5 in /home/jupyterlab/conda/envs/python/lib/python3.6/site-packages (from python-dateutil>=
2.6.1->pandas) (1.13.0)
Requirement already satisfied: scipy>=0.13.3 in /home/jupyterlab/conda/envs/python/lib/python3.6/site-packages (from scikit-learn
->sklearn) (1.2.1)
Building wheels for collected packages: sklearn
  Building wheel for sklearn (setup.py) ... done
  Stored in directory: /home/jupyterlab/.cache/pip/wheels/76/03/bb/589d421d27431bcd2c6da284d5f2286c8e3b2ea3cf1594c074
Successfully built sklearn
Installing collected packages: sklearn
Successfully installed sklearn-0.0
Note: you may need to restart the kernel to use updated packages.
```
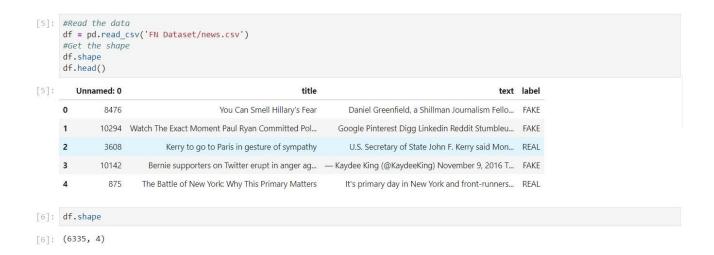
2.4. Steps for detecting fake news

The following are the steps to detect fake news and to complete this project.

1. Make necessary imports.

```
[1]: import numpy as np
     import pandas as pd
     import itertools
     from sklearn.model_selection import train_test_split
     from sklearn.feature_extraction.text import TfidfVectorizer
     from sklearn.linear_model import PassiveAggressiveClassifier
     from sklearn.metrics import accuracy_score, confusion_matrix
```

2. Now let's read the data into DataFrame and get the shape and first 5 rows of the dataframe.

```
[5]: #Read the data
     df = pd.read_csv('FN Dataset/news.csv')
     #Get the shape
     df.shape
     df.head()
```

[5]:

	Unnamed: 0	title	text	label
0	8476	You Can Smell Hillary's Fear	Daniel Greenfield, a Shillman Journalism Fello...	FAKE
1	10294	Watch The Exact Moment Paul Ryan Committed Pol...	Google Pinterest Digg Linkedin Reddit Stumbleu...	FAKE
2	3608	Kerry to go to Paris in gesture of sympathy	U.S. Secretary of State John F. Kerry said Mon...	REAL
3	10142	Bernie supporters on Twitter erupt in anger ag...	— Kaydee King (@KaydeeKing) November 9, 2016 T...	FAKE
4	875	The Battle of New York: Why This Primary Matters	It's primary day in New York and front-runners...	REAL

```
[6]: df.shape
```

```
[6]: (6335, 4)
```

3. Get the labels from the data

```
[7]: #Get the labels
     labels = df.label
     labels.head()
```

```
[7]: 0    FAKE
     1    FAKE
     2    REAL
     3    FAKE
     4    REAL
     Name: label, dtype: object
```

4. Data Sampling: Split the data into training and test datasets.

```
[8]: x = df.text
     x.head()
```

```
[8]: 0    Daniel Greenfield, a Shillman Journalism Fello...
     1    Google Pinterest Digg Linkedin Reddit Stumbleu...
     2    U.S. Secretary of State John F. Kerry said Mon...
     3    — Kaydee King (@KaydeeKing) November 9, 2016 T...
     4    It's primary day in New York and front-runners...
     Name: text, dtype: object
```

```
[9]: y = labels
     y.tail()
```

```
[9]: 6330    REAL
     6331    FAKE
     6332    FAKE
     6333    REAL
     6334    REAL
     Name: label, dtype: object
```

```
[10]: #Splitting the dataset
      x_train, x_test, y_train, y_test = train_test_split(x,y, test_size = 0.2, random_state = 42)
```

5. Initializing TfidfVectorizer: Lets initialize **TfidfVectorizer** with *stop words* from English language and maximum dcoument frequency of 0.7 (terms with higher frequency are discarded). Stop words are the most common words in a language that are to be filtered out before processing the natural language

data. Now, fit and transform the vectorizer on the train set and transform the vectorizer on the test set.

```
[13]:  #Initializing TfidfVectorizer
       tfidf_vectorizer = TfidfVectorizer(stop_words='english', max_df=0.7)
       #Fit and transform train set and transform test set
       tfidf_train = tfidf_vectorizer.fit_transform(x_train)
       tfidf_test = tfidf_vectorizer.transform(x_test)
```

6. Next, we'll initialize PassiveAggressiveClassifier and we'll fit this on tfidf_train and y_train. Then we'll predict on the test set from TfidfVectorizer and calculate the accuracy with accuracy_score() from sklearn.metrics. Finally, we'll print out the confusion matrix to gain insight into the number of false and true negatives and positives.

```
[50]:  #Initiliazing the PassiveAggressiveClassifier
       pac = PassiveAggressiveClassifier(max_iter=50)
       pac.fit(tfidf_train,y_train)
       #Predict on the test set and calculate accuracy
       y_pred = pac.predict(tfidf_test)
       score = accuracy_score(y_test,y_pred)
       print(f'Accuracy: {round(score*100,2)}%')
       #Creating confusion matrix
       confusion_matrix(y_test,y_pred, labels=['FAKE','REAL'])

       Accuracy: 94.0%
[50]:  array([[592,  36],
              [ 40, 599]])
```

2.5. Conclusion:

Thus, we've accomplished our machine learning model to classify the news as REAL or FAKE with an accuracy of 94%. We have taken a fake news dataset and implemented TfidfVectorizer, initialised PassiveAggressiveClassifier, and fit our model. We ended up obtaining an accuracy of 94% in magnitude.

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