INTRODUCTION

The detection of false or misleading information in news reports and other online sources is part of the Fake News Detection process. In order to find patterns and anomalies in the text that identify indicators of fraudulent news, different methods must be applied such as language processing, machine learning or data analysis.

By providing accurate and reliable information to people, the objective of combating fake news is to help them differentiate between real and false reports. This can be achieved by means of fact checker websites, media literacy education and more initiatives to promote fundamental thinking and responsible use of information through the Internet.

There was a time when we have to wait for the next day to know the information about the news via newspaper. Now as we are in 21st century so we get any type of news instantly in a minute through online platform. Today social networking system, online news portals, and alternative social media platform became the main source of reports for sharing the news at fast pace. Since most of our time surrounded around social media platforms and we get most our news on a online mode, we can’t able to differentiate between the fake news and real news.

Training algorithms, to identify patterns and characteristics in news articles that indicate a false story, are part of fake news detection through the use of machine learning techniques. Training the machine learning model in large datasets of news articles which have been marked as real or fake is done using labelled examples to learn how to classify a new article as either true or false.

In this project, we have built a model to detect fake news. Our model is trained on a large dataset of both real and fake news articles, with the goal of learning to distinguish between the two. We have used variety of natural language processing techniques to extract useful data from the text of the news articles.

The main goal of this project is to develop a model that can assist the large population of social media users, fact-checkers, and other professionals in identifying fake news articles. By building a reliable machine learning model, we can help to combat the spread of misinformation and ensure that accurate information reaches the public.

Detecting false news is a significant tool to combat misinformation, which plays an essential role in promoting the soundness and transparency of dialogue within society.

Application

In a wide range of industries and areas, fake news detection has many potential applications.

Top Applications of Fake News Detection:

News Media:

In order to filter out false or misleading information in their reporting, news organisations can help to improve the accuracy and reliability of their content by detecting fake news.

Social Media:

With the help of detection of false news, social media platforms are able to identify and delete posts or articles that contain inaccurate information in order to avoid spread of false news.

Politics:

With misleading information being used in the electoral process and influencing public opinion, misinformation has become an important issue in politics. In order to ensure the integrity of a democratic process, false news detection may assist policy campaigns and organizations in identifying and responding to such misleading information.

Business:

With false information influencing the behaviour of consumers and stock prices, fake news can have a significant impact on businesses. Businesses can be helped by the detection of false news that may affect their activities or reputations, helping to track and react to it.

Academia:

For the analysis and understanding of trends and characteristics of false news, which can be useful for informing policy discussions and initiatives on media literacy, detection of misleading information may be applied in academic research.

MOTIVATION

Motivation is one of the crucial driving forces for any well-accomplished goal. The main inspiration behind the making of this project work is to contribute to our college. The reason why everyone prefers smartphones for news reading on different social platforms like Facebook, blogs, and Twitter is that everyone has a smartphone with them. These platforms can share all the news information instantly and distribute the information all over the world within a few seconds. Individuals get misdirected due to the large number of rumors evaporating a large number of negative thoughts among the people, So we are required to deal with all these activities. A fake news detector can be a great idea to deal with the problem of fake news on various online news platforms to provide both good quantity and quality information.

PROBLEM

Before the development of fake news detection techniques, there were several challenges in identifying and filtering out fake news from online sources. Some of the main problems included:

Volume of Information:

With an increasing amount of information available online, it is difficult to manually identify and filter out fake news resulting from the vast amounts of content that are produced every day due to the rise of internet and social media.

Speed of dissemination:

Fake news can circulate quickly and often without a proper verification or denial of truth, in social media and other online platforms. Consequently, the dissemination of false information can be difficult to avoid once it has been made available in broad circulation.

Difficulty of detection:

It can be hard to trace the counterfeit news, since it often behaves in a similar style and format as legitimate print media. Moreover, the spread of false information can happen from a wide variety of sources, e.g. websites, Social Networks accounts and email chains, which make it difficult to identify its original source.

So there is a need for a technique or assistance that guides primarily a newcomer to surf our machine learning algorithms.

PROPOSED WORK:

For the problems mentioned above, Fake News Detection is the most prominent solution that can solve our problems in several ways.

Data collection: A vast database of newspaper articles, both true and false, will be collected in the first step. For the purposes of detecting false news, such data is used for machine learning model training and testing.

Extraction of relevant features from the text of the news article: The next step is to extract relevant features from the text of the news article. In this case, the analysis of articles' contents is generally carried out using natural language processing methods like sentiment analysis, name entity recognition and text classification.

Model training: Machine learning models are trained on a labeled dataset of news articles once features have been extracted. For this task a number of algorithms such as decision trees, vector machines and deep neural networks may be used.

Assessment of models: In order to evaluate their accuracy and effectiveness at detecting false news, they are assessed on a specific dataset of News articles after training has been completed.

Model deployment: In order to enable automatic detection and filtering of fake news, the training model should be deployed in real world situations such as media organisations or platforms where it could be exploited for this purpose.

Natural Language Processing (NLP) is a prerequisite for our project Fake News Detection. It allows computers and algorithms to understand human interactions via various languages. To process a large amount of natural language data and text, an AI will need NLP or Natural Language Processing. We have several NLP research ongoingto improve and help them understand the complicated nuances and undertones of human conversations**.**

Following are the fields:

Natural language generation (NLG): NLG is a part of natural language processing. It is a technology that automatically transforms data into English.

Natural language understanding (NLU): This branch of natural language processing (NLP) helps end systems understand and analyze human language by fragmenting speech into its constituent elements. However, it goes beyond speech recognition to understand what the user tries to communicate with their address.

Natural language interaction (NLI): It is also known as recognizing textual entailment (RTE). NLI brings together various natural language principles to immerse with any connected device or service in a human-like manner.

RELATED WORK

1. D. M. J. Lazer, M. A. Baum, Y. Benkler et al., "The science of fake news," *Science*, vol. 359, no. 6380, pp. 1094–1096, 2018.
   View at: Publisher Site | Google Scholar

2. A. Douglas, "News consumption and the new electronic media," *The International Journal of Press/Politics*, vol. 11, no. 1, pp. 29–52, 2006.
   View at: Publisher Site | Google Scholar

3. A review paper on fake news detection uisng Machine Learning
   View at:https://www.researchgate.net/publication/351775335_A_Review_of_Fake_News_Detection_Methods_using_Machine_Learning

This paper reviewed the previous works on fake news detection methods using machine learning. This article does not only provide the literature review on the earlier work or related work, but it also provides the deep analysis of various algorithmis of data miningrelated to machine learning, discussion, and suggestions for future work.

METHODOLOGY:

1. **Dataset collection**
2. **Preprocessing**
3. **Feature extraction**
4. **Classification models**
5. **Model training**
6. **Model evaluation**
7. **Model deployment**

Importing libraries and modules:

- **NLTK**

  NLTK (Natural Language Toolkit) is a library of Python that provides tools and resources for working with human language data. It is one of the Python ecosystem's most used natural language processing (NLP) libraries. Researchers and developers have developed it from universities,research institutes, and industry.
  It provides various functionalities for NLP tasks, such as tokenization, stemming, lemmatization, part-of-speech tagging, named entity recognition, chunking, parsing, and sentiment analysis. It also includes corpora, linguistic resources, and other datasets which can be used for language modeling and analysis.

- **Sklearn**

  Scikit-learn (sklearn) is a popular open-source machine-learning library for Python. It provides various tools for machine learning tasks, includingclassification, regression, clustering, and dimensionality reduction.
  Scikit-learn provides various machine learning algorithms, including logistic regression, linear regression, decision trees, random forests, k-nearest neighbors, support vector machines, and many others.

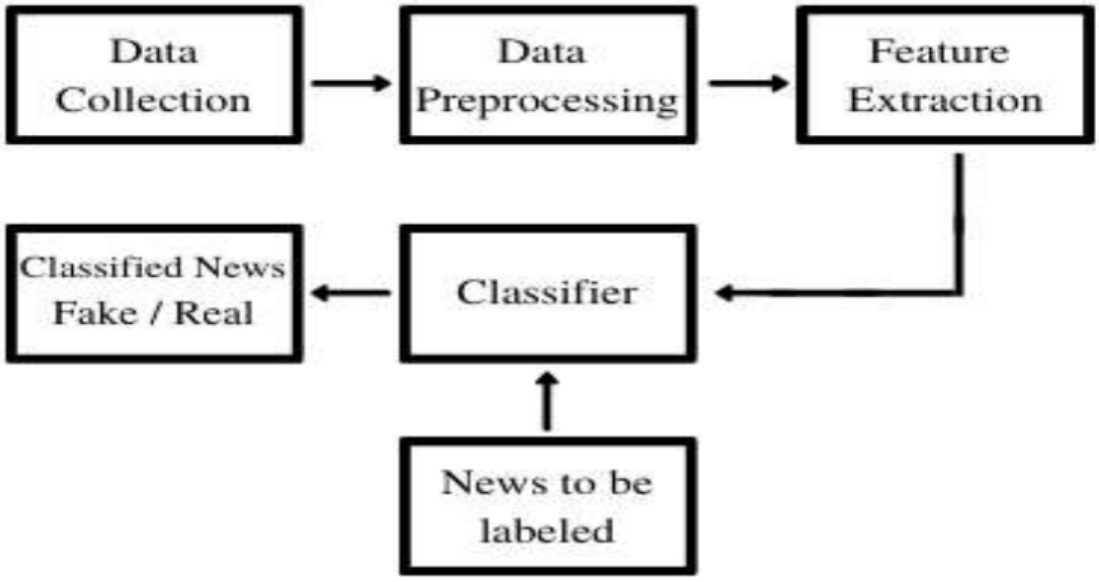
It also includes tools for model selection, data preprocessing, feature extraction,and feature selection.

- **Numpy**

NumPy (Numerical Python) is a library in Python that supports multi-dimensional arrays and matrices and various mathematical functions to operate on these arrays. NumPy is the foundation of many Python scientific computing and data analysis workflows and is used widely in academia and industry.
NumPy also provides tools for integrating with other Python libraries, such as SciPy, Pandas, and Matplotlib, making it a versatile library for scientific computing and data analysis tasks.

FLOW CHART DIAGRAM

The different steps involved in building the proposed system is as follows:



Flow chart of Detection Model

1. Data Collection:

Data are being collected from the Kaggle database, consisting of a set of labelled data. There's two datasets, one of which is about fake news and the other on real news. Approximately 21000 real news and 23000 fake news are included in the dataset. For each article, the headline, text and target is included in the dataset. Both datasets are accompanied by a label attribute. Only the headline and label attribute shall be retained by combining these two datasets.

2. Data Preprocessing:

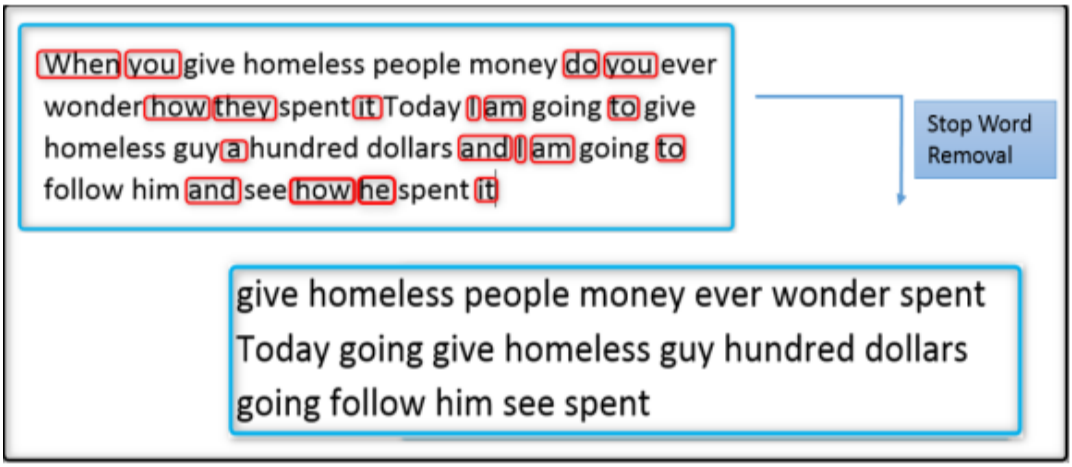
The raw style of statements, digits and qualitative terms shall continue to apply to the primary data collected from the net sources. Errors, omissions and inconsistencies are present in the data. After careful examination of the final questionnaire, it needs corrections. A subsequent step area unit is concerned in the process of basic knowledge. For similar detail on individual responses, it is necessary to sort out an enormous amount of data collected through field surveys.

Data Pre processing could be a technique that's accustomed convert the raw knowledge into a clean data set. In other words, when information is collected from a variety of sources, it is collected in a raw form, which is impossible to analyse. Therefore, in order to convert the knowledge into very small clean data sets, a sure step area unit is dead. This system shall be implemented prior to the execution of unvarying analyses. As data are processed before, the set of steps is regarded as preprocessing.

- Data Improvement
- Data Integration
- Data Transformation
- Data Reduction
-

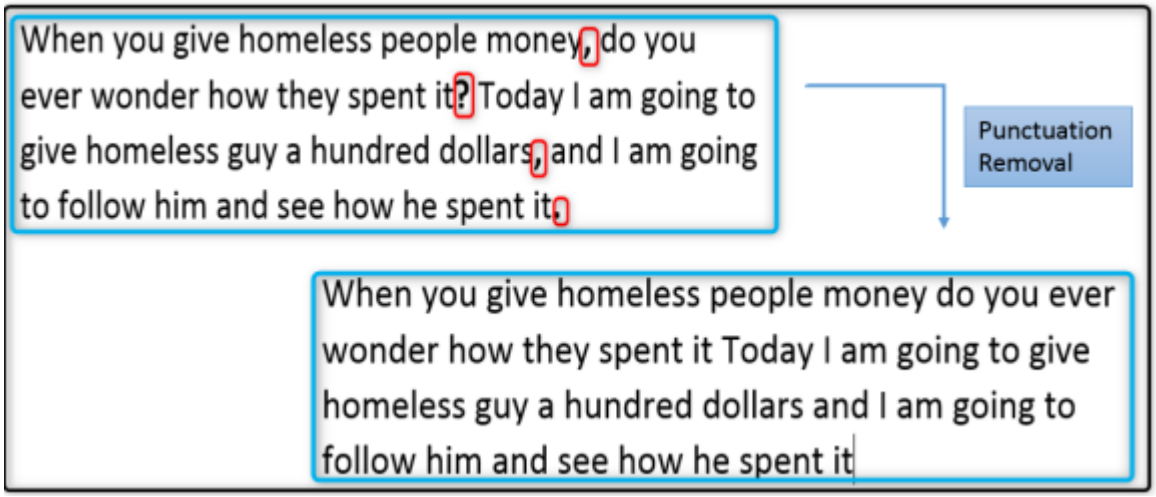
- ## Stop Word Removal:

We start with removing stop words from the text data available. Stops Words (most common words in a language which do not provide much context) can be processed and filtered from the text as they are more common and hold less useful information. Stop words acts more like a connecting part of the sentences, for example, conjunctions like “and”, “or” and “but”, prepositions like “of”, “in”, “from”, “to”, etc. and the articles “a”, “an”, and “the”. Such stop words which are of less importance may take up valuable processing time, and hence removing stop words as a part of data preprocessing is a key first step in natural language processing. We used Natural Language Toolkit – (NLTK) library to remove stop word. Figure 2 illustrates an example of stop word removal.



- **Punctuation Removal**

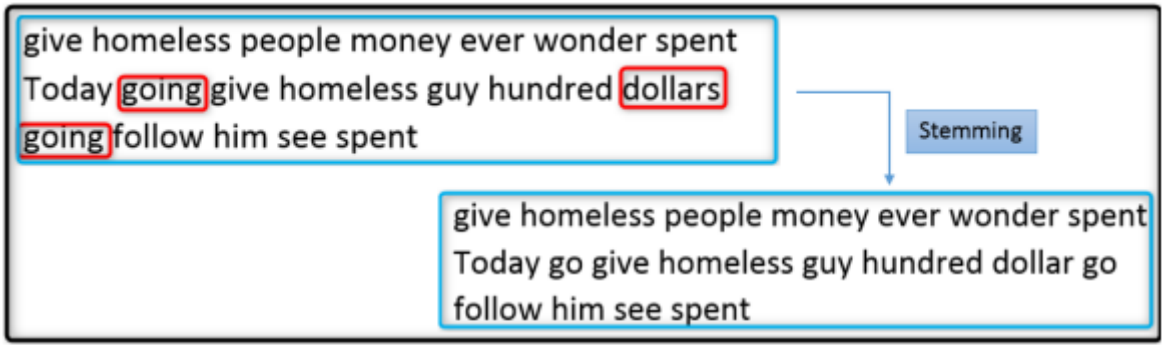
Punctuations in the natural language provide a sentence's linguistic context. When it comes to understanding the meaning of a sentence, expressions such as commas don't add much value. An example of the Punctuation Removal Process is shown in Figure .

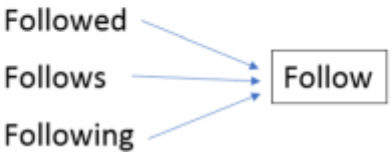


- **Stemming:**

Stemming is a technique to remove prefixes and suffixes from a word, ending up with the stem. It is possible to reduce inflectional forms and

sometimes derivational forms of a word to a common base form by means of stemming. An example of a stem technique is shown in Figure .





3. Feature Extraction:

- **Word Vector Representation:**

  It's pretty hard to get the text in the headline and body of a news article ready for modeling. Converting raw data to numerical representations is necessary in order to do text analysis. In our project we used TF-IDF technique to transform the raw text and feature extraction.

- **TF-IDF:**

  We've used a technique called Term Frequency Inverse Document Frequency" (TF-IDF) for feature extraction. Term Frequency and Inverse Document Frequency are two components of TF-IDF. When a word occurs in a document, the term frequency provides an indication of its local importance. Inverse Document Frequency identifies the Signatory words, which do not appear more frequently on the documents Words that have a high TFIDF are the signature words important for this document Consider that it has a great deal of frequency in the document but is not an often used word across other texts.

4. Classification Models:

- ## Logistic Regression:

  Logistic regression is a widely used machine learning algorithm extensively used for predicting the probably of a variable. It is a supervised learning classification algorithm. Here the target variable can have two classes, i.e. it is binary in nature. It can be used for multiple classification problems like fake news detection, email spam detection, heart disease etc.

$$p(x) = \frac{1}{1 + e^{-(\beta_0 + \beta_1 x)}}$$

- ## Decision Tree Classification:

  The Decision Tree Classifier is one of the more commonly used classification algorithms. Decision tree classifier is a supervised learning algorithm and also a very powerful classifier. Like support vector machines, a decision tree classifier can be used for both classification and regression. There is a graphic representation of every possible solution to this decision.

  It is easy to understand as it uses tree analysis to classify the data. The data is broken into smaller parts and the decision tree is built. Decision trees support both categorical data and numeric data.

- ## Random Forest Classification:

  The group of decision tree from a subset of randomly chosen training data set is called randomized forest classification. It To find the last test object, a combination of weight from each decision tree is used. In order to determine random forest species, an ensemble learning method is used. It's a kind of learning where you're joining different classes. types of algorithms multiple times to form a more powerful algorithm which can give higher accuracy.

Sampling techniques:

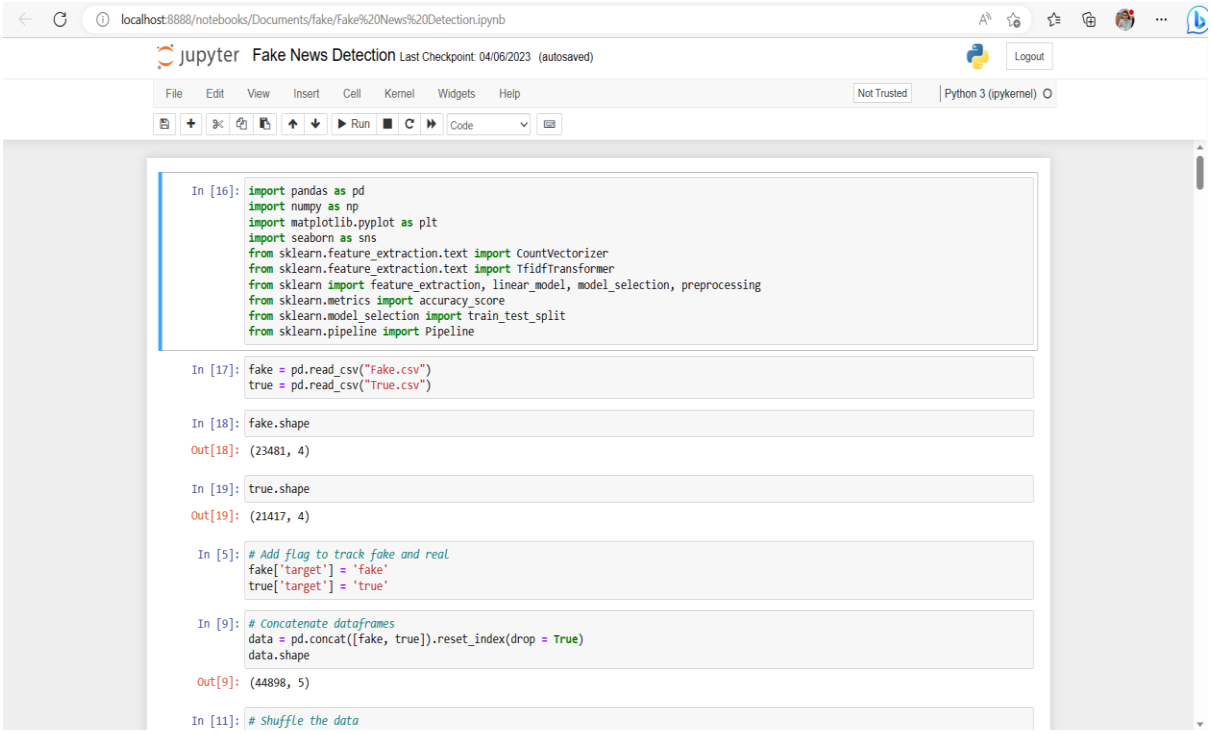
Machine learning models require two sets of data to work. The data obtained is further divided into two parts for training and testing purpose. 80% of data obtained is used to train the models and the remining 20% data is used to test the accuracy of the models selected.

FEATURES

The features used in fake news detection can vary depending on the specific approach and algorithm used, but some common features include:

- Text based features: This feature consists of word frequency, sentence structure, grammar and emotions analysis. In comparison to actual reports, fake news articles may contain linguistic patterns and styles of writing which they can use to determine that it is a bogus report.
- Source based features: These elements deal with the assessment of a news source's credibility and reputation. For instance, there might be a greater likelihood of the present article being counterfeit if the source has been known to publish unsubstantiated or incorrect information in the past.
- Social context based features: it includes analysing the social context in which posts are shared, e.g. on a social media platform, user who shares them and engagement metrics. For instance, there may be a higher likelihood of fake news when it is widely shared on social media by accounts that are known to spread false information.
- Image based features: These features are used to analyse the images used in the report. For instance, it may be evidence of a fake article when the images used in an article are altered or removed from context.
- The combination of these features can, in general, contribute to correctly identifying and categorising fake news articles. It is important to note, however, that different characteristics or approaches are not able to detect all fake news and often a multifaceted approach combining various aspects is necessary for an effective detection of false reports.

Experimental Setup and Result Analysis



localhost:8888/notebooks/Documents/fake/Fake%20News%20Detection.ipynb

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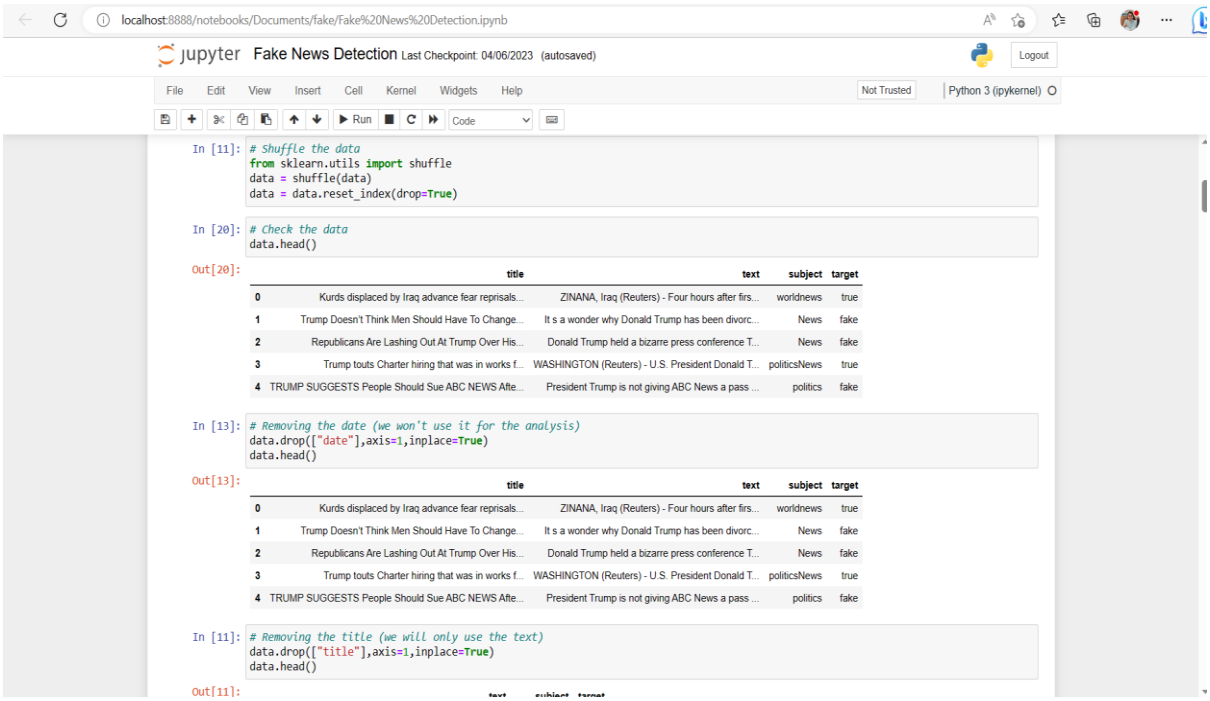
Run Code

```
In [16]: import pandas as pd
         import numpy as np
         import matplotlib.pyplot as plt
         import seaborn as sns
         from sklearn.feature_extraction.text import CountVectorizer
         from sklearn.feature_extraction.text import TfidfTransformer
         from sklearn import feature_extraction, linear_model, model_selection, preprocessing
         from sklearn.metrics import accuracy_score
         from sklearn.model_selection import train_test_split
         from sklearn.pipeline import Pipeline

In [17]: fake = pd.read_csv("Fake.csv")
         true = pd.read_csv("True.csv")

In [18]: fake.shape

Out[18]: (23481, 4)

In [19]: true.shape

Out[19]: (21417, 4)

In [5]: # Add flag to track fake and real
        fake['target'] = 'fake'
        true['target'] = 'true'

In [9]: # Concatenate dataframes
        data = pd.concat([fake, true]).reset_index(drop = True)
        data.shape

Out[9]: (44898, 5)

In [11]: # Shuffle the data
```



localhost:8888/notebooks/Documents/fake/Fake%20News%20Detection.ipynb

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Run Code

```
In [11]: # Shuffle the data
         from sklearn.utils import shuffle
         data = shuffle(data)
         data = data.reset_index(drop=True)

In [20]: # Check the data
         data.head()
```

Out[20]:

	title	text	subject	target
0	Kurds displaced by Iraq advance fear reprisals...	ZINANA, Iraq (Reuters) - Four hours after firs...	worldnews	true
1	Trump Doesn't Think Men Should Have To Change...	It s a wonder why Donald Trump has been divorc...	News	fake
2	Republicans Are Lashing Out At Trump Over His...	Donald Trump held a bizarre press conference T...	News	fake
3	Trump touts Charter hiring that was in works f...	WASHINGTON (Reuters) - U.S. President Donald T...	politicsNews	true
4	TRUMP SUGGESTS People Should Sue ABC NEWS Afte...	President Trump is not giving ABC News a pass ...	politics	fake

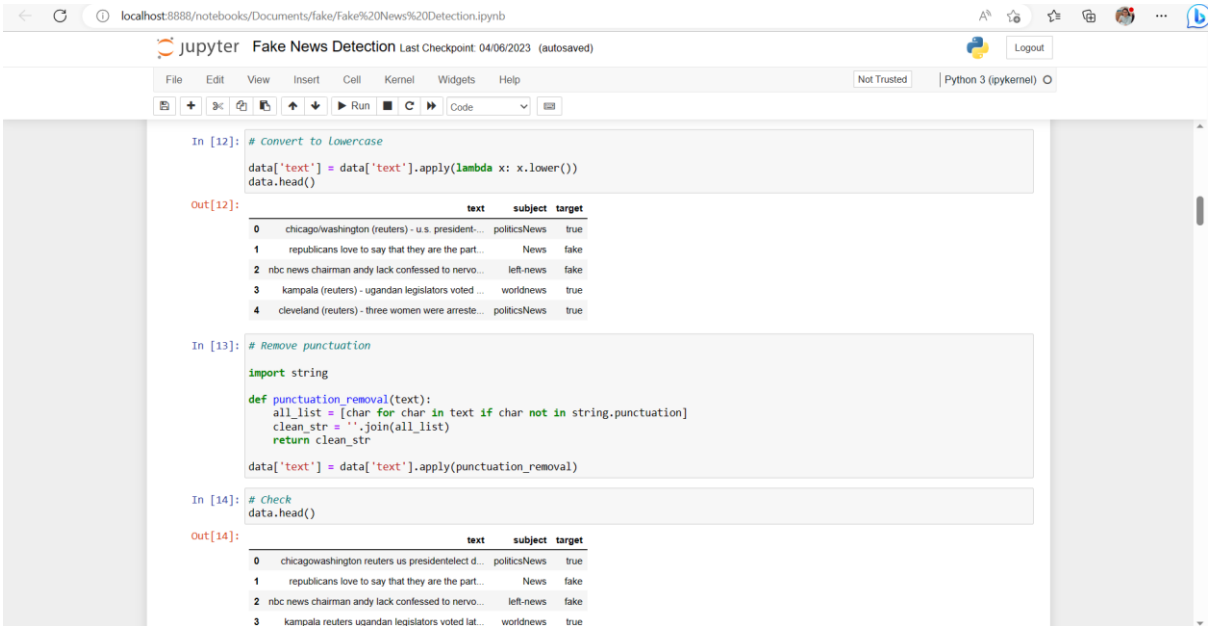
```
In [13]: # Removing the date (we won't use it for the analysis)
         data.drop(["date"],axis=1,inplace=True)
         data.head()
```

Out[13]:

	title	text	subject	target
0	Kurds displaced by Iraq advance fear reprisals...	ZINANA, Iraq (Reuters) - Four hours after firs...	worldnews	true
1	Trump Doesn't Think Men Should Have To Change...	It s a wonder why Donald Trump has been divorc...	News	fake
2	Republicans Are Lashing Out At Trump Over His...	Donald Trump held a bizarre press conference T...	News	fake
3	Trump touts Charter hiring that was in works f...	WASHINGTON (Reuters) - U.S. President Donald T...	politicsNews	true
4	TRUMP SUGGESTS People Should Sue ABC NEWS Afte...	President Trump is not giving ABC News a pass ...	politics	fake

```
In [11]: # Removing the title (we will only use the text)
         data.drop(["title"],axis=1,inplace=True)
         data.head()

Out[11]:
```


localhost:8888/notebooks/Documents/fake/Fake%20News%20Detection.ipynb
jupyter Fake News Detection Last Checkpoint: 04/06/2023 (autosaved)
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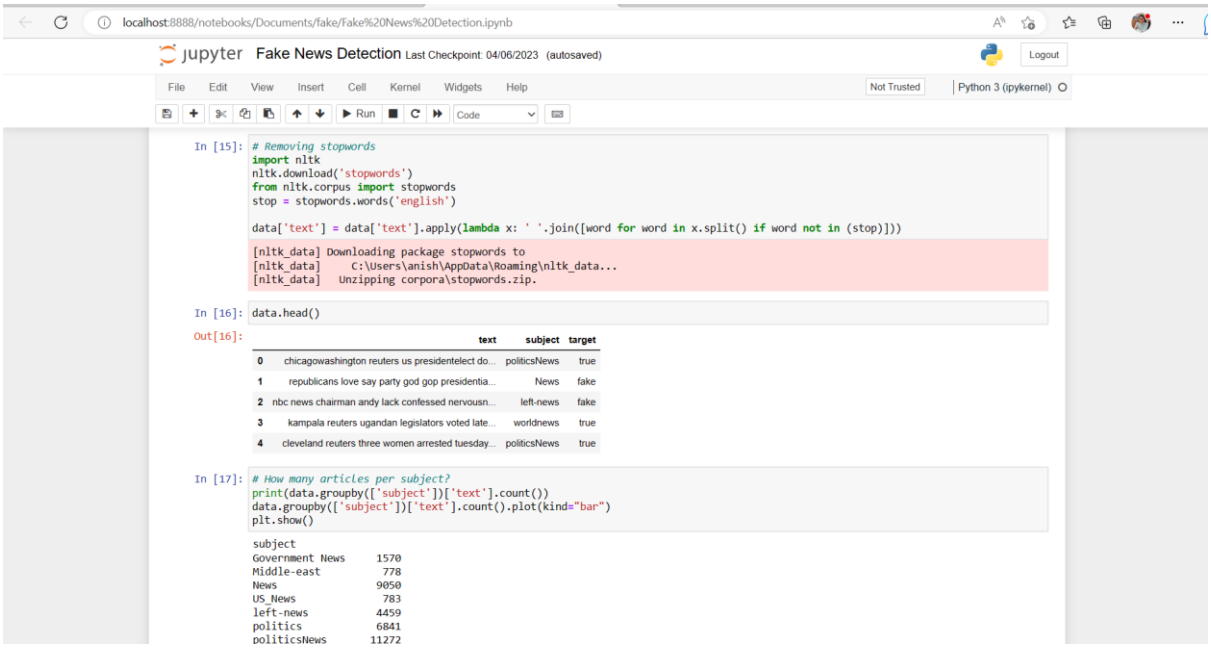
File Edit View Insert Cell Kernel Widgets Help
Not Trusted
Python 3 (ipykernel)
Run
Code
In [12]:
Convert to lowercase
data['text'] = data['text'].apply(lambda x: x.lower())
data.head()
Out[12]:
text subject target
0 chicago/washington (reuters) - u.s. president-... politicsNews true
1 republicans love to say that they are the part... News fake
2 nbc news chairman andy lack confessed to nervo... left-news fake
3 kampala (reuters) - ugandan legislators voted ... worldnews true
4 cleveland (reuters) - three women were arreste... politicsNews true
In [13]:
# Remove punctuation
import string
def punctuation_removal(text):
all_list = [char for char in text if char not in string.punctuation]
clean_str = ''.join(all_list)
return clean_str
data['text'] = data['text'].apply(punctuation_removal)
In [14]:
# Check
data.head()
Out[14]:
text subject target
0 chicagowashington reuters us presidentelect d... politicsNews true
1 republicans love to say that they are the part... News fake
2 nbc news chairman andy lack confessed to nervo... left-news fake
3 kampala reuters ugandan legislators voted lat... worldnews true


localhost:8888/notebooks/Documents/fake/Fake%20News%20Detection.ipynb
jupyter Fake News Detection Last Checkpoint: 04/06/2023 (autosaved)
Logout
File Edit View Insert Cell Kernel Widgets Help
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Python 3 (ipykernel)
Run
Code
In [15]:
# Removing stopwords
import nltk
nltk.download('stopwords')
from nltk.corpus import stopwords
stop = stopwords.words('english')
data['text'] = data['text'].apply(lambda x: ' '.join([word for word in x.split() if word not in (stop)]))
[nltk_data] Downloading package stopwords to
[nltk_data] C:\Users\anish\AppData\Roaming\nltk_data...
[nltk_data] Unzipping corpora\stopwords.zip.
In [16]:
data.head()
Out[16]:
text subject target
0 chicagowashington reuters us presidentelect do... politicsNews true
1 republicans love say party god gop presidentia... News fake
2 nbc news chairman andy lack confessed nervousn... left-news fake
3 kampala reuters ugandan legislators voted late... worldnews true
4 cleveland reuters three women arrested tuesday... politicsNews true
In [17]:
# How many articles per subject?
print(data.groupby(['subject'])['text'].count())
data.groupby(['subject'])['text'].count().plot(kind="bar")
plt.show()
subject
Government News 1570
Middle-east 778
News 9050
US_News 783
left-news 4459
politics 6841
politicsNews 11272

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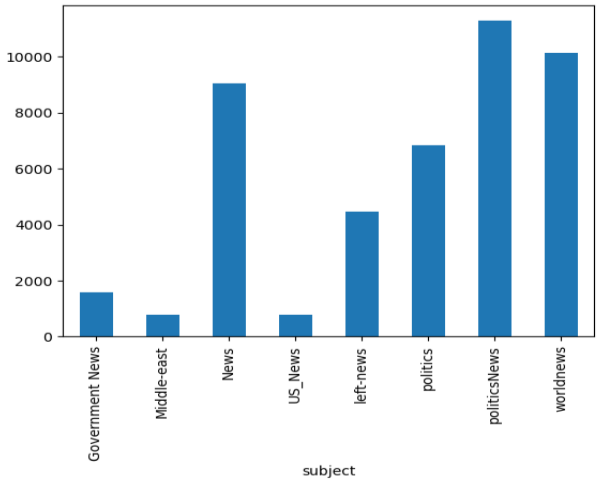
Run Code

In [17]:
```
# How many articles per subject?
print(data.groupby(['subject'])['text'].count())
data.groupby(['subject'])['text'].count().plot(kind="bar")
plt.show()
```

```
subject
Government News     1570
Middle-east          778
News                9050
US_News              783
left-news           4459
politics            6841
politicsNews       11272
worldnews          10145
Name: text, dtype: int64
```



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Run Code

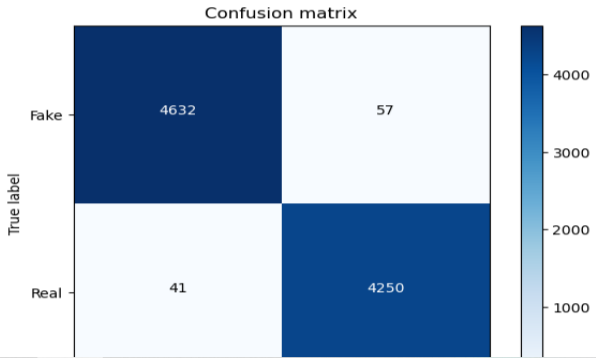
In [25]:
```
# Split the data
X_train,X_test,y_train,y_test = train_test_split(data['text'], data.target, test_size=0.2, random_state=42)
```

In [26]:
```
# Vectorizing and applying TF-IDF
from sklearn.linear_model import LogisticRegression

pipe = Pipeline([('vect', CountVectorizer()),
                 ('tfidf', TfidfTransformer()),
                 ('model', LogisticRegression())])

# Fitting the model
model = pipe.fit(X_train, y_train)

# Accuracy
prediction = model.predict(X_test)
print("accuracy: {}%".format(round(accuracy_score(y_test, prediction)*100,2)))
```

```
accuracy: 98.91%
```

In [27]:
```
cm = metrics.confusion_matrix(y_test, prediction)
plot_confusion_matrix(cm, classes=['Fake', 'Real'])
```

```
Confusion matrix, without normalization
```

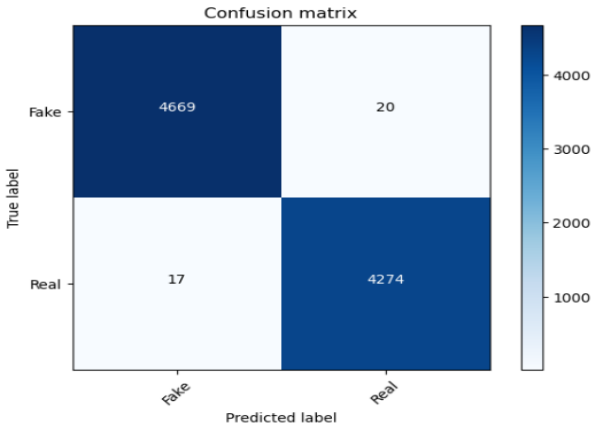


In [28]:
```
from sklearn.tree import DecisionTreeClassifier

# Vectorizing and applying TF-IDF
pipe = Pipeline([('vect', CountVectorizer()),
                 ('tfidf', TfidfTransformer()),
                 ('model', DecisionTreeClassifier(criterion= 'entropy',
                                                  max_depth = 20,
                                                  splitter='best',
                                                  random_state=42))])
# Fitting the model
model = pipe.fit(X_train, y_train)

# Accuracy
prediction = model.predict(X_test)
print("accuracy: {}%".format(round(accuracy_score(y_test, prediction)*100,2)))
```

```
accuracy: 99.59%
```

In [29]:
```
cm = metrics.confusion_matrix(y_test, prediction)
plot_confusion_matrix(cm, classes=['Fake', 'Real'])
```

```
Confusion matrix, without normalization
```



jupyter Fake News Detection Last Checkpoint: 04/06/2023 (autosaved)

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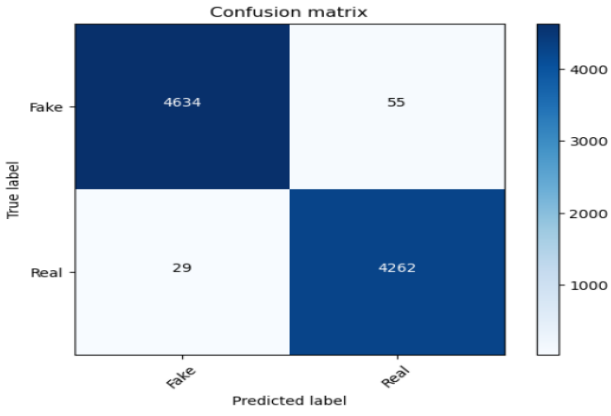
Run Code

In [30]:
```
from sklearn.ensemble import RandomForestClassifier

pipe = Pipeline([('vect', CountVectorizer()),
                 ('tfidf', TfidfTransformer()),
                 ('model', RandomForestClassifier(n_estimators=50, criterion="entropy"))])

model = pipe.fit(X_train, y_train)
prediction = model.predict(X_test)
print("accuracy: {}%".format(round(accuracy_score(y_test, prediction)*100,2)))
```

```
accuracy: 99.06%
```

In [31]:
```
cm = metrics.confusion_matrix(y_test, prediction)
plot_confusion_matrix(cm, classes=['Fake', 'Real'])
```

```
Confusion matrix, without normalization
```



In [ ]:

FUTURE WORK

Future work in fake news detection will likely involve a combination of machine learning techniques, natural language processing, and data analysis, as well as interdisciplinary collaborations with experts in areas such as psychology, sociology, and communication.

There are several areas of future work in the field of fake news detection. Some of the most promising directions for future research include:

Improving model accuracy: In order to find false information with a high level of accuracy, one of the key challenges in detecting disinformation is to improve model accuracy. The development of new more advanced machine learning models capable of detecting subtle patterns and ambiguities in the language and structure of news articles could be a priority for future work on this subject.

Realtime detection: In order to prevent the spread of false information, the rapid dissemination of fake news on social media and other online platforms means that timely detection is essential. In the years to come, work could concentrate on developing technologies which will allow for rapid identification and detection of false news transmitted over the Internet.

Evaluation of the effectiveness of detecting fake news:
While there has been a growing amount of research in this field, it is not yet clear how effective these techniques are to reduce dissemination of false information. The evaluation of the realworld impacts of detection systems for false news could be addressed in future work, and most effective strategies to fight fake news online could be identified.

CONCLUSION

To identify anomalies in the news, it is necessary to have a thorough understanding of the domain and expertise required when classifying news manually. We discussed the issue of classification of fake news report based on machine learning models and ensembles during this project. The data we used in our work is collected from the Kaggle and contains news articles from various domains to cover most of the news rather than specifically classifying political news.

With the help of artificial Intelligence, compared to the spread of such disinformation, we will be able to control and reduce it more quickly and effectivelymanual efforts. Identifying the patterns of text which distinguish between false articles and real news is a key objective of this project. There are many open issues in the area of fake news detection that require researchers' attention. For instance, it is a critical step to identify key elements that contribute to the spread of false news so as to reduce its circulation.

Another possible future trend could be real time identification of fake news in videos. Effective fake news video detection using domain knowledge, multimodal data fusion, and machine learning can be a great future project.

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