FAKE NEWS DETECTION-Phase 5 Development

Introduction:

Fake news detection involves the use of various techniques and technologies, including natural language processing, machine learning, and data analysis, to distinguish between accurate, reliable information and false or misleading content. Researchers and data scientists develop algorithms and models to analyze the textual and visual content of news articles, social media posts, and other online sources to assess their credibility and truthfulness.

Problem Statement:

- Clearly defines the problem you are addressing,eg..,detecting fake news based on many factors.
- Load your preprocessed dataset.
- Define the features and target variable.
- Split the dataset into training and testing sets.
- Create a NLP model and train it on training data
- Make predictions on the test data and calculate the mean squared error as a measure of model performance .

Design Thinking Process:

1. **Empathize:**
   - Understand the needs and challenges of various stakeholders, including individuals seeking reliable information, fact-checkers, news organizations, and policymakers.
   - Conduct user research to gain insights into how people interact with news and misinformation online and how it affects them emotionally and cognitively.
2. **Define:**

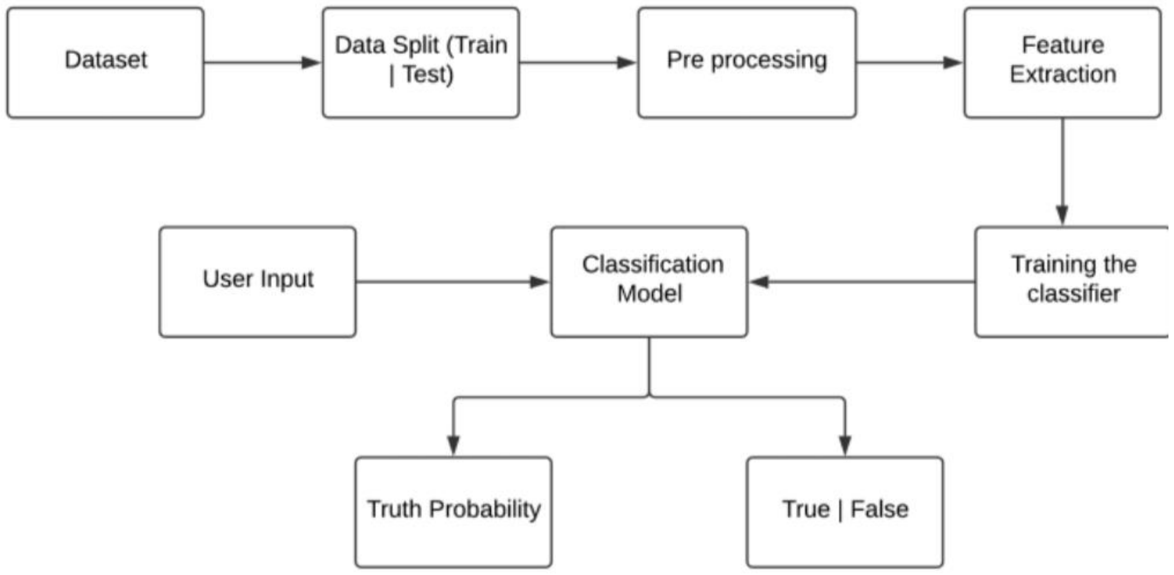
   During this phase,we define the problem statement:

   Problem Statement : ” To develop a fake news detection model using a Kaggle dataset. The goal is to distinguish between genuine and fake news articles based on their titles and text. “
3. **Ideate:**
   - Brainstorm potential solutions to the defined problem. Encourage a diverse group of experts, including data scientists, linguists, and psychologists, to contribute their ideas.
   - Consider a range of technological and non-technological solutions, such as algorithms, user interfaces, and educational campaigns.
4. **Prototype:**

- Create a simplified version of the fake news detection model to test and refine the concept. This may include developing a basic algorithm or a user interface for fact-checking.
- Use a subset of data to validate the prototype's effectiveness and usability.

5. **Test:**

- Gather feedback by testing the prototype with real users and stakeholders. Understand how well it meets their needs and whether it effectively identifies fake news.
- Iterate on the prototype based on user feedback and further refine the model's design.



<u>Why it's Important:</u>

Fake news detection models are critically important for several reasons:

1. Preserving Information Integrity: Fake news detection models help preserve the integrity of information ecosystems. In a world where misinformation can spread rapidly, these models act as a safeguard against the dissemination of false or misleading information, ensuring that accurate and reliable news is more accessible to the public.
2. Protecting Democracy: Misinformation, especially during elections and political events, can manipulate public opinion and influence democratic processes. Fake news detection models help protect the integrity of democratic systems by identifying and countering attempts to spread false information for political gain.
3. Fostering Informed Decision-Making: Accurate information is crucial for making informed decisions, whether in politics, health, finance, or other aspects of life. Fake news detection models empower individuals to make decisions based on credible sources and facts, rather than fallacies and fabrications.

4. Mitigating Social and Cultural Conflicts: False information can exacerbate social and cultural conflicts. By identifying and preventing the spread of fake news, these models contribute to reducing tensions and promoting a more harmonious society.

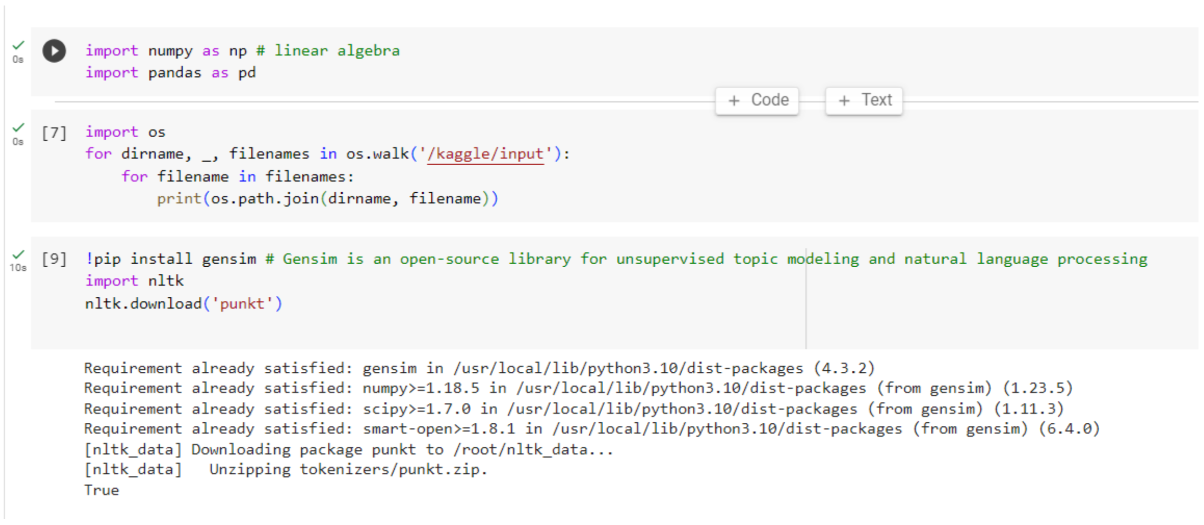
5. Maintaining Trust in Media: Trust in the media is essential for a well-informed society. Fake news detection models help news organizations and media outlets maintain their credibility by weeding out false stories and emphasizing accurate reporting.

Phases of Development:

1. **Data Source:**

   Choose the fake news dataset available on Kaggle, containing articles titles and text, along with their labels (genuine or fake).This dataset should represent various topics and sources to ensure the model's generalizability

Import the data:

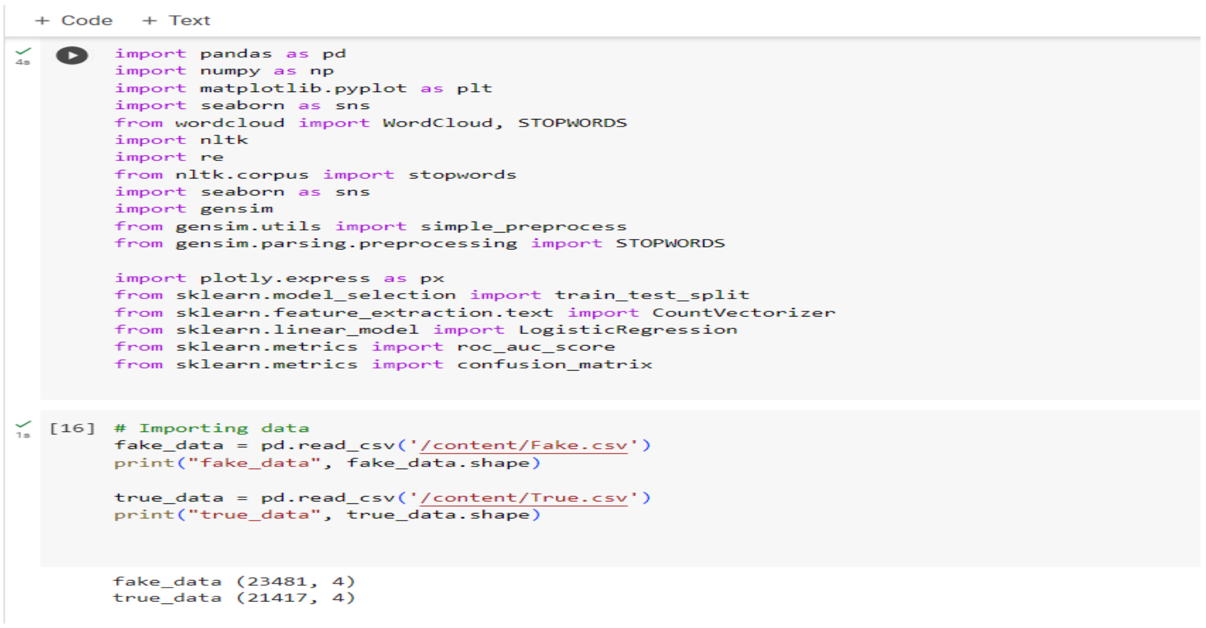


```
import numpy as np # linear algebra
import pandas as pd
```

```
[7] import os
    for dirname, _, filenames in os.walk('/kaggle/input'):
        for filename in filenames:
            print(os.path.join(dirname, filename))
```

```
[9] !pip install gensim # Gensim is an open-source library for unsupervised topic modeling and natural language processing
    import nltk
    nltk.download('punkt')
```

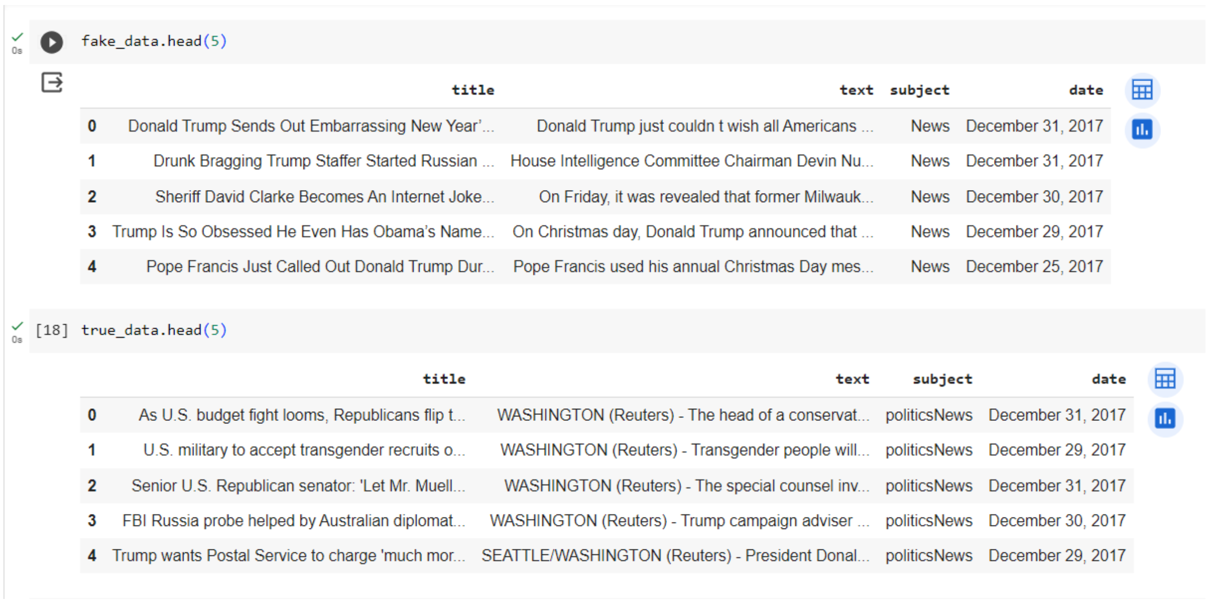
```
Requirement already satisfied: gensim in /usr/local/lib/python3.10/dist-packages (4.3.2)
Requirement already satisfied: numpy>=1.18.5 in /usr/local/lib/python3.10/dist-packages (from gensim) (1.23.5)
Requirement already satisfied: scipy>=1.7.0 in /usr/local/lib/python3.10/dist-packages (from gensim) (1.11.3)
Requirement already satisfied: smart-open>=1.8.1 in /usr/local/lib/python3.10/dist-packages (from gensim) (6.4.0)
[nltk_data] Downloading package punkt to /root/nltk_data...
[nltk_data]   Unzipping tokenizers/punkt.zip.
True
```



```
import pandas as pd
import numpy as np
import matplotlib.pyplot as plt
import seaborn as sns
from wordcloud import WordCloud, STOPWORDS
import nltk
import re
from nltk.corpus import stopwords
import seaborn as sns
import gensim
from gensim.utils import simple_preprocess
from gensim.parsing.preprocessing import STOPWORDS

import plotly.express as px
from sklearn.model_selection import train_test_split
from sklearn.feature_extraction.text import CountVectorizer
from sklearn.linear_model import LogisticRegression
from sklearn.metrics import roc_auc_score
from sklearn.metrics import confusion_matrix
```

```
[16] # Importing data
     fake_data = pd.read_csv('/content/Fake.csv')
     print("fake_data", fake_data.shape)

     true_data = pd.read_csv('/content/True.csv')
     print("true_data", true_data.shape)
```

```
fake_data (23481, 4)
true_data (21417, 4)
```

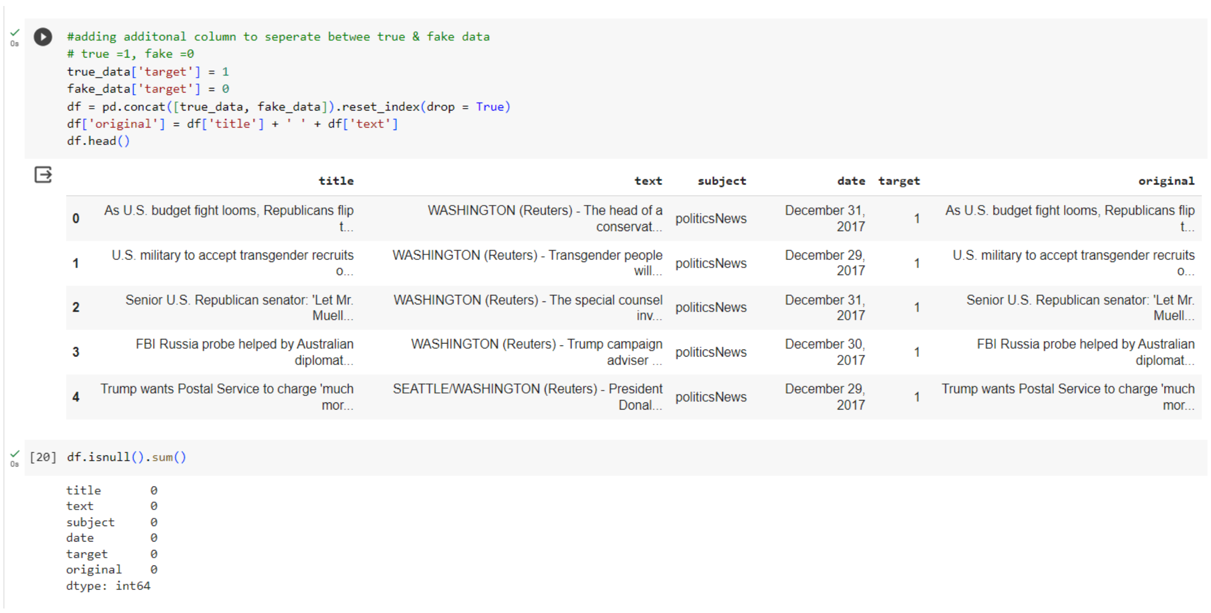


```python
fake_data.head(5)
```

	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

```python
[18] true_data.head(5)
```

	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 will...	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



```python
#adding additonal column to seperate betwee true & fake data
# true =1, fake =0
true_data['target'] = 1
fake_data['target'] = 0
df = pd.concat([true_data, fake_data]).reset_index(drop = True)
df['original'] = df['title'] + ' ' + df['text']
df.head()
```

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

```python
[20] df.isnull().sum()
```

```
title       0
text        0
subject     0
date        0
target      0
original    0
dtype: int64
```

2. Data Preprocessing:

Clean and preprocess the textual data to prepare it for analysis. This may involve tasks such as tokenization, lowercasing, removing stop words, and stemming/lemmatization.

Data Cleanup:

```python
import nltk
nltk.download('stopwords')
```

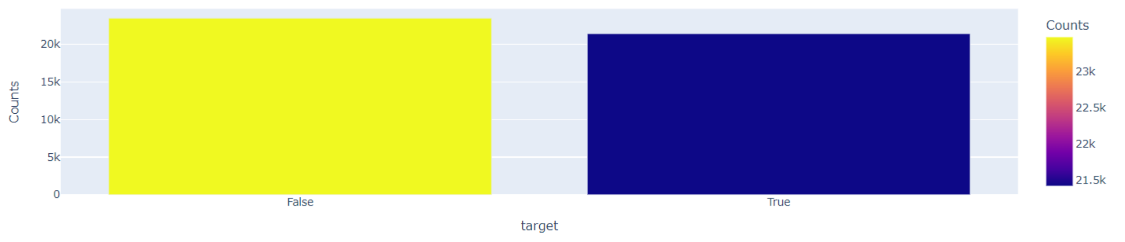
```
[nltk_data] Downloading package stopwords to /root/nltk_data...
[nltk_data]   Unzipping corpora/stopwords.zip.
True
```

```python
[23] import nltk
nltk.download('stopwords')

from nltk.corpus import stopwords
import gensim
from gensim.utils import simple_preprocess

stop_words = stopwords.words('english')
stop_words.extend(['from', 'subject', 're', 'edu', 'use'])

def preprocess(text):
    result = []
    for token in gensim.utils.simple_preprocess(text):
        if token not in gensim.parsing.preprocessing.STOPWORDS and len(token) > 2 and token not in stop_words:
            result.append(token)

    return result
```

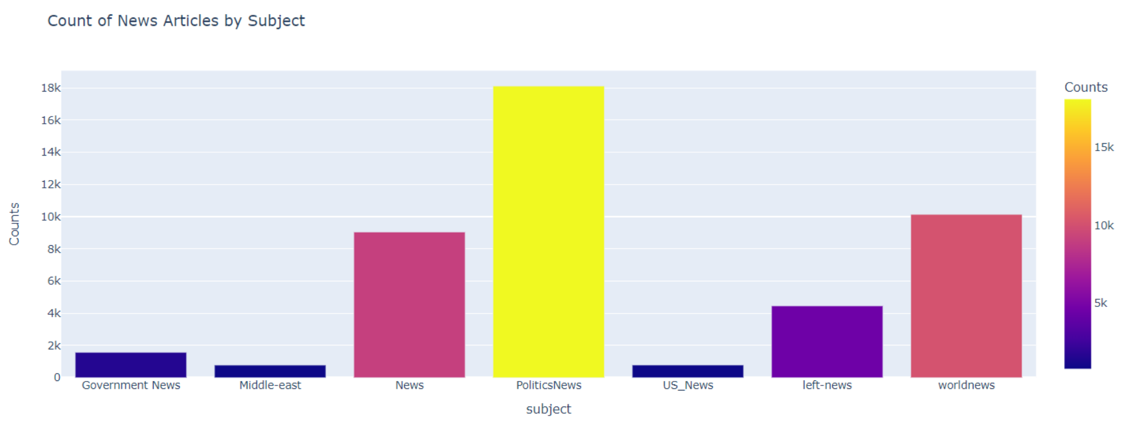
```
[nltk_data] Downloading package stopwords to /root/nltk_data...
[nltk_data]   Package stopwords is already up-to-date!
```

```python
[24] # Transforming the unmatching subjects to the same notation
df.subject=df.subject.replace({'politics':'PoliticsNews','politicsNews':'PoliticsNews'})
```

```python
[25] sub_tf_df=df.groupby('target').apply(lambda x:x['title'].count()).reset_index(name='Counts')
sub_tf_df.target.replace({0:'False',1:'True'},inplace=True)
fig = px.bar(sub_tf_df, x="target", y="Counts",
             color='Counts', barmode='group',
             height=350)
fig.show()
```



```python
sub_check=df.groupby('subject').apply(lambda x:x['title'].count()).reset_index(name='Counts')
fig=px.bar(sub_check,x='subject',y='Counts',color='Counts',title='Count of News Articles by Subject')
fig.show()
```



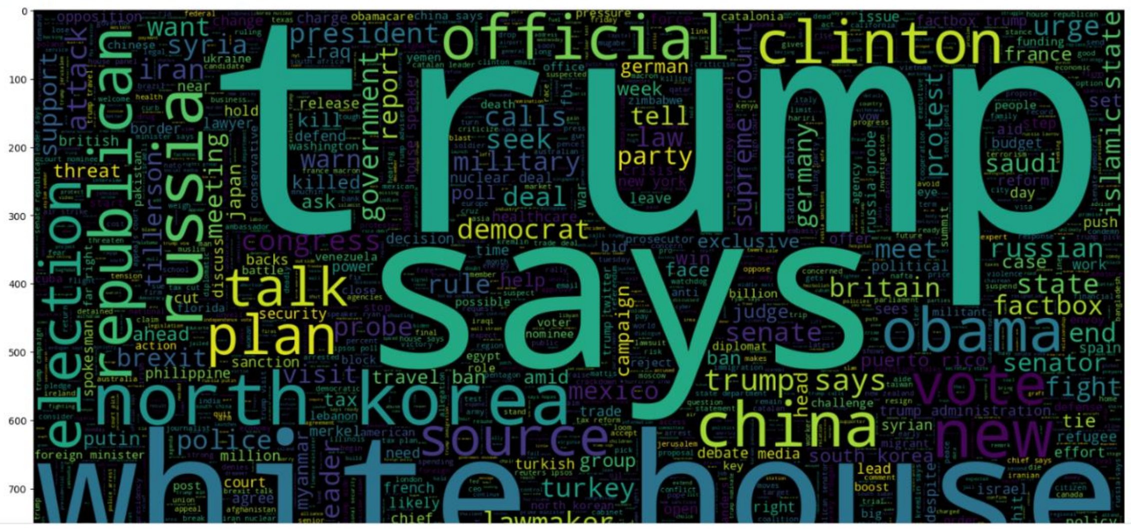
```
df['clean_title'] = df['title'].apply(preprocess)
df['clean_title'][0]
```

```
['budget', 'fight', 'looms', 'republicans', 'flip', 'fiscal', 'script']
```

```
[28] df['clean_joined_title']=df['clean_title'].apply(lambda x:" ".join(x))
```

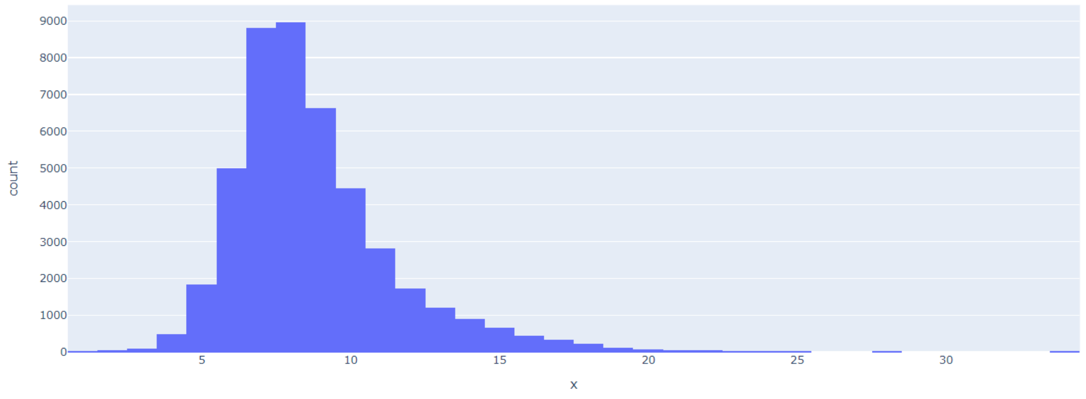
```
plt.figure(figsize = (20,20))
wc = WordCloud(max_words = 2000 , width = 1600 , height = 800 , stopwords = stop_words).generate(" ".join(df[df.target == 1].clean_joined_title))
plt.imshow(wc, interpolation = 'bilinear')
```

```
<matplotlib.image.AxesImage at 0x7adbcf47df30>
```



```
maxlen = -1
for doc in df.clean_joined_title:
    tokens = nltk.word_tokenize(doc)
    if(maxlen<len(tokens)):
        maxlen = len(tokens)
print("The maximum number of words in a title is =", maxlen)
fig = px.histogram(x = [len(nltk.word_tokenize(x)) for x in df.clean_joined_title], nbins = 50)
fig.show()
```

```
The maximum number of words in a title is = 34
```

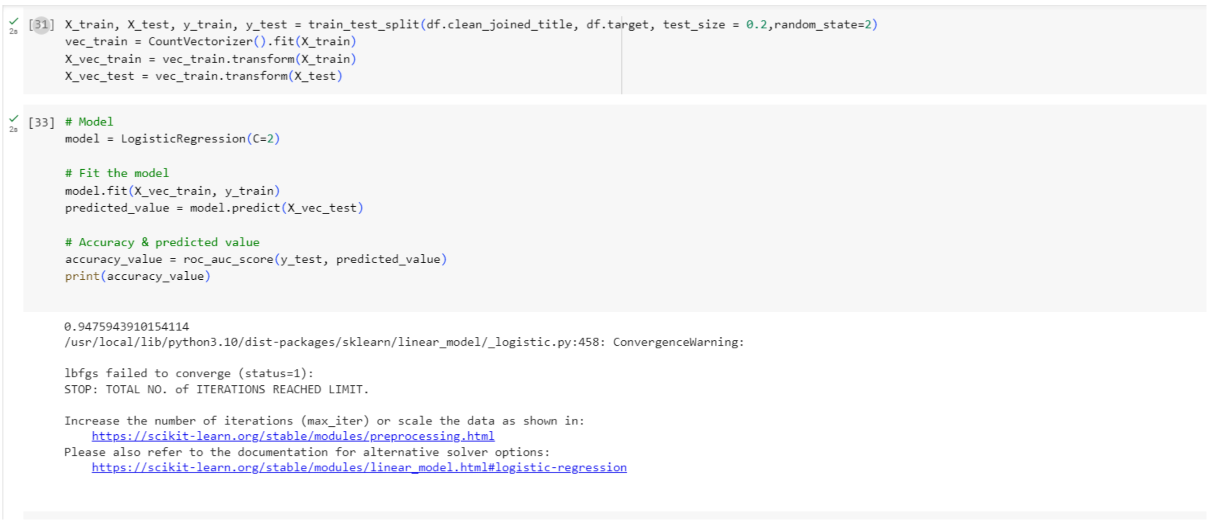


3. Model Selection:

Creating a Prediction Model:

Choose an appropriate machine learning or deep learning model for fake news detection. Common choices include logistic regression, Naive Bayes, Support Vector Machines (SVM), recurrent neural networks (RNNs), or transformers like BERT.

Here we are using Logistic Regression

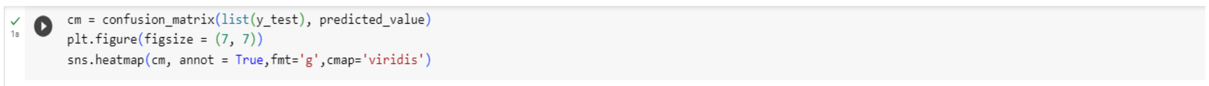


```
[31] X_train, X_test, y_train, y_test = train_test_split(df.clean_joined_title, df.target, test_size = 0.2,random_state=2)
     vec_train = CountVectorizer().fit(X_train)
     X_vec_train = vec_train.transform(X_train)
     X_vec_test = vec_train.transform(X_test)
```

```
[33] # Model
     model = LogisticRegression(C=2)

     # Fit the model
     model.fit(X_vec_train, y_train)
     predicted_value = model.predict(X_vec_test)

     # Accuracy & predicted value
     accuracy_value = roc_auc_score(y_test, predicted_value)
     print(accuracy_value)
```

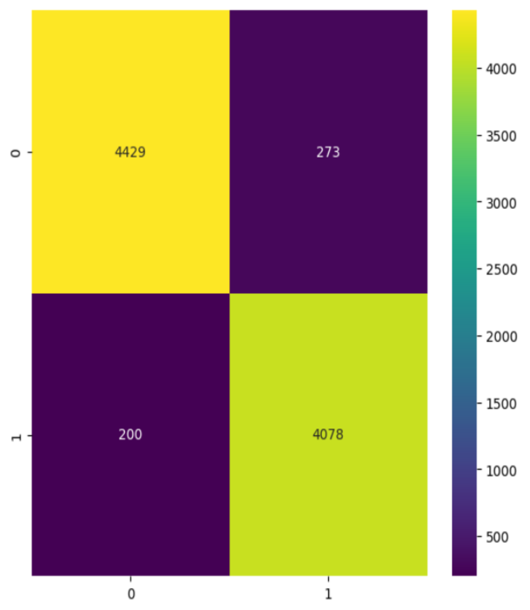
```
0.9475943910154114
/usr/local/lib/python3.10/dist-packages/sklearn/linear_model/_logistic.py:458: ConvergenceWarning:

lbfgs failed to converge (status=1):
STOP: TOTAL NO. of ITERATIONS REACHED LIMIT.

Increase the number of iterations (max_iter) or scale the data as shown in:
    https://scikit-learn.org/stable/modules/preprocessing.html
Please also refer to the documentation for alternative solver options:
    https://scikit-learn.org/stable/modules/linear_model.html#logistic-regression
```

Create the confusion matrix:



```
cm = confusion_matrix(list(y_test), predicted_value)
plt.figure(figsize = (7, 7))
sns.heatmap(cm, annot = True,fmt='g',cmap='viridis')
```

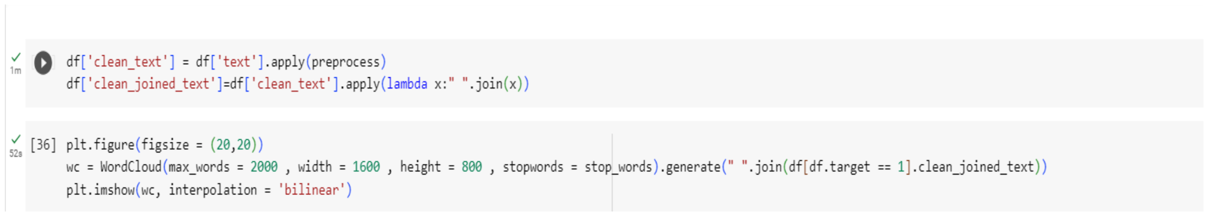
```
<Axes: >
```



4.Model Training:

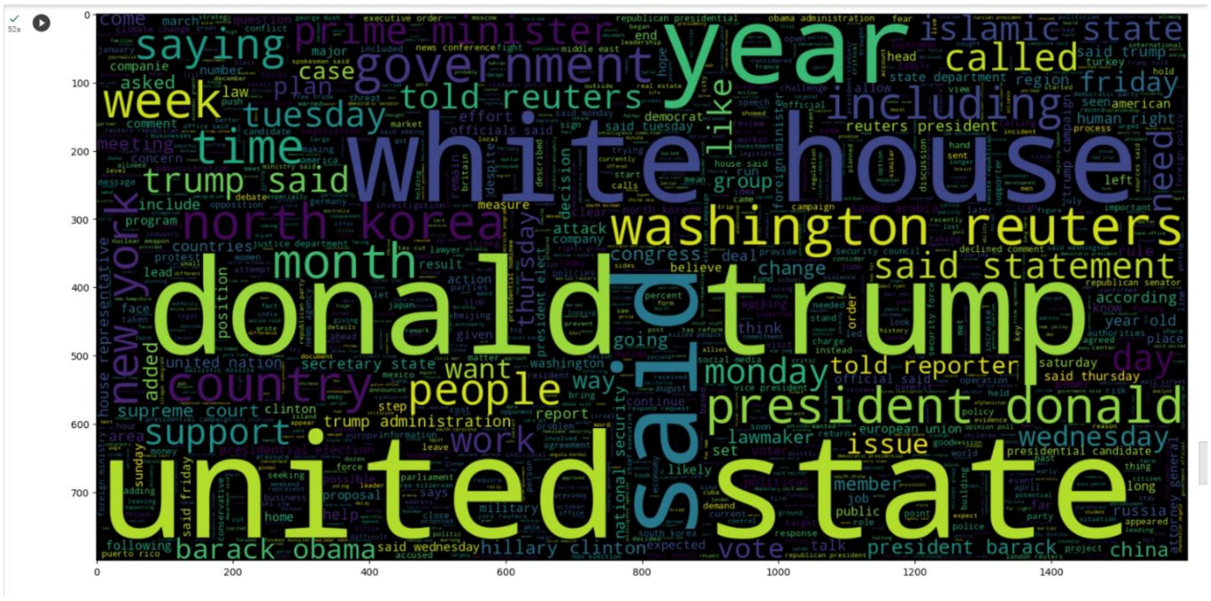
Train the selected model using the preprocessed data, using labeled examples to learn the patterns associated with real and fake news.The model learns to distinguish between real and fake news based on the provided features.

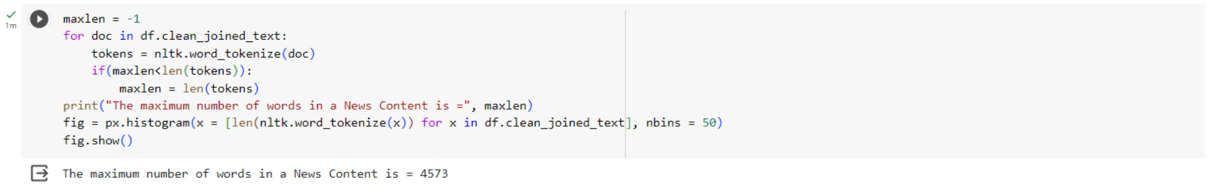
Checking the content of news:



```
df['clean_text'] = df['text'].apply(preprocess)
df['clean_joined_text']=df['clean_text'].apply(lambda x:" ".join(x))
```

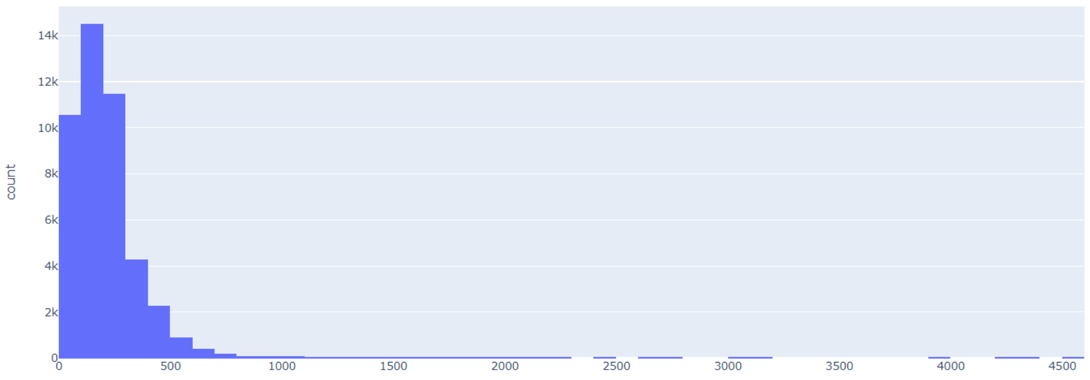
```
[36] plt.figure(figsize = (20,20))
     wc = WordCloud(max_words = 2000 , width = 1600 , height = 800 , stopwords = stop_words).generate(" ".join(df[df.target == 1].clean_joined_text))
     plt.imshow(wc, interpolation = 'bilinear')
```





```
maxlen = -1
for doc in df.clean_joined_text:
    tokens = nltk.word_tokenize(doc)
    if(maxlen<len(tokens)):
        maxlen = len(tokens)
print("The maximum number of words in a News Content is =", maxlen)
fig = px.histogram(x = [len(nltk.word_tokenize(x)) for x in df.clean_joined_text], nbins = 50)
fig.show()
```

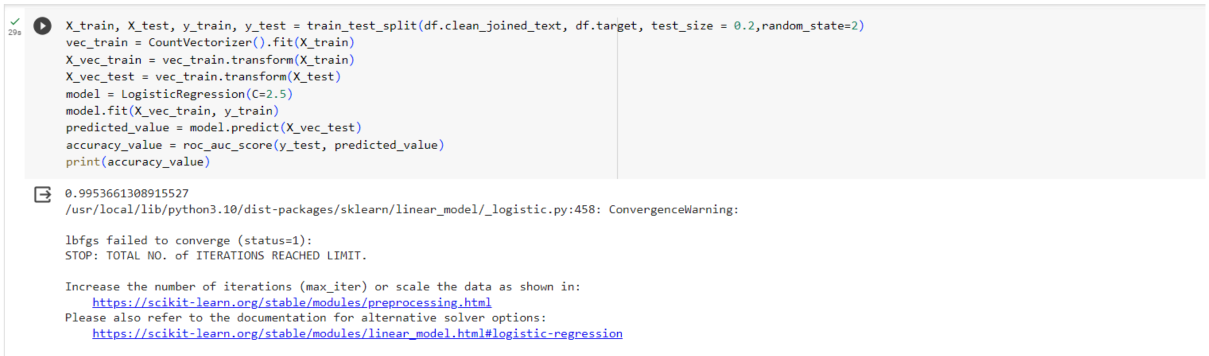
```
The maximum number of words in a News Content is = 4573
```



5. Evaluation:

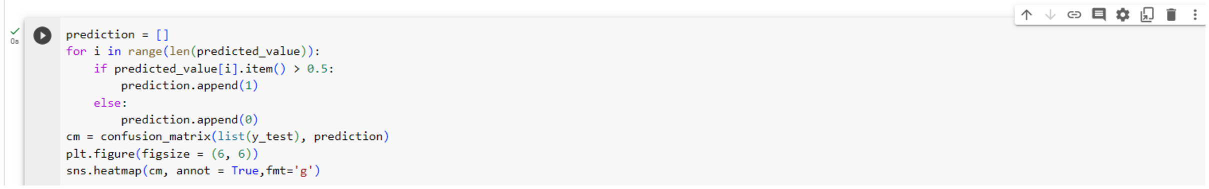
Evaluate the model's performance using metrics like accuracy, precision, recall, F1-score, and ROC-AUC. It's essential to consider the class imbalance issue, as fake news might be a minority class.

Predicting the model:

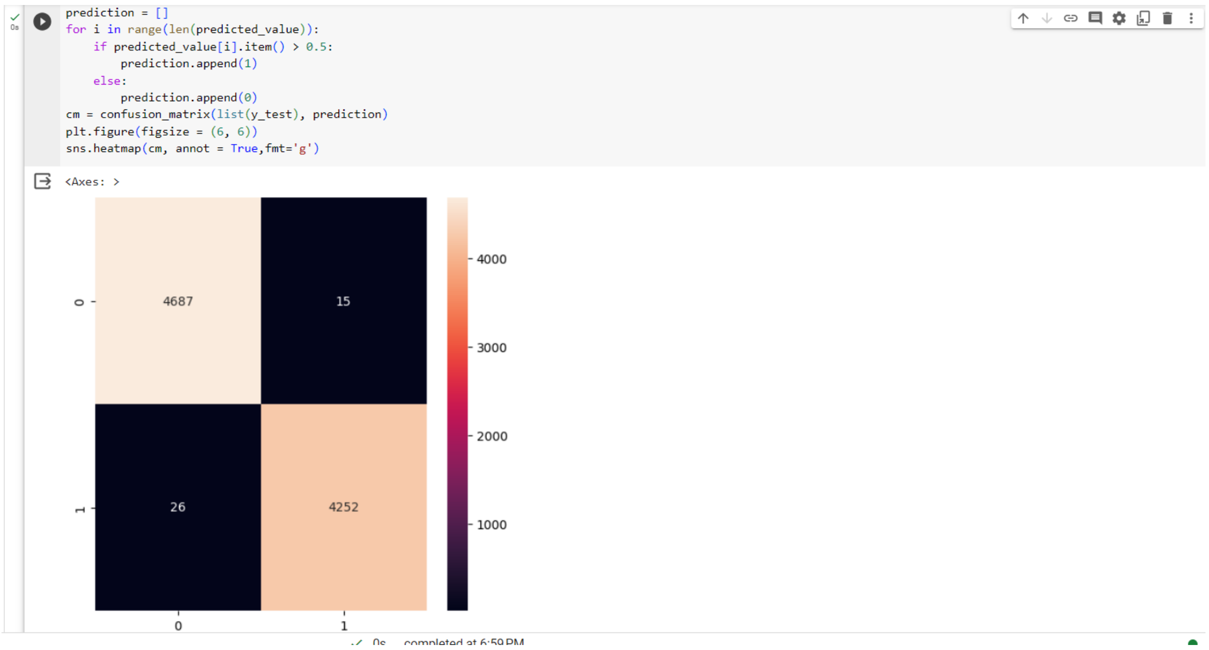


```
X_train, X_test, y_train, y_test = train_test_split(df.clean_joined_text, df.target, test_size = 0.2,random_state=2)
vec_train = CountVectorizer().fit(X_train)
X_vec_train = vec_train.transform(X_train)
X_vec_test = vec_train.transform(X_test)
model = LogisticRegression(C=2.5)
model.fit(X_vec_train, y_train)
predicted_value = model.predict(X_vec_test)
accuracy_value = roc_auc_score(y_test, predicted_value)
print(accuracy_value)
```

```
0.9953661308915527
/usr/local/lib/python3.10/dist-packages/sklearn/linear_model/_logistic.py:458: ConvergenceWarning:

lbfgs failed to converge (status=1):
STOP: TOTAL NO. of ITERATIONS REACHED LIMIT.

Increase the number of iterations (max_iter) or scale the data as shown in:
    https://scikit-learn.org/stable/modules/preprocessing.html
Please also refer to the documentation for alternative solver options:
    https://scikit-learn.org/stable/modules/linear_model.html#logistic-regression
```



```
prediction = []
for i in range(len(predicted_value)):
    if predicted_value[i].item() > 0.5:
        prediction.append(1)
    else:
        prediction.append(0)
cm = confusion_matrix(list(y_test), prediction)
plt.figure(figsize = (6, 6))
sns.heatmap(cm, annot = True,fmt='g')
```



```
prediction = []
for i in range(len(predicted_value)):
    if predicted_value[i].item() > 0.5:
        prediction.append(1)
    else:
        prediction.append(0)
cm = confusion_matrix(list(y_test), prediction)
plt.figure(figsize = (6, 6))
sns.heatmap(cm, annot = True,fmt='g')
```

```
<Axes: >
```

Installation steps and the Program:

import numpy as np

import pandas as pd

import os

for dirname, _, filenames in os.walk('/kaggle/input'):

 for filename in filenames:

```
 print(os.path.join(dirname, filename))
!pip install genism
import nltk
nltk.download('punkt')
import pandas as pd
import numpy as np
import matplotlib.pyplot as plt
import seaborn as sns
from wordcloud import WordCloud, STOPWORDS
import nltk
import re
from nltk.corpus import stopwords
import seaborn as sns
import gensim
from gensim.utils import simple_preprocess
from gensim.parsing.preprocessing import STOPWORDS
import plotly.express as px
from sklearn.model_selection import train_test_split
from sklearn.feature_extraction.text import CountVectorizer
from sklearn.linear_model import LogisticRegression
from sklearn.metrics import roc_auc_score
from sklearn.metrics import confusion_matrix
fake_data = pd.read_csv('/kaggle/input/fake-and-real-news-dataset/Fake.csv')
print("fake_data",fake_data.shape)
true_data= pd.read_csv('/kaggle/input/fake-and-real-news-dataset/True.csv')
print("true_data",true_data.shape)
fake_data.head(5)
true_data.head(5)
true_data['target'] = 1
fake_data['target'] = 0
df = pd.concat([true_data, fake_data]).reset_index(drop = True)
```

```
df['original'] = df['title'] + ' ' + df['text']
df.head()
df.isnull().sum()
stop_words = stopwords.words('english')
stop_words.extend(['from', 'subject', 're', 'edu', 'use'])
def preprocess(text):
 result = []
 for token in gensim.utils.simple_preprocess(text):
 if token not in gensim.parsing.preprocessing.STOPWORDS and len(token) > 2 and token not in
stop_words:
 result.append(token)
 return result
df.subject=df.subject.replace({'politics':'PoliticsNews','politicsNews':'PoliticsNews'})
sub_tf_df=df.groupby('target').apply(lambda x:x['title'].count()).reset_index(name='Counts')
sub_tf_df.target.replace({0:'False',1:'True'},inplace=True)
fig = px.bar(sub_tf_df, x="target", y="Counts",
 color='Counts', barmode='group',
 height=350)
fig.show()
sub_check=df.groupby('subject').apply(lambda x:x['title'].count()).reset_index(name='Counts')
fig=px.bar(sub_check,x='subject',y='Counts',color='Counts',title='Count of News Articles by Subject')
fig.show()
df['clean_title'] = df['title'].apply(preprocess)
df['clean_title'][0]
df['clean_joined_title']=df['clean_title'].apply(lambda x:" ".join(x))
plt.figure(figsize = (20,20))
wc = WordCloud(max_words = 2000 , width = 1600 , height = 800 , stopwords =
stop_words).generate(" ".join(df[df.target == 1].clean_joined_title))
plt.imshow(wc, interpolation = 'bilinear')
maxlen = -1
for doc in df.clean_joined_title:
 tokens = nltk.word_tokenize(doc)
 if(maxlen<len(tokens)):
 maxlen = len(tokens)
print("The maximum number of words in a title is =", maxlen)
fig = px.histogram(x = [len(nltk.word_tokenize(x)) for x in df.clean_joined_title], nbins = 50)
fig.show()
X_train, X_test, y_train, y_test = train_test_split(df.clean_joined_title, df.target, test_size =
0.2,random_state=2)
vec_train = CountVectorizer().fit(X_train)
X_vec_train = vec_train.transform(X_train)
X_vec_test = vec_train.transform(X_test)
model = LogisticRegression(C=2)
model.fit(X_vec_train, y_train)
predicted_value = model.predict(X_vec_test)
accuracy_value = roc_auc_score(y_test, predicted_value)
print(accuracy_value)
cm = confusion_matrix(list(y_test), predicted_value)
plt.figure(figsize = (7, 7))
sns.heatmap(cm, annot = True,fmt='g',cmap='viridis')
df['clean_text'] = df['text'].apply(preprocess)
df['clean_joined_text']=df['clean_text'].apply(lambda x:" ".join(x))
plt.figure(figsize = (20,20))
wc = WordCloud(max_words = 2000 , width = 1600 , height = 800 , stopwords =
stop_words).generate(" ".join(df[df.target == 1].clean_joined_text))
plt.imshow(wc, interpolation = 'bilinear')
maxlen = -1
for doc in df.clean_joined_text:
 tokens = nltk.word_tokenize(doc)
 if(maxlen<len(tokens)):
 maxlen = len(tokens)
print("The maximum number of words in a News Content is =", maxlen)
```

```
fig = px.histogram(x = [len(nltk.word_tokenize(x)) for x in df.clean_joined_text], nbins = 50)
fig.show()
X_train, X_test, y_train, y_test = train_test_split(df.clean_joined_text, df.target, test_size =
0.2,random_state=2)
vec_train = CountVectorizer().fit(X_train)
X_vec_train = vec_train.transform(X_train)
X_vec_test = vec_train.transform(X_test)
model = LogisticRegression(C=2.5)
model.fit(X_vec_train, y_train)
predicted_value = model.predict(X_vec_test)
accuracy_value = roc_auc_score(y_test, predicted_value)
print(accuracy_value)
prediction = []
for i in range(len(predicted_value)):
 if predicted_value[i].item() > 0.5:
 prediction.append(1)
 else:
 prediction.append(0)
cm = confusion_matrix(list(y_test), prediction)
plt.figure(figsize = (6, 6))
sns.heatmap(cm, annot = True,fmt='g')
```

Conclusion:

In this phase ,we have successfully developed a fake news detection model by importing required datasets and through training and testing part the model evaluation is done.