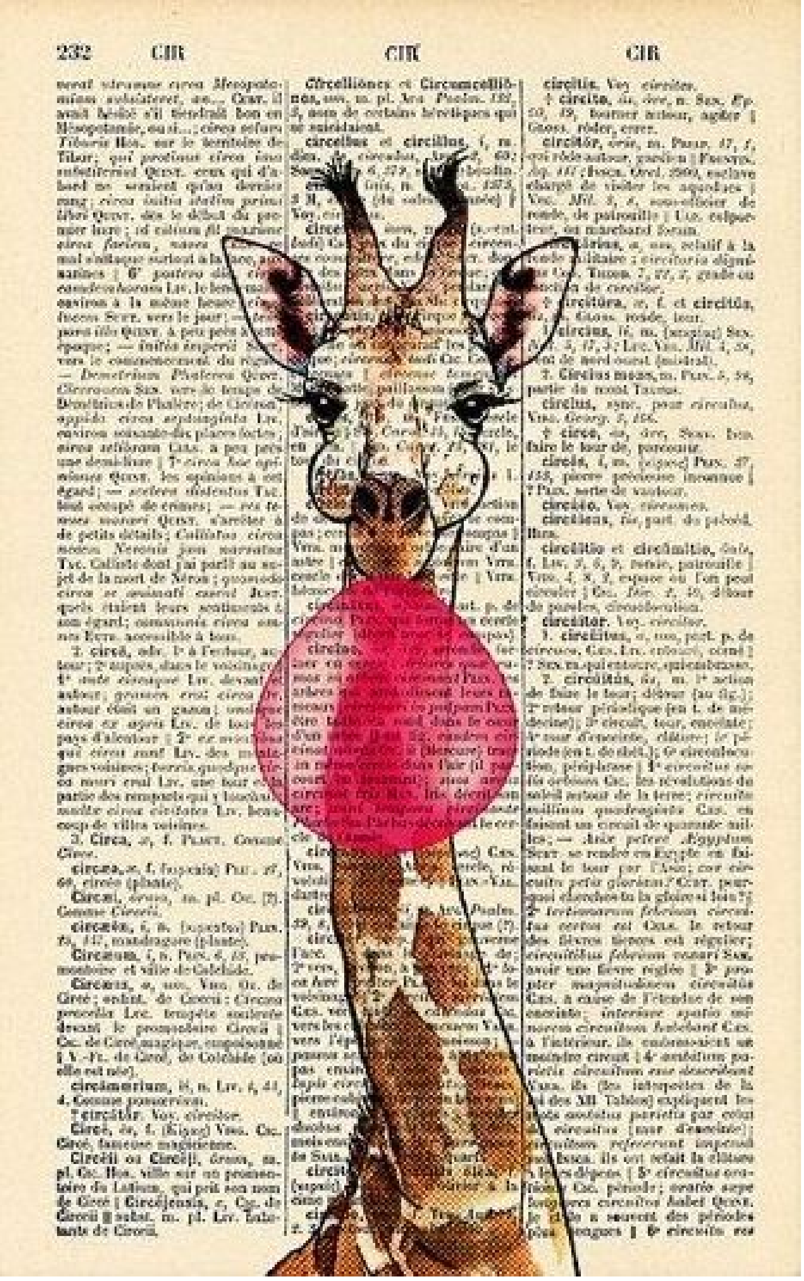
Fake or Real news



Done by: Lujain Yousef

Columns:

- **title:**

  ```
  This column
  contains the
  titles of news
  articles or
  headlines. It
  represents the
  main headline or
  title of the news story.
  ```

- **text:**

  ```
  This column contains the main body of the news article. It includes
  the full text of the news story, providing more context and details
  beyond the headline.
  ```

- **label:**

  ```
  This column indicates whether the news article is classified as "FAKE"
  or "REAL". It's likely a binary classification  where "FAKE" denotes
  articles that are considered false or misleading, while "REAL" denotes
  articles that are considered accurate.
  ```

Text Vectorization and Classification:

- I performed text vectorization using both CountVectorizer and TF-IDF to convert the text data into numerical features suitable for machine learning models. After that, I applied Multinomial Naive Bayes classifier to classify the news articles into "FAKE" or "REAL" categories.

Data

In [7]:

```
import pandas as pd
df = pd.read_csv('fake_or_real_news.csv',index_col='Unnamed: 0')
df
```

Out[7]:

	title	text	label
8476	You Can Smell Hillary’s Fear	Daniel Greenfield, a Shillman Journalism Fello...	FAKE
10294	Watch The Exact Moment Paul Ryan Committed Pol...	Google Pinterest Digg Linkedin Reddit Stumbleu...	FAKE
3608	Kerry to go to Paris in gesture of sympathy	U.S. Secretary of State John F. Kerry said Mon...	REAL
10142	Bernie supporters on Twitter erupt in anger ag...	— Kaydee King (@KaydeeKing) November 9, 2016 T...	FAKE
875	The Battle of New York: Why This Primary Matters	It's primary day in New York and front-runners...	REAL
...	...	...	...
4490	State Department says it can't find emails fro...	The State Department told the Republican Natio...	REAL
8062	The ‘P’ in PBS Should Stand for ‘Plutocratic’ ...	The ‘P’ in PBS Should Stand for ‘Plutocratic’ ...	FAKE
8622	Anti-Trump Protesters Are Tools of the Oligarc...	Anti-Trump Protesters Are Tools of the Oligar...	FAKE
4021	In Ethiopia, Obama seeks progress on peace, se...	ADDIS ABABA, Ethiopia —President Obama convene...	REAL
4330	Jeb Bush Is Suddenly Attacking Trump. Here's W...	Jeb Bush Is Suddenly Attacking Trump. Here's W...	REAL

6335 rows × 3 columns

In [2]:

```
df.columns
```

Out[2]:

```
Index(['title', 'text', 'label'], dtype='object')
```

Named entity recognation

In [8]:

```
from nltk import word_tokenize, pos_tag, ne_chunk
from nltk.chunk import conlltags2tree, tree2conlltags
# Function to perform named entity recognition on text
def extract_entities(text):
    tokens = word_tokenize(text)
    pos_tags = pos_tag(tokens)
    tree = ne_chunk(pos_tags)
    iob_tags = tree2conlltags(tree)
    entities = [(token, iob) for token, _, iob in iob_tags if iob != 'O']
    return entities
```

In [9]:

```
# Apply the function to the 'text_column' and create a new column for extracted e
df['extracted_entities'] = df['text'].apply(extract_entities)
```

In [6]:

```
display(df[['text','extracted_entities']])
```

	text	extracted_entities
8476	Daniel Greenfield, a Shillman Journalism Fello...	[(Daniel, B-PERSON), (Greenfield, B-ORGANIZATI...
10294	Google Pinterest Digg Linkedin Reddit Stumbleu...	[(Google, B-PERSON), (Pinterest, B-PERSON), (D...
3608	U.S. Secretary of State John F. Kerry said Mon...	[(U.S., B-GPE), (State, B-ORGANIZATION), (John...
10142	— Kaydee King (@KaydeeKing) November 9, 2016 T...	[(Kaydee, B-PERSON), (King, I-PERSON), (Dem, B...
875	It's primary day in New York and front-runners...	[(New, B-GPE), (York, I-GPE), (Hillary, B-PERS...
...	...	...
4490	The State Department told the Republican Natio...	[(State, B-ORGANIZATION), (Department, I-ORGAN...
8062	The ‘P’ in PBS Should Stand for ‘Plutocratic’ ...	[(PBS, B-ORGANIZATION), (Should, I-ORGANIZATIO...
8622	Anti-Trump Protesters Are Tools of the Oligar...	[(Oligarchy, B-ORGANIZATION), (Arthur, B-PERSO...
4021	ADDIS ABABA, Ethiopia —President Obama convene...	[(ADDIS, B-ORGANIZATION), (ABABA, B-GPE), (Eth...
4330	Jeb Bush Is Suddenly Attacking Trump. Here's W...	[(Jeb, B-PERSON), (Bush, B-ORGANIZATION), (Jeb...

6335 rows × 2 columns

Words Frequency & dispersion plot

In [24]:

```
import nltk
from nltk.tokenize import word_tokenize
from nltk.probability import FreqDist
import string
import matplotlib.pyplot as plt

# Combine all text from the 'text' column into a single string
all_text = ' '.join(df['text'])

# Tokenize the combined text into words and remove punctuation
tokens = word_tokenize(all_text)
tokens = [word.lower() for word in tokens if word.isalnum()]

# Remove stop words
stop_words.update({'aa','aaa','ยงade','also','aaas'})
filtered_tokens = [word for word in tokens if word not in stop_words]

# Calculate the frequency distribution of words
freq_dist = FreqDist(filtered_tokens)
```

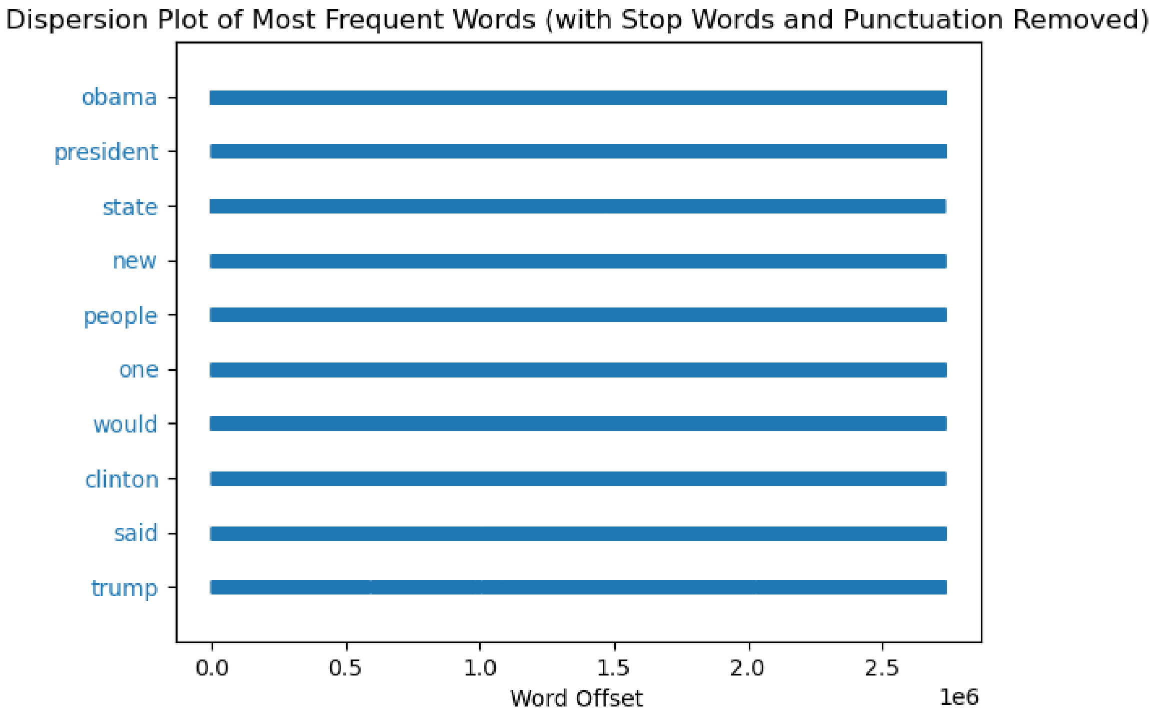
```
# Select the most frequent words (e.g., top 10)
most_common_words = freq_dist.most_common(10)  # Adjust as needed

# Extract the most frequent words
words = [word for word, _ in most_common_words]

# Determine the positions of these words in the text
positions = [i for i, token in enumerate(filtered_tokens) if token in words]

# Create a dispersion plot
plt.figure(figsize=(10, 5))
nltk.draw.dispersion.dispersion_plot(filtered_tokens, words)
plt.title('Dispersion Plot of Most Frequent Words (with Stop Words and Punctuatio
plt.show()
```

```
<Figure size 1000x500 with 0 Axes>
```



Text Preprocessing

In [11]:

```
df.drop('extracted_entities',axis=1,inplace=True)
```

In [21]:

```
from nltk.tokenize import RegexpTokenizer
from nltk.stem import WordNetLemmatizer
from nltk.corpus import stopwords

def preprocess_text(text):
    tokenizer = RegexpTokenizer(r'\w+')
    tokens = tokenizer.tokenize(text.lower())
    # Lemmatize the words
    lemmatizer = WordNetLemmatizer()
    lemmatized_tokens = [lemmatizer.lemmatize(token) for token in tokens]
    # Remove stop words for English
    stop_words_en = set(stopwords.words('english'))
    stop_words_en.update({'aa','aaa','ยงade','also','aaas'})
    filtered_tokens = [token for token in tokens if token not in stop_words_en an
    # Remove stop words for Arabic
    stop_words_ar = set(stopwords.words('arabic'))
    filtered_tokens = [token for token in filtered_tokens if token not in stop_wo
    # Join the tokens back into a string
    processed_text = ' '.join(filtered_tokens)
    return processed_text
```

In [22]:

```
df['text'] = df['text'].apply( preprocess_text)
```

In [15]:

```
df['text']
```

Out[15]:

```
8476     daniel greenfield shillman journalism fellow f...
10294    google pinterest digg linkedin reddit stumbleu...
3608     u secretary state john f kerry said monday sto...
10142    kaydee king kaydeeking november lesson tonight...
875      primary day new york front runners hillary cli...
                               ...                        
4490     state department told republican national comm...
8062     p pbs stand plutocratic pentagon posted oct wi...
8622     anti trump protesters tools oligarchy reform a...
4021     addis ababa ethiopia president obama convened ...
4330     jeb bush suddenly attacking trump matters jeb ...
Name: text, Length: 6335, dtype: object
```

Splitting the Data

In [25]:

```
X = df['text']
y = df.label
```

In [26]:

```
from sklearn.model_selection import train_test_split
X_train,X_test,y_train,y_test = train_test_split(X,y,test_size=0.30,random_state=
```

In [10]:

```
y.value_counts()
```

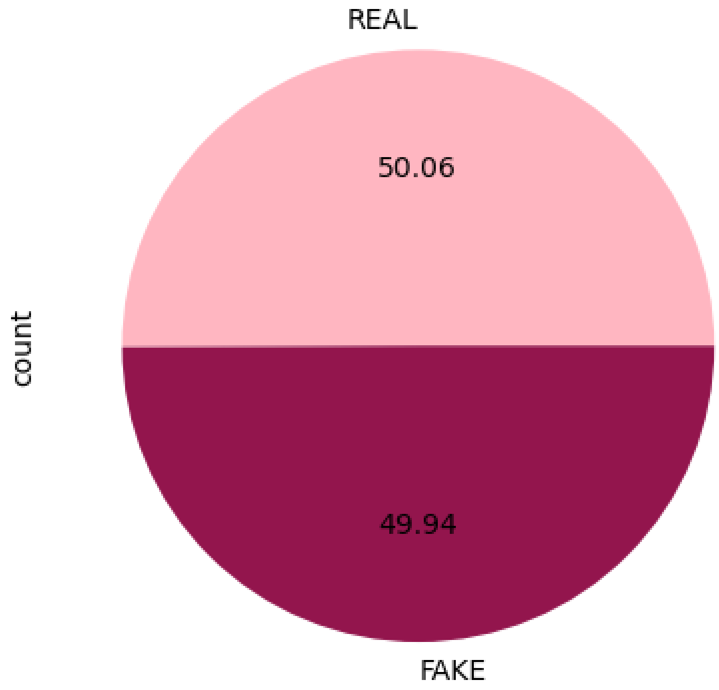
Out[10]:

```
label
REAL    3171
FAKE    3164
Name: count, dtype: int64
```

In [6]:

```
import matplotlib.pyplot as plt

# Assuming y is your pandas Series or DataFrame column
y.value_counts().plot.pie(autopct='%.2f', colors=['#ffb6c1', "#93154d"])
plt.show()
```



Count Vectorizer

In [27]:

```
from sklearn.feature_extraction.text import CountVectorizer
count_vec = CountVectorizer()
```

In [28]:

```
count_train = count_vec.fit_transform(X_train)
count_test = count_vec.transform(X_test)
```

In [29]:

```
# feature names
count_vec.get_feature_names_out()[:10]
```

Out[29]:

```
array(['aab', 'aadmi', 'aahing', 'aaib', 'aalia', 'aam', 'aamaq', 'aamon',
       'aap', 'aarhus'], dtype=object)
```

In [30]:

```
import pandas as pd
# Create DataFrame from CountVectorizer transformed data
count_df = pd.DataFrame(count_train.A, columns=count_vec.get_feature_names_out())
count_df
```

Out[30]:

	aab	aadmi	aahing	aaib	aalia	aam	aamaq	aamon	aap	aarhus	...	الدولية	القادمون
0	0	0	0	0	0	0	0	0	0	0	...	0	0
1	0	0	0	0	0	0	0	0	0	0	...	0	0
2	0	0	0	0	0	0	0	0	0	0	...	0	0
3	0	0	0	0	0	0	0	0	0	0	...	0	0
4	0	0	0	0	0	0	0	0	0	0	...	0	0
...	...	...	...	...	...	...	...	...	...	...	...	...	...
4429	0	0	0	0	0	0	0	0	0	0	...	0	0
4430	0	0	0	0	0	0	0	0	0	0	...	0	0
4431	0	0	0	0	0	0	0	0	0	0	...	0	0
4432	0	0	0	0	0	0	0	0	0	0	...	0	0
4433	0	0	0	0	0	0	0	0	0	0	...	0	0

4434 rows × 55393 columns

In [32]:

```
count_df.columns
```

Out[32]:

```
Index(['aab', 'aadmi', 'aahing', 'aaib', 'aalia', 'aam', 'aamaq', 'aamon',
       'aap', 'aarhus',
       ...
       'الدولية', 'القادمون', 'اللجنة', 'تحتاج', 'تعرفه', 'تنجح', 'حلب',
       'عربي', 'محاولات', 'والمرضى'],
      dtype='object', length=48377)
```

Tfidf Vectorizer

In [31]:

```
from sklearn.feature_extraction.text import TfidfVectorizer
tfidf_vec = TfidfVectorizer()
```

In [32]:

```
tfidf_train = tfidf_vec.fit_transform(X_train)
tfidf_test = tfidf_vec.transform(X_test)
```

In [33]:

```
tfidf_df = pd.DataFrame(tfidf_train.A,columns=tfidf_vec.get_feature_names_out())
tfidf_df
```

Out[33]:

	aab	aadmi	aahing	aaib	aalia	aam	aamaq	aamon	aap	aarhus	...	الدولية	القادمون
0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	...	0.0	0.0
1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	...	0.0	0.0
2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	...	0.0	0.0
3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	...	0.0	0.0
4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	...	0.0	0.0
...	...	...	...	...	...	...	...	...	...	...	...	...	...
4429	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	...	0.0	0.0
4430	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	...	0.0	0.0
4431	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	...	0.0	0.0
4432	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	...	0.0	0.0
4433	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	...	0.0	0.0

4434 rows × 55393 columns

check count_df and tfidf_df if

In [34]:

```
# Calculate the difference in columns: difference
difference = set(count_df.columns) - set(tfidf_df.columns)
print(difference)

# Check whether the DataFrames are equal
print(count_df.equals(tfidf_df))
```

```
set()
False
```

Naive Bayes Model on count_df

In [35]:

```
from sklearn.pipeline import Pipeline
from sklearn.model_selection import RandomizedSearchCV
from sklearn.naive_bayes import MultinomialNB
from scipy.stats import uniform, randint

nb_classifier = MultinomialNB()
# Define the pipeline with CountVectorizer and MultinomialNB
pipeline = Pipeline([
    ('vect', count_vec),
    ('clf', nb_classifier )
])

# Define the parameter distributions to sample from
param_dist = {
    'vect__min_df': randint(1, 3),
    'vect__max_df': uniform(0.5, 0.25),  # Sampling from a uniform distribution be
    'clf__alpha': uniform(0.1, 0.9),  # Sampling from a uniform distribution betw
}

# Perform randomized search using 5-fold cross-validation
random_search = RandomizedSearchCV(pipeline, param_distributions=param_dist, n_it
random_search.fit(X_train, y_train)

# Print the best parameters found
print("Best parameters found:")
print(random_search.best_params_)

# Evaluate the model on the test set
accuracy = random_search.score(X_test, y_test)
print("Accuracy on test set:", accuracy)
```

```
Fitting 5 folds for each of 10 candidates, totalling 50 fits
Best parameters found:
{'clf__alpha': 0.3207004242339442, 'vect__max_df': 0.7004663059716135, 'vect__min
_df': 2}
Accuracy on test set: 0.8979484481851657
```

Naive Bayes Model on tfidf_df

In [36]:

```
# Define the pipeline with TfidfVectorizer and MultinomialNB
pipeline = Pipeline([
    ('vect', tfidf_vec),
    ('clf', nb_classifier)
])

# Define the parameter distributions to sample from
param_dist = {
    'vect__min_df': randint(1, 3),
    'vect__max_df': uniform(0.5, 0.25),  # Sampling from a uniform distribution be
    'clf__alpha': uniform(0.1, 0.9),  # Sampling from a uniform distribution betw
}

# Perform randomized search using 5-fold cross-validation
random_search = RandomizedSearchCV(pipeline, param_distributions=param_dist, n_ite
random_search.fit(X_train, y_train)

# Print the best parameters found
print("Best parameters found:")
print(random_search.best_params_)

# Evaluate the model on the test set
accuracy = random_search.score(X_test, y_test)
print("Accuracy on test set:", accuracy)
```

```
Fitting 5 folds for each of 10 candidates, totalling 50 fits
Best parameters found:
{'clf__alpha': 0.23807810840304605, 'vect__max_df': 0.6592016762875144, 'vect__mi
n_df': 2}
Accuracy on test set: 0.9021567596002105
```

Confusion matrix

In [24]:

```
y.unique()
```

Out[24]:

```
array(['FAKE', 'REAL'], dtype=object)
```

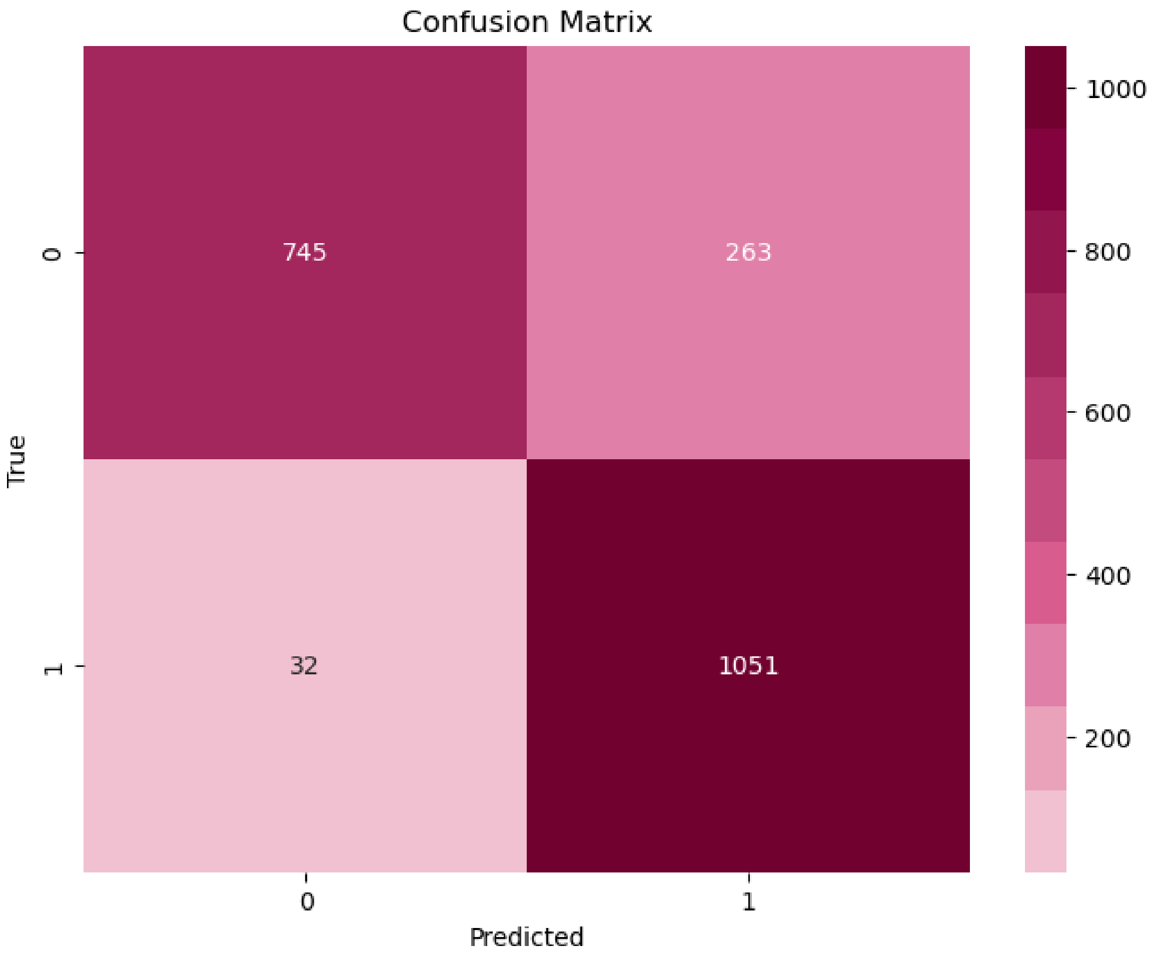
In [55]:

```
# Calculate the confusion matrix: cm
cm = confusion_matrix(y_test, pred, labels=['FAKE', 'REAL'])
```

In [56]:

```
# Plot the confusion matrix using a heatmap
colors = ["#f1c1d1", "#eaa2bb", "#e080a8", "#d95c8f", "#c44b7e", "#b5386e", "#a32
```

```
# Plot the confusion matrix using a heatmap with the custom color palette
plt.figure(figsize=(8, 6))
plt.figure(figsize=(8, 6))
sns.heatmap(cm, annot=True, cmap=colors, fmt='g', xticklabels=[0, 1], yticklabels
plt.xlabel('Predicted')
plt.ylabel('True')
plt.title('Confusion Matrix')
plt.show()
```



The End