Title

Fake News Detection

Overview of Problem Statement

Fake news has become a critical issue with the rise of online platforms. The spread of misinform
can mislead the public and create social, political, or economic consequences. Detecting and cla
fake news is therefore a significant challenge in Natural Language Processing (NLP).

Objective

The main objective of this project is to develop a deep learning-based classifier that can accurate
distinguish between Fake and Real news articles based on their textual content.

Import Libraries

```
In [1]: # Import Libraries
        import pandas as pd
        import numpy as np
        import matplotlib.pyplot as plt
        import seaborn as sns
        from wordcloud import WordCloud
        from sklearn.model_selection import train_test_split
        from sklearn.preprocessing import LabelEncoder
        from sklearn.metrics import accuracy_score, classification_report
        from tensorflow.keras.preprocessing.text import Tokenizer
        from tensorflow.keras.preprocessing.sequence import pad_sequences
        from tensorflow.keras.models import Sequential
        from tensorflow.keras.layers import Embedding, LSTM, Dense, Dropout, Bidi
        from tensorflow.keras.callbacks import EarlyStopping
```

```
In [ ]:
```

```
In [2]: # Step 2: Load Dataset
        df = pd.read_csv('news.csv')
        df
```

Out[2]:

	Unnamed: 0	title	text
0	8476	You Can Smell Hillary’s Fear	Daniel Greenfield, a Shillman Journalism Fello...
1	10294	Watch The Exact Moment Paul Ryan Committed Pol...	Google Pinterest Digg Linkedin Reddit Stumbleu...
2	3608	Kerry to go to Paris in gesture of sympathy	U.S. Secretary of State John F. Kerry said Mon...
3	10142	Bernie supporters on Twitter erupt in anger ag...	— Kaydee King (@KaydeeKing) November 9, 2016 T...
4	875	The Battle of New York: Why This Primary Matters	It's primary day in New York and front-runners...
...	...	...	...
6330	4490	State Department says it can't find emails fro...	The State Department told the Republican Natio...
6331	8062	The ‘P’ in PBS Should Stand for ‘Plutocratic’ ...	The ‘P’ in PBS Should Stand for ‘Plutocratic’ ...
6332	8622	Anti-Trump Protesters Are Tools of the Oligarc...	Anti-Trump Protesters Are Tools of the Oligar...
6333	4021	In Ethiopia, Obama seeks progress on peace, se...	ADDIS ABABA, Ethiopia —President Obama convene...
6334	4330	Jeb Bush Is Suddenly Attacking Trump. Here's W...	Jeb Bush Is Suddenly Attacking Trump. Here's W...

6335 rows × 4 columns

Data Cleaning

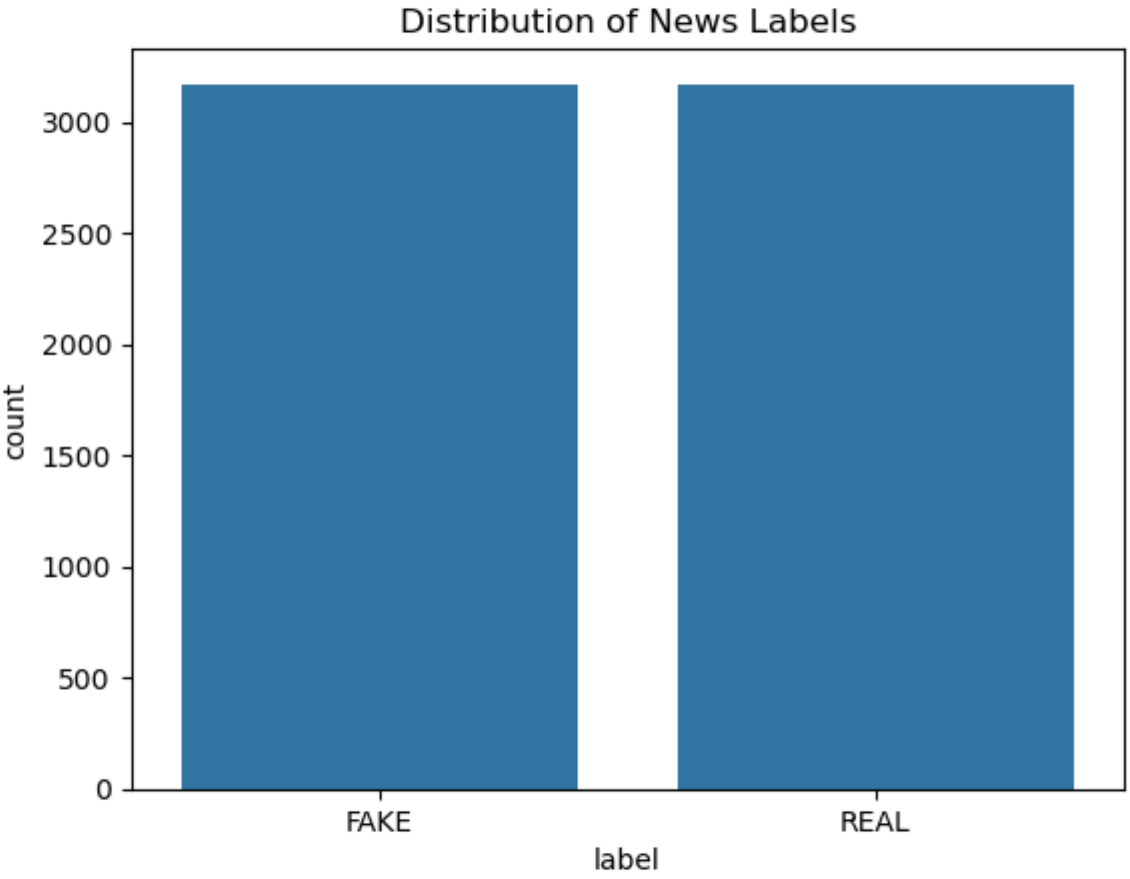
In [3]:

```
df.drop(columns=['Unnamed: 0'], inplace=True)
df.dropna(inplace=True)
df['text_length'] = df['text'].apply(lambda x: len(str(x).split()))
df.head()
```

Out[3]:

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

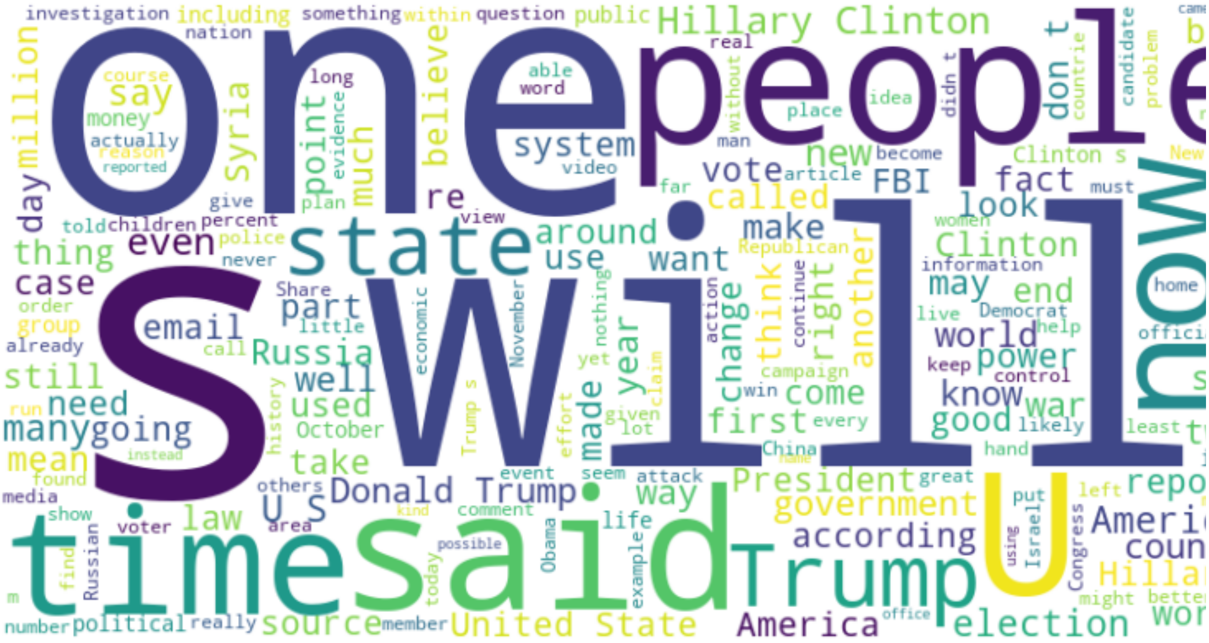
In [4]:
```
# EDA - Label Distribution
sns.countplot(data=df, x='label')
plt.title('Distribution of News Labels')
plt.show()
```



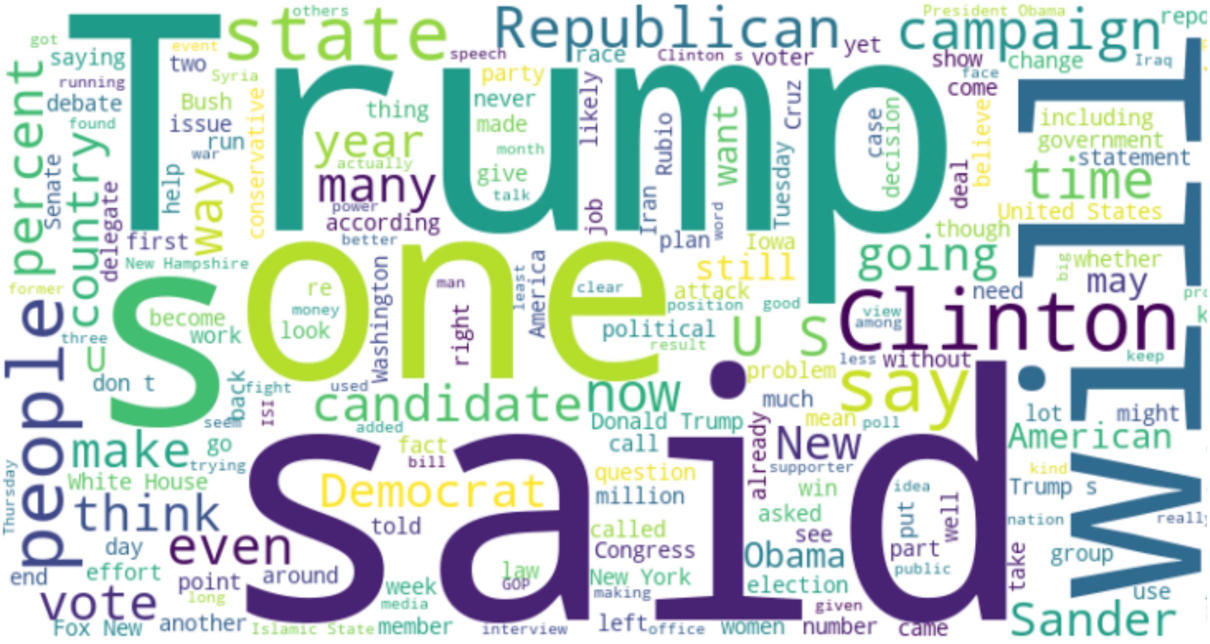
In [5]:
```
# EDA - Word Cloud
def generate_wordcloud(text, title):
    wordcloud = WordCloud(width=800, height=400, background_color='white'
    plt.figure(figsize=(10, 5))
    plt.imshow(wordcloud, interpolation='bilinear')
    plt.title(title)
    plt.axis('off')
    plt.show()

generate_wordcloud(df[df['label'] == 'FAKE']['text'], 'Fake News WordClou
generate_wordcloud(df[df['label'] == 'REAL']['text'], 'Real News WordClou
```

Fake News WordCloud



Real News WordCloud



Encoding label

```
In [6]: #  Preprocessing
        le = LabelEncoder()
        df['label_encoded'] = le.fit_transform(df['label'])
```

```
In [7]: X = df['text']
        y = df['label_encoded']
        X_train, X_test, y_train, y_test = train_test_split(X, y, test_size=0.2, 
In [8]: tokenizer = Tokenizer(num_words=6000, oov_token='<OOV>')
        tokenizer.fit_on_texts(X_train)
        X_train_seq = tokenizer.texts_to_sequences(X_train)
        X_test_seq = tokenizer.texts_to_sequences(X_test)
        X_train_pad = pad_sequences(X_train_seq, maxlen=500)
        X_test_pad = pad_sequences(X_test_seq, maxlen=500)
```

```
In [9]: # Optimized LSTM Model
        model = Sequential([
            Embedding(input_dim=6000, output_dim=128, input_length=500),
            SpatialDropout1D(0.3),
            Bidirectional(LSTM(64, return_sequences=True)),
            Dropout(0.4),
            Bidirectional(LSTM(32)),
            Dense(64, activation='relu'),
            Dropout(0.5),
            Dense(1, activation='sigmoid')
        ])

        model.compile(loss='binary_crossentropy', optimizer='adam', metrics=['accu
        early_stop = EarlyStopping(monitor='val_loss', patience=2, restore_best_we

        history = model.fit(X_train_pad, y_train, epochs=10, batch_size=64, valida
```

```
Epoch 1/10
G:\Anaconda\Lib\site-packages\keras\src\layers\core\embedding.py:97: UserWarn
Argument `input_length` is deprecated. Just remove it.
  warnings.warn(
72/72 ━━━━━━━━━━━━━━━━━━━━ 95s 1s/step - accuracy: 0.6403 - loss: 0.6455 -
val_accuracy: 0.8028 - val_loss: 0.4589
Epoch 2/10
72/72 ━━━━━━━━━━━━━━━━━━━━ 89s 1s/step - accuracy: 0.8727 - loss: 0.3258 -
val_accuracy: 0.8698 - val_loss: 0.3187
Epoch 3/10
72/72 ━━━━━━━━━━━━━━━━━━━━ 130s 1s/step - accuracy: 0.9427 - loss: 0.1690 -
val_accuracy: 0.8895 - val_loss: 0.2949
Epoch 4/10
72/72 ━━━━━━━━━━━━━━━━━━━━ 82s 1s/step - accuracy: 0.9869 - loss: 0.0576 -
val_accuracy: 0.8600 - val_loss: 0.3980
Epoch 5/10
72/72 ━━━━━━━━━━━━━━━━━━━━ 136s 1s/step - accuracy: 0.9908 - loss: 0.0387 -
val_accuracy: 0.8698 - val_loss: 0.4606
```

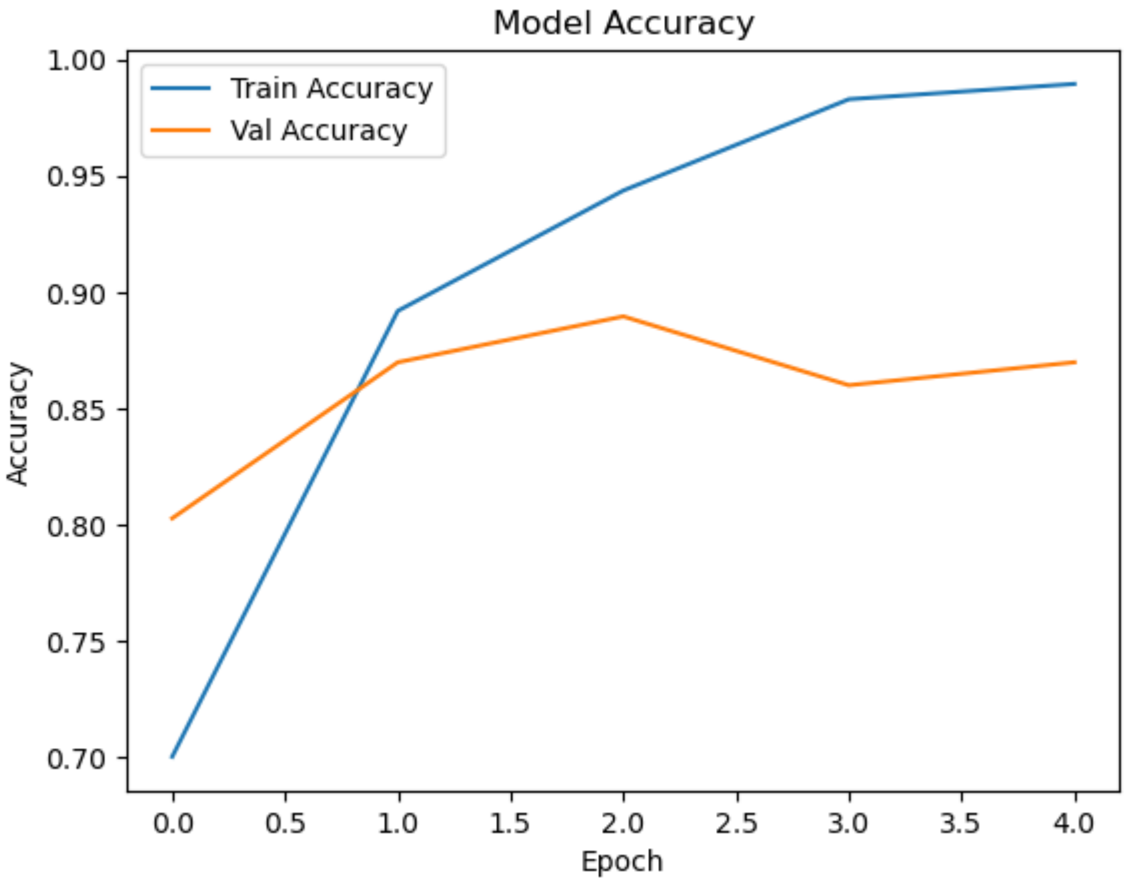
```
In [10]: # Model Evaluation
         y_pred_prob = model.predict(X_test_pad)
         y_pred = (y_pred_prob > 0.5).astype(int)
         print('Accuracy:', accuracy_score(y_test, y_pred))
         print(classification_report(y_test, y_pred, target_names=le.classes_))
```

```
40/40 ━━━━━━━━━━━━━━━━━━━━ 8s 179ms/step
Accuracy: 0.8997632202052092
              precision    recall  f1-score   support

        FAKE       0.91      0.88      0.90       628
        REAL       0.89      0.92      0.90       639

    accuracy                           0.90      1267
   macro avg       0.90      0.90      0.90      1267
weighted avg       0.90      0.90      0.90      1267
```

```
In [11]: # Accuracy Over Epochs
         plt.plot(history.history['accuracy'], label='Train Accuracy')
         plt.plot(history.history['val_accuracy'], label='Val Accuracy')
         plt.title('Model Accuracy')
         plt.xlabel('Epoch')
         plt.ylabel('Accuracy')
         plt.legend()
         plt.show()
```



In [12]:
```
from tensorflow.keras.preprocessing.sequence import pad_sequences

# Input news
X = "Karry to go to France in gesture of sympathy"

# Define padding and truncation types
padding_type = 'post'
trunc_type = 'post'

# Convert input to sequence
sequences = tokenizer.texts_to_sequences([X])
padded = pad_sequences(sequences, maxlen=500, padding=padding_type, trunca

# Predict using the model
prediction = model.predict(padded, verbose=0)[0][0]

# Interpret result
if prediction >= 0.5:
    print("This news is True (REAL)")
else:
    print("This news is False (FAKE)")
```

```
This news is False (FAKE)
```

Results

Accuracy: ~90% (based on evaluation in notebook).

Classification Report: Balanced precision, recall, and F1-scores for both Fake and Real labels.

Training Curve: Accuracy improved steadily, validation stabilized after early stopping.

Conclusion

The Bidirectional LSTM model effectively classifies Fake vs Real news with high accuracy. The p
demonstrates the potential of deep learning for fake news detection in NLP

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