In [1]:

```
#Import Libraries
```

In [2]:

```
!pip install tensorflow
```

```
Requirement already satisfied: tensorflow in c:\users\gayathri v\anaconda3\lib\site-packages (2.20.0)
Requirement already satisfied: absl-py>=1.0.0 in c:\users\gayathri v\anaconda3\lib\site-packages (from tensorflo
w) (2.3.1)
Requirement already satisfied: astunparse>=1.6.0 in c:\users\gayathri v\anaconda3\lib\site-packages (from tensor
flow) (1.6.3)
Requirement already satisfied: flatbuffers>=24.3.25 in c:\users\gayathri v\anaconda3\lib\site-packages (from ten
sorflow) (25.2.10)
Requirement already satisfied: gast!=0.5.0,!=0.5.1,!=0.5.2,>=0.2.1 in c:\users\gayathri v\anaconda3\lib\site-pac
kages (from tensorflow) (0.6.0)
Requirement already satisfied: google_pasta>=0.1.1 in c:\users\gayathri v\anaconda3\lib\site-packages (from tens
orflow) (0.2.0)
Requirement already satisfied: libclang>=13.0.0 in c:\users\gayathri v\anaconda3\lib\site-packages (from tensorf
low) (18.1.1)
Requirement already satisfied: opt_einsum>=2.3.2 in c:\users\gayathri v\anaconda3\lib\site-packages (from tensor
flow) (3.4.0)
Requirement already satisfied: packaging in c:\users\gayathri v\anaconda3\lib\site-packages (from tensorflow) (2
4.2)
Requirement already satisfied: protobuf>=5.28.0 in c:\users\gayathri v\anaconda3\lib\site-packages (from tensorf
low) (5.29.3)
Requirement already satisfied: requests<3,>=2.21.0 in c:\users\gayathri v\anaconda3\lib\site-packages (from tens
orflow) (2.32.3)
Requirement already satisfied: setuptools in c:\users\gayathri v\anaconda3\lib\site-packages (from tensorflow) (
72.1.0)
Requirement already satisfied: six>=1.12.0 in c:\users\gayathri v\anaconda3\lib\site-packages (from tensorflow)
(1.17.0)
Requirement already satisfied: termcolor>=1.1.0 in c:\users\gayathri v\anaconda3\lib\site-packages (from tensorf
low) (3.1.0)
Requirement already satisfied: typing_extensions>=3.6.6 in c:\users\gayathri v\anaconda3\lib\site-packages (from
tensorflow) (4.12.2)
Requirement already satisfied: wrapt>=1.11.0 in c:\users\gayathri v\anaconda3\lib\site-packages (from tensorflow
) (1.17.0)
Requirement already satisfied: grpcio<2.0,>=1.24.3 in c:\users\gayathri v\anaconda3\lib\site-packages (from tens
orflow) (1.75.0)
Requirement already satisfied: tensorboard~=2.20.0 in c:\users\gayathri v\anaconda3\lib\site-packages (from tens
orflow) (2.20.0)
Requirement already satisfied: keras>=3.10.0 in c:\users\gayathri v\anaconda3\lib\site-packages (from tensorflow
) (3.11.3)
Requirement already satisfied: numpy>=1.26.0 in c:\users\gayathri v\anaconda3\lib\site-packages (from tensorflow
) (2.1.3)
Requirement already satisfied: h5py>=3.11.0 in c:\users\gayathri v\anaconda3\lib\site-packages (from tensorflow)
(3.12.1)
Requirement already satisfied: ml_dtypes<1.0.0,>=0.5.1 in c:\users\gayathri v\anaconda3\lib\site-packages (from
tensorflow) (0.5.3)
Requirement already satisfied: charset-normalizer<4,>=2 in c:\users\gayathri v\anaconda3\lib\site-packages (from
requests<3,>=2.21.0->tensorflow) (3.3.2)
Requirement already satisfied: idna<4,>=2.5 in c:\users\gayathri v\anaconda3\lib\site-packages (from requests<3,
>=2.21.0->tensorflow) (3.7)
Requirement already satisfied: urllib3<3,>=1.21.1 in c:\users\gayathri v\anaconda3\lib\site-packages (from reque
sts<3,>=2.21.0->tensorflow) (2.3.0)
Requirement already satisfied: certifi>=2017.4.17 in c:\users\gayathri v\anaconda3\lib\site-packages (from reque
sts<3,>=2.21.0->tensorflow) (2025.4.26)
Requirement already satisfied: markdown>=2.6.8 in c:\users\gayathri v\anaconda3\lib\site-packages (from tensorbo
ard~=2.20.0->tensorflow) (3.8)
Requirement already satisfied: pillow in c:\users\gayathri v\anaconda3\lib\site-packages (from tensorboard~=2.20
.0->tensorflow) (11.1.0)
Requirement already satisfied: tensorboard-data-server<0.8.0,>=0.7.0 in c:\users\gayathri v\anaconda3\lib\site-p
ackages (from tensorboard~=2.20.0->tensorflow) (0.7.2)
Requirement already satisfied: werkzeug>=1.0.1 in c:\users\gayathri v\anaconda3\lib\site-packages (from tensorbo
ard~=2.20.0->tensorflow) (3.1.3)
Requirement already satisfied: wheel<1.0,>=0.23.0 in c:\users\gayathri v\anaconda3\lib\site-packages (from astun
parse>=1.6.0->tensorflow) (0.45.1)
Requirement already satisfied: rich in c:\users\gayathri v\anaconda3\lib\site-packages (from keras>=3.10.0->tens
orflow) (13.9.4)
Requirement already satisfied: namex in c:\users\gayathri v\anaconda3\lib\site-packages (from keras>=3.10.0->ten
sorflow) (0.1.0)
Requirement already satisfied: optree in c:\users\gayathri v\anaconda3\lib\site-packages (from keras>=3.10.0->te
nsorflow) (0.17.0)
Requirement already satisfied: MarkupSafe>=2.1.1 in c:\users\gayathri v\anaconda3\lib\site-packages (from werkze
ug>=1.0.1->tensorboard~=2.20.0->tensorflow) (3.0.2)
Requirement already satisfied: markdown-it-py>=2.2.0 in c:\users\gayathri v\anaconda3\lib\site-packages (from ri
ch->keras>=3.10.0->tensorflow) (2.2.0)
Requirement already satisfied: pygments<3.0.0,>=2.13.0 in c:\users\gayathri v\anaconda3\lib\site-packages (from
rich->keras>=3.10.0->tensorflow) (2.19.1)
Requirement already satisfied: mdurl~=0.1 in c:\users\gayathri v\anaconda3\lib\site-packages (from markdown-it-p
y>=2.2.0->rich->keras>=3.10.0->tensorflow) (0.1.0)
```

In [3]:

```
import numpy as np
import pandas as pd
import matplotlib.pyplot as plt
import re
import nltk

from sklearn.model_selection import train_test_split
from sklearn.metrics import classification_report, confusion_matrix

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
```

In [4]:

```
#Load Dataset
```

In [5]:

```
fake = pd.read_csv("Fake.csv")
true = pd.read_csv("True.csv")
```

In [6]:

```
# Add labels
```

In [7]:

```
fake['label'] = 1
true['label'] = 0
```

In [8]:

```
# Combine datasets
```

In [9]:

```
df = pd.concat([fake, true], axis=0).reset_index(drop=True)
print(df.shape)
print(df.head())
```

```
(44898, 5)
                                               title  \
0   Donald Trump Sends Out Embarrassing New Year’...
1   Drunk Bragging Trump Staffer Started Russian ...
2   Sheriff David Clarke Becomes An Internet Joke...
3   Trump Is So Obsessed He Even Has Obama’s Name...
4   Pope Francis Just Called Out Donald Trump Dur...

                                                text subject  \
0  Donald Trump just couldn t wish all Americans ...    News
1  House Intelligence Committee Chairman Devin Nu...    News
2  On Friday, it was revealed that former Milwauk...    News
3  On Christmas day, Donald Trump announced that ...    News
4  Pope Francis used his annual Christmas Day mes...    News

                date  label
0  December 31, 2017      1
1  December 31, 2017      1
2  December 30, 2017      1
3  December 29, 2017      1
4  December 25, 2017      1
```

In [10]:

```
# Preprocessing Dataset
```

In [11]:

```
def clean_text(text):
    text = re.sub(r'[^a-zA-Z]', ' ', text)  # Remove special characters and numbers
    text = text.lower()                     # Convert to lowercase
    text = text.split()                     # Tokenize by whitespace
    return " ".join(text)                   # Rejoin into cleaned string

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

In [12]:

```
# Data Encoding
```

In [13]:

```
X = df['clean_text'].values
y = df['label'].values
```

In [16]:

```
#  Variables Setup
```

In [17]:

```
max_words = 10000  # vocab size
max_len = 100      # max length of sequences
```

In [18]:

```
# Tokenization
```

In [19]:

```
tokenizer = Tokenizer(num_words=max_words, split=' ')
tokenizer.fit_on_texts(X)

X_seq = tokenizer.texts_to_sequences(X)
X_pad = pad_sequences(X_seq, maxlen=max_len)
```

In [20]:

```
# Splitting Data for Training and Testing
```

In [21]:
```
X_train, X_test, y_train, y_test = train_test_split(
    X_pad, y, test_size=0.2, random_state=42
)
```

In [22]:
```
# Test the Model & Training the Model (LSTM)
```

In [30]:
```
from tensorflow.keras.models import Sequential
from tensorflow.keras.layers import Embedding, LSTM, Dense, Dropout, Bidirectional
from tensorflow.keras.callbacks import EarlyStopping

# Define model
model = Sequential()
model.add(Embedding(max_words, 128))
model.add(Bidirectional(LSTM(128, dropout=0.3, recurrent_dropout=0.3)))
model.add(Dense(64, activation='relu'))
model.add(Dropout(0.5))
model.add(Dense(1, activation='sigmoid'))

# Compile
model.compile(loss='binary_crossentropy', optimizer='adam', metrics=['accuracy'])

# Build model so summary works
model.build(input_shape=(None, max_len))

# Print model summary
model.summary()

# Early stopping (example)
early_stop = EarlyStopping(monitor='val_loss', patience=2, restore_best_weights=True)

# Dummy data for example (replace with your preprocessed dataset)
X_train = np.random.randint(1, max_words, size=(1000, max_len))
y_train = np.random.randint(0, 2, size=(1000,))
X_test = np.random.randint(1, max_words, size=(200, max_len))
y_test = np.random.randint(0, 2, size=(200,))

# Train
history = model.fit(
    X_train, y_train,
    epochs=5,
    batch_size=32,
    validation_data=(X_test, y_test),
    callbacks=[early_stop],
    verbose=1
)
```

Model: "sequential_6"

Layer (type)	**Output Shape**	**Param #**
embedding_6 (Embedding)	(None, 100, 128)	1,280,000
bidirectional_6 (Bidirectional)	(None, 256)	263,168
dense_12 (Dense)	(None, 64)	16,448
dropout_6 (Dropout)	(None, 64)	0
dense_13 (Dense)	(None, 1)	65

Total params: 1,559,681 (5.95 MB)

Trainable params: 1,559,681 (5.95 MB)

Non-trainable params: 0 (0.00 B)

```
Epoch 1/5
32/32 ━━━━━━━━━━━━━━━━━━━━ 15s 339ms/step - accuracy: 0.4730 - loss: 0.6941 - val_accuracy: 0.5300 - val_loss: 0
.6923
Epoch 2/5
32/32 ━━━━━━━━━━━━━━━━━━━━ 10s 303ms/step - accuracy: 0.7040 - loss: 0.6514 - val_accuracy: 0.5600 - val_loss: 0
.6895
Epoch 3/5
32/32 ━━━━━━━━━━━━━━━━━━━━ 10s 300ms/step - accuracy: 0.9480 - loss: 0.2797 - val_accuracy: 0.5150 - val_loss: 0
.9313
Epoch 4/5
32/32 ━━━━━━━━━━━━━━━━━━━━ 10s 301ms/step - accuracy: 0.9970 - loss: 0.0242 - val_accuracy: 0.5000 - val_loss: 1
.2387
```

In [31]:
```
# Sample Prediction
```

In [32]:
```
sample_text = ["Breaking news! The president resigns after scandal."]
seq = tokenizer.texts_to_sequences(sample_text)
padded = pad_sequences(seq, maxlen=max_len)
```

```
prediction = model.predict(padded)
print("Prediction:", "Fake News" if prediction > 0.5 else "Real News")
```

```
1/1 ━━━━━━━━━━━━━━━━━━━━ 2s 2s/step
Prediction: Real News
```

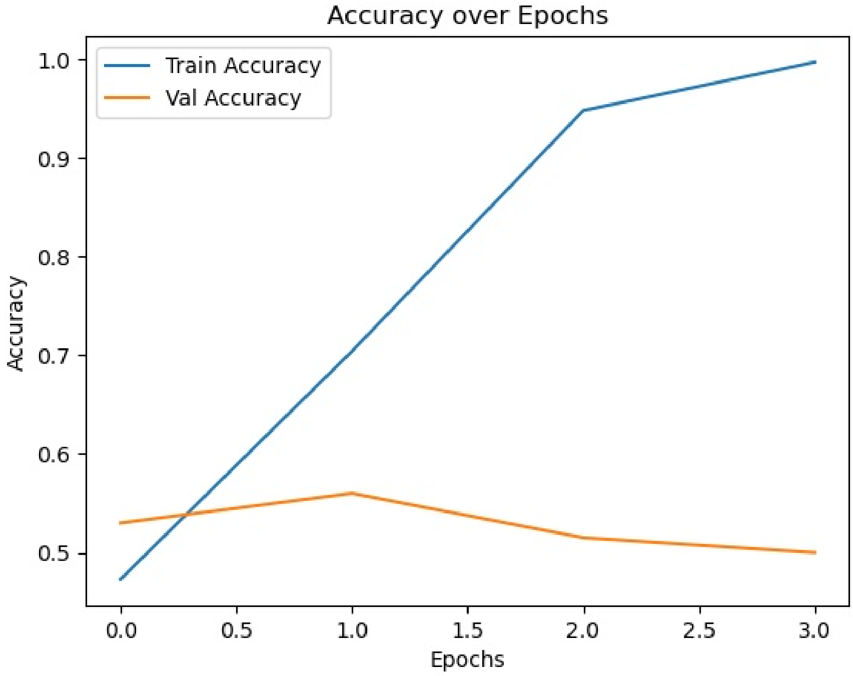
In [33]:

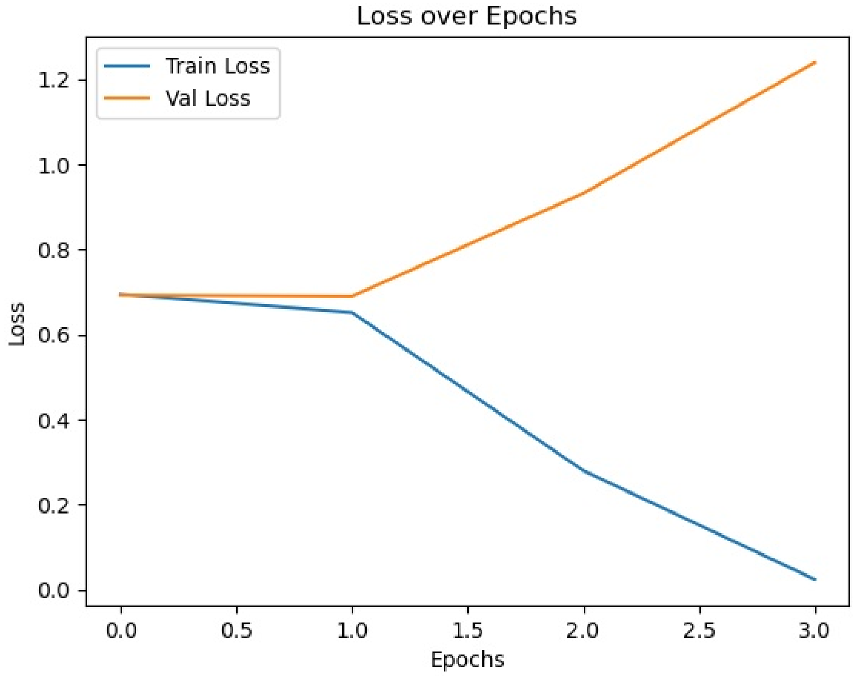
```
# Visualization for accuracy of fake news
```

In [34]:

```
plt.plot(history.history['accuracy'], label='Train Accuracy')
plt.plot(history.history['val_accuracy'], label='Val Accuracy')
plt.title('Accuracy over Epochs')
plt.xlabel('Epochs')
plt.ylabel('Accuracy')
plt.legend()
plt.show()

plt.plot(history.history['loss'], label='Train Loss')
plt.plot(history.history['val_loss'], label='Val Loss')
plt.title('Loss over Epochs')
plt.xlabel('Epochs')
plt.ylabel('Loss')
plt.legend()
plt.show()
```





In [35]:

```
 # Evaluation on Test Data
```

In [36]:

```
y_pred = (model.predict(X_test) > 0.5).astype("int32")
print("\nClassification Report:\n", classification_report(y_test, y_pred))
print("\nConfusion Matrix:\n", confusion_matrix(y_test, y_pred))
```

```
7/7 ━━━━━━━━━━━━━━━━━━━━ 2s 215ms/step

Classification Report:
               precision    recall  f1-score   support

           0       0.60      0.49      0.54       106
           1       0.53      0.64      0.58        94

    accuracy                           0.56       200
   macro avg       0.57      0.56      0.56       200
weighted avg       0.57      0.56      0.56       200


Confusion Matrix:
 [[52 54]
 [34 60]]
```