```
import numpy as np
import pandas as pd
import matplotlib.pyplot as plt
import tensorflow as tf
import seaborn as sns
import nltk
import re
import re,string,unicodedata
from nltk.corpus import stopwords

from keras.preprocessing.text import Tokenizer
from keras.preprocessing.sequence import pad_sequences
from keras.models import Sequential

import warnings
warnings.filterwarnings("ignore")

import pandas as pd
df = pd.read_json("Sarcasm_Headlines_Dataset_v2.json", lines=True)
df.head()
```

```
   is_sarcastic                                           headline  \
0             1  thirtysomething scientists unveil doomsday clo...
1             0  dem rep. totally nails why congress is falling...
2             0  eat your veggies: 9 deliciously different recipes
3             1  inclement weather prevents liar from getting t...
4             1  mother comes pretty close to using word 'strea...

                                        article_link
0  https://www.theonion.com/thirtysomething-scien...
1  https://www.huffingtonpost.com/entry/donna-edw...
2  https://www.huffingtonpost.com/entry/eat-your-...
3  https://local.theonion.com/inclement-weather-p...
4  https://www.theonion.com/mother-comes-pretty-c...
```

```
df.head()
```

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4  https://www.theonion.com/mother-comes-pretty-c...
```

```
df.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 28619 entries, 0 to 28618
Data columns (total 3 columns):
 #   Column        Non-Null Count  Dtype 
---  ------        --------------  ----- 
 0   is_sarcastic  28619 non-null  int64 
 1   headline      28619 non-null  object
 2   article_link  28619 non-null  object
dtypes: int64(1), object(2)
memory usage: 670.9+ KB
```

```
df.shape
```

```
(28619, 3)
```

```
#checking for null values in train data
df.isnull().sum()
```

```
is_sarcastic    0
headline        0
article_link    0
dtype: int64
```

```
df.describe(include='object')
```

```
                                                 headline  \
count                                               28619   
unique                                              28503   
top     'no way to prevent this,' says only nation whe...   
freq                                                   12   

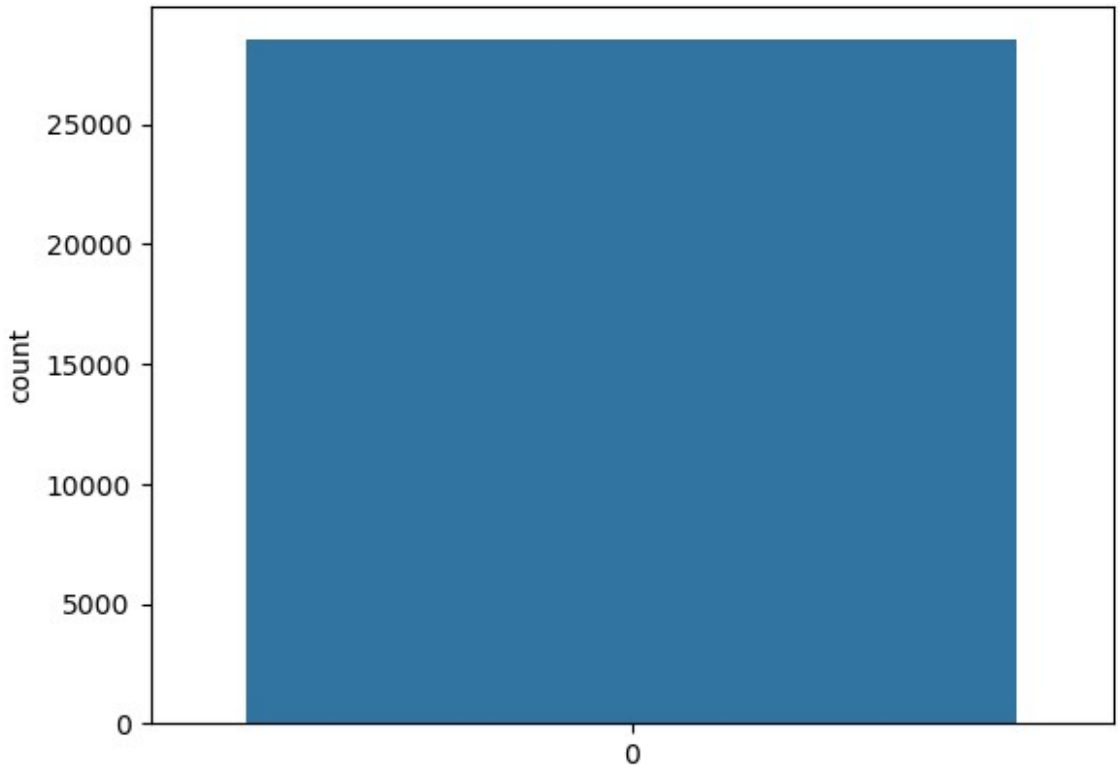
                                                article_link
count                                                28619
unique                                               28617
top     https://politics.theonion.com/nation-not-sure-...
freq                                                     2
```

```
#checking for duplicate values
df['headline'].duplicated().sum()
```

```
116
```

```
df=df.drop(df[df['headline'].duplicated()].index,axis=0)
```

```
sns.countplot(df['is_sarcastic']);
```




```
# this function is copied from another kernel. Don't know who is the
original author of it.
import nltk
nltk.download('stopwords')
stop = set(stopwords.words('english'))
punctuation = list(string.punctuation)
stop.update(punctuation)

#Removing the stopwords from text
def split_into_words(text):
    # split into words by white space
    words = text.split()
    return words

def to_lower_case(words):
    # convert to lower case
    words = [word.lower() for word in words]
    return words

def remove_punctuation(words):
    # prepare regex for char filtering
    re_punc = re.compile('[%s]' % re.escape(string.punctuation))
    # remove punctuation from each word
    stripped = [re_punc.sub('', w) for w in words]
    return stripped
```

```
def keep_alphabetic(words):
    # remove remaining tokens that are not alphabetic
    words = [word for word in words if word.isalpha()]
    return words

def remove_stopwords(words):
    # filter out stop words
    stop_words = set(stopwords.words('english'))
    words = [w for w in words if not w in stop_words]
    return words

def to_sentence(words):
    # join words to a sentence
    return ' '.join(words)

#Removing the noisy text
def denoise_text(text):
    words = split_into_words(text)
    words = to_lower_case(words)
    words = remove_punctuation(words)
    words = keep_alphabetic(words)
    words = remove_stopwords(words)
    return to_sentence(words)
```

```
[nltk_data] Downloading package stopwords to
[nltk_data]     C:\Users\Lenovo\AppData\Roaming\nltk_data...
[nltk_data]   Package stopwords is already up-to-date!
```

```
#Apply function on review column
df['headline']=df['headline'].apply(denoise_text)

labels = (df['is_sarcastic'])
data = (df['headline'])

train_ratio = 0.80

train_size = int(len(labels)*train_ratio)

train_data = data[:train_size]
train_labels= labels[:train_size]

test_data = data[train_size:]
test_labels = labels[train_size:]

tokenizer = Tokenizer(oov_token='<OOV>')
tokenizer.fit_on_texts(train_data)

vocab_size = len(tokenizer.word_index)
print(vocab_size)
```

```
train_sequences = tokenizer.texts_to_sequences(train_data)
test_sequences = tokenizer.texts_to_sequences(test_data)
```

```
25662
```

```
maxlen=max([len(i) for i in train_sequences])

train_padded = pad_sequences(train_sequences, maxlen=maxlen,
padding='post')
test_padded = pad_sequences(test_sequences, maxlen=maxlen,
padding='post')

# Print a sample headline
index = 10
print(f'sample headline: {train_sequences[index]}')
print(f'padded sequence: {train_padded[index]} \n')

print(f'Original Sentence:  \n
{tokenizer.sequences_to_texts(train_sequences[index:index+1])} \n')

# Print dimensions of padded sequences
print(f'shape of padded sequences: {train_padded.shape}')
```

```
sample headline: [1972, 2572, 315, 3022, 943, 7]
padded sequence: [1972 2572  315 3022  943    7    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    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
    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    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]
```

```
Original Sentence:
 ['lesbian considered father indiana amazing one']
```

```
shape of padded sequences: (22802, 106)
```

```
model = tf.keras.Sequential([
    tf.keras.layers.Embedding(vocab_size+1,100,input_length=maxlen),
    tf.keras.layers.Bidirectional( tf.keras.layers.LSTM(128)),
    tf.keras.layers.Flatten(),
    tf.keras.layers.Dropout(0.50),
    tf.keras.layers.Dense(64,activation='relu'),
    tf.keras.layers.Dense(1,activation='sigmoid')
])
model.compile(optimizer='adam', loss='binary_crossentropy',
metrics=['accuracy'])
model.summary()
```

```
Model: "sequential"
_________________________________________________________________
 Layer (type)                Output Shape              Param #
=================================================================
 embedding (Embedding)       (None, 106, 100)          2566300

 bidirectional (Bidirection  (None, 256)               234496
 al)

 flatten (Flatten)           (None, 256)               0

 dropout (Dropout)           (None, 256)               0

 dense (Dense)               (None, 64)                16448

 dense_1 (Dense)             (None, 1)                 65

=================================================================
Total params: 2817309 (10.75 MB)
Trainable params: 2817309 (10.75 MB)
Non-trainable params: 0 (0.00 Byte)
_________________________________________________________________
```

```
history=model.fit(train_padded, np.array(train_labels),validation_data
= (test_padded,np.array(test_labels)) , epochs = 5 , verbose=2)

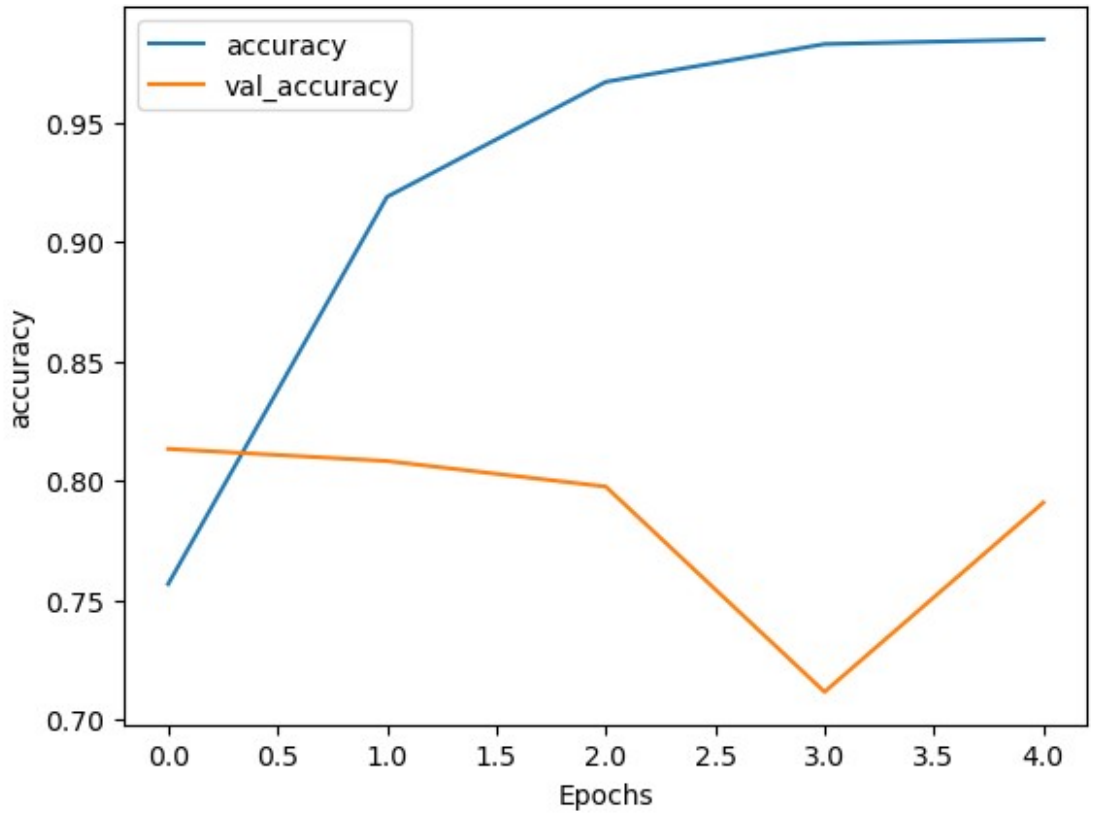
Epoch 1/5
713/713 - 262s - loss: 0.4810 - accuracy: 0.7566 - val_loss: 0.4027 -
val_accuracy: 0.8132 - 262s/epoch - 367ms/step
Epoch 2/5
713/713 - 255s - loss: 0.2079 - accuracy: 0.9187 - val_loss: 0.4597 -
val_accuracy: 0.8081 - 255s/epoch - 357ms/step
Epoch 3/5
713/713 - 323s - loss: 0.0899 - accuracy: 0.9668 - val_loss: 0.6117 -
val_accuracy: 0.7974 - 323s/epoch - 452ms/step
Epoch 4/5
713/713 - 329s - loss: 0.0665 - accuracy: 0.9827 - val_loss: 0.5877 -
val_accuracy: 0.7115 - 329s/epoch - 461ms/step
Epoch 5/5
713/713 - 307s - loss: 0.0448 - accuracy: 0.9847 - val_loss: 0.9116 -
val_accuracy: 0.7907 - 307s/epoch - 430ms/step
```

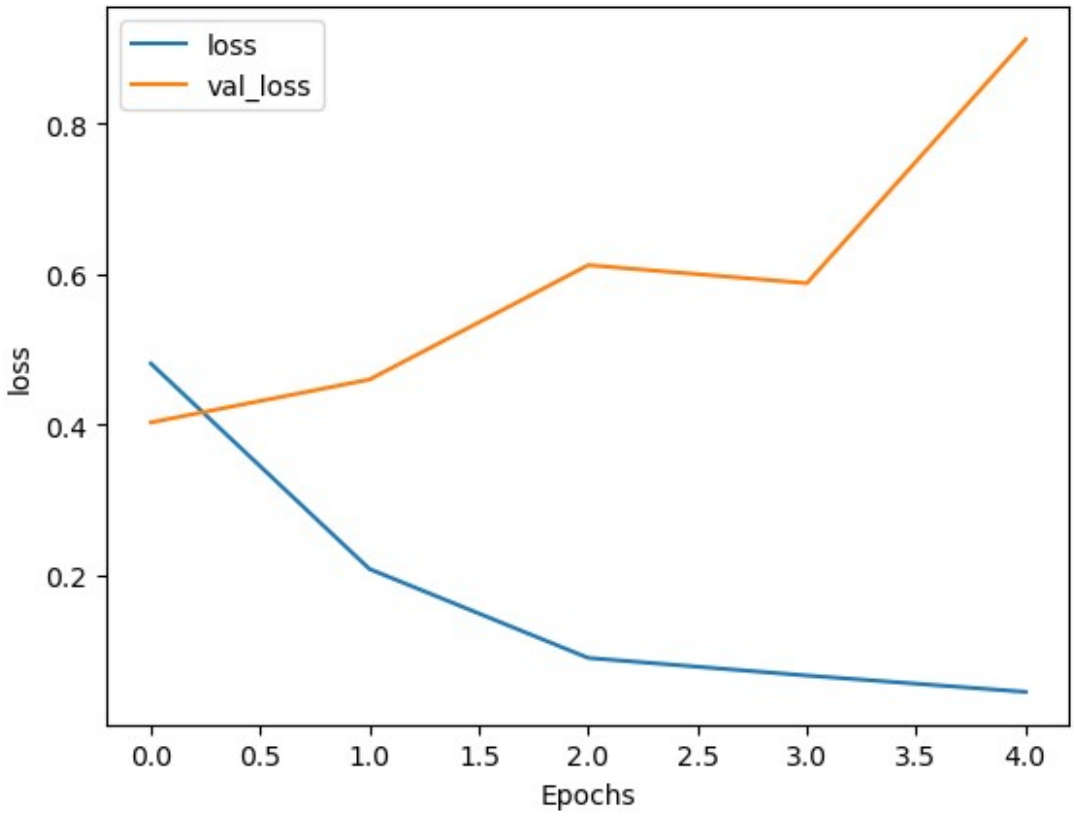
```
import matplotlib.pyplot as plt

# Plot utility
def plot_graphs(model, string):
  plt.plot(model.history[string])
  plt.plot(model.history['val_'+string])
  plt.xlabel("Epochs")
  plt.ylabel(string)
```

```
  plt.legend([string, 'val_'+string])
  plt.show()

# Plot the accuracy and loss
plot_graphs(history, "accuracy")
plot_graphs(history, "loss")
```




loss
val_loss
0.8
0.6
0.4
0.2
loss
0.0
0.5
1.0
1.5
2.0
2.5
3.0
3.5
4.0
Epochs