Getting Data

```
%%writefile kaggle.json
{"username":"rushikeshdarge","key":"********************************"}
```

```
Writing kaggle.json
```

```
! pip install kaggle
! mkdir ~/.kaggle
! cp kaggle.json ~/.kaggle/
! chmod 600 ~/.kaggle/kaggle.json
! kaggle competitions download -c learn-ai-bbc
! unzip /content/learn-ai-bbc.zip
```

```
Looking in indexes: https://pypi.org/simple, https://us-python.pkg.dev/colab-wheels/
Requirement already satisfied: kaggle in /usr/local/lib/python3.7/dist-packages (1.5
Requirement already satisfied: certifi in /usr/local/lib/python3.7/dist-packages (fr
Requirement already satisfied: urllib3 in /usr/local/lib/python3.7/dist-packages (fr
Requirement already satisfied: six>=1.10 in /usr/local/lib/python3.7/dist-packages (
Requirement already satisfied: requests in /usr/local/lib/python3.7/dist-packages (f
Requirement already satisfied: python-slugify in /usr/local/lib/python3.7/dist-packa
Requirement already satisfied: tqdm in /usr/local/lib/python3.7/dist-packages (from
Requirement already satisfied: python-dateutil in /usr/local/lib/python3.7/dist-pack
Requirement already satisfied: text-unidecode>=1.3 in /usr/local/lib/python3.7/dist-
Requirement already satisfied: idna<3,>=2.5 in /usr/local/lib/python3.7/dist-package
Requirement already satisfied: chardet<4,>=3.0.2 in /usr/local/lib/python3.7/dist-pa
Downloading learn-ai-bbc.zip to /content
  0% 0.00/1.85M [00:00<?, ?B/s]
100% 1.85M/1.85M [00:00<00:00, 143MB/s]
Archive:  /content/learn-ai-bbc.zip
  inflating: BBC News Sample Solution.csv
  inflating: BBC News Test.csv
  inflating: BBC News Train.csv
```

```
import pandas as pd
import numpy as np
import re
import seaborn as sns
import matplotlib.pyplot as plt
import warnings
warnings.filterwarnings("ignore")
```

Read Data

```
df = pd.read_csv('/content/BBC News Train.csv')
df.head()
```

	ArticleId	Text	Category
0	1833	worldcom ex-boss launches defence lawyers defe...	business
1	154	german business confidence slides german busin...	business
2	1101	bbc poll indicates economic gloom citizens in ...	business
3	1976	lifestyle governs mobile choice faster bett...	tech
4	917	enron bosses in $168m payout eighteen former e...	business

```
df.shape
```

```
(1490, 3)
```

```
df.Category.value_counts()
```

```
sport            346
business         336
politics         274
entertainment    273
tech             261
Name: Category, dtype: int64
```

```
df.isnull().sum()
```

```
ArticleId    0
Text         0
Category     0
dtype: int64
```

```
df.Text.sample(10)
```

```
730     russia wto talks  make progress  talks on russ...
438     pupils to get anti-piracy lessons lessons on m...
974     butler strikes gold in spain britain s kathy b...
1481    liverpool pledge to keep gerrard liverpool chi...
870     farrell due to make us tv debut actor colin fa...
509     virus poses as christmas e-mail security firms...
36      corry backs skipper robinson england forward m...
1314    rem concerts blighted by illness us rock band ...
1072    games maker fights for survival one of britain...
68      us state acts to stop  spammers  us state texa...
Name: Text, dtype: object
```

Pre-Processing

```
# ref : from reference notebook
def decontractions(phrase):
    """decontracted takes text and convert contractions into natural form.
     ref: https://stackoverflow.com/questions/19790188/expanding-english-language-con
    # specific
```

```
    phrase = re.sub(r"won\'t", "will not", phrase)
    phrase = re.sub(r"can\'t", "can not", phrase)
    phrase = re.sub(r"won\’t", "will not", phrase)
    phrase = re.sub(r"can\’t", "can not", phrase)

    # general
    phrase = re.sub(r"n\'t", " not", phrase)
    phrase = re.sub(r"\'re", " are", phrase)
    phrase = re.sub(r"\'s", " is", phrase)
    phrase = re.sub(r"\'d", " would", phrase)
    phrase = re.sub(r"\'ll", " will", phrase)
    phrase = re.sub(r"\'t", " not", phrase)
    phrase = re.sub(r"\'ve", " have", phrase)
    phrase = re.sub(r"\'m", " am", phrase)

    phrase = re.sub(r"n\’t", " not", phrase)
    phrase = re.sub(r"\’re", " are", phrase)
    phrase = re.sub(r"\’s", " is", phrase)
    phrase = re.sub(r"\’d", " would", phrase)
    phrase = re.sub(r"\’ll", " will", phrase)
    phrase = re.sub(r"\’t", " not", phrase)
    phrase = re.sub(r"\’ve", " have", phrase)
    phrase = re.sub(r"\’m", " am", phrase)

    return phrase

def preprocess(text):
    # convert all the text into lower letters
    text = text.lower()
    text = decontractions(text)
    text = re.sub('[^A-Za-z0-9 ]+', '', text)
    text = re.sub('-', ' ', text)
    return text

df['Text'] = df['Text'].apply(preprocess)
df.head()
```

	ArticleId	Text	Category
0	1833	worldcom exboss launches defence lawyers defen...	business
1	154	german business confidence slides german busin...	business
2	1101	bbc poll indicates economic gloom citizens in ...	business
3	1976	lifestyle governs mobile choice faster bett...	tech
4	917	enron bosses in 168m payout eighteen former en...	business

```
df = df[['Text', 'Category']]
df.head()
```

	Text	Category
0	worldcom exboss launches defence lawyers defen...	business
1	german business confidence slides german busin...	business
2	bbc poll indicates economic gloom citizens in ...	business

Prepare data for model

```
X = df.Text
y = df.Category
```

```
# split dataset
from sklearn.model_selection import train_test_split
X_train, X_test, y_train, y_test = train_test_split(X, y, test_size=0.10, random_stat
```

```
X_train.shape, X_test.shape, y_train.shape, y_test.shape
```

```
((1341,), (149,), (1341,), (149,))
```

```
from tensorflow.keras.preprocessing.text import Tokenizer
from tensorflow.keras.preprocessing.sequence import pad_sequences
```

```
token = Tokenizer(num_words=10000, oov_token='unk')
token.fit_on_texts(X_train.values)
data_xtrain = token.texts_to_sequences(X_train.values)
data_xtest = token.texts_to_sequences(X_test.values)
```

```
# saving tokenizer for deploying model
# ref : https://stackoverflow.com/a/45737582
import pickle

# saving
with open('tokenizer.pickle', 'wb') as handle:
    pickle.dump(token, handle, protocol=pickle.HIGHEST_PROTOCOL)

# # loading
# with open('tokenizer.pickle', 'rb') as handle:
#     token = pickle.load(handle)
```

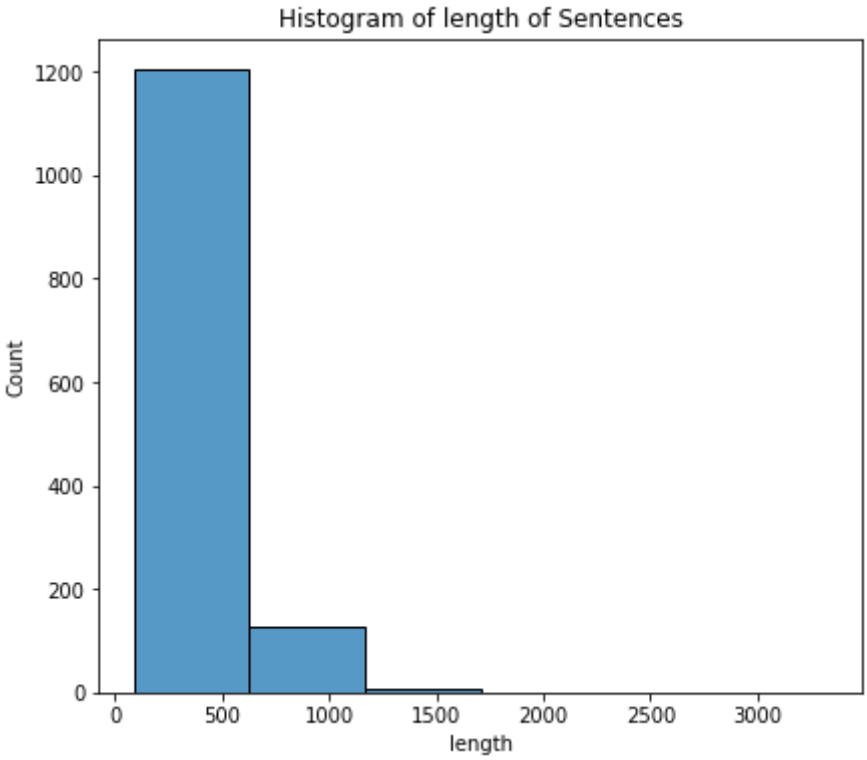
```
print('Number of unique words',len(token.word_index.keys()))
```

```
Number of unique words 26061
```

```
leng = [len(ele) for ele in data_xtrain]
plt.figure(figsize = (15,6))
plt.subplot(1,2,1)
```

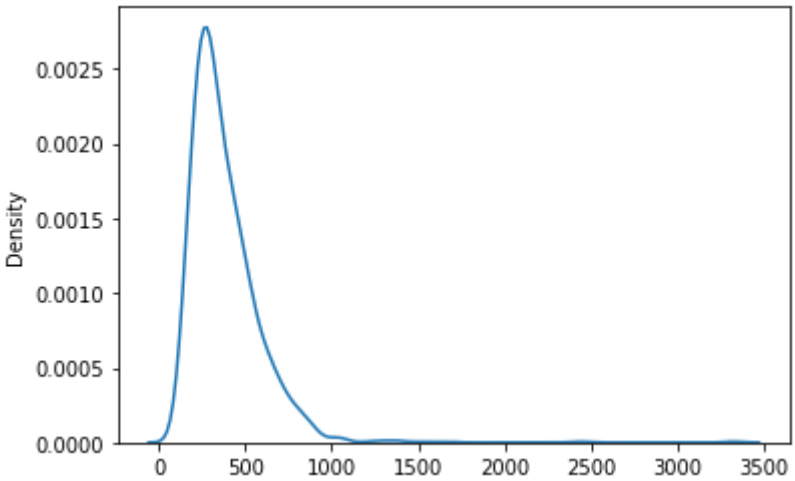
```
sns.histplot(leng, bins=6)
plt.title("Histogram of length of Sentences")
plt.xlabel("length")
```

```
Text(0.5, 0, 'length')
```




```
sns.kdeplot(leng)
```

```
<matplotlib.axes._subplots.AxesSubplot at 0x7f865bbe7250>
```




```
for i in np.arange(0.1,1.1,0.1):
    print('{0} Quantile is {1}'.format(int(i*100),np.quantile(leng, i)))
```

```
10 Quantile is 192.0
20 Quantile is 232.0
30 Quantile is 264.0
40 Quantile is 298.0
50 Quantile is 331.0
60 Quantile is 384.0
70 Quantile is 435.0000000000001
80 Quantile is 507.0
```

```
90 Quantile is 630.0
100 Quantile is 3324.0
```

- We take 80 Quantile as words which is 507 we round up and take 500

```
max_len = 500
# padding
data_xtrain_pad = pad_sequences(data_xtrain, maxlen=max_len, padding='post', dtype='i
data_xtest_pad = pad_sequences(data_xtest, maxlen=max_len, padding='post', dtype='int
```

```
data_xtrain_pad.shape
```

```
(1341, 500)
```

```
index = 50
print('text: ',X_train[0][:index])
print('\n text to num: ',data_xtrain[0][:index])
print('\n num to padded: ',data_xtrain_pad[0][:index])
```

```
text:  worldcom exboss launches defence lawyers defending

 text to num:  [1160, 1139, 1003, 3, 5929, 2, 1160, 1139, 23, 329, 7, 677, 5930, 41,

 num to padded:  [1278 2582  717  752  149   27  786  319  298    3 3315  161   74
  139 5935    5 4675    1 1536   27   70 2206    6  983 1098 3883   27
  181   11  158  319  148    5  468  143  139    1    6 1160 1139   83
  744   48 8281    3 5486    4 7271   64]
```

Model Building

```
from tensorflow.keras.layers import Embedding, LSTM, Input, Dense, Activation, Dropou
from tensorflow.keras.utils import to_categorical
from tensorflow.keras.callbacks import EarlyStopping
from tensorflow.keras.models import Model
```

```
from sklearn.preprocessing import LabelEncoder
lenc = LabelEncoder()
y_train_class = lenc.fit_transform(y_train)
y_test_class = lenc.transform(y_test)

y_train_class = to_categorical(y_train_class, num_classes=5)
```

```
data_xtrain_pad.shape
```

```
(1341, 500)
```

```
embed_input = len(token.word_index.keys()) + 1
```

```
# train acc = 41 te = 35
input = Input(shape=(max_len,))
embed = Embedding(embed_input, 128)(input)
lstm1 = LSTM(100, return_sequences=True, return_state=False)(embed)
lstm2 = LSTM(50, dropout=0.2)(lstm1)
dense1 = Dense(50)(lstm2)
drop1 = Dropout(0.3)(dense1)
dense2 = Dense(24)(drop1)
dense3 = Dense(5, activation='softmax')(dense2)

model = Model(inputs=input, outputs=dense3)
```

```
model.summary()
```

```
Model: "model_4"
_________________________________________________________________
 Layer (type)                Output Shape              Param #
=================================================================
 input_5 (InputLayer)        [(None, 500)]             0

 embedding_4 (Embedding)     (None, 500, 128)          3335936

 lstm_7 (LSTM)               (None, 500, 100)          91600

 lstm_8 (LSTM)               (None, 50)                30200

 dense_10 (Dense)            (None, 50)                2550

 dropout_3 (Dropout)         (None, 50)                0

 dense_11 (Dense)            (None, 24)                1224

 dense_12 (Dense)            (None, 5)                 125

=================================================================
Total params: 3,461,635
Trainable params: 3,461,635
Non-trainable params: 0
_________________________________________________________________
```

```
model.compile(optimizer='adam', loss='categorical_crossentropy', metrics=['accuracy']
callback = EarlyStopping(monitor='val_accuracy', verbose=1, patience=3)

history = model.fit(data_xtrain_pad, y_train_class, validation_split=0.1, epochs=70,
```

```
38/38 [==============================] - 2s 42ms/step - loss: 1.1458 - accuracy: 0
Epoch 43/70
38/38 [==============================] - 2s 42ms/step - loss: 1.1183 - accuracy: 0
Epoch 44/70
38/38 [==============================] - 2s 41ms/step - loss: 1.1495 - accuracy: 0
Epoch 45/70
38/38 [==============================] - 2s 42ms/step - loss: 1.0705 - accuracy: 0
Epoch 46/70
38/38 [==============================] - 2s 42ms/step - loss: 1.0093 - accuracy: 0
Epoch 47/70
```

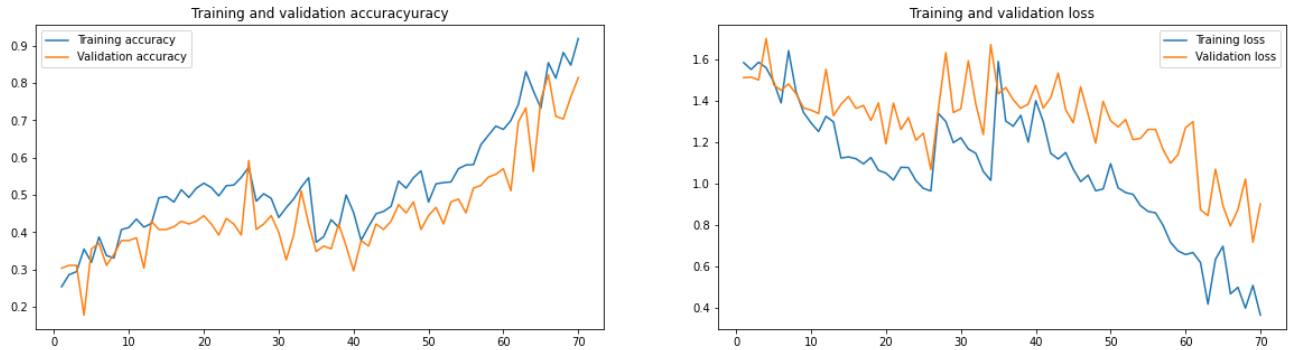
```
38/38 [==============================] - 2s 42ms/step - loss: 1.0405 - accuracy: 0
Epoch 48/70
38/38 [==============================] - 2s 43ms/step - loss: 0.9653 - accuracy: 0
Epoch 49/70
38/38 [==============================] - 2s 42ms/step - loss: 0.9737 - accuracy: 0
Epoch 50/70
38/38 [==============================] - 2s 42ms/step - loss: 1.0960 - accuracy: 0
Epoch 51/70
38/38 [==============================] - 2s 42ms/step - loss: 0.9791 - accuracy: 0
Epoch 52/70
38/38 [==============================] - 2s 42ms/step - loss: 0.9565 - accuracy: 0
Epoch 53/70
38/38 [==============================] - 2s 42ms/step - loss: 0.9478 - accuracy: 0
Epoch 54/70
38/38 [==============================] - 2s 42ms/step - loss: 0.8929 - accuracy: 0
Epoch 55/70
38/38 [==============================] - 2s 42ms/step - loss: 0.8658 - accuracy: 0
Epoch 56/70
38/38 [==============================] - 2s 42ms/step - loss: 0.8585 - accuracy: 0
Epoch 57/70
38/38 [==============================] - 2s 42ms/step - loss: 0.7988 - accuracy: 0
Epoch 58/70
38/38 [==============================] - 2s 42ms/step - loss: 0.7167 - accuracy: 0
Epoch 59/70
38/38 [==============================] - 2s 41ms/step - loss: 0.6753 - accuracy: 0
Epoch 60/70
38/38 [==============================] - 2s 42ms/step - loss: 0.6580 - accuracy: 0
Epoch 61/70
38/38 [==============================] - 2s 43ms/step - loss: 0.6671 - accuracy: 0
Epoch 62/70
38/38 [==============================] - 2s 42ms/step - loss: 0.6197 - accuracy: 0
Epoch 63/70
38/38 [==============================] - 2s 42ms/step - loss: 0.4188 - accuracy: 0
Epoch 64/70
38/38 [==============================] - 2s 43ms/step - loss: 0.6347 - accuracy: 0
Epoch 65/70
38/38 [==============================] - 2s 42ms/step - loss: 0.6978 - accuracy: 0
Epoch 66/70
38/38 [==============================] - 2s 42ms/step - loss: 0.4682 - accuracy: 0
Epoch 67/70
38/38 [==============================] - 2s 42ms/step - loss: 0.5000 - accuracy: 0
Epoch 68/70
38/38 [==============================] - 2s 43ms/step - loss: 0.3995 - accuracy: 0
Epoch 69/70
38/38 [==============================] - 2s 42ms/step - loss: 0.5090 - accuracy: 0
Epoch 70/70
38/38 [==============================] - 2s 44ms/step - loss: 0.3660 - accuracy: 0
```

```
model.save('news_model.h5')
```

Testing performance of model

```
import matplotlib.pyplot as plt

```

```
accuracy = history.history['accuracy']
val_accuracy = history.history['val_accuracy']
loss = history.history['loss']
val_loss = history.history['val_loss']

epochs = range(1, len(accuracy) + 1)

plt.figure(figsize=(20,5))
plt.subplot(121)
sns.lineplot(epochs, accuracy, label='Training accuracy')
sns.lineplot(epochs, val_accuracy, label='Validation accuracy')
plt.title('Training and validation accuracyuracy')
plt.legend()


plt.subplot(122)
sns.lineplot(epochs, loss, label='Training loss')
sns.lineplot(epochs, val_loss, label='Validation loss')
plt.title('Training and validation loss')
plt.legend()

plt.show()
```




```
y_true = lenc.transform(y_test)
y_pred = model.predict(data_xtest_pad)
y_pred = np.argmax(y_pred,axis=1)
```

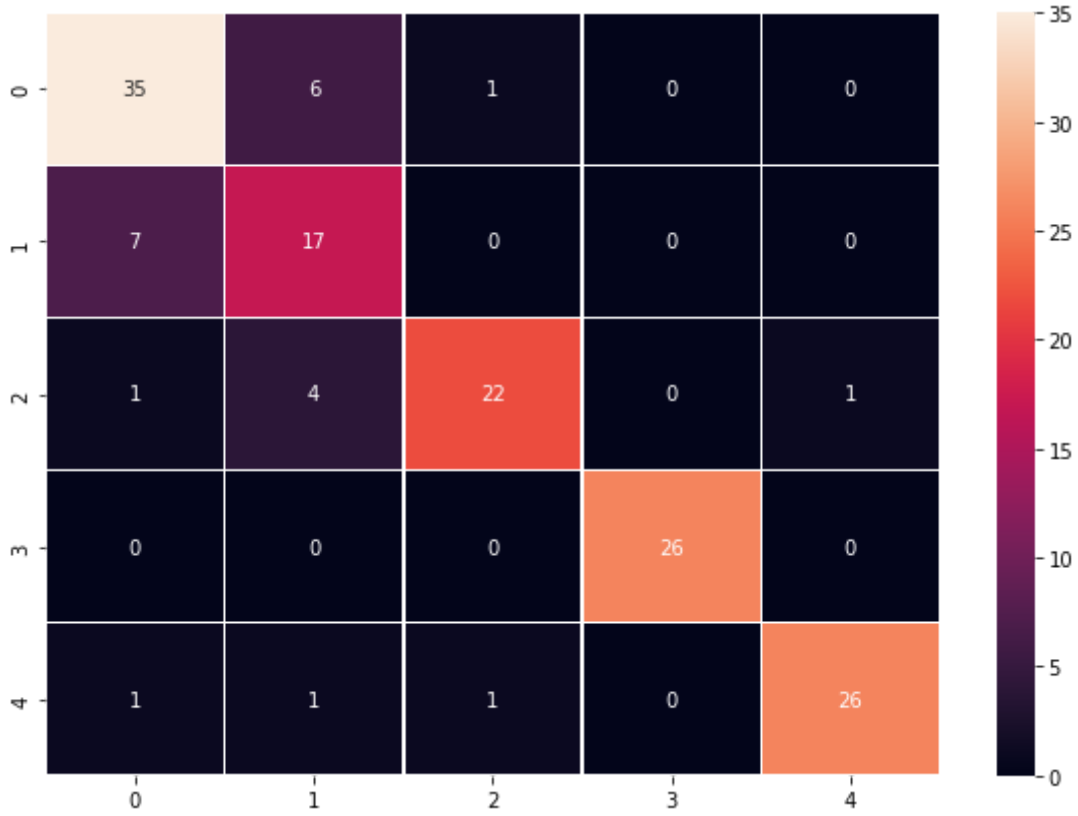
```
from sklearn.metrics import classification_report, confusion_matrix
target_names = lenc.classes_
print(classification_report(y_true, y_pred, target_names=target_names))
```

```
              precision    recall  f1-score   support

    business       0.80      0.83      0.81        42
entertainment       0.61      0.71      0.65        24
    politics       0.92      0.79      0.85        28
       sport       1.00      1.00      1.00        26
        tech       0.96      0.90      0.93        29

    accuracy                           0.85       149
   macro avg       0.86      0.84      0.85       149
```

```
weighted avg       0.86      0.85      0.85       149
```

```
plt.figure(figsize=(10,7))
sns.heatmap(confusion_matrix(y_true, y_pred), annot=True, linewidths=.5)
```

```
<matplotlib.axes._subplots.AxesSubplot at 0x7f85579d2fd0>
```



Pipeline

```
from tensorflow.keras.models import load_model
news_model = load_model('/content/news_model.h5')
```

```
# loading tokenizer
with open('tokenizer.pickle', 'rb') as handle:
    token = pickle.load(handle)
```

```
classes = ['business', 'entertainment', 'politics', 'sport', 'tech']
```

```
# ref : https://economictimes.indiatimes.com/markets/stocks/news/stocks-in-the-news-w
new_news = '''Wipro: The IT major reported a 21 per cent decline in its June quarter
NTPC: The state-owned power giant has inked a pact with Moroccan Agency for Sustainab
```

```
# apply preprocessing
new_news = preprocess(new_news)
# to create make suitable for model
```

```
new_news = new_news , '''news'''

# text to num
news_text = token.texts_to_sequences(new_news)
# padding
max_len = 500
news_text_pad = pad_sequences(news_text, maxlen=max_len, padding='post', dtype='int32
```

```
classes[np.argmax(news_model.predict(new_text_pad)[0])]
```

```
'business'
```

Future Work

- we have very less data we can increase the size of dataset and also we can add more categories

✓ 1s completed at 12:41 PM