4.Pretained GloVe with Bi-LSTM

November 4, 2020

Acknowledgements - https://www.kaggle.com/lakshmi25npathi/imdb-dataset-of-50k-movie-reviews/notebooks

[ ]:
```
from google.colab import drive
drive.mount('/content/gdrive')
```

```
Drive already mounted at /content/gdrive; to attempt to forcibly remount, call
drive.mount("/content/gdrive", force_remount=True).
```

[ ]:
```
import numpy as np # linear algebra
import pandas as pd # data processing, CSV file I/O
import seaborn as sns # data visualization
import matplotlib.pyplot as plt # data visualization
from nltk.corpus import stopwords # text preprocessing - stopwords
import re, string, unicodedata # text preprocessing - regular expressions,␣
 ↪string
from bs4 import BeautifulSoup # html processing
from wordcloud import WordCloud, STOPWORDS # visualizing word cloud from corpus␣
 ↪& ignoring stopwords
from collections import Counter # counter for most common words
from sklearn.feature_extraction.text import CountVectorizer # feature-oriented␣
 ↪counting of words
from sklearn.model_selection import train_test_split # splitting the dataset␣
 ↪into train & test sets
from keras.preprocessing import text, sequence # word tokenization
from keras.models import Sequential # class to construct the model
from keras.layers import Embedding, Bidirectional, LSTM, Dense, Dropout,␣
 ↪Flatten # RNN layers to be used
from keras.optimizers import Adam # optimizer to be used
from keras.callbacks import ReduceLROnPlateau # learning rate decay on plateau
```

[ ]:
```
!pip install -q kaggle
```

[ ]:
```
from google.colab import files
```

[ ]:
```
files.upload()
```

```
<IPython.core.display.HTML object>
```

```
Saving kaggle.json to kaggle (1).json
```

```
[ ]: {'kaggle.json':
     b'{"username":"nabhsanjaymehtautd","key":"ee0e2e2e8b50d345f23e44404b090088"}'}
```

```
[ ]: !mkdir ~/.kaggle/
```

```
mkdir: cannot create directory ‘/root/.kaggle/’: File exists
```

```
[ ]: !cp kaggle.json ~/.kaggle/
```

```
[ ]: !chmod 60 ~/.kaggle/kaggle.json
```

```
[ ]: !kaggle datasets list
```

```
Warning: Your Kaggle API key is readable by other users on this system! To fix
this, you can run 'chmod 600 /root/.kaggle/kaggle.json'
Warning: Looks like you're using an outdated API Version, please consider
updating (server 1.5.9 / client 1.5.4)
ref                                                         title
size  lastUpdated          downloadCount
----------------------------------------------------------
----------------------------------------------  -----  -------------------
-------------
terenceshin/covid19s-impact-on-airport-traffic              COVID-19's Impact on
Airport Traffic               106KB  2020-10-19 12:40:17           1885
sootersaalu/amazon-top-50-bestselling-books-2009-2019       Amazon Top 50
Bestselling Books 2009 - 2019         15KB  2020-10-13 09:39:21           1810
thomaskonstantin/highly-rated-children-books-and-stories    Highly Rated Children
Books And Stories             106KB  2020-10-24 12:09:59            379
tunguz/euro-parliament-proceedings-1996-2011                Euro Parliament
Proceedings 1996 - 2011              1GB  2020-10-26 17:48:29             26
rishidamarla/judicial-expenditures-across-all-50-states     Judicial Expenditures
across all 50 States           2KB  2020-10-25 00:07:45            235
docstein/brics-world-bank-indicators                        BRICS World Bank
Indicators                           4MB  2020-10-22 12:18:40            397
kanishk307/6000-indian-food-recipes-dataset                 6000+ Indian Food
Recipes Dataset                    9MB  2020-10-24 01:08:23            475
elvinagammed/chatbots-intent-recognition-dataset            Chatbots: Intent
Recognition Dataset                17KB  2020-10-23 07:44:59            196
omarhanyy/500-greatest-songs-of-all-time                    500 Greatest Songs of
All Time                      33KB  2020-10-26 13:36:09            484
balraj98/synthetic-objective-testing-set-sots-reside        Synthetic Objective
Testing Set (SOTS) [RESIDE]    415MB  2020-10-24 10:07:29             53
lunamcbride24/pokemon-type-matchup-data                     Pokemon Type Matchup
Data                           9KB  2020-10-14 18:56:23            288
```

```
gaurav2796/kaggle-competions-rankings-and-kernels         Kaggle Competions,
Rankings and Kernels            698KB  2020-10-15 04:05:15             37
balraj98/indoor-training-set-its-residestandard           Indoor Training Set
(ITS) [RESIDE-Standard]          5GB  2020-10-24 10:07:30             37
romazepa/moscow-schools-winners-of-educational-olympiads  Moscow schools -
winners of educational Olympiads    1MB  2020-10-12 21:45:01             58
sootersaalu/nigerian-songs-spotify                        Nigerian Songs Spotify
24KB  2020-10-25 19:10:23             68
salmaneunus/mechanical-tools-dataset                      Mechanical Tools
Classification Dataset           652MB  2020-11-01 11:28:22            178
thanatoz/hinglish-blogs                                   Hinglish blogs
2MB  2020-10-13 18:16:05             12
shivamb/netflix-shows                                     Netflix Movies and TV
Shows                         971KB  2020-01-20 07:33:56          53154
nehaprabhavalkar/indian-food-101                          Indian Food 101
7KB  2020-09-30 06:23:43           6057
heeraldedhia/groceries-dataset                            Groceries dataset
257KB  2020-09-17 04:36:08           6282
```

[ ]:
```
!kaggle competitions download -c transferlearning-dl-spring2020
```

```
Warning: Your Kaggle API key is readable by other users on this system! To fix
this, you can run 'chmod 600 /root/.kaggle/kaggle.json'
Warning: Looks like you're using an outdated API Version, please consider
updating (server 1.5.9 / client 1.5.4)
train.csv.zip: Skipping, found more recently modified local copy (use --force to
force download)
test.csv: Skipping, found more recently modified local copy (use --force to
force download)
sample_submission.csv: Skipping, found more recently modified local copy (use
--force to force download)
```

[ ]:
```
!unzip train.csv.zip -d train
```

```
Archive:  train.csv.zip
replace train/train.csv? [y]es, [n]o, [A]ll, [N]one, [r]ename: y
  inflating: train/train.csv
```

[ ]:
```
data = pd.read_csv('/content/train/train.csv', encoding = "ISO-8859-1")
testdata = pd.read_csv('/content/test.csv', encoding="ISO-8859-1")
```

[ ]:
```
data.head()
```

[ ]:

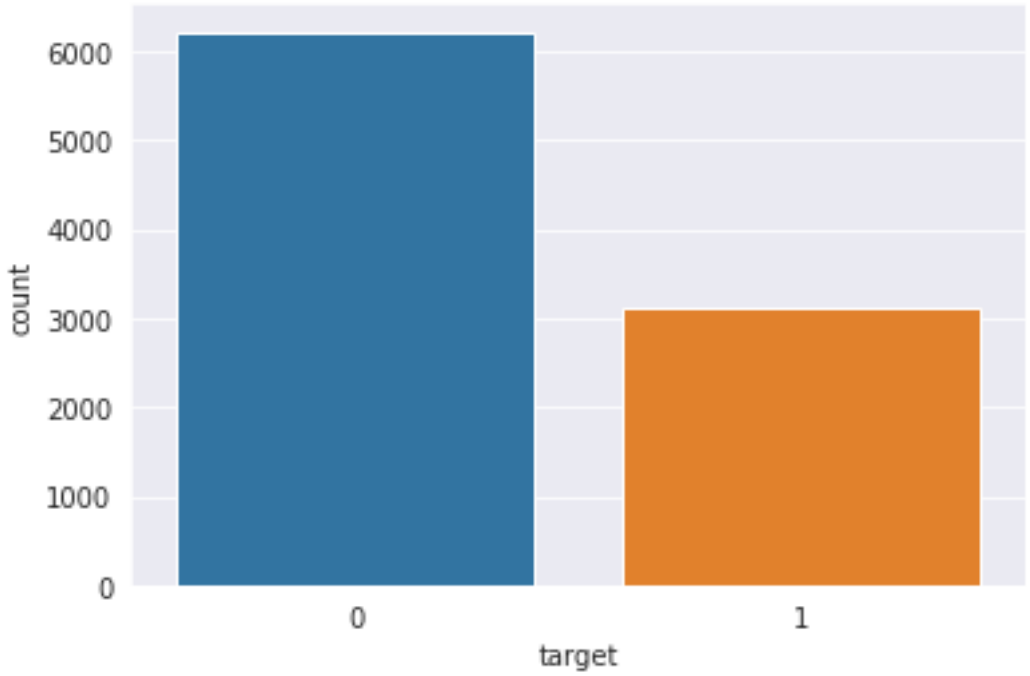
	id	text	target
0	86426	@USER She should ask a few native Americans wh…	1
1	16820	Amazon is investigating Chinese employees who …	0
2	62688	@USER Someone should'veTaken" this piece of sh…	1
3	43605	@USER @USER Obama wanted liberals & illega…	0

```
4  97670                  @USER Liberals are all Kookoo !!!       1
```

[ ]:
```
sns.set_style('darkgrid')
sns.countplot(data.target)
```

```
/usr/local/lib/python3.6/dist-packages/seaborn/_decorators.py:43: FutureWarning:
Pass the following variable as a keyword arg: x. From version 0.12, the only
valid positional argument will be `data`, and passing other arguments without an
explicit keyword will result in an error or misinterpretation.
  FutureWarning
```

[ ]:
```
<matplotlib.axes._subplots.AxesSubplot at 0x7f8768f4d630>
```



[ ]:
```
import nltk
nltk.download('stopwords')
```

```
[nltk_data] Downloading package stopwords to /root/nltk_data…
[nltk_data]   Package stopwords is already up-to-date!
```

[ ]:
```
True
```

[ ]:
```
stop = set(stopwords.words('english'))
punctuation = list(string.punctuation)
stop.update(punctuation)
```

[ ]:
```
def strip_html(text):
    soup = BeautifulSoup(text, "html.parser")
    return soup.get_text()

#Removing the square brackets
def remove_between_square_brackets(text):
    return re.sub('\[[^]]*\]', '', text)
# Removing URL's
def remove_between_square_brackets(text):
    return re.sub(r'http\S+', '', text)
#Removing the stopwords from text
def remove_stopwords(text):
    final_text = []
    for i in text.split():
        if i.strip().lower() not in stop and i.strip().lower().isalpha():
            final_text.append(i.strip().lower())
    return " ".join(final_text)
#Removing the noisy text
def denoise_text(text):
    text = strip_html(text)
    text = remove_between_square_brackets(text)
    text = remove_stopwords(text)
    return text
#Apply function on review column
data['text']=data['text'].apply(denoise_text)
```

[ ]:
```
data.head()
```

[ ]:

	id	text	target
0	86426	ask native americans take	1
1	16820	amazon investigating chinese employees selling…	0
2	62688	someone piece shit	1
3	43605	obama wanted liberals illegals move red states	0
4	97670	liberals kookoo	1

[ ]:
```
fig, (ax1, ax2) = plt.subplots(1,2, figsize=(12, 8))
text_len = data[data['target'] == 1]['text'].str.len()
ax1.set_title('Positive Reviews')
ax1.hist(text_len, color='green')
text_len = data[data['target'] == 0]['text'].str.len()
ax2.set_title('Negative Reviews')
ax2.hist(text_len, color='red')
fig.suptitle('Character Count in Reviews')
```

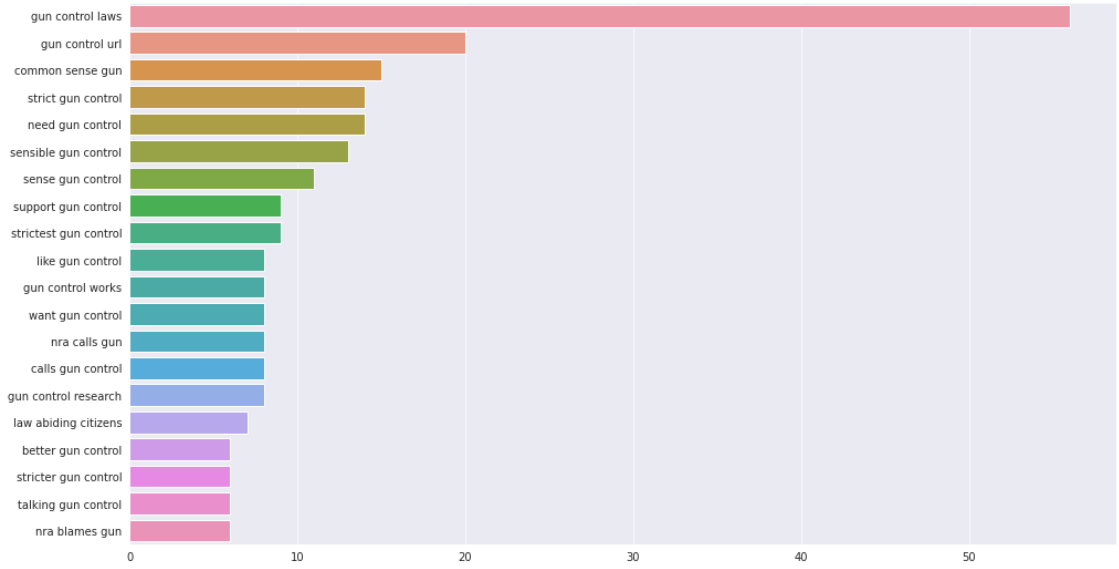
[ ]:
```
Text(0.5, 0.98, 'Character Count in Reviews')
```

[ ]:
```
def get_top_ngrams(corpus, n, g):

    vec = CountVectorizer(ngram_range=(g, g)).fit(corpus)
    bag_of_words = vec.transform(corpus)
    sum_words = bag_of_words.sum(axis=0)
    words_freq = [(word, sum_words[0, idx]) for word, idx in vec.vocabulary_.
↪items()]
    words_freq =sorted(words_freq, key = lambda x: x[1], reverse=True)
    return words_freq[:n]
```

[ ]:
```
plt.figure(figsize=(16, 9))
most_common_uni = dict(get_top_ngrams(data.text, 20, 3))
sns.barplot(x=list(most_common_uni.values()), y=list(most_common_uni.keys()))
```

[ ]:
```
<matplotlib.axes._subplots.AxesSubplot at 0x7f8737dfdef0>
```



[ ]:
```
X_train, X_test, y_train, y_test = train_test_split(data.text, data.target,
                                                    train_size=0.9,
                                                    random_state=0)
X_test_temp = X_test
y_test_temp = y_test
```

[ ]:
```
max_features = 10000
max_len = 128

tokenizer = text.Tokenizer(num_words=max_features)
tokenizer.fit_on_texts(X_train)

tokenized_train = tokenizer.texts_to_sequences(X_train)
X_train = sequence.pad_sequences(tokenized_train, maxlen=max_len)

tokenized_test = tokenizer.texts_to_sequences(X_test)
X_test = sequence.pad_sequences(tokenized_test, maxlen=max_len)
```

[ ]:
```
!wget http://nlp.stanford.edu/data/glove.6B.zip
```

```
--2020-11-03 20:37:41--  http://nlp.stanford.edu/data/glove.6B.zip
Resolving nlp.stanford.edu (nlp.stanford.edu)… 171.64.67.140
Connecting to nlp.stanford.edu (nlp.stanford.edu)|171.64.67.140|:80…
connected.
HTTP request sent, awaiting response… 302 Found
Location: https://nlp.stanford.edu/data/glove.6B.zip [following]
--2020-11-03 20:37:41--  https://nlp.stanford.edu/data/glove.6B.zip
Connecting to nlp.stanford.edu (nlp.stanford.edu)|171.64.67.140|:443…
```

```
connected.
HTTP request sent, awaiting response… 301 Moved Permanently
Location: http://downloads.cs.stanford.edu/nlp/data/glove.6B.zip [following]
--2020-11-03 20:37:41--  http://downloads.cs.stanford.edu/nlp/data/glove.6B.zip
Resolving downloads.cs.stanford.edu (downloads.cs.stanford.edu)… 171.64.64.22
Connecting to downloads.cs.stanford.edu
(downloads.cs.stanford.edu)|171.64.64.22|:80… connected.
HTTP request sent, awaiting response… 200 OK
Length: 862182613 (822M) [application/zip]
Saving to: ‘glove.6B.zip.2’

glove.6B.zip.2      100%[===================>] 822.24M  2.13MB/s    in 6m 32s

2020-11-03 20:44:13 (2.10 MB/s) - ‘glove.6B.zip.2’ saved [862182613/862182613]
```

[ ]:
```
!unzip glove*.zip
```

```
Archive:  glove.6B.zip
replace glove.6B.50d.txt? [y]es, [n]o, [A]ll, [N]one, [r]ename: y
  inflating: glove.6B.50d.txt
replace glove.6B.100d.txt? [y]es, [n]o, [A]ll, [N]one, [r]ename: y
  inflating: glove.6B.100d.txt
replace glove.6B.200d.txt? [y]es, [n]o, [A]ll, [N]one, [r]ename: y
  inflating: glove.6B.200d.txt
replace glove.6B.300d.txt? [y]es, [n]o, [A]ll, [N]one, [r]ename: y
  inflating: glove.6B.300d.txt
```

[ ]:
```
!ls
!pwd
```

```
 gdrive              glove.6B.50d.txt  'kaggle (1).json'        test.csv
 glove.6B.100d.txt   glove.6B.zip       kaggle.json             train
 glove.6B.200d.txt   glove.6B.zip.1     sample_data             train.csv.zip
 glove.6B.300d.txt   glove.6B.zip.2     sample_submission.csv
/content
```

[ ]:
```
EMBEDDING_FILE ="/content/glove.6B.300d.txt"
```

[ ]:
```
def get_coeffs(word, *arr):
    return word, np.asarray(arr, dtype='float32')
embeddings_dict = dict(get_coeffs(*o.rstrip().rsplit(' ')) for o in␣
 ↪open(EMBEDDING_FILE))
```

[ ]:
```
all_embs = np.stack(embeddings_dict.values())
emb_mean, emb_std = all_embs.mean(), all_embs.std()
embed_size = all_embs.shape[1]
```

```
word_index = tokenizer.word_index
num_words = min(max_features, len(word_index))

embedding_matrix = np.random.normal(emb_mean, emb_std, (num_words, embed_size))

for word, i in word_index.items():

    if i >= num_words: continue
    embedding_vector = embeddings_dict.get(word)
    if embedding_vector is not None: embedding_matrix[i] = embedding_vector
```

```
/usr/local/lib/python3.6/dist-packages/IPython/core/interactiveshell.py:2822:
FutureWarning: arrays to stack must be passed as a "sequence" type such as list
or tuple. Support for non-sequence iterables such as generators is deprecated as
of NumPy 1.16 and will raise an error in the future.
  if self.run_code(code, result):
```

[ ]:
```
batch_size = 256
epochs=10
embed_size=300
```

[ ]:
```
learning_rate_reduction = ReduceLROnPlateau(monitor='val_loss', patience=2,␣
↪verbose=1, factor=0.5, min_lr=0.00001)
```

[ ]:
```
from keras import backend as K
```

[ ]:
```
def f_score(y_true, y_pred, threshold=0.1, beta=2):

    tp = tp_score(y_true, y_pred, threshold)
    fp = fp_score(y_true, y_pred, threshold)
    fn = fn_score(y_true, y_pred, threshold)

    precision = tp / (tp + fp)
    recall = tp / (tp + fn)
    return (1+beta**2) * ((precision * recall) / ((beta**2)*precision + recall))
```

[ ]:
```
def tp_score(y_true, y_pred, threshold=0.1):

    tp_3d = K.concatenate(
        [
            K.cast(K.expand_dims(K.flatten(y_true)), 'bool'),
            K.cast(K.expand_dims(K.flatten(K.greater(y_pred, K.
↪constant(threshold)))), 'bool'),
            K.cast(K.ones_like(K.expand_dims(K.flatten(y_pred))), 'bool')
        ], axis=1
    )
```

```
    tp = K.sum(K.cast(K.all(tp_3d, axis=1), 'int32'))

    return tp


def fp_score(y_true, y_pred, threshold=0.1):

    fp_3d = K.concatenate(
        [
            K.cast(K.expand_dims(K.flatten(K.abs(y_true - K.
 ↪ones_like(y_true)))), 'bool'),
            K.cast(K.expand_dims(K.flatten(K.greater(y_pred, K.
 ↪constant(threshold)))), 'bool'),
            K.cast(K.ones_like(K.expand_dims(K.flatten(y_pred))), 'bool')
        ], axis=-1
    )

    fp = K.sum(K.cast(K.all(fp_3d, axis=1), 'int32'))

    return fp


def fn_score(y_true, y_pred, threshold=0.1):

    fn_3d = K.concatenate(
        [
            K.cast(K.expand_dims(K.flatten(y_true)), 'bool'),
            K.cast(K.expand_dims(K.flatten(K.abs(K.cast(K.greater(y_pred, K.
 ↪constant(threshold)), 'float') - K.ones_like(y_pred)))), 'bool'),
            K.cast(K.ones_like(K.expand_dims(K.flatten(y_pred))), 'bool')
        ], axis=1
    )

    fn = K.sum(K.cast(K.all(fn_3d, axis=1), 'int32'))

    return fn


def precision_score(y_true, y_pred, threshold=0.1):

    tp = tp_score(y_true, y_pred, threshold)
    fp = fp_score(y_true, y_pred, threshold)

    return tp / (tp + fp)


def recall_score(y_true, y_pred, threshold=0.1):
```

```
    tp = tp_score(y_true, y_pred, threshold)
    fn = fn_score(y_true, y_pred, threshold)

    return tp / (tp + fn)
```

[ ]:
```
model = Sequential()

model.add(Embedding(max_features, output_dim=embed_size,␣
 ↪weights=[embedding_matrix], input_length=max_len, trainable=False))
model.add(Bidirectional(LSTM(units=128)))
model.add(Dropout(rate=0.8))
model.add(Dense(units=16, activation='relu'))
model.add(Dense(units=1, activation='sigmoid'))

model.compile(optimizer=Adam(lr=0.002), loss='binary_crossentropy',
              metrics=f_score)
```

[ ]:
```
model.summary()
```

```
Model: "sequential"
_________________________________________________________________
Layer (type)                 Output Shape              Param #
=================================================================
embedding (Embedding)        (None, 128, 300)          3000000
_________________________________________________________________
bidirectional (Bidirectional (None, 256)               439296
_________________________________________________________________
dropout (Dropout)            (None, 256)               0
_________________________________________________________________
dense (Dense)                (None, 16)                4112
_________________________________________________________________
dense_1 (Dense)              (None, 1)                 17
=================================================================
Total params: 3,443,425
Trainable params: 443,425
Non-trainable params: 3,000,000
_________________________________________________________________
```

[ ]:
```
history = model.fit(X_train, y_train, epochs=epochs, batch_size=batch_size,␣
 ↪validation_data=(X_test, y_test), callbacks=[learning_rate_reduction])
```

```
Epoch 1/10
33/33 [==============================] - 2s 73ms/step - loss: 0.6321 - f_score:
0.7129 - val_loss: 0.5864 - val_f_score: 0.7172
Epoch 2/10
33/33 [==============================] - 2s 48ms/step - loss: 0.5678 - f_score:
```

```
0.7190 - val_loss: 0.5355 - val_f_score: 0.7180
Epoch 3/10
33/33 [==============================] - 2s 48ms/step - loss: 0.5366 - f_score:
0.7190 - val_loss: 0.5132 - val_f_score: 0.7203
Epoch 4/10
33/33 [==============================] - 2s 48ms/step - loss: 0.5190 - f_score:
0.7280 - val_loss: 0.5102 - val_f_score: 0.7290
Epoch 5/10
33/33 [==============================] - 2s 48ms/step - loss: 0.5085 - f_score:
0.7302 - val_loss: 0.5158 - val_f_score: 0.7342
Epoch 6/10
33/33 [==============================] - 2s 48ms/step - loss: 0.4942 - f_score:
0.7346 - val_loss: 0.5067 - val_f_score: 0.7297
Epoch 7/10
33/33 [==============================] - 2s 48ms/step - loss: 0.4860 - f_score:
0.7389 - val_loss: 0.5085 - val_f_score: 0.7313
Epoch 8/10
33/33 [==============================] - ETA: 0s - loss: 0.4653 - f_score:
0.7451
Epoch 00008: ReduceLROnPlateau reducing learning rate to 0.0010000000474974513.
33/33 [==============================] - 2s 48ms/step - loss: 0.4653 - f_score:
0.7451 - val_loss: 0.5075 - val_f_score: 0.7339
Epoch 9/10
33/33 [==============================] - 2s 48ms/step - loss: 0.4461 - f_score:
0.7519 - val_loss: 0.5250 - val_f_score: 0.7306
Epoch 10/10
33/33 [==============================] - ETA: 0s - loss: 0.4260 - f_score:
0.7619
Epoch 00010: ReduceLROnPlateau reducing learning rate to 0.0005000000237487257.
33/33 [==============================] - 2s 48ms/step - loss: 0.4260 - f_score:
0.7619 - val_loss: 0.5382 - val_f_score: 0.7306
```

[ ]:
```
print("Model Accuracy on Training Data: ", round(model.evaluate(X_train,␣
↪y_train)[1]*100), "%")
print("Model Accuraccy on Testing Data: ", round(model.evaluate(X_test,␣
↪y_test)[1]*100), "%")
```

```
263/263 [==============================] - 2s 8ms/step - loss: 0.3937 - f_score:
0.7533
Model Accuracy on Training Data:  75 %
30/30 [==============================] - 0s 7ms/step - loss: 0.5382 - f_score:
0.7171
Model Accuraccy on Testing Data:  72 %
```

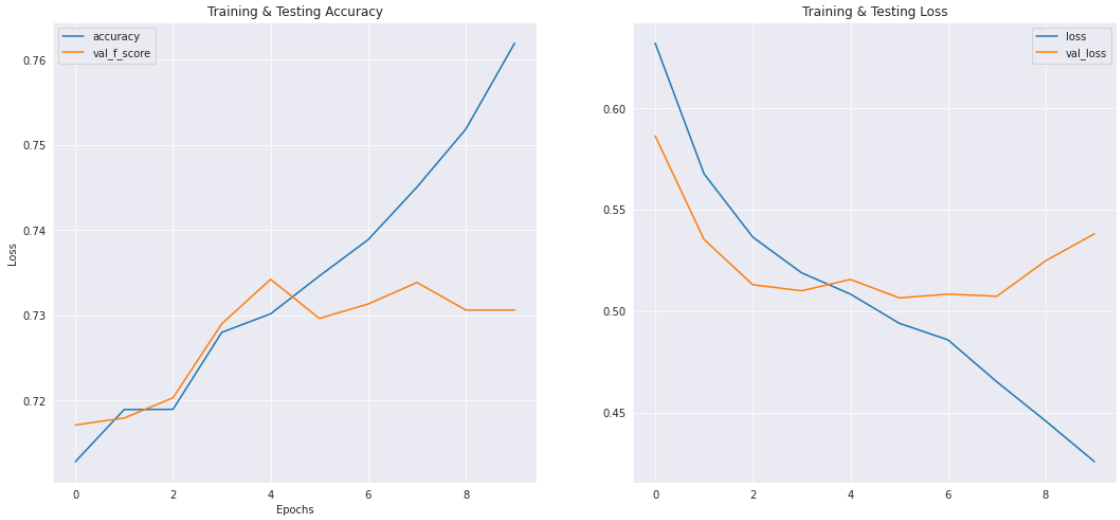
[ ]:
```
history.history
```

[ ]:
```
{'f_score': [0.7128528952598572,
  0.7189640998840332,
  0.7189900875091553,
  0.7280216217041016,
  0.7301872372627258,
  0.7346366047859192,
  0.7388955354690552,
  0.745067298412323,
  0.7518593072891235,
  0.7619423270225525],
 'loss': [0.632097601890564,
  0.5678114891052246,
  0.5365914106369019,
  0.5190249681472778,
  0.5085451006889343,
  0.49418380856513977,
  0.48599594831466675,
  0.46534425020217896,
  0.4460606575012207,
  0.4260425567626953],
 'lr': [0.002, 0.002, 0.002, 0.002, 0.002, 0.002, 0.002, 0.002, 0.001, 0.001],
 'val_f_score': [0.7171559929847717,
  0.7179653644561768,
  0.7203402519226074,
  0.729023814201355,
  0.7342402338981628,
  0.7296569347381592,
  0.7313453555107117,
  0.7338710427284241,
  0.7306410074234009,
  0.7306411862373352],
 'val_loss': [0.5863938331604004,
  0.5354620218276978,
  0.5131537318229675,
  0.5101721882820129,
  0.515751302242279,
  0.5066903233528137,
  0.5085200667381287,
  0.5074759721755981,
  0.5249583721160889,
  0.5382400751113892]}
```

[ ]:
```
fig, (ax1, ax2) = plt.subplots(1, 2, figsize=(18, 8))
ax1.plot(history.history['f_score'])
ax1.plot(history.history['val_f_score'])
ax1.set_title('Training & Testing Accuracy')
ax1.set_xlabel('Epochs')
```

```
ax1.set_ylabel('Accuracy')
ax1.legend(['accuracy', 'val_f_score'])
ax2.plot(history.history['loss'])
ax2.plot(history.history['val_loss'])
ax2.set_title('Training & Testing Loss')
ax1.set_xlabel('Epochs')
ax1.set_ylabel('Loss')
ax2.legend(['loss', 'val_loss'])
```

[ ]: <matplotlib.legend.Legend at 0x7f86cec5df98>



[ ]:
```
testdata['text']=testdata['text'].apply(denoise_text)
```

[ ]:
```
testdata_X = testdata['text']
```

[ ]:
```
testdata_X.head()
```

[ ]:
```
0                                go home url
1                                   oh tough
2    canada need another already enough great
3          scare every playing hockey warped
4                throwing bullshit flag url
Name: text, dtype: object
```

[ ]:

[ ]:
```
max_features = 10000
max_len = 128
```

```
tokenizer = text.Tokenizer(num_words=max_features)
tokenizer.fit_on_texts(testdata_X)

tokenized_train = tokenizer.texts_to_sequences(testdata_X)
testdata_X = sequence.pad_sequences(tokenized_train, maxlen=max_len)
```

[ ]:
```
predictions = model.predict(testdata_X)
```

[ ]:
```
type(predictions)
```

[ ]:
```
numpy.ndarray
```

[ ]:
```
submit = pd.DataFrame(data=predictions, columns=['target'])
```

[ ]:
```
submit
```

[ ]:
```
        target
0     0.076413
1     0.088850
2     0.309796
3     0.425224
4     0.056183
…        …
3889  0.150014
3890  0.072804
3891  0.651642
3892  0.563634
3893  0.096666

[3894 rows x 1 columns]
```

[ ]:
```
submit1 = pd.DataFrame(data=testdata['id'], columns=['id'])
```

[ ]:
```
submit1
```

[ ]:
```
          id
0     90194
1     77444
2     13384
3     54920
4     56117
…     …
3889  90041
3890  98824
3891  95338
3892  67210
3893  46552
```

```
[3894 rows x 1 columns]
```

[ ]:
```
submit1['target'] = submit['target']
```

[ ]:
```
submit1.to_csv('/content/gdrive/My Drive/submit2.csv', index = False)
```

[ ]:
```
submit1
```

[ ]:
```
          id    target
0      90194  0.076413
1      77444  0.088850
2      13384  0.309796
3      54920  0.425224
4      56117  0.056183
…      …        …
3889   90041  0.150014
3890   98824  0.072804
3891   95338  0.651642
3892   67210  0.563634
3893   46552  0.096666

[3894 rows x 2 columns]
```

[ ]:

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