Exercise: Amazon Fine Food reviews LSTM model.

Step By Step Process

- Lets start working on this assignment and as we know the main objective of this assignmenst is to Try LSTM Models on Amazon Food Reviews
- So in this assignment we will try to implement LSTM but before that we need do some certain operations i.e First we need to convert our data set in imdb data set formant.
- Lets do that
    1. As we know we have a data set which has reviews and class lables belongs to that review i.e positive(1) or negative(0) and then we need to make a vocab for of set of all the words in all the reviews and for each words we need to count the frequency of the each words in the reviews and then we will sort it out and set the ranking of the words beased on its occurance and after doing all that we need to set the ranking of the words in the reviews and so on
    2. but here we are uwing keras lib which is automatically doing all these for us.
    3. and using keras.preprocessing.text lib we will first Tokenizer(num_words=5000) and set num_words =5000 i.e we only want top 5000 words in our corpus and turning texts into sequences (=list of word indexes, where the word of rank i in the dataset (starting at 1) has index i). and then using this we will convert our train and test texts/reviews to turn to sequences.
    4. After that we will truncate and/or pad input sequences to trun our each into same length so that it will be easy for us to apply model on top of it
- After doing all above we will try RNN with various LSTM layers i.e 1 and 2 using train and test and try to meansure accuracy.

In [1]:

```
# Importing libraries
%matplotlib inline

import sqlite3
import pandas as pd
import numpy as np

import matplotlib.pyplot as plt
%matplotlib inline
import seaborn as sns

from keras.models import Sequential
from keras.layers import Dense
from keras.layers import LSTM
from keras.layers.embeddings import Embedding
from keras.preprocessing import sequence
from keras.layers import Dropout
# fix random seed for reproducibility
np.random.seed(7)

import pickle
```

```
C:\Users\nisha\Anaconda3\lib\site-packages\h5py\__init__.py:36: FutureWarning: Conversion of the s
econd argument of issubdtype from `float` to `np.floating` is deprecated. In future, it will be
treated as `np.float64 == np.dtype(float).type`.
  from ._conv import register_converters as _register_converters
Using TensorFlow backend.
```

In [2]:

```
#taking cleaned data i.e in Reviews table  from final sql database
#making connection with database
conn = sqlite3.connect('final.sqlite')
final = pd.read_sql_query(""" SELECT * FROM Reviews ORDER BY Time""", conn)
```

In [3]:

```
final.shape
```

Out[3]:

```
(364171, 12)
```

In [4]:

```
final = final[:50000]
print(len(final))
```

```
50000
```

In [5]:

```
# Changing the class lables from positive negative to 0/1
def scorepol(y):
    if y == "positive":
        return 1
    else:
        return 0

final['Score'] = final['Score'].map(scorepol)
```

In [6]:

```
final.head()
```

Out[6]:

	index	Id	ProductId	UserId	ProfileName	HelpfulnessNumerator	HelpfulnessDenominator	Score
0	138706	150524	0006641040	ACITT7DI6IDDL	shari zychinski	0	0	1
1	138683	150501	0006641040	AJ46FKXOVC7NR	Nicholas A Mesiano	2	2	1
2	417839	451856	B00004CXX9	AIUWLEQ1ADEG5	Elizabeth Medina	0	0	1
3	346055	374359	B00004CI84	A344SMIA5JECGM	Vincent P. Ross	1	2	1
4	417838	451855	B00004CXX9	AJH6LUC1UT1ON	The Phantom of the Opera	0	0	1

In [7]:

```
x = final['CleanedText'].values
y = final['Score']

# Splitting the data into 80-20 train_data and test_data
from sklearn.model_selection import train_test_split
X_train, X_test, Y_train, Y_test = train_test_split(x, y, test_size=0.2, random_state=42)

print("No. of datapoints in X_train :",len(X_train))
print("No. of datapoints in X_test :",len(X_test))
print("Shape of Y_train :",Y_train.shape)
print("Shape of Y_test :",Y_test.shape)
```

```
No. of datapoints in X_train : 40000
No. of datapoints in X_test : 10000
Shape of Y_train : (40000,)
Shape of Y_test : (10000,)
```

In [8]:

```
# https://keras.io/preprocessing/text/
from keras.preprocessing.text import Tokenizer
tokenizer = Tokenizer(num_words=5000)
tokenizer.fit_on_texts(X_train)

X_train = tokenizer.texts_to_sequences(X_train)
```

In [9]:

```
X_test = tokenizer.texts_to_sequences(X_test)
```

In [10]:

```
print(X_train[1])
print(type(X_train[1]))
print(len(X_train[1]))
```

```
[243, 9, 19, 3411, 355, 272, 263, 162, 125, 355, 58, 2, 37, 125, 355, 636, 75, 37, 4, 33, 115, 26,
520]
<class 'list'>
23
```

In [11]:

```
# truncate and/or pad input sequences
max_review_length = 400
X_train = sequence.pad_sequences(X_train, maxlen=max_review_length)
X_test = sequence.pad_sequences(X_test, maxlen=max_review_length)

print(X_train[1])
print(X_train.shape)
```

```
[    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    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    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    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  243
     9   19 3411  355  272  263  162  125  355   58    2   37  125  355
   636   75   37    4   33  115   26  520]
(40000, 400)
```

In [12]:

```
# utility function
def plt_dynamic_model(x, vy, ty):
    plt.figure(figsize=(10,5))
    plt.plot(x, vy, 'b', label="Val Loss")
    plt.plot(x, ty, 'r', label="Train Loss")
    plt.xlabel('Epochs val')
    plt.ylabel('Crossentropy Loss')
    plt.title('\nCrossentropy Loss VS Epochs')
    plt.legend()
    plt.show()
```

1. RNN with 1 LSTM layer

In [14]:

```
embedding_vecor_length = 32
model1 = Sequential()
model1.add(Embedding(5000, embedding_vecor_length, input_length=max_review_length))
model1.add(LSTM(100))
model1.add(Dropout(0.2))
model1.add(Dense(1, activation='sigmoid'))

model1.compile(loss='binary_crossentropy', optimizer='adam', metrics=['accuracy'])
print(model1.summary())
#Refer: https://datascience.stackexchange.com/questions/10615/number-of-parameters-in-an-lstm-mode
l
history1 = model1.fit(X_train, Y_train, nb_epoch=10, batch_size=64  ,verbose=1,validation_data=(X_t
est, Y_test))
```

```
_________________________________________________________________
Layer (type)                 Output Shape              Param #
=================================================================
embedding_2 (Embedding)      (None, 400, 32)           160000
_________________________________________________________________
lstm_2 (LSTM)                (None, 100)               53200
_________________________________________________________________
dropout_2 (Dropout)          (None, 100)               0
_________________________________________________________________
dense_2 (Dense)              (None, 1)                 101
=================================================================
Total params: 213,301
Trainable params: 213,301
Non-trainable params: 0
_________________________________________________________________
None
```

```
C:\Users\nisha\Anaconda3\lib\site-packages\ipykernel_launcher.py:11: UserWarning: The `nb_epoch` a
rgument in `fit` has been renamed `epochs`.
  # This is added back by InteractiveShellApp.init_path()
```

```
Train on 40000 samples, validate on 10000 samples
Epoch 1/10
40000/40000 [==============================] - 457s 11ms/step - loss: 0.2469 - acc: 0.9103 - val_l
oss: 0.1863 - val_acc: 0.9311
Epoch 2/10
40000/40000 [==============================] - 408s 10ms/step - loss: 0.1670 - acc: 0.9375 - val_l
oss: 0.1839 - val_acc: 0.9315
Epoch 3/10
40000/40000 [==============================] - 400s 10ms/step - loss: 0.1462 - acc: 0.9461 - val_l
oss: 0.1883 - val_acc: 0.9309
Epoch 4/10
40000/40000 [==============================] - 408s 10ms/step - loss: 0.1310 - acc: 0.9528 - val_l
oss: 0.1910 - val_acc: 0.9291
Epoch 5/10
40000/40000 [==============================] - 423s 11ms/step - loss: 0.1176 - acc: 0.9575 - val_l
oss: 0.2045 - val_acc: 0.9252
Epoch 6/10
40000/40000 [==============================] - 450s 11ms/step - loss: 0.1054 - acc: 0.9636 - val_l
oss: 0.2153 - val_acc: 0.9279
Epoch 7/10
```

```
40000/40000 [==============================] - 420s 11ms/step - loss: 0.0942 - acc: 0.9679 - val_l
oss: 0.2384 - val_acc: 0.9220
Epoch 8/10
40000/40000 [==============================] - 482s 12ms/step - loss: 0.0822 - acc: 0.9727 - val_l
oss: 0.2735 - val_acc: 0.9119
Epoch 9/10
40000/40000 [==============================] - 426s 11ms/step - loss: 0.0771 - acc: 0.9747 - val_l
oss: 0.2566 - val_acc: 0.9155
Epoch 10/10
40000/40000 [==============================] - 478s 12ms/step - loss: 0.0639 - acc: 0.9795 - val_l
oss: 0.2994 - val_acc: 0.9153
```

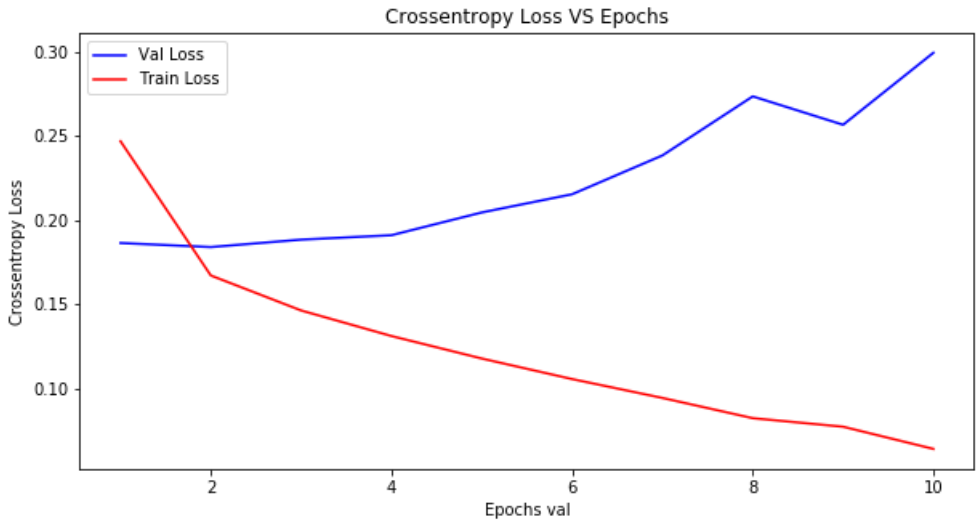
In [15]:

```
#-------------------------------------------------PLOT-------------------------------------------
--------
x = list(range(1,11))
vy = history1.history['val_loss']
ty = history1.history['loss']

plt_dynamic_model(x, vy, ty)

model_scores = model1.evaluate(X_test, Y_test, verbose=0)
print("Accuracy: %.2f%%" % (model_scores[1]*100))

model1_test_acc = model_scores[1]
model1_train_acc = max(history1.history['acc'])
```




```
Accuracy: 91.53%
```

2. RNN with 2 LSTM layers

In [16]:

```
embedding_vecor_length = 32
model2 = Sequential()
model2.add(Embedding(5000, embedding_vecor_length, input_length=max_review_length))
model2.add(LSTM(100, return_sequences=True))
model2.add(LSTM(100))
model2.add(Dense(1, activation='sigmoid'))
model2.compile(loss='binary_crossentropy', optimizer='adam', metrics=['accuracy'])
print(model2.summary())

history2 = model2.fit(X_train, Y_train, nb_epoch=10, batch_size=64,verbose=1,validation_data=(X_tes
t, Y_test))
```

```
_________________________________________________________________
Layer (type)                 Output Shape              Param #
=================================================================
embedding_3 (Embedding)      (None, 400, 32)           160000
_________________________________________________________________
```

```
lstm_3 (LSTM)                (None, 400, 100)          53200
_________________________________________________________________
lstm_4 (LSTM)                (None, 100)               80400
_________________________________________________________________
dense_3 (Dense)              (None, 1)                 101
=================================================================
Total params: 293,701
Trainable params: 293,701
Non-trainable params: 0
_________________________________________________________________
None
```

```
C:\Users\nisha\Anaconda3\lib\site-packages\ipykernel_launcher.py:10: UserWarning: The `nb_epoch` a
rgument in `fit` has been renamed `epochs`.
  # Remove the CWD from sys.path while we load stuff.
```

```
Train on 40000 samples, validate on 10000 samples
Epoch 1/10
40000/40000 [==============================] - 1055s 26ms/step - loss: 0.2380 - acc: 0.9134 - val_
loss: 0.1926 - val_acc: 0.9250
Epoch 2/10
40000/40000 [==============================] - 976s 24ms/step - loss: 0.1638 - acc: 0.9397 - val_l
oss: 0.1844 - val_acc: 0.9291
Epoch 3/10
40000/40000 [==============================] - 922s 23ms/step - loss: 0.1382 - acc: 0.9501 - val_l
oss: 0.1930 - val_acc: 0.9306
Epoch 4/10
40000/40000 [==============================] - 971s 24ms/step - loss: 0.1177 - acc: 0.9583 - val_l
oss: 0.2085 - val_acc: 0.9228
Epoch 5/10
40000/40000 [==============================] - 1058s 26ms/step - loss: 0.1018 - acc: 0.9657 - val_
loss: 0.2295 - val_acc: 0.9245
Epoch 6/10
40000/40000 [==============================] - 1019s 25ms/step - loss: 0.0872 - acc: 0.9715 - val_
loss: 0.2656 - val_acc: 0.9201
Epoch 7/10
40000/40000 [==============================] - 1044s 26ms/step - loss: 0.0733 - acc: 0.9766 - val_
loss: 0.3021 - val_acc: 0.9158
Epoch 8/10
40000/40000 [==============================] - 1019s 25ms/step - loss: 0.0611 - acc: 0.9813 - val_
loss: 0.2912 - val_acc: 0.9205
Epoch 9/10
40000/40000 [==============================] - 985s 25ms/step - loss: 0.0530 - acc: 0.9836 - val_l
oss: 0.3417 - val_acc: 0.9114
Epoch 10/10
40000/40000 [==============================] - 993s 25ms/step - loss: 0.0438 - acc: 0.9866 - val_l
oss: 0.3483 - val_acc: 0.9164
```

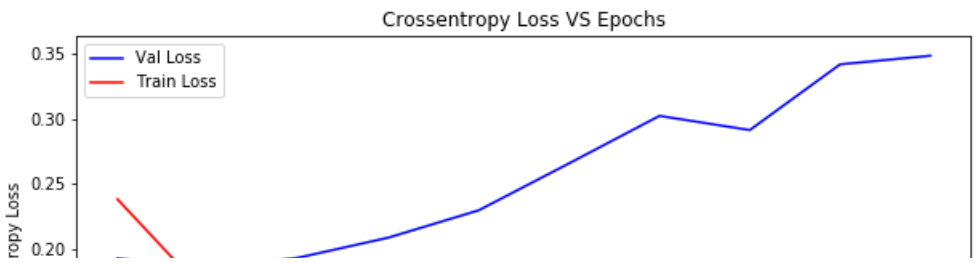
In [18]:

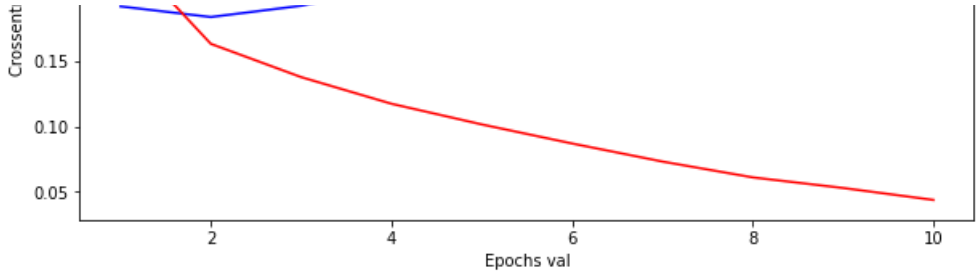
```
#-------------------------------------------------PLOT-------------------------------------------
--------
x = list(range(1,11))
vy = history2.history['val_loss']
ty = history2.history['loss']

plt_dynamic_model(x, vy, ty)

model_scores = model2.evaluate(X_test, Y_test, verbose=0)
print("Accuracy: %.2f%%" % (model_scores[1]*100))

model2_test_acc = model_scores[1]
model2_train_acc = max(history2.history['acc'])
```






```
Accuracy: 91.64%
```

Conclusion

In [19]:

```
from prettytable import PrettyTable

print('Performance Table')
x = PrettyTable()
x.field_names =["Models","Train","Test"]

x.add_row(["RNN with 1 LSTM layers",model1_train_acc,model1_test_acc])
x.add_row(["RNN with 2 LSTM layers",model2_train_acc,model2_test_acc])

print(x)
```

```
Performance Table
+------------------------+----------+--------+
|         Models         |  Train   |  Test  |
+------------------------+----------+--------+
| RNN with 1 LSTM layers |  0.9795  | 0.9153 |
| RNN with 2 LSTM layers | 0.986575 | 0.9164 |
+------------------------+----------+--------+
```