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Subject Code: 21CAP722
Final Lab Practical Worksheet

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Aim/Overview of the practical: To detect which tweet are about real disaster or not.

Solution:

1. **Task to be done:**

Twitter has become an important communication channel in times of emergency. The iniquitousness of smartphones enables people to announce an emergency they're observing in real-time. Because of this, more agencies are interested in programmatically monitoring Twitter (i.e. disaster relief organizations and news agencies).

The author explicitly uses the word "ABLAZE" but means it metaphorically. This is clear to a human right away, especially with the visual aid. But it's less clear to a machine.

In this competition, you're challenged to build a machine learning model that predicts which Tweets are about real disasters and which one's aren't. You'll have access to a dataset of 10,000 tweets that were hand classified

2. **Dataset:**
Dataset is taken from kaggle, which is provided by twitter for that are hand classified.

3. **Code for experiment/practical:**

```
#importing libraries
import numpy as np
import pandas as pd
import matplotlib.pyplot as plt
%matplotlib inline
import tensorflow as tf
from tensorflow import keras
from tensorflow.keras import layers
```

```
from tensorflow.keras.preprocessing.text import one_hot
from tensorflow.keras.preprocessing.sequence import pad_sequences
from keras import regularizers
from sklearn import metrics
from sklearn.metrics import classification_report, confusion_matrix

train_df = pd.read_csv("train.csv")
test_df = pd.read_csv("test.csv")

train_df

VOCAB_SIZE = 50000  # vocabulary size
MAX_LEN = 50

train_df.isnull().sum()
train_df.info()
train_df["target"].hist()
import re
import nltk
nltk.download('wordnet')
nltk.download('omw-1.4')
from nltk.stem import WordNetLemmatizer

nltk.download("stopwords")
from nltk.corpus import stopwords
# for cleaning tweets
lemmatizer = WordNetLemmatizer()

def clean_data(tweet):
   tweet = re.sub("[@&]\w*", "", tweet)
   tweet = re.sub("https?:\S*", "", tweet)
   tweet = re.sub("[^A-Za-z#]", " ", tweet)
   tweet = tweet.lower()
   tweet = [lemmatizer.lemmatize(word) for word in tweet.split() if word not in
stopwords.words("english")]
   tweet = " ".join(tweet)

   return tweet

# add clean text column
train_df["clean_text"] = train_df["text"].apply(clean_data)
test_df["clean_text"] = test_df["text"].apply(clean_data)

train_df[['text', 'clean_text']]

# one hot encoding
train_df["text_ohe"] = train_df["clean_text"].apply(lambda x: one_hot(x, VOCAB_SIZE))
test_df["text_ohe"] = test_df["clean_text"].apply(lambda x: one_hot(x, VOCAB_SIZE))

train_df[['clean_text', 'text_ohe']].head()
```

```
X = train_df["text_ohe"].values
y = train_df["target"].values

from sklearn.model_selection import train_test_split

X_train, X_val, y_train, y_val = train_test_split(X, y, test_size=0.2, random_state=42)

print(X_train.shape, X_val.shape)

# pad_sequences
X_train = pad_sequences(X_train, MAX_LEN)
X_val = pad_sequences(X_val, MAX_LEN)

print(X_train.shape, X_val.shape)

# Input for variable-length sequences of integers
inputs = keras.Input(shape=(None,), dtype="int32")

# Embed each integer in a 128-dimensional vector
x = layers.Embedding(VOCAB_SIZE, 64)(inputs)

# Add 2 bidirectional LSTMs
x = layers.Bidirectional(layers.LSTM(32, kernel_regularizer=regularizers.l2(1e-3),
recurrent_regularizer=regularizers.l2(1e-4), return_sequences=True))(x)
x = layers.Bidirectional(layers.LSTM(32, kernel_regularizer=regularizers.l2(1e-3),
recurrent_regularizer=regularizers.l2(1e-4)))(x)
x = layers.Dropout(0.2)(x)

# Add a classifier
x = layers.Dense(16, activation="relu")(x)
outputs = layers.Dense(1, activation="sigmoid")(x)

model = keras.Model(inputs, outputs)
model.summary()

model.compile(optimizer=tf.optimizers.RMSprop(1e-3),
          loss="binary_crossentropy",
          metrics=["accuracy"])
hist = model.fit(X_train, y_train, batch_size=30, epochs=10,
            validation_data=(X_val, y_val))

loss_df = pd.DataFrame(hist.history)
loss_df

plt.figure(figsize=(12, 4))
plt.subplot(1, 2, 1)
plt.plot(loss_df["loss"], label="loss")
plt.plot(loss_df["val_loss"], label="val_loss")
plt.title("loss")
plt.legend()
```

```
plt.subplot(1, 2, 2)
plt.plot(loss_df["accuracy"], label="acc")
plt.plot(loss_df["val_accuracy"], label="val_acc")
plt.title("accuracy")
plt.legend()

# Restore weights
model.load_weights(checkpoint_filepath)
scores = model.evaluate(X_val, y_val)

print(scores)
X_test = test_df["text_ohe"].values

# pad_sequences
X_test = pad_sequences(X_test, MAX_LEN)

print(X_test.shape)

y_pred = model.predict(X_test)
y_pred = [1 if x >= 0.5 else 0 for x in y_pred]

print(y_pred)

output = pd.DataFrame({'id': test_df.id, 'target': y_pred})
output.to_csv('output.csv', index=False)

output = pd.read_csv("output.csv")

output.head(20)
```

4. Result/Output:

```
#importing libraries
import numpy as np
import pandas as pd
import matplotlib.pyplot as plt
%matplotlib inline
import tensorflow as tf
from tensorflow import keras
from tensorflow.keras import layers
from tensorflow.keras.preprocessing.text import one_hot
from tensorflow.keras.preprocessing.sequence import pad_sequences
from keras import regularizers
from sklearn import metrics
from sklearn.metrics import classification_report, confusion_matrix
```

```
train_df = pd.read_csv("train.csv")
test_df = pd.read_csv("test.csv")
```

```
train_df
```

	id	keyword	location	text	target
0	1	NaN	NaN	Our Deeds are the Reason of this #earthquake M...	1
1	4	NaN	NaN	Forest fire near La Ronge Sask. Canada	1
2	5	NaN	NaN	All residents asked to 'shelter in place' are ...	1
3	6	NaN	NaN	13,000 people receive #wildfires evacuation or...	1
4	7	NaN	NaN	Just got sent this photo from Ruby #Alaska as ...	1
...	...	...	...	...	...
7608	10869	NaN	NaN	Two giant cranes holding a bridge collapse int...	1
7609	10870	NaN	NaN	@aria_ahrary @TheTawniest The out of control w...	1
7610	10871	NaN	NaN	M1.94 [01:04 UTC]?5km S of Volcano Hawaii. htt...	1
7611	10872	NaN	NaN	Police investigating after an e-bike collided ...	1
7612	10873	NaN	NaN	The Latest: More Homes Razed by Northern Calif...	1

7613 rows × 5 columns

```
VOCAB_SIZE = 50000  # vocabulary size
MAX_LEN = 50
```

```
train_df.isnull().sum()
```

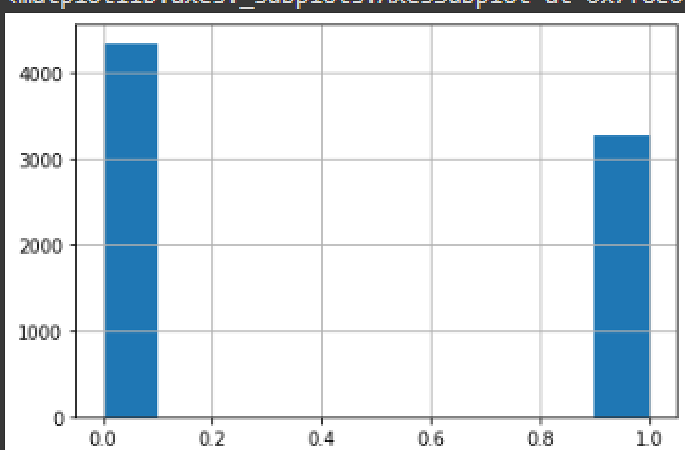
```
id              0
keyword        61
location     2533
text            0
target          0
dtype: int64
```

```
train_df.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 7613 entries, 0 to 7612
Data columns (total 5 columns):
 #   Column    Non-Null Count  Dtype
---  ------    --------------  -----
 0   id        7613 non-null   int64
 1   keyword   7552 non-null   object
 2   location  5080 non-null   object
 3   text      7613 non-null   object
 4   target    7613 non-null   int64
dtypes: int64(2), object(3)
memory usage: 297.5+ KB
```

```
train_df["target"].hist()
```

```
<matplotlib.axes._subplots.AxesSubplot at 0x7f8e0722bd90>
```



data cleaning

```
[52] import re
     import nltk
     nltk.download('wordnet')
     nltk.download('omw-1.4')
     from nltk.stem import WordNetLemmatizer

     nltk.download("stopwords")
     from nltk.corpus import stopwords
```

```
[nltk_data] Downloading package wordnet to /root/nltk_data...
[nltk_data]   Package wordnet is already up-to-date!
[nltk_data] Downloading package omw-1.4 to /root/nltk_data...
[nltk_data]   Package omw-1.4 is already up-to-date!
[nltk_data] Downloading package stopwords to /root/nltk_data...
[nltk_data]   Package stopwords is already up-to-date!
```

```
[53] # for cleaning tweets
     lemmatizer = WordNetLemmatizer()

     def clean_data(tweet):
         tweet = re.sub("[@&]\w*", "", tweet)
         tweet = re.sub("https?:\S*", "", tweet)
         tweet = re.sub("[^A-Za-z#]", " ", tweet)
         tweet = tweet.lower()
         tweet = [lemmatizer.lemmatize(word) for word in tweet.split() if word not in stopwords.words("english")]
         tweet = " ".join(tweet)

         return tweet
```

```
# add clean text column
train_df["clean_text"] = train_df["text"].apply(clean_data)
test_df["clean_text"] = test_df["text"].apply(clean_data)
```

```
train_df[['text', 'clean_text']]
```

	text	clean_text
0	Our Deeds are the Reason of this #earthquake M...	deed reason #earthquake may allah forgive u
1	Forest fire near La Ronge Sask. Canada	forest fire near la ronge sask canada
2	All residents asked to 'shelter in place' are ...	resident asked shelter place notified officer ...
3	13,000 people receive #wildfires evacuation or...	people receive #wildfires evacuation order cal...
4	Just got sent this photo from Ruby #Alaska as ...	got sent photo ruby #alaska smoke #wildfires p...
...	...	...
7608	Two giant cranes holding a bridge collapse int...	two giant crane holding bridge collapse nearby...
7609	@aria_ahrary @TheTawniest The out of control w...	control wild fire california even northern par...
7610	M1.94 [01:04 UTC]?5km S of Volcano Hawaii. htt...	utc km volcano hawaii
7611	Police investigating after an e-bike collided ...	police investigating e bike collided car littl...
7612	The Latest: More Homes Razed by Northern Calif...	latest home razed northern california wildfire...

7613 rows × 2 columns

Data Preprocessing

```
[56] # one hot encoding
     train_df["text_ohe"] = train_df["clean_text"].apply(lambda x: one_hot(x, VOCAB_SIZE))
     test_df["text_ohe"] = test_df["clean_text"].apply(lambda x: one_hot(x, VOCAB_SIZE))
```

```
[57] train_df[['clean_text', 'text_ohe']].head()
```

	clean_text	text_ohe
0	deed reason #earthquake may allah forgive u	[21522, 43542, 42189, 8828, 21201, 28073, 14464]
1	forest fire near la ronge sask canada	[5878, 39487, 12850, 26831, 19348, 23096, 31587]
2	resident asked shelter place notified officer ...	[8632, 34139, 26967, 45260, 21293, 40258, 3614...
3	people receive #wildfires evacuation order cal...	[46632, 5930, 24586, 36146, 37857, 20221]
4	got sent photo ruby #alaska smoke #wildfires p...	[22312, 17762, 26386, 49615, 47992, 32448, 245...

Train-Test Split

```
[58] X = train_df["text_ohe"].values
     y = train_df["target"].values
```

```
[59] from sklearn.model_selection import train_test_split

     X_train, X_val, y_train, y_val = train_test_split(X, y, test_size=0.2, random_state=42)

     print(X_train.shape, X_val.shape)
```

```
(6090,) (1523,)
```

```
[60] # pad_sequences
     X_train = pad_sequences(X_train, MAX_LEN)
     X_val = pad_sequences(X_val, MAX_LEN)

     print(X_train.shape, X_val.shape)
```

```
(6090, 50) (1523, 50)
```

Create Model

```
# Input for variable-length sequences of integers
inputs = keras.Input(shape=(None,), dtype="int32")

# Embed each integer in a 128-dimensional vector
x = layers.Embedding(VOCAB_SIZE, 64)(inputs)

# Add 2 bidirectional LSTMs
x = layers.Bidirectional(layers.LSTM(32, kernel_regularizer=regularizers.l2(1e-3), recurrent_regularizer=regularizers.l2(1e-4), return_sequences=True))(x)
x = layers.Bidirectional(layers.LSTM(32, kernel_regularizer=regularizers.l2(1e-3), recurrent_regularizer=regularizers.l2(1e-4)))(x)
x = layers.Dropout(0.2)(x)

# Add a classifier
x = layers.Dense(16, activation="relu")(x)
outputs = layers.Dense(1, activation="sigmoid")(x)

model = keras.Model(inputs, outputs)
model.summary()
```

```
Model: "model_1"
_________________________________________________________________
 Layer (type)                Output Shape              Param #
=================================================================
 input_2 (InputLayer)        [(None, None)]            0

 embedding_1 (Embedding)     (None, None, 64)          3200000

 bidirectional_2 (Bidirectio  (None, None, 64)         24832
 nal)

 bidirectional_3 (Bidirectio  (None, 64)               24832
 nal)

 dropout_1 (Dropout)         (None, 64)                0

 dense_2 (Dense)             (None, 16)                1040

 dense_3 (Dense)             (None, 1)                 17

=================================================================
Total params: 3,250,721
Trainable params: 3,250,721
Non-trainable params: 0
_________________________________________________________________
```

```
model.compile(optimizer=tf.optimizers.RMSprop(1e-3),
              loss="binary_crossentropy",
              metrics=["accuracy"])
```

Model Training

```
hist = model.fit(X_train, y_train, batch_size=30, epochs=10,
                 validation_data=(X_val, y_val))
```

```
Epoch 1/10
203/203 [==============================] - 56s 85ms/step - loss: 0.6765 - accuracy: 0.6941 - val_loss: 0.5001 - val_accuracy: 0.7912
Epoch 2/10
203/203 [==============================] - 15s 75ms/step - loss: 0.4046 - accuracy: 0.8414 - val_loss: 0.4858 - val_accuracy: 0.8004
Epoch 3/10
203/203 [==============================] - 16s 81ms/step - loss: 0.3385 - accuracy: 0.8722 - val_loss: 0.5138 - val_accuracy: 0.7676
Epoch 4/10
203/203 [==============================] - 15s 75ms/step - loss: 0.3030 - accuracy: 0.8911 - val_loss: 0.5066 - val_accuracy: 0.7892
Epoch 5/10
203/203 [==============================] - 15s 75ms/step - loss: 0.2795 - accuracy: 0.9010 - val_loss: 0.5024 - val_accuracy: 0.7748
Epoch 6/10
203/203 [==============================] - 15s 75ms/step - loss: 0.2604 - accuracy: 0.9100 - val_loss: 0.5258 - val_accuracy: 0.7866
Epoch 7/10
203/203 [==============================] - 16s 81ms/step - loss: 0.2448 - accuracy: 0.9149 - val_loss: 0.6047 - val_accuracy: 0.7708
Epoch 8/10
203/203 [==============================] - 15s 75ms/step - loss: 0.2315 - accuracy: 0.9220 - val_loss: 0.5502 - val_accuracy: 0.7794
Epoch 9/10
203/203 [==============================] - 15s 75ms/step - loss: 0.2275 - accuracy: 0.9256 - val_loss: 0.6046 - val_accuracy: 0.7617
Epoch 10/10
203/203 [==============================] - 15s 75ms/step - loss: 0.1954 - accuracy: 0.9389 - val_loss: 0.6089 - val_accuracy: 0.7623
```

Model evaluation

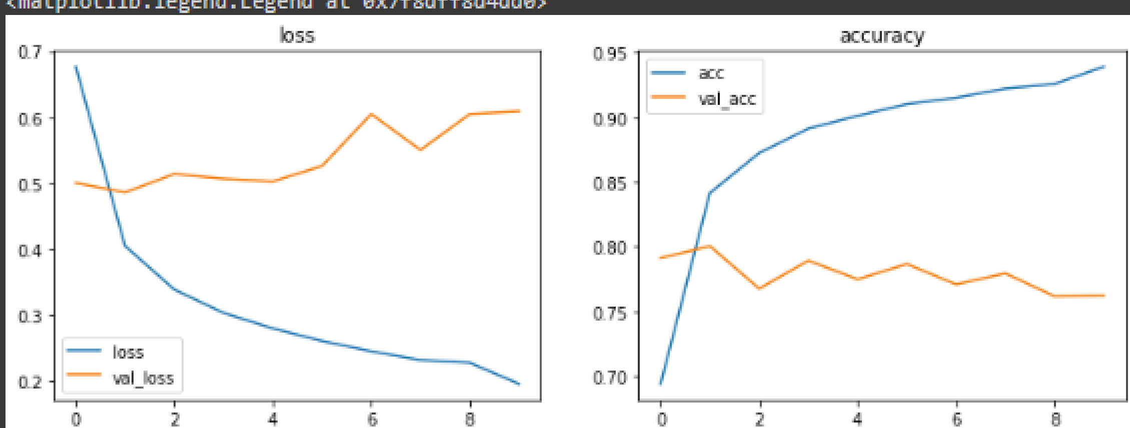
```
[65] loss_df = pd.DataFrame(hist.history)
     loss_df
```

	loss	accuracy	val_loss	val_accuracy
0	0.676508	0.694089	0.500120	0.791202
1	0.404607	0.841379	0.485759	0.800394
2	0.338490	0.872250	0.513842	0.767564
3	0.302999	0.891133	0.506574	0.789232
4	0.279521	0.900985	0.502434	0.774787
5	0.260415	0.910016	0.525837	0.786605
6	0.244782	0.914943	0.604677	0.770847
7	0.231498	0.922003	0.550201	0.779383
8	0.227454	0.925616	0.604603	0.761655
9	0.195418	0.938916	0.608950	0.762311

```
[66] plt.figure(figsize=(12, 4))
     plt.subplot(1, 2, 1)
     plt.plot(loss_df["loss"], label="loss")
     plt.plot(loss_df["val_loss"], label="val_loss")
     plt.title("loss")
     plt.legend()

     plt.subplot(1, 2, 2)
     plt.plot(loss_df["accuracy"], label="acc")
     plt.plot(loss_df["val_accuracy"], label="val_acc")
     plt.title("accuracy")
     plt.legend()
```

<matplotlib.legend.Legend at 0x7f8dff8d4dd0>



Predictions

```
[69] X_test = test_df["text_ohe"].values
```

```
# pad_sequences
X_test = pad_sequences(X_test, MAX_LEN)

print(X_test.shape)
```

```
(3263, 50)
```

```
[72] y_pred = model.predict(X_test)
     y_pred = [1 if x >= 0.5 else 0 for x in y_pred]

     print(y_pred)
```

```
102/102 [==============================] - 4s 19ms/step
[1, 1, 1, 0, 1, 1, 0, 0, 0, 0, 0, 0, 0, 0, 0, 1, 0, 1, 0, 0, 0, 0, 0, 1, 0, 0, 0, 0, 0, 1, 0, 0, 1, 0, 1, 0, 1, 0, 0, 1, 0, 1, 0, 1, 0, 0,
```

```
[73] output = pd.DataFrame({'id': test_df.id, 'target': y_pred})
     output.to_csv('output.csv', index=False)
```

```
[74] output = pd.read_csv("output.csv")
```

```
output.head(20)
```

	id	target
0	0	1
1	2	1
2	3	1
3	9	0
4	11	1
5	12	1
6	21	0
7	22	0
8	27	0
9	29	0
10	30	0
11	35	0
12	42	0
13	43	0
14	45	0
15	46	1
16	47	0
17	51	1
18	58	0
19	60	0

5. Learning outcomes (What I have learnt):

- I have learnt about Bidirectional LSTM.
- I have learnt how to find out that whether a tweet is about a real disaster or not.

Evaluation Grid:

Sr. No.	Parameters	Marks Obtained	Maximum Marks
1.	Demonstration and Performance (Pre Lab Quiz)		5
2.	Worksheet		10
3.	Post Lab Quiz		5