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SMS Text Classification v2.ipynb

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[1]
```python
# import libraries
import tensorflow as tf
import pandas as pd
from tensorflow import keras

import tensorflow_datasets as tfds
import numpy as np
import matplotlib.pyplot as plt

print(tf.__version__)
```

```
2.15.0
```

[2]
```python
# get data files
!wget https://cdn.freecodecamp.org/project-data/sms/train-data.tsv
!wget https://cdn.freecodecamp.org/project-data/sms/valid-data.tsv

train_file_path = "train-data.tsv"
test_file_path = "valid-data.tsv"
```

```
--2024-02-14 21:14:40--  https://cdn.freecodecamp.org/project-data/sms/train-data.tsv
Resolving cdn.freecodecamp.org (cdn.freecodecamp.org)... 104.26.3.33, 104.26.2.33, 172.67.70.149, ...
Connecting to cdn.freecodecamp.org (cdn.freecodecamp.org)|104.26.3.33|:443... connected.
HTTP request sent, awaiting response... 200 OK
Length: 358233 (350K) [text/tab-separated-values]
Saving to: 'train-data.tsv'

train-data.tsv      100%[===================>] 349.84K  --.-KB/s    in 0.07s

2024-02-14 21:14:41 (4.79 MB/s) - 'train-data.tsv' saved [358233/358233]

--2024-02-14 21:14:41--  https://cdn.freecodecamp.org/project-data/sms/valid-data.tsv
Resolving cdn.freecodecamp.org (cdn.freecodecamp.org)... 104.26.3.33, 104.26.2.33, 172.67.70.149, ...
Connecting to cdn.freecodecamp.org (cdn.freecodecamp.org)|104.26.3.33|:443... connected.
HTTP request sent, awaiting response... 200 OK
Length: 118774 (116K) [text/tab-separated-values]
Saving to: 'valid-data.tsv'

valid-data.tsv      100%[===================>] 115.99K  --.-KB/s    in 0.04s

2024-02-14 21:14:41 (3.04 MB/s) - 'valid-data.tsv' saved [118774/118774]
```

[3]
```python
# Reading Data & Setting Column Labels
train_data = pd.read_table(train_file_path, header=None, names=["spam", "message"])
test_data = pd.read_table(test_file_path, header=None, names=["spam", "message"])

train_data.head()
```

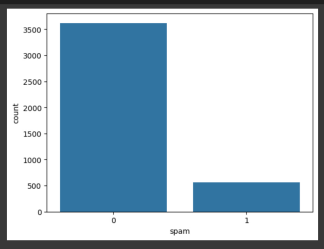
| | spam | message |
|---|---|---|
| 0 | ham | ahhhh...just woken up!had a bad dream about u ... |
| 1 | ham | you can never do nothing |
| 2 | ham | now u sound like manky scouse boy steve,like! ... |
| 3 | ham | mum say we wan to go then go... then she can s... |
| 4 | ham | never y lei... i v lazy... got wat? dat day ü ... |

Next steps: Generate code with train_data  View recommended plots

[4]
```python
# Converting Categorical Data to Integers
train_data["spam"] = train_data["spam"].replace({"ham": 0, "spam": 1})
test_data["spam"] = test_data["spam"].replace({"ham": 0, "spam": 1})
train_data["spam"].value_counts()
```

```
0    3619
1     560
Name: spam, dtype: int64
```

[5]
```python
# Modeling HamOrSpam Data
import seaborn as sns

sns.countplot(x='spam', data=train_data)
plt.show()
```




[6]
```python
# Calculating HamOrSpam & Creating Data Frame
ham_msg = train_data[train_data["spam"] == 0]
neg = ham_msg.shape[0]
print(f"negative: {neg}")

spam_msg = train_data[train_data["spam"] == 1]
pos = spam_msg.shape[0]
print(f"positive: {pos}")

total = neg + pos
print(f"total: {total}")

balanced_data = train_data
```

```
negative: 3619
positive: 560
total: 4179
```

[7]
```python
# Cleaning Data: Removing Punctuation

import string
punctuations_list = string.punctuation
def remove_punctuations(text):
    temp = str.maketrans('', '', punctuations_list)
    return text.translate(temp)

balanced_data['message'] = balanced_data['message'].apply(lambda x: remove_punctuations(x))

# Perform the same pre-processing on test data as on training data.
test_data['message'] = test_data['message'].apply(lambda x: remove_punctuations(x))

balanced_data.head()
```

| | spam | message |
|---|---|---|
| 0 | 0 | ahhhhjust woken uphad a bad dream about u thos... |
| 1 | 0 | you can never do nothing |
| 2 | 0 | now u sound like manky scouse boy stevelike i ... |
| 3 | 0 | mum say we wan to go then go then she can shun... |
| 4 | 0 | never y lei i v lazy got wat dat day ü send me... |

Next steps: Generate code with balanced_data  View recommended plots

```python
# Cleaning Data: Removing Stop Words

import nltk
from nltk.corpus import stopwords
nltk.download('stopwords')

stop_words = stopwords.words('english')
new_stopwords = ["u", "ur"]
stop_words.extend(new_stopwords)

def remove_stopwords(text):
    imp_words = []

    # Storing the important words
    for word in str(text).split():
        word = word.lower()

        if word not in stop_words:
            imp_words.append(word)

    output = " ".join(imp_words)

    return output

balanced_data['message'] = balanced_data['message'].apply(lambda text: remove_stopwords(text))

# Perform the same pre-processing on test data as on training data.
test_data['message'] = test_data['message'].apply(lambda text: remove_stopwords(text))

balanced_data.head()
```

```
[nltk_data] Downloading package stopwords to /root/nltk_data...
[nltk_data]   Unzipping corpora/stopwords.zip.
```

| | spam | message |
|---|---|---|
| 0 | 0 | ahhhhjust woken uphad bad dream thoso dont lik... |
| 1 | 0 | never nothing |
| 2 | 0 | sound like manky scouse boy stevelike travelli... |

| | | |
|---|---|---|
| 3 | 0 | mum say wan go go shun bian watch da glass exh... |
| 4 | 0 | never lei v lazy got wat dat day ü send da url... |

Next steps: Generate code with balanced_data  View recommended plots

[9]
```
# Displaying Data as WordCloud

from wordcloud import WordCloud
def plot_word_cloud(data, typ):
    email_corpus = " ".join(data['message'])

    plt.figure(figsize=(7, 7))

    wc = WordCloud(
        background_color='black',
        max_words=100,
        width=800,
        height=400,
        collocations=False
    ).generate(email_corpus)

    plt.imshow(wc, interpolation='bilinear')
    plt.title(f'WordCloud for {typ} emails', fontsize=15)
    plt.axis('off')
    plt.show()

plot_word_cloud(balanced_data[balanced_data['spam'] == 0], typ='Non-Spam')
plot_word_cloud(balanced_data[balanced_data['spam'] == 1], typ='Spam')
```

[10]
```
# Removing Spam Classification Column

train_labels = balanced_data.pop("spam")
test_labels = test_data.pop("spam")

balanced_data
```

| | message |
|---|---|
| 0 | ahhhhjust woken uphad bad dream thoso dont lik... |
| 1 | never nothing |
| 2 | sound like manky scouse boy stevelike travelli... |
| 3 | mum say wan go go shun bian watch da glass exh... |
| 4 | never lei v lazy got wat dat day ü send da url... |
| ... | ... |
| 4174 | woke yeesh late didnt fall asleep til ltgt |
| 4175 | reckon need 2 arrange transport cant thanks |
| 4176 | free entry £250 weekly competition text word w... |
| 4177 | pls stop bootydelious 32f inviting friend repl... |
| 4178 | tell bad character dnt lik ill try change ltgt... |

4179 rows × 1 columns

[11]
```
# Converting Message Column into Numpy Array

train_X = balanced_data["message"].to_numpy()
train_Y = train_labels.to_numpy()
test_X = test_data["message"].to_numpy()
test_Y = test_labels.to_numpy()
train_X
```

```
array(['ahhhhjust woken uphad bad dream thoso dont like right didnt know anything comedy night guess im',
       'never nothing',
       'sound like manky scouse boy stevelike travelling da bus homewot innmind 4 recreation dis eve',
       ...,
       'free entry £250 weekly competition text word win 80086 18 tc wwwtxttowincouk',
       'pls stop bootydelious 32f inviting friend reply yes434 no434 see www.smsacubootydelious stop send stop frnd 62468',
       'tell bad character dnt lik ill try change ltgt add tat 2 new year resolution waiting replybe frankgood morning'],
      dtype=object)
```

[12]
```
# Tokenizing & Padding Text

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

# Tokenize the text data
tokenizer = Tokenizer()
tokenizer.fit_on_texts(train_X)

# Convert text to sequences
train_sequences = tokenizer.texts_to_sequences(train_X)
test_sequences = tokenizer.texts_to_sequences(test_X)

# Pad sequences to have the same length
max_len = 100

train_sequences = pad_sequences(
    train_sequences,
    maxlen=max_len,
    padding='post',
    truncating='post'
)
test_sequences = pad_sequences(
    test_sequences,
    maxlen=max_len,
    padding='post',
    truncating='post'
)
print(train_sequences[0])
```

```
[3468 2262 3469  293  663 3470    7   12   76   94   11   86 1731   48
  203    2    0    0    0    0    0    0    0    0    0    0    0    0
    0    0    0    0    0    0    0    0    0    0    0    0    0    0
    0    0    0    0    0    0    0    0    0    0    0    0    0    0
    0    0    0    0    0    0    0    0    0    0    0    0    0    0
    0    0    0    0    0    0    0    0    0    0    0    0    0    0
    0    0    0    0    0    0    0    0    0    0    0    0    0    0
    0    0]
```

[13]
```
# Build the model
model = tf.keras.models.Sequential([
    tf.keras.layers.Embedding(
        input_dim=len(tokenizer.word_index) + 1,
        output_dim=32,
        mask_zero=True,
    ),
    tf.keras.layers.Dropout(0.1),
    tf.keras.layers.LSTM(16),
    tf.keras.layers.Dense(16, activation='relu'),
    tf.keras.layers.Dense(1, activation='sigmoid')
])

# Print the model summary
model.summary()
```

```
Model: "sequential"
_________________________________________________________________
 Layer (type)                Output Shape              Param #
=================================================================
 embedding (Embedding)       (None, None, 32)          257568

 dropout (Dropout)           (None, None, 32)          0

 lstm (LSTM)                 (None, 16)                3136

 dense (Dense)               (None, 16)                272

 dense_1 (Dense)             (None, 1)                 17

=================================================================
Total params: 260993 (1019.50 KB)
Trainable params: 260993 (1019.50 KB)
Non-trainable params: 0 (0.00 Byte)
_________________________________________________________________
```

[14]
```
# Compiling Model

model.compile(
    loss = tf.keras.losses.BinaryCrossentropy(),
    metrics=['accuracy'],
    optimizer= tf.keras.optimizers.Adam(learning_rate=0.01, beta_1=0.9, beta_2=0.999)
)
```

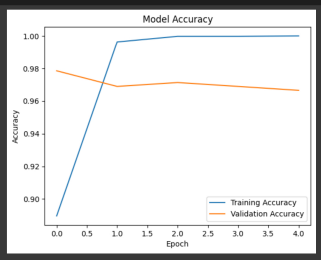
[15] # Setting up Early Stopping & Reducing Learning Rate to reduce overfitting

```
from keras.callbacks import EarlyStopping, ReduceLROnPlateau
# Callback
es = EarlyStopping(
    patience=4,
    monitor = 'val_accuracy',
    restore_best_weights = True
)

lr = ReduceLROnPlateau(
    patience = 2,
    monitor = 'val_loss',
    factor = 0.2,
    verbose = 1
)

# Weights
weight_for_0 = (1 / neg) * (total / 2.0)
weight_for_1 = (1 / pos) * (total / 2.0)

class_weight = {0: weight_for_0, 1: weight_for_1}

# Training
history = model.fit(
    x=train_sequences,
    y=train_Y,
    validation_split=0.1,
    epochs=20,
    batch_size=32,
    callbacks = [lr, es],
    class_weight=class_weight
)
```

```
Epoch 1/20
118/118 [==============================] - 35s 124ms/step - loss: 0.2418 - accuracy: 0.8897 - val_loss: 0.0835 - val_accuracy: 0.9785 - lr: 0.0100
Epoch 2/20
118/118 [==============================] - 7s 62ms/step - loss: 0.0251 - accuracy: 0.9963 - val_loss: 0.0934 - val_accuracy: 0.9689 - lr: 0.0100
Epoch 3/20
118/118 [==============================] - ETA: 0s - loss: 0.0025 - accuracy: 0.9997
Epoch 3: ReduceLROnPlateau reducing learning rate to 0.0019999999552965165.
118/118 [==============================] - 5s 42ms/step - loss: 0.0025 - accuracy: 0.9997 - val_loss: 0.1203 - val_accuracy: 0.9713 - lr: 0.0100
Epoch 4/20
118/118 [==============================] - 4s 34ms/step - loss: 0.0011 - accuracy: 0.9997 - val_loss: 0.1178 - val_accuracy: 0.9689 - lr: 0.0020
Epoch 5/20
118/118 [==============================] - ETA: 0s - loss: 6.0699e-04 - accuracy: 1.0000
Epoch 5: ReduceLROnPlateau reducing learning rate to 0.0003999999724328518.
118/118 [==============================] - 4s 36ms/step - loss: 6.0699e-04 - accuracy: 1.0000 - val_loss: 0.1220 - val_accuracy: 0.9665 - lr: 0.0020
```

[16] # Displaying Model Accuracy over Epochs

```
plt.plot(history.history['accuracy'], label='Training Accuracy')
plt.plot(history.history['val_accuracy'], label='Validation Accuracy')
plt.title('Model Accuracy')
plt.ylabel('Accuracy')
plt.xlabel('Epoch')
plt.legend()
plt.show()
```




[17] # Evaluating Model

```
test_loss, test_accuracy = model.evaluate(test_sequences, test_Y)
print('Test Loss :',test_loss)
print('Test Accuracy :',test_accuracy)
```

```
44/44 [==============================] - 0s 6ms/step - loss: 0.0651 - accuracy: 0.9871
Test Loss : 0.06512806556456473
Test Accuracy : 0.9870689511299133
```

```
# function to predict messages based on model
# (should return list containing prediction and label, ex. [0.008318834938108921, 'ham'])

intToLabel = {0: "ham", 1: "spam"}

def predict_message(pred_text):
  pred_text = remove_punctuations(pred_text)
  pred_text = remove_stopwords(pred_text)

  sequence = tokenizer.texts_to_sequences([pred_text])
  sequence = pad_sequences(sequence, maxlen=max_len)

  prediction = model.predict(sequence)[0]

  label = "ham"
  if prediction >= 0.5:
      label = "spam"

  print((prediction[0], label))
  return (prediction[0], label)

pred_text = "how are you doing today?"

prediction = predict_message(pred_text)
```

```
1/1 [==============================] - 1s 1s/step
(0.045758728, 'ham')
```

```
# Run this cell to test your function and model. Do not modify contents.

def test_predictions():
  test_messages = ["how are you doing today",
                   "sale today! to stop texts call 98912460324",
                   "i dont want to go. can we try it a different day? available sat",
                   "our new mobile video service is live. just install on your phone to start watching.",
                   "you have won £1000 cash! call to claim your prize.",
                   "i'll bring it tomorrow. don't forget the milk.",
                   "wow, is your arm alright. that happened to me one time too"
                 ]

  test_answers = ["ham", "spam", "ham", "spam", "spam", "ham", "ham"]
  passed = True

  for msg, ans in zip(test_messages, test_answers):
    prediction = predict_message(msg)
    if prediction[1] != ans:
      passed = False

  if passed:
    print("You passed the challenge. Great job!")
  else:
    print("You haven't passed yet. Keep trying.")

test_predictions()
```

```
1/1 [==============================] - 0s 32ms/step
(0.045758728, 'ham')
1/1 [==============================] - 0s 33ms/step
(0.6922271, 'spam')
1/1 [==============================] - 0s 39ms/step
(0.024520492, 'ham')
1/1 [==============================] - 0s 39ms/step
(0.992569, 'spam')
1/1 [==============================] - 0s 37ms/step
(0.9945590, 'spam')
1/1 [==============================] - 0s 38ms/step
(0.028450316, 'ham')
1/1 [==============================] - 0s 60ms/step
(0.013669308, 'ham')
You passed the challenge. Great job!
```

Colab paid products - Cancel contracts here
0s completed at 2:16 PM