Assignment -4

SMS SPAM CLASSIFICATION

Assignment Date	21 October 2022
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Maximum Marks	2 Marks

Download the dataset

+ Code + Text

```
[1] from google.colab import files
    uploaded = files.upload()
```

Choose Files spam.csv

- **spam.csv**(text/csv) - 503663 bytes, last modified: 10/31/2022 - 100% done

```
Saving spam.csv to spam.csv
```

Import required libraries

```
[2] import csv
    import tensorflow as tf
    import pandas as pd
    import numpy as np
    import matplotlib.pyplot as plt
    from tensorflow.keras.preprocessing.text import Tokenizer
    from tensorflow.keras.preprocessing.sequence import pad_sequences
    import nltk
    nltk.download('stopwords')
    from nltk.corpus import stopwords
    STOPWORDS = set(stopwords.words('english'))
```

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

Import dataset

```
[3] import io
    dataset = pd.read_csv(io.BytesIO(uploaded['spam.csv']), encoding = "ISO-8859-1")
```

```
[4] vocab_size = 5000
    embedding_dim = 64
    max_length = 200
    trunc_type = 'post'
    padding_type = 'post'
    oov_tok = ''
    training_portion = .8
```

Read dataset and do pre-processing

To remove the stop words

```
[5]  articles = []
     labels = []

     with open("spam.csv", 'r', encoding = "ISO-8859-1") as dataset:
         reader = csv.reader(dataset, delimiter=',')
         next(reader)
         for row in reader:
             labels.append(row[0])
             article = row[1]
             for word in STOPWORDS:
                 token = ' ' + word + ' '
                 article = article.replace(token, ' ')
                 article = article.replace('  ', ' ')
             articles.append(article)
     print(len(labels))
     print(len(articles))
```

```
5572
5572
```

Train the model

```
[6]  train_size = int(len(articles) * training_portion)
     train_articles = articles[0: train_size]
     train_labels = labels[0: train_size]
     validation_articles = articles[train_size:]
     validation_labels = labels[train_size:]
     print(train_size)
     print(len(train_articles))
     print(len(train_labels))
     print(len(validation_articles))
     print(len(validation_labels))
```

```
4457
4457
4457
1115
1115
```

```
     tokenizer = Tokenizer(num_words = vocab_size, oov_token=oov_tok)
     tokenizer.fit_on_texts(train_articles)
     word_index = tokenizer.word_index
     dict(list(word_index.items())[0:10])
```

```
{'': 1,
 'i': 2,
 'u': 3,
 'call': 4,
 'you': 5,
 '2': 6,
 'get': 7,
 "i'm": 8,
 'ur': 9,
 'now': 10}
```

Training data to sequence

```
[8]  train_sequences = tokenizer.texts_to_sequences(train_articles)
     print(train_sequences[10])
```

```
[8, 189, 37, 201, 30, 260, 293, 991, 222, 53, 153, 3815, 423, 46]
```

Train neural network for NLP

```
[9] train_padded = pad_sequences(train_sequences, maxlen=max_length, padding=padding_type, truncating=trunc_type)
    print(len(train_sequences[0]))
    print(len(train_padded[0]))

    print(len(train_sequences[1]))
    print(len(train_padded[1]))

    print(len(train_sequences[10]))
    print(len(train_padded[10]))
```

```
16
200
6
200
14
200
```

```
print(train_padded[10])
```

```
[   8  189   37  201   30  260  293  991  222   53  153 3815  423   46
    0    0    0    0    0    0    0    0    0    0    0    0    0    0
    0    0    0    0    0    0    0    0    0    0    0    0    0    0
    0    0    0    0    0    0    0    0    0    0    0    0    0    0
    0    0    0    0    0    0    0    0    0    0    0    0    0    0
    0    0    0    0    0    0    0    0    0    0    0    0    0    0
    0    0    0    0    0    0    0    0    0    0    0    0    0    0
    0    0    0    0    0    0    0    0    0    0    0    0    0    0
    0    0    0    0    0    0    0    0    0    0    0    0    0    0
```

```
[11] validation_sequences = tokenizer.texts_to_sequences(validation_articles)
     validation_padded = pad_sequences(validation_sequences, maxlen=max_length, padding=padding_type, truncating=trunc_type)

     print(len(validation_sequences))
     print(validation_padded.shape)
```

```
1115
(1115, 200)
```

```
label_tokenizer = Tokenizer()
label_tokenizer.fit_on_texts(labels)

training_label_seq = np.array(label_tokenizer.texts_to_sequences(train_labels))
validation_label_seq = np.array(label_tokenizer.texts_to_sequences(validation_labels))
print(training_label_seq[0])
print(training_label_seq[1])
print(training_label_seq[2])
print(training_label_seq.shape)

print(validation_label_seq[0])
print(validation_label_seq[1])
print(validation_label_seq[2])
print(validation_label_seq.shape)
```

```
[1]
[1]
[2]
(4457, 1)
```

```
[13] reverse_word_index = dict([(value, key) for (key, value) in word_index.items()])

     def decode_article(text):
         return ' '.join([reverse_word_index.get(i, '?') for i in text])
     print(decode_article(train_padded[10]))
     print('---')
     print(train_articles[10])
```

```
i'm gonna home soon want talk stuff anymore tonight k i've cried enough today ? ? ? ? ? ? ? ? ? ? ? ? ? ? ? ? ? ? ? ? ? ? ? ? ? ? ? ? ? ? ? ? ? ? ? ? ? ? ? ? ? ? ? ? ? ? ? ? ? ? ?
---
I'm gonna home soon want talk stuff anymore tonight, k? I've cried enough today.
```

To implement LSTM

```
model = tf.keras.Sequential([

    tf.keras.layers.Embedding(vocab_size, embedding_dim),
    tf.keras.layers.Bidirectional(tf.keras.layers.LSTM(embedding_dim)),
    tf.keras.layers.Dense(embedding_dim, activation='relu'),
    tf.keras.layers.Dense(6, activation='softmax')
])
model.summary()
```

```
Model: "sequential"
_________________________________________________________________
 Layer (type)                Output Shape              Param #
=================================================================
 embedding (Embedding)       (None, None, 64)          320000

 bidirectional (Bidirectiona  (None, 128)              66048
 l)

 dense (Dense)               (None, 64)                8256

 dense_1 (Dense)             (None, 6)                 390

=================================================================
Total params: 394,694
Trainable params: 394,694
```

```
print(set(labels))
```

```
{'spam', 'ham'}
```

```
model.compile(loss='sparse_categorical_crossentropy', optimizer='adam', metrics=['accuracy'])
num_epochs = 10
history = model.fit(train_padded, training_label_seq, epochs=num_epochs, validation_data=(validation_padded, validation_label_seq), verbose=2)
```

```
Epoch 1/10
140/140 - 38s - loss: 0.3650 - accuracy: 0.9044 - val_loss: 0.0440 - val_accuracy: 0.9865 - 38s/epoch - 268ms/step
Epoch 2/10
140/140 - 28s - loss: 0.0356 - accuracy: 0.9899 - val_loss: 0.0318 - val_accuracy: 0.9901 - 28s/epoch - 199ms/step
Epoch 3/10
140/140 - 28s - loss: 0.0133 - accuracy: 0.9964 - val_loss: 0.0431 - val_accuracy: 0.9865 - 28s/epoch - 198ms/step
Epoch 4/10
140/140 - 30s - loss: 0.0058 - accuracy: 0.9987 - val_loss: 0.0433 - val_accuracy: 0.9874 - 30s/epoch - 212ms/step
Epoch 5/10
140/140 - 28s - loss: 0.0036 - accuracy: 0.9989 - val_loss: 0.0448 - val_accuracy: 0.9901 - 28s/epoch - 198ms/step
Epoch 6/10
140/140 - 28s - loss: 0.0023 - accuracy: 0.9996 - val_loss: 0.0475 - val_accuracy: 0.9857 - 28s/epoch - 198ms/step
Epoch 7/10
140/140 - 28s - loss: 0.0016 - accuracy: 0.9996 - val_loss: 0.0512 - val_accuracy: 0.9883 - 28s/epoch - 198ms/step
Epoch 8/10
140/140 - 28s - loss: 4.0214e-04 - accuracy: 1.0000 - val_loss: 0.0619 - val_accuracy: 0.9883 - 28s/epoch - 198ms/step
Epoch 9/10
140/140 - 28s - loss: 2.6316e-04 - accuracy: 1.0000 - val_loss: 0.0659 - val_accuracy: 0.9874 - 28s/epoch - 197ms/step
Epoch 10/10
140/140 - 28s - loss: 1.2626e-04 - accuracy: 1.0000 - val_loss: 0.0648 - val_accuracy: 0.9883 - 28s/epoch - 198ms/step
```

```
def plot_graphs(history, string):
  plt.plot(history.history[string])
  plt.plot(history.history['val_'+string])
  plt.xlabel("Epochs")
  plt.ylabel(string)
  plt.legend([string, 'val_'+string])
  plt.show()

plot_graphs(history, "accuracy")
plot_graphs(history, "loss")
```