Assignment10_BasitAbdul

November 2, 2022

1 Assignment 10-1

1.0.1 10.1.a - Create a tokenize function

[1]:
```
import string
```

[2]:
```
def tokenize(sentence):
    # Split the sentence by spaces
    words = sentence.split()
    # Remove punctuation
    table = str.maketrans('', '', string.punctuation)
    stripped = [w.translate(table) for w in words]
    return stripped
```

[3]:
```
sentence = "This is my sentence, to parse. Get all punctuation out# of here!"
tokens = tokenize(sentence)
print(type(tokens))
print(tokens)
```

```
<class 'list'>
['This', 'is', 'my', 'sentence', 'to', 'parse', 'Get', 'all', 'punctuation',
'out', 'of', 'here']
```

1.0.2 Assignment 10.1 b

[4]:
```
! pip install nltk
```

```
Requirement already satisfied: nltk in /opt/conda/lib/python3.8/site-packages
(3.7)
Requirement already satisfied: click in /opt/conda/lib/python3.8/site-packages
(from nltk) (7.1.2)
Requirement already satisfied: joblib in /opt/conda/lib/python3.8/site-packages
(from nltk) (0.16.0)
Requirement already satisfied: regex>=2021.8.3 in /opt/conda/lib/python3.8/site-
packages (from nltk) (2022.10.31)
Requirement already satisfied: tqdm in /opt/conda/lib/python3.8/site-packages
(from nltk) (4.47.0)
```

[5]:
```
import nltk
```

[6]:
```
def ngram(paragraph, n):
    # Split the sentence by spaces
    words = paragraph.split()
    # Remove punctuation
    table = str.maketrans('', '', string.punctuation)
    stripped = [w.translate(table) for w in words]
    bi_grams = nltk.ngrams(stripped, n)
    return bi_grams
```

[7]:
```
paragraph = "This is my sentence, to parse. Get all punctuation out# of here!"
bi_grams = ngram(paragraph, 3)
for gram in bi_grams:
    print(gram)
```

```
('This', 'is', 'my')
('is', 'my', 'sentence')
('my', 'sentence', 'to')
('sentence', 'to', 'parse')
('to', 'parse', 'Get')
('parse', 'Get', 'all')
('Get', 'all', 'punctuation')
('all', 'punctuation', 'out')
('punctuation', 'out', 'of')
('out', 'of', 'here')
```

1.0.3 Assignment 10.1 c - Create a Vector

[8]:
```
import string
import nltk
from numpy import array
from numpy import argmax
from keras.utils import to_categorical
```

[9]:
```
def onehtencode(data):
    data = array(data)
    print("Received array")
    print(data)
    # one hot encode
    encoded = to_categorical(data)
    return encoded
```

[10]:
```
data = [1, 3, 2, 0, 3, 2, 2, 1, 0, 1]
encodedval = onehtencode(data)
print("One Hot Encoded values")
print(encodedval)
```

```
Received array
[1 3 2 0 3 2 2 1 0 1]
One Hot Encoded values
[[0. 1. 0. 0.]
 [0. 0. 0. 1.]
 [0. 0. 1. 0.]
 [1. 0. 0. 0.]
 [0. 0. 0. 1.]
 [0. 0. 1. 0.]
 [0. 0. 1. 0.]
 [0. 1. 0. 0.]
 [1. 0. 0. 0.]
 [0. 1. 0. 0.]]
```

[ ]:

2 Assignment 10-2

[11]:
```
from keras.preprocessing.text import Tokenizer
from keras.preprocessing.sequence import pad_sequences
import numpy as np
import matplotlib.pyplot as plt
from pathlib import Path
from keras.models import Sequential
from keras.layers import Embedding, Flatten, Dense
import os
from contextlib import redirect_stdout
import time
start_time = time.time()
```

[12]:
```
results_dir = Path('results').joinpath('model_1')
results_dir.mkdir(parents=True, exist_ok=True)
imdb_dir = Path('imdb/aclImdb/')
test_dir = os.path.join(imdb_dir, 'test')
train_dir = os.path.join(imdb_dir, 'train')
```

[13]:
```
training_samples = 200
maxlen = 100
max_words = 1000
embedding_dim = 100

training_samples = 200
validation_samples = 10000
```

[16]:
```
# Process the labels of the raw IMDB data
import os
```

```
imdb_dir = '/home/jovyan/dsc650/data/external/imdb/aclImdb'
train_dir = os.path.join(imdb_dir, 'train')

labels = []
texts = []

for label_type in ['neg', 'pos']:
  dir_name = os.path.join(train_dir, label_type)
  for fname in os.listdir(dir_name):
    if fname[-4:] == '.txt':
      f = open(os.path.join(dir_name, fname))
      texts.append(f.read())
      f.close()
      if label_type == 'neg':
        labels.append(0)
      else:
        labels.append(1)
```

[17]:
```
tokenizer = Tokenizer(num_words=max_words)
tokenizer.fit_on_texts(texts)
sequences = tokenizer.texts_to_sequences(texts)

word_index = tokenizer.word_index
print('Found %s unique tokens.' % len(word_index))

data = pad_sequences(sequences, maxlen=maxlen)
labels = np.asarray(labels)
print('Shape of data tensor:', data.shape)
print('Shape of label tensor:', labels.shape)
```

```
Found 88582 unique tokens.
Shape of data tensor: (25000, 100)
Shape of label tensor: (25000,)
```

[18]:
```
indices = np.arange(data.shape[0])
np.random.shuffle(indices)
data = data[indices]
labels = labels[indices]

x_train = data[:training_samples]
y_train = labels[:training_samples]
x_val = data[training_samples: training_samples + validation_samples]
y_val = labels[training_samples: training_samples + validation_samples]
```

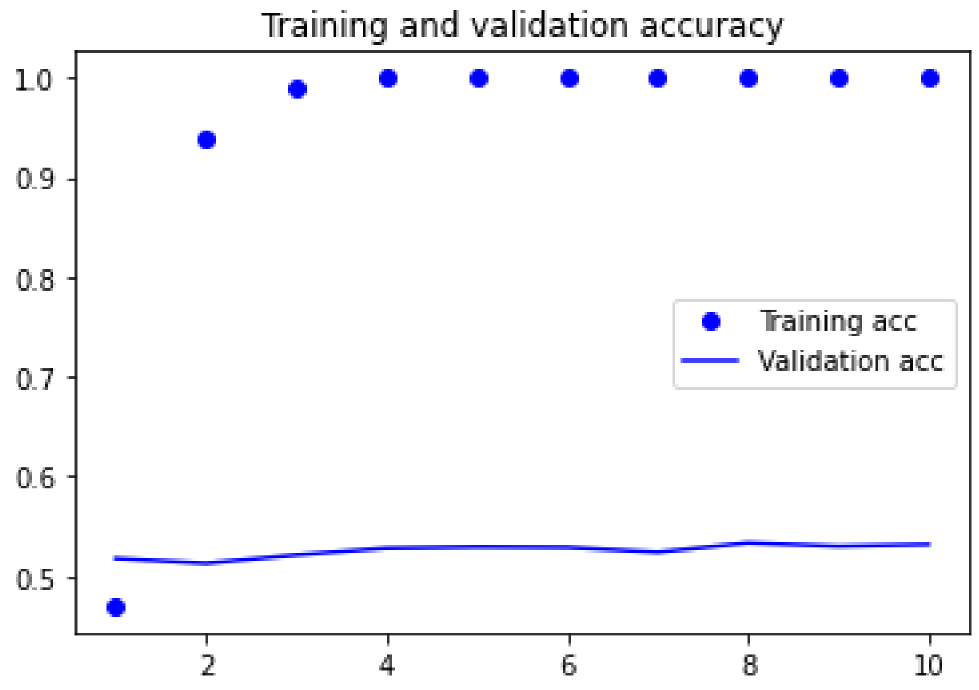
[19]:
```
model = Sequential()
model.add(Embedding(max_words, embedding_dim, input_length=maxlen))
model.add(Flatten())
model.add(Dense(32,activation='relu'))
model.add(Dense(1, activation='sigmoid'))
```

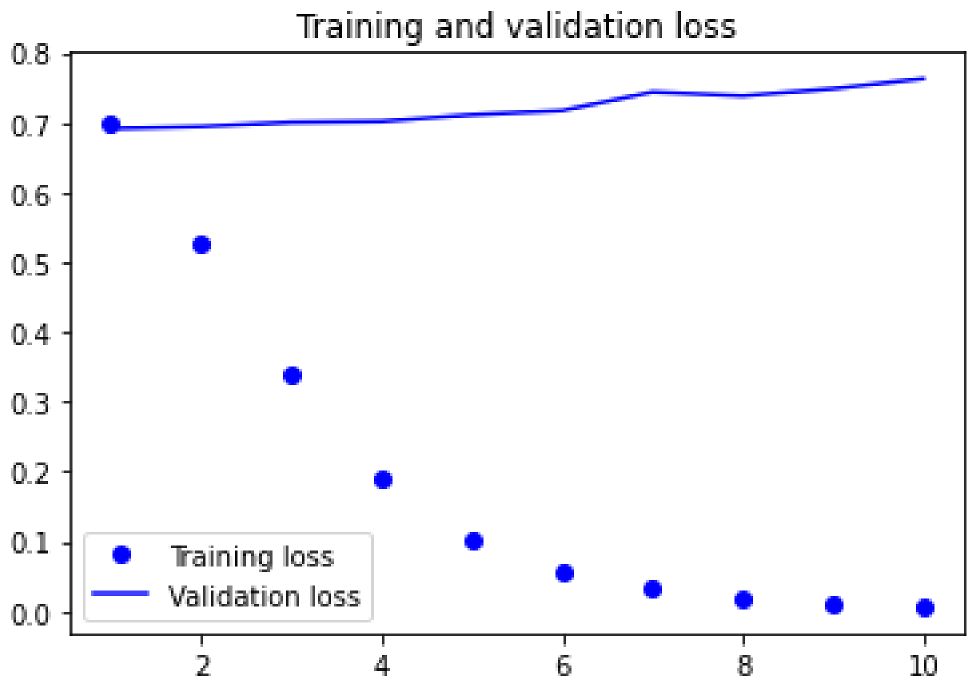
[20]:
```
# Save the summary to file
summary_file = results_dir.joinpath('Assignment_10.2_ModelSummary.txt')
with open(summary_file, 'w') as f:
    with redirect_stdout(f):
        model.summary()

model.compile(optimizer='rmsprop', loss='binary_crossentropy', metrics=['acc'])
history=model.fit(x_train, y_train, epochs=10, batch_size=32,␣
 ↪validation_data=(x_val, y_val))

result_model_file = results_dir.joinpath('pre_trained_glove_model.h5')
model.save_weights(result_model_file)
```

```
Epoch 1/10
7/7 [==============================] - 1s 121ms/step - loss: 0.6991 - acc:
0.4700 - val_loss: 0.6913 - val_acc: 0.5177
Epoch 2/10
7/7 [==============================] - 1s 97ms/step - loss: 0.5254 - acc: 0.9400
- val_loss: 0.6942 - val_acc: 0.5128
Epoch 3/10
7/7 [==============================] - 1s 107ms/step - loss: 0.3390 - acc:
0.9900 - val_loss: 0.7003 - val_acc: 0.5212
Epoch 4/10
7/7 [==============================] - 1s 109ms/step - loss: 0.1919 - acc:
1.0000 - val_loss: 0.7016 - val_acc: 0.5281
Epoch 5/10
7/7 [==============================] - 1s 106ms/step - loss: 0.1017 - acc:
1.0000 - val_loss: 0.7111 - val_acc: 0.5293
Epoch 6/10
7/7 [==============================] - 1s 103ms/step - loss: 0.0576 - acc:
1.0000 - val_loss: 0.7171 - val_acc: 0.5289
Epoch 7/10
7/7 [==============================] - 1s 108ms/step - loss: 0.0324 - acc:
1.0000 - val_loss: 0.7437 - val_acc: 0.5240
Epoch 8/10
7/7 [==============================] - 1s 109ms/step - loss: 0.0200 - acc:
1.0000 - val_loss: 0.7383 - val_acc: 0.5333
Epoch 9/10
7/7 [==============================] - 1s 112ms/step - loss: 0.0116 - acc:
1.0000 - val_loss: 0.7484 - val_acc: 0.5300
Epoch 10/10
7/7 [==============================] - 1s 109ms/step - loss: 0.0072 - acc:
1.0000 - val_loss: 0.7629 - val_acc: 0.5317
```

```
      ␣
↪---------------------------------------------------------------------------

       AttributeError                            Traceback (most recent call␣
↪last)

       <ipython-input-20-f2517e222056> in <module>
         9
        10 result_model_file = results_dir.joinpath('pre_trained_glove_model.
↪h5')
   ---> 11 model.save_weights(result_model_file)


       /opt/conda/lib/python3.8/site-packages/tensorflow/python/keras/engine/
↪network.py in save_weights(self, filepath, overwrite, save_format)
      1112     """
      1113     self._assert_weights_created()
   -> 1114     filepath_is_h5 = _is_hdf5_filepath(filepath)
      1115     if save_format is None:
      1116       if filepath_is_h5:


       /opt/conda/lib/python3.8/site-packages/tensorflow/python/keras/engine/
↪network.py in _is_hdf5_filepath(filepath)
      1614
      1615 def _is_hdf5_filepath(filepath):
   -> 1616   return (filepath.endswith('.h5') or filepath.endswith('.keras') or
      1617           filepath.endswith('.hdf5'))
      1618


       AttributeError: 'PosixPath' object has no attribute 'endswith'
```

[21]:
```
# Place plot here
acc = history.history['acc']
val_acc = history.history['val_acc']
loss = history.history['loss']
val_loss = history.history['val_loss']

epochs = range(1, len(acc) + 1)

plt.plot(epochs, acc, 'bo', label='Training acc')
plt.plot(epochs, val_acc, 'b', label='Validation acc')
plt.title('Training and validation accuracy')
plt.legend()
plt.figure()
plt.plot(epochs, loss, 'bo', label='Training loss')
plt.plot(epochs, val_loss, 'b', label='Validation loss')
plt.title('Training and validation loss')
plt.legend()
img_file = results_dir.joinpath('Assignment_10.2_Model Accuracy Validation.png')
plt.savefig(img_file)
plt.show()
```





[28]:
```
import os

imdb_dir = '/home/jovyan/dsc650/data/external/imdb/aclImdb/'
train_dir = os.path.join(imdb_dir, 'train')

labels=[]
texts=[]

for label_type in ['neg', 'pos']:
    dir_name = os.path.join(test_dir, label_type)
    for fname in sorted(os.listdir(dir_name)):
        if fname[-4:] == '.txt':
            f = open(os.path.join(dir_name, fname), encoding="utf8")
            texts.append(f.read())
            f.close()
            if label_type == 'neg':
                labels.append(0)
            else:
                labels.append(1)

sequence = tokenizer.texts_to_sequences(texts)
x_test = pad_sequences(sequences, maxlen=maxlen)
y_test = np.asarray(labels)
```

```
model.load_weights(result_model_file)
eval = model.evaluate(x_test, y_test)
print("")
print(eval)
print("Complete: --- %s seconds has passed ---" % (time.time() - start_time))
```

```
       ␣
↪---------------------------------------------------------------------------

       AttributeError                            Traceback (most recent call␣
↪last)

       <ipython-input-28-c9f2a8bd245c> in <module>
        23 y_test = np.asarray(labels)
        24
   ---> 25 model.load_weights(result_model_file)
        26 eval = model.evaluate(x_test, y_test)
        27 print("")


       /opt/conda/lib/python3.8/site-packages/tensorflow/python/keras/engine/
↪training.py in load_weights(self, filepath, by_name, skip_mismatch)
       248         raise ValueError('Load weights is not yet supported with␣
↪TPUStrategy '
       249                          'with steps_per_run greater than 1.')
   --> 250     return super(Model, self).load_weights(filepath, by_name,␣
↪skip_mismatch)
       251
       252   def compile(self,


       /opt/conda/lib/python3.8/site-packages/tensorflow/python/keras/engine/
↪network.py in load_weights(self, filepath, by_name, skip_mismatch)
      1225           'True when by_name is True.')
      1226
   -> 1227     if _is_hdf5_filepath(filepath):
      1228       save_format = 'h5'
      1229     else:


       /opt/conda/lib/python3.8/site-packages/tensorflow/python/keras/engine/
↪network.py in _is_hdf5_filepath(filepath)
      1614
      1615 def _is_hdf5_filepath(filepath):
   -> 1616   return (filepath.endswith('.h5') or filepath.endswith('.keras') or
      1617           filepath.endswith('.hdf5'))
```

```
1618
```

```
AttributeError: 'PosixPath' object has no attribute 'endswith'
```

[ ]:

```

```

3 Assignment 10-3

[25]:

```python
import tensorflow.compat.v1 as tf
tf.disable_v2_behavior()
from keras.preprocessing.text import Tokenizer
from keras.preprocessing.sequence import pad_sequences
import numpy as np
import matplotlib.pyplot as plt
from pathlib import Path
from keras.models import Sequential
from keras.layers import Embedding, Flatten, Dense
import os
from contextlib import redirect_stdout
import time
start_time = time.time()
from keras.layers import LSTM
# Needed the following as caused CUDA DNN errors
#physical_devices = tf.config.list_physical_devices('GPU')
#tf.config.experimental.set_memory_growth(physical_devices[0], True)

from keras.datasets import imdb
from keras.preprocessing import sequence
```

```
WARNING:tensorflow:From /opt/conda/lib/python3.8/site-
packages/tensorflow/python/compat/v2_compat.py:96: disable_resource_variables
(from tensorflow.python.ops.variable_scope) is deprecated and will be removed in
a future version.
Instructions for updating:
non-resource variables are not supported in the long term
```

[26]:

```python
imdb_dir = Path('/home/jovyan/dsc650/data/external/imdb/aclImdb/')
test_dir = os.path.join(imdb_dir, 'test')
train_dir = os.path.join(imdb_dir, 'train')

results_dir = Path('results').joinpath('model_1')
results_dir.mkdir(parents=True, exist_ok=True)
```

[27]:
```
max_features = 10000
maxlen = 500
batch_size = 32
max_words = 1000
training_samples = 200
validation_samples = 10000
```

[29]:
```
import os

imdb_dir = '/home/jovyan/dsc650/data/external/imdb/aclImdb/'
train_dir = os.path.join(imdb_dir, 'train')

labels = []
texts = []

for label_type in ['neg', 'pos']:
    dir_name = os.path.join(test_dir, label_type)
    for fname in sorted(os.listdir(dir_name)):
        if fname[-4:] == '.txt':
            f = open(os.path.join(dir_name, fname), encoding="utf8")
            texts.append(f.read())
            f.close()
            if label_type == 'neg':
                labels.append(0)
            else:
                labels.append(1)
```

[30]:
```
tokenizer = Tokenizer(num_words=max_words)
tokenizer.fit_on_texts(texts)
sequences = tokenizer.texts_to_sequences(texts)

print('Loading data... ')

word_index = tokenizer.word_index
print('Found %s unique tokens.' % len(word_index))

data = pad_sequences(sequences, maxlen=maxlen)
labels = np.asarray(labels)
print('Shape of data tensor:', data.shape)
print('Shape of label tensor:', labels.shape)

indices = np.arange(data.shape[0])
np.random.shuffle(indices)
data = data[indices]
labels = labels[indices]
```

```
Loading data…
```

```
Found 87393 unique tokens.
Shape of data tensor: (25000, 500)
Shape of label tensor: (25000,)
```

[31]:
```python
#x_train
input_train = data[:training_samples]
#y_train
y_train = labels[:training_samples]

#x_val
input_test = data[training_samples: training_samples + validation_samples]
#y_val
y_test = labels[training_samples: training_samples + validation_samples]

print('input_train shape:', input_train.shape)
print('input_test shape:', input_test.shape)
```

```
input_train shape: (200, 500)
input_test shape: (10000, 500)
```

[32]:
```python
model = Sequential()
model.add(Embedding(max_features, 32))
model.add(LSTM(32))
model.add(Dense(1, activation='sigmoid'))
model.compile(optimizer='rmsprop', loss='binary_crossentropy', metrics=['acc'])
history=model.fit(input_train, y_train, epochs=10, batch_size=32,␣
 ↪validation_data=(input_test, y_test))

result_model_file = results_dir.joinpath('pre_trained_glove_model_LSTM.h5')
model.save_weights(result_model_file)
```

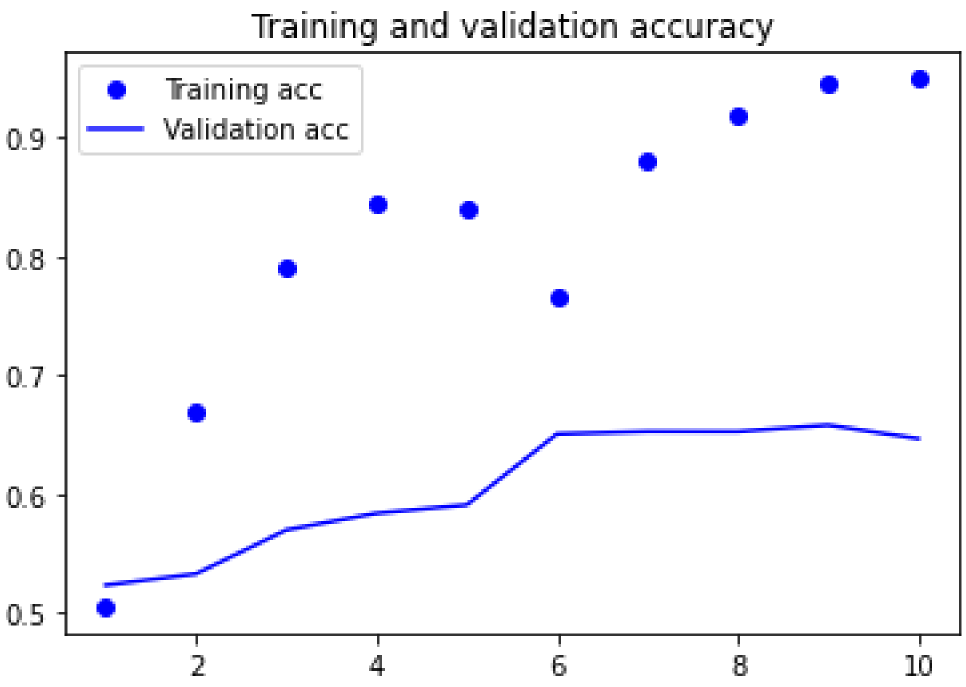
```
WARNING:tensorflow:From /opt/conda/lib/python3.8/site-
packages/tensorflow/python/keras/initializers.py:118: calling
RandomUniform.__init__ (from tensorflow.python.ops.init_ops) with dtype is
deprecated and will be removed in a future version.
Instructions for updating:
Call initializer instance with the dtype argument instead of passing it to the
constructor
WARNING:tensorflow:From /opt/conda/lib/python3.8/site-
packages/tensorflow/python/ops/resource_variable_ops.py:1659: calling
BaseResourceVariable.__init__ (from tensorflow.python.ops.resource_variable_ops)
with constraint is deprecated and will be removed in a future version.
Instructions for updating:
If using Keras pass *_constraint arguments to layers.
Train on 200 samples, validate on 10000 samples
Epoch 1/10
200/200 [==============================] - 27s 135ms/sample - loss: 0.6942 -
acc: 0.5050 - val_loss: 0.6928 - val_acc: 0.5230
```

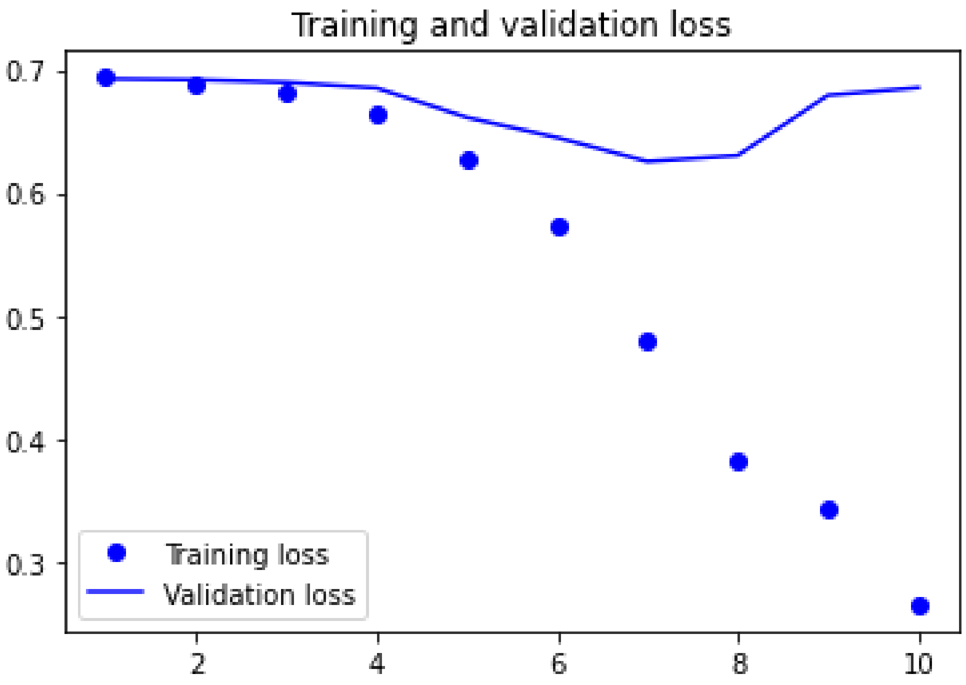
```
Epoch 2/10
200/200 [==============================] - 24s 118ms/sample - loss: 0.6886 -
acc: 0.6700 - val_loss: 0.6920 - val_acc: 0.5325
Epoch 3/10
200/200 [==============================] - 21s 107ms/sample - loss: 0.6811 -
acc: 0.7900 - val_loss: 0.6899 - val_acc: 0.5696
Epoch 4/10
200/200 [==============================] - 20s 100ms/sample - loss: 0.6654 -
acc: 0.8450 - val_loss: 0.6852 - val_acc: 0.5835
Epoch 5/10
200/200 [==============================] - 18s 92ms/sample - loss: 0.6267 - acc:
0.8400 - val_loss: 0.6615 - val_acc: 0.5906
Epoch 6/10
200/200 [==============================] - 18s 91ms/sample - loss: 0.5728 - acc:
0.7650 - val_loss: 0.6450 - val_acc: 0.6505
Epoch 7/10
200/200 [==============================] - 18s 91ms/sample - loss: 0.4789 - acc:
0.8800 - val_loss: 0.6256 - val_acc: 0.6526
Epoch 8/10
200/200 [==============================] - 18s 91ms/sample - loss: 0.3828 - acc:
0.9200 - val_loss: 0.6305 - val_acc: 0.6525
Epoch 9/10
200/200 [==============================] - 18s 92ms/sample - loss: 0.3422 - acc:
0.9450 - val_loss: 0.6794 - val_acc: 0.6580
Epoch 10/10
200/200 [==============================] - 18s 90ms/sample - loss: 0.2652 - acc:
0.9500 - val_loss: 0.6855 - val_acc: 0.6465


       ␣
 ↪---------------------------------------------------------------------------

       AttributeError                            Traceback (most recent call␣
 ↪last)

       <ipython-input-32-66f092b7aa36> in <module>
         7
         8 result_model_file = results_dir.
 ↪joinpath('pre_trained_glove_model_LSTM.h5')
   ----> 9 model.save_weights(result_model_file)


       /opt/conda/lib/python3.8/site-packages/tensorflow/python/keras/engine/
 ↪network.py in save_weights(self, filepath, overwrite, save_format)
      1112     """
      1113     self._assert_weights_created()
   -> 1114     filepath_is_h5 = _is_hdf5_filepath(filepath)
      1115     if save_format is None:
```

```
    1116         if filepath_is_h5:


     /opt/conda/lib/python3.8/site-packages/tensorflow/python/keras/engine/
↪network.py in _is_hdf5_filepath(filepath)
    1614
    1615 def _is_hdf5_filepath(filepath):
 -> 1616   return (filepath.endswith('.h5') or filepath.endswith('.keras') or
    1617           filepath.endswith('.hdf5'))
    1618


     AttributeError: 'PosixPath' object has no attribute 'endswith'
```

[33]:
```
# Save the summary to file
summary_file = results_dir.joinpath('Assignment_10.3_ModelSummary.txt')
with open(summary_file, 'w') as f:
    with redirect_stdout(f):
        model.summary()
```

[34]:
```
# Place plot here
acc = history.history['acc']
val_acc = history.history['val_acc']
loss = history.history['loss']
val_loss = history.history['val_loss']

epochs = range(1, len(acc) + 1)

plt.plot(epochs, acc, 'bo', label='Training acc')
plt.plot(epochs, val_acc, 'b', label='Validation acc')
plt.title('Training and validation accuracy')
plt.legend()
plt.figure()
plt.plot(epochs, loss, 'bo', label='Training loss')
plt.plot(epochs, val_loss, 'b', label='Validation loss')
plt.title('Training and validation loss')
plt.legend()
img_file = results_dir.joinpath('Assignment_10.3_Model Accuracy Validation.png')
plt.savefig(img_file)
plt.show()
```


Training and validation accuracy
Training acc
Validation acc
0.9
0.8
0.7
0.6
0.5
2
4
6
8
10


Training and validation loss
Training loss
Validation loss
0.7
0.6
0.5
0.4
0.3
2
4
6
8
10

```
[ ]:
```

4 Assignment 10-4

[35]:
```
import tensorflow.compat.v1 as tf
import matplotlib.pyplot as plt
tf.disable_v2_behavior()
```

[36]:
```
from keras.models import Sequential
from keras import layers
from keras.optimizers import RMSprop
from keras.datasets import imdb
from keras.preprocessing import sequence
from contextlib import redirect_stdout
from pathlib import Path
import time
start_time = time.time()
```

[37]:
```
results_dir = Path('results').joinpath('model_1')
results_dir.mkdir(parents=True, exist_ok=True)
```

[38]:
```
max_features = 10000
max_len = 500

print('Loading data ...')

(x_train, y_train), (x_test, y_test) = imdb.load_data(num_words=max_features)
print(len(x_train), 'train sequences')
print(len(x_test), 'test sequences')

print('Pad sequences (samples x time)')
x_train = sequence.pad_sequences(x_train, maxlen = max_len)
x_test = sequence.pad_sequences(x_test, maxlen = max_len)
print('x_train shape:', x_train.shape)
print('x_test shape:', x_test.shape)
```

```
Loading data …
25000 train sequences
25000 test sequences
Pad sequences (samples x time)
x_train shape: (25000, 500)
x_test shape: (25000, 500)
```

[39]:
```
model = Sequential()
model.add(layers.Embedding(max_features, 128, input_length=max_len))
model.add(layers.Conv1D(32, 7, activation='relu'))
model.add(layers.MaxPooling1D(5))
model.add(layers.Conv1D(32, 7, activation='relu'))
model.add(layers.GlobalMaxPooling1D())
model.add(layers.Dense(1))
model.summary()
```

```
Model: "sequential_2"
_________________________________________________________________
Layer (type)                 Output Shape              Param #
=================================================================
embedding_2 (Embedding)      (None, 500, 128)          1280000
_________________________________________________________________
conv1d (Conv1D)              (None, 494, 32)           28704
_________________________________________________________________
max_pooling1d (MaxPooling1D) (None, 98, 32)            0
_________________________________________________________________
conv1d_1 (Conv1D)            (None, 92, 32)            7200
_________________________________________________________________
global_max_pooling1d (Global (None, 32)                0
_________________________________________________________________
dense_3 (Dense)              (None, 1)                 33
=================================================================
Total params: 1,315,937
Trainable params: 1,315,937
Non-trainable params: 0
_________________________________________________________________
```

[40]:
```
model.compile(optimizer=RMSprop(lr=1e-4), loss='binary_crossentropy',␣
 ↪metrics=['acc'])
history = model.fit(x_train, y_train, epochs=10, batch_size=128,␣
 ↪validation_split=0.2)
```

```
Train on 20000 samples, validate on 5000 samples
Epoch 1/10
20000/20000 [==============================] - 10s 497us/sample - loss: 0.7302 -
acc: 0.5252 - val_loss: 0.6837 - val_acc: 0.5930
Epoch 2/10
20000/20000 [==============================] - 10s 491us/sample - loss: 0.6645 -
acc: 0.6702 - val_loss: 0.6602 - val_acc: 0.6762
Epoch 3/10
20000/20000 [==============================] - 10s 509us/sample - loss: 0.6198 -
acc: 0.7692 - val_loss: 0.6056 - val_acc: 0.7402
Epoch 4/10
20000/20000 [==============================] - 10s 499us/sample - loss: 0.5278 -
acc: 0.8163 - val_loss: 0.4961 - val_acc: 0.8078
Epoch 5/10
20000/20000 [==============================] - 10s 495us/sample - loss: 0.4111 -
acc: 0.8503 - val_loss: 0.4123 - val_acc: 0.8404
Epoch 6/10
20000/20000 [==============================] - 10s 493us/sample - loss: 0.3401 -
```

```
acc: 0.8788 - val_loss: 0.4034 - val_acc: 0.8538
Epoch 7/10
20000/20000 [==============================] - 10s 485us/sample - loss: 0.2948 -
acc: 0.8929 - val_loss: 0.4142 - val_acc: 0.8592
Epoch 8/10
20000/20000 [==============================] - 10s 484us/sample - loss: 0.2642 -
acc: 0.9061 - val_loss: 0.4315 - val_acc: 0.8648
Epoch 9/10
20000/20000 [==============================] - 10s 475us/sample - loss: 0.2399 -
acc: 0.9165 - val_loss: 0.4426 - val_acc: 0.8674
Epoch 10/10
20000/20000 [==============================] - 10s 477us/sample - loss: 0.2198 -
acc: 0.9261 - val_loss: 0.4754 - val_acc: 0.8738
```

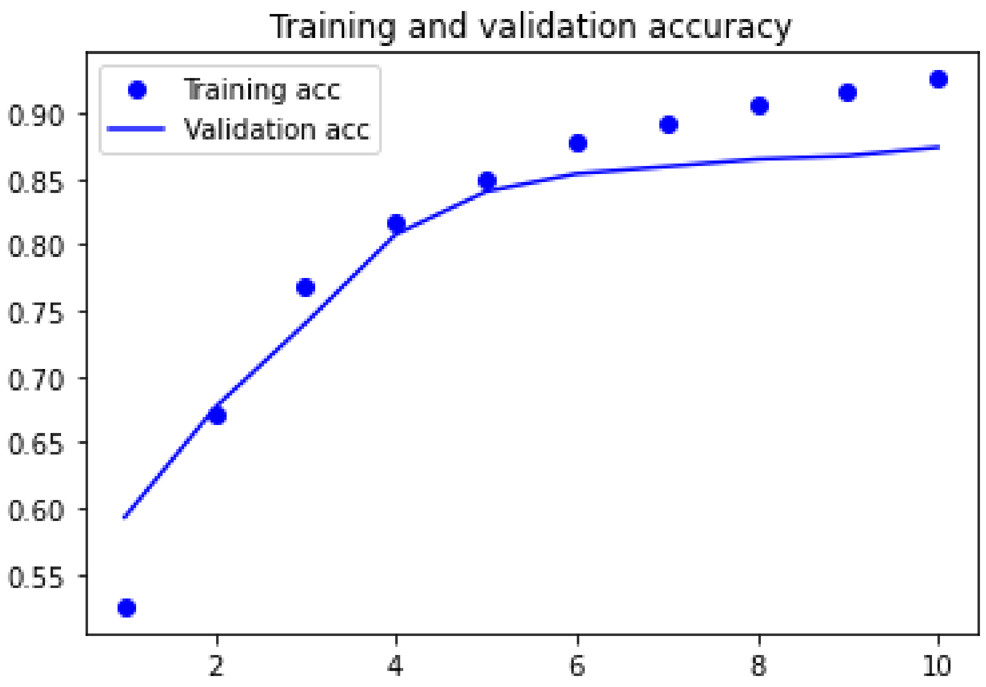
[41]:
```
# Save the summary to file
summary_file = results_dir.joinpath('Assignment_10.4_ModelSummary.txt')
with open(summary_file, 'w') as f:
    with redirect_stdout(f):
        model.summary()
```

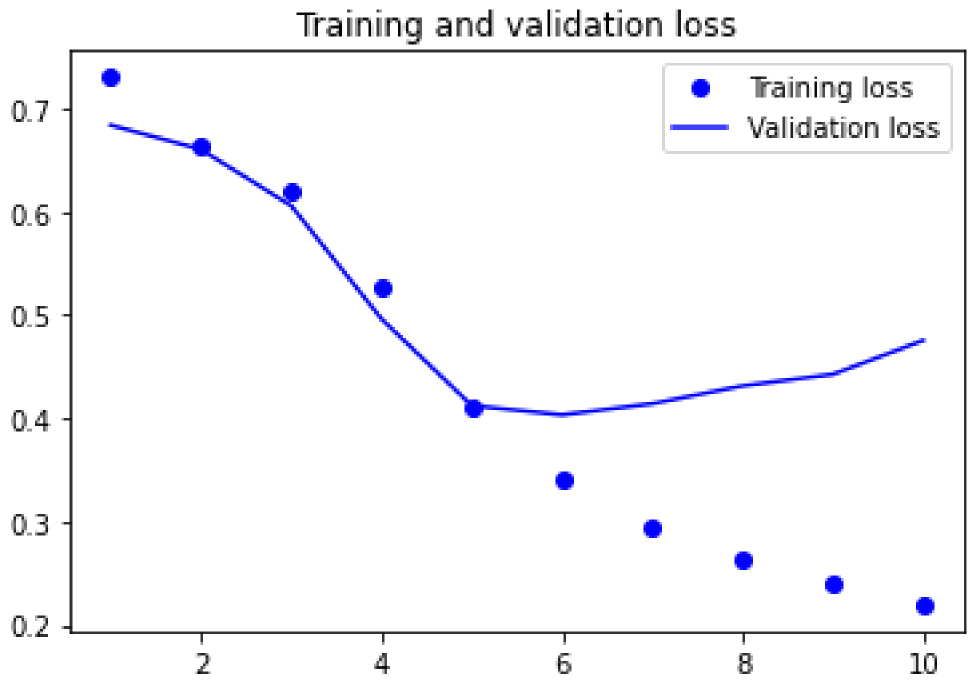
[42]:
```
result_model_file = results_dir.joinpath('pre_trained_glove_model_1D_Convnet.
 ↪h5')
model.save_weights(result_model_file)
```

```
      ␣
↪---------------------------------------------------------------------------

       AttributeError                            Traceback (most recent call␣
↪last)

       <ipython-input-42-3490a0303bf2> in <module>
         1 result_model_file = results_dir.
↪joinpath('pre_trained_glove_model_1D_Convnet.h5')
   ----> 2 model.save_weights(result_model_file)


       /opt/conda/lib/python3.8/site-packages/tensorflow/python/keras/engine/
↪network.py in save_weights(self, filepath, overwrite, save_format)
      1112     """
      1113     self._assert_weights_created()
   -> 1114     filepath_is_h5 = _is_hdf5_filepath(filepath)
      1115     if save_format is None:
      1116       if filepath_is_h5:
```

```
    /opt/conda/lib/python3.8/site-packages/tensorflow/python/keras/engine/
↪network.py in _is_hdf5_filepath(filepath)
      1614
      1615 def _is_hdf5_filepath(filepath):
   -> 1616   return (filepath.endswith('.h5') or filepath.endswith('.keras') or
      1617           filepath.endswith('.hdf5'))
      1618


    AttributeError: 'PosixPath' object has no attribute 'endswith'
```

[43]:
```python
# Place plot here
acc = history.history['acc']
val_acc = history.history['val_acc']
loss = history.history['loss']
val_loss = history.history['val_loss']

epochs = range(1, len(acc) + 1)

plt.plot(epochs, acc, 'bo', label='Training acc')
plt.plot(epochs, val_acc, 'b', label='Validation acc')
plt.title('Training and validation accuracy')
plt.legend()
plt.figure()
plt.plot(epochs, loss, 'bo', label='Training loss')
plt.plot(epochs, val_loss, 'b', label='Validation loss')
plt.title('Training and validation loss')
plt.legend()
img_file = results_dir.joinpath('Assignment_10.4_Model Accuracy Validation.png')
plt.savefig(img_file)
plt.show()
```





[44]:
```
#save the model performance metrics and training and validation accuracy curves␣
↪in the results/model_2 direc
```

```
model.load_weights(result_model_file)
eval = model.evaluate(x_test, y_test)
print("")
print(eval)
```

```
      ␣
↪---------------------------------------------------------------------------

       AttributeError                            Traceback (most recent call␣
↪last)

       <ipython-input-44-ea90e157ce3a> in <module>
         1 #save the model performance metrics and training and validation␣
↪accuracy curves in the results/model_2 direc
   ----> 2 model.load_weights(result_model_file)
         3 eval = model.evaluate(x_test, y_test)
         4 print("")
         5 print(eval)


       /opt/conda/lib/python3.8/site-packages/tensorflow/python/keras/engine/
↪training_v1.py in load_weights(self, filepath, by_name, skip_mismatch)
       231         raise ValueError('Load weights is not yet supported with␣
↪TPUStrategy '
       232                          'with steps_per_run greater than 1.')
   --> 233     return super(Model, self).load_weights(filepath, by_name,␣
↪skip_mismatch)
       234
       235   @trackable.no_automatic_dependency_tracking


       /opt/conda/lib/python3.8/site-packages/tensorflow/python/keras/engine/
↪training.py in load_weights(self, filepath, by_name, skip_mismatch)
       248         raise ValueError('Load weights is not yet supported with␣
↪TPUStrategy '
       249                          'with steps_per_run greater than 1.')
   --> 250     return super(Model, self).load_weights(filepath, by_name,␣
↪skip_mismatch)
       251
       252   def compile(self,


       /opt/conda/lib/python3.8/site-packages/tensorflow/python/keras/engine/
↪network.py in load_weights(self, filepath, by_name, skip_mismatch)
      1225           'True when by_name is True.')
      1226
```

```
-> 1227     if _is_hdf5_filepath(filepath):
   1228       save_format = 'h5'
   1229     else:


     /opt/conda/lib/python3.8/site-packages/tensorflow/python/keras/engine/
↪network.py in _is_hdf5_filepath(filepath)
   1614
   1615 def _is_hdf5_filepath(filepath):
-> 1616   return (filepath.endswith('.h5') or filepath.endswith('.keras') or
   1617           filepath.endswith('.hdf5'))
   1618


     AttributeError: 'PosixPath' object has no attribute 'endswith'
```

[ ]: