assignment5_2

July 9, 2021

[1]:

```
from keras.datasets import reuters

(train_data, train_labels), (test_data, test_labels) = reuters.
 ↪load_data(num_words=10000)
```

```
/opt/conda/lib/python3.8/site-
packages/tensorflow/python/keras/datasets/reuters.py:148:
VisibleDeprecationWarning: Creating an ndarray from ragged nested sequences
(which is a list-or-tuple of lists-or-tuples-or ndarrays with different lengths
or shapes) is deprecated. If you meant to do this, you must specify
'dtype=object' when creating the ndarray
  x_train, y_train = np.array(xs[:idx]), np.array(labels[:idx])
/opt/conda/lib/python3.8/site-
packages/tensorflow/python/keras/datasets/reuters.py:149:
VisibleDeprecationWarning: Creating an ndarray from ragged nested sequences
(which is a list-or-tuple of lists-or-tuples-or ndarrays with different lengths
or shapes) is deprecated. If you meant to do this, you must specify
'dtype=object' when creating the ndarray
  x_test, y_test = np.array(xs[idx:]), np.array(labels[idx:])
```

[2]:

```
word_index = reuters.get_word_index()
reverse_word_index = dict([(value, key) for (key, value) in word_index.items()])
decoded_newswire = ''.join([reverse_word_index.get(i - 3, '?') for i in␣
 ↪train_data[0]])
```

[3]:

```
train_labels[0]
```

[3]:

```
3
```

[4]:

```
import numpy as np

def vectorize_sequences(sequences, dimension=10000):
    results = np.zeros((len(sequences), dimension))
    for i, sequence in enumerate(sequences):
        results[i, sequence] = 1
    return results

x_train = vectorize_sequences(train_data)
```

```
x_test = vectorize_sequences(test_data)
```

[5]:

```
def to_one_hot(labels, dimension=46):
    results=np.zeros((len(labels), dimension))
    for i, label in enumerate(labels):
        results[i, label] = 1
    return results

one_hot_train_labels = to_one_hot(train_labels)
one_hot_test_labels = to_one_hot(test_labels)
```

[7]:

```
from keras import models
from keras import layers

model = models.Sequential()
model.add(layers.Dense(64, activation='relu', input_shape=(10000,)))
model.add(layers.Dense(64, activation='relu'))
model.add(layers.Dense(46, activation='softmax'))
```

[8]:

```
x_val = x_train[:1000]
partial_x_train = x_train[1000:]
y_val = one_hot_train_labels[:1000]
partial_y_train = one_hot_train_labels[1000:]
```

[9]:

```
model.compile('rmsprop',
             loss='categorical_crossentropy',
             metrics=['accuracy'])

history = model.fit(partial_x_train,
                    partial_y_train,
                    epochs=20,
                    batch_size=512,
                    validation_data=(x_val, y_val))
```

```
Epoch 1/20
16/16 [==============================] - 2s 63ms/step - loss: 3.2604 - accuracy:
0.4234 - val_loss: 1.8140 - val_accuracy: 0.6390
Epoch 2/20
16/16 [==============================] - 0s 21ms/step - loss: 1.5419 - accuracy:
0.6878 - val_loss: 1.3408 - val_accuracy: 0.7030
Epoch 3/20
16/16 [==============================] - 0s 17ms/step - loss: 1.0606 - accuracy:
0.7712 - val_loss: 1.1375 - val_accuracy: 0.7510
Epoch 4/20
16/16 [==============================] - 0s 16ms/step - loss: 0.8251 - accuracy:
0.8260 - val_loss: 1.0390 - val_accuracy: 0.7700
Epoch 5/20
```

```
16/16 [==============================] - 0s 14ms/step - loss: 0.6687 - accuracy:
0.8584 - val_loss: 0.9629 - val_accuracy: 0.8100
Epoch 6/20
16/16 [==============================] - 0s 17ms/step - loss: 0.5499 - accuracy:
0.8876 - val_loss: 0.9301 - val_accuracy: 0.8220
Epoch 7/20
16/16 [==============================] - 0s 16ms/step - loss: 0.4313 - accuracy:
0.9117 - val_loss: 0.9129 - val_accuracy: 0.8080
Epoch 8/20
16/16 [==============================] - 0s 17ms/step - loss: 0.3437 - accuracy:
0.9299 - val_loss: 0.8975 - val_accuracy: 0.8180
Epoch 9/20
16/16 [==============================] - 0s 15ms/step - loss: 0.2833 - accuracy:
0.9404 - val_loss: 0.9015 - val_accuracy: 0.8190
Epoch 10/20
16/16 [==============================] - 0s 14ms/step - loss: 0.2390 - accuracy:
0.9493 - val_loss: 0.9065 - val_accuracy: 0.8080
Epoch 11/20
16/16 [==============================] - 0s 15ms/step - loss: 0.2058 - accuracy:
0.9510 - val_loss: 0.9051 - val_accuracy: 0.8140
Epoch 12/20
16/16 [==============================] - 0s 15ms/step - loss: 0.1769 - accuracy:
0.9564 - val_loss: 0.9883 - val_accuracy: 0.8150
Epoch 13/20
16/16 [==============================] - 0s 14ms/step - loss: 0.1510 - accuracy:
0.9593 - val_loss: 0.9551 - val_accuracy: 0.8100
Epoch 14/20
16/16 [==============================] - 0s 17ms/step - loss: 0.1317 - accuracy:
0.9627 - val_loss: 1.0741 - val_accuracy: 0.7860
Epoch 15/20
16/16 [==============================] - 0s 15ms/step - loss: 0.1403 - accuracy:
0.9573 - val_loss: 0.9958 - val_accuracy: 0.8100
Epoch 16/20
16/16 [==============================] - 0s 16ms/step - loss: 0.1200 - accuracy:
0.9597 - val_loss: 1.0271 - val_accuracy: 0.8130
Epoch 17/20
16/16 [==============================] - 0s 16ms/step - loss: 0.1188 - accuracy:
0.9610 - val_loss: 1.0835 - val_accuracy: 0.8040
Epoch 18/20
16/16 [==============================] - 0s 14ms/step - loss: 0.1134 - accuracy:
0.9601 - val_loss: 1.0241 - val_accuracy: 0.8080
Epoch 19/20
16/16 [==============================] - 0s 16ms/step - loss: 0.1052 - accuracy:
0.9619 - val_loss: 1.1301 - val_accuracy: 0.7880
Epoch 20/20
16/16 [==============================] - 0s 17ms/step - loss: 0.1151 - accuracy:
0.9600 - val_loss: 1.0689 - val_accuracy: 0.7990
```

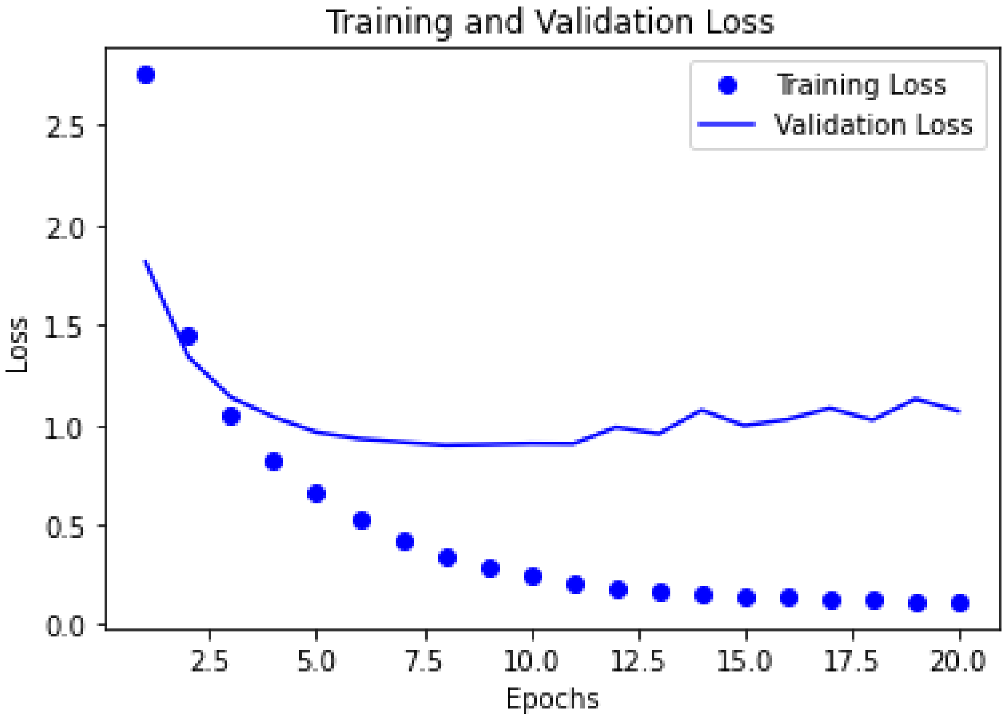
[10]:

```
import matplotlib.pyplot as plt

loss = history.history['loss']
val_loss = history.history['val_loss']

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

plt.plot(epochs, loss, 'bo', label='Training Loss')
plt.plot(epochs, val_loss, 'b', label='Validation Loss')
plt.title('Training and Validation Loss')
plt.xlabel('Epochs')
plt.ylabel('Loss')
plt.legend()
plt.show()
```

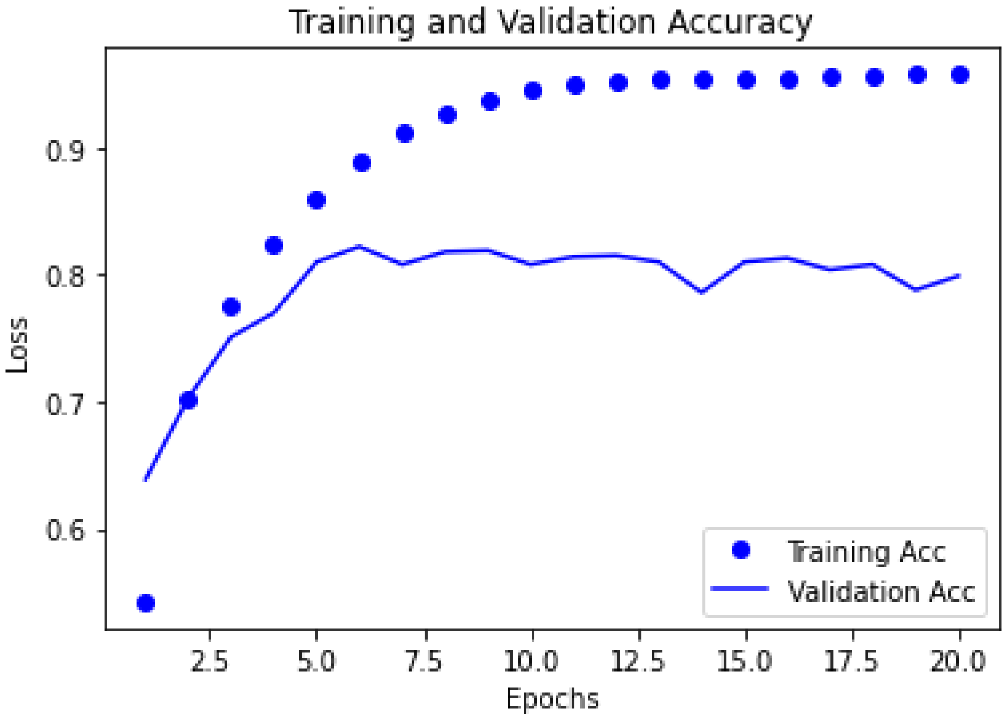


[11]:

```
plt.clf()

acc = history.history['accuracy']
val_acc = history.history['val_accuracy']

plt.plot(epochs, acc, 'bo', label='Training Acc')
plt.plot(epochs, val_acc, 'b', label='Validation Acc')
plt.title('Training and Validation Accuracy')
plt.xlabel('Epochs')
plt.ylabel('Loss')
plt.legend()
plt.show()
```



[12]:
```
model = models.Sequential()
model.add(layers.Dense(64, activation='relu', input_shape=(10000,)))
model.add(layers.Dense(64, activation='relu'))
model.add(layers.Dense(46, activation='softmax'))

model.compile('rmsprop',
             loss='categorical_crossentropy',
             metrics=['accuracy'])

model.fit(partial_x_train,
                   partial_y_train,
                   epochs=9,
                   batch_size=512,
                   validation_data=(x_val, y_val))

results = model.evaluate(x_test, one_hot_test_labels)
```

```
Epoch 1/9
16/16 [==============================] - 1s 31ms/step - loss: 3.3030 - accuracy:
```

```
0.3609 - val_loss: 1.8871 - val_accuracy: 0.6300
Epoch 2/9
16/16 [==============================] - 0s 21ms/step - loss: 1.6305 - accuracy:
0.6799 - val_loss: 1.3594 - val_accuracy: 0.7190
Epoch 3/9
16/16 [==============================] - 0s 17ms/step - loss: 1.1709 - accuracy:
0.7595 - val_loss: 1.1616 - val_accuracy: 0.7620
Epoch 4/9
16/16 [==============================] - 0s 17ms/step - loss: 0.8877 - accuracy:
0.8165 - val_loss: 1.0573 - val_accuracy: 0.7740
Epoch 5/9
16/16 [==============================] - 0s 17ms/step - loss: 0.7011 - accuracy:
0.8565 - val_loss: 0.9745 - val_accuracy: 0.8030
Epoch 6/9
16/16 [==============================] - 0s 16ms/step - loss: 0.5432 - accuracy:
0.8885 - val_loss: 0.9335 - val_accuracy: 0.8080
Epoch 7/9
16/16 [==============================] - 0s 17ms/step - loss: 0.4246 - accuracy:
0.9175 - val_loss: 0.9011 - val_accuracy: 0.8180
Epoch 8/9
16/16 [==============================] - 0s 15ms/step - loss: 0.3511 - accuracy:
0.9295 - val_loss: 0.8893 - val_accuracy: 0.8190
Epoch 9/9
16/16 [==============================] - 0s 18ms/step - loss: 0.2873 - accuracy:
0.9391 - val_loss: 0.8952 - val_accuracy: 0.8220
71/71 [==============================] - 0s 2ms/step - loss: 0.9734 - accuracy:
0.7881
```

[13]:

```
predictions = model.predict(x_test)

predictions[0].shape
```

[13]:

```
(46,)
```

[14]:

```
np.sum(predictions[0])
```

[14]:

```
1.0
```

[15]:

```
np.argmax(predictions[0])
```

[15]:

```
3
```

[ ]:

```

```