Assignment 5.1: IMDB Movie Classifier

In [25]:
```
import numpy as np
import matplotlib.pyplot as plt

from keras import models
from keras import layers
from tensorflow.keras import optimizers
from keras.datasets import imdb
from keras import losses
from keras import metrics
```

In [2]:
```
(train_data, train_labels), (test_data, test_labels) = imdb.load_data(num_wo
```

Vectorize Data

In [6]:
```
def vectorize_sequences(sequences, dimension=10000):
    results = np.zeros((len(sequences), dimension))
    for i, sequence in enumerate(sequences):
        results[i, sequence] = 1.
    return results
```

In [7]:
```
x_train = vectorize_sequences(train_data)
x_test = vectorize_sequences(test_data)
```

In [8]:
```
y_train = np.asarray(train_labels).astype('float32')
y_test = np.asarray(test_labels).astype('float32')
```

Building the Network

In [10]:
```
model = models.Sequential()
model.add(layers.Dense(16, activation='relu', input_shape=(10000,)))
model.add(layers.Dense(16, activation='relu'))
model.add(layers.Dense(1, activation='sigmoid'))
```

In [20]:
```
model.compile(optimizer='rmsprop',
              loss='binary_crossentropy',
              metrics=['acc'])
```

Validation Set

In [19]:
```
x_val = x_train[:10000]
partial_x_train = x_train[10000:]

y_val = y_train[:10000]
partial_y_train = y_train[10000:]
```

Training the Model

In [21]:
```
history = model.fit(partial_x_train,
                    partial_y_train,
                    epochs=20,
                    batch_size=512,
                    validation_data=(x_val, y_val))
```

```
Epoch 1/20
30/30 [==============================] - 6s 175ms/step - loss: 0.5021 - ac
c: 0.7969 - val_loss: 0.3771 - val_acc: 0.8709
Epoch 2/20
30/30 [==============================] - 1s 27ms/step - loss: 0.2973 - acc:
0.9022 - val_loss: 0.3072 - val_acc: 0.8828
Epoch 3/20
30/30 [==============================] - 1s 32ms/step - loss: 0.2177 - acc:
0.9281 - val_loss: 0.3106 - val_acc: 0.8753
Epoch 4/20
30/30 [==============================] - 1s 27ms/step - loss: 0.1718 - acc:
0.9454 - val_loss: 0.2914 - val_acc: 0.8850
Epoch 5/20
30/30 [==============================] - 1s 26ms/step - loss: 0.1425 - acc:
0.9545 - val_loss: 0.2841 - val_acc: 0.8869
Epoch 6/20
30/30 [==============================] - 1s 25ms/step - loss: 0.1169 - acc:
0.9634 - val_loss: 0.2981 - val_acc: 0.8873
Epoch 7/20
30/30 [==============================] - 1s 30ms/step - loss: 0.0976 - acc:
0.9713 - val_loss: 0.3127 - val_acc: 0.8843
Epoch 8/20
30/30 [==============================] - 1s 25ms/step - loss: 0.0782 - acc:
0.9783 - val_loss: 0.3280 - val_acc: 0.8821
Epoch 9/20
30/30 [==============================] - 2s 75ms/step - loss: 0.0670 - acc:
0.9813 - val_loss: 0.3504 - val_acc: 0.8810
Epoch 10/20
30/30 [==============================] - 1s 35ms/step - loss: 0.0526 - acc:
0.9873 - val_loss: 0.3792 - val_acc: 0.8790
Epoch 11/20
30/30 [==============================] - 1s 41ms/step - loss: 0.0426 - acc:
0.9909 - val_loss: 0.4060 - val_acc: 0.8730
Epoch 12/20
30/30 [==============================] - 1s 37ms/step - loss: 0.0351 - acc:
0.9917 - val_loss: 0.4347 - val_acc: 0.8697
Epoch 13/20
30/30 [==============================] - 1s 36ms/step - loss: 0.0264 - acc:
0.9954 - val_loss: 0.4621 - val_acc: 0.8733
Epoch 14/20
30/30 [==============================] - 1s 29ms/step - loss: 0.0235 - acc:
0.9956 - val_loss: 0.5110 - val_acc: 0.8659
Epoch 15/20
30/30 [==============================] - 1s 30ms/step - loss: 0.0136 - acc:
0.9991 - val_loss: 0.5457 - val_acc: 0.8700
Epoch 16/20
30/30 [==============================] - 1s 30ms/step - loss: 0.0122 - acc:
0.9989 - val_loss: 0.5772 - val_acc: 0.8679
Epoch 17/20
30/30 [==============================] - 1s 32ms/step - loss: 0.0123 - acc:
0.9981 - val_loss: 0.5937 - val_acc: 0.8678
Epoch 18/20
30/30 [==============================] - 1s 32ms/step - loss: 0.0055 - acc:
0.9998 - val_loss: 0.6288 - val_acc: 0.8654
Epoch 19/20
30/30 [==============================] - 1s 27ms/step - loss: 0.0068 - acc:
```

```
0.9989 - val_loss: 0.6667 - val_acc: 0.8665
Epoch 20/20
30/30 [==============================] - 1s 30ms/step - loss: 0.0062 - acc:
0.9992 - val_loss: 0.6994 - val_acc: 0.8663
```

Training and Validation Loss

In [24]:
```
history_dict = history.history
```

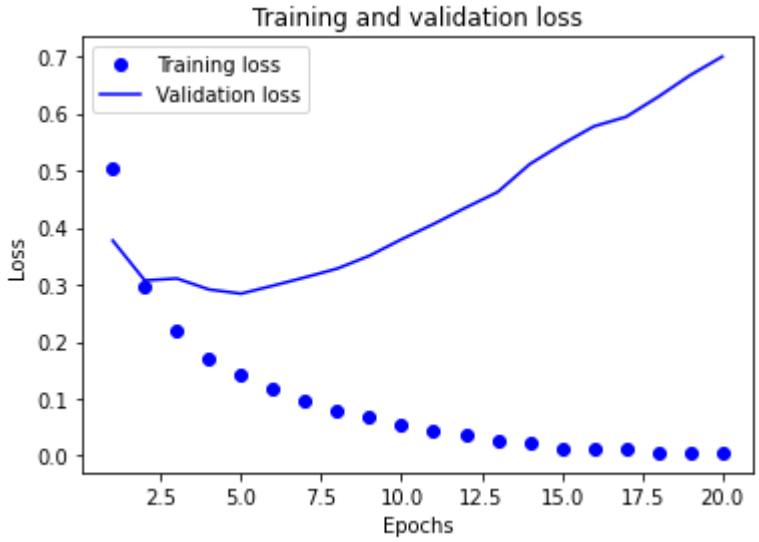
In [26]:
```
history_dict = history.history
loss_values = history_dict['loss']
val_loss_values = history_dict['val_loss']
```

In [30]:
```
epochs = range(1, 21)
```

In [31]:
```
plt.plot(epochs, loss_values, 'bo', label='Training loss')
plt.plot(epochs, val_loss_values, 'b', label='Validation loss')

plt.title('Training and validation loss')
plt.xlabel('Epochs')
plt.ylabel('Loss')
plt.legend()

plt.show()
```



Training and Validation Accuracy

In [32]:
```
plt.clf()
```

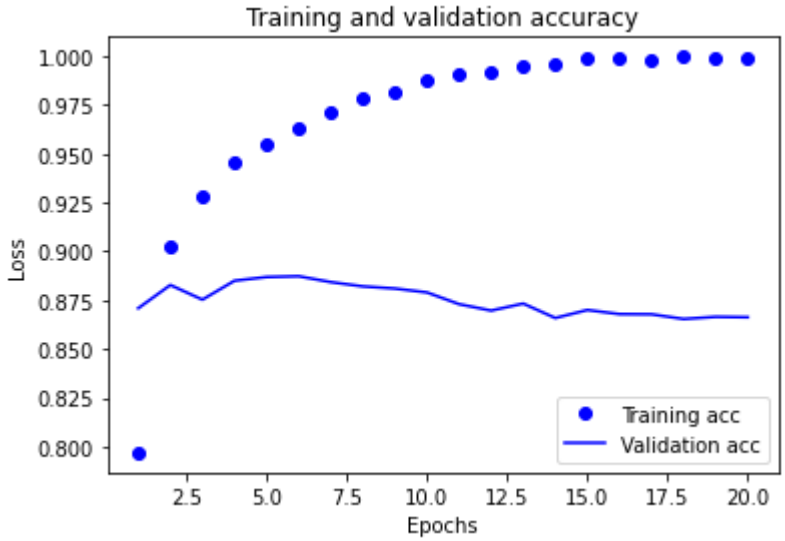
```
<Figure size 432x288 with 0 Axes>
```

In [35]:
```
acc = history_dict['acc']
val_acc = history_dict['val_acc']
```

In [37]:
```
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()
```



Results

In [39]:
```
results = model.evaluate(x_test, y_test)
results
```

```
782/782 [==============================] - 3s 3ms/step - loss: 0.7563 - ac
c: 0.8517
```

Out[39]:
```
[0.7562754154205322, 0.8516799807548523]
```

The model has an 85.17% accuracy.