Assignment 5.2: News Classifier

In [19]:
```
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 reuters
from keras import losses
from keras import metrics
from keras.utils.np_utils import to_categorical
```

In [20]:
```
(train_data, train_labels), (test_data, test_labels) = reuters.load_data(num
```

Vectorize Data

In [30]:
```
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 [31]:
```
x_train = vectorize_sequences(train_data)
x_test = vectorize_sequences(test_data)
```

In [32]:
```
one_hot_train_labels = to_categorical(train_labels)
one_hot_test_labels = to_categorical(test_labels)
```

Building the Network

In [33]:
```
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'))
```

In [34]:
```
model.compile(optimizer='rmsprop',
              loss='categorical_crossentropy',
              metrics=['accuracy'])
```

Validation Set

In [35]:
```
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:]
```

Training the Model

In [36]:
```
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 55ms/step - loss: 2.6948 - accu
racy: 0.5563 - val_loss: 1.7709 - val_accuracy: 0.6510
Epoch 2/20
16/16 [==============================] - 1s 40ms/step - loss: 1.4326 - accu
racy: 0.7117 - val_loss: 1.3039 - val_accuracy: 0.7110
Epoch 3/20
16/16 [==============================] - 1s 36ms/step - loss: 1.0663 - accu
racy: 0.7745 - val_loss: 1.1308 - val_accuracy: 0.7670
Epoch 4/20
16/16 [==============================] - 1s 47ms/step - loss: 0.8533 - accu
racy: 0.8206 - val_loss: 1.0289 - val_accuracy: 0.7870
Epoch 5/20
16/16 [==============================] - 1s 42ms/step - loss: 0.6873 - accu
racy: 0.8563 - val_loss: 0.9745 - val_accuracy: 0.7990
Epoch 6/20
16/16 [==============================] - 1s 45ms/step - loss: 0.5519 - accu
racy: 0.8854 - val_loss: 0.9256 - val_accuracy: 0.8040
Epoch 7/20
16/16 [==============================] - 1s 47ms/step - loss: 0.4496 - accu
racy: 0.9047 - val_loss: 0.9409 - val_accuracy: 0.7930
Epoch 8/20
16/16 [==============================] - 1s 44ms/step - loss: 0.3626 - accu
racy: 0.9230 - val_loss: 0.8769 - val_accuracy: 0.8240
Epoch 9/20
16/16 [==============================] - 1s 81ms/step - loss: 0.2989 - accu
racy: 0.9360 - val_loss: 0.8974 - val_accuracy: 0.8220
Epoch 10/20
16/16 [==============================] - 1s 62ms/step - loss: 0.2510 - accu
racy: 0.9426 - val_loss: 0.9231 - val_accuracy: 0.8140
Epoch 11/20
16/16 [==============================] - 1s 38ms/step - loss: 0.2150 - accu
racy: 0.9496 - val_loss: 0.9047 - val_accuracy: 0.8190
Epoch 12/20
16/16 [==============================] - 1s 44ms/step - loss: 0.1908 - accu
racy: 0.9501 - val_loss: 0.9395 - val_accuracy: 0.8180
Epoch 13/20
16/16 [==============================] - 1s 47ms/step - loss: 0.1714 - accu
racy: 0.9528 - val_loss: 0.9483 - val_accuracy: 0.8130
Epoch 14/20
16/16 [==============================] - 1s 54ms/step - loss: 0.1537 - accu
racy: 0.9531 - val_loss: 0.9705 - val_accuracy: 0.8260
Epoch 15/20
16/16 [==============================] - 1s 58ms/step - loss: 0.1444 - accu
racy: 0.9557 - val_loss: 0.9949 - val_accuracy: 0.8100
Epoch 16/20
16/16 [==============================] - 1s 47ms/step - loss: 0.1347 - accu
racy: 0.9560 - val_loss: 1.0125 - val_accuracy: 0.8130
Epoch 17/20
16/16 [==============================] - 1s 39ms/step - loss: 0.1274 - accu
racy: 0.9564 - val_loss: 1.0403 - val_accuracy: 0.8040
Epoch 18/20
16/16 [==============================] - 1s 50ms/step - loss: 0.1237 - accu
racy: 0.9546 - val_loss: 1.0747 - val_accuracy: 0.8010
Epoch 19/20
16/16 [==============================] - 1s 51ms/step - loss: 0.1187 - accu
```

```
racy: 0.9567 - val_loss: 1.0842 - val_accuracy: 0.7970
Epoch 20/20
16/16 [==============================] - 1s 54ms/step - loss: 0.1136 - accu
racy: 0.9594 - val_loss: 1.1199 - val_accuracy: 0.8000
```

Training and Validation Loss

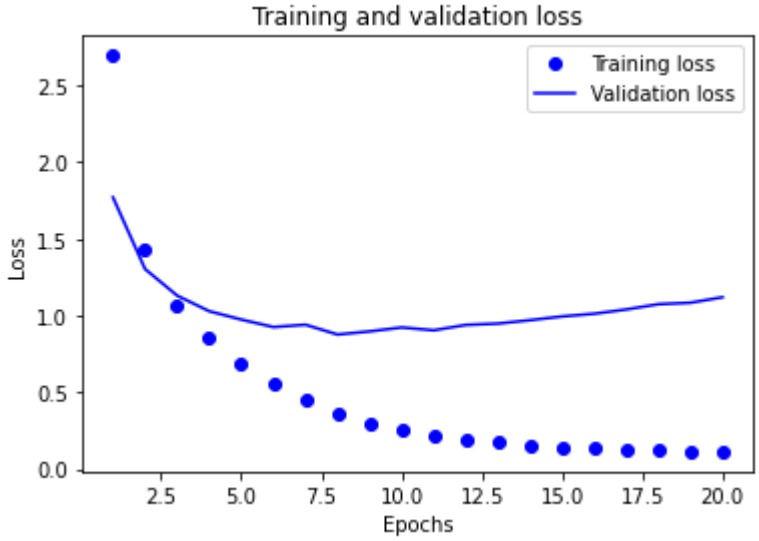
In [37]:
```
loss = history.history['loss']
val_loss = history.history['val_loss']
```

In [38]:
```
epochs = range(1, 21)
```

In [39]:
```
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()
```



Training and Validation Accuracy

In [40]:
```
plt.clf()
```

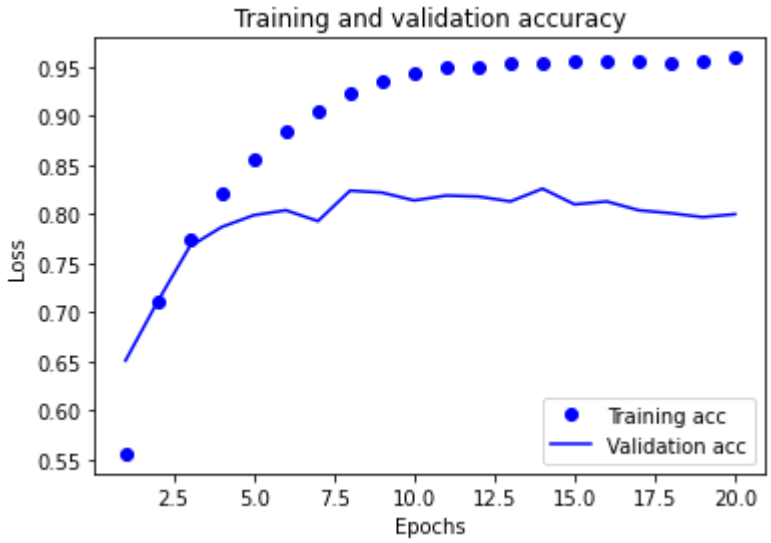
```
<Figure size 432x288 with 0 Axes>
```

In [43]:
```
acc = history.history['accuracy']
val_acc = history.history['val_accuracy']
```

In [44]:
```
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 [46]:
```
results = model.evaluate(x_test, one_hot_test_labels)
results
```

```
71/71 [==============================] - 1s 6ms/step - loss: 1.2256 - accur
acy: 0.7792
```

Out[46]:
```
[1.2256207466125488, 0.7791629433631897]
```

The model has a 77.92% accuracy.