IMDB 데이터셋 로드하기

In [1]:

```
from keras.datasets import imdb

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

In [2]:

```
train_data[0]
```

```
476,
26,
480,
5,
144,
30,
5535,
18,
51,
36,
28,
224,
92,
25,
104,
4,
226,
65,
16,
38,
1334,
88,
12,
16,
283,
5,
16,
4472,
113,
103,
32,
15,
16,
5345,
19,
178,
32]
```

In [3]:

```
train_labels[0]
```

Out[3]:

```
1
```

In [4]:

```
max([max(sequence) for sequence in train_data])
```

Out[4]:

```
9999
```

In [5]:

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

정수 시퀀스를 이진 행렬로 인코딩하기

In [6]:

```
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)
```

In [7]:

```
x_train[0]
```

Out[7]:

```
array([0., 1., 1., ..., 0., 0., 0.])
```

In [8]:

```
y_train = np.asarray(train_labels).astype('float32')
y_test = np.asarray(test_labels).astype('float32')
```

In [9]:

```
#output = relu(dot(W, input) + b)
```

모델 정의하기

In [10]:

```
from keras import models, layers

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'))
```

```
WARNING:tensorflow:From C:WUsersWJWAnaconda3WlibWsite-packagesWtensorflowWpythonWf
rameworkWop_def_library.py:263: colocate_with (from tensorflow.python.framework.op
s) is deprecated and will be removed in a future version.
Instructions for updating:
Colocations handled automatically by placer.
```

모델 컴파일하기

In [11]:

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

옵티마이저 설정하기

In [ ]:

```
from keras import optimizers

model.compile(optimizer=optimizers.RMSprop(lr=0.001),
              loss='binary_crossentropy',
              metrics=['accuracy'])
```

손실과 측정을 함수 객체로 지정하기

In [ ]:

```
from keras import losses, metrics

model.compile(optimizer=optimizers.RMSprop(lr=0.001),
              loss = losses.binary_crossentropy,
              metrics=[metrics.binary_accuracy])
```

검증 세트 준비하기

In [13]:

```
x_val = x_train[:10000]
partial_x_train = x_train[10000:]
y_val = y_train[:10000]
partial_y_train = y_train[10000:]
```

모델 훈련하기

In [15]:

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

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

```
WARNING:tensorflow:From C:₩Users₩JW₩Anaconda3₩lib₩site-packages₩tensorflow₩python₩ops₩math_ops.py:3066: to_int32 (from tensorflow.python.ops.math_ops) is deprecated and will be removed in a future version.
Instructions for updating:
Use tf.cast instead.
Train on 15000 samples, validate on 10000 samples
Epoch 1/20
15000/15000 [==============================] - 6s 395us/step - loss: 0.5084 - acc: 0.7813 - val_loss: 0.3797 - val_acc: 0.8684
Epoch 2/20
15000/15000 [==============================] - 2s 125us/step - loss: 0.3004 - acc: 0.9047 - val_loss: 0.3004 - val_acc: 0.8897
Epoch 3/20
15000/15000 [==============================] - 2s 124us/step - loss: 0.2179 - acc: 0.9285 - val_loss: 0.3085 - val_acc: 0.8711
Epoch 4/20
15000/15000 [==============================] - 2s 124us/step - loss: 0.1750 - acc: 0.9437 - val_loss: 0.2840 - val_acc: 0.8832
Epoch 5/20
15000/15000 [==============================] - 2s 123us/step - loss: 0.1427 - acc: 0.9543 - val_loss: 0.2841 - val_acc: 0.8872
Epoch 6/20
15000/15000 [==============================] - 2s 123us/step - loss: 0.1150 - acc: 0.9650 - val_loss: 0.3166 - val_acc: 0.8772
Epoch 7/20
15000/15000 [==============================] - 2s 123us/step - loss: 0.0980 - acc: 0.9705 - val_loss: 0.3127 - val_acc: 0.8846
Epoch 8/20
15000/15000 [==============================] - 2s 123us/step - loss: 0.0807 - acc: 0.9763 - val_loss: 0.3859 - val_acc: 0.8649
Epoch 9/20
15000/15000 [==============================] - 2s 124us/step - loss: 0.0661 - acc: 0.9821 - val_loss: 0.3635 - val_acc: 0.8782
Epoch 10/20
15000/15000 [==============================] - 2s 123us/step - loss: 0.0561 - acc: 0.9853 - val_loss: 0.3842 - val_acc: 0.8792
Epoch 11/20
15000/15000 [==============================] - 2s 124us/step - loss: 0.0439 - acc: 0.9893 - val_loss: 0.4153 - val_acc: 0.8779
Epoch 12/20
15000/15000 [==============================] - 2s 123us/step - loss: 0.0381 - acc: 0.9921 - val_loss: 0.4525 - val_acc: 0.8690
Epoch 13/20
15000/15000 [==============================] - 2s 124us/step - loss: 0.0300 - acc: 0.9928 - val_loss: 0.4699 - val_acc: 0.8729
Epoch 14/20
15000/15000 [==============================] - 2s 123us/step - loss: 0.0247 - acc: 0.9945 - val_loss: 0.5023 - val_acc: 0.8726
Epoch 15/20
15000/15000 [==============================] - 2s 125us/step - loss: 0.0175 - acc: 0.9979 - val_loss: 0.5341 - val_acc: 0.8693
Epoch 16/20
15000/15000 [==============================] - 2s 124us/step - loss: 0.0149 - acc: 0.9983 - val_loss: 0.5710 - val_acc: 0.8697
Epoch 17/20
15000/15000 [==============================] - 2s 124us/step - loss: 0.0151 - acc: 0.9971 - val_loss: 0.6024 - val_acc: 0.8697
Epoch 18/20
15000/15000 [==============================] - 2s 124us/step - loss: 0.0075 - acc: 0.9996 - val_loss: 0.6781 - val_acc: 0.8633
Epoch 19/20
15000/15000 [==============================] - 2s 124us/step - loss: 0.0117 - acc: 0.9975 - val_loss: 0.6690 - val_acc: 0.8673
Epoch 20/20
15000/15000 [==============================] - 2s 124us/step - loss: 0.0041 - acc: 0.9999 - val_loss: 0.6941 - val_acc: 0.8657
```

In [16]:

```
history_dict = history.history
history_dict.keys()
```

Out[16]:

```
dict_keys(['val_loss', 'val_acc', 'loss', 'acc'])
```

훈련과 검증 손실 그리기

In [18]:

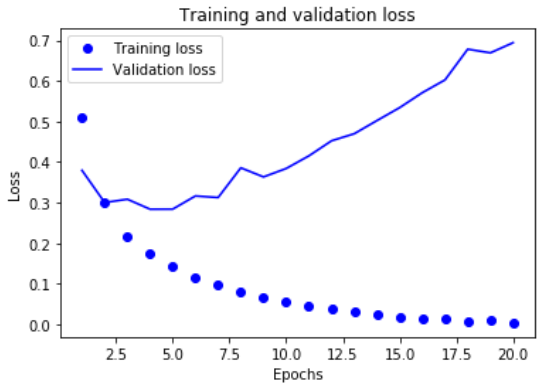
```
import matplotlib.pyplot as plt

loss = history_dict['loss']
val_loss = history_dict['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()
```



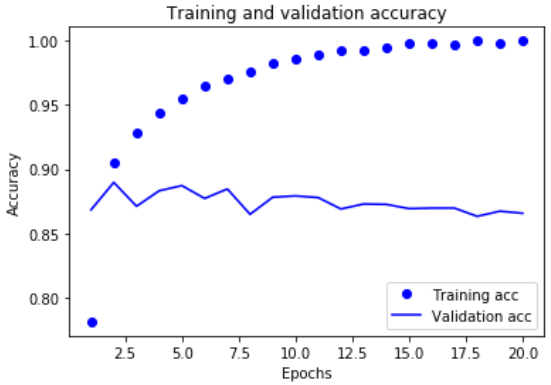
훈련과 검증 정확도 그리기

In [19]:

```
plt.clf()
acc = history_dict['acc']
val_acc = history_dict['val_acc']

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('Accuracy')
plt.legend()

plt.show()
```



모델을 처음부터 다시 훈련하기

In [20]:

```
from keras import models, layers

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'))

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

history = model.fit(x_train,y_train,epochs=4,batch_size=512)
results = model.evaluate(x_test, y_test)
```

```
Epoch 1/4
25000/25000 [==============================] - 2s 85us/step - loss: 0.4749 - acc:
0.8217
Epoch 2/4
25000/25000 [==============================] - 2s 74us/step - loss: 0.2658 - acc:
0.9097
Epoch 3/4
25000/25000 [==============================] - 2s 75us/step - loss: 0.1982 - acc:
0.9299
Epoch 4/4
25000/25000 [==============================] - 2s 74us/step - loss: 0.1679 - acc:
0.9404
25000/25000 [==============================] - 3s 122us/step
```

In [21]:

```
results
```

Out[21]:

```
[0.3231440426158905, 0.87348]
```

In [22]:

```
model.predict(x_test)
```

Out[22]:

```
array([[0.1402615 ],
       [0.9997028 ],
       [0.29552516],
       ...,
       [0.07234982],
       [0.04342842],
       [0.48153397]], dtype=float32)
```

1개의 은닉층 테스트

In [23]:

```
from keras import models, layers

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'))

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

history = model.fit(x_train,y_train,epochs=4,batch_size=512)
results = model.evaluate(x_test, y_test)
```

```
Epoch 1/4
25000/25000 [==============================] - 2s 85us/step - loss: 0.4477 - acc:
0.8325
Epoch 2/4
25000/25000 [==============================] - 2s 75us/step - loss: 0.2797 - acc:
0.9077
Epoch 3/4
25000/25000 [==============================] - 2s 75us/step - loss: 0.2214 - acc:
0.9244
Epoch 4/4
25000/25000 [==============================] - 2s 75us/step - loss: 0.1878 - acc:
0.9354
25000/25000 [==============================] - 3s 110us/step
```

In [24]:

```
results
```

Out[24]:

```
[0.2789423728942871, 0.8888]
```

3개의 은닉층 테스트

In [25]:

```
from keras import models, layers

model = models.Sequential()
model.add(layers.Dense(16, activation='relu', input_shape=(10000,)))
model.add(layers.Dense(16, activation='relu'))
model.add(layers.Dense(16, activation='relu'))
model.add(layers.Dense(1, activation='sigmoid'))

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

history = model.fit(x_train,y_train,epochs=4,batch_size=512)
results = model.evaluate(x_test, y_test)
```

```
Epoch 1/4
25000/25000 [==============================] - 2s 90us/step - loss: 0.4602 - acc:
0.8176
Epoch 2/4
25000/25000 [==============================] - 2s 76us/step - loss: 0.2505 - acc:
0.9106
Epoch 3/4
25000/25000 [==============================] - 2s 76us/step - loss: 0.2010 - acc:
0.9260
Epoch 4/4
25000/25000 [==============================] - 2s 76us/step - loss: 0.1652 - acc:
0.9406
25000/25000 [==============================] - 3s 110us/step
```

In [26]:

```
results
```

Out[26]:

```
[0.3063558402490616, 0.88016]
```

3개 은닉층 + 유닛 증가

In [27]:

```
from keras import models, layers

model = models.Sequential()
model.add(layers.Dense(32, activation='relu', input_shape=(10000,)))
model.add(layers.Dense(32, activation='relu'))
model.add(layers.Dense(32, activation='relu'))
model.add(layers.Dense(1, activation='sigmoid'))

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

history = model.fit(x_train,y_train,epochs=4,batch_size=512)
results = model.evaluate(x_test, y_test)
```

```
Epoch 1/4
25000/25000 [==============================] - 2s 91us/step - loss: 0.4386 - acc:
0.8087
Epoch 2/4
25000/25000 [==============================] - 2s 76us/step - loss: 0.2432 - acc:
0.9084
Epoch 3/4
25000/25000 [==============================] - 2s 76us/step - loss: 0.1839 - acc:
0.9327
Epoch 4/4
25000/25000 [==============================] - 2s 77us/step - loss: 0.1526 - acc:
0.9446
25000/25000 [==============================] - 3s 116us/step
```

In [28]:

```
results
```

Out[28]:

```
[0.3377230154514313, 0.87672]
```

3개 은닉층 + 유닛 증가

In [29]:

```
from keras import models, 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(64, activation='relu'))
model.add(layers.Dense(1, activation='sigmoid'))

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

history = model.fit(x_train,y_train,epochs=4,batch_size=512)
results = model.evaluate(x_test, y_test)
```

```
Epoch 1/4
25000/25000 [==============================] - 2s 96us/step - loss: 0.4221 - acc:
0.8108
Epoch 2/4
25000/25000 [==============================] - 2s 78us/step - loss: 0.2297 - acc:
0.9097
Epoch 3/4
25000/25000 [==============================] - 2s 78us/step - loss: 0.1841 - acc:
0.9299
Epoch 4/4
25000/25000 [==============================] - 2s 78us/step - loss: 0.1372 - acc:
0.9480
25000/25000 [==============================] - 3s 112us/step
```

In [30]:

```
results
```

Out[30]:

```
[0.4243271171236038, 0.84944]
```

4개 은닉층 + 유닛 수 다 다르게

In [31]:

```
from keras import models, layers

model = models.Sequential()
model.add(layers.Dense(64, activation='relu', input_shape=(10000,)))
model.add(layers.Dense(32, activation='relu'))
model.add(layers.Dense(16, activation='relu'))
model.add(layers.Dense(8, activation='relu'))
model.add(layers.Dense(1, activation='sigmoid'))

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

history = model.fit(x_train,y_train,epochs=4,batch_size=512)
results = model.evaluate(x_test, y_test)
```

```
Epoch 1/4
25000/25000 [==============================] - 2s 99us/step - loss: 0.4383 - acc:
0.8052
Epoch 2/4
25000/25000 [==============================] - 2s 78us/step - loss: 0.2523 - acc:
0.9031
Epoch 3/4
25000/25000 [==============================] - 2s 77us/step - loss: 0.1874 - acc:
0.9308
Epoch 4/4
25000/25000 [==============================] - 2s 78us/step - loss: 0.1493 - acc:
0.9446
25000/25000 [==============================] - 3s 116us/step
```

In [32]:

```
results
```

Out[32]:

```
[0.3450305989265442, 0.87308]
```

loss를 mse로 변경

In [33]:

```
from keras import models, layers

model = models.Sequential()
model.add(layers.Dense(32, activation='relu', input_shape=(10000,)))
model.add(layers.Dense(32, activation='relu'))
model.add(layers.Dense(32, activation='relu'))
model.add(layers.Dense(1, activation='sigmoid'))

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

history = model.fit(x_train,y_train,epochs=4,batch_size=512)
results = model.evaluate(x_test, y_test)
```

```
Epoch 1/4
25000/25000 [==============================] - 2s 99us/step - loss: 0.1418 - acc:
0.8076
Epoch 2/4
25000/25000 [==============================] - 2s 79us/step - loss: 0.0729 - acc:
0.9080
Epoch 3/4
25000/25000 [==============================] - 2s 77us/step - loss: 0.0551 - acc:
0.9305
Epoch 4/4
25000/25000 [==============================] - 2s 78us/step - loss: 0.0457 - acc:
0.9424
25000/25000 [==============================] - 3s 114us/step
```

In [34]:

```
results
```

Out[34]:

```
[0.0904668045437336, 0.87912]
```

In [35]:

```
from keras import models, layers

model = models.Sequential()
model.add(layers.Dense(32, activation='tanh', input_shape=(10000,)))
model.add(layers.Dense(16, activation='tanh'))
model.add(layers.Dense(8, activation='tanh'))
model.add(layers.Dense(1, activation='sigmoid'))

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

history = model.fit(x_train,y_train,epochs=4,batch_size=512)
results = model.evaluate(x_test, y_test)
```

```
Epoch 1/4
25000/25000 [==============================] - 2s 93us/step - loss: 0.1311 - acc:
0.8225
Epoch 2/4
25000/25000 [==============================] - 2s 74us/step - loss: 0.0655 - acc:
0.9158
Epoch 3/4
25000/25000 [==============================] - 2s 74us/step - loss: 0.0509 - acc:
0.9348
Epoch 4/4
25000/25000 [==============================] - 2s 74us/step - loss: 0.0442 - acc:
0.9434
25000/25000 [==============================] - 3s 114us/step
```

In [36]:

```
results
```

Out[36]:

```
[0.09722661297380925, 0.8726]
```

In [37]:

```
from keras import models, layers

model = models.Sequential()
model.add(layers.Dense(32, activation='tanh', input_shape=(10000,)))
model.add(layers.Dense(32, activation='tanh'))
model.add(layers.Dense(32, activation='tanh'))
model.add(layers.Dense(1, activation='sigmoid'))

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

history = model.fit(x_train,y_train,epochs=4,batch_size=512)
results = model.evaluate(x_test, y_test)
```

```
Epoch 1/4
25000/25000 [==============================] - 2s 95us/step - loss: 0.1270 - acc:
0.8171
Epoch 2/4
25000/25000 [==============================] - 2s 76us/step - loss: 0.0663 - acc:
0.9116
Epoch 3/4
25000/25000 [==============================] - 2s 75us/step - loss: 0.0515 - acc:
0.9332
Epoch 4/4
25000/25000 [==============================] - 2s 75us/step - loss: 0.0441 - acc:
0.9436
25000/25000 [==============================] - 3s 113us/step
```

In [38]:

```
results
```

Out[38]:

```
[0.09701340472504497, 0.87428]
```

In [39]:

```
from keras import models, layers

model = models.Sequential()
model.add(layers.Dense(32, activation='relu', input_shape=(10000,)))
model.add(layers.Dense(16, activation='tanh'))
model.add(layers.Dense(8, activation='relu'))
model.add(layers.Dense(1, activation='sigmoid'))

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

history = model.fit(x_train,y_train,epochs=4,batch_size=512)
results = model.evaluate(x_test, y_test)
```

```
Epoch 1/4
25000/25000 [==============================] - 2s 97us/step - loss: 0.1456 - acc:
0.8111
Epoch 2/4
25000/25000 [==============================] - 2s 76us/step - loss: 0.0733 - acc:
0.9120
Epoch 3/4
25000/25000 [==============================] - 2s 75us/step - loss: 0.0542 - acc:
0.9330
Epoch 4/4
25000/25000 [==============================] - 2s 75us/step - loss: 0.0415 - acc:
0.9501
25000/25000 [==============================] - 3s 115us/step
```

In [40]:

```
results
```

Out[40]:

```
[0.09185329184770584, 0.87756]
```

In [ ]:

In [ ]: