영화 리뷰 분류: 이진 분류 예제

2020.04.29

IMDB 데이터셋

인터넷 영화 데이터베이스로부터 가져온 양극단의 리뷰 5만개로 이루어진 데이터셋

- 리뷰 텍스트 기반으로 영화 리뷰를 긍정(1)/부정(0)으로 분류
- 훈련 데이터: 25,000, 테스트 데이터: 25,000

  각각 50% 긍정, 50% 부정 리뷰로 구성
- 데이터: 전처리 O

  각 리뷰(단어 시퀀스) → 숫자 시퀀스 변환

  사전에 있는 고유한 단어

```
# IMDB 데이터셋 로드

from keras.datasets import imdb

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

훈련 데이터에서
가장 자주 나타나는 단어 1만개만 사용

리뷰의 목록
각 리뷰 == 단어 인덱스의 리스트

긍정을 나타내는 1과
부정을 나타내는 0의 리스트

```
train_data[0] # train_data의 0번째 인덱스 확인
```

```
[1,
 14,
 22,
 16,
 43,
 530,
 973,
 1622,
 1385,
 65,
 458,
 4468,
 66,
 3941,
 4,
 173,
 36,
 256,
 5,
 25,
 100,
 43,
 838,
 112,
 50,
 670,
 2,
 9,
 35,
 480,
```

단어 인덱스의 리스트

```
train_labels[0] # train_labels의 0번째 인덱스 확인: 1이 출력되었으므로 해당 리뷰는 긍정
```

```
1
```

```
max([max(sequence) for sequence in train_data]) # 가장 자주 등장하는 1만개의 단어로 제한했기에 단어 인덱스는 9,999를 넘지 않음
```

```
9999
```

```python
# 원래의 영어 단어로 변경해보기

word_index = imdb.get_word_index()
reverse_word_index = dict([(value, key) for (key, value) in word_index.items()]) # 정수 인덱스와 단어를 매핑하도록 뒤집음
decoded_review = ' '.join([reverse_word_index.get(i-3, '?') for i in train_data[0]]) # 리뷰 디코딩
# 0, 1, 2는 '패딩', '문서 시작', '사전에 없음'을 위한 인덱스이므로 3을 빼줌
# 사전에 없는 단어는 ?로 처리함

print(decoded_review)
```

```
? this film was just brilliant casting location scenery story direction everyone's really suited the part they played and you could jus
t imagine being there robert ? is an amazing actor and now the same being director ? father came from the same scottish island as mysel
f so i loved the fact there was a real connection with this film the witty remarks throughout the film were great it was just brilliant
so much that i bought the film as soon as it was released for ? and would recommend it to everyone to watch and the fly fishing was ama
zing really cried at the end it was so sad and you know what they say if you cry at a film it must have been good and this definitely w
as also ? to the two little boy's that played the ? of norman and paul they were just brilliant children are often left out of the ? li
st i think because the stars that play them all grown up are such a big profile for the whole film but these children are amazing and s
hould be praised for what they have done don't you think the whole story was so lovely because it was true and was someone's life after
all that was shared with us all
```

```
# 데이터 준비
# 정수 시퀀스를 이진 행렬로 인코딩

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)
```

신경망에 숫자 리스트 주입 불가능
리스트를 텐서로 변환

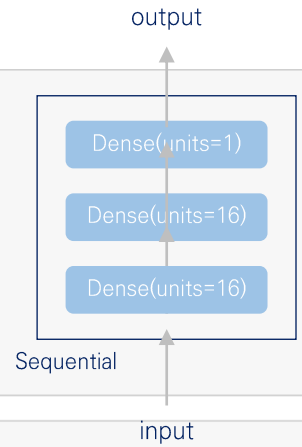
```
x_train[0]
```

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

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

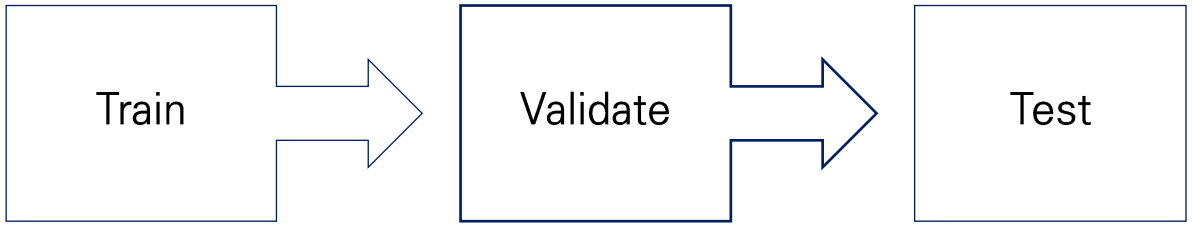
```python
# 모델 정의

from keras import models
from keras import layers
            hidden 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'))
```

리뷰의 감정을
스칼라 값의 예측으로 출력하는 layer




```python
# 모델 컴파일

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

```python
# 옵티마이저 설정

from keras import optimizers

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

# 손실과 측정을 함수 객체로 지정

from keras import losses
from keras import metrics

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




```
# 훈련 검증
# 검증 세트 준비

x_val = x_train[:10000]
partial_x_train = x_train[10000:] # 25,000개에서 10,000개를 떼어 15,000개의 훈련 검증 세트 제작
y_val = y_train[:10000]
partial_y_train = y_train[10000:] # 25,000개에서 10,000개를 떼어 15,000개의 훈련 검증 세트 제작
```

훈련 데이터를 일부 가공하여
훈련 검증 데이터 제작

```python
# 모델 훈련

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

history = model.fit(partial_x_train,    # history 객체: 훈련하는 동안 발생한 모든 정보를 담고 있는 딕셔너리인 history 속성 가지고 있음
                    partial_y_train,
                    epochs=20,          # 20번 반복
                    batch_size=512,     # 랜덤한 512개씩 선정
                    validation_data=(x_val, y_val))
```

훈련 데이터 | 훈련 검증 데이터

```
Train on 15000 samples, validate on 10000 samples
Epoch 1/20
15000/15000 [==============================] - 3s 181us/step - loss: 0.5239 - accuracy: 0.7821 - val_loss: 0.4103 - val_accuracy: 0.8510
Epoch 2/20
15000/15000 [==============================] - 2s 164us/step - loss: 0.3152 - accuracy: 0.9010 - val_loss: 0.3291 - val_accuracy: 0.8739
Epoch 3/20
15000/15000 [==============================] - 2s 164us/step - loss: 0.2307 - accuracy: 0.9280 - val_loss: 0.3074 - val_accuracy: 0.8755
Epoch 4/20
15000/15000 [==============================] - 2s 165us/step - loss: 0.1831 - accuracy: 0.9413 - val_loss: 0.2739 - val_accuracy: 0.8901
Epoch 5/20
15000/15000 [==============================] - 2s 161us/step - loss: 0.1485 - accuracy: 0.9528 - val_loss: 0.2820 - val_accuracy: 0.8885
Epoch 6/20
15000/15000 [==============================] - 2s 162us/step - loss: 0.1228 - accuracy: 0.9612 - val_loss: 0.2869 - val_accuracy: 0.8866
Epoch 7/20
15000/15000 [==============================] - 2s 165us/step - loss: 0.1004 - accuracy: 0.9708 - val_loss: 0.3175 - val_accuracy: 0.8786
Epoch 8/20
15000/15000 [==============================] - 3s 168us/step - loss: 0.0834 - accuracy: 0.9765 - val_loss: 0.3427 - val_accuracy: 0.8768
Epoch 9/20
15000/15000 [==============================] - 3s 168us/step - loss: 0.0684 - accuracy: 0.9809 - val_loss: 0.3765 - val_accuracy: 0.8700
Epoch 10/20
15000/15000 [==============================] - 2s 163us/step - loss: 0.0579 - accuracy: 0.9855 - val_loss: 0.3822 - val_accuracy: 0.8722
Epoch 11/20
15000/15000 [==============================] - 2s 166us/step - loss: 0.0459 - accuracy: 0.9903 - val_loss: 0.3913 - val_accuracy: 0.8774
Epoch 12/20
15000/15000 [==============================] - 2s 167us/step - loss: 0.0359 - accuracy: 0.9916 - val_loss: 0.4203 - val_accuracy: 0.8753
Epoch 13/20
15000/15000 [==============================] - 2s 165us/step - loss: 0.0306 - accuracy: 0.9937 - val_loss: 0.4570 - val_accuracy: 0.8696
Epoch 14/20
15000/15000 [==============================] - 2s 164us/step - loss: 0.0248 - accuracy: 0.9947 - val_loss: 0.4795 - val_accuracy: 0.8718
Epoch 15/20
15000/15000 [==============================] - 2s 161us/step - loss: 0.0165 - accuracy: 0.9979 - val_loss: 0.5063 - val_accuracy: 0.8714
Epoch 16/20
15000/15000 [==============================] - 3s 168us/step - loss: 0.0145 - accuracy: 0.9981 - val_loss: 0.5443 - val_accuracy: 0.8725
Epoch 17/20
15000/15000 [==============================] - 3s 169us/step - loss: 0.0136 - accuracy: 0.9972 - val_loss: 0.5734 - val_accuracy: 0.8697
Epoch 18/20
```

history 객체

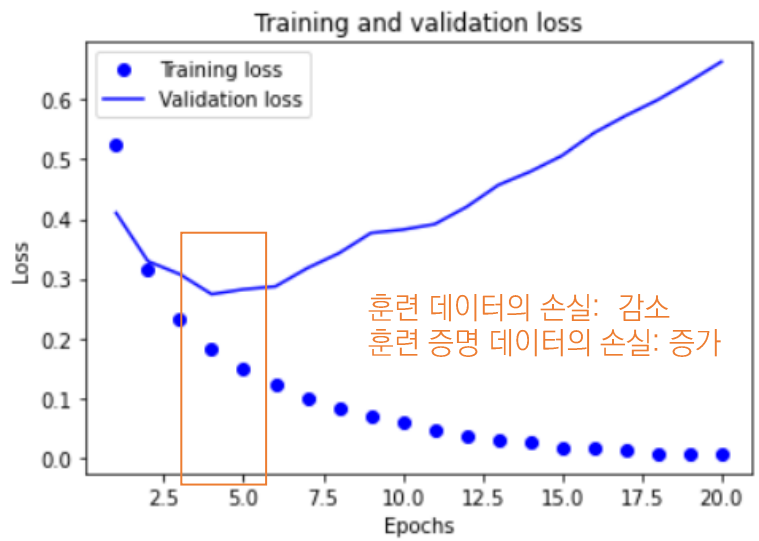
history 속성: 훈련하는 동안 발생하는
모든 정보를 담고 있는 딕셔너리

```
history_dict = history.history
```

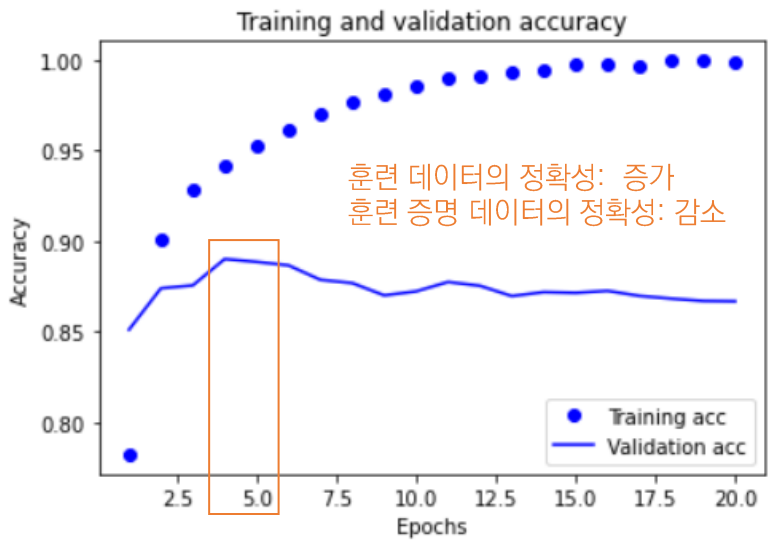
```
history_dict.keys()
```

```
dict_keys(['val_loss', 'val_accuracy', 'loss', 'accuracy'])
```

```python
# 훈련과 검증 손실(loss) 그리기

import matplotlib.pyplot as plt

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

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

plt.plot(epochs, loss, 'bo', label='Training loss') # bo: 파란색 점
plt.plot(epochs, val_loss, 'b', label='Validation loss') # b: 파란색 실선
plt.title('Training and validation loss')
plt.xlabel('Epochs')
plt.ylabel('Loss')
plt.legend()

plt.show()
```



```
# 훈련과 검증 정확도(accuracy) 그리기

plt.clf() # 그래프 초기화

acc = history_dict['accuracy']
val_acc = history_dict['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('Accuracy')
plt.legend()

plt.show()
```



```
# 모델 처음부터 다시 훈련

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'])

model.fit(x_train, y_train, epochs=4, batch_size=512) # epoch를 4로 줄임

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

```
Epoch 1/4
25000/25000 [==============================] - 3s 117us/step - loss: 0.4938 - accuracy: 0.7941
Epoch 2/4
25000/25000 [==============================] - 3s 106us/step - loss: 0.2754 - accuracy: 0.9085
Epoch 3/4
25000/25000 [==============================] - 3s 105us/step - loss: 0.2097 - accuracy: 0.9270
Epoch 4/4
25000/25000 [==============================] - 3s 104us/step - loss: 0.1745 - accuracy: 0.9398
25000/25000 [==============================] - 3s 135us/step
```

```
# 훈련된 모델로 새로운 데이터에 대해 예측

model.predict(x_test)
```

```
array([[0.1731599 ],
       [0.9970788 ],
       [0.8335266 ],
       ...,
       [0.16215259],
       [0.0823496 ],
       [0.67877716]], dtype=float32)
```

어떤 샘플에 대해서는 확신 O

어떤 샘플에 대해서는 확신 X

확신 O: 0.99 이상, 0.01 이하
확신 X: 0.6, 0.4 ...