회귀_실습_carseat

1.환경준비

(1) 라이브러리 로딩

```
import pandas as pd
import numpy as np
import matplotlib.pyplot as plt
import seaborn as sns

from sklearn.model_selection import train_test_split
from sklearn.metrics import *
from sklearn.preprocessing import MinMaxScaler

from keras.models import Sequential
from keras.layers import Dense
from keras.backend import clear_session
from keras.optimizers import Adam
```

- 학습곡선 그래프 함수 만들기

```
def dl_history_plot(history):
    plt.figure(figsize=(10,6))
    plt.plot(history['loss'], label='train_err', marker = '.')
    plt.plot(history['val_loss'], label='val_err', marker = '.')

    plt.ylabel('Loss')
    plt.xlabel('Epoch')
    plt.legend()
    plt.grid()
    plt.show()
```

(2) 데이터로딩

```
path = 'https://raw.githubusercontent.com/DA4BAM/dataset/master/Carseats.csv'
data = pd.read_csv(path)
data.head()
```

```
   Sales  CompPrice  Income  Advertising  Population  Price  ShelveLoc  Age  Education  Urban
0   9.50        138      73           11         276    120        Bad   42         17    Yes
1  11.22        111      48           16         260     83       Good   65         10    Yes
2  10.06        113      35           10         269     80     Medium   59         12    Yes
3   7.40        117     100            4         466     97     Medium   55         14    Yes
4   4.15        141      64            3         340    128        Bad   38         13    Yes
```

Next steps: Generate code with data View recommended plots

변수명	설명	구분
Sales	각 지역 판매량(단위 : 1000개)	Target
CompPrice	지역별 경쟁사 판매가격(달러)	feature
Income	가구당 평균 소득액(1000달러)	feature
Advertising	각 지역, 회사의 광고 예산(1000달러)	feature
Population	지역 인구수(단위 : 1000명)	feature
Price	자사 지역별 판매가격(달러)	feature
ShelveLoc	진열상태(범주 : Bad, Medium, Good)	feature
Age	지역 인구의 평균 연령	feature
Education	교육수준(범주 : 10~18)	feature

변수명	설명	구분
Urban	매장이 도심에 있는지 여부(범주 : Yes, No)	feature
US	매장이 미국에 있는지 여부(범주 : Yes, No)	feature

2.데이터 준비

(1) 데이터 준비

```
target = 'Sales'
x = data.drop(target, axis=1)
y = data.loc[:, target]
```

(2) 가변수화

```
cat_cols = ['ShelveLoc', 'Education', 'US', 'Urban']
x = pd.get_dummies(x, columns = cat_cols, drop_first = True)
```

(3) 데이터분할

```
x_train, x_val, y_train, y_val = train_test_split(x, y, test_size=.2, random_state = 20)
```

(4) Scaling

```
scaler = MinMaxScaler()
x_train = scaler.fit_transform(x_train)
x_val = scaler.transform(x_val)
```

3.모델링

- 히든레이어를 추가한 모델 두 개 이상을 생성한 후
- 성능을 비교하시오.
- 성능을 높이기 위해서 조절할 것들
    - 히든레이어 수
    - 히든레이어 노드수
    - epochs 수
    - learning_rate : 0.1 ~ 0.0001 사이에서 조정(예 Adam(learning_rate = 0.01))

(1) 모델1

- 모델 설계
    - 일단 먼저 손으로 구조를 그려본 후
    - 코드로 옮겨 봅시다.

```
nfeature = x_train.shape[1]
nfeature
```

```
18
```

```
clear_session()
model1 = Sequential([Dense(1, input_shape=(nfeature, ))])
model1.summary()
```

```
Model: "sequential"
_________________________________________________________________
 Layer (type)                Output Shape              Param #   
=================================================================
 dense (Dense)               (None, 1)                 19

=================================================================
Total params: 19 (76.00 Byte)
Trainable params: 19 (76.00 Byte)
Non-trainable params: 0 (0.00 Byte)
_________________________________________________________________
```

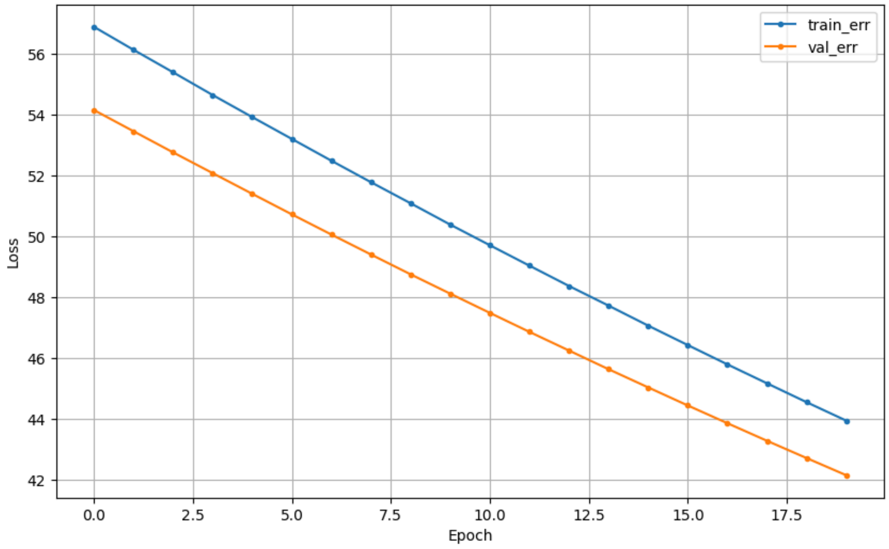
- 컴파일 + 학습

```
model1.compile(optimizer=Adam(0.001), loss='mse')
hist = model1.fit(x_train, y_train, epochs=20, validation_split=0.2).history
```

```
Epoch 1/20
8/8 [==============================] - 1s 38ms/step - loss: 56.8770 - val_loss: 54.1443
Epoch 2/20
8/8 [==============================] - 0s 12ms/step - loss: 56.1221 - val_loss: 53.4482
Epoch 3/20
8/8 [==============================] - 0s 21ms/step - loss: 55.3834 - val_loss: 52.7540
Epoch 4/20
8/8 [==============================] - 0s 21ms/step - loss: 54.6370 - val_loss: 52.0725
Epoch 5/20
8/8 [==============================] - 0s 10ms/step - loss: 53.9123 - val_loss: 51.3927
Epoch 6/20
8/8 [==============================] - 0s 17ms/step - loss: 53.1954 - val_loss: 50.7189
Epoch 7/20
8/8 [==============================] - 0s 26ms/step - loss: 52.4788 - val_loss: 50.0550
Epoch 8/20
8/8 [==============================] - 0s 14ms/step - loss: 51.7736 - val_loss: 49.3995
Epoch 9/20
8/8 [==============================] - 0s 13ms/step - loss: 51.0816 - val_loss: 48.7488
Epoch 10/20
8/8 [==============================] - 0s 12ms/step - loss: 50.3822 - val_loss: 48.1146
Epoch 11/20
8/8 [==============================] - 0s 16ms/step - loss: 49.7057 - val_loss: 47.4840
Epoch 12/20
8/8 [==============================] - 0s 10ms/step - loss: 49.0340 - val_loss: 46.8603
Epoch 13/20
8/8 [==============================] - 0s 11ms/step - loss: 48.3662 - val_loss: 46.2471
Epoch 14/20
8/8 [==============================] - 0s 26ms/step - loss: 47.7213 - val_loss: 45.6337
Epoch 15/20
8/8 [==============================] - 0s 15ms/step - loss: 47.0645 - val_loss: 45.0364
Epoch 16/20
8/8 [==============================] - 0s 6ms/step - loss: 46.4263 - val_loss: 44.4434
Epoch 17/20
8/8 [==============================] - 0s 6ms/step - loss: 45.7926 - val_loss: 43.8613
Epoch 18/20
8/8 [==============================] - 0s 6ms/step - loss: 45.1712 - val_loss: 43.2837
Epoch 19/20
8/8 [==============================] - 0s 5ms/step - loss: 44.5516 - val_loss: 42.7169
Epoch 20/20
8/8 [==============================] - 0s 8ms/step - loss: 43.9464 - val_loss: 42.1544
```

- 학습곡선

```
dl_history_plot(hist)
```



- 검증

```
pred = model1.predict(x_val)
print('RMSE:', mean_squared_error(y_val, pred))
print('MAE:', mean_absolute_error(y_val, pred))
print('MAPE:', mean_absolute_error(y_val, pred))
```

```
3/3 [==============================] - 0s 9ms/step
RMSE: 41.15651468749719
MAE: 5.723876590430737
MAPE: 5.723876590430737
```

(2) 모델2

- 모델 설계
  - 일단 먼저 손으로 구조를 그려본 후
  - 코드로 옮겨 봅시다.

```
clear_session()
model2 = Sequential([Dense(9, input_shape=(nfeature,), activation='relu'),
                     Dense(1)])
model2.summary()
```

```
Model: "sequential"
_________________________________________________________________
 Layer (type)                Output Shape              Param #
=================================================================
 dense (Dense)               (None, 9)                 171

 dense_1 (Dense)             (None, 1)                 10

=================================================================
Total params: 181 (724.00 Byte)
Trainable params: 181 (724.00 Byte)
Non-trainable params: 0 (0.00 Byte)
_________________________________________________________________
```

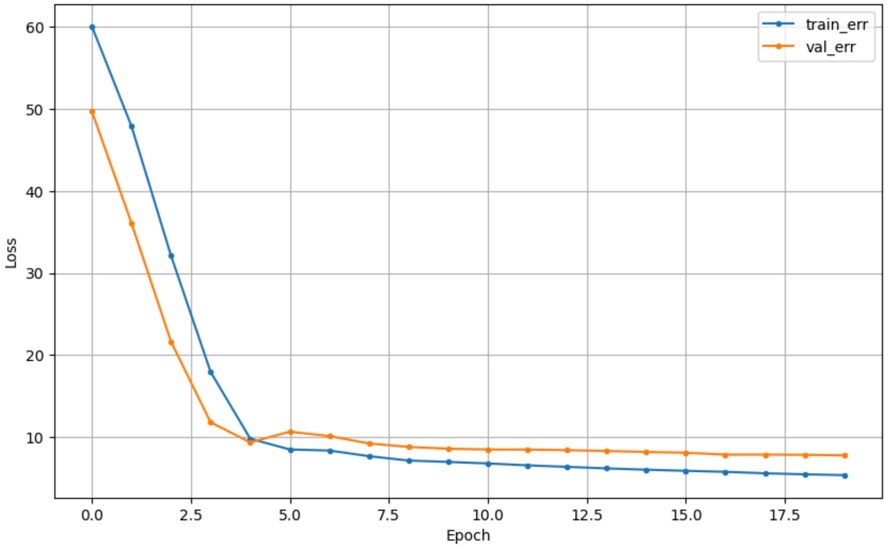
- 컴파일 + 학습

```
model2.compile(optimizer=Adam(0.01), loss='mse')
hist = model2.fit(x_train, y_train, epochs=20, validation_split=0.2).history
```

```
Epoch 1/20
8/8 [==============================] - 1s 27ms/step - loss: 60.1006 - val_loss: 49.7352
Epoch 2/20
8/8 [==============================] - 0s 6ms/step - loss: 47.9327 - val_loss: 36.1064
Epoch 3/20
8/8 [==============================] - 0s 8ms/step - loss: 32.1186 - val_loss: 21.6291
Epoch 4/20
8/8 [==============================] - 0s 8ms/step - loss: 17.9443 - val_loss: 11.8022
Epoch 5/20
8/8 [==============================] - 0s 9ms/step - loss: 9.8068 - val_loss: 9.3640
Epoch 6/20
8/8 [==============================] - 0s 6ms/step - loss: 8.4967 - val_loss: 10.6631
Epoch 7/20
8/8 [==============================] - 0s 8ms/step - loss: 8.3654 - val_loss: 10.1298
Epoch 8/20
8/8 [==============================] - 0s 9ms/step - loss: 7.6782 - val_loss: 9.2312
Epoch 9/20
8/8 [==============================] - 0s 6ms/step - loss: 7.1495 - val_loss: 8.8048
Epoch 10/20
8/8 [==============================] - 0s 6ms/step - loss: 6.9754 - val_loss: 8.5884
Epoch 11/20
8/8 [==============================] - 0s 6ms/step - loss: 6.7930 - val_loss: 8.4922
Epoch 12/20
8/8 [==============================] - 0s 8ms/step - loss: 6.5617 - val_loss: 8.4851
Epoch 13/20
8/8 [==============================] - 0s 8ms/step - loss: 6.3735 - val_loss: 8.4167
Epoch 14/20
8/8 [==============================] - 0s 6ms/step - loss: 6.1879 - val_loss: 8.3117
Epoch 15/20
8/8 [==============================] - 0s 9ms/step - loss: 6.0282 - val_loss: 8.1871
Epoch 16/20
8/8 [==============================] - 0s 6ms/step - loss: 5.8928 - val_loss: 8.0960
Epoch 17/20
8/8 [==============================] - 0s 8ms/step - loss: 5.7721 - val_loss: 7.8694
Epoch 18/20
8/8 [==============================] - 0s 8ms/step - loss: 5.5910 - val_loss: 7.8721
Epoch 19/20
8/8 [==============================] - 0s 6ms/step - loss: 5.4649 - val_loss: 7.8456
Epoch 20/20
8/8 [==============================] - 0s 6ms/step - loss: 5.3672 - val_loss: 7.7742
```

- 학습곡선

```
dl_history_plot(hist)
```



- 검증

```
pred = model1.predict(x_val)
print('RMSE:', mean_squared_error(y_val, pred))
print('MAE:', mean_absolute_error(y_val, pred))
print('MAPE:', mean_absolute_error(y_val, pred))
```

```
3/3 [==============================] - 0s 7ms/step
RMSE: 41.15651468749719
MAE: 5.723876590430737
MAPE: 5.723876590430737
```

(3) 모델3

- 모델 설계
  - 일단 먼저 손으로 구조를 그려본 후
  - 코드로 옮겨 봅시다.

```
clear_session()
model3 = Sequential([Dense(12, input_shape=(nfeature, ), activation='relu'),
                     Dense(6, activation='relu'),
                     Dense(3, activation='relu'),
                     Dense(1)])
model3.summary()
```

```
Model: "sequential"
_________________________________________________________________
 Layer (type)                Output Shape              Param #
=================================================================
 dense (Dense)               (None, 12)                228

 dense_1 (Dense)             (None, 6)                 78

 dense_2 (Dense)             (None, 3)                 21

 dense_3 (Dense)             (None, 1)                 4

=================================================================
Total params: 331 (1.29 KB)
Trainable params: 331 (1.29 KB)
Non-trainable params: 0 (0.00 Byte)
_________________________________________________________________
```

- 컴파일 + 학습

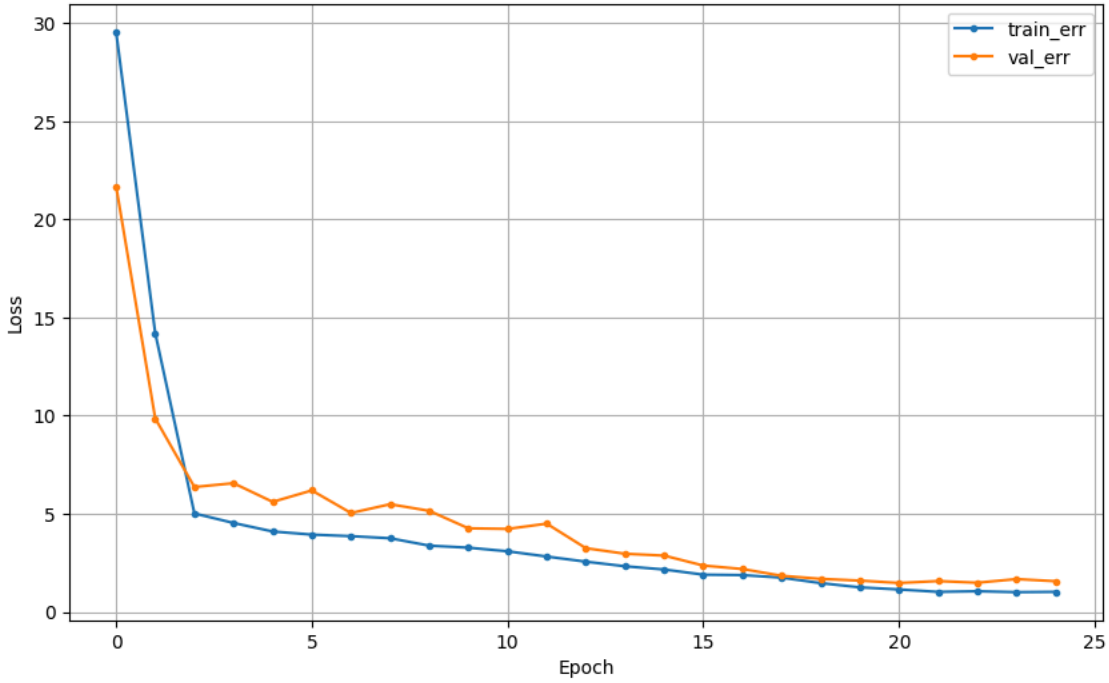
```
model3.compile(optimizer=Adam(0.1), loss='mse')
hist = model3.fit(x_train, y_train, epochs=25, validation_split=0.2).history
```

```
Epoch 1/25
8/8 [==============================] - 2s 45ms/step - loss: 29.5669 - val_loss: 21.6932
Epoch 2/25
8/8 [==============================] - 0s 13ms/step - loss: 14.2043 - val_loss: 9.8578
Epoch 3/25
8/8 [==============================] - 0s 14ms/step - loss: 5.0173 - val_loss: 6.3646
Epoch 4/25
8/8 [==============================] - 0s 14ms/step - loss: 4.5311 - val_loss: 6.5576
Epoch 5/25
8/8 [==============================] - 0s 13ms/step - loss: 4.0970 - val_loss: 5.6069
Epoch 6/25
8/8 [==============================] - 0s 10ms/step - loss: 3.9387 - val_loss: 6.1895
Epoch 7/25
8/8 [==============================] - 0s 9ms/step - loss: 3.8589 - val_loss: 5.0388
Epoch 8/25
8/8 [==============================] - 0s 6ms/step - loss: 3.7523 - val_loss: 5.4871
Epoch 9/25
8/8 [==============================] - 0s 8ms/step - loss: 3.3757 - val_loss: 5.1495
Epoch 10/25
8/8 [==============================] - 0s 9ms/step - loss: 3.2723 - val_loss: 4.2584
Epoch 11/25
8/8 [==============================] - 0s 7ms/step - loss: 3.0877 - val_loss: 4.2279
Epoch 12/25
8/8 [==============================] - 0s 9ms/step - loss: 2.8209 - val_loss: 4.4963
Epoch 13/25
8/8 [==============================] - 0s 6ms/step - loss: 2.5586 - val_loss: 3.2459
Epoch 14/25
8/8 [==============================] - 0s 8ms/step - loss: 2.3247 - val_loss: 2.9626
Epoch 15/25
8/8 [==============================] - 0s 8ms/step - loss: 2.1598 - val_loss: 2.8675
```

```
Epoch 16/25
8/8 [==============================] - 0s 8ms/step - loss: 1.8970 - val_loss: 2.3612
Epoch 17/25
8/8 [==============================] - 0s 8ms/step - loss: 1.8751 - val_loss: 2.1846
Epoch 18/25
8/8 [==============================] - 0s 8ms/step - loss: 1.7447 - val_loss: 1.8404
Epoch 19/25
8/8 [==============================] - 0s 8ms/step - loss: 1.4654 - val_loss: 1.6817
Epoch 20/25
8/8 [==============================] - 0s 6ms/step - loss: 1.2498 - val_loss: 1.5946
Epoch 21/25
8/8 [==============================] - 0s 6ms/step - loss: 1.1426 - val_loss: 1.4736
Epoch 22/25
8/8 [==============================] - 0s 8ms/step - loss: 1.0196 - val_loss: 1.5699
Epoch 23/25
8/8 [==============================] - 0s 9ms/step - loss: 1.0514 - val_loss: 1.4864
Epoch 24/25
8/8 [==============================] - 0s 6ms/step - loss: 1.0058 - val_loss: 1.6711
Epoch 25/25
8/8 [==============================] - 0s 6ms/step - loss: 1.0207 - val_loss: 1.5625
```

- 학습곡선

```
dl_history_plot(hist)
```



- 검증

```
pred = model1.predict(x_val)
print('RMSE:', mean_squared_error(y_val, pred))
print('MAE:', mean_absolute_error(y_val, pred))
print('MAPE:', mean_absolute_error(y_val, pred))
```

```
3/3 [==============================] - 0s 4ms/step
RMSE: 41.15651468749719
MAE: 5.723876590430737
```