Binary Classification - 분류

```
import warnings
warnings.filterwarnings('ignore')
```

실습용 데이터 설정

- pandas DataFrame
  - Default.csv

```
import pandas as pd

DF = pd.read_csv('https://raw.githubusercontent.com/rusita-ai/pyData/master/Default.csv')

DF.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 10000 entries, 0 to 9999
Data columns (total 4 columns):
 #   Column   Non-Null Count  Dtype  
---  ------   --------------  -----  
 0   default  10000 non-null  object 
 1   student  10000 non-null  object 
 2   balance  10000 non-null  float64
 3   income   10000 non-null  float64
dtypes: float64(2), object(2)
memory usage: 312.6+ KB
```

```
DF.head()
```

	default	student	balance	income
0	No	No	729.526495	44361.62507
1	No	Yes	817.180407	12106.13470
2	No	No	1073.549164	31767.13895
3	No	No	529.250605	35704.49394
4	No	No	785.655883	38463.49588

I. 탐색적 데이터 분석

1) 빈도분석

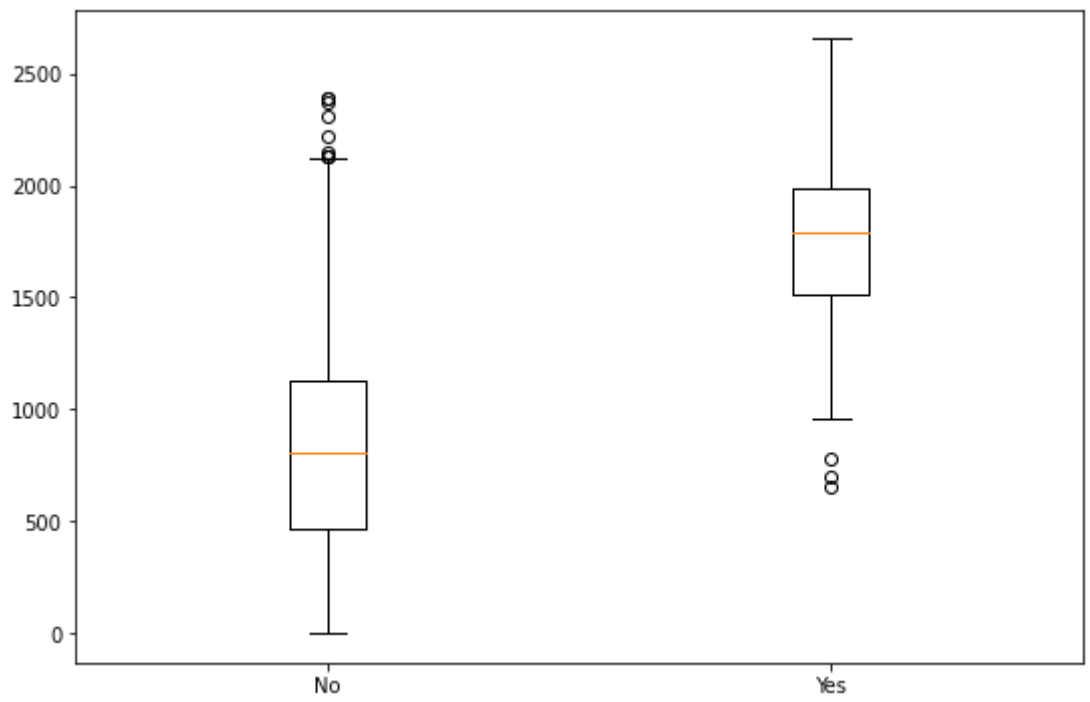
```
DF.default.value_counts()
```

```
No     9667
Yes     333
Name: default, dtype: int64
```

2) 분포 시각화

```
import matplotlib.pyplot as plt

plt.figure(figsize = (9, 6))
plt.boxplot([DF[DF.default == 'No'].balance,
             DF[DF.default == 'Yes'].balance],
            labels = ['No', 'Yes'])
plt.show()
```



II. Data Preprocessing

1) Standardization

```
X = DF[['balance']]
y = DF['default']
```

```
from sklearn.preprocessing import StandardScaler

scaler = StandardScaler()
X_Scaled = scaler.fit_transform(X)

X_Scaled[:5]
```

```
array([[-0.21883482],
       [-0.03761593],
       [ 0.49241019],
       [-0.6328925 ],
       [-0.10279088]])
```

2) Train & Test Split

- 7:3

```
from sklearn.model_selection import train_test_split

X_train, X_test, y_train, y_test = train_test_split(X_Scaled, y,
                                                    test_size = 0.3,
                                                    random_state = 2045)

print('Train Data : ', X_train.shape, y_train.shape)
print('Test Data : ', X_test.shape, y_test.shape)
```

```
Train Data :  (7000, 1) (7000,)
Test Data :  (3000, 1) (3000,)
```

III. Modeling

1) Train_Data로 모델 생성

```
from sklearn.linear_model import LogisticRegression
```

```
Model_lr = LogisticRegression()
Model_lr.fit(X_train, y_train)
```

```
LogisticRegression(C=1.0, class_weight=None, dual=False, fit_intercept=True,
                   intercept_scaling=1, l1_ratio=None, max_iter=100,
                   multi_class='auto', n_jobs=None, penalty='l2',
                   random_state=None, solver='lbfgs', tol=0.0001, verbose=0,
                   warm_start=False)
```

2) Test_Data에 Model 적용

```
y_hat = Model_lr.predict(X_test)
```

```
y_hat
```

```
array(['No', 'No', 'No', ..., 'No', 'No', 'No'], dtype=object)
```

IV. Model Validation

1) Accuracy

- Train Accuracy

```
Model_lr.score(X_train, y_train)
```

```
0.9724285714285714
```

- Test Accuracy

```
Model_lr.score(X_test, y_test)
```

```
0.9736666666666667
```

2) Confusion Matrix

- 'No'(상환) 기준

```
from sklearn.metrics import confusion_matrix

confusion_matrix(y_test, y_hat)
```

```
array([[2889,    7],
       [  72,   32]])
```

- 'Yes'(연체) 기준

```
from sklearn.metrics import confusion_matrix

confusion_matrix(y_test, y_hat, labels = ['Yes','No'])
```

```
array([[  32,   72],
       [   7, 2889]])
```

3) Accuracy, Precision, Recall - 'No(상환)'

```
from sklearn.metrics import accuracy_score, precision_score, recall_score

print(accuracy_score(y_test, y_hat))
print(precision_score(y_test, y_hat, pos_label = 'No'))
print(recall_score(y_test, y_hat, pos_label = 'No'))
```

```
0.9736666666666667
0.9756838905775076
0.9975828729281768
```

4) Accuracy, Precision, Recall - 'Yes(연체)'

```
from sklearn.metrics import accuracy_score, precision_score, recall_score

print(accuracy_score(y_test, y_hat))
print(precision_score(y_test, y_hat, pos_label = 'Yes'))
print(recall_score(y_test, y_hat, pos_label = 'Yes'))
```

```
0.9736666666666667
0.8205128205128205
0.3076923076923077
```

5) F1_Score - 'No(상환)'

```
from sklearn.metrics import f1_score

f1_score(y_test, y_hat, pos_label = 'No')
```

```
0.9865118661430767
```

6) F1_Score - 'Yes(연체)'

```
from sklearn.metrics import f1_score

f1_score(y_test, y_hat, pos_label = 'Yes')
```

```
0.44755244755244755
```

7) Classification Report

```
from sklearn.metrics import classification_report

print(classification_report(y_test, y_hat,
                            target_names = ['No', 'Yes'],
                            digits = 5))
```

```
                precision    recall  f1-score   support

            No    0.97568   0.99758   0.98651      2896
           Yes    0.82051   0.30769   0.44755       104

      accuracy                        0.97367      3000
     macro avg    0.89810   0.65264   0.71703      3000
  weighted avg    0.97030   0.97367   0.96783      3000
```

#

#

#

The End

#

#

#