

```

In [1]: import pandas as pd
import numpy as np
from scipy import stats
import math

# matplotlib and seaborn for visualizations
import seaborn as sns
import matplotlib.pyplot as plt
plt.rcParams['font.size'] = 12

# Suppress warnings from pandas
import warnings
warnings.filterwarnings('ignore')

# modeling
import lightgbm as lgb

# utilities
from sklearn.model_selection import train_test_split
from sklearn.metrics import roc_auc_score

sns.set_style("darkgrid")
# memory management
import gc
import os
# 운영체제별 한글 폰트 설정
if os.name == 'posix': # Mac 환경 폰트 설정
    plt.rc('font', family='AppleGothic')
elif os.name == 'nt': # Windows 환경 폰트 설정
    plt.rc('font', family='Malgun Gothic')

plt.rc('axes', unicode_minus=False) # 마이너스 폰트 설정

# 글씨 선명하게 출력하는 설정
%config InlineBackend.figure_format = 'retina'

df = pd.read_csv("dataset2.csv")
# import mglearn
# from sklearn.model_selection import KFold
# from sklearn.preprocessing import LabelEncoder

```

```

In [2]: len(df[df['당뇨여부']==1])

```

Out[2]: 46579

```

In [3]: nodang = df[df['당뇨여부']==0].copy()
dang = df[df['당뇨여부']==1].copy()
print(len(nodang))
print(len(dang))

```

1133541
46579

```

In [4]: x = df[['허리둘레', '연령대코드 (5세단위)', '감마지티피', '수축기혈압', '(혈청지오티)AST']].copy()
y = df[['당뇨여부']].copy()

```

비당뇨 : 당뇨 = 10 : 1

```
In [5]: from imblearn.under_sampling import RandomUnderSampler

rus = RandomUnderSampler(random_state=42, sampling_strategy=0.1)
X_rus, y_rus = rus.fit_resample(X, y)
```

```
In [6]: print(len(X_rus))
print(len(y_rus))
print(np.sum(y_rus))
```

```
512369
512369
당뇨여부      46579.0
dtype: float64
```

```
In [7]: y_rus
```

```
Out[7]:
```

	당뇨여부
0	0.0
1	0.0
2	0.0
3	0.0
4	0.0
...	...
512364	1.0
512365	1.0
512366	1.0
512367	1.0
512368	1.0

512369 rows × 1 columns

```
In [8]: X_train, X_test, y_train, y_test = train_test_split(X_rus, y_rus.values, stratify=y_rus,
from lightgbm import LGBMClassifier, plot_importance
from sklearn.preprocessing import StandardScaler, RobustScaler
sc = RobustScaler()
x_train = sc.fit_transform(X_train)
x_test = sc.transform(X_test)
lgb = LGBMClassifier(n_estimators=400)
evals = [(x_test, y_test)]
```

```
In [9]: # lgb.fit(x_train, y_train, early_stopping_rounds=100, eval_metric="logloss",
lgb.fit(x_train, y_train, eval_metric="logloss", eval_set=evals, verbose=False)
```

```
Out[9]: LGBMClassifier(n_estimators=400)
```

```
In [10]: y_pred = lgb.predict(x_test)
```

정확도

```
In [11]: lgb.score(x_test, y_test)
```

```
Out[11]: 0.9088354119093623
```

예측 결과

```
In [12]: print("당뇨로 예측한 데이터 수 :", np.sum(y_pred))
print("실제 당뇨 데이터 수 :", np.sum(y_test))
print("전체 데이터 수 :", len(y_test))
```

당뇨로 예측한 데이터 수 : 68.0
실제 당뇨 데이터 수 : 9316.0
전체 데이터 수 : 102474

TN, FP, FN, TP

```
In [13]: from sklearn import metrics
metrics.confusion_matrix(y_test, y_pred)

# [[TN, FP],
#  [FN, TP]]
```

```
Out[13]: array([[93111,  47],
               [ 9295,  21]])
```

TN, FP, FN, TP 검토

```
In [14]: y_test = y_test.reshape(-1)
```

```
In [15]: P = sum(y_test)
TP = sum((y_test==1) & (y_pred==1))
TPR = TP/P
FN = sum((y_test==1) & (y_pred==0))
FNR = FN/P
N = sum(y_test==0)
TN = sum((y_test==0) & (y_pred==0))
TNR = TN/N
FP = sum((y_test==0) & (y_pred==1))
FPR = FP/N
print(TN, FP, FN, TP)
print(TPR, FPR)
```

93111 47 9295 21
0.0022541863460712754 0.0005045192039331029

데이터 별 당뇨 분류 확률

```
In [16]: y_pred_proba = lgb.predict_proba(x_test)
y_pred_proba
```

```
Out[16]: array([[0.99751806, 0.00248194],
               [0.96229162, 0.03770838],
               [0.91927851, 0.08072149],
               ...,
               [0.95385366, 0.04614634],
```

```
[0.98071124, 0.01928876],  
[0.91208333, 0.08791667]])
```

[당뇨X 확률, 당뇨 확률]

```
In [17]: y_pred_proba.shape
```

```
Out[17]: (102474, 2)
```

데이터 별 당뇨로 예측할 확률

```
In [18]: pos_proba = y_pred_proba[:,1]  
# np.unique(pos_proba)  
print(len(pos_proba[pos_proba > 0.8]))
```

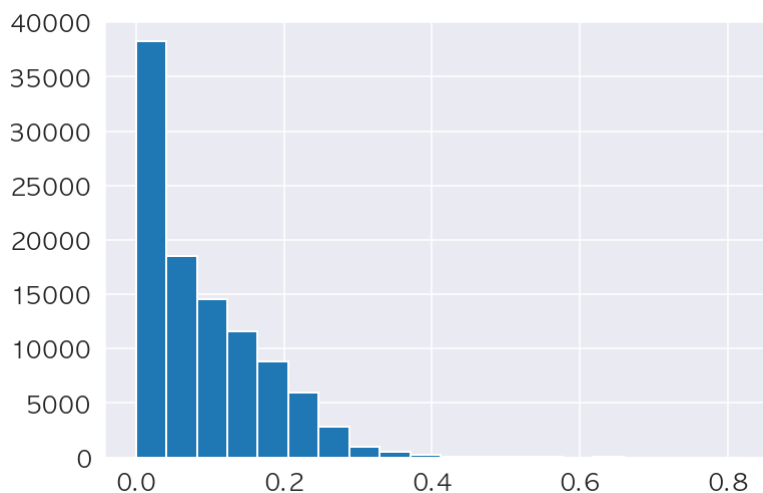
```
2
```

```
In [19]: print("pos_proba 최솟값 :", min(pos_proba))  
print("pos_proba 최댓값 :", max(pos_proba))
```

```
pos_proba 최솟값 : 8.082838002650548e-06  
pos_proba 최댓값 : 0.8237013360546861
```

```
In [20]: plt.hist(pos_proba, range=(min(pos_proba),max(pos_proba)), bins=20)
```

```
Out[20]: (array([3.8235e+04, 1.8551e+04, 1.4575e+04, 1.1574e+04, 8.7940e+03,  
6.0090e+03, 2.8250e+03, 1.0070e+03, 5.0000e+02, 2.0500e+02,  
8.0000e+01, 4.6000e+01, 2.7000e+01, 2.0000e+01, 9.0000e+00,  
1.0000e+01, 2.0000e+00, 2.0000e+00, 1.0000e+00, 2.0000e+00]),  
array([8.08283800e-06, 4.11927455e-02, 8.23774082e-02, 1.23562071e-01,  
1.64746733e-01, 2.05931396e-01, 2.47116059e-01, 2.88300721e-01,  
3.29485384e-01, 3.70670047e-01, 4.11854709e-01, 4.53039372e-01,  
4.94224035e-01, 5.35408697e-01, 5.76593360e-01, 6.17778023e-01,  
6.58962685e-01, 7.00147348e-01, 7.41332011e-01, 7.82516673e-01,  
8.23701336e-01]),  
<BarContainer object of 20 artists>)
```



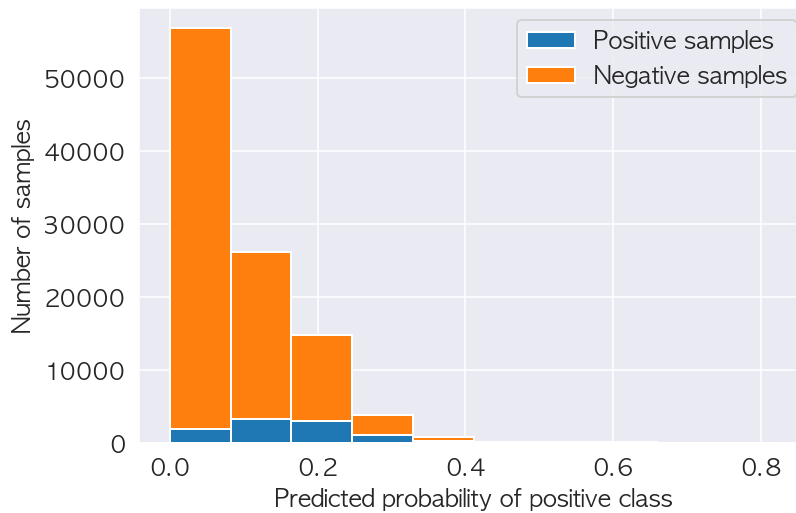
당뇨 예측 확률과 실제 데이터

```
In [21]: pos_sample_pos_proba = pos_proba[y_test==1]  
neg_sample_pos_proba = pos_proba[y_test==0]
```

```
In [22]:
```

```
plt.hist([pos_sample_pos_proba, neg_sample_pos_proba], histtype="barstacked")
plt.legend(["Positive samples", "Negative samples"])
plt.xlabel("Predicted probability of positive class")
plt.ylabel("Number of samples")
```

Out[22]: Text(0, 0.5, 'Number of samples')

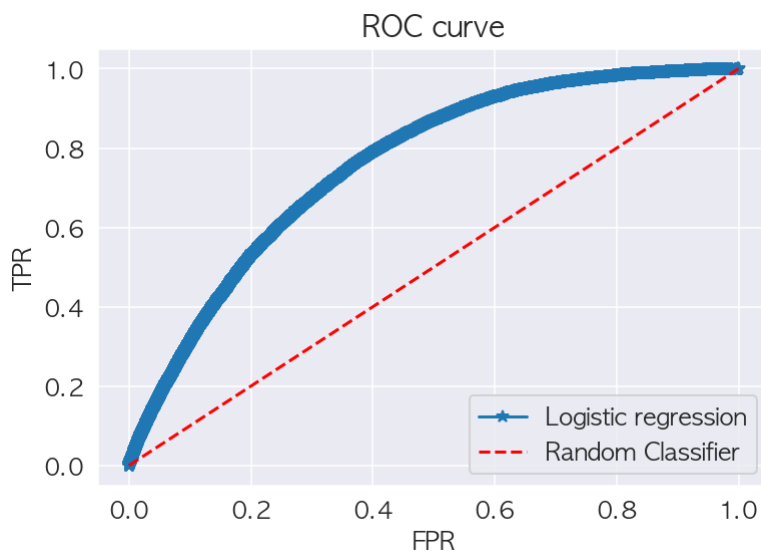


ROC Curve

```
In [23]: fpr, tpr, thresholds = metrics.roc_curve(y_test, pos_proba)
```

```
In [24]: plt.plot(fpr, tpr, '*-')
plt.plot([0,1], [0,1], 'r--')
plt.legend(['Logistic regression', 'Random Classifier'])
plt.xlabel('FPR')
plt.ylabel('TPR')
plt.title('ROC curve')
```

Out[24]: Text(0.5, 1.0, 'ROC curve')



AUC Score

```
In [25]: metrics.roc_auc_score(y_test, pos_proba)
```

Out[25]: 0.7590135853121219

Precision, Recall, Accuracy

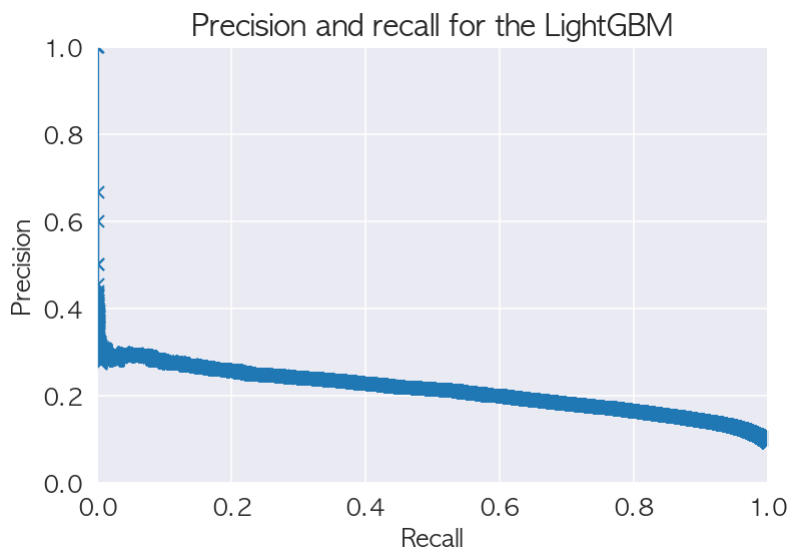
```
In [26]: precision = TP/(TP+FP)
recall = TP/(TP+FN)
accuracy = (TP+TN)/(TP+FP+TN+FN)
print("precision :", precision)
print("recall :", recall)
print("accuracy :", accuracy)
```

```
precision : 0.3088235294117647
recall : 0.0022541863460712754
accuracy : 0.9088354119093623
```

```
In [27]: precision2, recall2, thresholds2 = metrics.precision_recall_curve(y_test, pos_
```

```
In [28]: plt.plot(recall2, precision2, '-x')
plt.xlabel('Recall')
plt.ylabel('Precision')
plt.title('Precision and recall for the LightGBM')
plt.xlim([0,1])
plt.ylim([0,1])
```

Out[28]: (0.0, 1.0)



```
In [29]: metrics.auc(recall2, precision2)
```

Out[29]: 0.21048074432131336

In []: