위스콘신 유방암 데이터 셋 - LightGBM 모델 구현

학습 목표

- LightGBM 모델을 이용하여 학습과 예측을 수행해 본다.
- 예측을 수행한 결과에 대해 평가를 수행해 본다.(교차검증)

학습 내용

- LightGBM 모델 만들기 - 위스콘신 유방암 데이터 셋
- 평가해보기

목차

01 데이터 로드 및 전처리

목차로 이동하기

- 라이브러리가 없다고 확인되면 설치를 진행
  - (예) pip install lightgbm

In [1]:
```
import pandas as pd
from sklearn.datasets import load_breast_cancer
import matplotlib.pyplot as plt
import matplotlib

import lightgbm as lgbm
import sklearn as sk
from lightgbm import LGBMClassifier
from sklearn.model_selection import train_test_split
```

In [2]:
```
print("LightGBM : ", lgbm.__version__)
print("Scikit-learn : ", sk.__version__)
print("pandas : ", pd.__version__)
```

```
LightGBM :  3.3.5
Scikit-learn :  1.0.2
pandas :  1.4.4
```

In [3]:
```
cancer = load_breast_cancer()

cancer_df = pd.DataFrame(cancer.data, columns=cancer.feature_names)
cancer_df.head()
```

Out[3]:

	mean radius	mean texture	mean perimeter	mean area	mean smoothness	mean compactness	mean concavity	mean concave points	mean symmetry
0	17.99	10.38	122.80	1001.0	0.11840	0.27760	0.3001	0.14710	0.2419
1	20.57	17.77	132.90	1326.0	0.08474	0.07864	0.0869	0.07017	0.1812
2	19.69	21.25	130.00	1203.0	0.10960	0.15990	0.1974	0.12790	0.2069
3	11.42	20.38	77.58	386.1	0.14250	0.28390	0.2414	0.10520	0.2597
4	20.29	14.34	135.10	1297.0	0.10030	0.13280	0.1980	0.10430	0.1809

5 rows × 30 columns

In [4]:
```
print( cancer_df.shape)
```

```
(569, 30)
```

데이터 설명

- 위스콘신 유방암 데이터 세트는 유방암의 악성 종양, 양성 종양 여부를 결정하는 이진 분류
- 종양의 크기, 모양 등의 형태와 관련한 많은 피처를 가지고 있음.
- 569개의 행과, 30개의 피처로 이루어진 데이터
- null 값이 없음. 값들은 실수로 되어 있음.

데이터 나누기

In [21]:
```
# 피처와 레이블를 지정.
X = cancer_df[:]
y = cancer.target

X.shape, y.shape
```

Out[21]:
```
((569, 30), (569,))
```

In [22]:
```
X_train , X_test, y_train, y_test = train_test_split(X, y,
                                                     test_size=0.2, random_state=0)

X_train.shape, X_test.shape, y_train.shape, y_test.shape
```

Out[22]:
```
((455, 30), (114, 30), (455,), (114,))
```

02 LightGBM 모델

목차로 이동하기

- LightGBM은 XGBoost와 부스팅 계열 알고리즘에서 가장 각광을 받고 있음.
- LightGBM은 가장 큰 장점은 XGBoost보다 학습에 걸리는 시간이 훨씬 적다. 메모리 사용량도 적다.
- LightGBM과 XGBoost의 예측 성능은 별다른 차이가 없음.
- LightGBM이 XGBoost보다 2년 후에 만들어짐.

- [단점] 적은 데이터 셋일 경우, 과적합이 발생할 가능성이 있음. (문서상에는 10000건 이하의 데이터로 기술하고 있음.)

- lightgbm 설치
  - pip install lightgbm

LightGBM의 파이썬 패키지인 lightgbm에서 LGBMClassifier 불러오기

In [23]:
```
from lightgbm import LGBMClassifier
```

In [24]:
```
# 모델 선택
model_lgbm = LGBMClassifier(n_estimators= 100)

# Lgbm은 중간에 조기 중단이 가능.
evals = [(X_test, y_test)]

# 모델 학습
model_lgbm.fit(X_train, y_train, early_stopping_rounds=100,
               eval_metric='logloss',
               eval_set=evals,
               verbose=True)

# 모델을 활용한 예측
preds = model_lgbm.predict(X_test)
pred_proba = model_lgbm.predict_proba(X_test)[:, 1]
```

```
[1]	valid_0's binary_logloss: 0.602575
[2]	valid_0's binary_logloss: 0.536123
[3]	valid_0's binary_logloss: 0.482224
[4]	valid_0's binary_logloss: 0.439121
[5]	valid_0's binary_logloss: 0.399484
[6]	valid_0's binary_logloss: 0.360741
[7]	valid_0's binary_logloss: 0.329635
[8]	valid_0's binary_logloss: 0.300259
[9]	valid_0's binary_logloss: 0.279599
[10]	valid_0's binary_logloss: 0.259173
[11]	valid_0's binary_logloss: 0.239127
[12]	valid_0's binary_logloss: 0.222309
[13]	valid_0's binary_logloss: 0.209351
[14]	valid_0's binary_logloss: 0.194316
[15]	valid_0's binary_logloss: 0.185282
[16]	valid_0's binary_logloss: 0.173675
[17]	valid_0's binary_logloss: 0.165308
[18]	valid_0's binary_logloss: 0.155769
[19]	valid_0's binary_logloss: 0.14865
[20]	valid_0's binary_logloss: 0.140995
[21]	valid_0's binary_logloss: 0.134334
[22]	valid_0's binary_logloss: 0.126574
[23]	valid_0's binary_logloss: 0.119264
[24]	valid_0's binary_logloss: 0.114799
[25]	valid_0's binary_logloss: 0.110568
[26]	valid_0's binary_logloss: 0.106157
[27]	valid_0's binary_logloss: 0.100816
[28]	valid_0's binary_logloss: 0.0978631
[29]	valid_0's binary_logloss: 0.0945873
[30]	valid_0's binary_logloss: 0.0916942
[31]	valid_0's binary_logloss: 0.0863612
[32]	valid_0's binary_logloss: 0.0822965
[33]	valid_0's binary_logloss: 0.078824
[34]	valid_0's binary_logloss: 0.0752847
[35]	valid_0's binary_logloss: 0.0718233
[36]	valid_0's binary_logloss: 0.0696371
[37]	valid_0's binary_logloss: 0.0676798
[38]	valid_0's binary_logloss: 0.0665177
[39]	valid_0's binary_logloss: 0.0660656
[40]	valid_0's binary_logloss: 0.064516
[41]	valid_0's binary_logloss: 0.0634248
[42]	valid_0's binary_logloss: 0.0616478
[43]	valid_0's binary_logloss: 0.0603263
[44]	valid_0's binary_logloss: 0.0598075
[45]	valid_0's binary_logloss: 0.058935
[46]	valid_0's binary_logloss: 0.0594708
[47]	valid_0's binary_logloss: 0.0575433
[48]	valid_0's binary_logloss: 0.05764
[49]	valid_0's binary_logloss: 0.058022
[50]	valid_0's binary_logloss: 0.056115
[51]	valid_0's binary_logloss: 0.0551967
[52]	valid_0's binary_logloss: 0.0546137
[53]	valid_0's binary_logloss: 0.055392
[54]	valid_0's binary_logloss: 0.0550331
[55]	valid_0's binary_logloss: 0.0550406
[56]	valid_0's binary_logloss: 0.0551554
[57]	valid_0's binary_logloss: 0.0550553
[58]	valid_0's binary_logloss: 0.0549359
[59]	valid_0's binary_logloss: 0.056094
[60]	valid_0's binary_logloss: 0.0571328
[61]	valid_0's binary_logloss: 0.0580245
[62]	valid_0's binary_logloss: 0.0574484
[63]	valid_0's binary_logloss: 0.0577891
[64]	valid_0's binary_logloss: 0.0592917
[65]	valid_0's binary_logloss: 0.0597466
```

```
[66]    valid_0's binary_logloss: 0.0597562
[67]    valid_0's binary_logloss: 0.0608003
[68]    valid_0's binary_logloss: 0.0599771
[69]    valid_0's binary_logloss: 0.060662
[70]    valid_0's binary_logloss: 0.0610663
[71]    valid_0's binary_logloss: 0.0617392
[72]    valid_0's binary_logloss: 0.0611657
[73]    valid_0's binary_logloss: 0.0607031
[74]    valid_0's binary_logloss: 0.0607682
[75]    valid_0's binary_logloss: 0.0618635
[76]    valid_0's binary_logloss: 0.0632427
[77]    valid_0's binary_logloss: 0.0641161
[78]    valid_0's binary_logloss: 0.0648781
[79]    valid_0's binary_logloss: 0.064908
[80]    valid_0's binary_logloss: 0.0650122
[81]    valid_0's binary_logloss: 0.0651241
[82]    valid_0's binary_logloss: 0.0651113
[83]    valid_0's binary_logloss: 0.0650562
[84]    valid_0's binary_logloss: 0.0642698
[85]    valid_0's binary_logloss: 0.0629834
[86]    valid_0's binary_logloss: 0.0632386
[87]    valid_0's binary_logloss: 0.0623831
[88]    valid_0's binary_logloss: 0.0611975
[89]    valid_0's binary_logloss: 0.060535
[90]    valid_0's binary_logloss: 0.0604596
[91]    valid_0's binary_logloss: 0.0594299
[92]    valid_0's binary_logloss: 0.0594986
[93]    valid_0's binary_logloss: 0.0599838
[94]    valid_0's binary_logloss: 0.05974
[95]    valid_0's binary_logloss: 0.0606709
[96]    valid_0's binary_logloss: 0.0607891
[97]    valid_0's binary_logloss: 0.062165
[98]    valid_0's binary_logloss: 0.0608996
[99]    valid_0's binary_logloss: 0.062041
[100]   valid_0's binary_logloss: 0.0608407
C:₩Users₩daniel_wj₩anaconda3₩lib₩site-packages₩lightgbm₩sklearn.py:726: UserWarning:
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M. Pass 'log_evaluation()' callback via 'callbacks' argument instead.
  _log_warning("'verbose' argument is deprecated and will be removed in a future rel
ease of LightGBM. "
```

- 조기 중단으로 계속 수행하지 않고, 중간에 중단함.

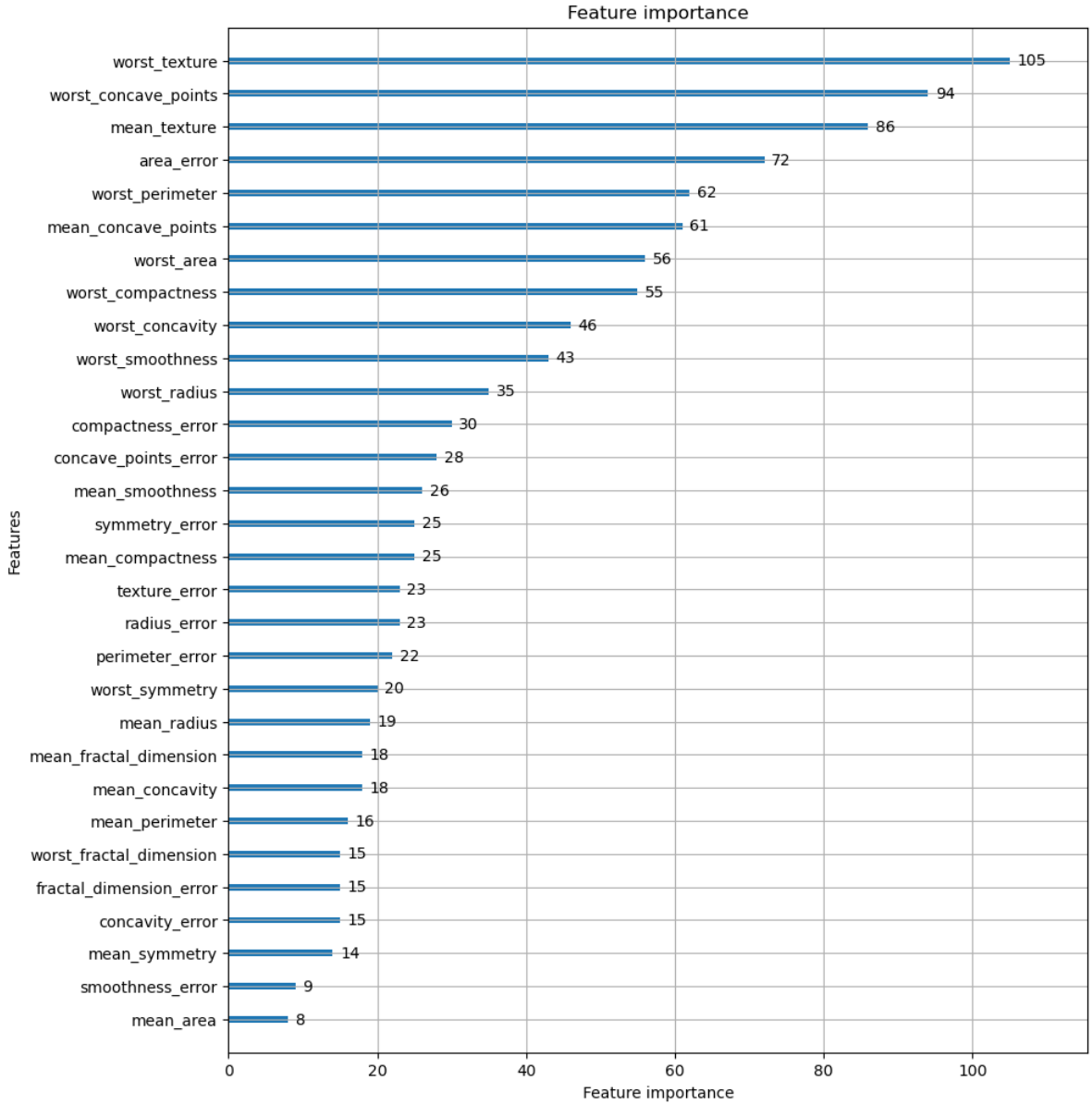
03 피처 중요도 시각화

목차로 이동하기

In [25]:
```
from lightgbm import plot_importance
import matplotlib.pyplot as plt

fig, ax = plt.subplots(figsize=(10,12))
plot_importance(model_lgbm, ax=ax)
```

Out[25]:
```
<AxesSubplot:title={'center':'Feature importance'}, xlabel='Feature importance', yla
bel='Features'>
```



04 모델 평가 - 교차 검증

목차로 이동하기

In [15]:
```
from sklearn.model_selection import cross_val_score
```

In [18]:
```
def model_val_lgbm(model_name):
    model = model_name

    # Lgbm은 중간에 조기 중단이 가능.
    evals = [(X_test, y_test)]

    # 모델 학습
    model.fit(X_train, y_train, early_stopping_rounds=100,
              eval_metric='logloss',
              eval_set=evals,
              verbose=False)  # True는 학습 과정이 보임

    score = cross_val_score(model, X_test, y_test, cv=5, scoring="roc_auc")

    print("auc :", score)
    m_score = score.mean()      # 절대값
```

```
    print("auc 평균(cv=5) : ", m_score)
    return m_score
```

In [19]:
```
# 모델 선택
model_lgbm = LGBMClassifier(n_estimators= 100,
                            learning_rate=0.1,
                             max_depth = 3)

score = model_val_lgbm(model_lgbm)
score
```

```
auc : [0.95384615 0.99230769 1.         0.98412698 0.97435897]
auc 평균(cv=5) :  0.980927960927961
C:₩Users₩daniel_wj₩anaconda3₩lib₩site-packages₩lightgbm₩sklearn.py:726: UserWarning:
'early_stopping_rounds' argument is deprecated and will be removed in a future relea
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  _log_warning("'verbose' argument is deprecated and will be removed in a future rel
ease of LightGBM. "
```

Out[19]:
```
0.980927960927961
```

05 모델 평가 - 교차 검증, GridSearchCV()

목차로 이동하기

In [35]:
```
param_grid = {'max_depth':[3,5,7],
              'learning_rate':[0.1, 0.01, 0.001],
              'n_estimators':[100, 300, 500]}
print("매개변수 그리드 :₩n", param_grid)
```

```
매개변수 그리드 :
 {'max_depth': [3, 5, 7], 'learning_rate': [0.1, 0.01, 0.001], 'n_estimators': [100,
300, 500]}
```

In [36]:
```
from sklearn.model_selection import GridSearchCV
```

In [37]:
```
grid_search = GridSearchCV(LGBMClassifier(),
                           param_grid, cv=5, return_train_score=True, scoring="roc_
grid_search
```

Out[37]:
```
GridSearchCV(cv=5, estimator=LGBMClassifier(),
             param_grid={'learning_rate': [0.1, 0.01, 0.001],
                         'max_depth': [3, 5, 7],
                         'n_estimators': [100, 300, 500]},
             return_train_score=True, scoring='roc_auc')
```

In [38]:
```
# 찾기 학습
evals = [(X_test, y_test)]
grid_search.fit(X_train, y_train, early_stopping_rounds=100,
              eval_metric='logloss',
              eval_set=evals,
              verbose=False)  # True는 학습 과정이 보임)
```

```
C:₩Users₩daniel_wj₩anaconda3₩lib₩site-packages₩lightgbm₩sklearn.py:726: UserWarning:
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```

```
C:\Users\daniel_wj\anaconda3\lib\site-packages\lightgbm\sklearn.py:736: UserWarning:
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```

Out[38]:

```
GridSearchCV(cv=5, estimator=LGBMClassifier(),
             param_grid={'learning_rate': [0.1, 0.01, 0.001],
                         'max_depth': [3, 5, 7],
                         'n_estimators': [100, 300, 500]},
             return_train_score=True, scoring='roc_auc')
```

In [39]:
```
best_model = grid_search.best_estimator_
best_params = grid_search.best_params_

best_model, best_params
```

Out[39]:
```
(LGBMClassifier(max_depth=5, n_estimators=300),
 {'learning_rate': 0.1, 'max_depth': 5, 'n_estimators': 300})
```

In [40]:
```
print("최적 매개변수 :", grid_search.best_params_)
print("최고 교차 검증 점수 : {:.4f}".format(grid_search.best_score_))
```

```
최적 매개변수 : {'learning_rate': 0.1, 'max_depth': 5, 'n_estimators': 300}
최고 교차 검증 점수 : 0.9935
```

정리

- gridSearchCV()를 이용하여 다양한 파라미터의 성능을 확인해 볼 수 있습니다.