Machine Learning in Finance Lab: Week 07

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Basic Import

In [9]:
```
from sklearn.model_selection import train_test_split
import matplotlib.pyplot as plt
from sklearn.neighbors import KNeighborsClassifier
from sklearn.ensemble import RandomForestClassifier
from sklearn.model_selection import StratifiedKFold,cross_validate,GridSearc

import numpy as np
import pandas as pd
from sklearn.metrics import accuracy_score
from sklearn import tree
```

In [33]:
```
cc = pd.read_csv(
    "/Users/yu-chingliao/Library/CloudStorage/GoogleDrive-josephliao0127@gma
    index_col='ID')
X = cc.drop("DEFAULT", axis=1)
y =cc["DEFAULT"]
```

Random Forest

In [34]:
```
hyperparameters = {
    'n_estimators': [10, 50, 100]
}

clf = RandomForestClassifier()

grid_search = GridSearchCV(clf, hyperparameters, cv=10, scoring='accuracy',r
grid_search.fit(X, y)
```

```
Out[34]: GridSearchCV(cv=10, estimator=RandomForestClassifier(),
                      param_grid={'n_estimators': [10, 50, 100]},
                      return_train_score=True, scoring='accuracy')
```

a) What is the relationship between n_estimators, in-sample CV accuracy and computation time?

As shown below, as the n_estimator grown, the in-sample CV accuracy will as well grown in their value. However, the calculation time elapse will grown even dramatically as the number of estimators grown.

```
In [35]: result = grid_search.cv_results_
         output = pd.DataFrame({'Parameters':result['params'] ,
                                            'Training Accuracy' : result['mean_train_sco
                                            'Testing Accuracy': result['mean_test_score'
                                            'Time Consumption': result['mean_score_time'
                                            })
         display(output)
```

	Parameters	Training Accuracy	Testing Accuracy	Time Consumption
0	{'n_estimators': 10}	0.979830	0.807767	0.007723
1	{'n_estimators': 50}	0.998781	0.815800	0.031192
2	{'n_estimators': 100}	0.999322	0.817033	0.062124

b) What is the optimal number of estimators for your forest?

As shown below, the optimal number of estimators is 50 in my model.

```
In [36]: print("The best number of estimators is: ",grid_search.best_params_)

         The best number of estimators is:  {'n_estimators': 100}
```

c) Which features contribute the most importance in your model according to scikit-learn function?

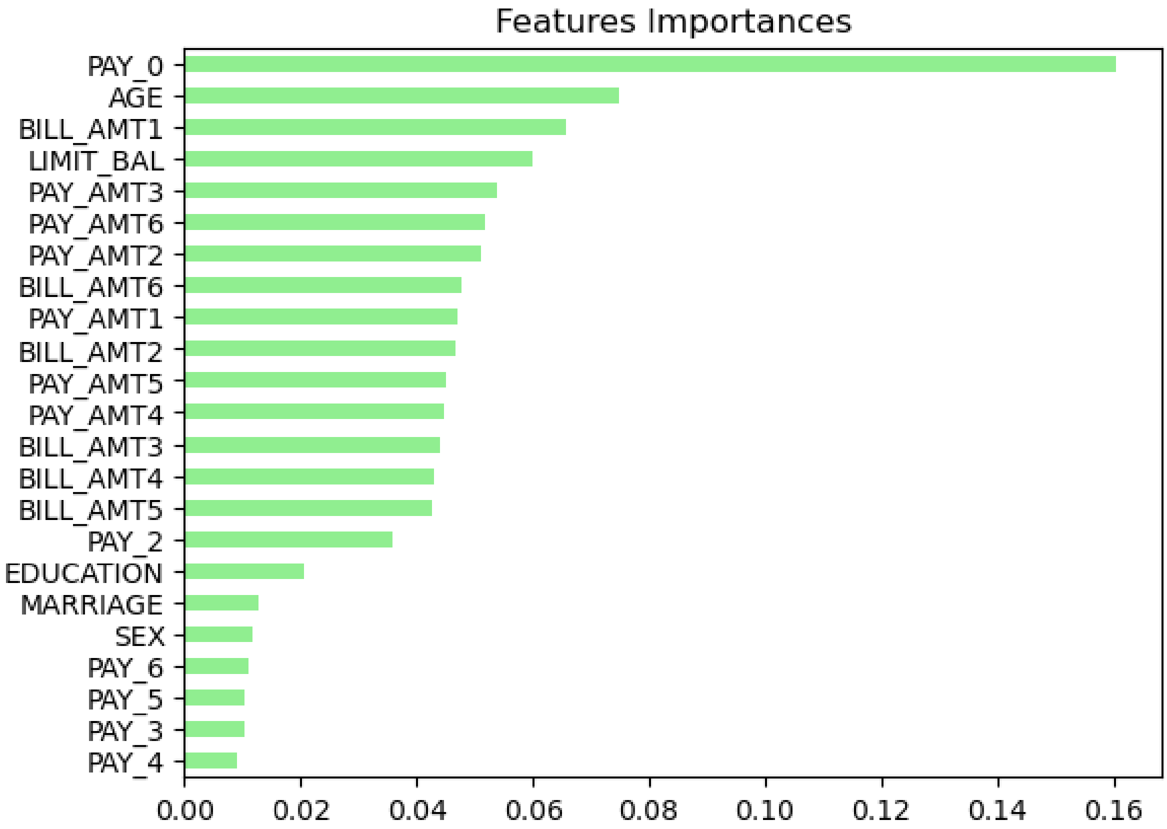
As shown below, "PAY_0" contribute the most importance in my model.

```
In [37]: best_n_est = list(grid_search.best_params_.values())[0]
```

```
rf = RandomForestRegressor(n_estimators=best_n_est)
rf.fit(x, y)
importances = pd.Series(data=rf.feature_importances_,
                            index= x.columns)

# Sort importances
importances_sorted = importances.sort_values()

# Draw a horizontal barplot of importances_sorted
importances_sorted.plot(kind='barh', color='lightgreen')
plt.title('Features Importances')
plt.show()
```



d) What is feature importance and how is it calculated? (If you are not sure, refer to the Scikit-Learn.org documentation.)

Feature importance is a method used to identify which features or variables in a dataset have the most significant impact on the outcome of a particular machine learning model. They are computed as the mean and standard deviation of accumulation of the impurity decrease within each tree.

Signing

My name is Yu-Ching Liao
My NetID is: 656724372
I hereby certify that I have read the University policy on Academic Integrity and that I am not in violation.

Link to github repo

https://github.com/yu7yu7/IE517_Machine-Learning-in-Finance-Lab/blob/main/IE517_SP23_HW7/%20ML_Week07_HW.ipynb