Credit_Risk

January 4, 2023

Prepare dataset

```
[ ]: import pandas as pd
     import numpy as np

     df = pd.read_csv("data/UCI_Credit_Card.csv")

     df["y"] = df["default.payment.next.month"]
     df.drop("default.payment.next.month", axis=1, inplace=True)
     df.drop("ID", axis=1, inplace=True)

     df.head()
```

```
[ ]:    LIMIT_BAL  SEX  EDUCATION  MARRIAGE  AGE  PAY_0  PAY_2  PAY_3  PAY_4  \
     0    20000.0    2          2         1   24      2      2     -1     -1
     1   120000.0    2          2         2   26     -1      2      0      0
     2    90000.0    2          2         2   34      0      0      0      0
     3    50000.0    2          2         1   37      0      0      0      0
     4    50000.0    1          2         1   57     -1      0     -1      0

        PAY_5  …  BILL_AMT4  BILL_AMT5  BILL_AMT6  PAY_AMT1  PAY_AMT2  PAY_AMT3  \
     0     -2  …        0.0        0.0        0.0       0.0     689.0       0.0
     1      0  …     3272.0     3455.0     3261.0       0.0    1000.0    1000.0
     2      0  …    14331.0    14948.0    15549.0    1518.0    1500.0    1000.0
     3      0  …    28314.0    28959.0    29547.0    2000.0    2019.0    1200.0
     4      0  …    20940.0    19146.0    19131.0    2000.0   36681.0   10000.0

        PAY_AMT4  PAY_AMT5  PAY_AMT6  y
     0       0.0       0.0       0.0  1
     1    1000.0       0.0    2000.0  1
     2    1000.0    1000.0    5000.0  0
     3    1100.0    1069.0    1000.0  0
     4    9000.0     689.0     679.0  0

     [5 rows x 24 columns]
```

Calculate imbalance in dataset

[ ]:

```
df["y"].value_counts()[0] / len(df["y"])
```

[ ]:

```
0.7788
```

Split data into test and validation sets

[ ]:

```
from sklearn.metrics import classification_report
from sklearn.model_selection import train_test_split

X, y = df.drop("y", axis=1), df["y"]

X_train, X_val, y_train, y_val = train_test_split(X, y, test_size=0.30,␣
 ↪random_state=0)
```

GBT Algorithm

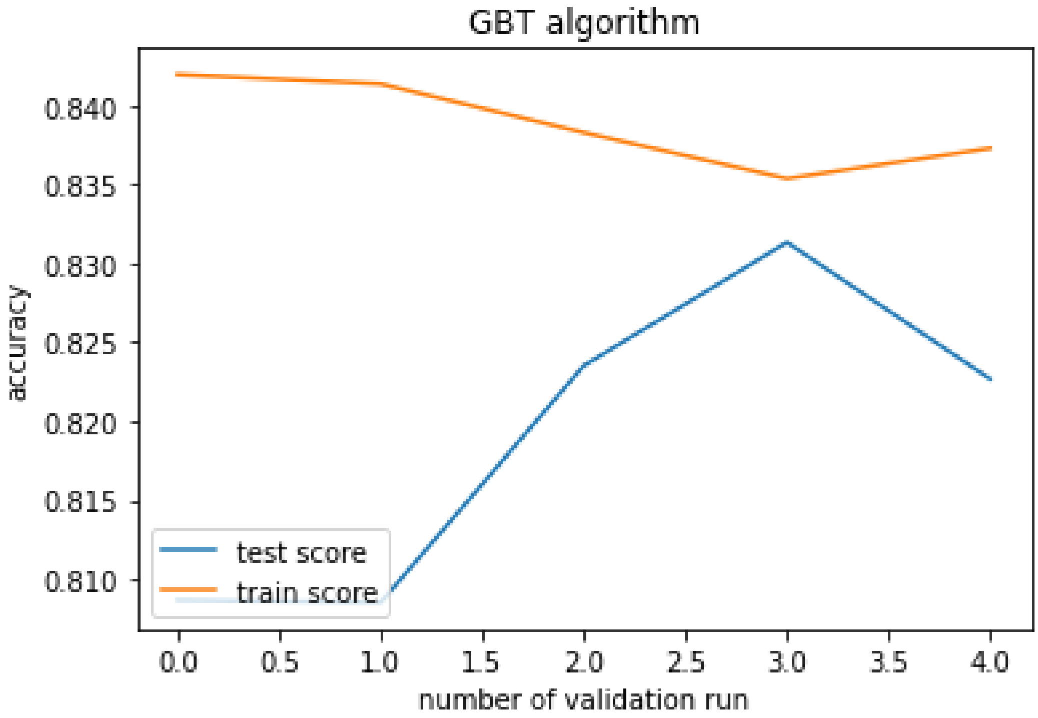
[ ]:

```
from sklearn.ensemble import GradientBoostingClassifier

model_gbt = GradientBoostingClassifier(learning_rate=0.1, max_depth=6,␣
 ↪criterion="friedman_mse", n_estimators=100, n_iter_no_change=5, tol=0.001,␣
 ↪random_state=0)

model_gbt.fit(X_train, y_train)
y_pred = model_gbt.predict(X_val)
print(classification_report(y_true=y_val, y_pred=y_pred))
```

```
              precision    recall  f1-score   support

           0       0.84      0.95      0.89      7060
           1       0.68      0.35      0.46      1940

    accuracy                           0.82      9000
   macro avg       0.76      0.65      0.68      9000
weighted avg       0.81      0.82      0.80      9000
```

[ ]:

```
from sklearn.model_selection import cross_validate
import matplotlib.pylab as plt

cv = cross_validate(model_gbt, X, y, return_train_score=True, cv=5)
plt.plot(cv["test_score"], label="test score")
plt.plot(cv["train_score"], label="train score")
plt.legend(loc="lower left")
plt.xlabel("number of validation run")
plt.ylabel("accuracy")
plt.title("GBT algorithm")
plt.show()
```



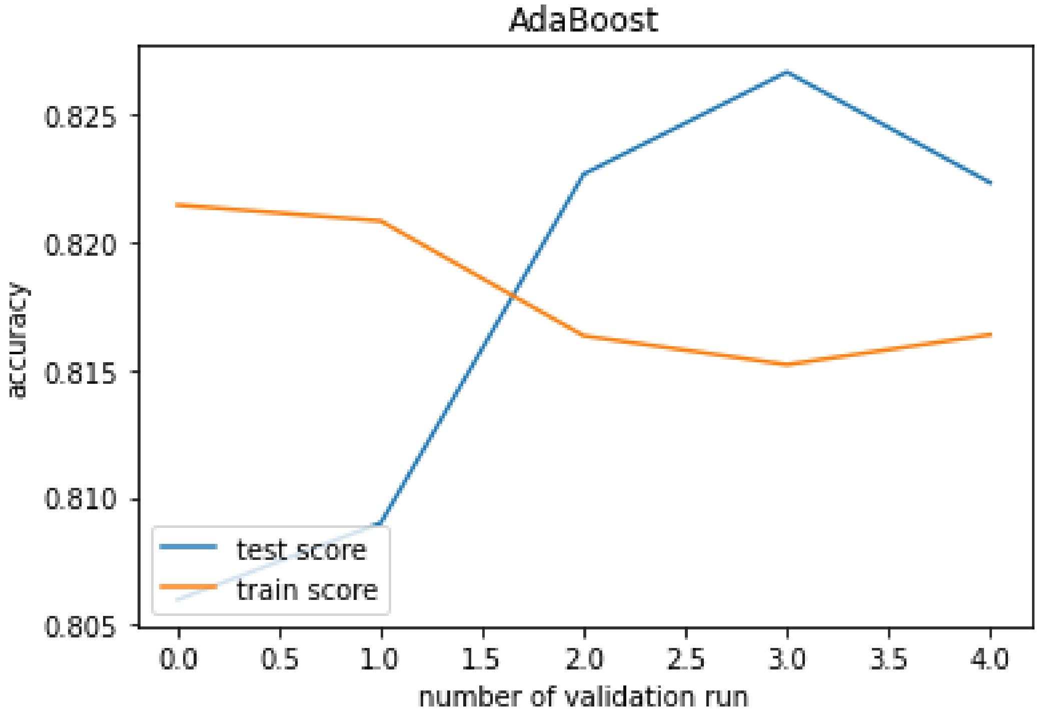
AdaBoost

```
[ ]: from sklearn.ensemble import AdaBoostClassifier

model_ada = AdaBoostClassifier(learning_rate=0.1, n_estimators=100,␣
 ↪random_state=0)

model_ada.fit(X_train, y_train)
y_pred = model_ada.predict(X_val)
print(classification_report(y_true=y_val, y_pred=y_pred))
```

```
              precision    recall  f1-score   support

           0       0.84      0.96      0.89      7060
           1       0.69      0.31      0.43      1940

    accuracy                           0.82      9000
   macro avg       0.76      0.64      0.66      9000
weighted avg       0.80      0.82      0.79      9000
```

```
[ ]: cv = cross_validate(model_ada, X, y, return_train_score=True, cv=5)
plt.plot(cv["test_score"], label="test score")
plt.plot(cv["train_score"], label="train score")
```

```python
plt.legend(loc="lower left")
plt.xlabel("number of validation run")
plt.ylabel("accuracy")
plt.title("AdaBoost")
plt.show()
```



XGBoost

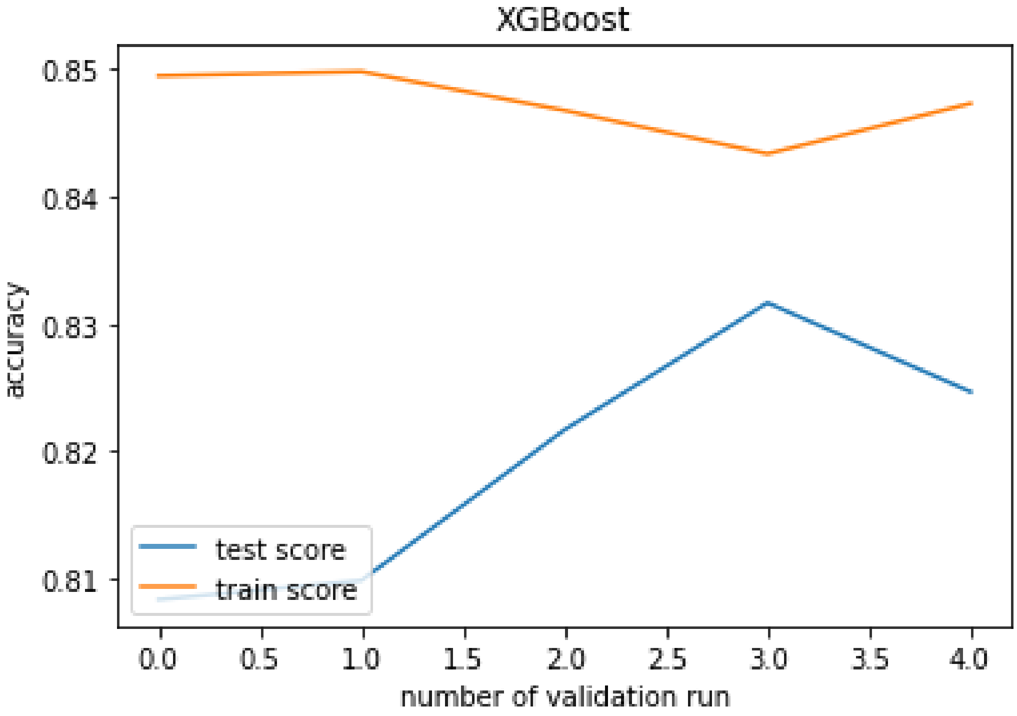
[ ]:

```python
import xgboost as xgb

model_xgb = xgb.XGBClassifier(learning_rate=0.1, max_depth=6, n_estimators=100)
model_xgb.fit(X_train, y_train)
y_pred = model_xgb.predict(X_val)
print(classification_report(y_true=y_val, y_pred=y_pred))
```

```
              precision    recall  f1-score   support

           0       0.84      0.95      0.89      7060
           1       0.67      0.36      0.47      1940

    accuracy                           0.82      9000
   macro avg       0.76      0.66      0.68      9000
weighted avg       0.81      0.82      0.80      9000
```

[ ]:

```
cv = cross_validate(model_xgb, X, y, return_train_score=True, cv=5)
plt.plot(cv["test_score"], label="test score")
plt.plot(cv["train_score"], label="train score")
plt.legend(loc="lower left")
plt.xlabel("number of validation run")
plt.ylabel("accuracy")
plt.title("XGBoost")
plt.show()
```


XGBoost
accuracy
test score
train score
number of validation run