Kod_Ada_i_Grad

April 20, 2021

[1]:

```
import pandas as pd
import numpy as np

from sklearn.datasets import load_boston
from sklearn.linear_model import LinearRegression, Lasso
from sklearn.metrics import mean_squared_error
from sklearn.compose import ColumnTransformer
from sklearn.preprocessing import FunctionTransformer
from sklearn.pipeline import Pipeline
from sklearn.model_selection import train_test_split

from matplotlib import pyplot as plt
import seaborn as sns
from scipy import stats
import matplotlib.image as mpimg


from sklearn.model_selection import train_test_split
from sklearn.metrics import confusion_matrix

from sklearn.ensemble import AdaBoostClassifier
from sklearn.metrics import accuracy_score
from sklearn.metrics import f1_score
```

[2]:

```
df = pd.DataFrame(pd.read_json("https://api.apispreadsheets.com/api/dataset/
 ↪congressional-voting/",
                    orient = 'split'))
def encode(x):
    if x == "n":
        return -1
    if x == "?":
        return 0
    if x == "y":
        return 1
    if x == "republican":
        return -1
    if x == "democrat":
        return 1

df = df.drop_duplicates()
df = df.applymap( encode)
```

[3]:
```
X = pd.DataFrame( df)
y = pd.DataFrame( X["political_party"])
X.drop( columns = ["political_party"], inplace=True )
```

[4]:
```
X_train, X_test, y_train, y_test \
    = train_test_split(X, y, stratify = y, test_size=0.2, random_state=1)

X_train, X_val, y_train, y_val \
    = train_test_split(X_train, y_train, stratify = y_train, test_size=0.25,␣
 ↪random_state=1)
```

0.0.1 Baseline na podstawie physician_fee_freeze

[5]:
```
def encode_base(x):
    if x==-1:
        return 1
    if x== 1:
        return -1
    if x == 0:
        return 0
```

[6]:
```
print( 'Accuracy val: %.3f' % accuracy_score( y_val,␣
 ↪X_val["physician_fee_freeze"].map( encode_base )))
print( 'Accuracy test: %.3f' % accuracy_score( y_test,␣
 ↪X_test["physician_fee_freeze"].map( encode_base )))
```

```
Accuracy val: 0.855
Accuracy test: 0.957
```

0.0.2 Adaboost

[7]:
```
alf = AdaBoostClassifier(n_estimators=100, random_state=0, learning_rate=0.9) #␣
 ↪dobrze działające parametry
alf.fit(X_train, y_train)
```

```
/home/kurowskik/anaconda3/lib/python3.8/site-
packages/sklearn/utils/validation.py:73: DataConversionWarning: A column-vector
y was passed when a 1d array was expected. Please change the shape of y to
(n_samples, ), for example using ravel().
  return f(**kwargs)
```

[7]:
```
AdaBoostClassifier(learning_rate=0.9, n_estimators=100, random_state=0)
```

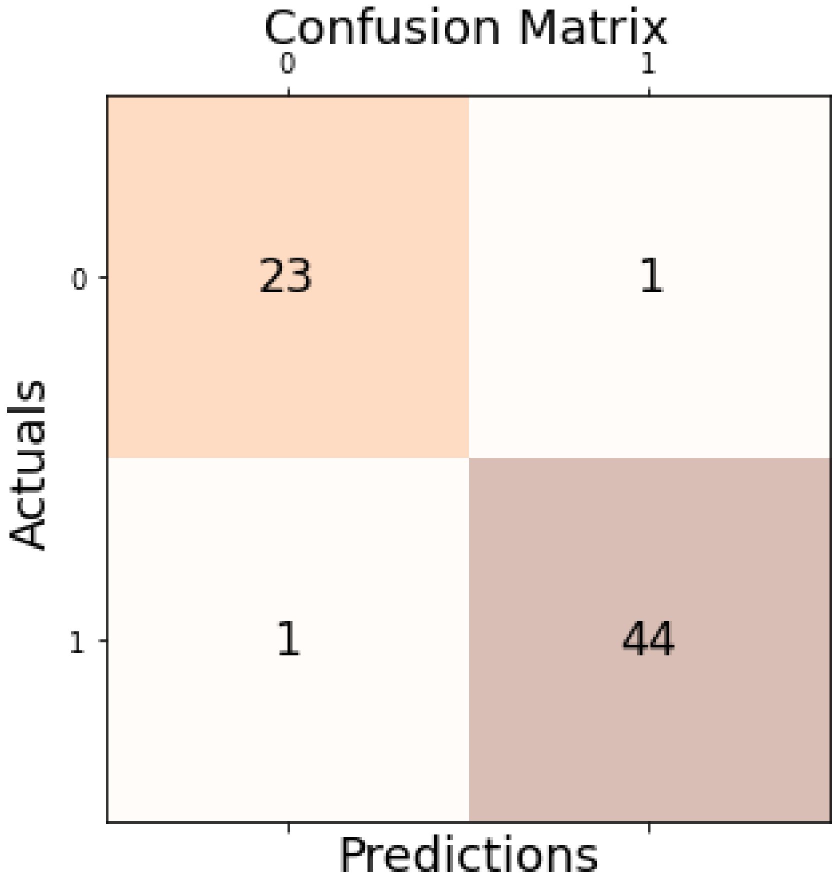
[8]:

```
y_val_hat = alf.predict(X_val)
y_test_hat = alf.predict(X_test)
```

[9]:

```
conf_matrix = confusion_matrix(y_true=y_val, y_pred=y_val_hat.round())
fig, ax = plt.subplots(figsize=(5, 5))
ax.matshow(conf_matrix, cmap=plt.cm.Oranges, alpha=0.3)
for i in range(conf_matrix.shape[0]):
    for j in range(conf_matrix.shape[1]):
        ax.text(x=j, y=i,s=conf_matrix[i, j], va='center', ha='center',␣
 ↪size='xx-large')

plt.xlabel('Predictions', fontsize=18)
plt.ylabel('Actuals', fontsize=18)
plt.title('Confusion Matrix', fontsize=18)
plt.show()
```



[10]:

```
print('F1 Score: %.3f' % f1_score(y_test, y_test_hat))
print('F1 Score: %.3f' % f1_score(y_val, y_val_hat))
print('Accuracy val: %.3f' % accuracy_score(y_val, y_val_hat))
print('Accuracy test: %.3f' % accuracy_score(y_test, y_test_hat))
```

```
F1 Score: 0.966
F1 Score: 0.978
Accuracy val: 0.971
Accuracy test: 0.957
```

0.0.3 GradBoost

[11]:
```
from sklearn.ensemble import GradientBoostingClassifier
```

[12]:
```
clf = GradientBoostingClassifier(n_estimators=90, learning_rate=0.8,
      max_depth=1, random_state=0).fit(X_train, y_train) # dobrze działające␣
 ↪parametry
clf.score(X_test, y_test)
```

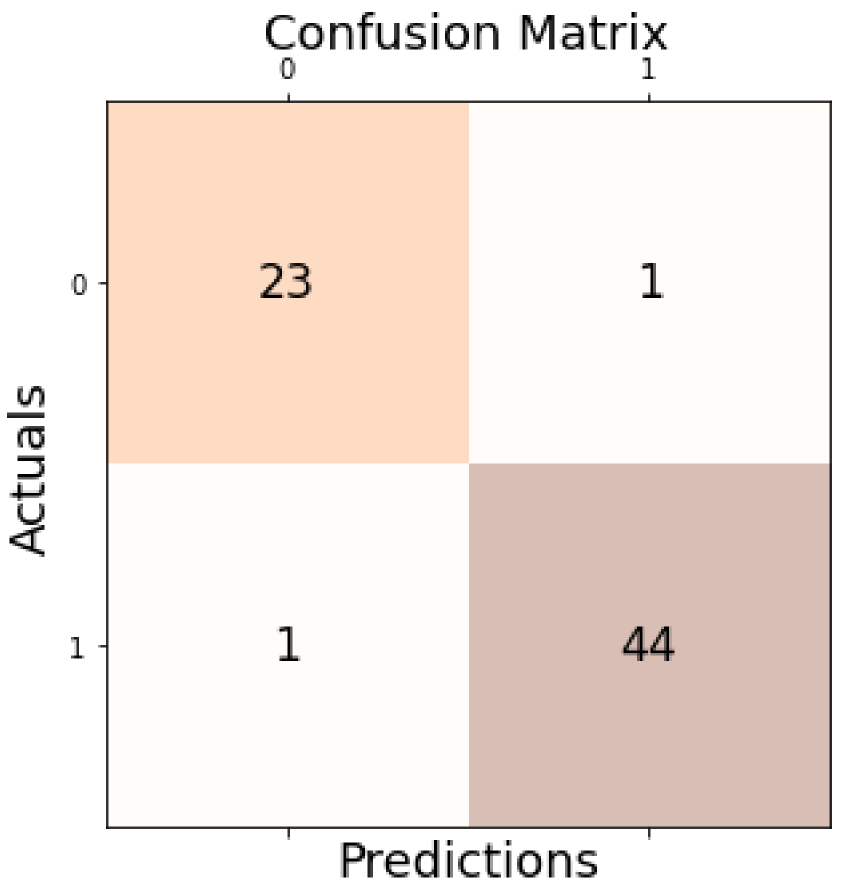
```
/home/kurowskik/anaconda3/lib/python3.8/site-
packages/sklearn/utils/validation.py:73: DataConversionWarning: A column-vector
y was passed when a 1d array was expected. Please change the shape of y to
(n_samples, ), for example using ravel().
  return f(**kwargs)
```

[12]:
```
0.9565217391304348
```

[13]:
```
y_val_hat = clf.predict(X_val)
y_test_hat = clf.predict(X_test)
```

[14]:
```
conf_matrix = confusion_matrix(y_true=y_val, y_pred=y_val_hat)
fig, ax = plt.subplots(figsize=(5, 5))
ax.matshow(conf_matrix, cmap=plt.cm.Oranges, alpha=0.3)
for i in range(conf_matrix.shape[0]):
    for j in range(conf_matrix.shape[1]):
        ax.text(x=j, y=i,s=conf_matrix[i, j], va='center', ha='center',␣
 ↪size='xx-large')

plt.xlabel('Predictions', fontsize=18)
plt.ylabel('Actuals', fontsize=18)
plt.title('Confusion Matrix', fontsize=18)
plt.show()
```



[15]:
```
print('F1 Score val : %.3f' % f1_score(y_val, y_val_hat))
print('F1 Score test: %.3f' % f1_score(y_test, y_test_hat))
print('Accuracy val: %.3f' % accuracy_score(y_val, y_val_hat))
print('Accuracy test: %.3f' % accuracy_score(y_test, y_test_hat))
```

```
F1 Score val : 0.978
F1 Score test: 0.966
Accuracy val: 0.971
Accuracy test: 0.957
```

0.0.4 HistGradBoost

[16]:
```
from sklearn.experimental import enable_hist_gradient_boosting
from sklearn.ensemble import HistGradientBoostingRegressor
```

[17]:
```
est = HistGradientBoostingRegressor( l2_regularization= 2, learning_rate=0.7).
 ↪fit(X_train, y_train)
est.score(X_val, y_val)
```

```
/home/kurowskik/anaconda3/lib/python3.8/site-
```

```
packages/sklearn/utils/validation.py:73: DataConversionWarning: A column-vector
y was passed when a 1d array was expected. Please change the shape of y to
(n_samples, ), for example using ravel().
  return f(**kwargs)
```

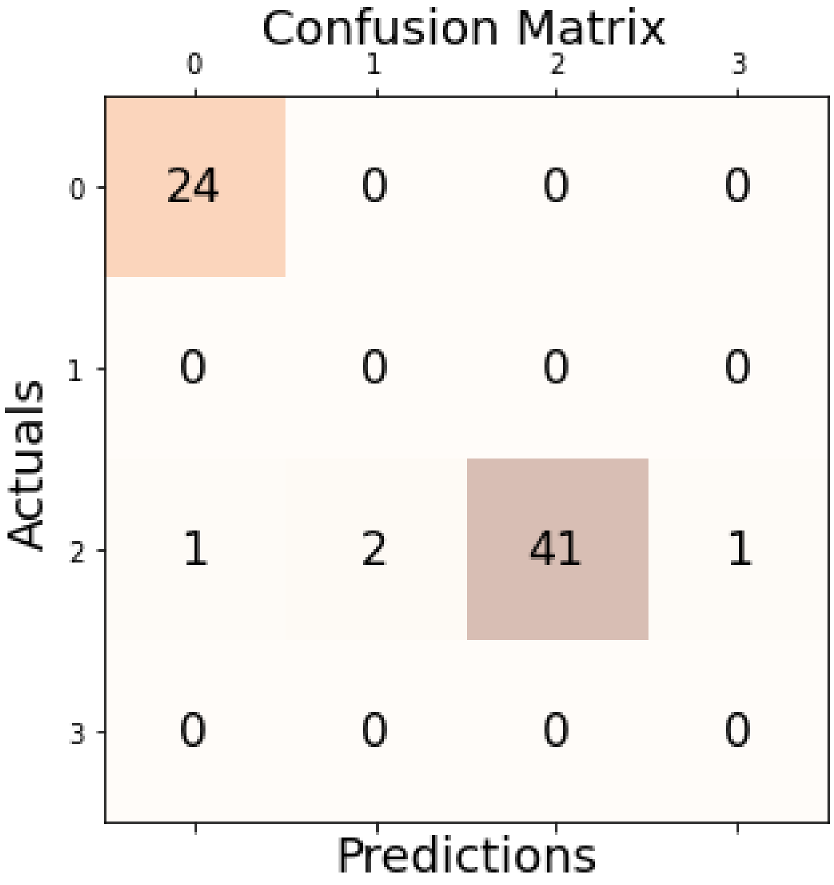
[17]:
```
0.5986765808634488
```

[18]:
```
y_val_hat = est.predict(X_val).round()
y_test_hat = est.predict(X_test).round()
```

[19]:
```
conf_matrix = confusion_matrix(y_true=y_test, y_pred=np.int64(y_test_hat))

fig, ax = plt.subplots(figsize=(5, 5))
ax.matshow(conf_matrix, cmap=plt.cm.Oranges, alpha=0.3)
for i in range(conf_matrix.shape[0]):
    for j in range(conf_matrix.shape[1]):
        ax.text(x=j, y=i,s=conf_matrix[i, j], va='center', ha='center',␣
 ↪size='xx-large')

plt.xlabel('Predictions', fontsize=18)
plt.ylabel('Actuals', fontsize=18)
plt.title('Confusion Matrix', fontsize=18)
plt.show()
```



```
[20]: print( accuracy_score(y_val, y_val_hat))
      print( accuracy_score(y_test, y_test_hat))
```

```
0.8695652173913043
0.9420289855072463
```

0.0.5 Test na danych tylko z dobrym rozdzielaniem

Sprawdziliśmy jak się zachowują wyniki, gdy wybieramy tylko te głosowania, które dobrze rozdzielają partie.

```
[21]: X2 = pd.DataFrame( X[ ["crime", "el_salvador_aid", "education_spending",␣
       ↪"physician_fee_freeze", "adoption_of_the_budget_resolution"]])
```

```
[22]: X_train2, X_test2, y_train2, y_test2 \
          = train_test_split(X2, y, stratify = y, test_size=0.2, random_state=1)

      X_train2, X_val2, y_train2, y_val2 \
          = train_test_split(X_train2, y_train2, stratify = y_train2, test_size=0.25,␣
       ↪random_state=1)
```

[23]:

```
alf2 = AdaBoostClassifier(n_estimators=100, random_state=0, learning_rate=0.9)
alf2.fit(X_train2, y_train2)
```

```
/home/kurowskik/anaconda3/lib/python3.8/site-
packages/sklearn/utils/validation.py:73: DataConversionWarning: A column-vector
y was passed when a 1d array was expected. Please change the shape of y to
(n_samples, ), for example using ravel().
  return f(**kwargs)
```

[23]:

```
AdaBoostClassifier(learning_rate=0.9, n_estimators=100, random_state=0)
```

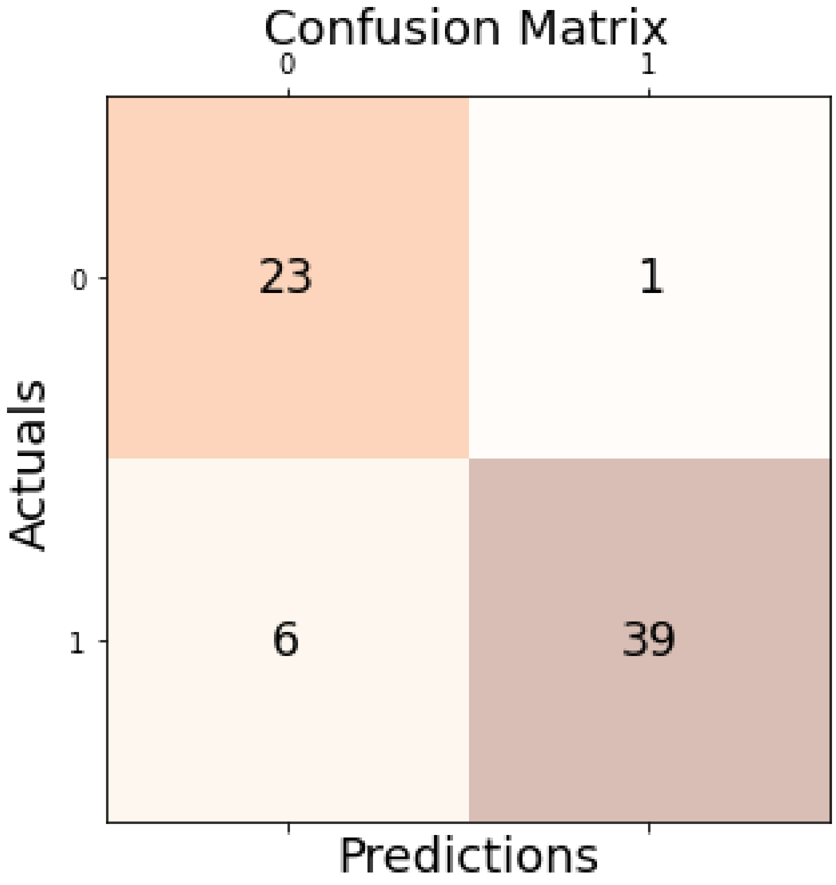
[24]:

```
y_val_hat2 = alf2.predict(X_val2)
y_test_hat2 = alf2.predict(X_test2)
```

[25]:

```
conf_matrix = confusion_matrix(y_true=y_val2, y_pred=y_val_hat2.round())
fig, ax = plt.subplots(figsize=(5, 5))
ax.matshow(conf_matrix, cmap=plt.cm.Oranges, alpha=0.3)
for i in range(conf_matrix.shape[0]):
    for j in range(conf_matrix.shape[1]):
        ax.text(x=j, y=i,s=conf_matrix[i, j], va='center', ha='center',␣
 ↪size='xx-large')

plt.xlabel('Predictions', fontsize=18)
plt.ylabel('Actuals', fontsize=18)
plt.title('Confusion Matrix', fontsize=18)
plt.show()
```



[26]:
```
print( accuracy_score(y_val2, y_val_hat2))
print( accuracy_score(y_test2, y_test_hat2))
```

```
0.8985507246376812
0.9565217391304348
```

wyniki są nieco gorsze od Ada czy Grad, ale wciąż nieco lepsze od Baseline'u.

0.0.6 Usuwanie danych

Sprawdziliśmy, czy przy usunięciu słabo rozdzielających głosowań i 'outlierowych' kongresmenów uzyskamy lepsze rezultaty - okazało się, że nie.

[27]:
```
X_count = np.apply_along_axis(sum, 1, abs(X))
indexes = df[X_count < 11].index
indexes = np.array(indexes)
print(df.shape)
X_dropped = df.drop(indexes, axis=0)

print(X_dropped.shape)
```

```
(342, 17)
(333, 17)
```

[28]:

```
col_ls = ['water_project_cost_sharing', 'immigration',␣
 ↪'export_administration_act_south_africa', ]
X_dropped = X_dropped.drop(col_ls, axis=1, errors='ignore')
print(X_dropped.shape)
```

```
(333, 14)
```

[29]:

```
y_dropped = X_dropped[['political_party']]
X_dropped.drop(['political_party'], axis=1, errors='ignore', inplace=True)
```

[30]:

```
X_dropped_train, X_dropped_test, y_dropped_train, y_dropped_test \
    = train_test_split(X_dropped, y_dropped, stratify = y_dropped, test_size=0.
 ↪2, random_state=1)

X_dropped_train, X_dropped_val, y_dropped_train, y_dropped_val \
    = train_test_split(X_dropped_train, y_dropped_train, stratify =␣
 ↪y_dropped_train, test_size=0.25, random_state=1)
```

[31]:

```
alf_dropped = AdaBoostClassifier(n_estimators=100, random_state=0,␣
 ↪learning_rate=0.9)
alf_dropped.fit(X_dropped_train, y_dropped_train)
```

```
/home/kurowskik/anaconda3/lib/python3.8/site-
packages/sklearn/utils/validation.py:73: DataConversionWarning: A column-vector
y was passed when a 1d array was expected. Please change the shape of y to
(n_samples, ), for example using ravel().
  return f(**kwargs)
```

[31]:

```
AdaBoostClassifier(learning_rate=0.9, n_estimators=100, random_state=0)
```

[32]:

```
y_dropped_val_hat = alf_dropped.predict(X_dropped_val)
y_dropped_test_hat = alf_dropped.predict(X_dropped_test)
```

[33]:

```
print( accuracy_score(y_dropped_val, y_dropped_val_hat))
print( accuracy_score(y_dropped_test, y_dropped_test_hat))
```

```
0.9253731343283582
0.9253731343283582
```