06c_eval_knn

May 26, 2024

1 Evaluate Classification with KNN

1.1 Content

1. Import Data
2. Create / Train Model
3. Metrics / Confusion Matrix
4. Grid Search

[1]:
```
# Imports
import numpy as np
import matplotlib.pyplot as plt
import pandas as pd
from sklearn.preprocessing import StandardScaler
from sklearn.model_selection import train_test_split
from sklearn.neighbors import KNeighborsClassifier
from sklearn.metrics import *
from sklearn.decomposition import PCA
import matplotlib.pyplot as plt
import seaborn as sns
from sklearn.metrics import confusion_matrix
from matplotlib import colors as mcolors
from sklearn.model_selection import GridSearchCV
from sklearn.feature_selection import SelectKBest, f_classif
from sklearn.metrics import accuracy_score, precision_score, recall_score,␣
↪f1_score, roc_auc_score
```

Import Data

[2]:
```
# import files
df = pd.read_csv('files/fo_smote.csv')
not_automatable = [item[0] for item in pd.read_csv("files/not_automatable.csv").
↪values.tolist()]

# calculate fo_computerisation based on 'df_probability'
df['fo_computerisation'] = df['fo_probability'].apply(lambda x: 1 if x >= 0.5␣
↪else 0)

df.head(2)
```

[2]:
```
   isco08  Berufshauptgruppe    s1    s2    s3    s4    s5    s6    s7    s8  \
0    2655                  2  0.72  0.72  0.69  0.69  0.50  0.50  0.50  0.47
1    2612                  2  0.81  0.75  0.81  0.72  0.81  0.66  0.56  0.72

   …  a45  a46  a47  a48  a49  a50  a51  a52  fo_probability  \
0  …  0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0            0.37
1  …  0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0            0.40

   fo_computerisation
0                   0
1                   0

[2 rows x 91 columns]
```

Split in Train / Test Set and train Model

[3]:
```python
# Declare x, y & split Data in training and test (80/20)
X = df[not_automatable]
y = df['fo_computerisation']

# Split the data into training and test sets
X_train, X_test, y_train, y_test = train_test_split(X, y, test_size=0.2,␣
↪random_state=42)
```

[4]:
```python
# Scale the features
scaler = StandardScaler()
X_train_scaled = scaler.fit_transform(X_train)
X_test_scaled = scaler.transform(X_test)

# Create and train the model
model = KNeighborsClassifier(metric='euclidean', n_neighbors=5,␣
↪weights='uniform')
model.fit(X_train_scaled, y_train)

# You can now use model.predict to make predictions on unseen data
predictions = model.predict(X_test_scaled)
```

[5]:
```python
# Make prediction with train data
y_pred_train = model.predict(X_train_scaled)

# Make prediction with test data
y_proba = model.predict_proba(X_test_scaled)
y_pred = model.predict(X_test_scaled)

# Create a DataFrame with the probabilities and predictions
prediction_df = pd.DataFrame(np.c_[y_proba, y_pred], columns = ['Wkt Nicht␣
↪Substituierbar', 'Wkt Substituierbar', 'Vorhersage der Klasse'])
```

```
prediction_df.head(5)
```

[5]:

	Wkt Nicht Substituierbar	Wkt Substituierbar	Vorhersage der Klasse
0	0.0	1.0	1.0
1	0.4	0.6	1.0
2	0.2	0.8	1.0
3	1.0	0.0	0.0
4	0.0	1.0	1.0

Metrics

[6]:
```
# Calculate metrics for the training set
train_accuracy = accuracy_score(y_train, y_pred_train)
train_precision = precision_score(y_train, y_pred_train)
train_recall = recall_score(y_train, y_pred_train)
train_f1 = f1_score(y_train, y_pred_train)
train_auc = roc_auc_score(y_train, model.predict_proba(X_train_scaled)[:, 1])

# Calculate metrics for the test set
test_accuracy = accuracy_score(y_test, y_pred)
test_precision = precision_score(y_test, y_pred)
test_recall = recall_score(y_test, y_pred)
test_f1 = f1_score(y_test, y_pred)
test_auc = roc_auc_score(y_test, y_proba[:, 1])
```

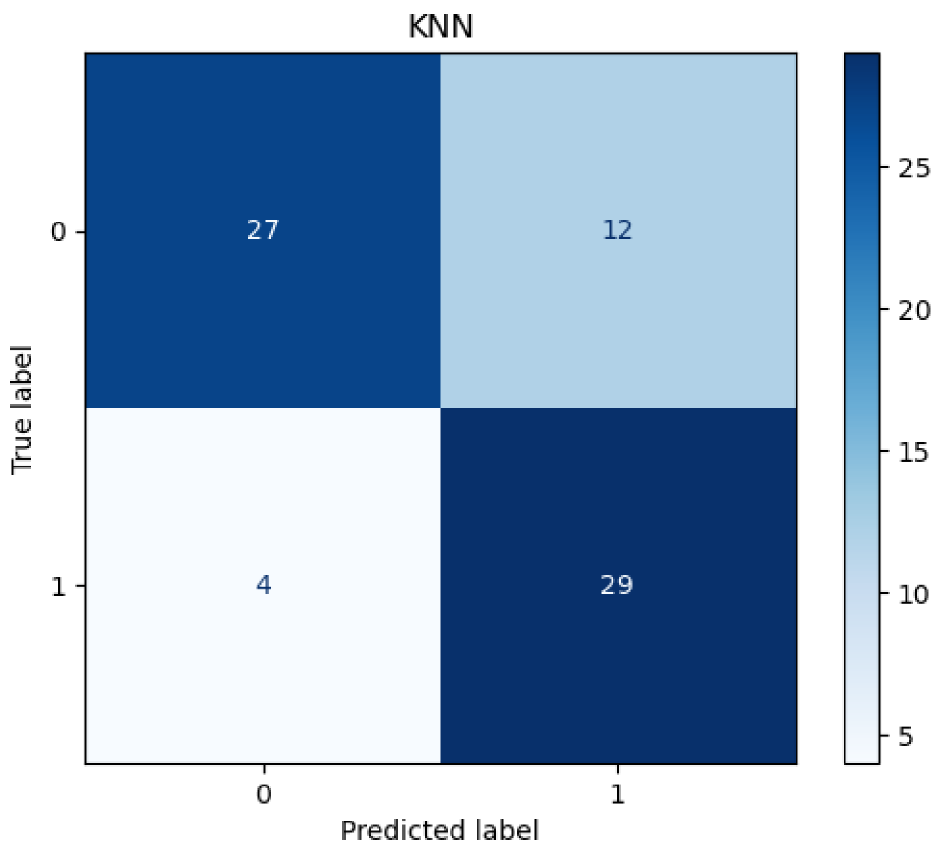
[7]:
```
# Read the CSV file into a DataFrame
try:
    metrics_df = pd.read_csv('files/metrics.csv')
except pd.errors.EmptyDataError:
    metrics_df = pd.DataFrame(columns=['Model', 'Test Accuracy', 'Train␣
↪Accuracy', 'Precision', 'Recall', 'F1 Score', 'AUC'])

# Check if the model exists in the DataFrame
if 'KNN' in metrics_df['Model'].values:
    # Update the row for the XGBoost model
    metrics_df.loc[metrics_df['Model'] == 'KNN', ['Test Accuracy', 'Train␣
↪Accuracy', 'Precision', 'Recall', 'F1 Score', 'AUC']] = [test_accuracy,␣
↪train_accuracy, test_precision, test_recall, test_f1, test_auc]
else:
    # Create a new DataFrame for the XGBoost model
    new_row = pd.DataFrame({'Model': ['KNN'], 'Test Accuracy': [test_accuracy],␣
↪'Train Accuracy': [train_accuracy], 'Precision': [test_precision], 'Recall':␣
↪[test_recall], 'F1 Score': [test_f1], 'AUC': [test_auc]})

    # Concatenate the new row with the existing DataFrame
    metrics_df = pd.concat([metrics_df, new_row], ignore_index=True)
```

```
# Save the DataFrame to the CSV file
metrics_df.to_csv('files/metrics.csv', index=False)
```

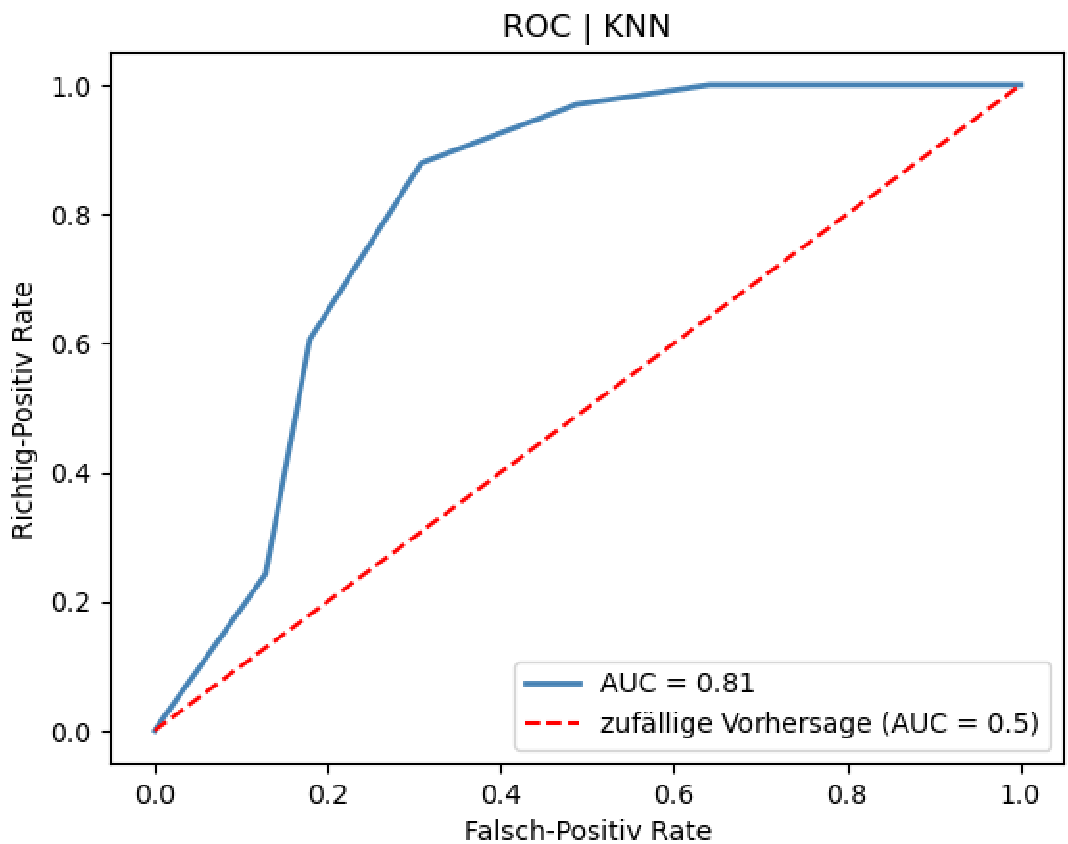
[8]:
```
# Assuming y_test is your true labels
conf_matrix = confusion_matrix(y_test, y_pred)

# The output is a 2x2 numpy array
# conf_matrix[0, 0] is the count of true negatives
# conf_matrix[0, 1] is the count of false positives
# conf_matrix[1, 0] is the count of false negatives
# conf_matrix[1, 1] is the count of true positives

print(f"True Negatives: {conf_matrix[0, 0]}")
print(f"False Positives: {conf_matrix[0, 1]}")
print(f"False Negatives: {conf_matrix[1, 0]}")
print(f"True Positives: {conf_matrix[1, 1]}")
```

```
True Negatives: 27
False Positives: 12
False Negatives: 4
True Positives: 29
```

[9]:
```
# Define the labels for your classes
class_names = ['0', '1']

# Create the ConfusionMatrixDisplay instance
disp = ConfusionMatrixDisplay(confusion_matrix=conf_matrix,␣
 ↪display_labels=class_names)

# Plot the confusion matrix
disp.plot(cmap='Blues')

plt.title('KNN')
plt.show()
```



[10]:
```
# plot ROC curve
fpr, tpr, _ = roc_curve(y_test, y_proba[:, 1])
roc_auc = auc(fpr, tpr)

plt.figure()
lw = 2
plt.plot(fpr, tpr, color='#4682B4', lw=lw, label='AUC = %0.2f' % roc_auc)
plt.ylabel('Richtig-Positiv Rate')
plt.plot([0 ,1] ,[0 ,1], 'r', label='zufällige Vorhersage (AUC = 0.5)',␣
 ↪linestyle='--')
plt.xlabel('Falsch-Positiv Rate')
plt.title('ROC | KNN')
plt.legend(loc="lower right")

plt.show()
```



Grid Search

[11]:
```python
# Define the parameter grid
param_grid = {
    'n_neighbors': [3, 5, 7, 9, 11],
    'weights': ['uniform', 'distance'],
    'metric': ['euclidean', 'manhattan']
}

# Create a GridSearchCV object
grid_search = GridSearchCV(KNeighborsClassifier(), param_grid, cv=5,␣
 ↪scoring='roc_auc')

# Fit the GridSearchCV object to the data
grid_search.fit(X_train_scaled, y_train)

# Print the best parameters and the best score
print("best params: ",grid_search.best_params_)
print(grid_search.best_score_)
```

```
best params:  {'metric': 'euclidean', 'n_neighbors': 7, 'weights': 'uniform'}
```

```
0.8623471994161649
```