CED-Classification

May 10, 2021

[1]:
```
import numpy as np
import pandas as pd
import matplotlib.pyplot as plt
%matplotlib inline
#sets the backend of matplotlib to the 'inline' backend
```

Data is downloaded from https://archive.ics.uci.edu/ml/datasets/Car+Evaluation and converted to car_data.xlsx

[2]:
```
data = pd.read_excel("data/processed/car_data.xlsx")
```

0.1 Exploratory Data Analysis(EDA)

[3]:
```
data.head()
```

[3]:
```
  buying  maint doors persons lug_boot safety  class
0  vhigh  vhigh     2       2    small    low  unacc
1  vhigh  vhigh     2       2    small    med  unacc
2  vhigh  vhigh     2       2    small   high  unacc
3  vhigh  vhigh     2       2      med    low  unacc
4  vhigh  vhigh     2       2      med    med  unacc
```

[4]:
```
data.info() # Check for null values
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 1728 entries, 0 to 1727
Data columns (total 7 columns):
 #   Column    Non-Null Count  Dtype 
---  ------    --------------  ----- 
 0   buying    1728 non-null   object
 1   maint     1728 non-null   object
 2   doors     1728 non-null   object
 3   persons   1728 non-null   object
 4   lug_boot  1728 non-null   object
 5   safety    1728 non-null   object
 6   class     1728 non-null   object
dtypes: object(7)
memory usage: 94.6+ KB
```

```
[5]: class_names = set(data['class'])
```

```
[6]: # check for unique values of each column
     for i in data.columns:
         print(f'{data[i].nunique()}\t{data[i].unique()}')
```

```
4       ['vhigh' 'high' 'med' 'low']
4       ['vhigh' 'high' 'med' 'low']
4       ['2' '3' '4' '5more']
3       ['2' '4' 'more']
3       ['small' 'med' 'big']
3       ['low' 'med' 'high']
4       ['unacc' 'acc' 'vgood' 'good']
```

Converted string values to integers to make them compatible with scikit learn

```
[7]: from sklearn.preprocessing import LabelEncoder
     le = LabelEncoder()
     for i in data.columns:
         data[i] = le.fit_transform(data[i])
     data.head()
```

```
[7]:    buying  maint  doors  persons  lug_boot  safety  class
     0       3      3      0        0         2       1      2
     1       3      3      0        0         2       2      2
     2       3      3      0        0         2       0      2
     3       3      3      0        0         1       1      2
     4       3      3      0        0         1       2      2
```

0.1.1 Splitting data into training and testing set

```
[8]: Y = data['class']  # actual output
     X = data[data.columns[:-1]]  # input data features
     data, target = X, Y
     from sklearn.model_selection import train_test_split as SPLIT
     X_train, X_test, Y_train, Y_test = SPLIT(X, Y, test_size=0.3, random_state=4)
     # 70% Data for Training, 30% Data for Testing
```

0.1.2 Scale the Data

```
[9]: from sklearn.preprocessing import StandardScaler as SS

     X = SS().fit_transform(X)
```

0.2 Train the Support Vector Classifier

[10]:

```
from sklearn.svm import SVC

# Hyperparameters
kernel = 'rbf'
C = 13
gamma = 0.325

from time import time as T
start = T()
model = SVC(kernel=kernel, C=C, gamma=gamma)
clf = model.fit(X_train, Y_train)
end = T()

pred = clf.predict(X_test)
mScore = clf.score(X_test, Y_test)
print(f'Score against Testing Data: {mScore * 100:.3f}%')
print(f'Model took {(end-start)*1000:.3f}ms to train')
```

```
Score against Testing Data: 99.422%
Model took 158.992ms to train
```

0.2.1 Generate Classification Report

[11]:

```
from sklearn.metrics import classification_report as CR

print("Classification Report:\n",CR(Y_test, pred, zero_division=0))
```

```
Classification Report:
               precision    recall  f1-score   support

           0       0.97      1.00      0.99       117
           1       1.00      1.00      1.00        17
           2       1.00      1.00      1.00       368
           3       1.00      0.82      0.90        17

    accuracy                           0.99       519
   macro avg       0.99      0.96      0.97       519
weighted avg       0.99      0.99      0.99       519
```

0.2.2 Cross Validation

[12]:

```
from sklearn.model_selection import StratifiedKFold as SKF
from sklearn.model_selection import cross_val_score as CVS

model = SVC(kernel='rbf', C=13, gamma=0.325)
```

```
folds = 5

start = T()
cross_val = SKF(n_splits=folds, shuffle=True, random_state=4)
scores = CVS(model, X, Y, scoring='accuracy', cv=cross_val)
end = T()

accuracy = scores.mean() * 100
print(f"SVC has mean accuracy of {accuracy:.3f}%\n"
    + f"Cross Validation took {(end-start)*1000:.3f}ms")
```

```
SVC has mean accuracy of 99.942%
Cross Validation took 1103.998ms
```

0.2.3 Calculate F1-Score of the model

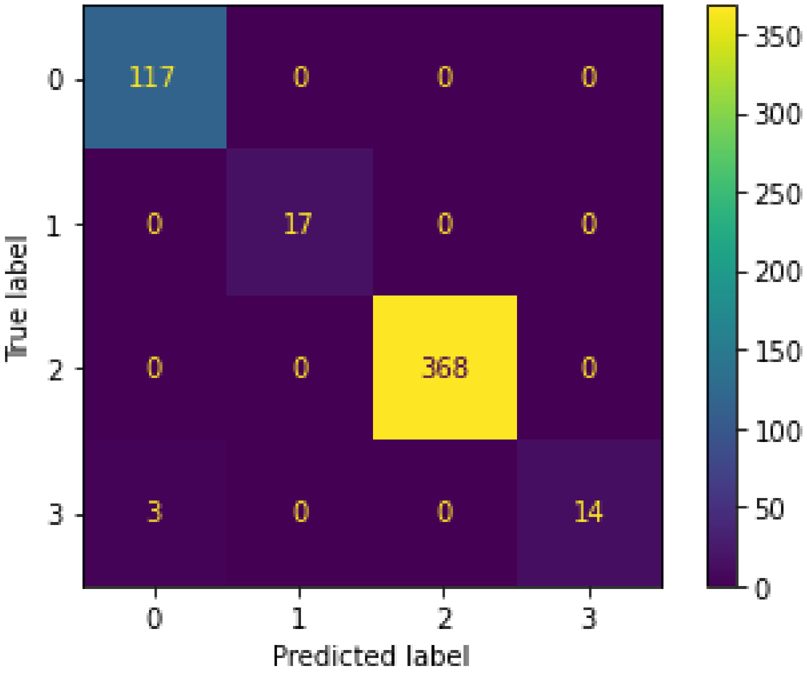
[13]:
```
from sklearn.metrics import f1_score as F1

f1score = F1(Y_test, pred, average = 'weighted')
print(f"SVC has F1-Score = {f1score * 100:.3f}%")
```

```
SVC has F1-Score = 99.398%
```

0.2.4 Plot Confusion Matrix

[14]:
```
from sklearn.metrics import plot_confusion_matrix as PCM
PCM(clf, X_test, Y_test);
```


True label
Predicted label