

## 2-letter-recognition

April 23, 2024

```
[16]: import pandas as pd
      from sklearn.model_selection import train_test_split
      from sklearn.preprocessing import StandardScaler
      from sklearn.neural_network import MLPClassifier
      from sklearn.metrics import accuracy_score
```

```
[17]: dataset = pd.read_csv("letter-recognition.data", sep = ",")
```

```
[19]: X = dataset.iloc[:, 1 : 17]
      Y = dataset.select_dtypes(include = [object])
```

```
[19]:      T
0      I
1      D
2      N
3      G
4      S
... ..
19994 D
19995 C
19996 T
19997 S
19998 A

[19999 rows x 1 columns]
```

```
[20]: X_train, X_validation, Y_train, Y_validation = train_test_split(X, Y, test_size=
      ↪ 0.20, random_state = 10)
```

```
[21]: scaler = StandardScaler()
      scaler.fit(X_train)
```

```
[21]: StandardScaler()
```

```
[22]: X_train = scaler.transform(X_train)
      X_validation = scaler.transform(X_validation)
```

```
[23]: mlp = MLPClassifier(hidden_layer_sizes = (250, 300), max_iter = 1000000,
    ↪activation = 'logistic')
```

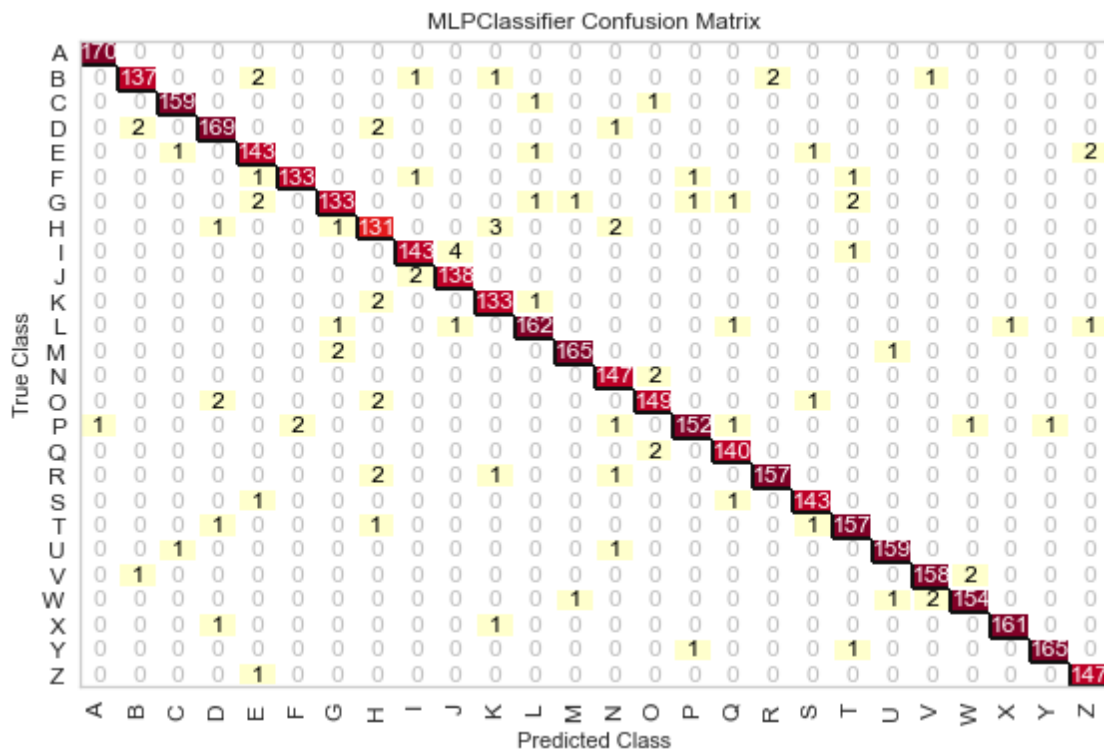
```
[27]: from yellowbrick.classifier import confusion_matrix
cm = confusion_matrix(mlp,X_train,Y_train, X_validation, Y_validation,
    ↪classes="A,B,C,D,E,F,G,H,I,J,K,L,M,N,O,P,Q,R,S,T,U,V,W,X,Y,Z".split(','))
```

c:\users\lenovo\appdata\local\programs\python\python37\lib\site-packages\sklearn\neural\_network\\_multilayer\_perceptron.py:1109: 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().

```
y = column_or_1d(y, warn=True)
```

c:\users\lenovo\appdata\local\programs\python\python37\lib\site-packages\sklearn\preprocessing\\_label.py:115: 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().

```
y = column_or_1d(y, warn=True)
```



```
[25]: # !pip install yellowbrick
```

Collecting yellowbrick

WARNING: Ignoring invalid distribution -illow

```
(c:\users\lenovo\appdata\local\programs\python\python37\lib\site-packages)
WARNING: Ignoring invalid distribution -illow
(c:\users\lenovo\appdata\local\programs\python\python37\lib\site-packages)
```

```
Downloading yellowbrick-1.5-py3-none-any.whl (282 kB)
----- 282.6/282.6 kB 1.2 MB/s eta 0:00:00
Requirement already satisfied: matplotlib!=3.0.0,>=2.0.2 in
c:\users\lenovo\appdata\local\programs\python\python37\lib\site-packages (from
yellowbrick) (3.5.1)
Requirement already satisfied: scipy>=1.0.0 in
c:\users\lenovo\appdata\local\programs\python\python37\lib\site-packages (from
yellowbrick) (1.7.3)
Requirement already satisfied: scikit-learn>=1.0.0 in
c:\users\lenovo\appdata\local\programs\python\python37\lib\site-packages (from
yellowbrick) (1.0.2)
Requirement already satisfied: numpy>=1.16.0 in
c:\users\lenovo\appdata\local\programs\python\python37\lib\site-packages (from
yellowbrick) (1.21.5)
Requirement already satisfied: cycler>=0.10.0 in
c:\users\lenovo\appdata\local\programs\python\python37\lib\site-packages (from
yellowbrick) (0.11.0)
Requirement already satisfied: fonttools>=4.22.0 in
c:\users\lenovo\appdata\local\programs\python\python37\lib\site-packages (from
matplotlib!=3.0.0,>=2.0.2->yellowbrick) (4.29.1)
Requirement already satisfied: kiwisolver>=1.0.1 in
c:\users\lenovo\appdata\local\programs\python\python37\lib\site-packages (from
matplotlib!=3.0.0,>=2.0.2->yellowbrick) (1.3.2)
Requirement already satisfied: packaging>=20.0 in
c:\users\lenovo\appdata\local\programs\python\python37\lib\site-packages (from
matplotlib!=3.0.0,>=2.0.2->yellowbrick) (21.3)
Requirement already satisfied: pillow>=6.2.0 in
c:\users\lenovo\appdata\local\programs\python\python37\lib\site-packages (from
matplotlib!=3.0.0,>=2.0.2->yellowbrick) (9.5.0)
Requirement already satisfied: pyparsing>=2.2.1 in
c:\users\lenovo\appdata\local\programs\python\python37\lib\site-packages (from
matplotlib!=3.0.0,>=2.0.2->yellowbrick) (3.0.7)
Requirement already satisfied: python-dateutil>=2.7 in
c:\users\lenovo\appdata\local\programs\python\python37\lib\site-packages (from
matplotlib!=3.0.0,>=2.0.2->yellowbrick) (2.8.2)
Requirement already satisfied: joblib>=0.11 in
c:\users\lenovo\appdata\local\programs\python\python37\lib\site-packages (from
scikit-learn>=1.0.0->yellowbrick) (1.1.0)
Requirement already satisfied: threadpoolctl>=2.0.0 in
c:\users\lenovo\appdata\local\programs\python\python37\lib\site-packages (from
scikit-learn>=1.0.0->yellowbrick) (3.1.0)
Requirement already satisfied: six>=1.5 in
c:\users\lenovo\appdata\local\programs\python\python37\lib\site-packages (from
```

```
python-dateutil>=2.7->matplotlib!=3.0.0,>=2.0.2->yellowbrick) (1.16.0)
Installing collected packages: yellowbrick
Successfully installed yellowbrick-1.5
```

```
[28]: cm.fit(X_train, Y_train.values.ravel())
```

```
[28]: ConfusionMatrix(ax=<AxesSubplot:title={'center': 'MLPClassifier Confusion
Matrix'}>, xlabel='Predicted Class', ylabel='True Class'>,
        classes=['A', 'B', 'C', 'D', 'E', 'F', 'G', 'H', 'I', 'J', 'K',
                  'L', 'M', 'N', 'O', 'P', 'Q', 'R', 'S', 'T', 'U', 'V',
                  'W', 'X', 'Y', 'Z'],
        cmap=<matplotlib.colors.ListedColormap object at
0x00000015FD8E45F88>,
        estimator=MLPClassifier(activation='logistic',
                                hidden_layer_sizes=(250, 300),
                                max_iter=1000000))
```

```
[29]: cm.score(X_validation, Y_validation)
```

```
c:\users\lenovo\appdata\local\programs\python\python37\lib\site-
packages\sklearn\preprocessing\_label.py:115: 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().
    y = column_or_1d(y, warn=True)
```

```
[29]: 0.97625
```

```
[30]: predictions = cm.predict(X_validation)
      predictions
```

```
[30]: array(['C', 'I', 'H', ..., 'H', 'B', 'W'], dtype='<U1'))
```

```
[31]: print("Accuracy: ", accuracy_score(Y_validation, predictions))
```

```
Accuracy:  0.97625
```

```
[ ]:
```