MLP Classifier

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1 Multi-Layer Perceptron Implementation

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[1]:
```
import sklearn
import pandas as pd
import numpy as np
import seaborn as sns

from sklearn.model_selection import train_test_split
from sklearn.neural_network import MLPClassifier
from sklearn.metrics import accuracy_score, confusion_matrix, precision_score,␣
↪balanced_accuracy_score

from warnings import filterwarnings    #to ignore MLP warnings for no convergence
filterwarnings('ignore')
```

[2]:
```
from sklearn.datasets import load_wine
```

[3]:
```
data = load_wine()
columns = data.feature_names
targets = np.array(data.target)

data = pd.DataFrame(data.data, columns=data.feature_names)
targets = pd.DataFrame(targets, columns=['class'])
frames = [data, targets]
dataset = pd.concat(frames, axis = 1)
```

[4]:
```
print(dataset.head())
```

```
   alcohol  malic_acid   ash  alcalinity_of_ash  magnesium  total_phenols  \
0    14.23        1.71  2.43               15.6      127.0           2.80
1    13.20        1.78  2.14               11.2      100.0           2.65
2    13.16        2.36  2.67               18.6      101.0           2.80
3    14.37        1.95  2.50               16.8      113.0           3.85
4    13.24        2.59  2.87               21.0      118.0           2.80

   flavanoids  nonflavanoid_phenols  proanthocyanins  color_intensity   hue  \
```

```
0        3.06                  0.28             2.29              5.64  1.04
1        2.76                  0.26             1.28              4.38  1.05
2        3.24                  0.30             2.81              5.68  1.03
3        3.49                  0.24             2.18              7.80  0.86
4        2.69                  0.39             1.82              4.32  1.04

   od280/od315_of_diluted_wines  proline  class
0                          3.92   1065.0      0
1                          3.40   1050.0      0
2                          3.17   1185.0      0
3                          3.45   1480.0      0
4                          2.93    735.0      0
```

[5]:
```
print("Number of Samples:", len(dataset))
print("\nNumber of Classes:")
print(dataset['class'].value_counts())
```

```
Number of Samples: 178

Number of Classes:
1    71
0    59
2    48
Name: class, dtype: int64
```

[6]:
```
pd.set_option('float_format', '{:.2f}'.format)
dataset.describe()
```

[6]:

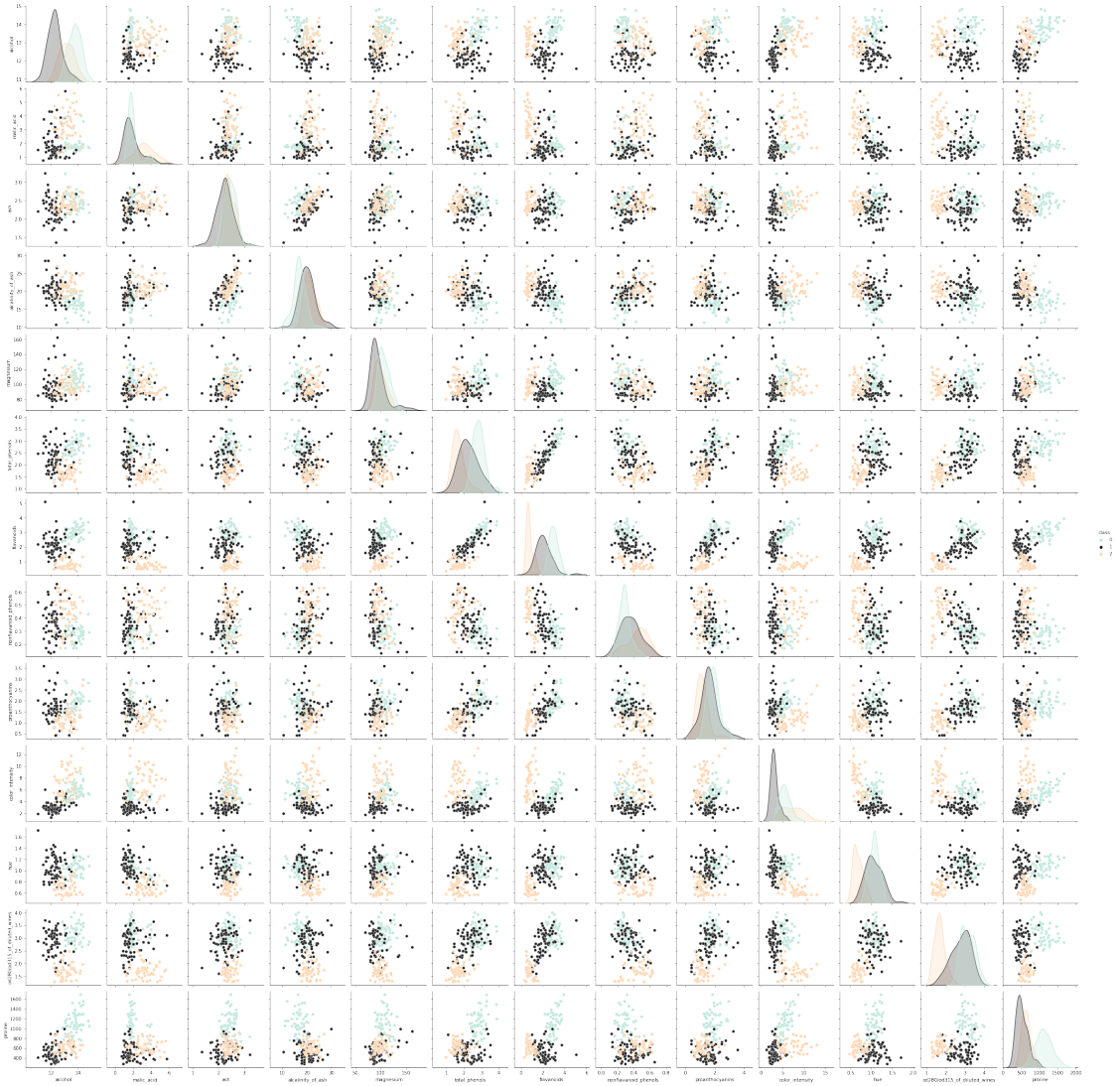
	alcohol	malic_acid	ash	alcalinity_of_ash	magnesium	\
count	178.00	178.00	178.00	178.00	178.00	
mean	13.00	2.34	2.37	19.49	99.74	
std	0.81	1.12	0.27	3.34	14.28	
min	11.03	0.74	1.36	10.60	70.00	
25%	12.36	1.60	2.21	17.20	88.00	
50%	13.05	1.87	2.36	19.50	98.00	
75%	13.68	3.08	2.56	21.50	107.00	
max	14.83	5.80	3.23	30.00	162.00	

	total_phenols	flavanoids	nonflavanoid_phenols	proanthocyanins	\
count	178.00	178.00	178.00	178.00	
mean	2.30	2.03	0.36	1.59	
std	0.63	1.00	0.12	0.57	
min	0.98	0.34	0.13	0.41	
25%	1.74	1.20	0.27	1.25	
50%	2.35	2.13	0.34	1.56	
75%	2.80	2.88	0.44	1.95	
max	3.88	5.08	0.66	3.58	

	color_intensity	hue	od280/od315_of_diluted_wines	proline	class
count	178.00	178.00	178.00	178.00	178.00
mean	5.06	0.96	2.61	746.89	0.94
std	2.32	0.23	0.71	314.91	0.78
min	1.28	0.48	1.27	278.00	0.00
25%	3.22	0.78	1.94	500.50	0.00
50%	4.69	0.96	2.78	673.50	1.00
75%	6.20	1.12	3.17	985.00	2.00
max	13.00	1.71	4.00	1680.00	2.00

[7]:
```
sns.pairplot(dataset, hue='class', palette='icefire')
```

[7]: <seaborn.axisgrid.PairGrid at 0x7f9fd6fd80d0>



[8]:
```
print("Columns:\n",columns)
```

```
Columns:
 ['alcohol', 'malic_acid', 'ash', 'alcalinity_of_ash', 'magnesium',
'total_phenols', 'flavanoids', 'nonflavanoid_phenols', 'proanthocyanins',
'color_intensity', 'hue', 'od280/od315_of_diluted_wines', 'proline']
```

[9]:
```
x = np.array(dataset[['alcohol','flavanoids', 'ash']])
y = np.array(dataset['class'])
```

[10]:
```
x_train, x_test, y_train, y_test = train_test_split(x, y, test_size=0.3,␣
 ↪random_state=0)
```

[11]:
```
mlp = MLPClassifier(activation='tanh', solver='sgd')
mlp.fit(x_train, y_train)
y_pred = mlp.predict(x_test)
```

[12]:
```
print("Accuracy: {0} %".format(round(100 * float(accuracy_score(y_test,y_pred)),␣
 ↪2)))
print("Precision: {0} %".format(round(100 * float(precision_score(y_test,␣
 ↪y_pred, average="weighted")), 2)))
```

```
Accuracy: 83.33 %
Precision: 84.56 %
```

[13]:
```
confusion_matrix(y_test, y_pred)
```

[13]:
```
array([[18,  1,  0],
       [ 6, 15,  1],
       [ 0,  1, 12]])
```

[14]:
```
bas = round(balanced_accuracy_score(y_test, y_pred) * 100, 2)

print("Balanced Accuracy Score:", bas, "%")
```

```
Balanced Accuracy Score: 85.08 %
```