File Edit View Insert Cell Kernel Widgets Help Trusted Python 3

Run Code

In [1]:
```
import numpy as np
import matplotlib.pyplot as plt
import pandas as pd
```

Importing the dataset

In [2]:
```
df = pd.read_csv("Wine.csv")
df.head()
```

Out[2]:

	Alcohol	Malic_Acid	Ash	Ash_Alcanity	Magnesium	Total_Phenols	Flavanoids	Nonflavanoid_Phenols	Proanthocyanins	Color_Intensity	Hue	OD280
0	14.23	1.71	2.43	15.6	127	2.80	3.06	0.28	2.29	5.64	1.04	3.92
1	13.20	1.78	2.14	11.2	100	2.65	2.76	0.26	1.28	4.38	1.05	3.40
2	13.16	2.36	2.67	18.6	101	2.80	3.24	0.30	2.81	5.68	1.03	3.17
3	14.37	1.95	2.50	16.8	113	3.85	3.49	0.24	2.18	7.80	0.86	3.45
4	13.24	2.59	2.87	21.0	118	2.80	2.69	0.39	1.82	4.32	1.04	2.93

In [3]:
```
df.shape
```

Out[3]:
```
(178, 14)
```

In [4]:
```
df.isna().sum()
```

Out[4]:
```
Alcohol               0
Malic_Acid            0
Ash                   0
Ash_Alcanity          0
Magnesium             0
Total_Phenols         0
Flavanoids            0
Nonflavanoid_Phenols  0
Proanthocyanins       0
Color_Intensity       0
Hue                   0
OD280                 0
Proline               0
Customer_Segment      0
dtype: int64
```

Principal Component Analysis (PCA)

常用于高维数据的降维，可用于提取数据的主要特征分量

In [5]:
```
X = df.iloc[:, :-1]
y = df.iloc[:, -1]
```

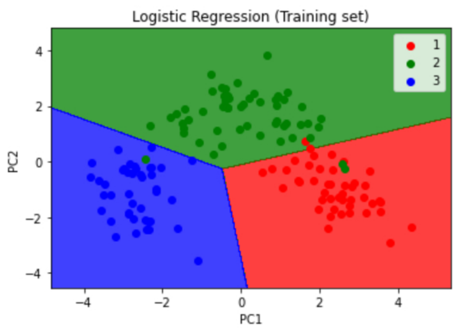
In [6]:
```
from sklearn.model_selection import train_test_split
from sklearn.preprocessing import StandardScaler
from sklearn.decomposition import PCA
from sklearn.linear_model import LogisticRegression
from sklearn.metrics import confusion_matrix, classification_report, accuracy_score

X_train, X_test, y_train, y_test = train_test_split(X, y, test_size=0.2, random_state=0)

sc = StandardScaler()
X_train = sc.fit_transform(X_train)
X_test = sc.transform(X_test)

pca = PCA(n_components=2) # creating 2 principal features (X)
X_train = pca.fit_transform(X_train)
X_test = pca.transform(X_test)

lr = LogisticRegression(random_state=0)
lr.fit(X_train, y_train)

predictions = lr.predict(X_test)

print(confusion_matrix(y_test, predictions))
print(classification_report(y_test, predictions))
print(accuracy_score(y_test, predictions))
```

```
[[14  0  0]
 [ 1 15  0]
 [ 0  0  6]]
              precision    recall  f1-score   support

           1       0.93      1.00      0.97        14
           2       1.00      0.94      0.97        16
           3       1.00      1.00      1.00         6

    accuracy                           0.97        36
   macro avg       0.98      0.98      0.98        36
weighted avg       0.97      0.97      0.97        36

0.9722222222222222
```

In [7]:

```python
from matplotlib.colors import ListedColormap
X_set, y_set = X_train, y_train
X1, X2 = np.meshgrid(np.arange(start = X_set[:, 0].min() - 1, stop = X_set[:, 0].max() + 1, step = 0.01),
                     np.arange(start = X_set[:, 1].min() - 1, stop = X_set[:, 1].max() + 1, step = 0.01))
plt.contourf(X1, X2, lr.predict(np.array([X1.ravel(), X2.ravel()]).T).reshape(X1.shape),
             alpha = 0.75, cmap = ListedColormap(('red', 'green', 'blue')))
plt.xlim(X1.min(), X1.max())
plt.ylim(X2.min(), X2.max())
for i, j in enumerate(np.unique(y_set)):
    plt.scatter(X_set[y_set == j, 0], X_set[y_set == j, 1],
                c = ListedColormap(('red', 'green', 'blue'))(i), label = j)
plt.title('Logistic Regression (Training set)')
plt.xlabel('PC1')
plt.ylabel('PC2')
plt.legend()
plt.show()
```

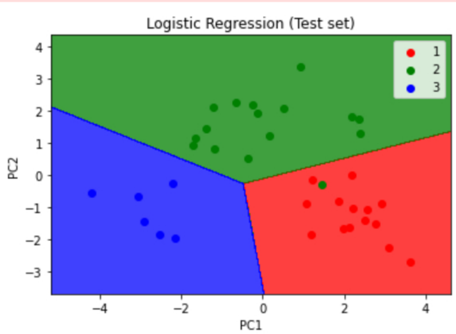
```
*c* argument looks like a single numeric RGB or RGBA sequence, which should be avoided as value-mapping will have precedence
in case its length matches with *x* & *y*.  Please use the *color* keyword-argument or provide a 2-D array with a single row
if you intend to specify the same RGB or RGBA value for all points.
*c* argument looks like a single numeric RGB or RGBA sequence, which should be avoided as value-mapping will have precedence
in case its length matches with *x* & *y*.  Please use the *color* keyword-argument or provide a 2-D array with a single row
if you intend to specify the same RGB or RGBA value for all points.
*c* argument looks like a single numeric RGB or RGBA sequence, which should be avoided as value-mapping will have precedence
in case its length matches with *x* & *y*.  Please use the *color* keyword-argument or provide a 2-D array with a single row
if you intend to specify the same RGB or RGBA value for all points.
```



In [8]:

```python
from matplotlib.colors import ListedColormap
X_set, y_set = X_test, y_test
X1, X2 = np.meshgrid(np.arange(start = X_set[:, 0].min() - 1, stop = X_set[:, 0].max() + 1, step = 0.01),
                     np.arange(start = X_set[:, 1].min() - 1, stop = X_set[:, 1].max() + 1, step = 0.01))
plt.contourf(X1, X2, lr.predict(np.array([X1.ravel(), X2.ravel()]).T).reshape(X1.shape),
             alpha = 0.75, cmap = ListedColormap(('red', 'green', 'blue')))
plt.xlim(X1.min(), X1.max())
plt.ylim(X2.min(), X2.max())
for i, j in enumerate(np.unique(y_set)):
    plt.scatter(X_set[y_set == j, 0], X_set[y_set == j, 1],
                c = ListedColormap(('red', 'green', 'blue'))(i), label = j)
plt.title('Logistic Regression (Test set)')
plt.xlabel('PC1')
plt.ylabel('PC2')
plt.legend()
plt.show()
```

```
*c* argument looks like a single numeric RGB or RGBA sequence, which should be avoided as value-mapping will have precedence
in case its length matches with *x* & *y*.  Please use the *color* keyword-argument or provide a 2-D array with a single row
if you intend to specify the same RGB or RGBA value for all points.
*c* argument looks like a single numeric RGB or RGBA sequence, which should be avoided as value-mapping will have precedence
in case its length matches with *x* & *y*.  Please use the *color* keyword-argument or provide a 2-D array with a single row
if you intend to specify the same RGB or RGBA value for all points.
*c* argument looks like a single numeric RGB or RGBA sequence, which should be avoided as value-mapping will have precedence
in case its length matches with *x* & *y*.  Please use the *color* keyword-argument or provide a 2-D array with a single row
if you intend to specify the same RGB or RGBA value for all points.
```



Linear Discriminant Analysis (LDA)

线性判别分析

In [9]:

```python
X = df.iloc[:, :-1]
y = df.iloc[:, -1]
```

In [10]:

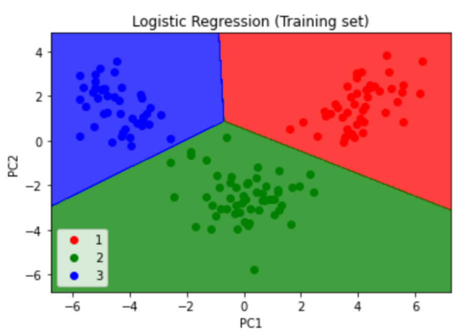
```
from sklearn.model_selection import train_test_split
from sklearn.preprocessing import StandardScaler
from sklearn.discriminant_analysis import LinearDiscriminantAnalysis as LDA
from sklearn.linear_model import LogisticRegression
from sklearn.metrics import confusion_matrix, classification_report, accuracy_score

X_train, X_test, y_train, y_test = train_test_split(X, y, test_size=0.2, random_state=0)

sc = StandardScaler()
X_train = sc.fit_transform(X_train)
X_test = sc.transform(X_test)

lda = LDA(n_components=2)
X_train = lda.fit_transform(X_train, y_train)
X_test = lda.transform(X_test)

lr = LogisticRegression(random_state=0)
lr.fit(X_train, y_train)

predictions = lr.predict(X_test)

print(confusion_matrix(y_test, predictions))
print(classification_report(y_test, predictions))
print(accuracy_score(y_test, predictions))
```

```
[[14  0  0]
 [ 0 16  0]
 [ 0  0  6]]
              precision    recall  f1-score   support

           1       1.00      1.00      1.00        14
           2       1.00      1.00      1.00        16
           3       1.00      1.00      1.00         6

    accuracy                           1.00        36
   macro avg       1.00      1.00      1.00        36
weighted avg       1.00      1.00      1.00        36

1.0
```

In [11]:

```
from matplotlib.colors import ListedColormap
X_set, y_set = X_train, y_train
X1, X2 = np.meshgrid(np.arange(start = X_set[:, 0].min() - 1, stop = X_set[:, 0].max() + 1, step = 0.01),
                     np.arange(start = X_set[:, 1].min() - 1, stop = X_set[:, 1].max() + 1, step = 0.01))
plt.contourf(X1, X2, lr.predict(np.array([X1.ravel(), X2.ravel()]).T).reshape(X1.shape),
             alpha = 0.75, cmap = ListedColormap(('red', 'green', 'blue')))
plt.xlim(X1.min(), X1.max())
plt.ylim(X2.min(), X2.max())
for i, j in enumerate(np.unique(y_set)):
    plt.scatter(X_set[y_set == j, 0], X_set[y_set == j, 1],
                c = ListedColormap(('red', 'green', 'blue'))(i), label = j)
plt.title('Logistic Regression (Training set)')
plt.xlabel('PC1')
plt.ylabel('PC2')
plt.legend()
plt.show()
```

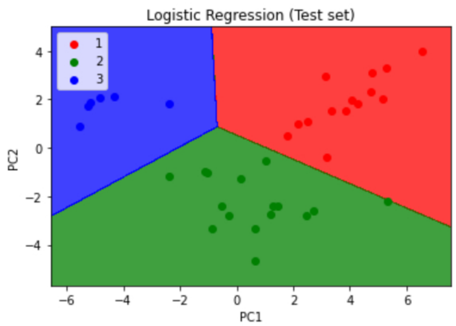
```
*c* argument looks like a single numeric RGB or RGBA sequence, which should be avoided as value-mapping will have precedence
in case its length matches with *x* & *y*.  Please use the *color* keyword-argument or provide a 2-D array with a single row
if you intend to specify the same RGB or RGBA value for all points.
*c* argument looks like a single numeric RGB or RGBA sequence, which should be avoided as value-mapping will have precedence
in case its length matches with *x* & *y*.  Please use the *color* keyword-argument or provide a 2-D array with a single row
if you intend to specify the same RGB or RGBA value for all points.
*c* argument looks like a single numeric RGB or RGBA sequence, which should be avoided as value-mapping will have precedence
in case its length matches with *x* & *y*.  Please use the *color* keyword-argument or provide a 2-D array with a single row
if you intend to specify the same RGB or RGBA value for all points.
```



In [12]:

```
from matplotlib.colors import ListedColormap
X_set, y_set = X_test, y_test
X1, X2 = np.meshgrid(np.arange(start = X_set[:, 0].min() - 1, stop = X_set[:, 0].max() + 1, step = 0.01),
                     np.arange(start = X_set[:, 1].min() - 1, stop = X_set[:, 1].max() + 1, step = 0.01))
plt.contourf(X1, X2, lr.predict(np.array([X1.ravel(), X2.ravel()]).T).reshape(X1.shape),
             alpha = 0.75, cmap = ListedColormap(('red', 'green', 'blue')))
plt.xlim(X1.min(), X1.max())
plt.ylim(X2.min(), X2.max())
for i, j in enumerate(np.unique(y_set)):
    plt.scatter(X_set[y_set == j, 0], X_set[y_set == j, 1],
                c = ListedColormap(('red', 'green', 'blue'))(i), label = j)
plt.title('Logistic Regression (Test set)')
plt.xlabel('PC1')
plt.ylabel('PC2')
plt.legend()
plt.show()
```

```
*c* argument looks like a single numeric RGB or RGBA sequence, which should be avoided as value-mapping will have precedence
in case its length matches with *x* & *y*.  Please use the *color* keyword-argument or provide a 2-D array with a single row
if you intend to specify the same RGB or RGBA value for all points.
*c* argument looks like a single numeric RGB or RGBA sequence, which should be avoided as value-mapping will have precedence
in case its length matches with *x* & *y*.  Please use the *color* keyword-argument or provide a 2-D array with a single row
if you intend to specify the same RGB or RGBA value for all points.
*c* argument looks like a single numeric RGB or RGBA sequence, which should be avoided as value-mapping will have precedence
in case its length matches with *x* & *y*.  Please use the *color* keyword-argument or provide a 2-D array with a single row
if you intend to specify the same RGB or RGBA value for all points.
```



Kernel PCA

核主成分分析, KernelPCA是PCA的一个改进版. 主成分分析(Principal Components Analysis, PCA)适用于数据的线性降维。而核主成分分析(Kernel PCA, KPCA)可实现数据的非线性降维

In [13]:

```python
X = df.iloc[:, :-1]
y = df.iloc[:, -1]
```

In [14]:

```python
from sklearn.model_selection import train_test_split
from sklearn.preprocessing import StandardScaler
from sklearn.decomposition import KernelPCA
from sklearn.linear_model import LogisticRegression
from sklearn.metrics import confusion_matrix, classification_report, accuracy_score

X_train, X_test, y_train, y_test = train_test_split(X, y, test_size=0.2, random_state=0)

sc = StandardScaler()
X_train = sc.fit_transform(X_train)
X_test = sc.transform(X_test)

kpca = KernelPCA(n_components=2, kernel ='rbf')
X_train = kpca.fit_transform(X_train)
X_test = kpca.transform(X_test)

lr = LogisticRegression(random_state=0)
lr.fit(X_train, y_train)

predictions = lr.predict(X_test)

print(confusion_matrix(y_test, predictions))
print(classification_report(y_test, predictions))
print(accuracy_score(y_test, predictions))
```

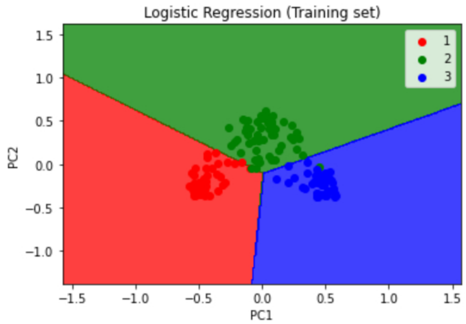
```
[[14  0  0]
 [ 0 16  0]
 [ 0  0  6]]
              precision    recall  f1-score   support

           1       1.00      1.00      1.00        14
           2       1.00      1.00      1.00        16
           3       1.00      1.00      1.00         6

    accuracy                           1.00        36
   macro avg       1.00      1.00      1.00        36
weighted avg       1.00      1.00      1.00        36

1.0
```

In [15]:

```python
from matplotlib.colors import ListedColormap
X_set, y_set = X_train, y_train
X1, X2 = np.meshgrid(np.arange(start = X_set[:, 0].min() - 1, stop = X_set[:, 0].max() + 1, step = 0.01),
                     np.arange(start = X_set[:, 1].min() - 1, stop = X_set[:, 1].max() + 1, step = 0.01))
plt.contourf(X1, X2, lr.predict(np.array([X1.ravel(), X2.ravel()]).T).reshape(X1.shape),
             alpha = 0.75, cmap = ListedColormap(('red', 'green', 'blue')))
plt.xlim(X1.min(), X1.max())
plt.ylim(X2.min(), X2.max())
for i, j in enumerate(np.unique(y_set)):
    plt.scatter(X_set[y_set == j, 0], X_set[y_set == j, 1],
                c = ListedColormap(('red', 'green', 'blue'))(i), label = j)
plt.title('Logistic Regression (Training set)')
plt.xlabel('PC1')
plt.ylabel('PC2')
plt.legend()
plt.show()
```

```
*c* argument looks like a single numeric RGB or RGBA sequence, which should be avoided as value-mapping will have precedence
in case its length matches with *x* & *y*.  Please use the *color* keyword-argument or provide a 2-D array with a single row
if you intend to specify the same RGB or RGBA value for all points.
*c* argument looks like a single numeric RGB or RGBA sequence, which should be avoided as value-mapping will have precedence
in case its length matches with *x* & *y*.  Please use the *color* keyword-argument or provide a 2-D array with a single row
```

```
if you intend to specify the same RGB or RGBA value for all points.
*c* argument looks like a single numeric RGB or RGBA sequence, which should be avoided as value-mapping will have precedence
in case its length matches with *x* & *y*.  Please use the *color* keyword-argument or provide a 2-D array with a single row
if you intend to specify the same RGB or RGBA value for all points.
```



In [16]:

```python
from matplotlib.colors import ListedColormap
X_set, y_set = X_test, y_test
X1, X2 = np.meshgrid(np.arange(start = X_set[:, 0].min() - 1, stop = X_set[:, 0].max() + 1, step = 0.01),
                     np.arange(start = X_set[:, 1].min() - 1, stop = X_set[:, 1].max() + 1, step = 0.01))
plt.contourf(X1, X2, lr.predict(np.array([X1.ravel(), X2.ravel()]).T).reshape(X1.shape),
             alpha = 0.75, cmap = ListedColormap(('red', 'green', 'blue')))
plt.xlim(X1.min(), X1.max())
plt.ylim(X2.min(), X2.max())
for i, j in enumerate(np.unique(y_set)):
    plt.scatter(X_set[y_set == j, 0], X_set[y_set == j, 1],
                c = ListedColormap(('red', 'green', 'blue'))(i), label = j)
plt.title('Logistic Regression (Test set)')
plt.xlabel('PC1')
plt.ylabel('PC2')
plt.legend()
plt.show()
```

```
*c* argument looks like a single numeric RGB or RGBA sequence, which should be avoided as value-mapping will have precedence
in case its length matches with *x* & *y*.  Please use the *color* keyword-argument or provide a 2-D array with a single row
if you intend to specify the same RGB or RGBA value for all points.
*c* argument looks like a single numeric RGB or RGBA sequence, which should be avoided as value-mapping will have precedence
in case its length matches with *x* & *y*.  Please use the *color* keyword-argument or provide a 2-D array with a single row
if you intend to specify the same RGB or RGBA value for all points.
*c* argument looks like a single numeric RGB or RGBA sequence, which should be avoided as value-mapping will have precedence
in case its length matches with *x* & *y*.  Please use the *color* keyword-argument or provide a 2-D array with a single row
if you intend to specify the same RGB or RGBA value for all points.
```