Kernel PCA

Importing Libraries

```
import numpy as np
import matplotlib.pyplot as plt
import pandas as pd
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, accuracy_score
```

Importing Datasets

```
df = pd.read_csv('Wine.csv')
df.head()
x = df.iloc[:, :-1].values
y = df.iloc[:, -1].values
```

Splitting the dataset into the Training set and Test set

```
x_train, x_test, y_train, y_test = train_test_split(x, y, test_size = 0.2, random_state = 0)
```

Feature Scaling

```
sc = StandardScaler()
x_train = sc.fit_transform(x_train)
x_test = sc.transform(x_test)
```

Applying PCA

```
kpa = KernelPCA(n_components = 2, kernel = 'rbf')
x_train = kpa.fit_transform(x_train)
x_test = kpa.transform(x_test)
```

Training the logistic regression model on training set

```
lr = LogisticRegression(random_state = 0)
lr.fit(x_train, y_train)
```

```
▾       LogisticRegression
LogisticRegression(random_state=0)
```

Making confusion matrix

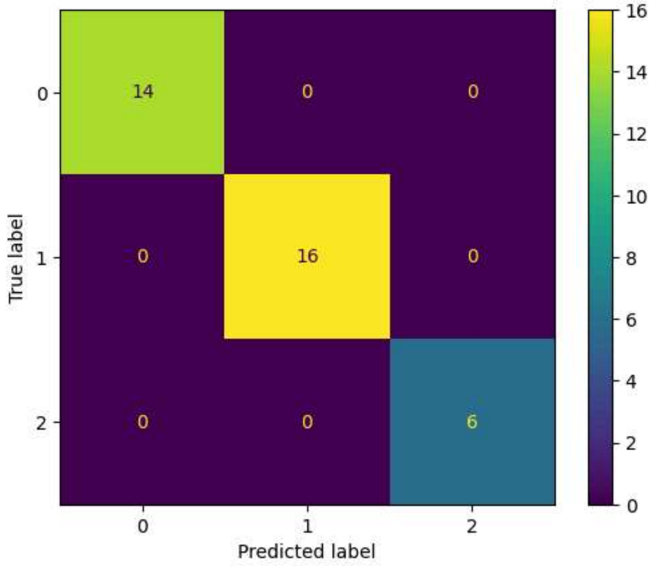
```
cm = confusion_matrix(y_test, lr.predict(x_test))
print(cm)
accuracy_score(y_test, lr.predict(x_test))
```

```
[[14  0  0]
 [ 0 16  0]
 [ 0  0  6]]
1.0
```

Visualizing confusion matrix

```
from sklearn import metrics
import matplotlib.pyplot as plt

# Assuming 'cm' is your confusion matrix
cm_display = metrics.ConfusionMatrixDisplay(confusion_matrix = cm) # Remove display_labels
cm_display.plot()
plt.show()
```



Visualizing the training result

```
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(('black', 'yellow', 'orange')))
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(('white', 'red', 'black'))(i), label = j)
plt.title('Logistic Regression (Training set)')
plt.xlabel('PC1')
plt.ylabel('PC2')
plt.legend()
plt.show()
```

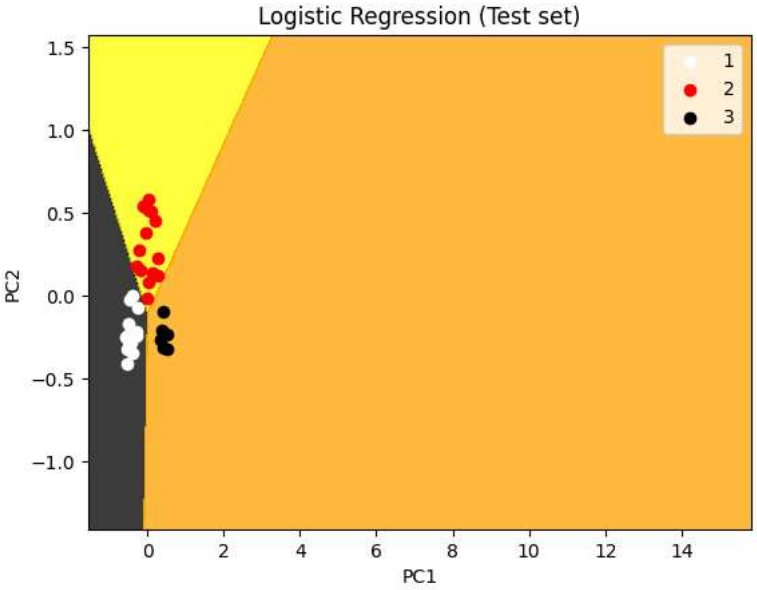
```
<ipython-input-9-212a150b7978>:10: UserWarning: *c* argument looks like a single numeric RGB or RGBA sequence, which should be avoided a
  plt.scatter(x_set[y_set == j, 0], x_set[y_set == j, 1],
```

Logistic Regression (Training set)

Visualizing the test result

```
x_set, y_set = x_test, y_test
x1, x2 = np.meshgrid(np.arange(start = x_set[:, 0].min() - 1, stop = x[:, 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(('black', 'yellow', 'orange')))
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(('white', 'red', 'black'))(i), label = j)
plt.title('Logistic Regression (Test set)')
plt.xlabel('PC1')
plt.ylabel('PC2')
plt.legend()
plt.show()
```

```
<ipython-input-10-8ba87aafc3a2>:9: UserWarning: *c* argument looks like a single numeric RGB or RGBA sequence, which should be avoided a
  plt.scatter(x_set[y_set == j, 0], x_set[y_set == j, 1],
```


Logistic Regression (Test set)
PC2
PC1