SVM_Kernel

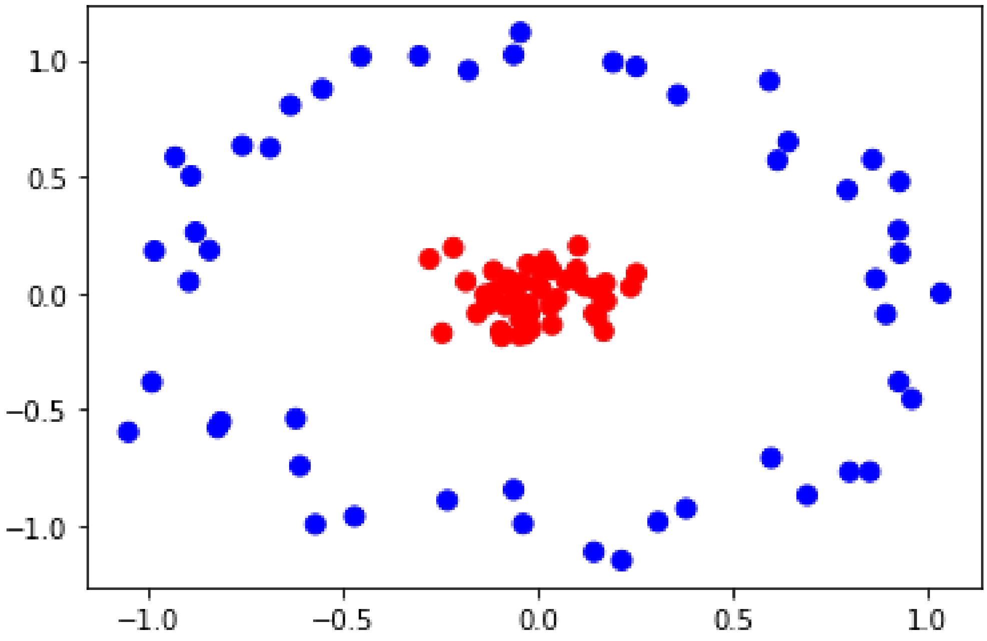
March 2022

[1]:
```
import numpy as np
import pandas as pd
import matplotlib.pyplot as plt
from matplotlib.axes._axes import _log as matplotlib_axes_logger
from mpl_toolkits import mplot3d
from sklearn.model_selection import train_test_split
from sklearn.svm import SVC
from matplotlib.colors import ListedColormap
```

[3]:
```
from sklearn.datasets import make_circles
X, y = make_circles(100, factor=.1, noise=.1)

plt.scatter(X[:, 0], X[:, 1], c=y, s=50, cmap='bwr')
```

[3]:
```
<matplotlib.collections.PathCollection at 0x7feca18ca250>
```



[4]:

```
X_train, X_test, y_train, y_test = train_test_split(X, y, test_size = 0.20)
```

[5]:

```
classifier = SVC(kernel="linear")
classifier.fit(X_train, y_train.ravel())
y_pred = classifier.predict(X_test)
```

[6]:

```
from sklearn.metrics import accuracy_score
accuracy_score(y_test, y_pred)
```

[6]:

```
0.55
```

[7]:

```
zero_one_colourmap = ListedColormap(('blue', 'red'))
def plot_decision_boundary(X, y, clf):
    X_set, y_set = X, y
    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, clf.predict(np.array([X1.ravel(),
                                             X2.ravel()]).T).reshape(X1.shape),
               alpha = 0.75,
               cmap = zero_one_colourmap)
    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 = (zero_one_colourmap)(i), label = j)
    plt.title('SVM Decision Boundary')
    plt.xlabel('X1')
    plt.ylabel('X2')
    plt.legend()
    return plt.show()
```

[8]:

```
plot_decision_boundary(X, y, classifier)
```

```
*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.
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```
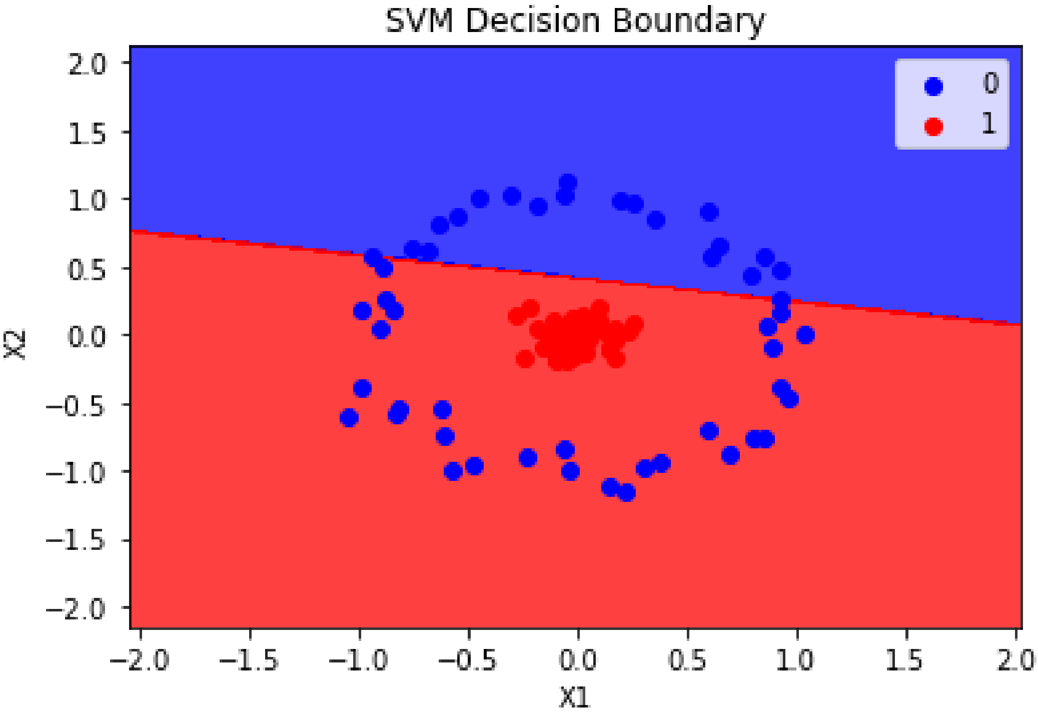
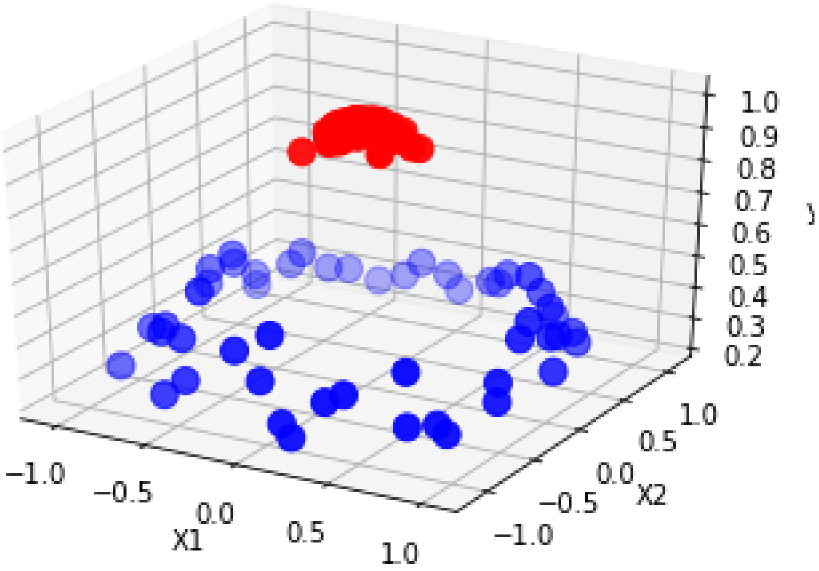



```
[9]: def plot_3d_plot(X, y):
         r = np.exp(-(X ** 2).sum(1))
         ax = plt.subplot(projection='3d')
         ax.scatter3D(X[:, 0], X[:, 1], r, c=y, s=100, cmap='bwr')
         ax.set_xlabel('X1')
         ax.set_ylabel('X2')
         ax.set_zlabel('y')
         return ax
```

```
[10]: plot_3d_plot(X,y)
```

```
[10]: <matplotlib.axes._subplots.Axes3DSubplot at 0x7feca1105490>
```



[11]:

```
rbf_classifier = SVC(kernel="rbf")
rbf_classifier.fit(X_train, y_train)
y_pred = rbf_classifier.predict(X_test)
```

[12]:

```
accuracy_score(y_test, y_pred)
```

[12]:

```
1.0
```

[13]:

```
plot_decision_boundary(X, y, rbf_classifier)
```

```
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```

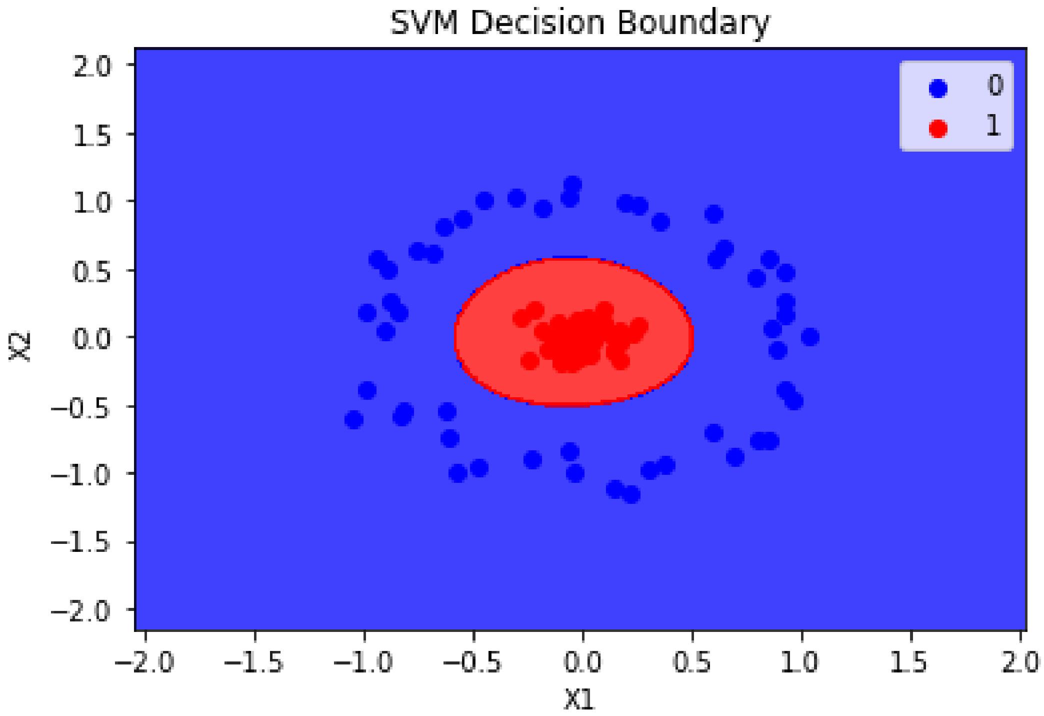

[17]:

```
poly_classifier = SVC(kernel="poly",degree=3)
poly_classifier.fit(X_train, y_train)
y_pred = poly_classifier.predict(X_test)
```

[18]:

```
accuracy_score(y_test, y_pred)
```

[18]:

```
0.55
```

[19]:

```
plot_decision_boundary(X, y, poly_classifier)
```

```
*c* argument looks like a single numeric RGB or RGBA sequence, which should be
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*x* & *y*.  Please use the *color* keyword-argument or provide a 2-D array with
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```

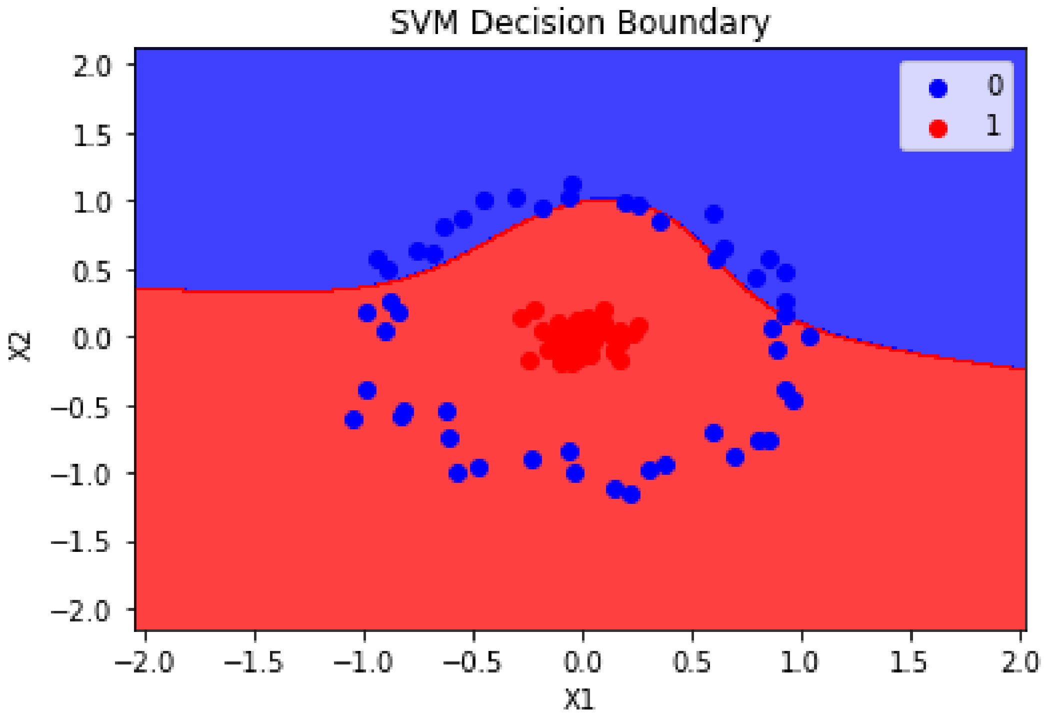
SVM Decision Boundary
0
1
X2
2.0
1.5
1.0
0.5
0.0
−0.5
−1.0
−1.5
−2.0
X1
−2.0
−1.5
−1.0
−0.5
0.0
0.5
1.0
1.5
2.0