SVMandClustering

November 30, 2021

SL Lab with Python 7: SVM and Clustering

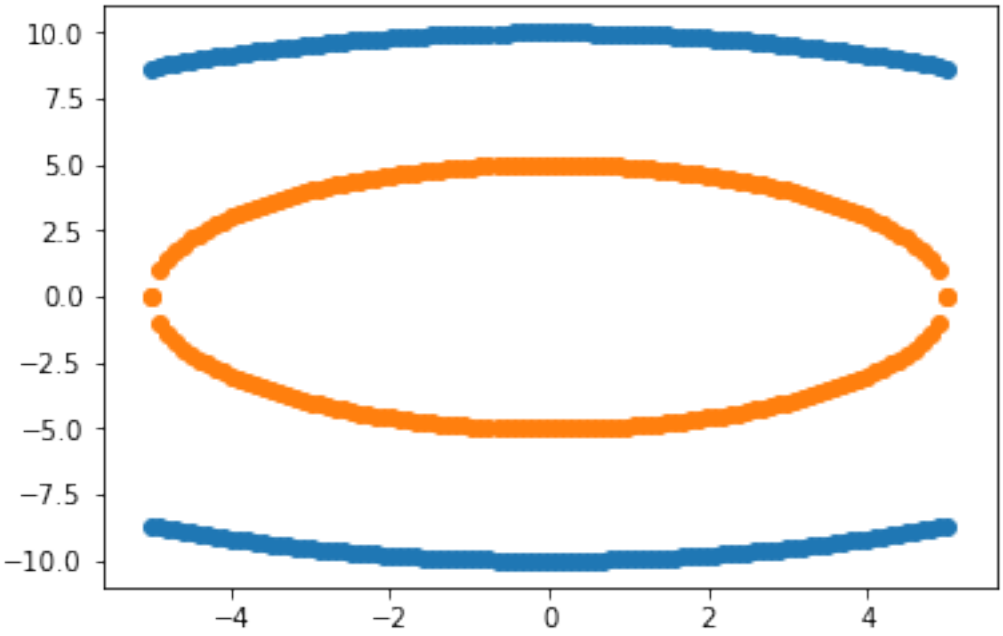
Statistical Learning (Sejong University)

Date: 2021.11.30 (By: S. M. Riazul Islam)

1. SVM

In [7]:
```
import numpy as np
import matplotlib.pyplot as plt
import pandas as pd

from sklearn.model_selection import train_test_split
from sklearn.svm import SVC
from sklearn.metrics import accuracy_score


#Outer Circle Data
x1 = np.linspace(-5.0, 5.0, 100)
y1 = np.sqrt(10**2 - x1**2) # Circle Equation
x1=np.hstack([x1,-x1])
y1=np.hstack([y1,-y1])

#Inner Circle Data
x2 = np.linspace(-5.0, 5.0, 100)
y2 = np.sqrt(5**2 - x2**2)

x2=np.hstack([x2,-x2])
y2=np.hstack([y2,-y2])


plt.scatter(x1,y1)
plt.scatter(x2,y2)
```

Out[7]:
```
<matplotlib.collections.PathCollection at 0x25029038f28>
```



In [2]:
```
# Create Dataset
df1 =pd.DataFrame(np.vstack([y1,x1]).T,columns=['X1','X2'])
df1['Y']=0

df2 =pd.DataFrame(np.vstack([y2,x2]).T,columns=['X1','X2'])
df2['Y']=1
df = df1.append(df2)
df.head()
```

Out[2]:

	X1	X2	Y
0	8.660254	-5.00000	0
1	8.717792	-4.89899	0
2	8.773790	-4.79798	0
3	8.828277	-4.69697	0
4	8.881281	-4.59596	0

In [3]:
```
# Predictors and Response Variable
X = df.iloc[:, :2]
y = df.Y

# Split the dataset into train and test
X_train,X_test,y_train,y_test=train_test_split(X,y,test_size=0.25,random_state=0)
```

In [4]:
```
#kernel{linear, poly, rbf, sigmoid, precomputed}, default=rbf

myclass=SVC(kernel="linear")
```

```
        myclass.fit(X_train,y_train)

        y_pred = myclass.predict(X_test)
        accuracy_score(y_test, y_pred)
```

```
Out[4]: 0.45
```

```
In [5]: myclass=SVC(kernel="poly")
        myclass.fit(X_train,y_train)

        y_pred = myclass.predict(X_test)
        accuracy_score(y_test, y_pred)
```

```
C:\Users\Preload\Anaconda3\lib\site-packages\sklearn\svm\base.py:196: FutureWarning: The defaul
  "avoid this warning.", FutureWarning)
```

```
Out[5]: 0.6
```

```
In [6]: myclass=SVC(kernel="rbf")
        myclass.fit(X_train,y_train)

        y_pred = myclass.predict(X_test)
        accuracy_score(y_test, y_pred)
```

```
C:\Users\Preload\Anaconda3\lib\site-packages\sklearn\svm\base.py:196: FutureWarning: The defaul
  "avoid this warning.", FutureWarning)
```

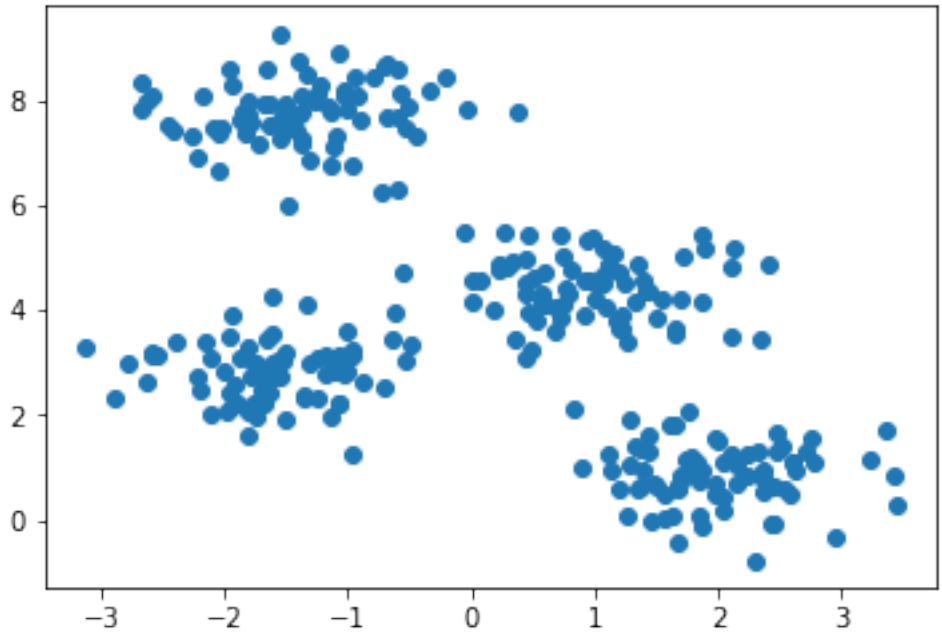
```
Out[6]: 1.0
```

2. K-means Clustering

```
In [8]: import numpy as np
        import pandas as pd
        from matplotlib import pyplot as plt

        from sklearn.datasets.samples_generator import make_blobs
        from sklearn.cluster import KMeans
```

```
In [12]: X, y = make_blobs(n_samples=300, n_features=2, centers=4, cluster_std=0.60, random_sta
         plt.scatter(X[:,0], X[:,1])
```

```
Out[12]: <matplotlib.collections.PathCollection at 0x250295d9f98>
```




```
In [34]: myCluster=KMeans(n_clusters=4)
         myCluster.fit_predict(X)
         centers=myCluster.cluster_centers_
         centers
```

```
Out[34]: array([[ 1.98258281,  0.86771314],
                [ 0.94973532,  4.41906906],
                [-1.58438467,  2.83081263],
                [-1.37324398,  7.75368871]])
```

```
In [35]: mykm=myCluster.fit_predict(X)
         mykm
```

```
Out[35]: array([1, 0, 3, 0, 1, 1, 2, 3, 0, 0, 2, 0, 3, 0, 1, 3, 3, 1, 2, 2, 1, 1,
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                0, 2, 3, 0, 3, 1, 1, 2, 2, 3, 1, 1, 1, 3, 0, 0, 1, 1, 3, 1, 1, 1,
                0, 2, 0, 3, 1, 1, 0, 0, 0, 1, 1, 3, 0, 2])
```

```
In [36]: X

Out[36]: array([[ 8.36856841e-01,  2.13635938e+00],
                [-1.41365810e+00,  7.40962324e+00],
                [ 1.15521298e+00,  5.09961887e+00],
                [-1.01861632e+00,  7.81491465e+00],
                [ 1.27135141e+00,  1.89254207e+00],
                [ 3.43761754e+00,  2.61654166e-01],
                [-1.80822253e+00,  1.59701749e+00],
                [ 1.41372442e+00,  4.38117707e+00],
                [-2.04932168e-01,  8.43209665e+00],
                [-7.11099611e-01,  8.66043846e+00],
                [-1.71237268e+00,  2.77780226e+00],
                [-2.67000792e+00,  8.35389140e+00],
                [ 1.24258802e+00,  4.50399192e+00],
                [-2.22783649e+00,  6.89479938e+00],
                [ 1.45513831e+00, -2.91989981e-02],
                [ 4.53791789e-01,  3.95647753e+00],
                [ 1.06923853e+00,  4.53068484e+00],
                [ 2.56936589e+00,  5.07048304e-01],
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                [-1.07859101e+00,  2.20451529e+00],
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                [ 1.77710994e+00,  1.18655254e+00],
                [ 7.34363910e-01,  5.03725437e+00],
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                [ 1.69747910e+00,  8.66123282e-01],
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                [-2.05701103e+00,  7.37851598e+00],
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                [-2.41933824e+00,  7.43952498e+00],
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                [-2.20299950e+00,  2.47947561e+00],
                [ 1.66382237e+00,  6.63091635e-01],
                [ 6.69786996e-01,  3.59540802e+00],
                [-1.98539037e+00,  2.05520738e+00],
                [-4.74920358e-02,  5.47425256e+00],
                [ 1.54462126e+00,  4.21078127e+00],
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```

```
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[ 2.40615694e+00,  4.87047502e+00],
[-1.53631328e+00,  3.01443916e+00],
[ 1.48859977e+00,  6.51633844e-01],
[ 5.14320434e-01,  4.62733684e+00],
[-1.81469750e+00,  3.29009724e+00],
[-1.93731055e+00,  3.91361274e+00],
[-6.14907097e-01,  3.94963585e+00],
[ 2.03169783e+00,  1.96807561e-01],
[ 2.14917144e+00,  1.03697228e+00],
[-1.36999388e+00,  7.76953035e+00],
[ 9.14338767e-01,  4.55014643e+00],
[ 3.33818506e-01,  4.93645836e+00],
[-2.15968109e+00,  3.41003096e+00],
[ 1.36678633e+00,  6.34971633e-01],
[-5.71099336e-01,  8.13306058e+00],
[-1.00552592e+00,  3.08400540e+00],
[ 1.49493180e+00,  3.85848832e+00],
[-5.90447667e-01,  7.69493053e+00],
[ 7.15177948e-01,  5.41334556e+00],
[ 2.11390250e+00,  1.24743587e+00],
[ 1.20083098e+00,  6.01671730e-01],
[-2.54576750e+00,  3.15025055e+00],
[-1.95866665e+00,  2.43008647e+00],
[ 2.33812285e+00,  3.43116792e+00],
[ 3.35320909e+00,  1.69958043e+00],
[ 1.84287117e+00,  7.26928839e-02],
[ 1.32000621e+00,  1.40428145e+00],
[ 2.09680545e+00,  4.84741412e+00],
[-1.24307904e+00,  8.15166254e+00],
[-1.85908090e+00,  7.78874716e+00],
[ 2.74666646e+00,  1.54543482e+00],
[ 2.60778282e+00,  1.08890025e+00],
[ 1.65991049e+00,  3.56289184e+00],
[ 2.35151259e+00,  8.28001297e-01],
[ 2.22322228e+00,  8.38773426e-01],
[ 3.22881491e+00,  1.13171965e+00],
```
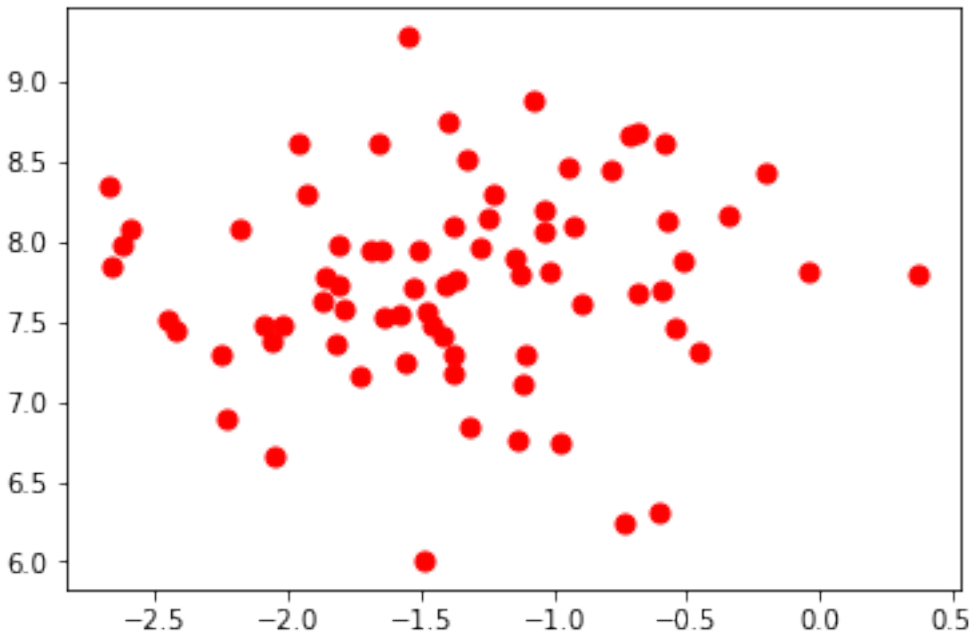

```
       [-1.55876720e+00,  7.24816210e+00],
       [-6.46956784e-01,  3.42941343e+00],
       [-1.32688818e+00,  8.51530794e+00],
       [ 9.17198564e-01,  3.90570036e+00],
       [ 2.29469533e+00, -7.65891994e-01],
       [ 1.81559810e+00,  1.11969719e+00],
       [-1.12016775e+00,  7.11031582e+00],
       [-1.65507124e+00,  8.61416749e+00],
       [-1.27567815e+00,  7.96776461e+00],
       [ 1.97369770e+00,  1.57979848e+00],
       [ 2.51834185e+00,  1.39176615e+00],
       [ 4.38990142e-01,  4.53592883e+00],
       [ 3.69478657e-01,  7.79110522e+00],
       [-1.79145759e+00,  2.74966896e+00]])
```

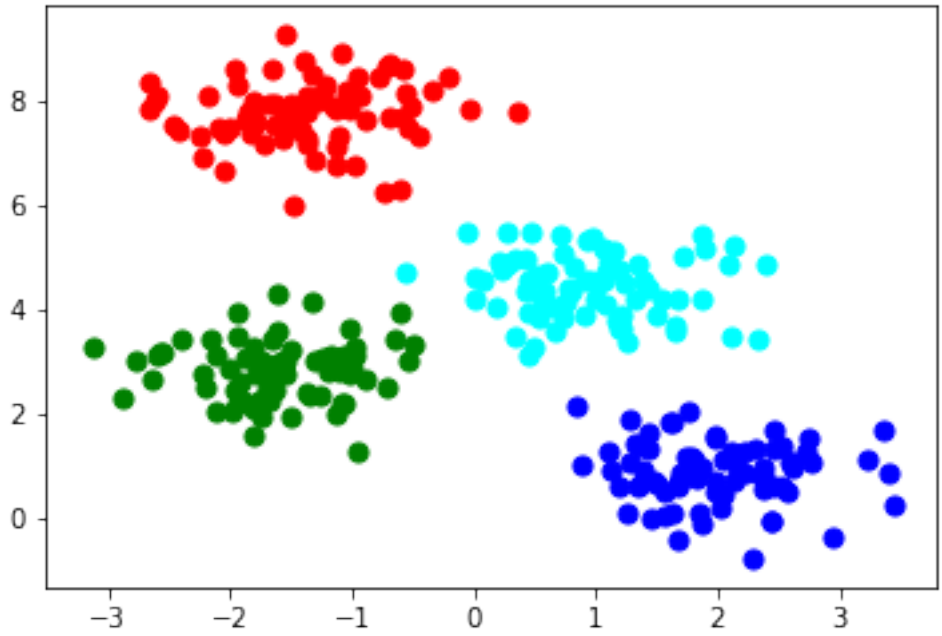
In [37]:
```
plt.scatter(X[mykm==0,0],X[mykm==0,1],s=50,color='red')
```

Out[37]:
```
<matplotlib.collections.PathCollection at 0x250297b9400>
```



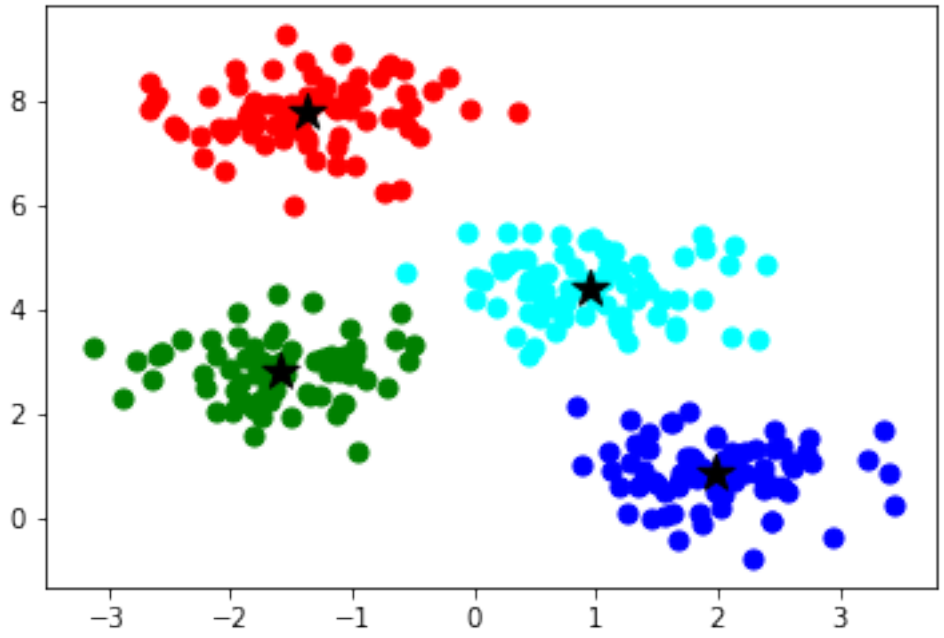
In [38]:
```
plt.scatter(X[mykm==0,0],X[mykm==0,1],s=50,color='red')
plt.scatter(X[mykm==1,0],X[mykm==1,1],s=50,color='blue')
plt.scatter(X[mykm==2,0],X[mykm==2,1],s=50,color='green')
plt.scatter(X[mykm==3,0],X[mykm==3,1],s=50,color='cyan')
```

Out[38]:
```
<matplotlib.collections.PathCollection at 0x2502981d588>
```



In [45]:
```
plt.scatter(X[mykm==0,0],X[mykm==0,1],s=50,color='red')
plt.scatter(X[mykm==1,0],X[mykm==1,1],s=50,color='blue')
plt.scatter(X[mykm==2,0],X[mykm==2,1],s=50,color='green')
plt.scatter(X[mykm==3,0],X[mykm==3,1],s=50,color='cyan')

plt.scatter(centers[0][0],centers[0][1], marker='*', s=200, color='black')
plt.scatter(centers[1][0],centers[1][1], marker='*', s=200, color='black')
plt.scatter(centers[2][0],centers[2][1], marker='*', s=200, color='black')
plt.scatter(centers[3][0],centers[3][1], marker='*', s=200, color='black')
```

Out[45]:
```
<matplotlib.collections.PathCollection at 0x2502aa57c18>
```



In [46]:
```
myCluster = KMeans(n_clusters=4, init='k-means++', max_iter=300, n_init=10, random_sta
pred_y = myCluster.fit_predict(X)

plt.scatter(X[:,0], X[:,1])
plt.scatter(myCluster.cluster_centers_[:, 0], myCluster.cluster_centers_[:, 1], s=300
plt.show()
```