

8_E

Importing the libraries

```
In [12]: import numpy as np
import pandas as pd
from sklearn.datasets import make_classification
import numpy as np
from sklearn.svm import SVC
from sklearn.cross_validation import train_test_split
import warnings
warnings.filterwarnings('ignore')
from sklearn import linear_model
import warnings
warnings.filterwarnings("ignore")
```

Making the dataset

```
In [2]: X, y = make_classification(n_samples=5000, n_features=5, n_redundant=2,
                                n_classes=2, weights=[0.7], class_sep=0.7, r
                                andom_state=15)
```

```
In [3]: x_train, x_test, y_train, y_test = train_test_split(X, y, test_size=0.2
0, random_state=15)
```

```
In [4]: x_train, x_cv, y_train, y_cv = train_test_split(x_train, y_train, test_s
ize=0.25, random_state=15)
```

```
In [5]: rbf=SVC(kernel="rbf",C=100,gamma=0.001) # svc classifier with rbf kerne
l
```

```
In [6]: rbf.fit(x_train,y_train)
```

```
Out[6]: SVC(C=100, cache_size=200, class_weight=None, coef0=0.0,
            decision_function_shape='ovr', degree=3, gamma=0.001, kernel='rbf',
            max_iter=-1, probability=False, random_state=None, shrinking=True,
            tol=0.001, verbose=False)
```

```
In [7]: sup_vecs=rbf.support_vectors_  
dual_coefs=rbf.dual_coef_  
intercept=rbf.intercept_
```

```
In [8]: def decision_function(x_cv, gamma):

    predict=[]
    decision=[]
    for xq in x_cv:
        dec_func = 0
        for j in range(len(sup_vecs)):
            norm2 = np.linalg.norm(sup_vecs[j, :] - xq)**2 # calculating the kernel(K(xi,xq))
            dec_func = dec_func + dual_coefs[0, j] * np.exp(-gamma*norm2) # calculating the sign
        dec_func += intercept
        decision.append(dec_func)
        if (dec_func)<0: #https://stackoverflow.com/questions/28503932/calculating-decision-function-of-svm-manually
            predict.append(0)
        else:
            predict.append(1)
    return np.array(predict),decision
```

```
In [9]: gamma=0.001
        f_cv,decision=decision_function(x_cv,gamma)
        print(f_cv)
```

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0]

```

In [10]: `print(np.array(decision).T)`

```

[[ 9.78553590e-01 -1.11760405e+00 -2.04720532e+00 -3.09565428e+00
 -2.79889732e+00 -3.19223178e+00 -3.06506013e+00 -2.65326082e+00
  3.33031294e+00 -1.27804286e+00  1.23713395e+00 -2.26620102e+00
  1.15545642e+00  1.55336237e+00 -3.18756150e-01  1.20293177e+00
  1.88290414e+00  1.19637781e+00 -2.78451489e-01 -2.12325762e+00
  1.96221487e+00 -4.75759780e-01  1.08589552e+00 -2.55752818e+00
 -2.89278575e+00 -2.43600679e+00 -3.82456176e+00 -2.45783486e+00
 -2.27106674e+00 -1.23683699e+00 -1.16338685e+00 -2.10126553e+00
 -1.80723683e+00 -2.97522570e+00 -1.78272899e+00 -2.57605838e+00
  1.08577450e+00 -1.38072948e-01 -2.30545739e+00 -2.29909830e+00
  7.42068597e-01 -2.97019249e+00 -2.90071729e+00  1.41309686e+00
  2.78861618e+00 -1.89767766e+00 -1.98425643e+00 -1.45561992e+00
 -2.89596097e+00 -2.67027549e+00 -2.39828370e+00 -3.04643574e+00
 -1.56860504e+00  3.60540603e-01 -1.74975096e+00 -1.77366133e+00
 -2.78686913e+00 -2.13619233e+00 -1.90398564e+00  1.33960705e+00
 -3.24020418e+00  8.97308121e-01 -2.21557816e+00 -2.99426446e+00
 -4.94047716e-02  1.59483473e+00 -1.83496676e+00  7.95082106e-02
 -2.79323852e+00 -3.98279565e+00 -1.79837344e+00 -2.00613380e+00
 -1.97130396e+00  2.07687621e+00 -2.41070545e+00 -1.65161037e+00
 -3.07902438e+00 -3.17027645e-01 -2.85843081e+00 -4.65434071e+00
  5.51521648e-01 -4.49305200e+00 -3.76755323e+00 -8.63617712e-01
 -1.60777008e+00 -3.16398958e+00 -3.78415750e+00 -1.08713016e+00
 -2.21569698e+00 -2.69281638e+00 -4.39129734e+00 -2.58718677e+00]

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-1.94996291e+00	9.55121457e-01	-2.25689728e+00	-1.79146566e+00
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1.55476940e+00	-2.41901755e+00	2.43495429e+00	-6.92820420e-01
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-1.54384069e-01	8.76104455e-01	-1.86226192e+00	-3.24401380e+00
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-2.78785281e+00	1.49657837e+00	-3.10132048e+00	-1.58929029e+00
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7.08262905e-03	-1.62374787e+00	-2.23197116e+00	-1.88855087e+00
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-1.14579020e-01	-3.09750928e+00	-5.71336384e-01	-3.32351152e+00
-2.03040865e+00	1.48345561e+00	-2.89320867e+00	-3.23236246e+00
-2.76063639e+00	-1.16955627e+00	-3.20772870e+00	-1.43282241e+00
-1.19180830e+00	-2.55531264e+00	-3.53444714e+00	1.71899705e+00
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-2.31522538e+00	-3.52640360e+00	-2.60175724e+00	1.11686390e+00
-3.09356890e+00	-3.84220493e-01	-4.46441589e+00	-1.84018079e+00
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-1.90013564e+00	-1.51684008e+00	1.28408027e+00	-2.77289561e+00
1.08205716e+00	-2.46084063e+00	-2.23340628e+00	-1.04278224e+00
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2.11544965e+00	-2.17103631e+00	-1.40126416e+00	-2.76278468e+00
1.76308408e+00	-1.74927632e+00	3.92471069e-01	1.54740507e-02
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-2.33280157e+00	-2.74972904e+00	-3.44733693e+00	-2.58871789e+00
-2.10489434e+00	-4.27717240e+00	-2.93848356e+00	1.60711203e+00
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-3.01393329e+00	-2.23370678e+00	1.25473632e+00	2.98018784e-01
1.69187402e+00	-3.28808381e+00	-2.16764159e+00	-6.40646896e-01
-1.86194805e+00	-2.37412082e+00	1.39818035e+00	4.97477376e-02
-4.92226163e-01	-2.35808767e+00	2.80711926e-01	-2.31831025e+00
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In [11]: rbf.decision_function(x_cv)
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- both output are same