In [1]:

```
import numpy as np
import pandas as pd
from sklearn.datasets import make_classification
import numpy as np
from sklearn.svm import SVC
```

In [59]:

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

In [60]:

```
X=pd.DataFrame(X)
X['5']=y
train, validate, test = np.split(X.sample(frac=1), [int(.6*len(X)), int(.8*len(X))])#sta
ckoverflow
X_train, y_train = np.split(train,[-1],axis=1)
X_val, y_val = np.split(validate,[-1],axis=1)
X_test,y_test=np.split(test,[-1],axis=1)
model=SVC(gamma=0.001,C=100).fit(X_train,y_train)
dual_coef=model.dual_coef_
constant=model.intercept_
vec=model.support_vectors_
```

```
C:\Users\91983\Anaconda3\lib\site-packages\sklearn\utils\validation.py:760: DataConversio
nWarning: A column-vector y was passed when a 1d array was expected. Please change the sh
ape of y to (n_samples, ), for example using ravel().
  y = column_or_1d(y, warn=True)
```

In [61]:

```
import math
def decision_function(X_val,dual_coef,c,vec):
    l=[]
    for i in range(np.shape(X_val)[0]):
        dec_fun=0
        for j in range(np.shape(vec)[0]):
            diff=vec[j:j+1]-X_val[i:i+1]
            norm2=np.linalg.norm(diff)
            dec_fun = dec_fun + dual_coef[0,j] * np.exp(-0.001*(norm2**2))
        dec_fun=dec_fun+ c

        l.append(float(dec_fun))
    return l
```

In [69]:

```
f_cv=decision_function(X_val,dual_coef,constant,vec)
```

f_cv and model.decision_function(X_val) value match true

In [70]:

```
y_0 = np.count_nonzero(y_train == 0)#count 0 in y_train
y_1 = np.count_nonzero(y_train== 1)
```

In [58]:

```
y_cv=[]
for i in (y_val['5']):#changing y_val values from y_train i.e y+ and y-
    if(i==1):
        y_cv.append((y_1+1)/(y_1+2))
    else:
        y_cv.append(1/(y_0 + 2))
```

In [57]:

```
w=np.random.normal(0,0.0001, size=1)
b=np.random.normal(0,0.0001)
eta0=0.0001
alpha=0.0001
n_epoch=50
N=(len(f_cv))
def compute_log_loss(y_cv,y_pre_train):
    loss=0.0
    n=len(y_cv)
    for i in range(n):
        loss+=- 1/n*((y_cv[i]*math.log10(y_pre_train[i])+((1-y_cv[i])*math.log10(1-y_pre
_train[i]))))
    return loss
def sigmoid(w,x,b):
    return 1/(1+np.exp(-(np.dot(x,w) + b)))
for epoch in (range(n_epoch)):
    y_pre_train=[]
    for i in range(N):
        w=((1-((alpha*eta0)/N)))*w + ((eta0*f_cv[i])*(y_cv[i]-sigmoid(w,f_cv[i],b)))
        b=((1-(alpha*eta0)/N)*b + (eta0*(y_cv[i]-sigmoid(w,f_cv[i],b))))

    for i in f_cv:
        y_pre_train.append(sigmoid(w,i,b))#predict y_pre from X_train
    l_train=compute_log_loss(y_cv  ,y_pre_train)#avera
    print("epoch :",epoch , "loss_train : ",l_train)
```

```
epoch : 0 loss_train :  0.2623637078672465
epoch : 1 loss_train :  0.2333653786896878
epoch : 2 loss_train :  0.21124784489337214
epoch : 3 loss_train :  0.19405033710356553
epoch : 4 loss_train :  0.18041219367585826
epoch : 5 loss_train :  0.1693941656028906
epoch : 6 loss_train :  0.1603421016478871
epoch : 7 loss_train :  0.15279333208420137
epoch : 8 loss_train :  0.14641471608434578
epoch : 9 loss_train :  0.14096195566540526
epoch : 10 loss_train :  0.1362527110432041
epoch : 11 loss_train :  0.13214860931533823
epoch : 12 loss_train :  0.12854301626414305
epoch : 13 loss_train :  0.12535258703700758
epoch : 14 loss_train :  0.12251133102325805
epoch : 15 loss_train :  0.11996637587576697
epoch : 16 loss_train :  0.11767489811103422
epoch : 17 loss_train :  0.1156018670837603
epoch : 18 loss_train :  0.11371836451832515
epoch : 19 loss_train :  0.11200031707085177
epoch : 20 loss_train :  0.1104275292417642
epoch : 21 loss_train :  0.10898293743628386
epoch : 22 loss_train :  0.1076520287701834
epoch : 23 loss_train :  0.1064223839556648
epoch : 24 loss_train :  0.10528331460499925
epoch : 25 loss_train :  0.10422557307632599
epoch : 26 loss_train :  0.10324111856076304
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epoch : 31 loss_train :  0.09919993789873868
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epoch : 39 loss_train :  0.09479651356914011
epoch : 40 loss_train :  0.09436765563537204
epoch : 41 loss_train :  0.09395976150117916
epoch : 42 loss_train :  0.09357144635448619
```

```
epoch : 43 loss_train :  0.09320144248421965
epoch : 44 loss_train :  0.09284858721490069
epoch : 45 loss_train :  0.09251181230072036
epoch : 46 loss_train :  0.09219013457738177
epoch : 47 loss_train :  0.09188264770120697
epoch : 48 loss_train :  0.09158851483089761
epoch : 49 loss_train :  0.09130696212889727
```

In [11]:

```
f_test=(decision_function(X_test,dual_coef,constant,vec))
```

In [53]:

```
p=[]
for i in range(len(X_test)):
    p.append((sigmoid(w,f_test[i],b).tolist()))#calculating probabilities
print("probability of Y=1|X_test ",p,end=' ')
```

```
probability of Y=1|X_test  [[0.002005329813450103], [0.007631094319239649], [0.0282553288
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