8A_SVM_LR_Assignment

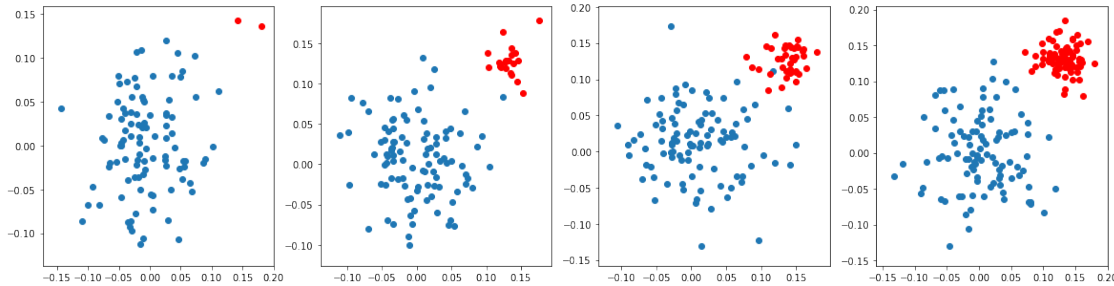
June 12, 2020

[1]:
```
import numpy as np
import matplotlib.pyplot as plt
from sklearn.linear_model import SGDClassifier
from sklearn.linear_model import LogisticRegression
import pandas as pd
import numpy as np
from sklearn.preprocessing import StandardScaler, Normalizer
import matplotlib.pyplot as plt
from sklearn.svm import SVC
import warnings
warnings.filterwarnings("ignore")
```

[2]:
```
def draw_line(coef,intercept, mi, ma):
    # for the separating hyper plane ax+by+c=0, the weights are [a, b] and the␣
↪intercept is c
    # to draw the hyper plane we are creating two points
    # 1. ((b*min-c)/a, min) i.e ax+by+c=0 ==> ax = (-by-c) ==> x = (-by-c)/a␣
↪here in place of y we are keeping the minimum value of y
    # 2. ((b*max-c)/a, max) i.e ax+by+c=0 ==> ax = (-by-c) ==> x = (-by-c)/a␣
↪here in place of y we are keeping the maximum value of y
    points=np.array([[((-coef[1]*mi - intercept)/coef[0]), mi],[((-coef[1]*ma -␣
↪intercept)/coef[0]), ma]])
    plt.plot(points[:,0], points[:,1])
```

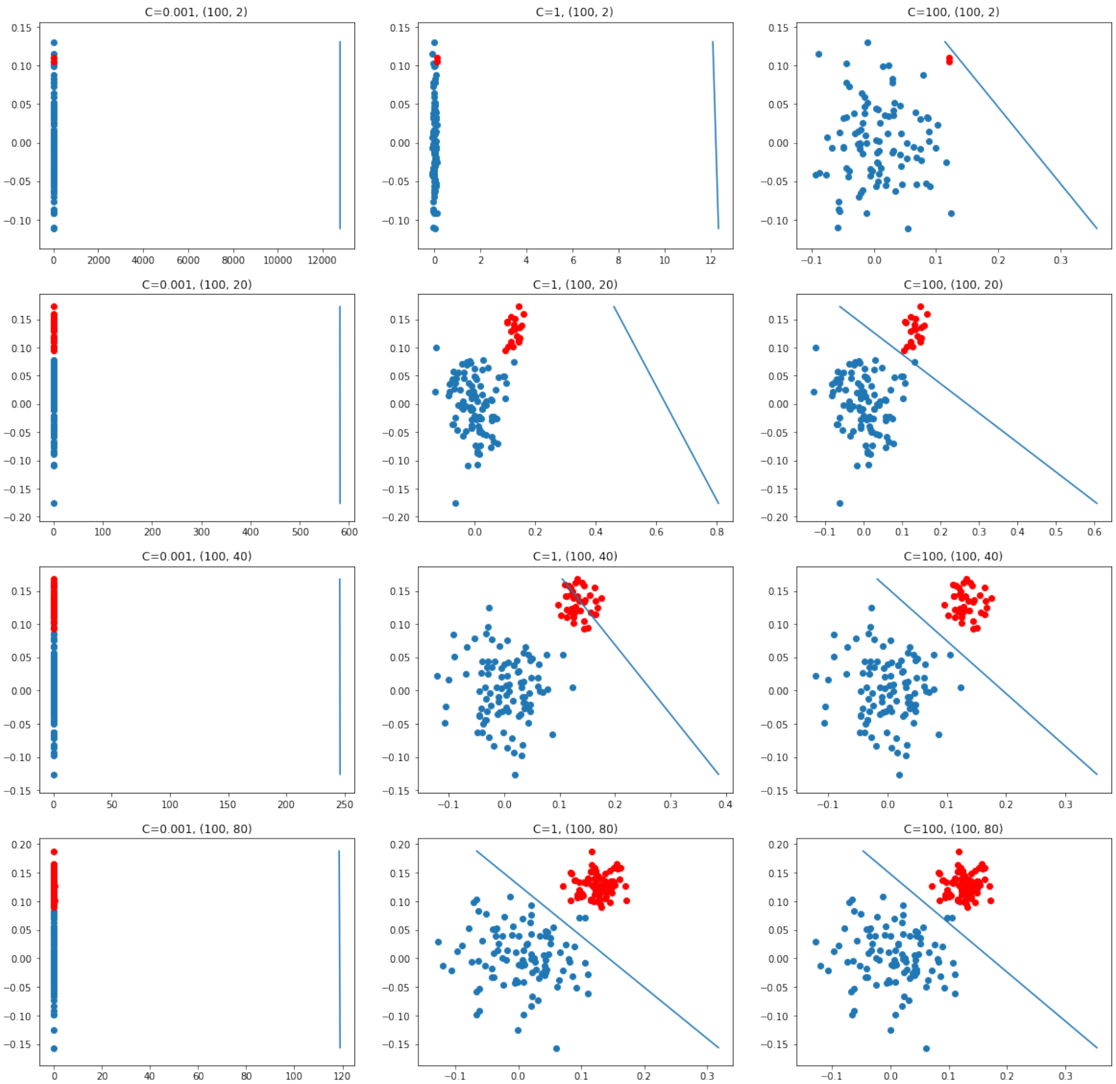
[3]:
```
# here we are creating 2d imbalanced data points
ratios = [(100,2), (100, 20), (100, 40), (100, 80)]
plt.figure(figsize=(20,5))
for j,i in enumerate(ratios):
    plt.subplot(1,4, j+1)
    X_p=np.random.normal(0,0.05,size=(i[0],2))
    X_n=np.random.normal(0.13,0.02,size=(i[1],2))
    y_p=np.array([1]*i[0]).reshape(-1,1)
    y_n=np.array([0]*i[1]).reshape(-1,1)
    X=np.vstack((X_p,X_n))
    y=np.vstack((y_p,y_n))
    plt.scatter(X_p[:,0],X_p[:,1])
    plt.scatter(X_n[:,0],X_n[:,1],color='red')
```

```
plt.show()
```



0.1 Task 1: Applying SVM

[4]:
```
ratios = [(100,2), (100, 20), (100, 40), (100, 80)]
c=[0.001,1,100]
plt.figure(figsize=(20,20))
grid=1
for j,i in enumerate(ratios):
    X_p=np.random.normal(0,0.05,size=(i[0],2))
    X_n=np.random.normal(0.13,0.02,size=(i[1],2))
    y_p=np.array([1]*i[0]).reshape(-1,1)
    y_n=np.array([0]*i[1]).reshape(-1,1)
    X=np.vstack((X_p,X_n))
    y=np.vstack((y_p,y_n))
    for k in range(3):
        plt.subplot(4,3,grid)
        grid+=1
        clf=SVC(C=c[k],gamma='auto',kernel='linear')
        clf.fit(X,y)
        coeff=clf.coef_
        intercept=clf.intercept_
        mi=np.min(X[:,1])
        ma=np.max(X[:,1])
        plt.scatter(X_p[:,0],X_p[:,1])
        plt.scatter(X_n[:,0],X_n[:,1],color='red')
        draw_line(coeff[0],intercept,mi,ma)
        plt.title('C='+str(c[k])+', '+str(i))
plt.show()
```

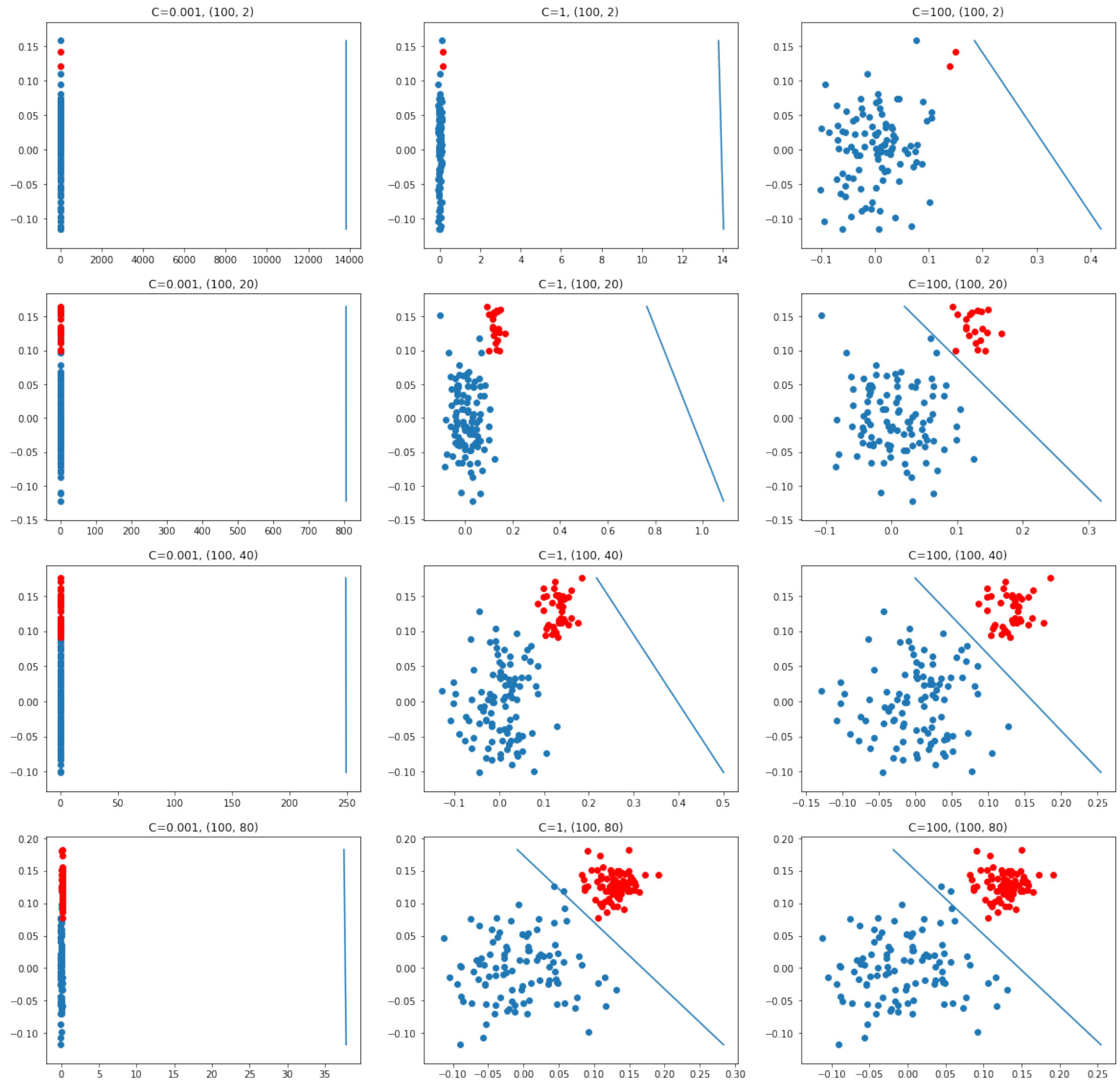


Observations:

1.when c is very small(0.001), the model(SVM) is unable to classify the data we can see that the hyper plane postion is far away from the data points data is balanced or imbalaned doesnot matter when c is very small. 2.when c=1 in case of data is imbalanced(100,2), the hyper plane is far away from datapoints we cannot classfiy the data which is imbalanced as the data balancing factor is increasing we can see hyper plane moving towards the datapoints in case of (100,40) imbalanced data, we can see hyper plane start moving towards the datapoints also same in case of dataset is almost balanced in last case(100,80), we can see model is classfiying but with few erros model seems to worked when data is balanced. 3.when c=100 we can see that model is not classfiying perfectly if c value is very high we will get smaller margins so either data is balanced or imbalanced, there is a high chance for misclassfication rate.

0.2 Task 2: Applying LR

[5]:
```
#you can start writing code here.
ratios = [(100,2), (100, 20), (100, 40), (100, 80)]
c=[0.001,1,100]
plt.figure(figsize=(20,20))
grid=1
for j,i in enumerate(ratios):
    X_p=np.random.normal(0,0.05,size=(i[0],2))
    X_n=np.random.normal(0.13,0.02,size=(i[1],2))
    y_p=np.array([1]*i[0]).reshape(-1,1)
    y_n=np.array([0]*i[1]).reshape(-1,1)
    X=np.vstack((X_p,X_n))
    y=np.vstack((y_p,y_n))
    for k in range(3):
        plt.subplot(4,3,grid)
        grid+=1
        clf = LogisticRegression(C=c[k])
        clf.fit(X,y)
        coeff=clf.coef_
        intercept=clf.intercept_
        mi=np.min(X[:,1])
        ma=np.max(X[:,1])
        plt.scatter(X_p[:,0],X_p[:,1])
        plt.scatter(X_n[:,0],X_n[:,1],color='red')
        draw_line(coeff[0],intercept,mi,ma)
        plt.title('C='+str(c[k])+', '+str(i))
plt.show()
```



Observations:

1.when c is very small(0.001), the model(Logistic regression) is unable to classify the data we can see that the decision boundary postion is far away from the data points data is balanced or imbalaned doesnot matter when c is very small. 2.when c=1 in case of data is imbalanced(100,2),(100,20),the decision boundary is far away from datapoints we cannot classfiy the datasets which is imbalanced (100,40) as the data balancing factor is increasing we can see decision boundary is moving towards the datapoints dataset is almost balanced in last case(100,80), we can see model is classfiying with few erros model seems to worked when data is balanced. 3.when c=100 in case of imbalanced data (100,2),the model is unable to classfiy the data in the next cases(2,3,4),we can see that model is not classfiying the data perfectly if c value is very high, model will not classfiy the data perfectly so either data is balanced or imbalanced, there is a high chance for misclassfication rate.

[ ]:

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