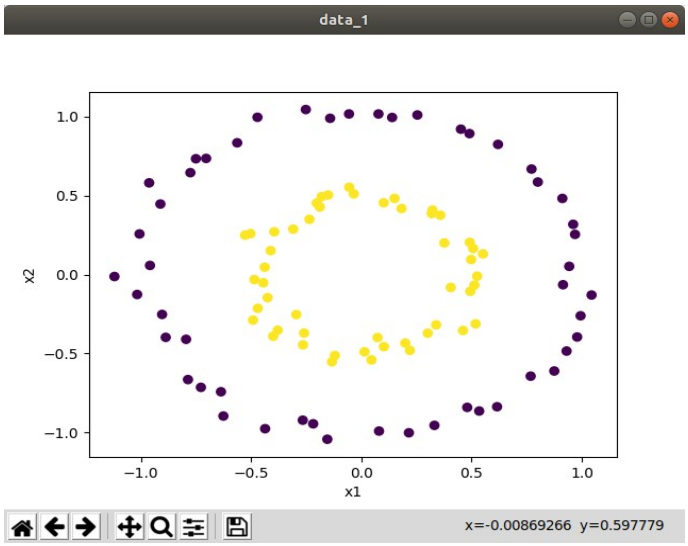
Report

1.

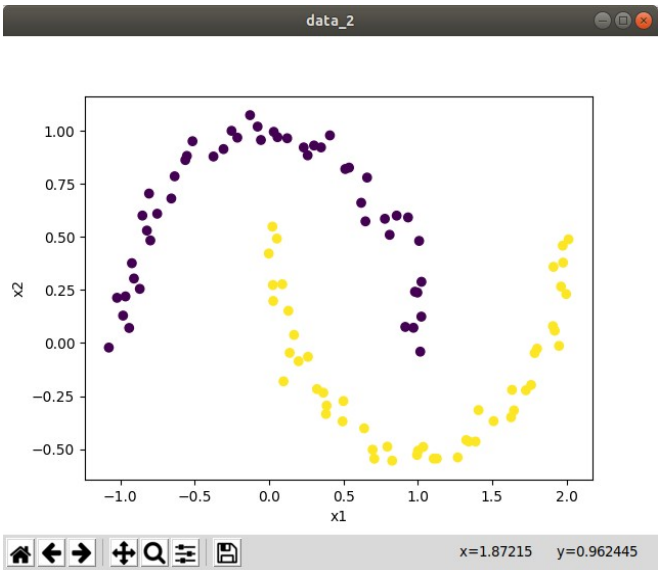
i. Dataset Analysis and plotting:

data_1:



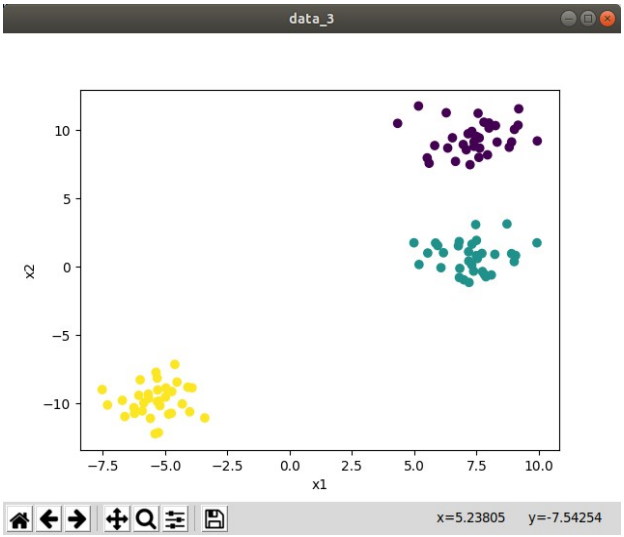
Balance: Yes
Number of samples: 100
Dimension: 2 dimensions
Separability: Non-Linear
Noise: No
Classes: {0,1}

data_2:



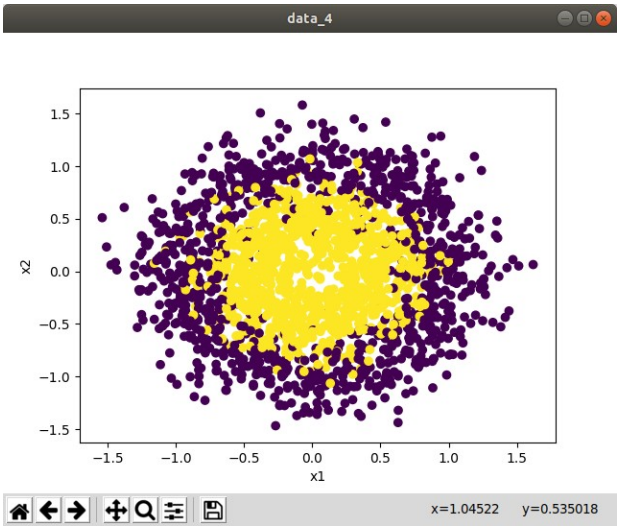
Balance:Yes
Number of samples:100
Dimension: 2 dimensions
Separability: Non Linear
Noise: No
Classes: {0,1}

data_3:



Balance:No
Number of samples:100
Dimension: 2 dimensions
Separability: Linear
Noise: No
Classes: {0,1,2}

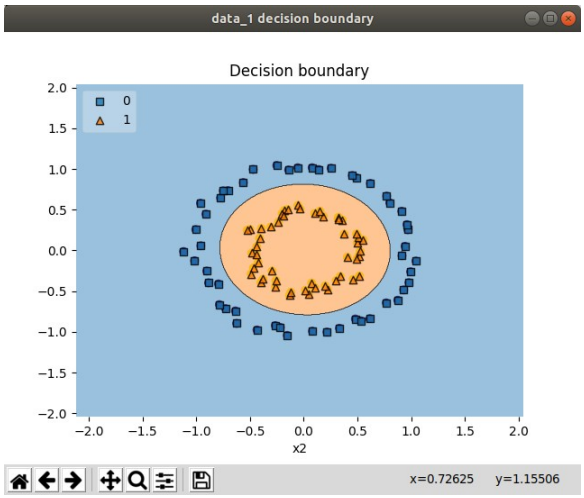
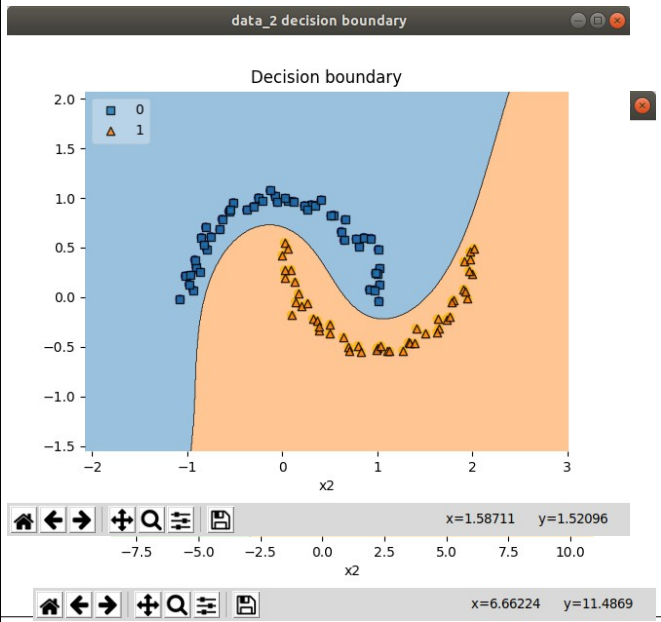
data_4:

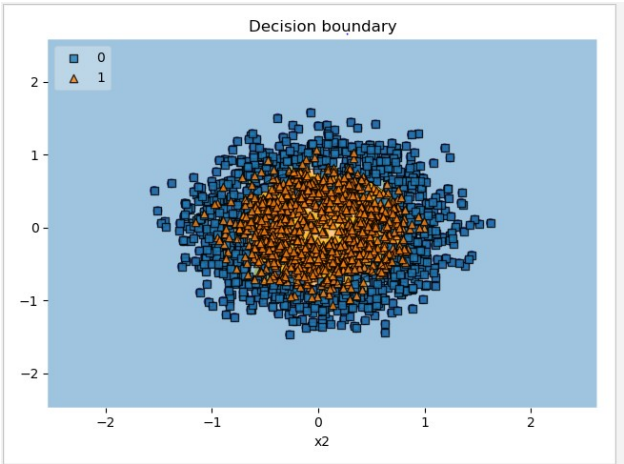


Balance:Yes
Number of samples:2000
Dimension: 2 dimensions
Separability: Non Linear
Noise: Yes
Classes: {0,1}

ii. <u>SVM Decision boundaries for Datasets</u>:

By observing the dataset, I chose following kernel and implemented by taking appropriate parameters(constant , degree)

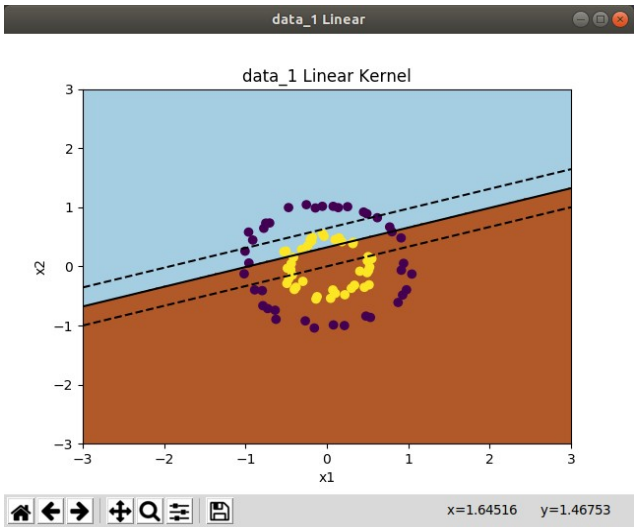
Dataset	Custom Kernel	Decision Boundary
Data_1	Polynomial (c=1,degree=2)	
data_2	Polynomial (c=1,degree=3)	
data_3	Linear	

data_4	Polynomial (c=1, degree=2)	

Used Custom Polynomial kernel: np.power((c+np.dot(x,y.T)),d)

iii. SVM with Linear Kernel:

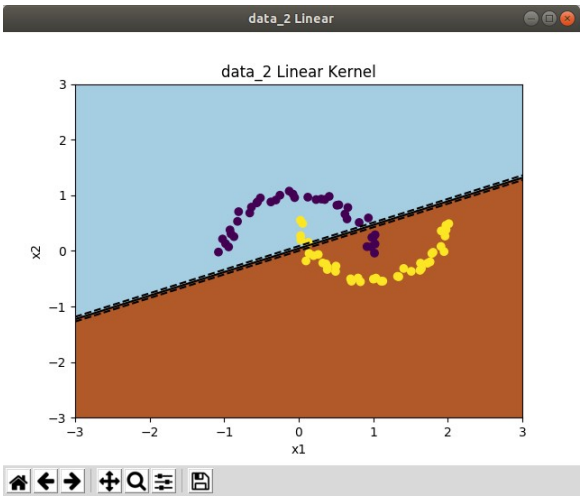
data_1:



F1-Score: 0.56
Accuracy:0.45
bias(b) : 0.38793275

Confusion matrix:
TP: 2 FP: 9
TN:2 TN: 7

data_2:

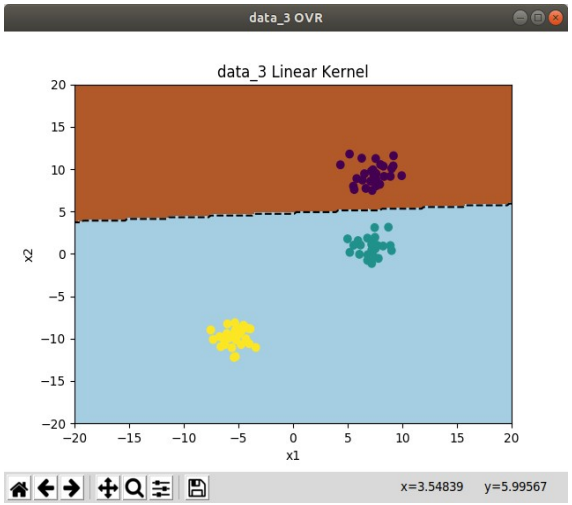


F1-Score: 0.8750000000000001
Accuracy:0.9
bias(b) : 0.08580343

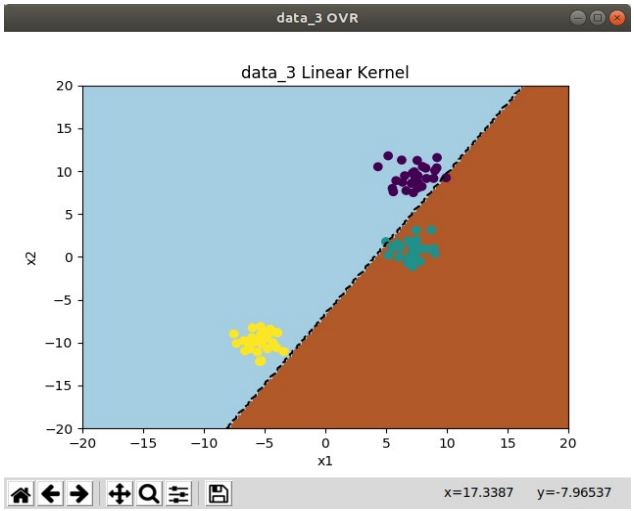
Confusion matrix:
TP: 11 FP: 0
TN:2 TN: 7

data_3 OVR:

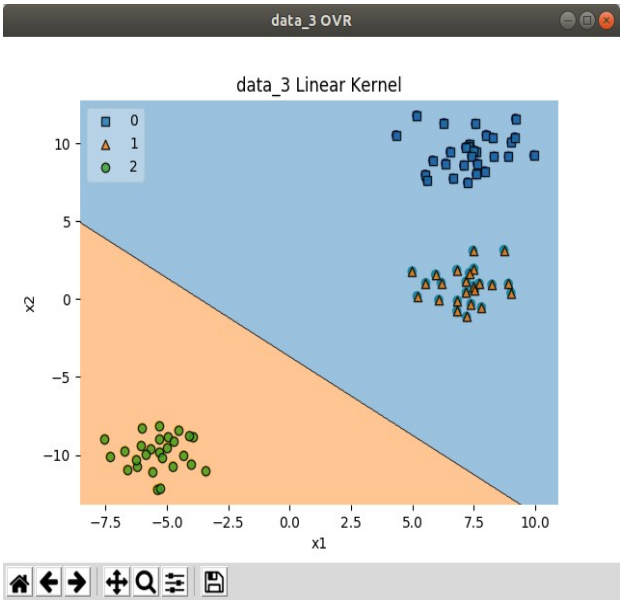
Accuracy for all individual plotting are 1.0



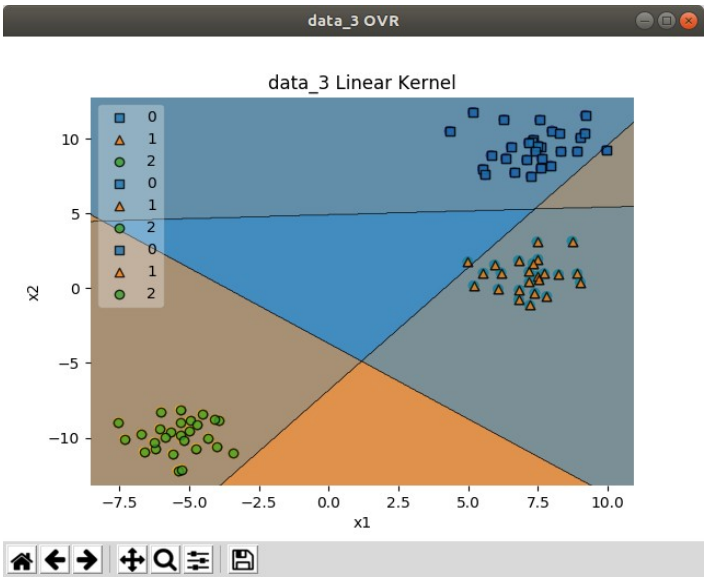
class 0 vs rest:
bias: -2.23721209
Confusion3:
[[15 0]
[0 5]]



class 1 vs Rest:
bias: -5.01318078
confusion3:
[[11 0]
[0 9]]

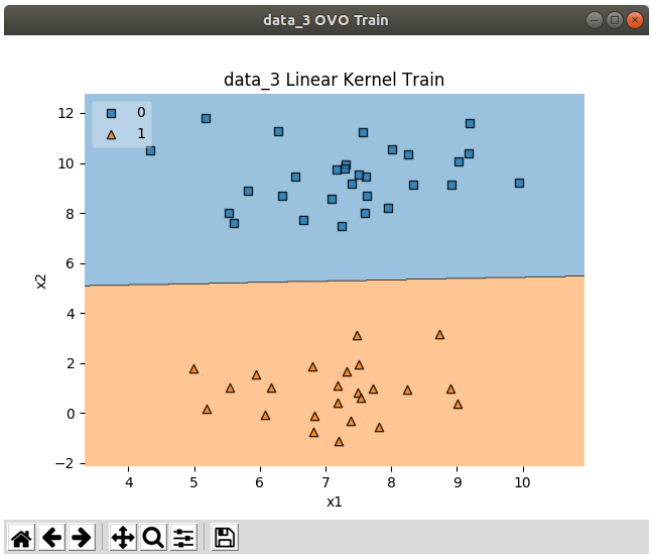


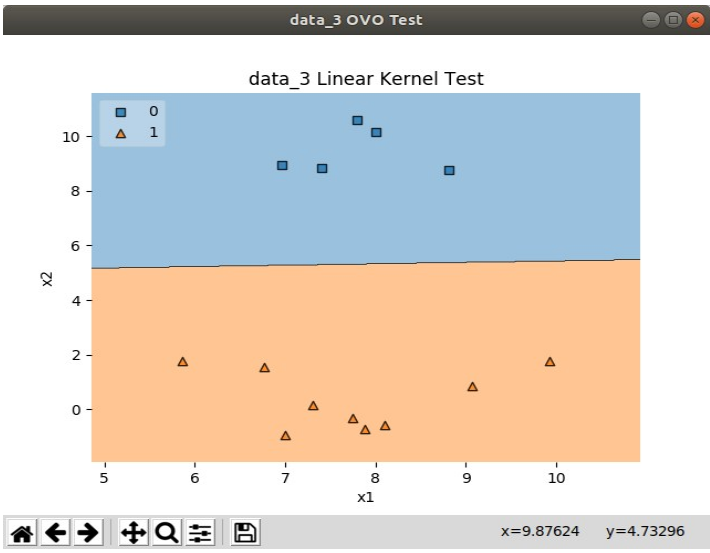
bias : -0.40477513
confusion3:
[[14 0]
[0 6]]



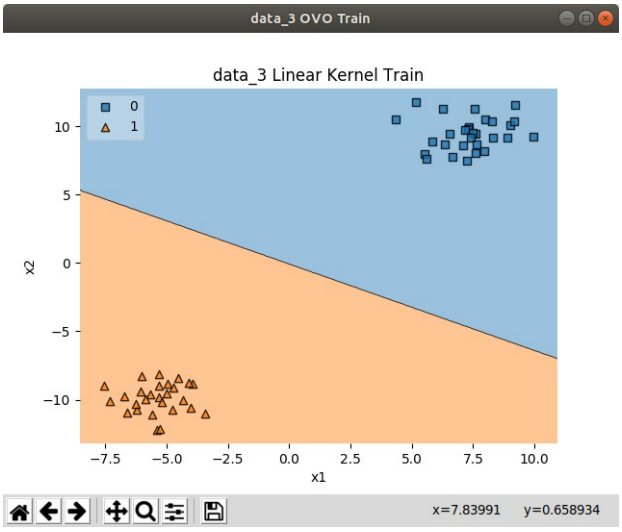
data_3 OVO:
Accuracy for all individual plotting are 1.0

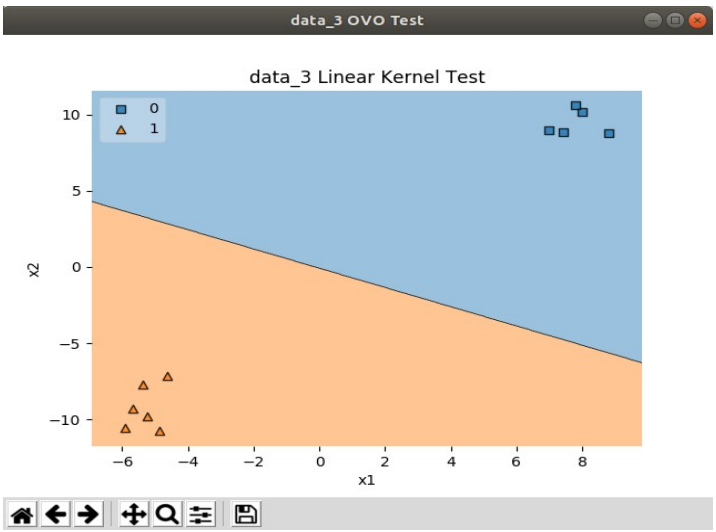
class 0 vs 1 Train and Test
bias : 2.23721216



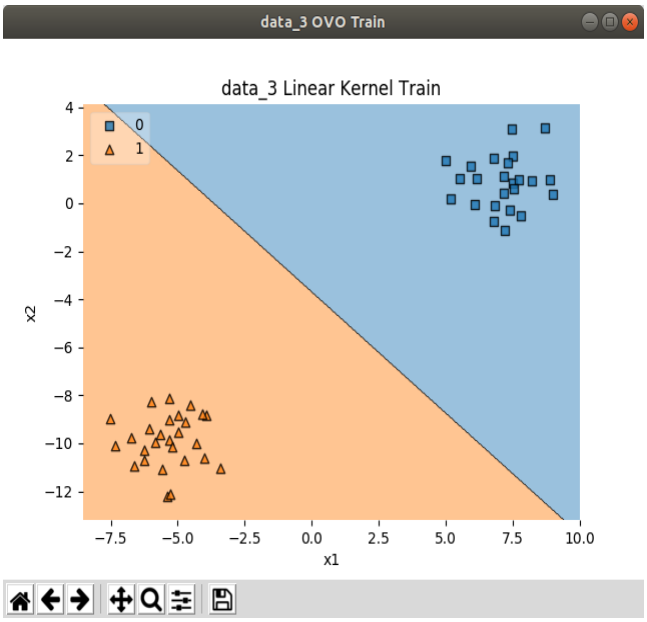


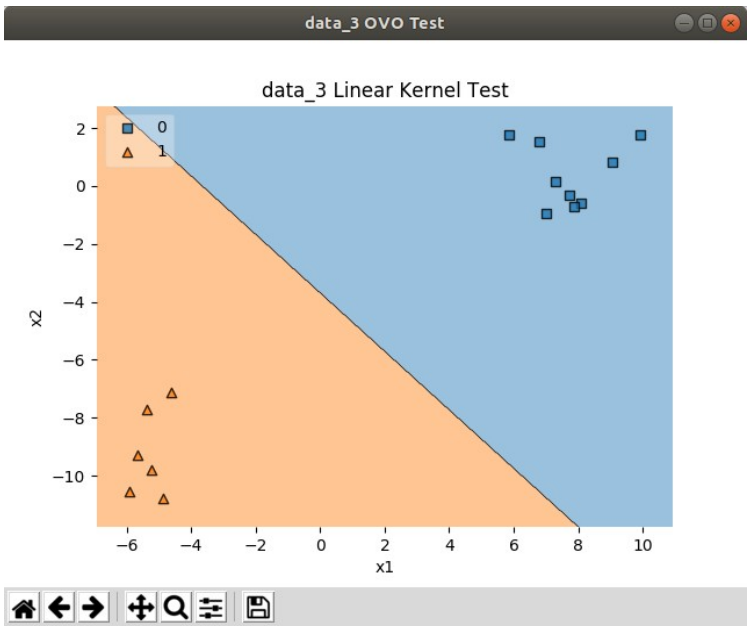
class 0 vs 2 Train and Test:
bias : -0.00693931



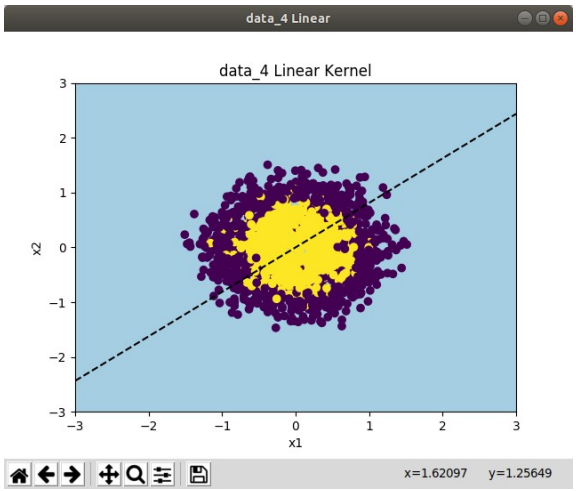


class 1 vs 2 Train and Test:
bias : -0.40477513





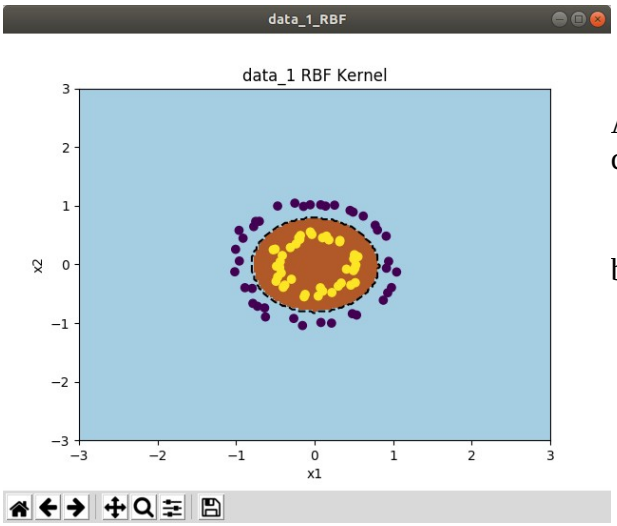
data_4:



Accuracy for test: 0.4625
confusion4:
[[0 11]
[0 9]]
bias4: [0.99993001]

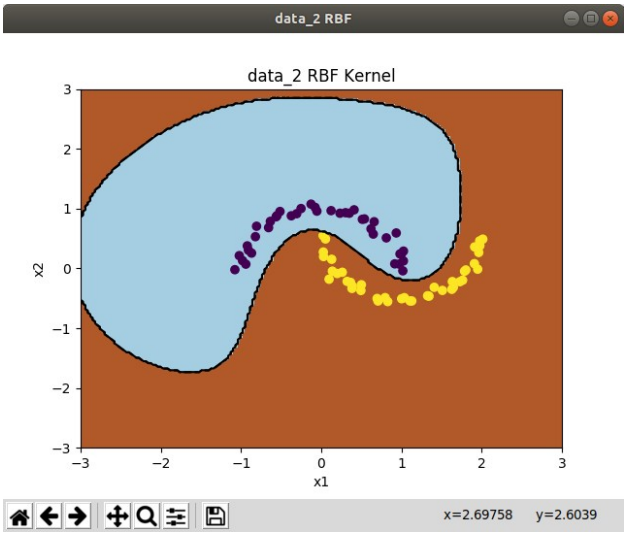
iv. <u>SVM with RBF Kernel:</u>

data_1:



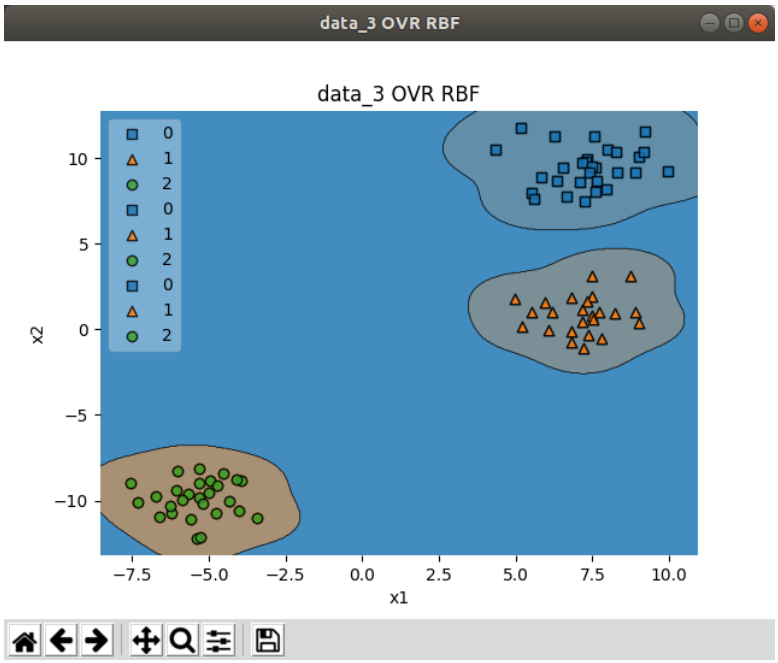
Accuracy for test: 1.0
confusion1:
[[11 0]
[0 9]]
bias1: [-2.6212776]

data_2:



f1 Score: 0.9411764705882353
Accuracy for test: 1.0
confusion2:
[[11 0]
[0 9]]
bias2: [0.11650227]

data_3 OVR:



class 0 vs Rest:

F1 : 1.0

bias3: [-0.22586886]

class 1 vs Rest:

F1: 1.0

intercept 3: [-0.38168894]

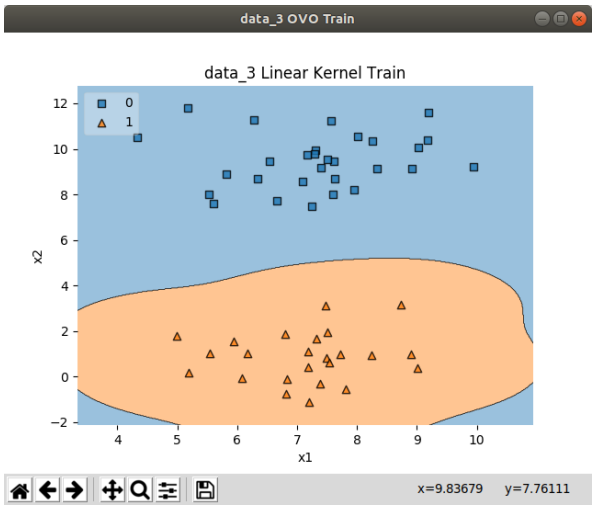
class 2 vs Rest:

F1: 1.0

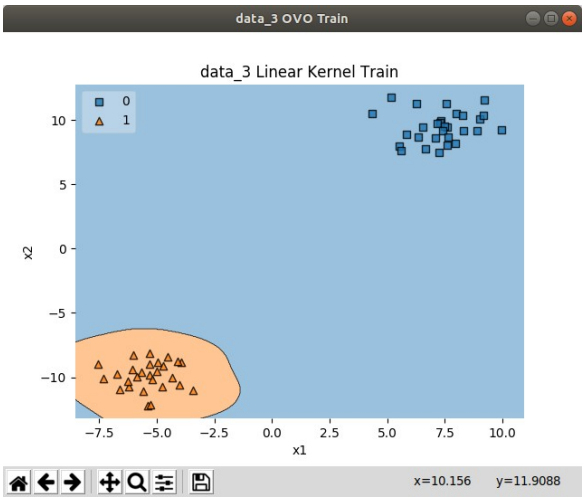
bias3: [-0.40387025]

data_3 OVO:

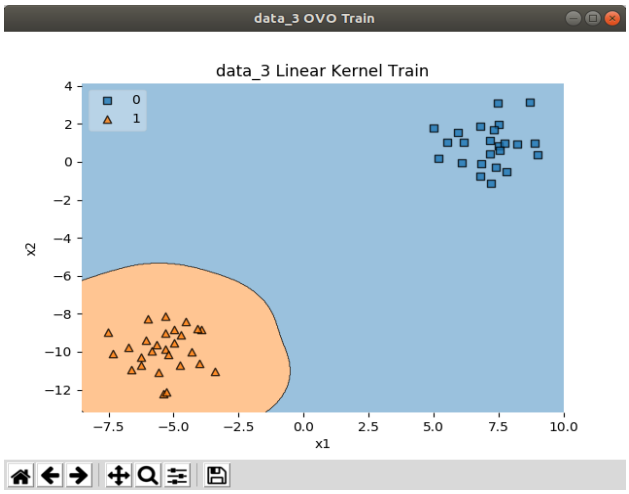
class 0 vs 1:



class 0 vs 2:



class 1 vs 2:



class 0 vs 1:

F1 : 1.0

intercept 3: [-0.11057571]

class 0 vs 2:

F1 1.0

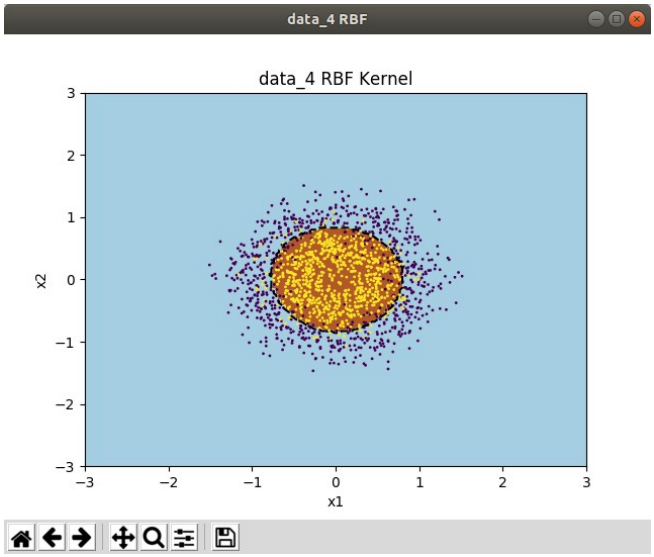
intercept 3: [-0.12318428]

class 1 vs 2:

F1: 1.0

intercept 3: [-0.012874]

data_4:



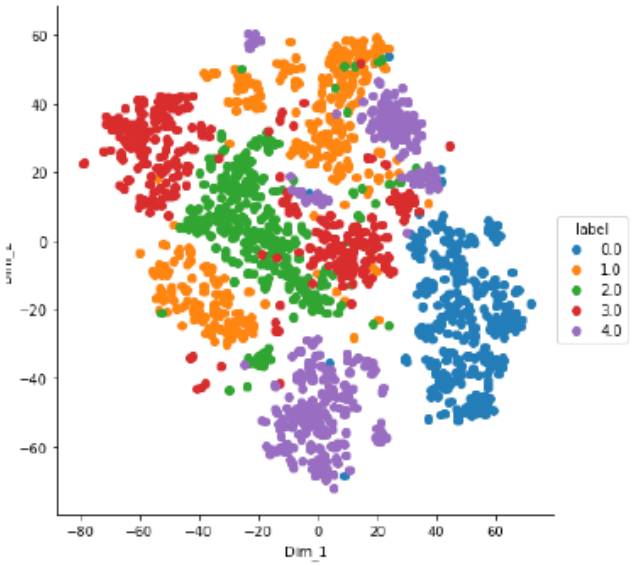
F1 score: 0.8475452196382429
Accuracy for test: 0.8525
confusion matrix:
[[9 2]
[0 9]]
bias: [-4.18883444]

v. <u>Hindi Handwritten Characters using RBF:</u>

In this, there are 5 hindi characters. So, I labelled them as classes from 0 to 4.

Initially loaded the data images and vectorized them and then trained on SVM using RBF Kernel.

T-SNE:



here I used cross validation=2

Validation error in fold:1: 0.85
Validation error in fold2:0.86