Neural Network and Deep Learning

Task 1

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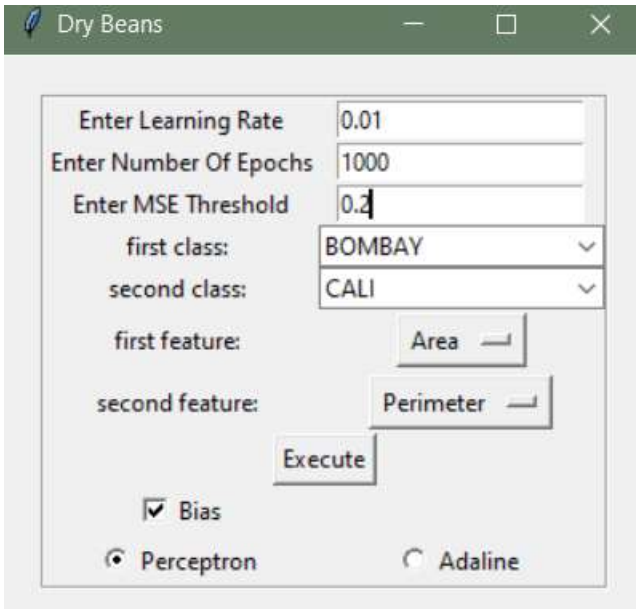
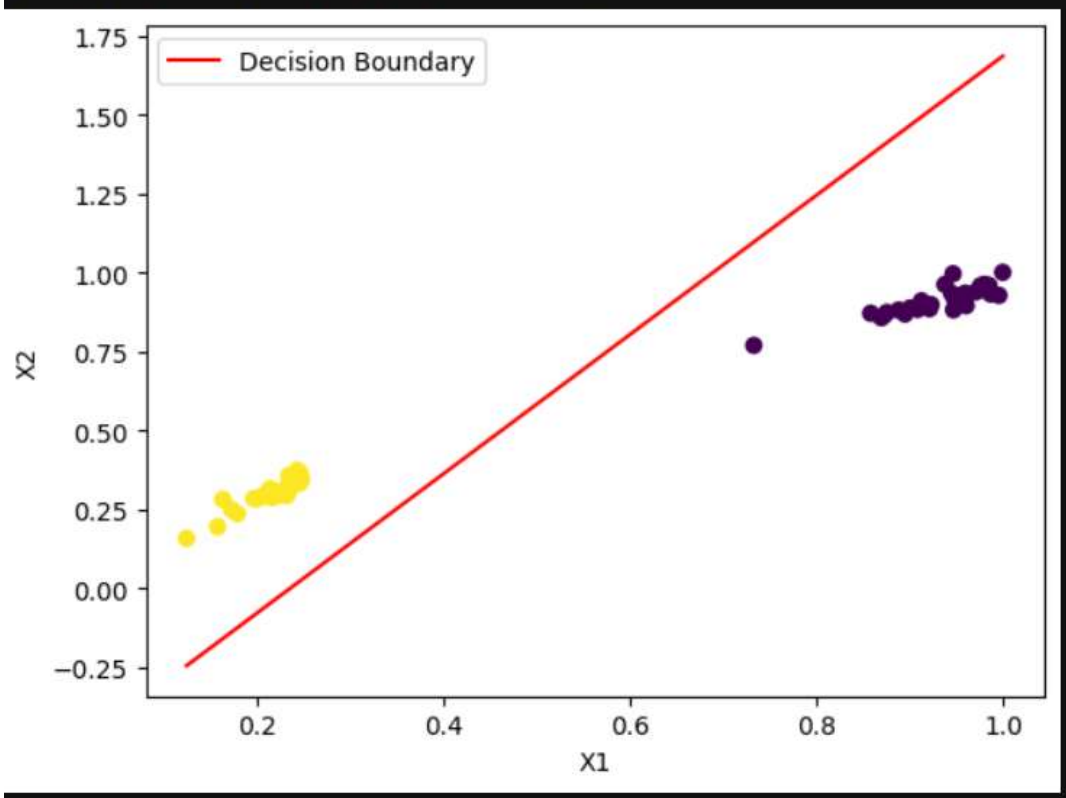
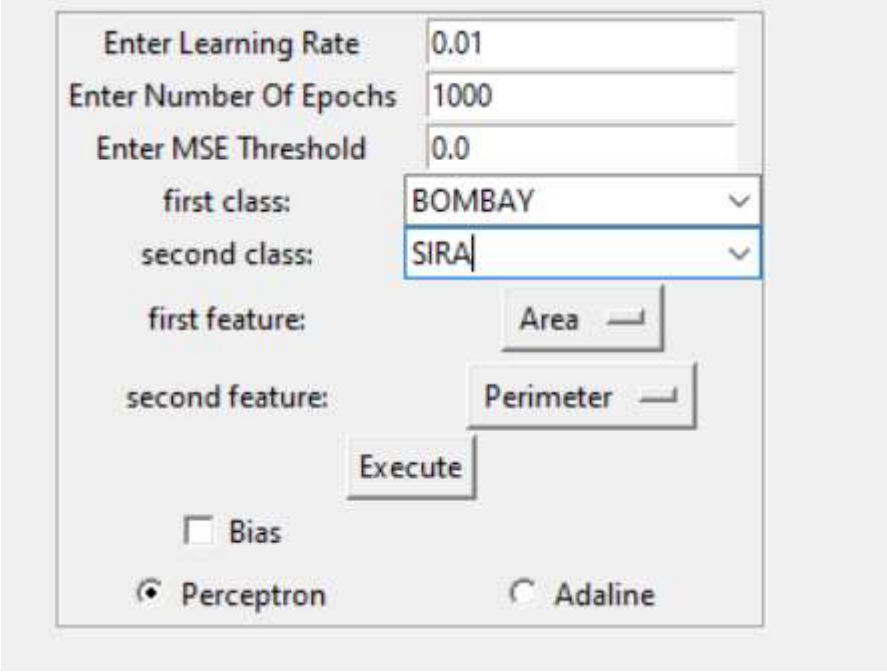
The following snippets show the overall accuracy using random combinations of features and classes

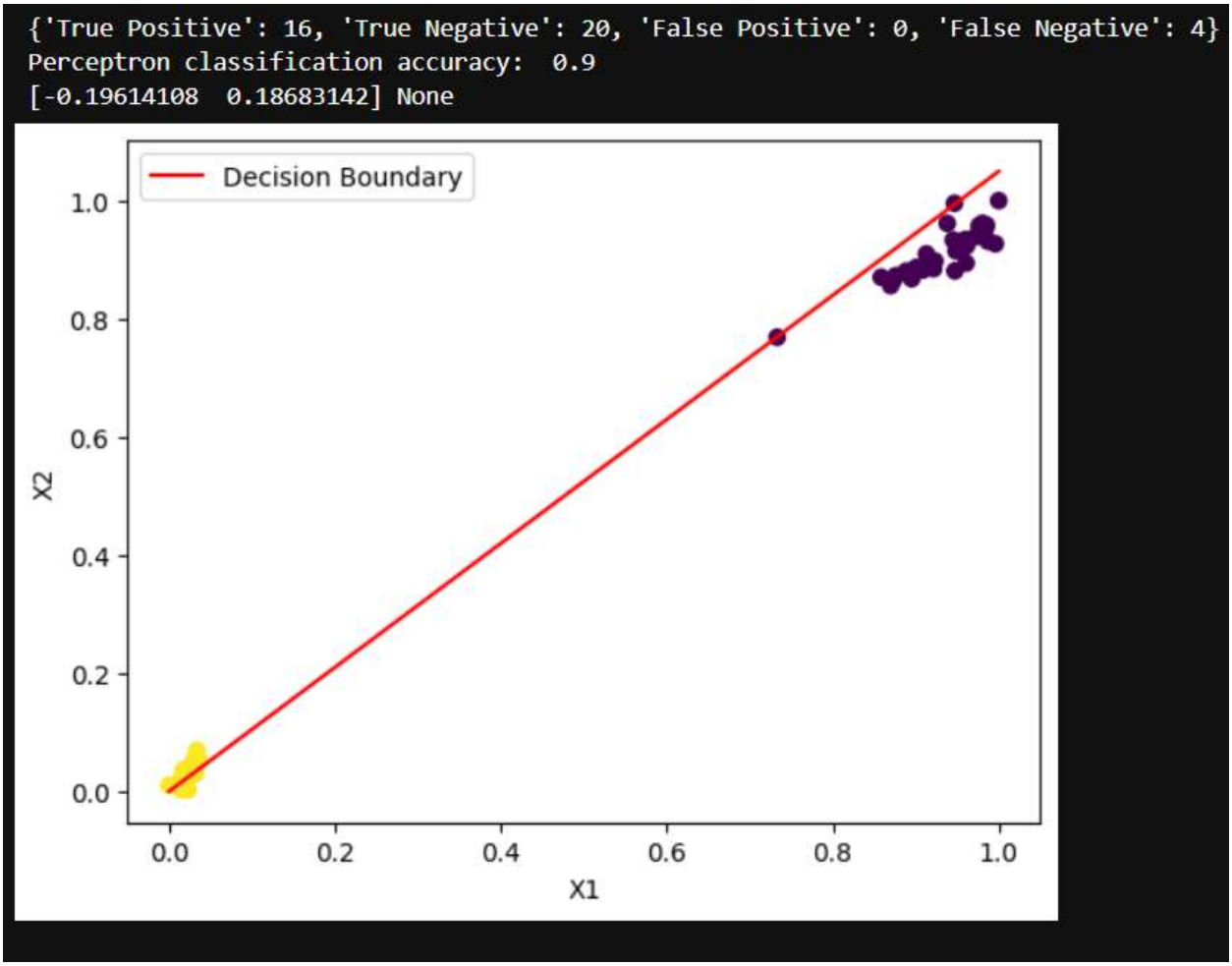
1.Perceptron Algorithm:

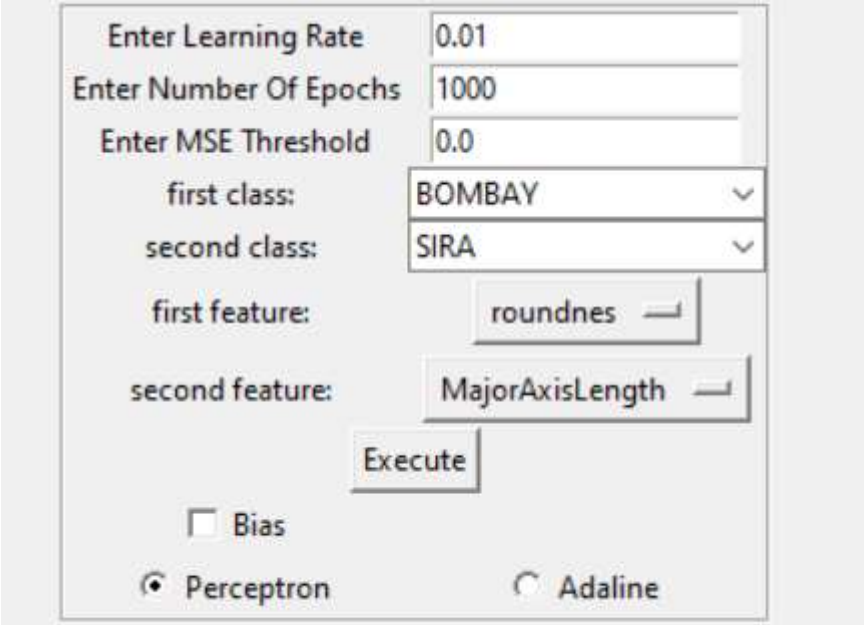


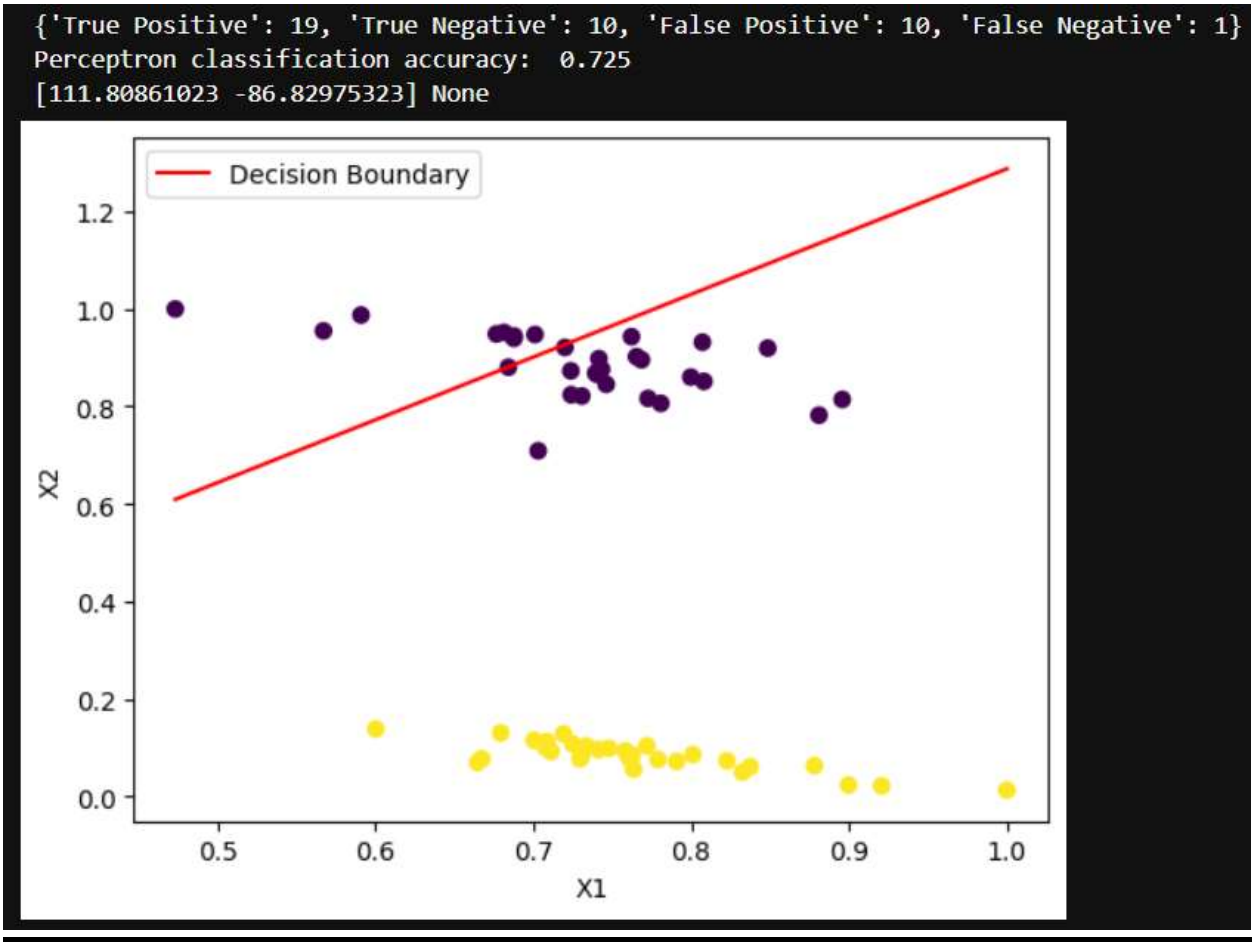

```
{'True Positive': 20, 'True Negative': 20, 'False Positive': 0, 'False Negative': 0}
Perceptron classification accuracy:  1.0
[-0.0848838   0.03850803] 0.019999999999999997
```

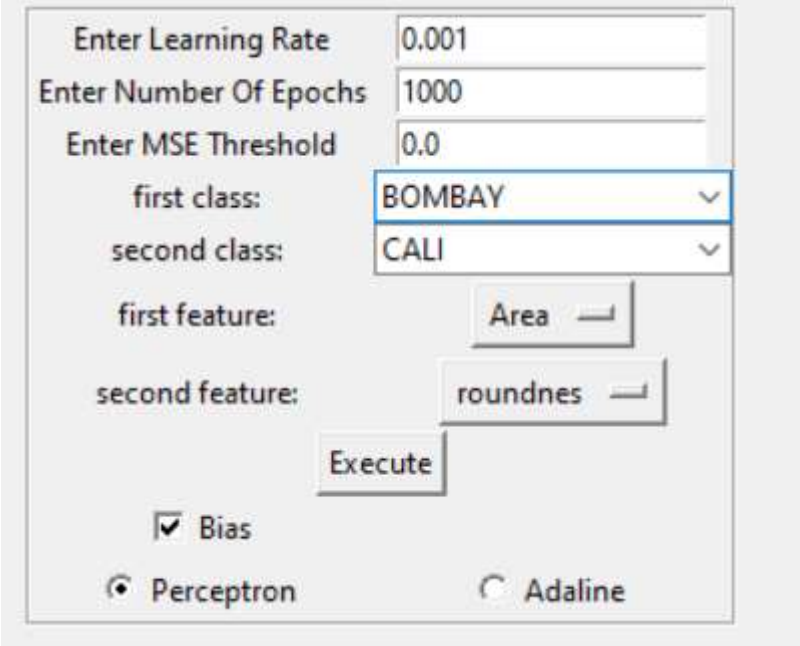



Enter Learning Rate
0.01
Enter Number Of Epochs
1000
Enter MSE Threshold
0.0
first class:
BOMBAY
second class:
SIRA
first feature:
Area
second feature:
Perimeter
Execute
Bias
Perceptron
Adaline

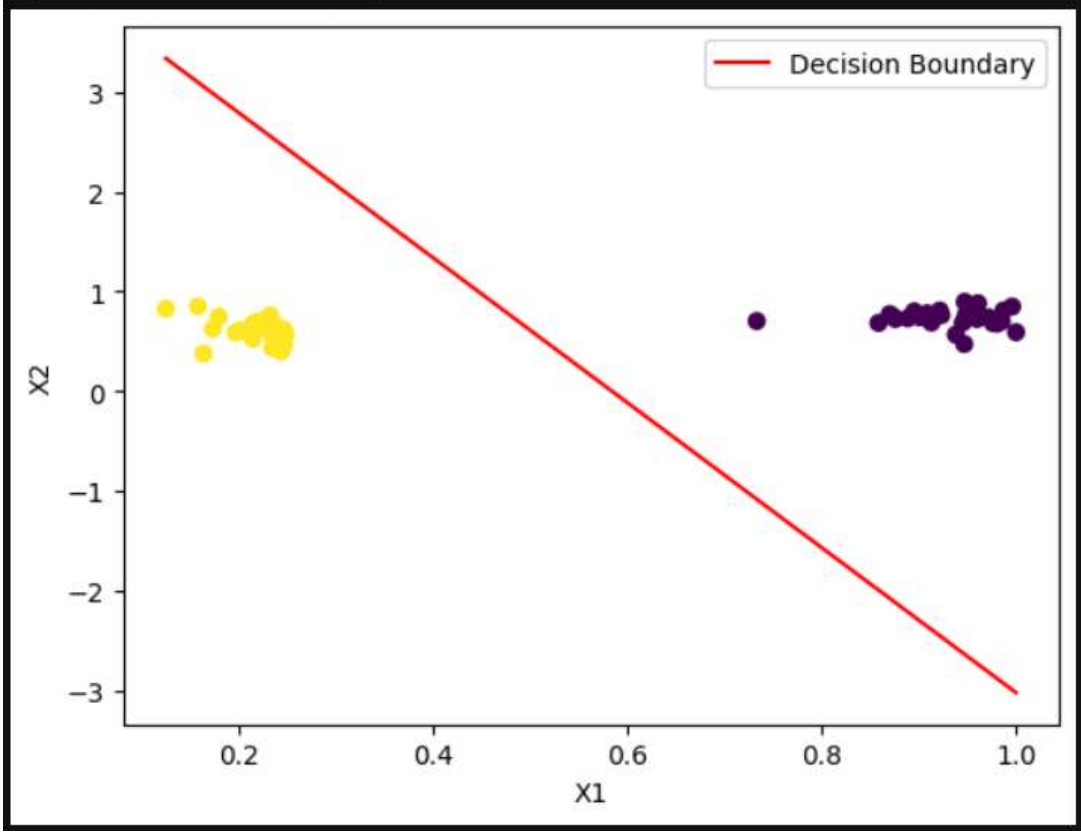

{'True Positive': 16, 'True Negative': 20, 'False Positive': 0, 'False Negative': 4}
Perceptron classification accuracy: 0.9
[-0.19614108 0.18683142] None
Decision Boundary
1.0
0.8
0.6
0.4
0.2
0.0
X2
0.0
0.2
0.4
0.6
0.8
1.0
X1

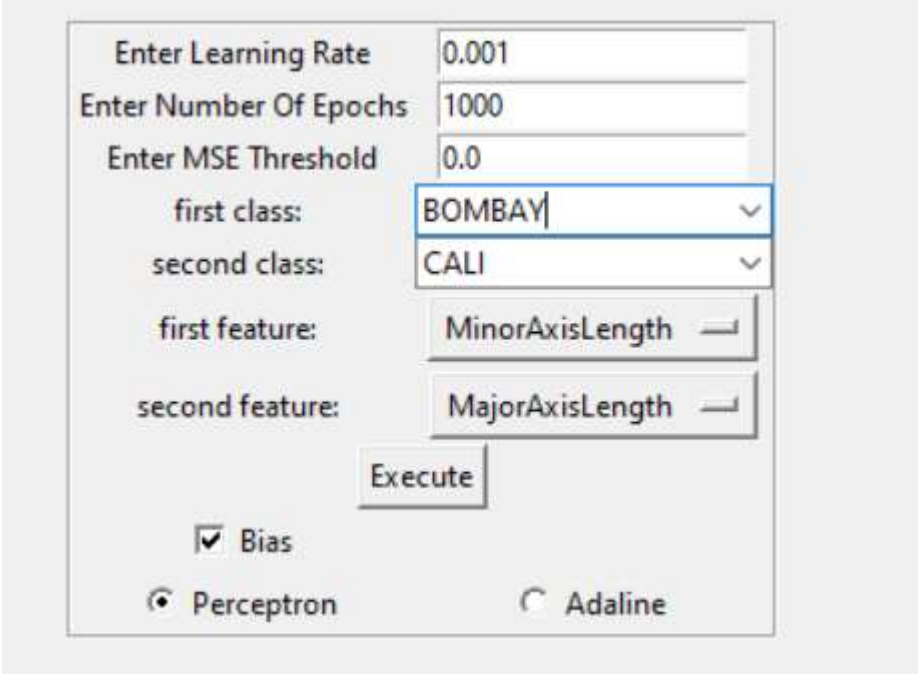

Enter Learning Rate
0.01
Enter Number Of Epochs
1000
Enter MSE Threshold
0.0
first class:
BOMBAY
second class:
SIRA
first feature:
roundnes
second feature:
MajorAxisLength
Execute
Bias
Perceptron
Adaline


{'True Positive': 19, 'True Negative': 10, 'False Positive': 10, 'False Negative': 1}
Perceptron classification accuracy: 0.725
[111.80861023 -86.82975323] None
Decision Boundary
1.2
1.0
0.8
0.6
0.4
0.2
0.0
X2
0.5
0.6
0.7
0.8
0.9
1.0
X1

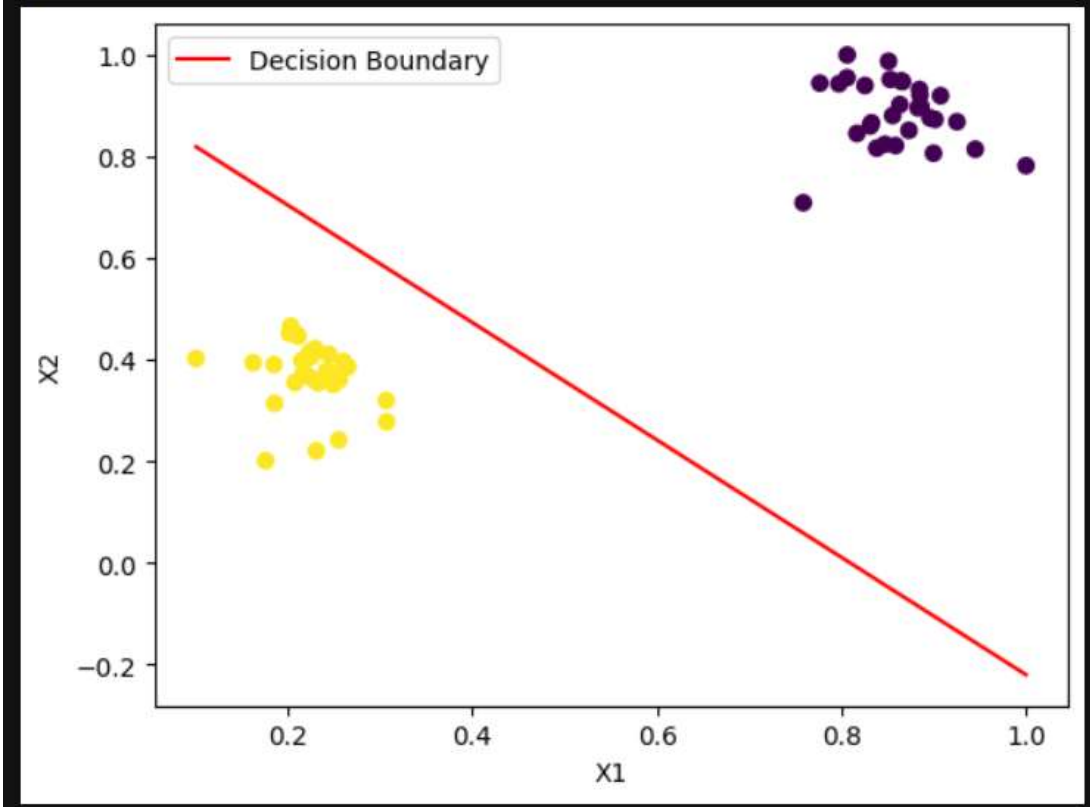



```
{'True Positive': 20, 'True Negative': 20, 'False Positive': 0, 'False Negative': 0}
Perceptron classification accuracy:  1.0
[-0.00342614 -0.00047194] 0.002
```

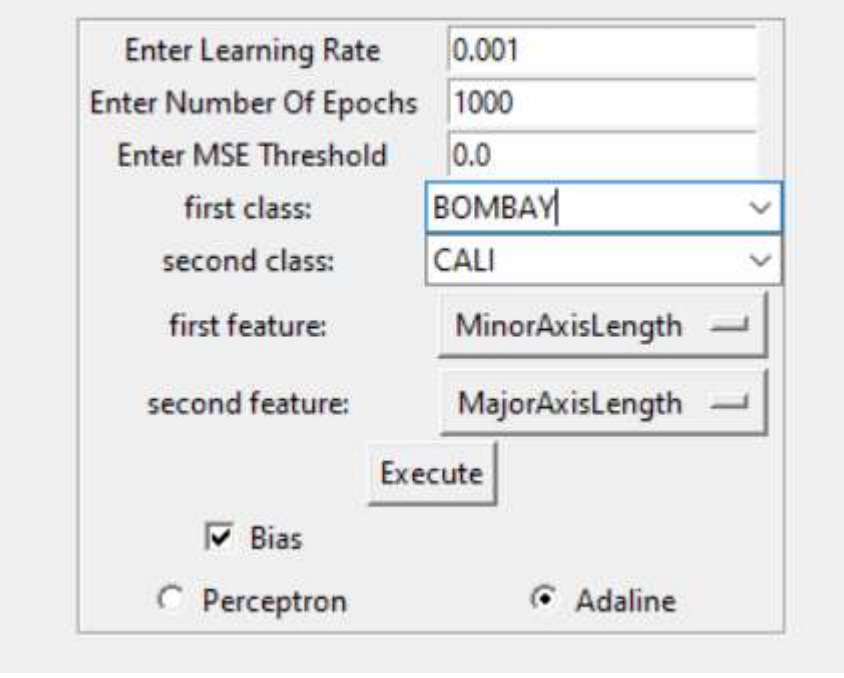


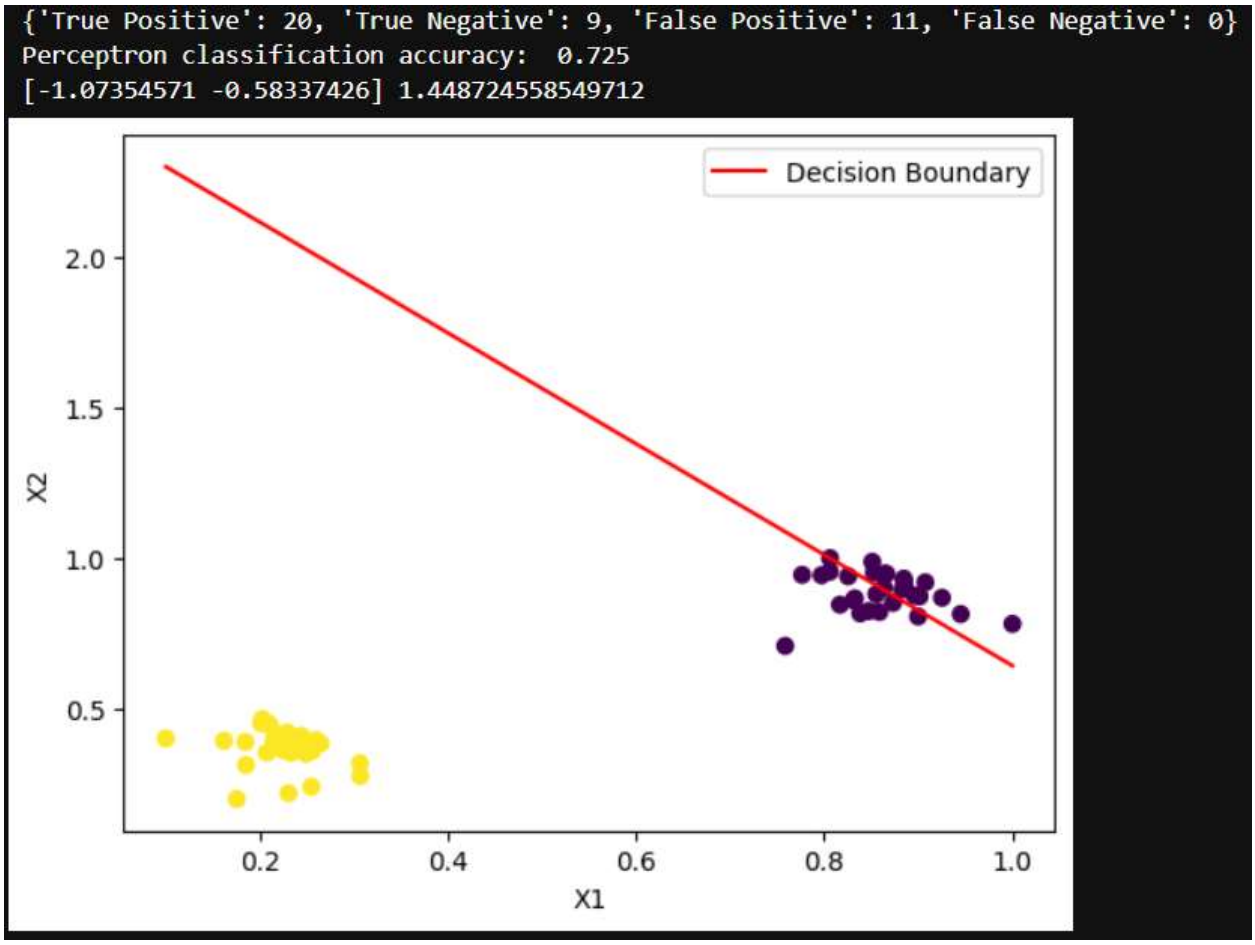


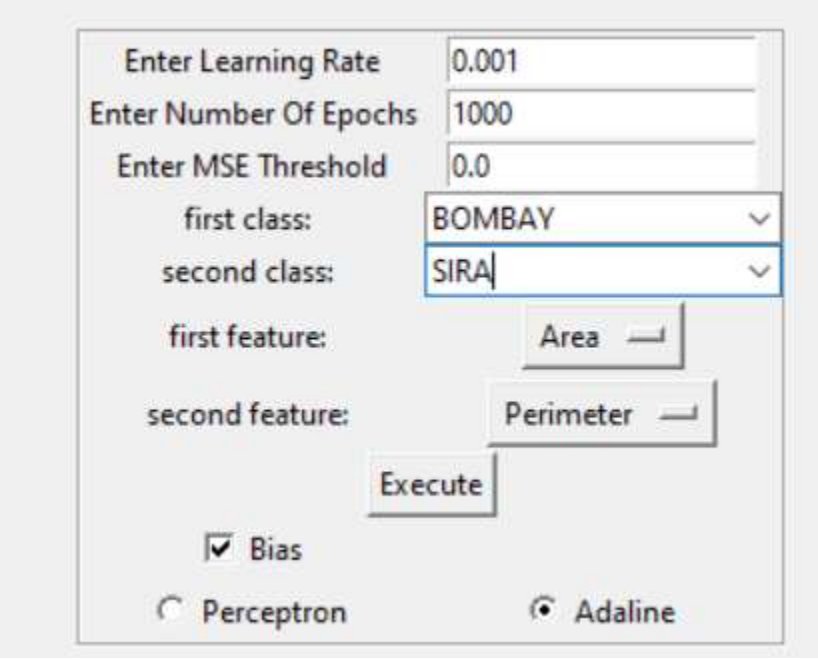

```
{'True Positive': 20, 'True Negative': 20, 'False Positive': 0, 'False Negative': 0}
Perceptron classification accuracy:  1.0
[-0.00247156 -0.00213783] 0.002
```



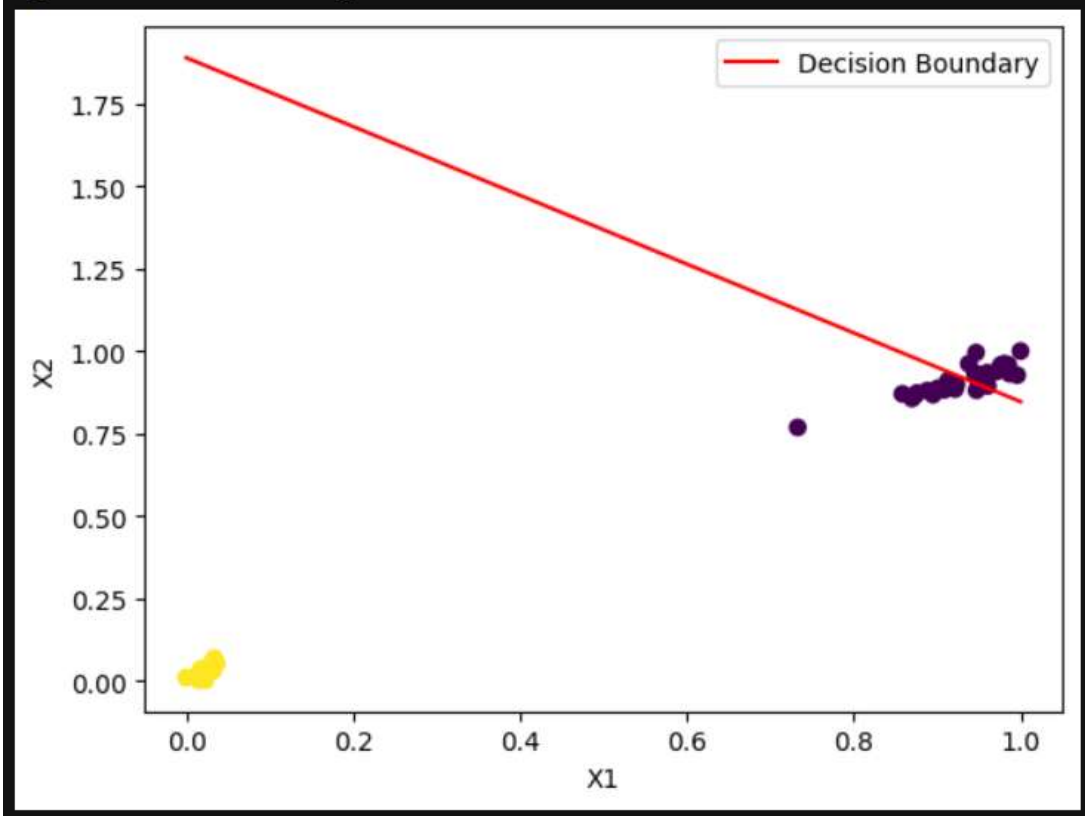
2. Adaline Algorithm:

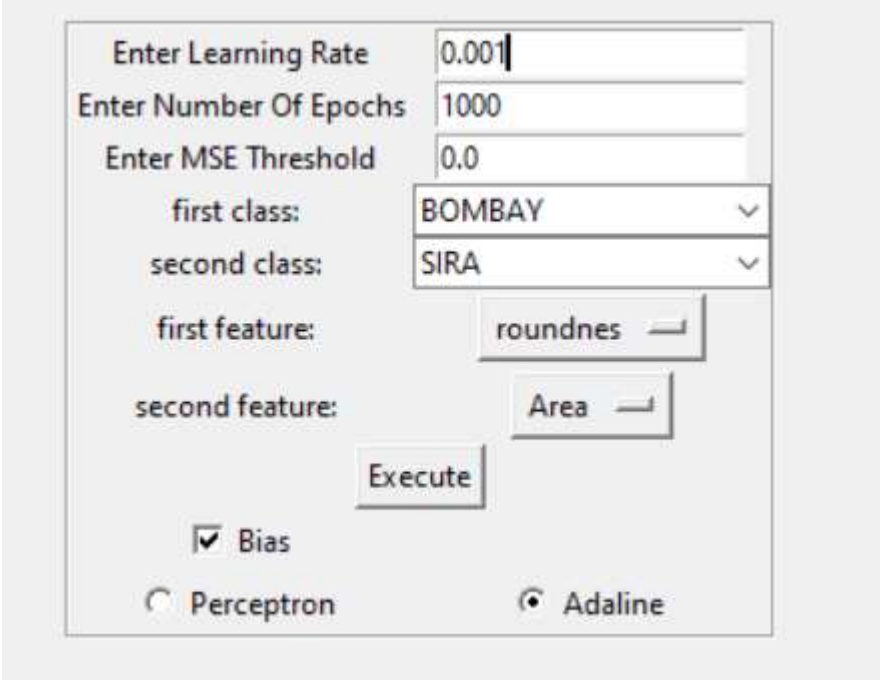




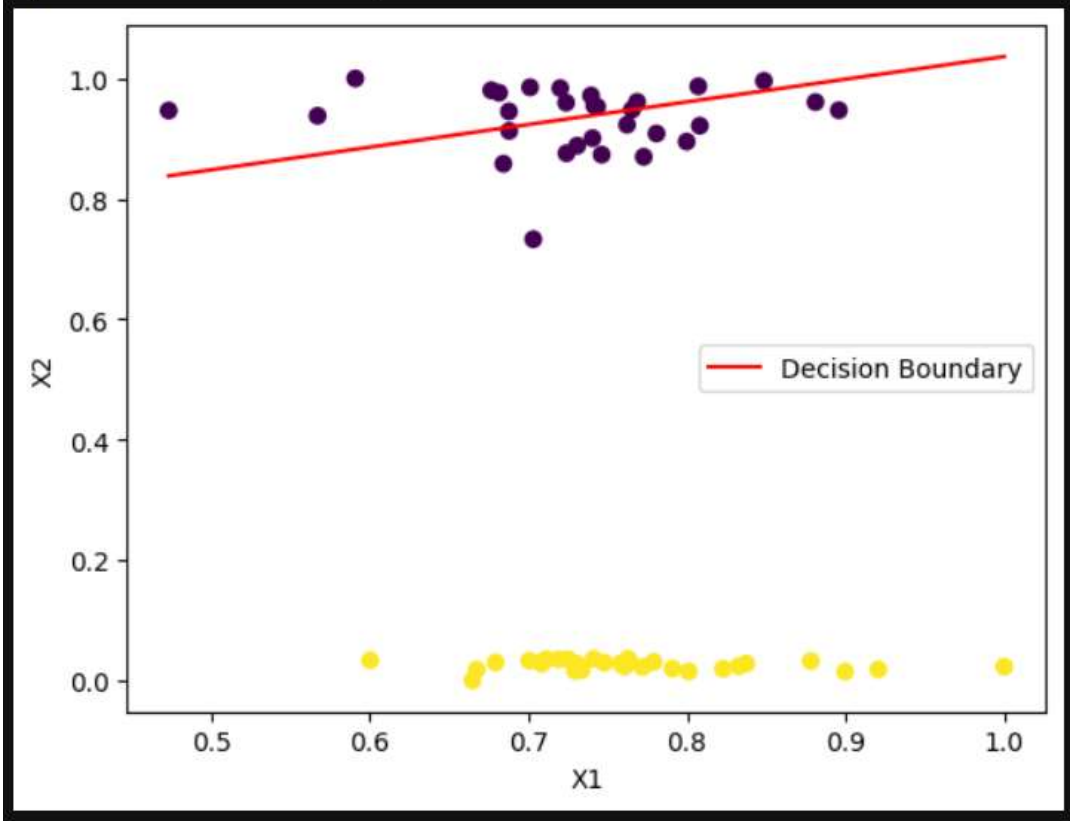


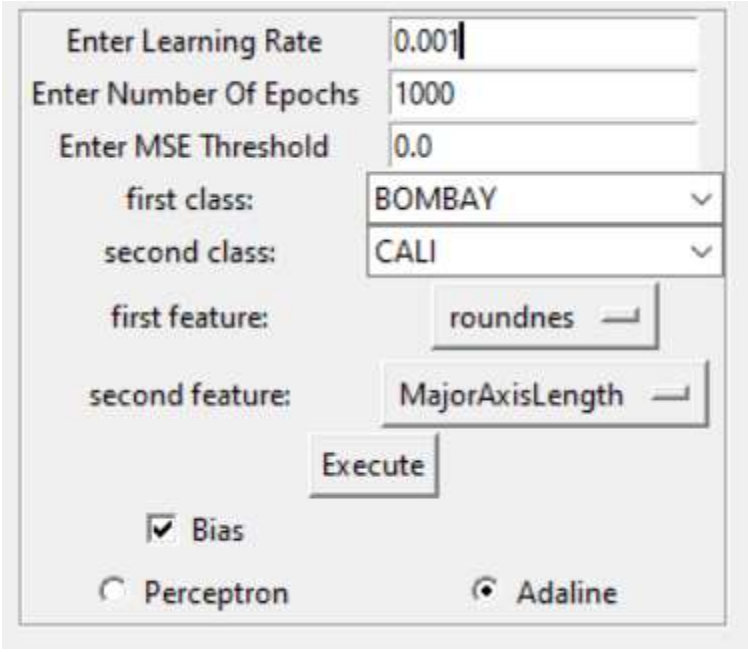

```
{'True Positive': 20, 'True Negative': 12, 'False Positive': 8, 'False Negative': 0}
Perceptron classification accuracy:  0.8
[-1.1378538 -1.0914548] 2.0617777746495696
```

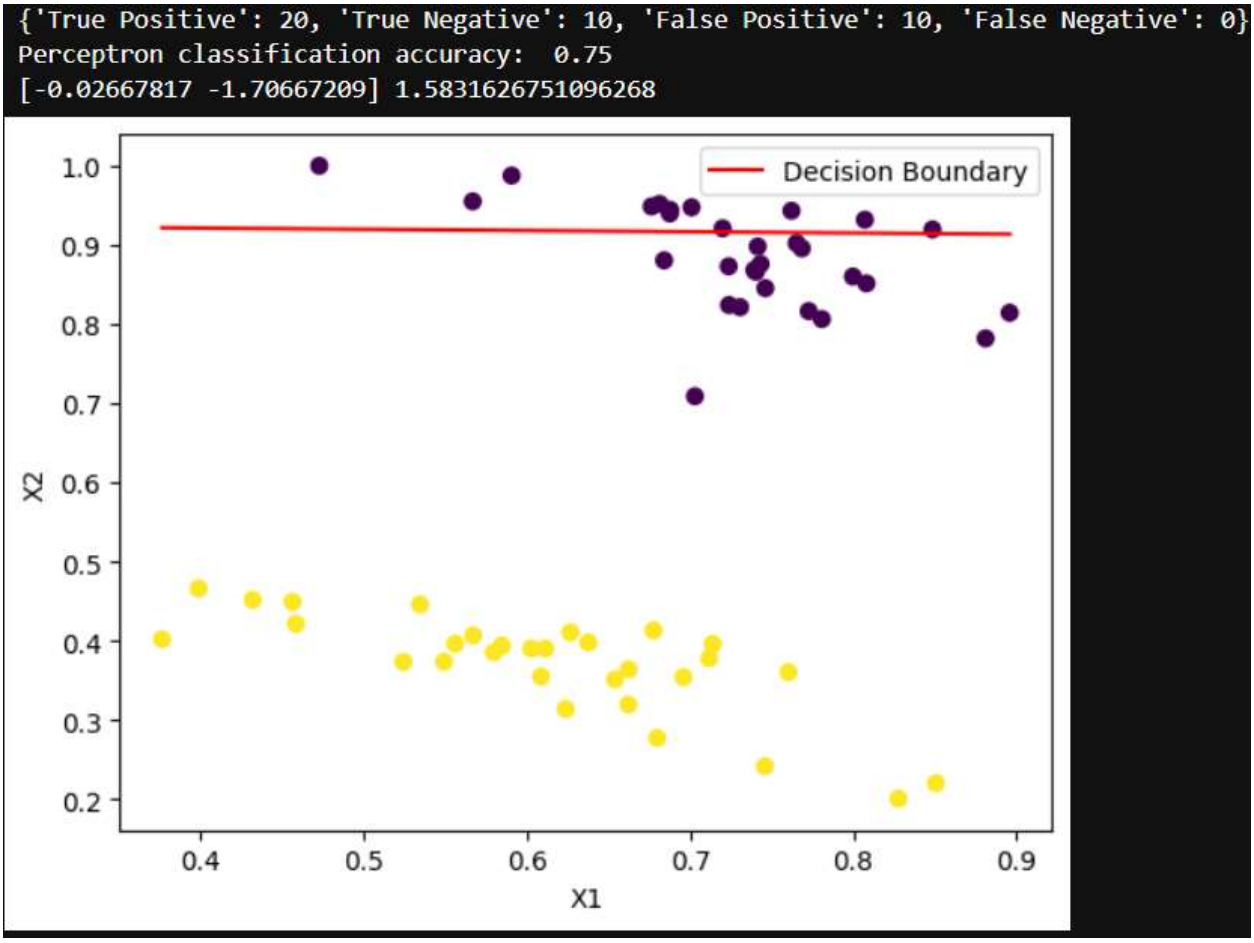


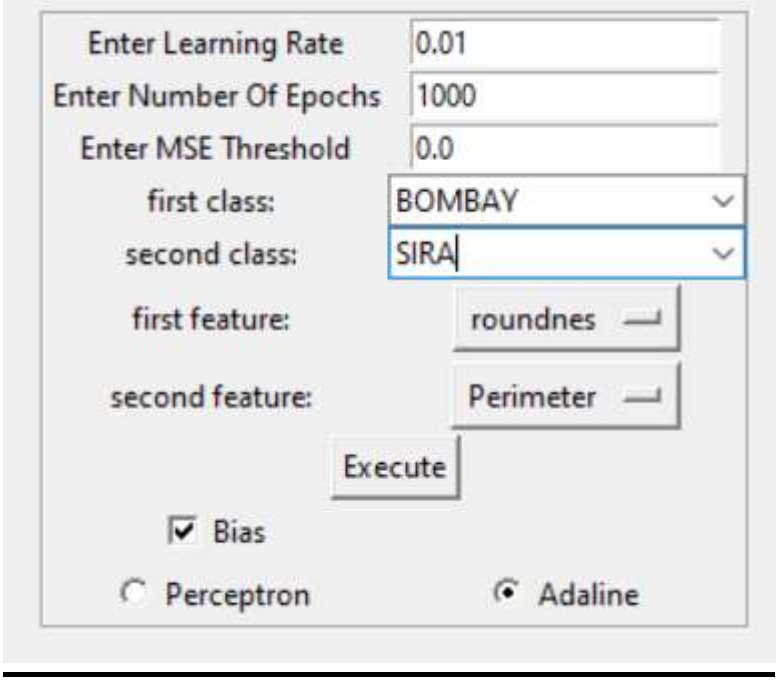



```
{'True Positive': 20, 'True Negative': 10, 'False Positive': 10, 'False Negative': 0}
Perceptron classification accuracy:  0.75
[ 0.81088426 -2.15461496] 1.4218119203718294
```

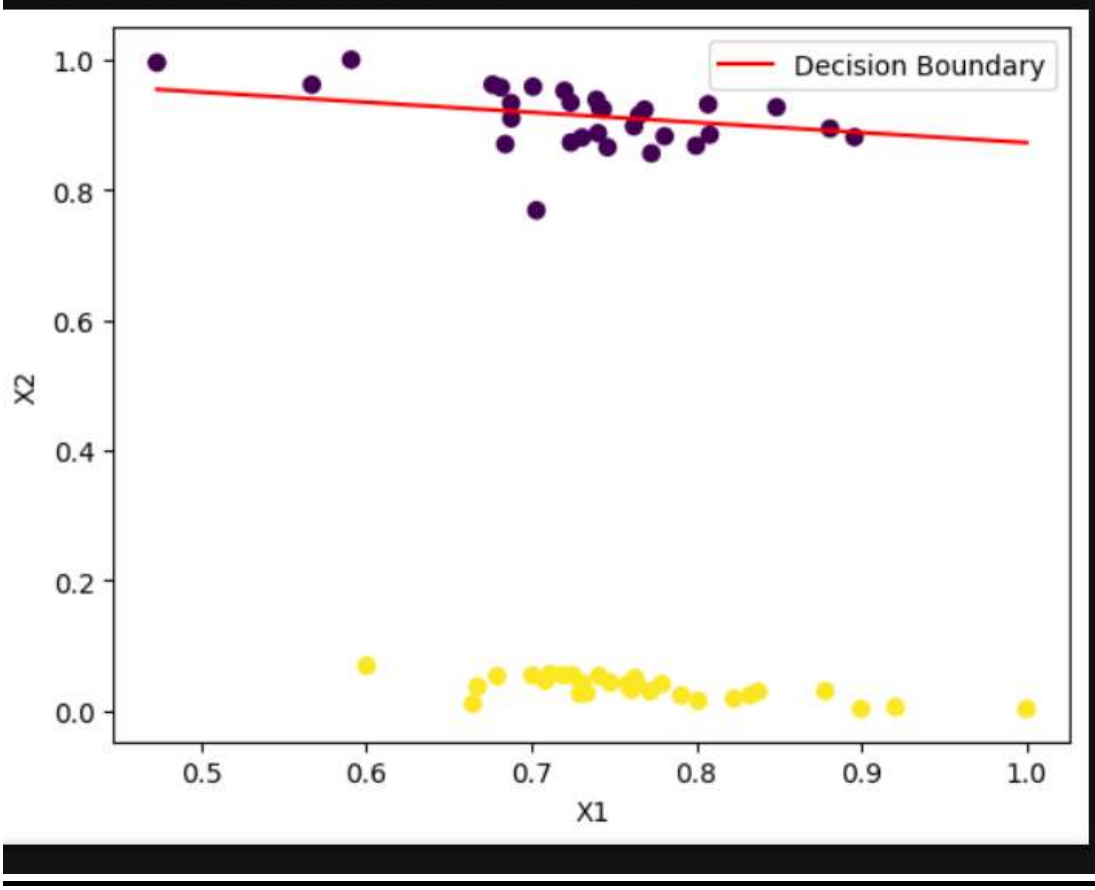



Enter Learning Rate
0.001
Enter Number Of Epochs
1000
Enter MSE Threshold
0.0
first class:
BOMBAY
second class:
CALI
first feature:
roundnes
second feature:
MajorAxisLength
Execute
Bias
Perceptron
Adaline


{'True Positive': 20, 'True Negative': 10, 'False Positive': 10, 'False Negative': 0}
Perceptron classification accuracy: 0.75
[-0.02667817 -1.70667209] 1.5831626751096268
Decision Boundary
1.0
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
X2
0.4
0.5
0.6
0.7
0.8
0.9
X1




```
{'True Positive': 20, 'True Negative': 12, 'False Positive': 8, 'False Negative': 0}
Perceptron classification accuracy:  0.8
[-0.35414714 -2.28271005] 2.346169065886712
```



**conclusion:

In our experience, Single-layer perceptron can reach up to very high accuracy, 100% in some cases, however, the average accuracy of adaline algorithm is higher which is expected since while both algorithms are linear classifiers, Adaline is more versatile and can handle a broader range of problems, including those that are not linearly separable.

We also noticed that some features when used give higher accuracy than others, same thing with some classes when used together.

****features achieved the highest accuracy after running Perceptron:**

“Area” and “Perimeter” with accuracy 1.0 when used with “BOMBAY” and “CALI” classes

****features achieved the highest accuracy after running Adaline:**

“roundnes” and “perimeter” with accuracy 0.8 when used with “BOMBAY” and “SIRA” classes