Neural Networks
2023-2024

Task 1
Dry Beans

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PRE-PROCESSING

1. Null Handling

Fill nulls with the mean

2. Normalize Train Data

Normalize using **Min Max Scaler**

3. Normalize Test Data

Normalize using **Min Max Scaler**

4. Label Encoder

Label the output classes

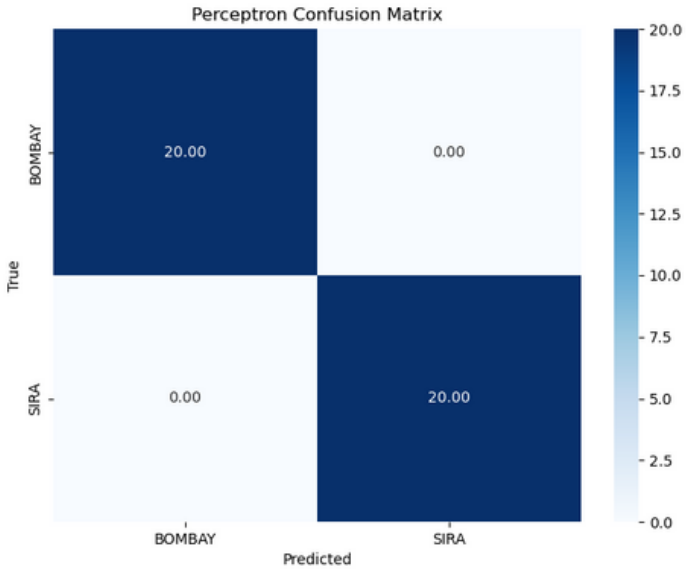
5. Data Splitting

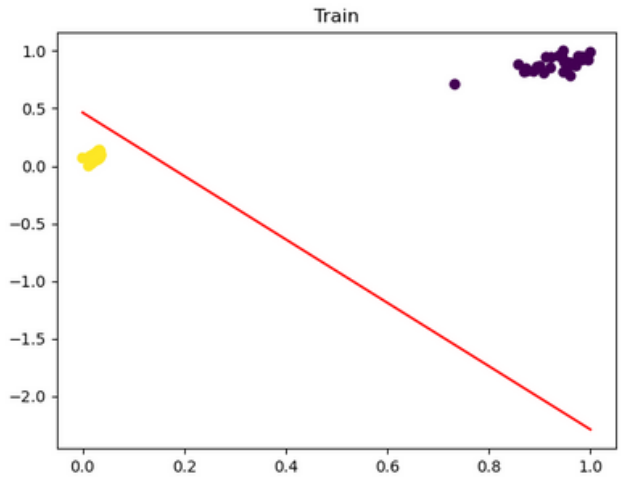
Split the data set into train & test

PERCEPTRON

PERCEPTRON

First Case



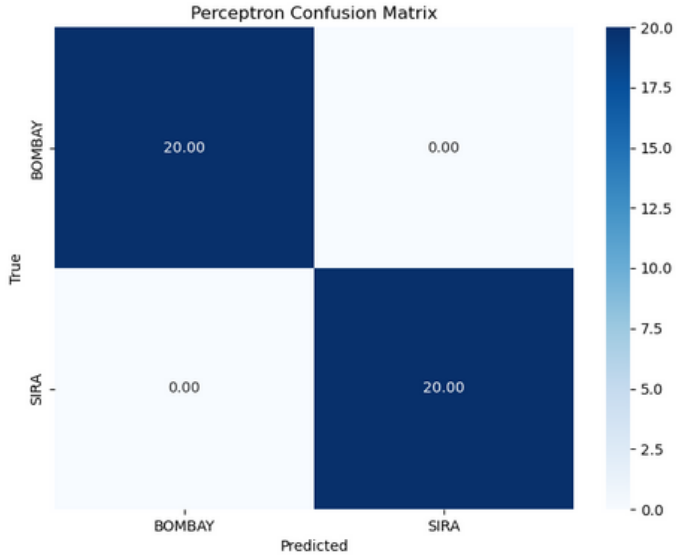


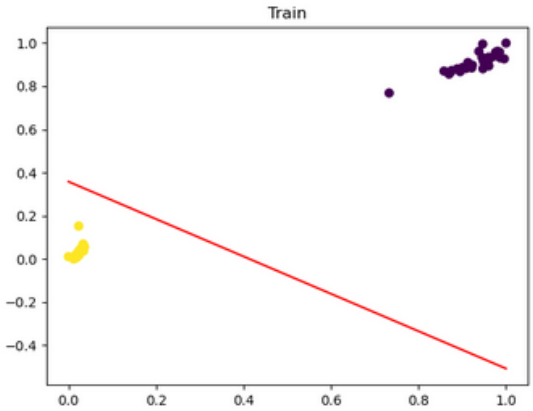
Accuracy = 100%

- **Features**: Area, and Major Axis Length.
- **Classes**: **class 1 (BOMBAY),** and **class 3 (SIRA).**
- The decision boundary separated the samples with **zero** error in training.
- The model is capable of **generalization** because it also performed well on testing data**.**

PERCEPTRON

Second Case



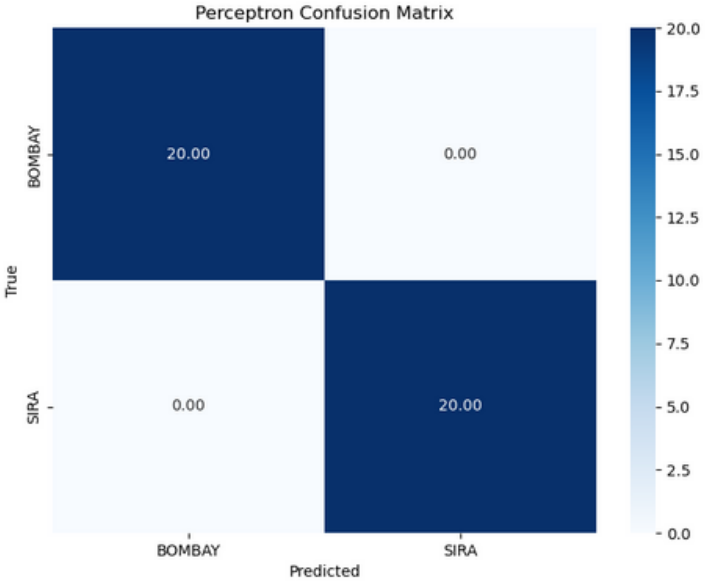


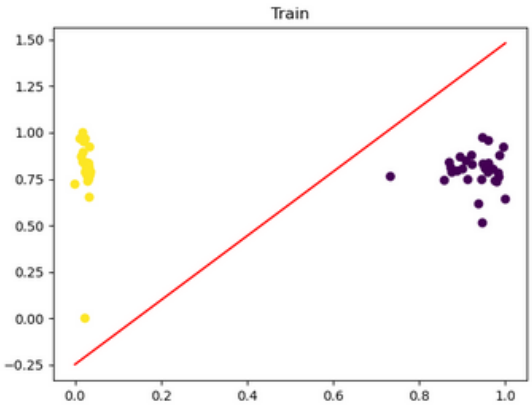
Accuracy = 100%

- **Features**: Area, and Perimeter.
- **Classes**: **class 1(BOMBAY),** and **class 3 (SIRA)**
- The decision boundary separated the samples with **zero** error in training.
- The model is capable of **generalization** because it also performed well on testing data.

PERCEPTRON

Third Case



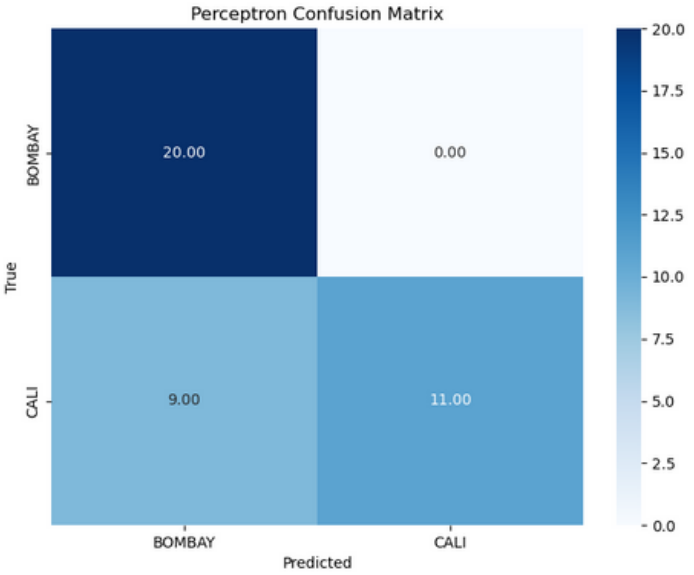


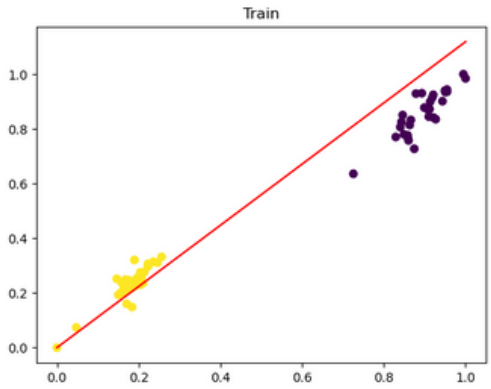
Accuracy = 100%

- **Features**: Area, and Roundness.
- **Classes**: **class 1 (BOMBAY)**, and **class 3 (SIRA)**
- The decision boundary separated the samples with **zero** error in training.
- The model is capable of **generalization** because it also performed well on testing data.

PERCEPTRON

Fourth Case



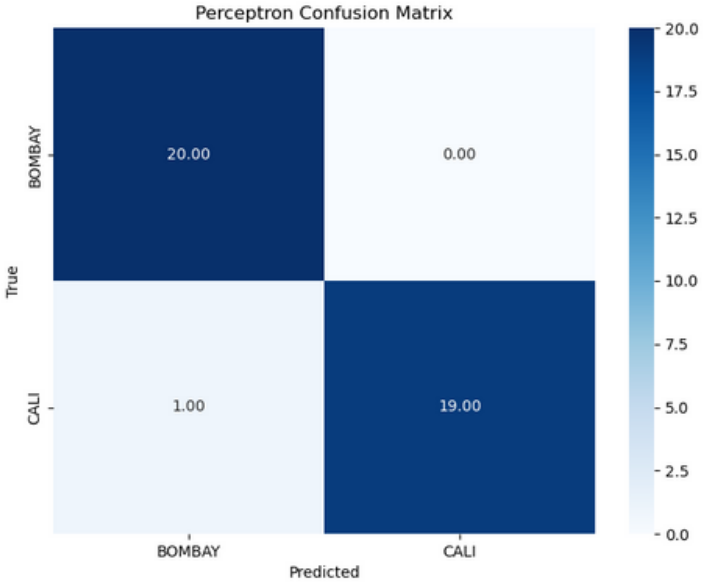


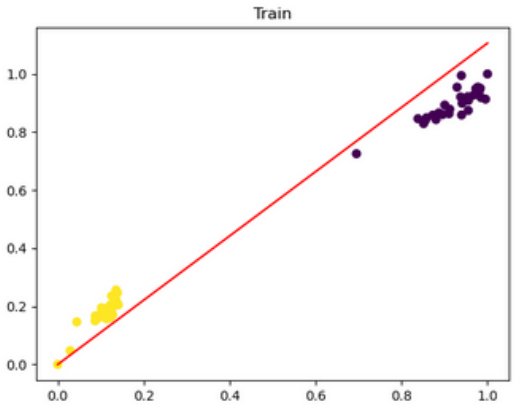
Accuracy = 76%

- **Features**: Perimeter, and Major Axis Length.
- **Classes**: **class 1 (BOMBAY)**, and **class 2 (CALI)**
- The decision boundary could not separate the samples even when they are **linearly separable** because there is **no bias**.

PERCEPTRON

Fifth Case





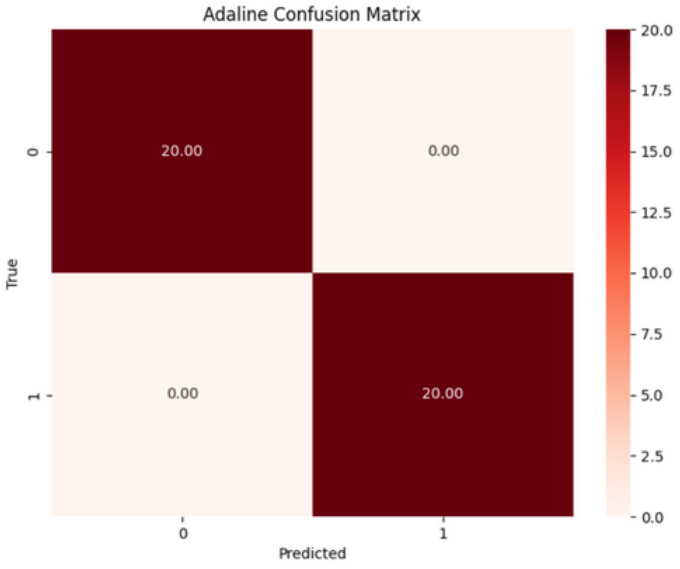
Accuracy = 0.96%

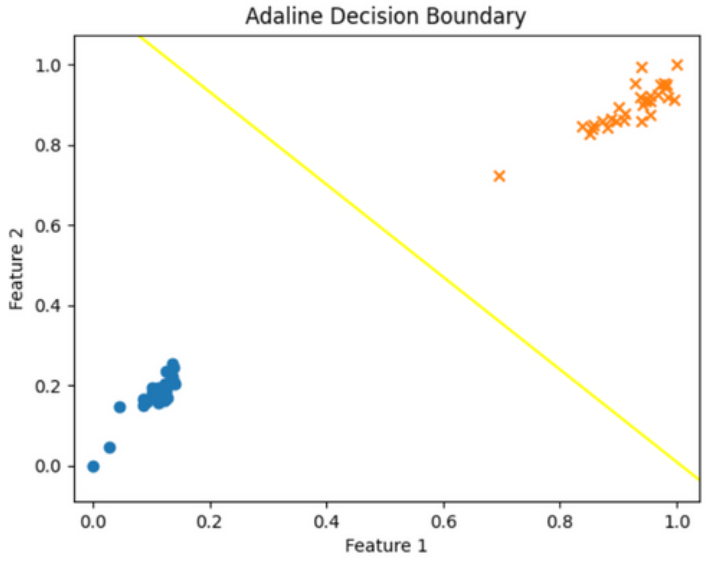
- **Features**: Area, and Perimeter.
- **Classes: class 1(BOMBAY)**, and **class 2(CALI)**
- The decision boundary separated the samples with minimal error in training. Since the data is linearly separable, adding bias could result zero error.

ADALINE

ADALINE

First Case



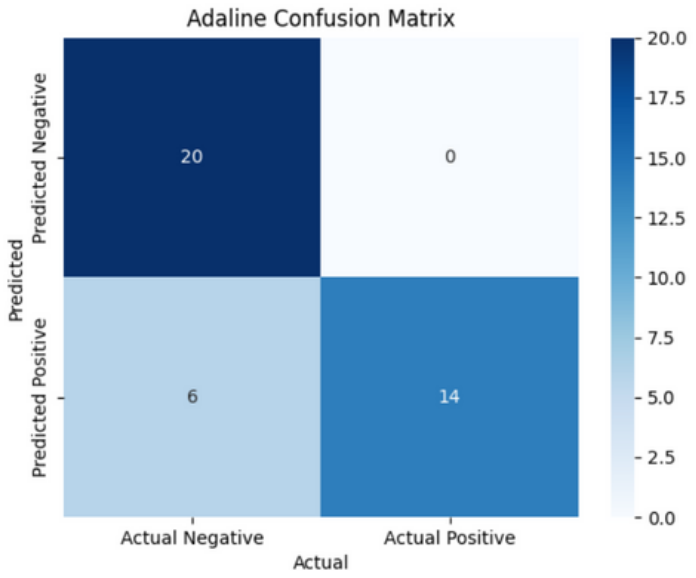


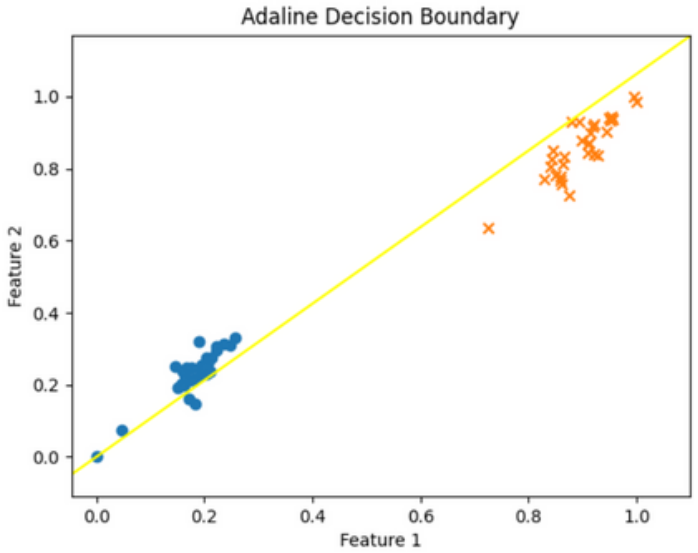
Accuracy = 100%

- Those 2 features are highly correlated to each other, they are linearly separable as figured
- This means that these features have the most useful information for classifying data

ADALINE

Second Case



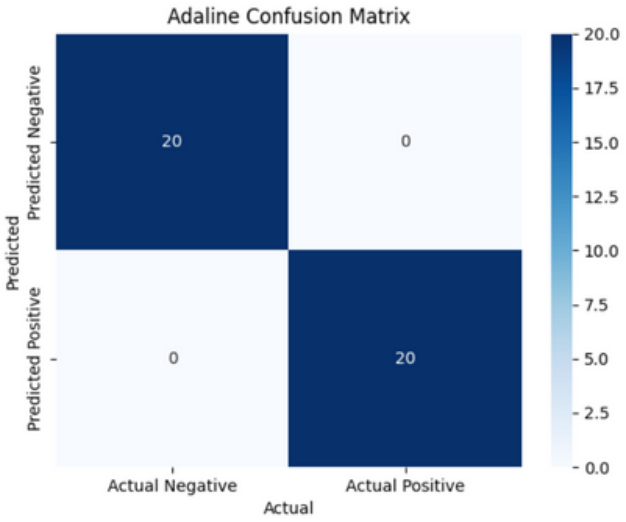


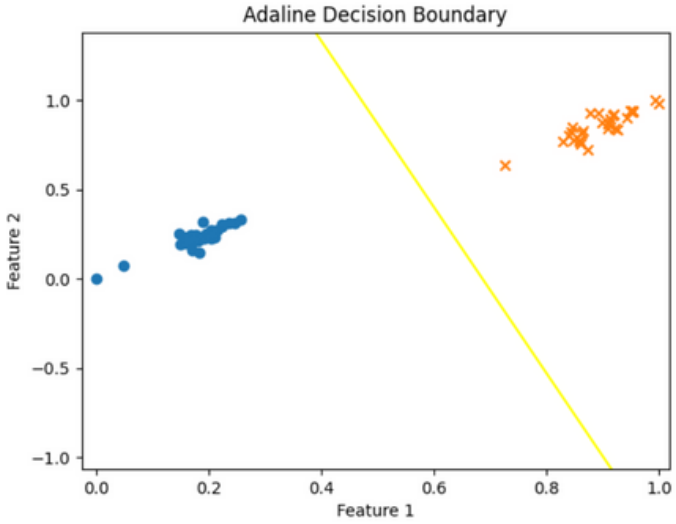
Accuracy = 85%

- Here we do not use bias so the line did not fit the data although it is linearly separable

ADALINE

Third Case



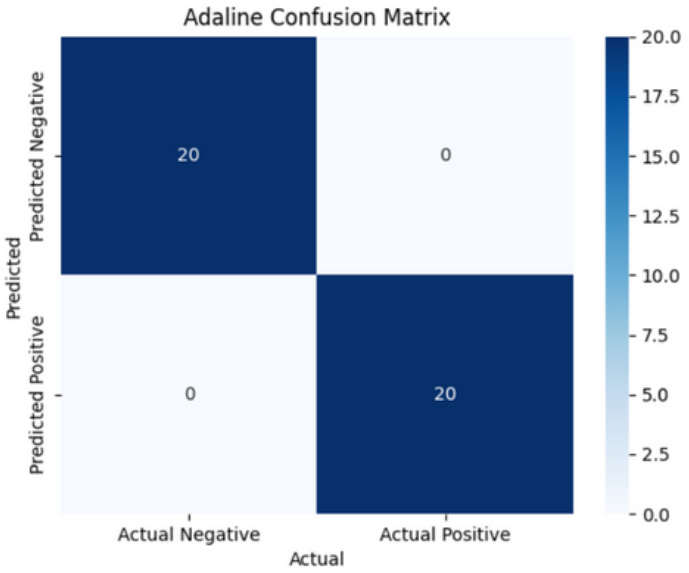


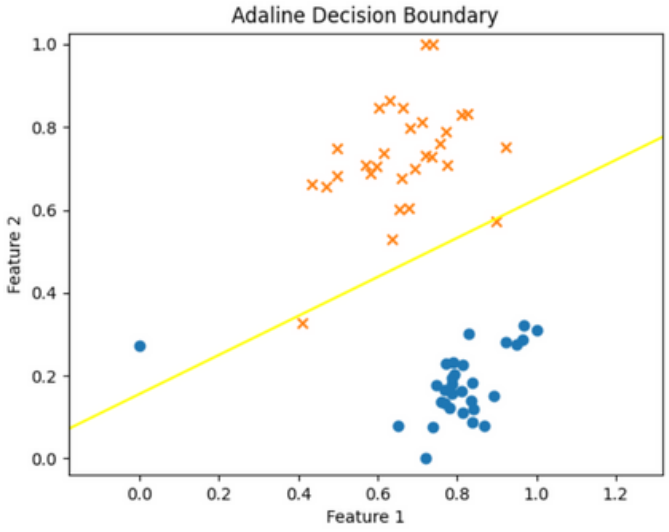
Accuracy = 100%

- Here we use bias with the previous case features and classes
- Now The line is able to separate data and get high accuracy

ADALINE

Fourth Case



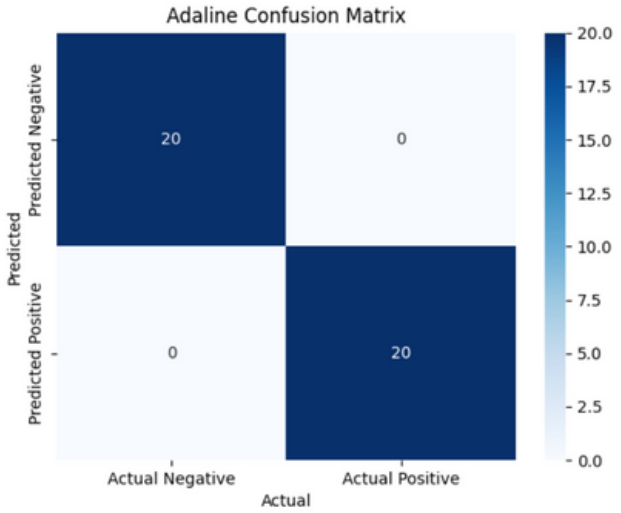


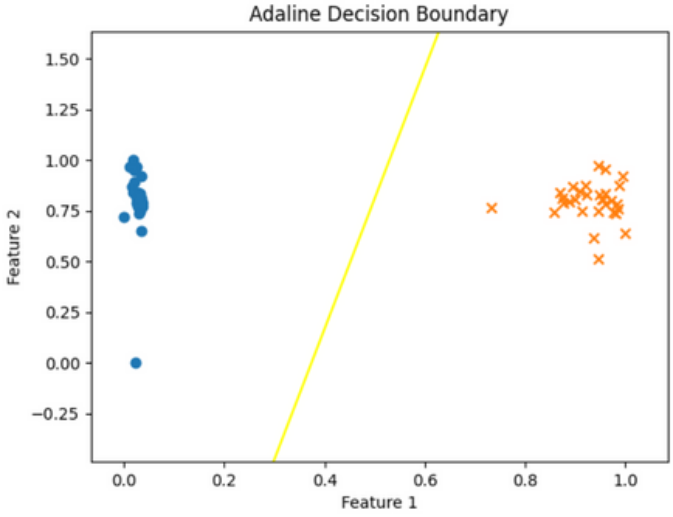
Accuracy = 100%

- In the training, we can see that there is an outlier, but in testing the algorithm gets high accuracy

ADALINE

Fifth Case





Accuracy = 100%

- The selected 2 features are highly correlated with the selected 2 classes

CONCLUSION

- Almost all combinations of features discriminate classes that are **Linearly Separable**
- Using **bias** improves the results.

Area & Perimeter have the most useful information for classifying data

THANK YOU