Perceptron

Objectives

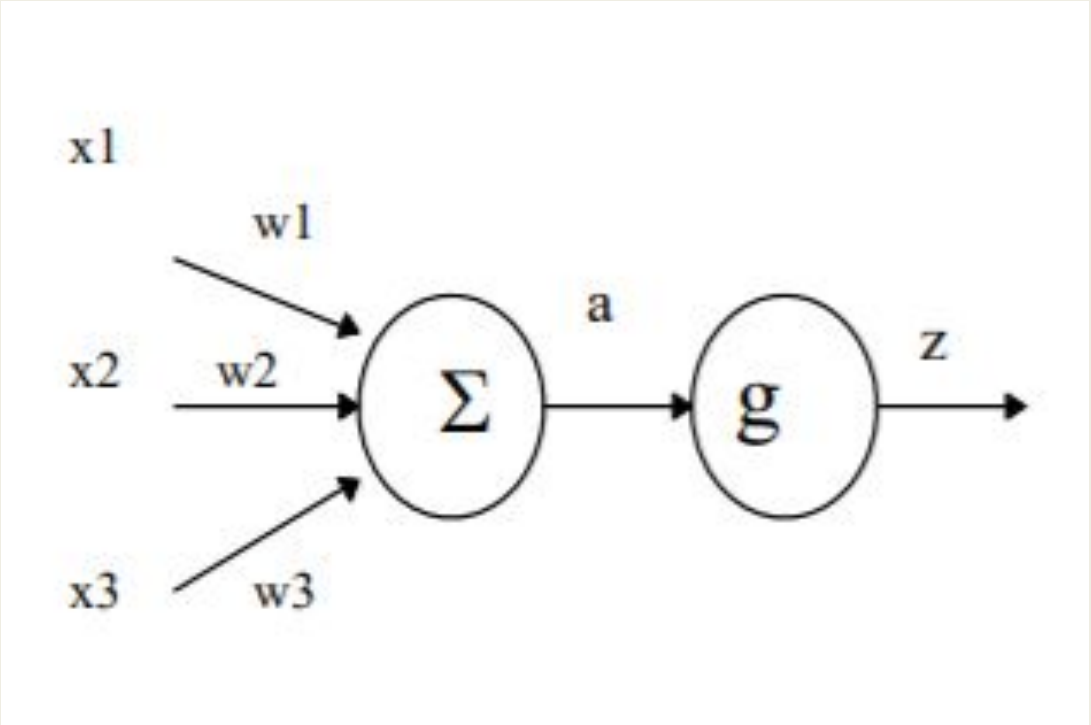
- Create a decision line than can help distinguish between 2 classes.

Summary of my Life

- Late Submission :(
- It was actually easy. The link below help me clarify what's w0 and x0.
- https://towardsdatascience.com/perceptron-learning-algorithm-d5db0deab975
- Needs Motivation

Overview: Perceptron

- To distinguish classes with features, weights are used to help in differentiating the classes.
- The sum of the product of weights **(x_j*w_j)** of each sample is determined as **a**.
- **a** is inputted on an activation function **g** that tries to identify the class with the result **z.**



Schematic Diagram on the Perceptron Algorithm

Overview

- The weights are modified depending on the sum of the difference of the determined value **z** and the intended value per sample and the learning rate.
- This is iterated until a certain error is reached (0.01) or a number of iterations is reached.
- Using 2 features separates classes with a line while 3 features separates with a plane and so on.

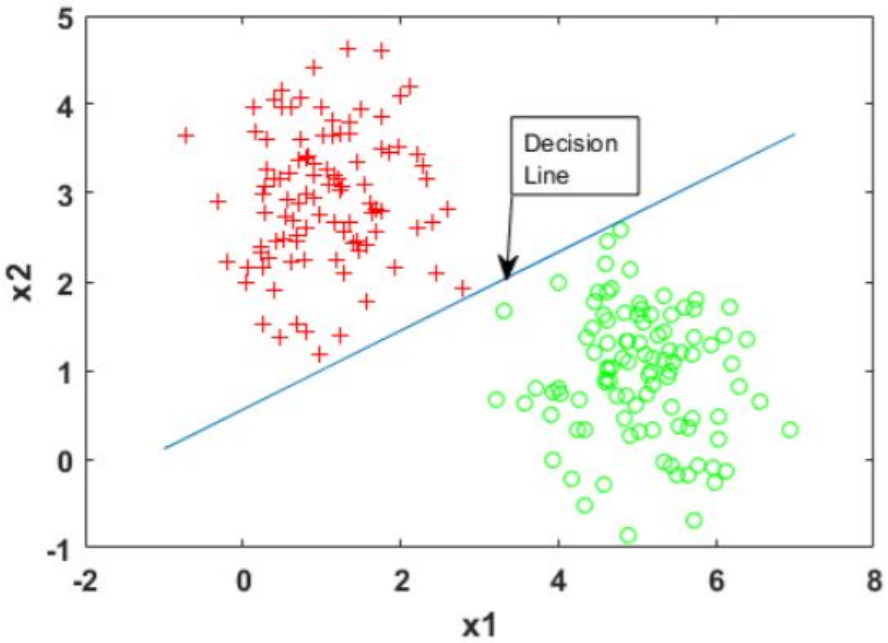
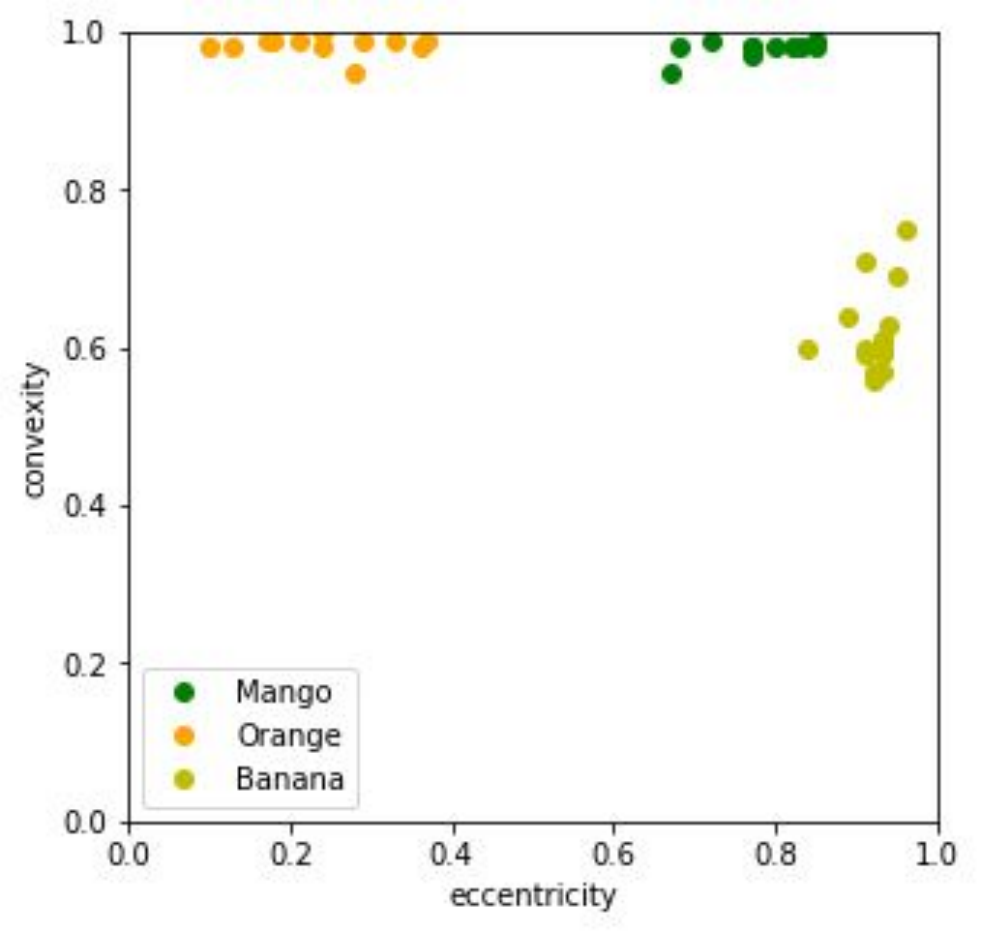


Figure 3: The two classes shown are linearly separable. A decision line can separate the two classes in feature space.

Step 0: Get Data from Act 12

- I used fruits (namely Bananas, Oranges and Mangoes)

- I had 4 features. In those features I chose eccentricity and convexity since the convexity vs eccentricity graph showed the best class clustering.



Step 1: Initializing Weights/ Variables

- Weights are initialized randomly.
- **X_0** = 1 (bias used)
- Activation function used (**g**)= Step-function
- No. of tries = Until the sqrt of sum of squares of (**d**-**z**) is less than 0.01 for all weights.
- Learning Rate set to 0.01 (recommended very small)

Step 2: Results

- I plotted the fruits based on class and features into 2D plots to look in the:

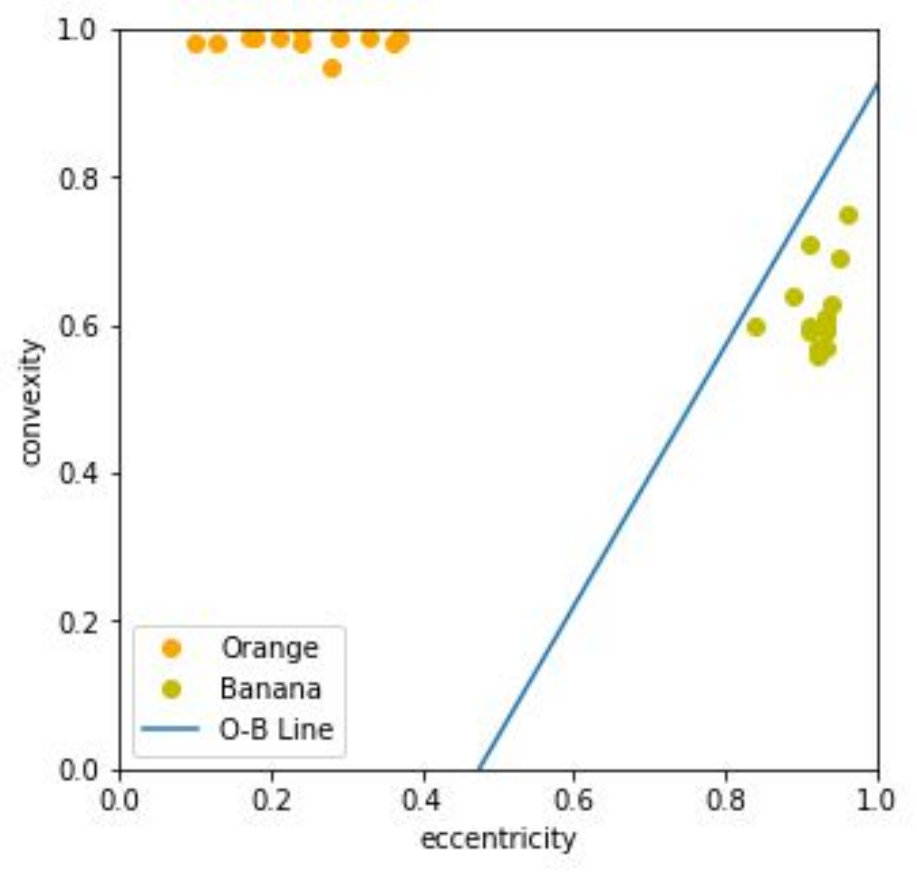
  1.) Decision line of Orange vs Banana

  2.) Decision line of Orange vs Mango

  3.) Decision line of Mango vs Banana

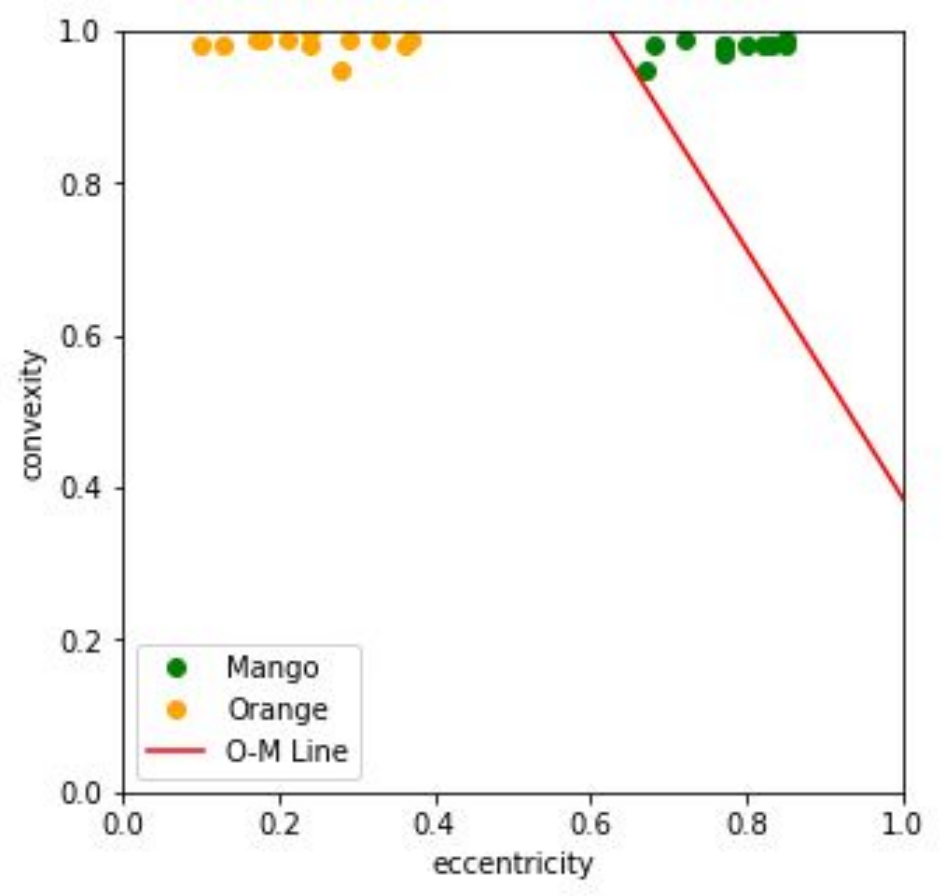
  4.) Combination of 1-3

Step 2: Decision line of Orange vs Banana



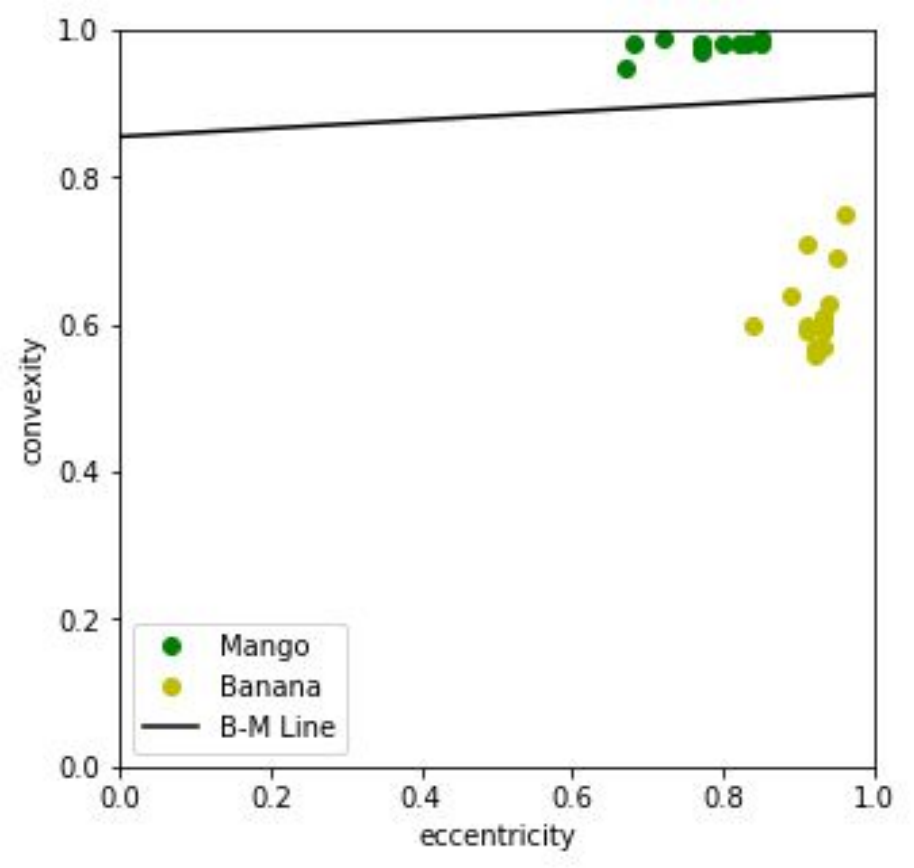
- Blue orange-banana line was able to separate the cluster of oranges and bananas for 5 iterations.

Step 2: Decision line of Orange vs Mango



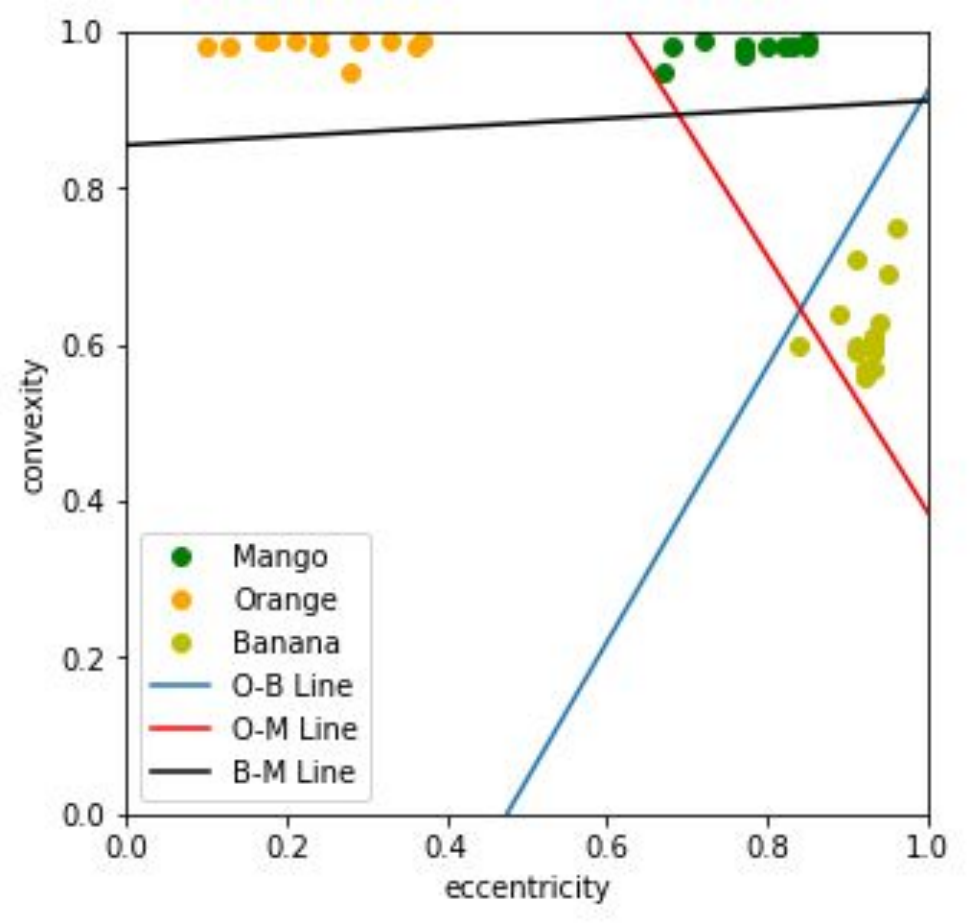
- Red orange-mango line was able to separate the cluster of oranges and mangos after 8 iterations.

Step 2: Decision line of Banana vs Mango



- Black mango-banana line was able to separate the cluster of mangos and bananas after 11 iterations.

Step 2: Combination



- Conclusion: The decision lines were able to differentiate between classes.

- Recommendations:
  - Try other activation functions.
  - Find a way that line divides at the midpoint between two clusters (maybe)