Activity 8

PERCEPTRON AND LOGISTIC REGRESSION

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table of CONTENTS

The outputs presented in the succeeding pages are created using MATLAB. Moreover, the codes are uploaded in Github.

INTRODUCTION

A perceptron, also referred to as a linear binary classifier, is one of the widely used model in supervised learning. It is particularly useful when the classes can be separated by a straight line, plane, or hyperplane [1]. The perceptron's primary purpose is to classify objects into two distinct categories, assigning them to one group or the other based on their features.

On the other hand, logistic regression is also used in supervised learning when the main goal is to predict the probability of an object to belong to a specified class [2, 3].

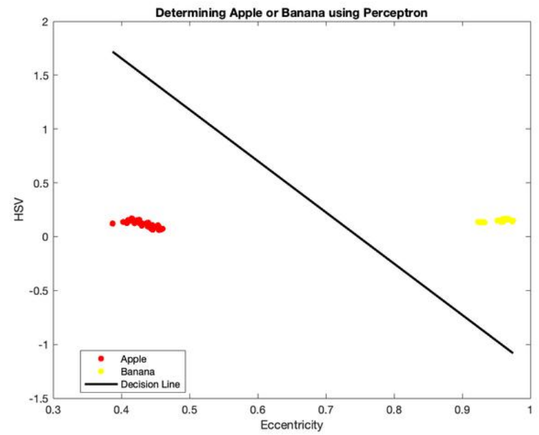
The primary distinction between the two lies in the activation function they employ: perceptrons use a step function, while logistic regression models utilize the sigmoid function to compute probabilities.

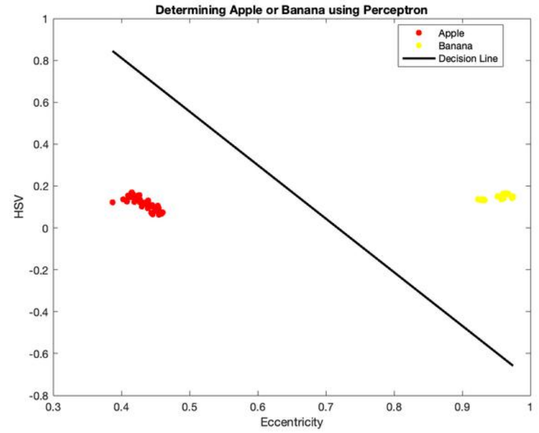
[1] S. Sharma, What the hell is perceptron? (2017), https://towardsdatascience.com/what-the-hell-is-perceptron-626217814f53
[2] Logistic Regression in Machine Learning (2023), https://www.geeksforgeeks.org/understanding-logistic-regression/
[3] D. Geng and S. Shih, Machine Learning Crash Course: Part 2 — SVMs, Perceptrons, and Logistic Regression (2019). https://medium.com/@ml.at.berkeley/machine-learning-crash-course-part-2-3046b4a7f943

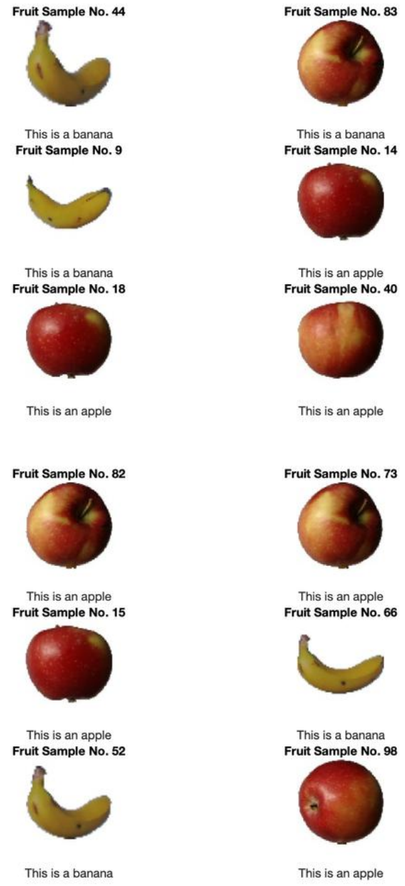
OBJECTIVES

01	02	03
Use Feature Extraction methods to extract necessary features for Machine Learning	Use Perceptron Algorithm to identify two fruit classes (Banana and Apple)	Use Logistic Regression to assess the degree of ripeness of a mango

RESULTS



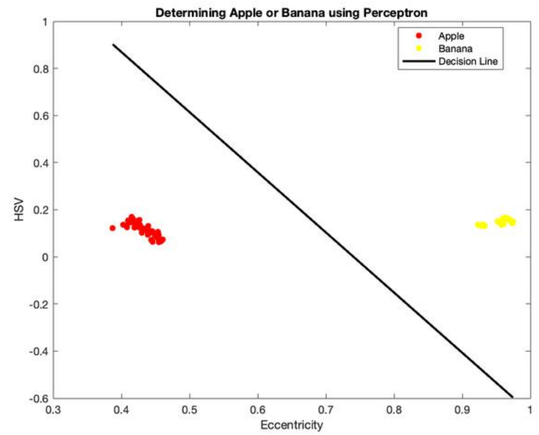


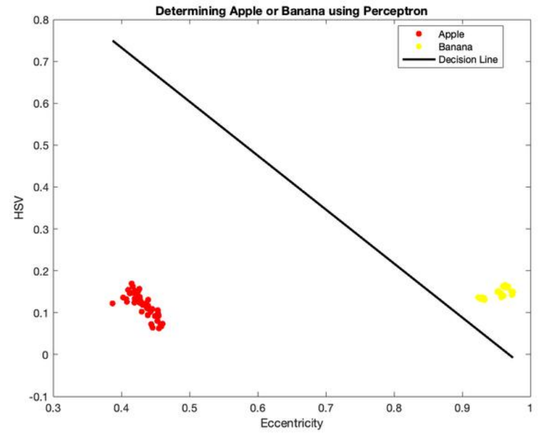


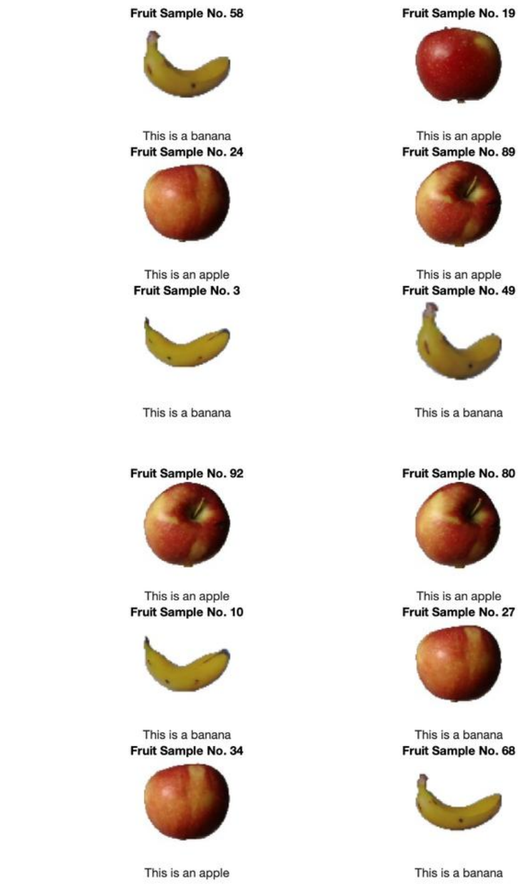
To implement the Perceptron algorithm, I began by acquiring datasets of apples and bananas from the fruits-360 dataset on the Kaggle website. After that, I extracted relevant features, focusing on eccentricity and HSV values. Next, I trained the algorithm using the step function as the activation function, ensuring that the decision line was plotted to visually confirm the separation of classes. Finally, I utilized the remaining images, which were not included in the training phase, to test the algorithm's performance.

Perceptron

RESULTS



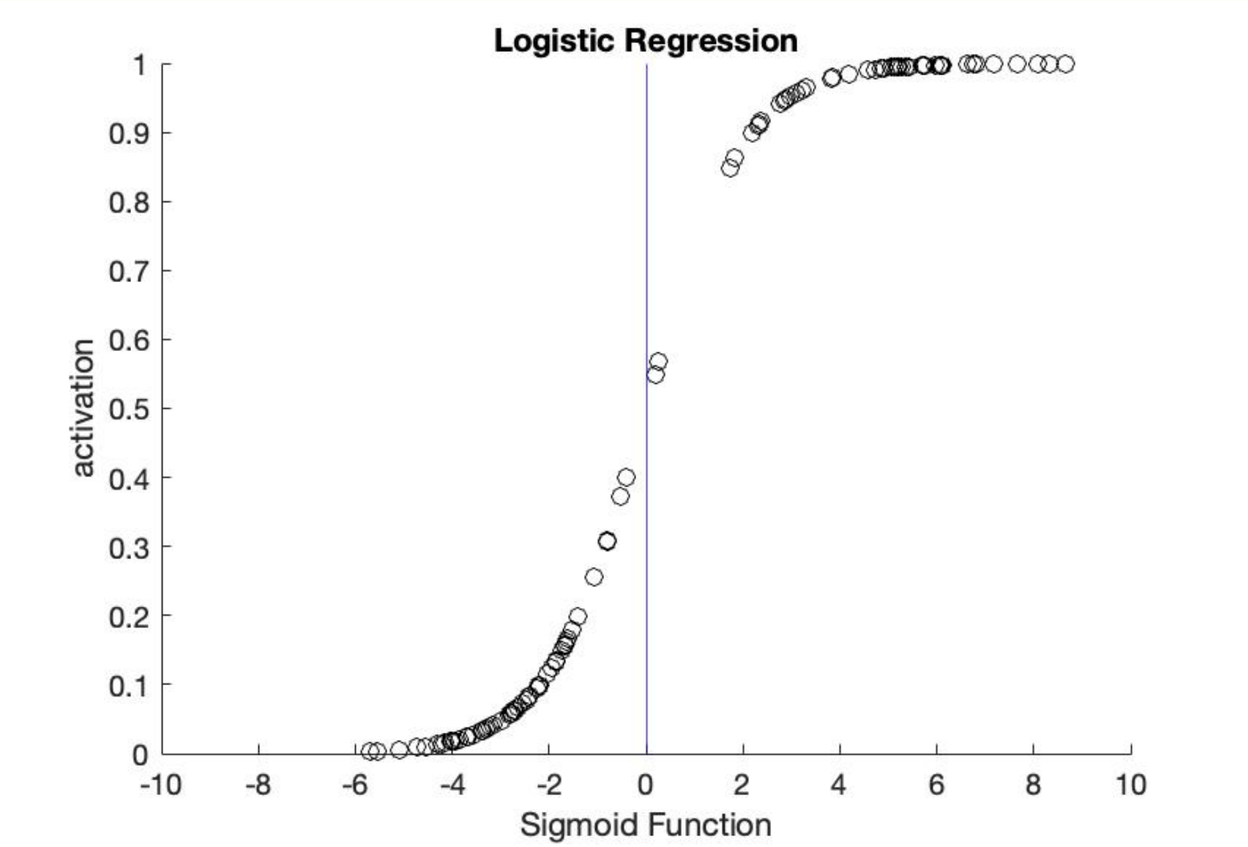




Through the entire process, I successfully distinguished between apples and bananas using the Perceptron algorithm. The decision line effectively separated the two classes, demonstrating the algorithm's ability to differentiate between them. Nonetheless, there were a few instances where the algorithm failed to accurately identify the fruit in certain images. It is important to note, however, that these occurrences were relatively infrequent compared to the overall success rate of the algorithm.

Perceptron

RESULTS

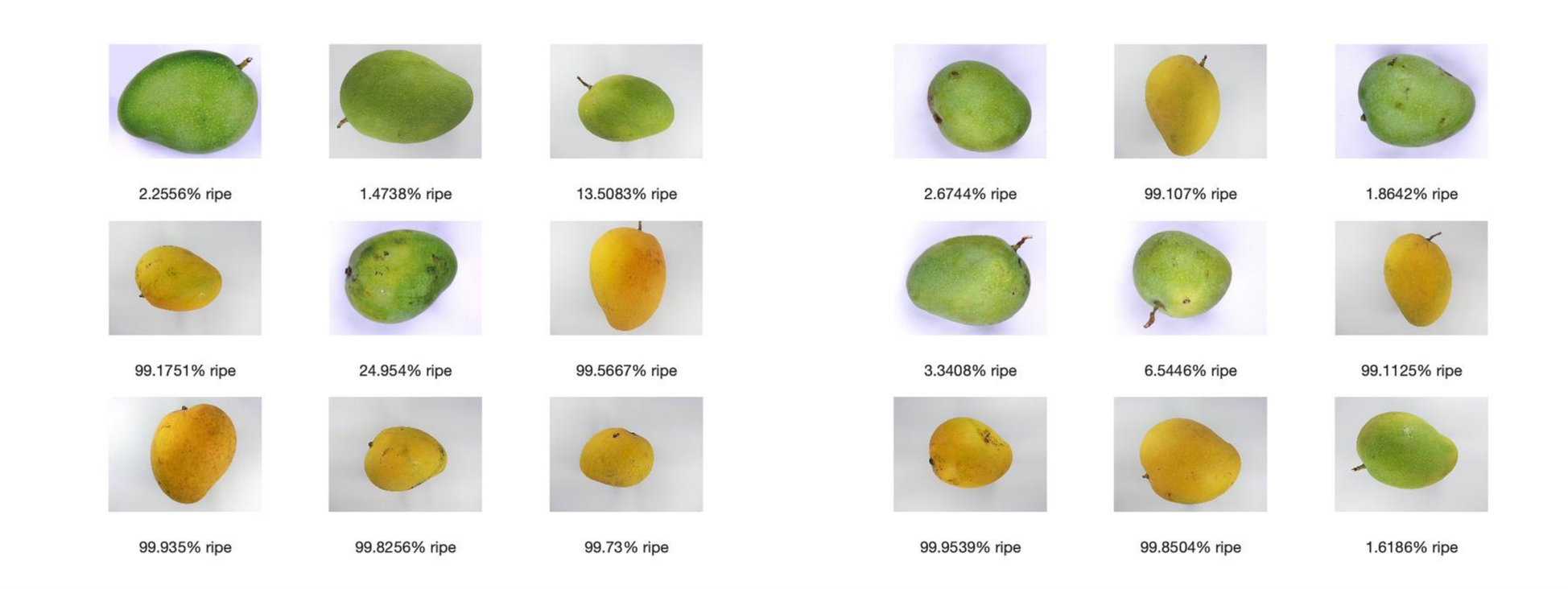


To implement the Logistic regression model, I began by acquiring datasets of ripe and unripe mangoes [4]. After that, I extracted the image's average colors through Normalized Chromaticity Coordinates. Next, I trained the algorithm using the sigmoid function as the activation function. The graph on the left shows that the data points form the said function. Finally, I utilized the available training images to test the algorithm's performance.

Logistic Regression

[4] Gururaj, N., Vinod, V. & Vijayakumar, K. Deep grading of mangoes using Convolutional Neural Network and Computer Vision. Multimed Tools Appl (2022). https://doi.org/10.1007/s11042-021-11616-2

RESULTS



The images presented above illustrate the outcomes of the implemented Logistic Regression model. Through this model, we achieved the capability to predict the ripeness of mango fruits. From the visual representations, it is evident that the model has successfully captured patterns and features that correlate with the ripeness levels of the mangoes.

Logistic Regression

REFLECTION

CRITERIA	SCORE
Technical Correctness	35
Quality of Presentation	35
Self Reflection	30
Initiative	5
Total	107

One of the most challenging aspects of this activity was grasping the underlying concepts of the machine learning models. In addition, locating and extracting the suitable dataset and relevant features posed a significant challenge. However, once these initial tasks were accomplished, implementing the perceptron and logistic regression algorithms proved to be relatively straightforward and simple. I am immensely grateful for the invaluable assistance provided by Kuya Richmond and Johnenn, as their guidance helped me comprehend the ideas for this activity. Without their support, completing this task would have required considerably more time and effort.