APPLIED PHYSICS 157

Activity 9

MACHINE LEARNING: NEURAL NETWORKS

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WFY-FX-2

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

SINE FUNCTION

PERCEPTRON DATA

INTRODUCTION

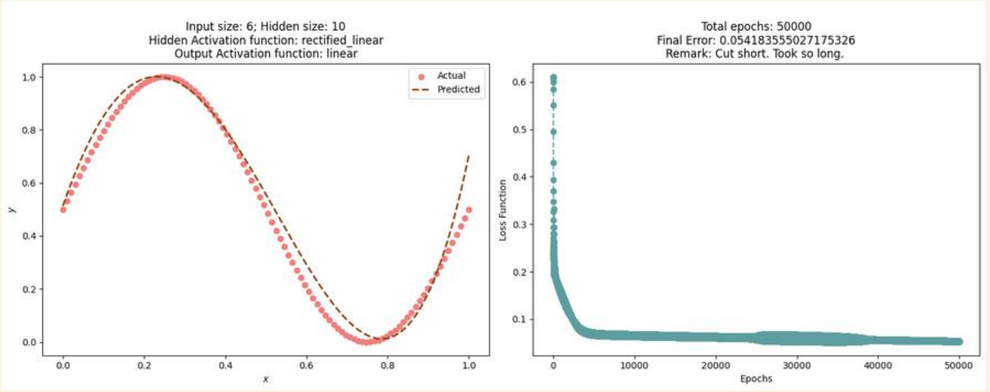
Neural networks mimics the human brain and consist of interconnected artificial neurons organized in layers (input, hidden, and output) to process data and produce results for various tasks, such as classification or prediction. There are many types of neural networks including backpropagation algorithm. The backpropagation algorithm is used to improve predictive capabilities through iterative feedback loops. It involves making guesses, evaluating correctness, and adjusting weights based on the correctness of the guesses to find the optimal path from input to output nodes.

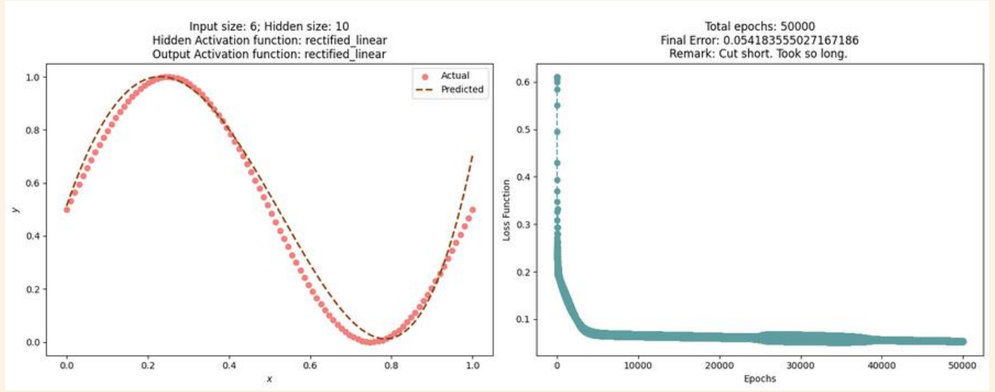
[1] What is a Neural Network? - Artificial Neural Network Explained - AWS. (n.d.). Amazon Web Services, Inc. https://aws.amazon.com/what-is/neural network/#:~:text=A%20neural%20network%20is%20a,that%20resembles%20the%20human%20brain.

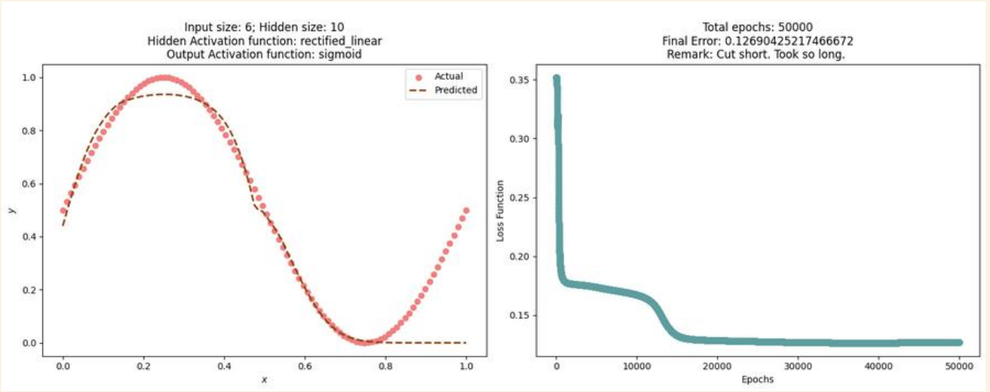
OBJECTIVES

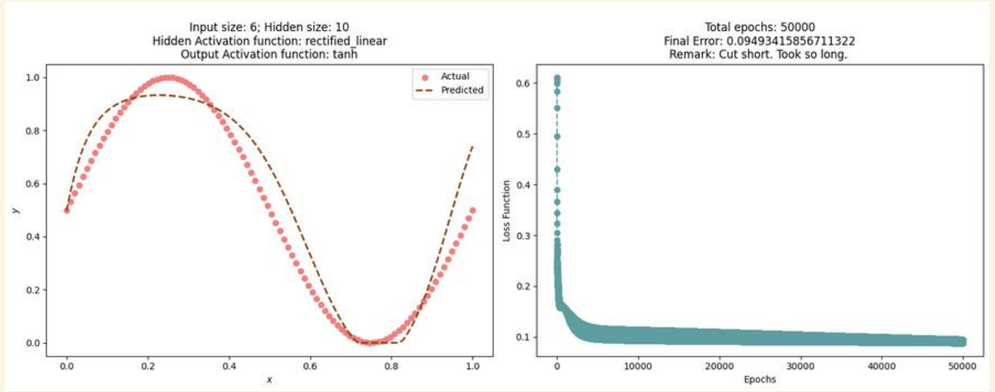
01	02
Program a neural network to learn a sine function using backpropagation.	Program another neural network to classify your fruit data in ML2 (Perceptron).

RESULTS: PART 1



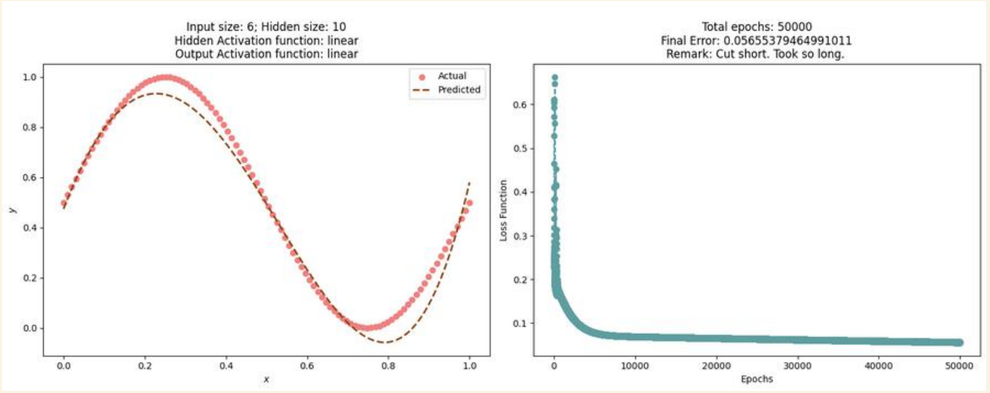


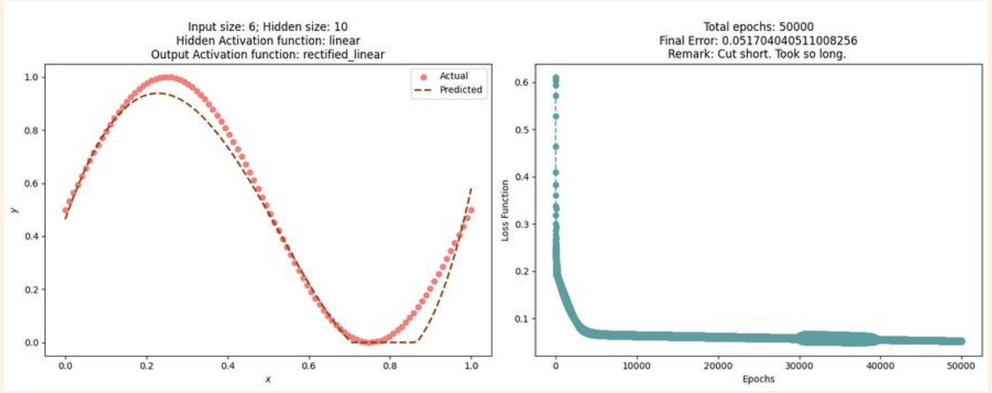


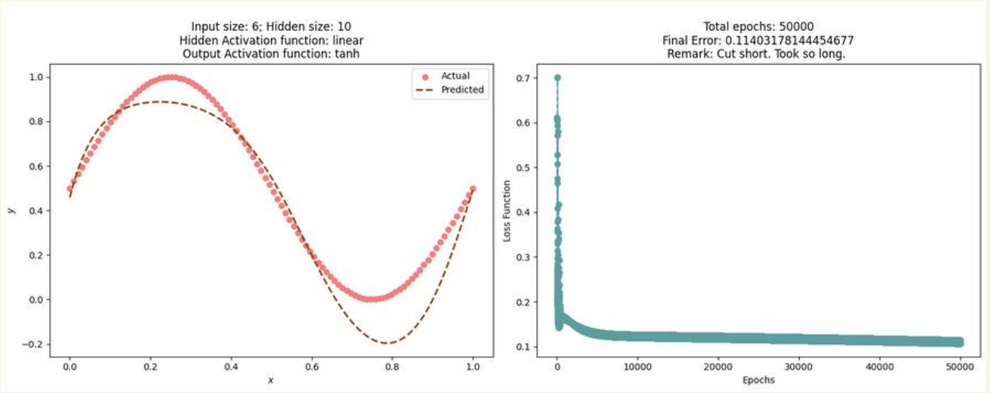


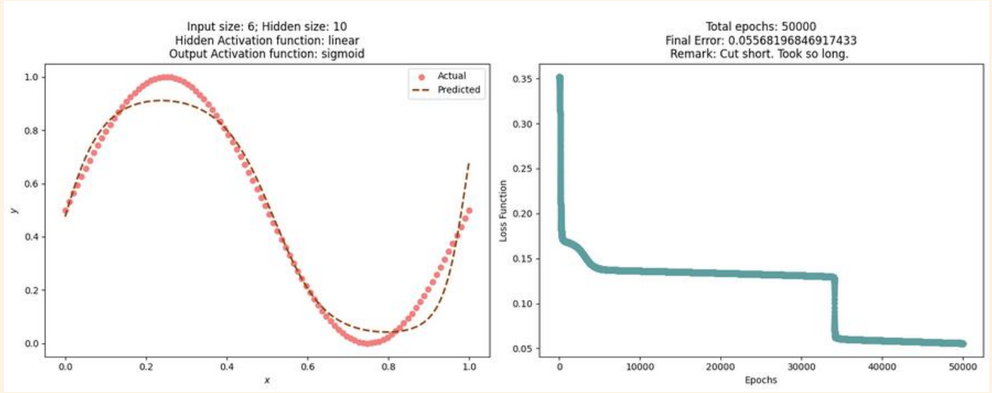
Sine Function

RESULTS: PART 1



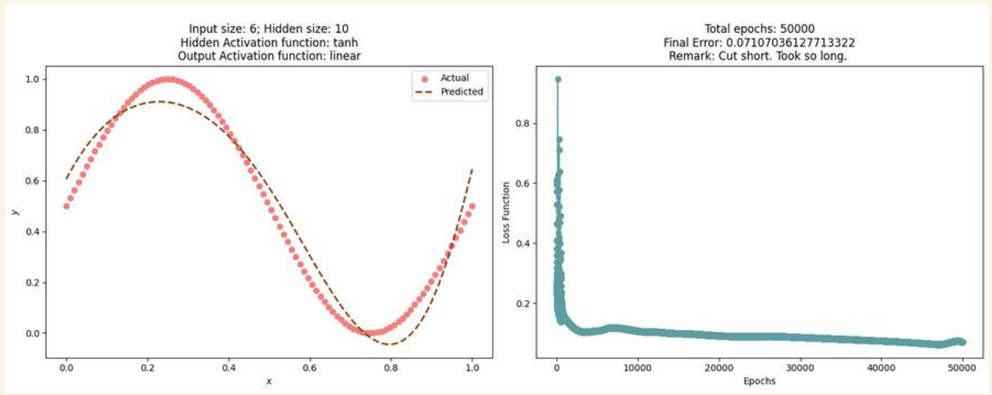


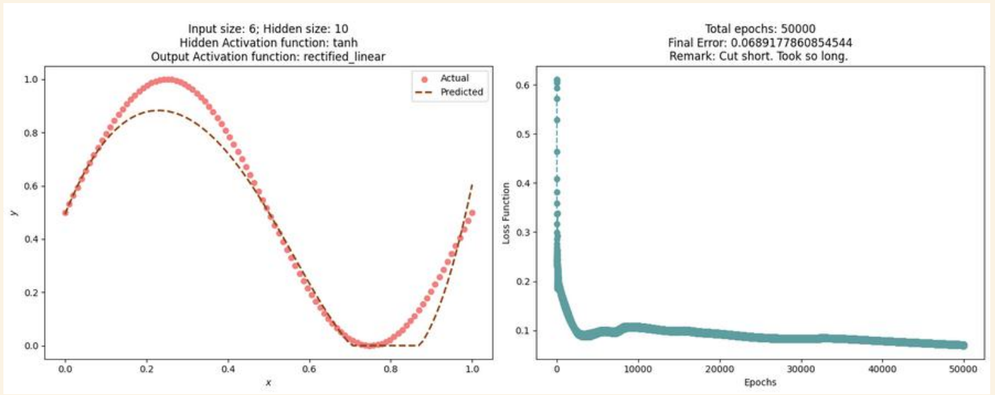


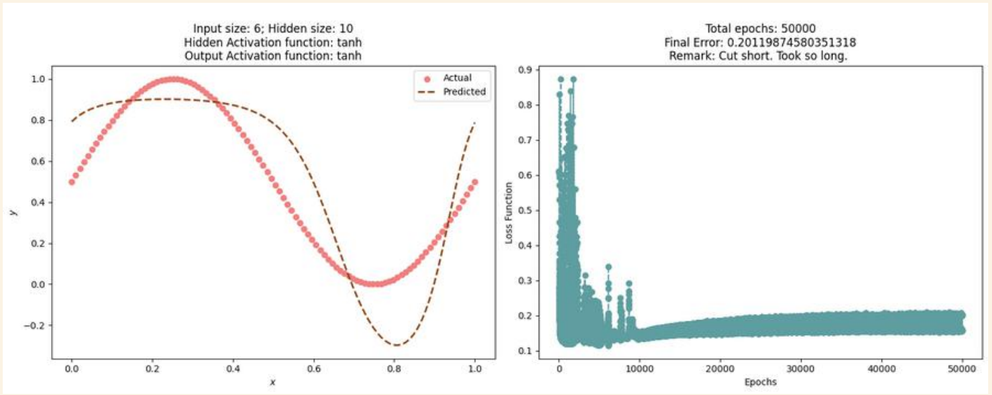


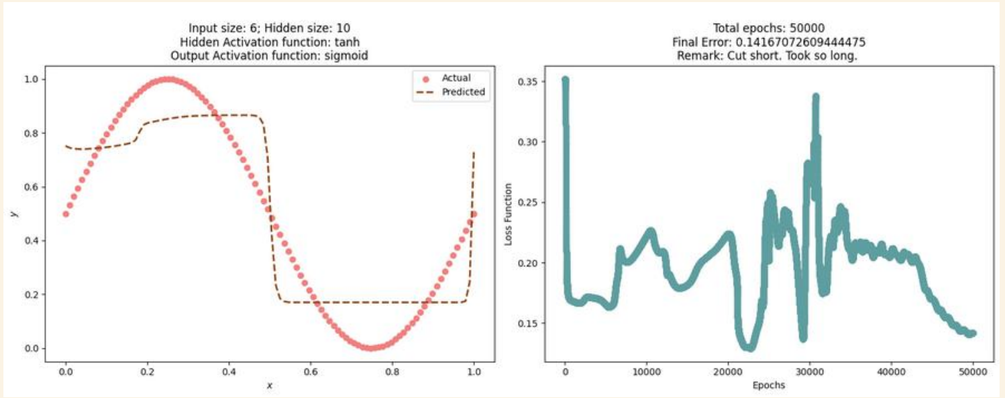
Sine Function

RESULTS: PART 1



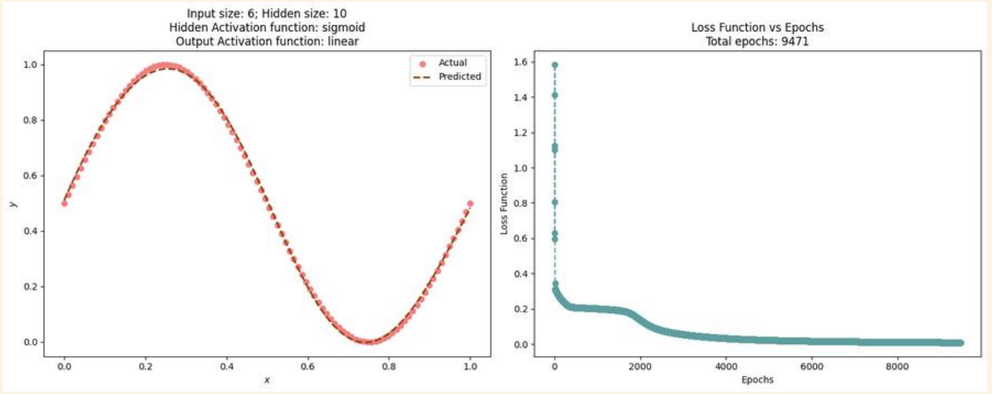


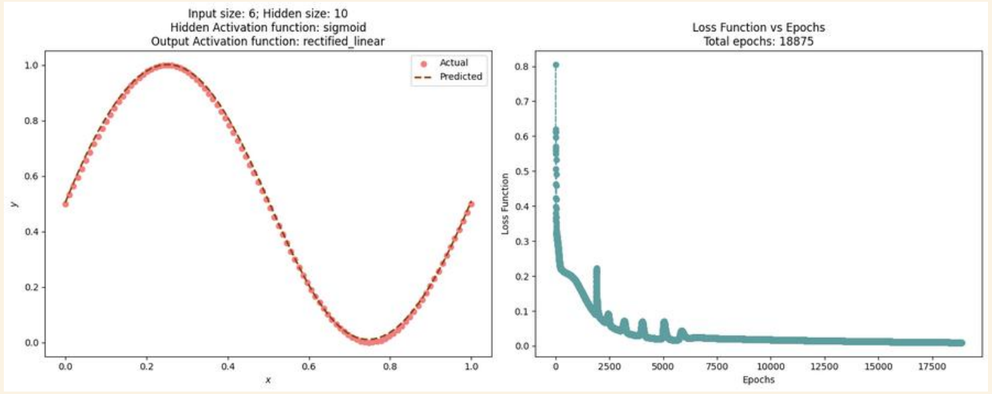


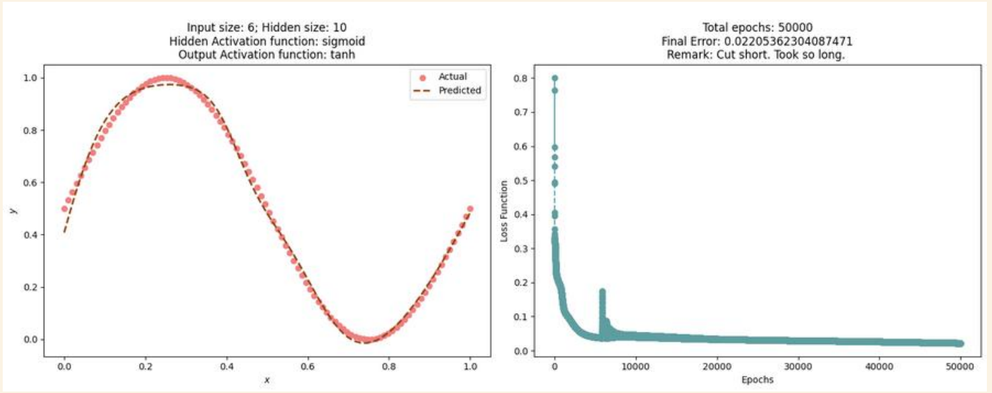


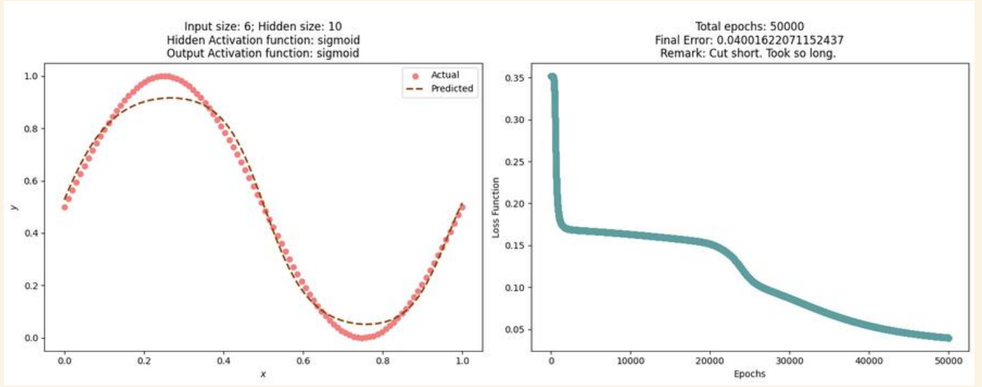
Sine Function

RESULTS: PART 1









Sine Function

RESULTS: PART 1

Output Activation Function	Hidden Activation Function			
	Sigmoid	Tanh	Linear	Rectified Linear
Sigmoid	Followed-Through with deviations	With great deviations	With deviations	Followed-Through but with slight deviations
Tanh	Followed-Through	With great deviations	With deviations	With deviations
Linear	Followed-Through	With deviations	With deviations	Followed-Through
Rectified Linear	Followed-Through	With deviations	Followed-Through with deviations	Followed-Through

Among all the combinations of hidden and output activation functions, the combination that yielded the best approximation was sigmoid as the hidden activation function and linear as the output activation function, followed by sigmoid as the hidden activation function and rectified linear as the output activation function.

Remarks of Efficiency in Approximating Sine Function

Note: the remarks above are subjective.

RESULTS: PART 2

Output Activation Function	Hidden Activation Function	
	Sigmoid	Rectified Linear
Sigmoid	100% Accuracy	
Tanh	100% Accuracy	
Linear	100% Accuracy	100% Accuracy
Rectified Linear	100% Accuracy	100% Accuracy

I decided to use the combination with the best approximate in the previous part of the activity. Based on the results, all of them yielded 100% accuracy in predicting whether the data is an Apple or a Banana. The dataset used were from the Perceptron activity conducted earlier. I converted the .mat file into .csv file to smoothen the flow of the algorithm in Python.

Remarks of Accuracy in Identifying Banana and Apple Images

REFLECTION

CRITERIA	SCORE
Technical Correctness	30
Quality of Presentation	30
Self Reflection	30
Initiative	0
Total	90

Of all the activities for this subject, I guarantee that this is the hardest one. I was unable to accomplish it in MATLAB, so I resorted to using Python. I chose Python because there are numerous available repositories that discuss the workings of Neural Networks, making it easier to comprehend and follow along. I would like to express my gratitude to Richmond, Ja, especially Abdel, Johnenn, and Julian for their assistance in completing this activity. Without their guidance, I would not have been able to submit it. I based my code on Julian and Johnenn's initial work, as well as other repositories I found on GitHub. Additionally, I utilized ChatGPT to help me understand certain Python codes that were unfamiliar to me at the beginning of the activity. Despite the challenges I encountered, I believe I have done enough to pass the activity, considering the substantial amount of assistance I received.