Work Integrated Learning Programmes

BITS Pilani
Pilani | Dubai | Goa | Hyderabad

Computer Science & Information Systems

Machine Learning - Lab sheet - Module 7

Exercise 2 - Multilayer Perceptron

1 Objective

The objective is to

- implement a Multilayer Perceptron.
- train the Multilayer Perceptron for OR and XOR gates.

2 Steps to be performed

Tool Python3

Libraries required numpy, matplotlib

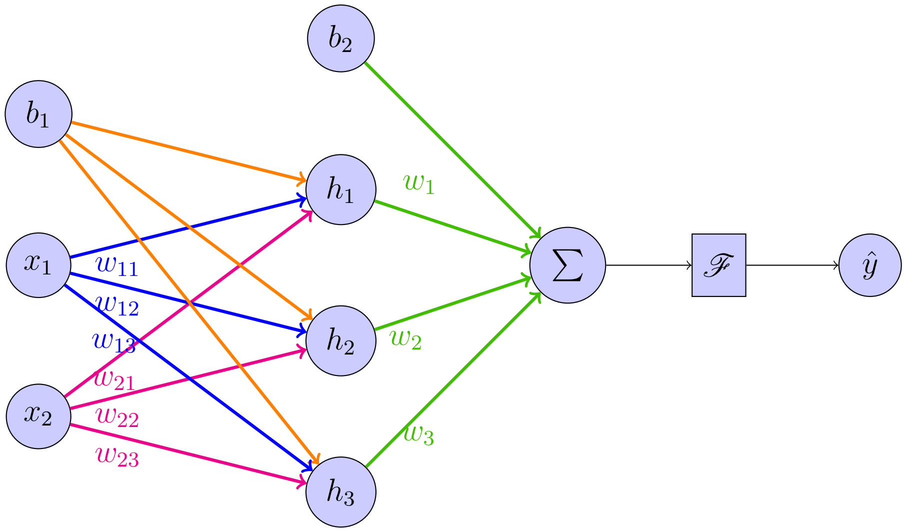
Input OR and XOR gate boolean data

Machine Learning Model Neural Network - Multilayer Perceptron

Implementation ML_Lab 15 Multi Layer Perceptron.ipynb

Steps .

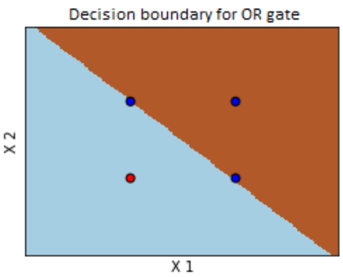
- Import required Python libraries.
- Create the dataset as numpy arrays.
- Visualize the dataset.
- Define the neural network architecture as shown below.

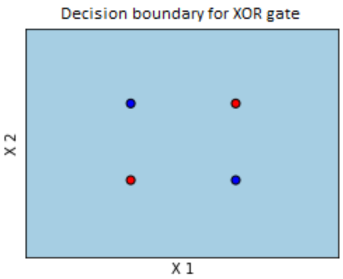


- Initialize the parameters, weights and bias, of the network.
- Implement forward propagation.
  For one example $x^{(i)}$
  - Compute the hypothesis.
  $$z^{(i)} = Wx^{(i)} + b \tag{1}$$
  - Compute the activation
  $$a^{(i)} = \begin{cases} 1 & \text{if } z(i) > 0 \\ 0 & \text{otherwise} \end{cases} \tag{2}$$
- Compute cost of the network.
$$J = \sum_{i=0}^{m} \left((y^{(i)} - a^{(i)}) * x^{(i)} \right) \tag{3}$$
- Update the parameters of the network using the learning rule.
$$W = W + \alpha * J \tag{4}$$
$$b = b + \alpha * J \tag{5}$$
- Visualize the decision boundary and cost function.
- Measure the performance of the model.

3 Results

- The Multilayer Perceptron was implemented.
- The parameters that will predict the desired output for OR and XOR gates were learned.
- The decision boundary and cost were plotted for OR and XOR gates.





4 Observation

- The trained Multilayer Perceptron predicted the OR gate outputs with 100% accuracy.
- The trained Multilayer Perceptron predicted the XOR gate outputs with 50% accuracy.
- The Multilayer Perceptron could not converge for the XOR gate data.