Indian Institute of Technology, Indore
Computer Science & Engineering
CS 354N: Assignment V - Perceptron
Date- 04-02-2025

Some general instructions:

- Name your file in "Assignment5_yourRollno.pdf" format.
- You are not allowed to use in-built libraries related to the topic. Code everything from scratch.
- Submission of the assignment should be made using the Google Classroom platform only.
- Plagiarism in any form will not be tolerated.
- You are allowed to submit only one before the deadline. Avoid multiple submissions. In such a case, only the last submitted file will be used for evaluation.
- Last date for submission of the assignment: **10-02-2025**
- Submit a single file (report) containing the procedure (screenshot of main procedures/code/Results).

1. Construct the 3-input perceptron neural network representation for the following logic gate, and after construction, you must change the initial weight values, learning rate value, and number of epochs. The threshold value is θ=0, and the threshold function is given below:

$$f(net) = \begin{cases} 1, & net \geq \theta \\ 0, & net < \theta \end{cases}$$

   i. AND GATE

   ii. OR GATE

   iii. NAND GATE

   iv. NOR GATE

   For the above gates, you must show in the report how the result changes after changing these values. The output should contain how many iterations are required for the training to converge and the final weights. Also, show in the output that your training has converged (target = predicted value) for every input.

2. The vectors defined below were obtained by measuring the weight and ear lengths of toy rabbits and bears in the Animal Factory. The target values indicate whether the respective input vector was taken from a rabbit (0) or a bear (1). The first element of the input vector is the weight of the toy, and the second element is the ear length

$$\{p_1 = \begin{bmatrix}1\\4\end{bmatrix}, t_1 = 0\}, \quad \{p_2 = \begin{bmatrix}1\\5\end{bmatrix}, t_2 = 0\}, \quad \{p_3 = \begin{bmatrix}2\\4\end{bmatrix}, t_3 = 0\}, \quad \{p_4 = \begin{bmatrix}2\\5\end{bmatrix}, t_4 = 0\}, \quad \{p_5 = \begin{bmatrix}3\\1\end{bmatrix}, t_5 = 1\}, \{p_6 = \begin{bmatrix}3\\2\end{bmatrix}, t_6 = 1\}, \{p_7 = \begin{bmatrix}4\\1\end{bmatrix}, t_7 = 1\}, \{p_8 = \begin{bmatrix}4\\2\end{bmatrix}, t_8 = 1\}$$

a. Code to initialize and train a network to solve this “practical” problem.
b. Code to test the resulting weight and bias values against the input vectors.

Note: All the programs must be user-friendly and user-interactive.