2023-August-Mathematics of Network Algorithms

Assignment 4

- Deadline: 10th Nov, 5pm. Please submit your assignment in the specified format here.
- You can only use numpy python library for math related functions.
- You **must** submit python file named as: *enrolment-nr-assignment-nr-question-nr-student-name*.py
  For example, for the student XYZ with enrolment number 20251010, a solution for the first question should be in the file 20251010-03-01-XYZ.py.
- Your code will be evaluated with the command $ python3 20251010-03-01-XYZ.py.
- Any deviation from these instructions related to submission will adversely affect the number of test cases your algorithm can solve.
- The points for each question will be determined by the quality of the output.
- Some test cases for the problem are available on the web-page.

The objective of this assignment is to build a artificial neural network that predicts whether an individual's income will be greater than $50,000$ per year based on several attributes from the census data. For all the following problems, we will use the data asst-4-data.txt, whose information can be bound in asst-4-data-info.txt.

1. (10 pts) [Cleaning Data] Write a python program that reads asst-4-data.txt and converts it into a useful format. The data contains 15 attributes. Your output should be a single line containing your roll number, total number of data points, followed by 15 numbers denoting the number of *valid entries*[1] in each columns.

2. (20 pts) [Building Neural Networks] Write a python code that creates a neural network and fits the above data.

   The output should be a single line containing your roll number, the number of perceptrons in each layer, the number of data points in asst-4-test.txt[2] on which the neural network correctly predicts output, total number of data points in asst-4-test.txt, and the time take by entire program.

   For example, if your neural network uses four layers with 20, 5, 10, and 1 perceptrons in these layers, and it solves 955 out of 1000 cases in 125 seconds, then the output should be

   20251010 20 5 10 1 955 1000 125

   You can assume that files asst-4-data.txt and asst-4-test.txt are present in the same folder as your program.

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[1]Use your judgment to define what constitutes a valid entry.

[2]Since you do not have this file, you need to split data in asst-4-test.txt into training set and test set.