The American University in Cairo

Department of Computer Science and Engineering

CSCE 5262/527 – Neural Networks and Genetic Algorithms

Dr. Mohamed Moustafa	Assignment 1 [10%]	Spring 2021

*Released February 21st, 2021 and due by March 7^{h}, 2021*

Implement a neural network classifier + its learning rule necessary to solve non-linearly separable problems. Your network implementation should be dynamic, e.g., should accept any configuration in terms of number of layers and number of neurons in each layer.

To facilitate testing and visualization of the results, make sure that your network implementation can successfully separate the two classes (blue and yellow) in the four two-dimensional data points cases shown in next page. The actual data points numerical values are provided in four separate text files with the same format. Each line represent one point: "x y class" with tab separation. "class" can be either 1 or 2 while x and y can be any value in the range -1.0 to +1.0. *You are not allowed to transform the input data.*
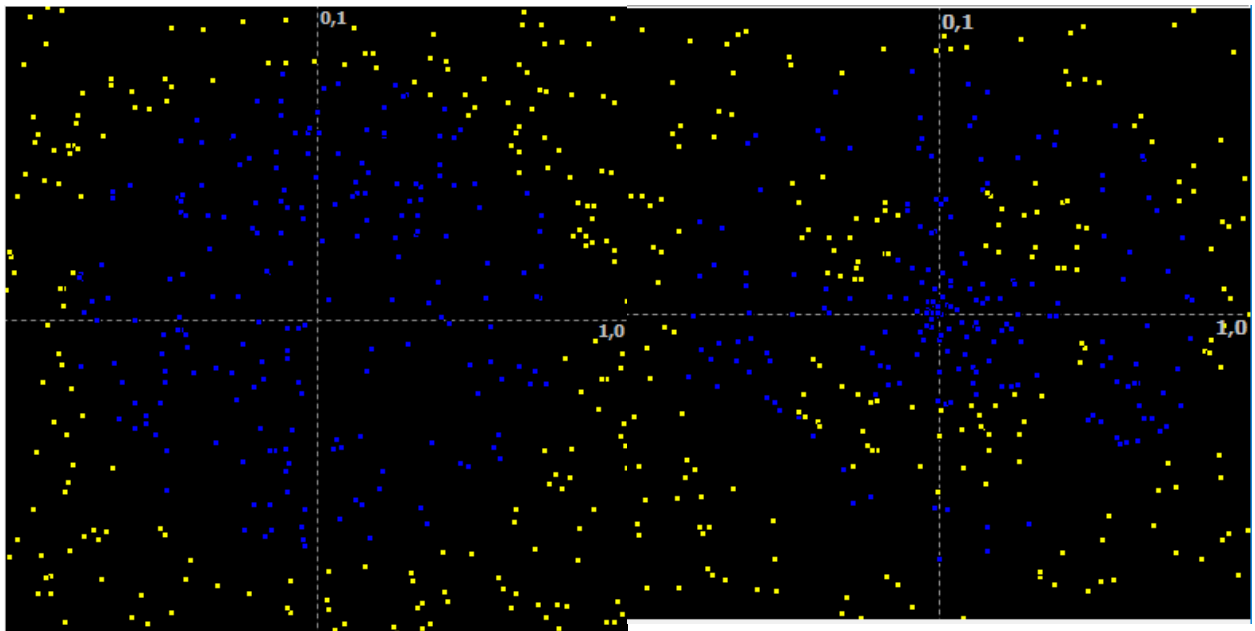
You are expected to deliver:

1. Mathematical derivation of the error backpropagation learning rule for two hidden layers network. **[1%]**

2. source code of your implementation **[2%]**

3. short report containing:
    a) a description of your network architecture and your training parameters. **[1%]**
    b) a plot of Mean square error (Y axis) versus number of training iterations (or epochs) showing decreasing training error and highlighting when did you stop the training for each of the four cases. **[1%]**
    c) a visualization of the decision boundary separating both classes. **[1%]**
    d) Minimum Correct Classification Rate (MCCR) for each of the four cases. MCCR is defined as the minimum of CCR1 and CCR2. CCRn is the ratio of the correctly classified points in class n divided by the total number of data points in class n. You get credit for each case as follows:

- "ring.txt": **[MCCR * 1%]**
- "xor.txt": **[MCCR * 1%]**
- "circle.txt": **[MCCR * 1%]**
- "face.txt": **[MCCR * 1%]**
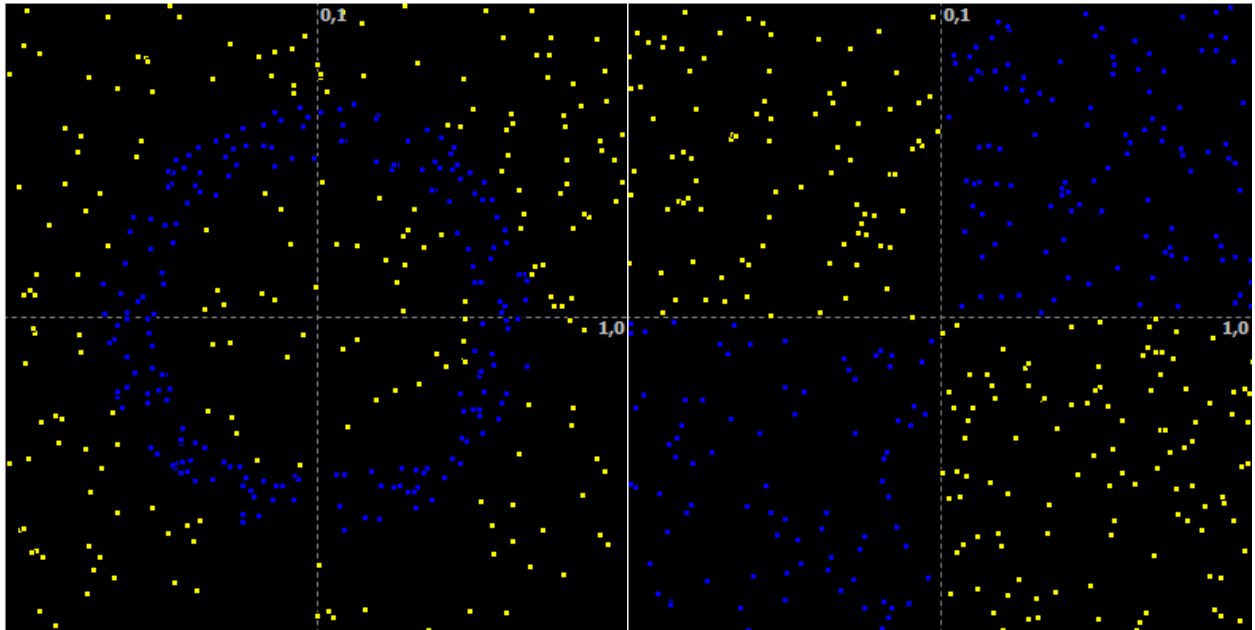
ring.txt

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