ECE 477/595 Artificial Neural Networks
Department of Electrical and Computer Engineering
University of Dayton

Fall 2022
Assignment 4 (*Due Date: 10/27/2022*)

Adaptive Resonance Theory

Design an ART based self-organized learning system for the classification/categorization of handwritten digits (0, 1...., 9). The input to the system will be a set of gray scale pixels (*use normalized values*) representing 28×28 image of handwritten digits. The output should indicate which cluster the input images are included.

Use a subset of the MNIST database consisting around 200 images of handwritten digits (*0....,9*) for training the system, and use another 100 images for testing the classification efficiency of the learned system. Use approximately the same number of data samples (images) for each digit in the training/testing processes.

Choose ***appropriate vigilance and learning rate parameters*** for the training process.

Refer to the sample code provide in the Resource folder on Isidore.

Plot the percentage error in testing your handwritten digit classification/categorization system:

a) with the training data
b) with the test data (***do not modify the synaptic weights during this process, test the classification efficiency***)

Provide the testing performances of tasks (a) and (b) as bar charts.

- Test the performance with different values of vigilance parameter.
- Test the performance with different values of learning rate parameter.

Design the **ART based classifier** with and without ***complement coding*** for input data representation and compare the classification performance.

Notes:

• The project should be implemented in MATLAB.

• **The methodology, program outline with flowchart and/or illustrations, implementation results with sample data sets, comments/discussions on the obtained results, and appropriate technical references** should be submitted on **Isidore**. (*Report Format: single column, single space, 11-point Times New Roman font*).

• The program codes along with the dataset used for testing and validation should be submitted through **Isidore** for evaluation.

• **Late submissions will not be accepted**.