ECE 477/595 Artificial Neural Networks

Department of Electrical and Computer Engineering

University of Dayton

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Assignment 7 (*Due Date: 11/17/2022*)

Bidirectional Associative Memory (BAM) Neural Network

Design a bidirectional associative memory neural network based **pattern association** learning system.

Identify a set of **10 binary image pairs** (*+1 and -1*) of **orthogonal patterns** for testing the pattern association capability of the bidirectional associative memory network.

The pattern pairs to be **stored** will be a set of binary values (*+1 and -1*) representing square patterns of dimensions **X_dim** by **X_dim** and **Y_dim** by **Y_dim** images of orthogonal patterns. (X_dim and Y_dim can be any number but use multiples of 4. We use X_dim=12 and Y_dim=20 as default setting. This makes pattern X as a **12 ×12 pattern** and pattern Y as a **20 ×20 pattern**).

Create a set of corrupted images by adding salt-and-pepper noise to the selected input pattern pairs (*0, 1,...., 9*) in the training set to evaluate the bidirectional pattern **recall** capability of the pattern associator. A corrupted X pattern would regenerate the corresponding Y pattern and that Y pattern would in turn regenerate the corrected X pattern, and vice versa.

Create different test sets with 0%, 10%, 20%, 30%, 40% and 50% salt-and-pepper noise to the images for testing.

You may refer to the sample codes provided in the **Resources**.

Plot the percentage error in testing your bidirectional pattern association system (*recalling the stored pattern pairs*) with at least 6 test data sets (*data sets with* 0%, 10%, 20%, 30%, 40% and 50% *salt-and-pepper noise added to the training set*).

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**.