Appendix: Associative memory applications 'ETAM Eq.(7---12)'.
Code in https://www.csie.ntu.edu.tw/~cyliou/red/demo/hairy/index.html

C code	M file

Data set in 'MNIST',
Number of saved handwritten patterns P= 60000 .
Number of attributes N=784= 28 X 28 pixels (B/W).
Number of training data = 55000.
Number of testing data = 5000.

Part I
https://scidm.nchc.org.tw/dataset/mnist
Window size = 5 X 5 pixels (convolution).
Total neurons = 28 X 28=784 in square grid points.
Total weights
=784 X 5 X 5 (including 4 edges and 4 corners) + 784 thresholds.
Note: delete all weights outside the window for each neuron.
Note that $w_{ij} \neq w_{ji}$ and $w_{ii} \neq 0$.

Part II
Augument one standard digit for each handwritten digit in the dataset, see the 10 digits with 96 pixels (8X12) in the paper..
Total neurons for the layer = 784 + 96
Total weights = 784 X 25 + 784 (thresholds) + 784 X 96 + 96X96+ 96 (thresholds).
Then apply the algorithm in ETAM' Eq.(7---12) training the neural network.
Any testing data will be associated with an unknown pattern, 96 pixels, that have assigned 96 '0' as input.
Note that $w_{ij} \neq w_{ji}$ and $w_{ii} \neq 0$
Note that CNN is hard for rotation and scale invariance.
It solved the invariance by enlarging the dataset with different rotations and/scales of each pattern