Name of Scholar	**:**	Thipendra Pal Singh
Supervisor	**:**	Dr. Suraiya Jabin
Department	**:**	Computer Science
Topic	**:**	Study of Recurrent Neural Networks for Pattern Storage and Recalling with Evolutionary Algorithms

Abstract

Key Words - *Machine learning, Artificial Neural Networks, Learning rule, Associative Memory, Storage capacity, Noise immunity, Hybrid system, Evolutionary Algorithm, Genetic Algorithm.*

The increasing quest of reducing the gap between information processing capabilities of human brain and a machine has motivated the researchers of various fields to collaborate and take up the challenge to build a general purpose machine which store the data the way human do and recall it while representing the partial or occluded form of it. Although researchers have progressed well into this by proposing various artificial neural network architectures but the gap is still wide. The first challenge is the storage capacity of these architectures while another one is correct recall of already stored information (pattern).

A neural network that is trained to associate a set of input vectors with a corresponding set of output vectors is called an associative memory. If the desired output vector is same as the input vector, the net is an auto-associative memory. If the output target vector is different from the input vector, the network is hetro-associative memory. The present work mainly focuses on neuro-genetic hybrid algorithm based systems to study the behavior of three RNN architectures–Hopfield neural network (HNN), Bi-directional Memory (BAM) and Adaptive Resonance Theory (ART1) for the following purposes: observing their dynamical behavior in combination with an

evolutionary algorithm, storing the information/patterns and later correct recall of it while presented information is incomplete, increasing the storage capacity of the network, and minimizing the problem of false minima.

Neuro-genetic hybrid algorithms have been devised to increase the capacity of associative memory in Hopfield network, BAM and ART1 networks. An appropriate encoding scheme is suggested to represent a chromosome consisting of weight vectors of synaptic connections. Suitable genetic operators are designed for the various operations of genetic algorithm (mutation, crossover, selection, elitism etc) to evolve the population of optimal weight matrices for the purpose of memorizing the input patterns and later recall these patterns with induced noise. The optimal weight matrix found during the training is used as seed for starting the GA, instead starting with random weight matrix.

The results thus obtained validate the fact that the application of hybrid neuro-genetic algorithms succeeded in achieving the target of pattern storage and recall along with noise immunity enlargement in the recurrent neural networks; namely HNN, BAM, and ART1.