A Review on Comparative Analysis of Back Propagation and Genetic Algorithm in Neural Network

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Abstract- Artificial neural networks (ANNs) have exposed that it has influential pattern classification and pattern recognition capabilities that can be worn as an implementation to get a realistic and exact prediction of future values for given data. This paper gives an outline on comparative analysis of back propagation and genetic algorithm. We compare the performances of a back-propagation neural network and genetic algorithm in the training outcomes Multilayer networks with Back propagation algorithm is acknowledged to be extremely helpful in real world problems. Genetic algorithm is extensively useful in the optimization of the neural networks parameters.

Keywords - *Artificial neural networks, Back-propagation, Convergence, Gradient descent, Genetic Algorithm, local minima, Partial Differential Equations.*

I. INTRODUCTION

In recent years modeling, simulation and control of internal parameters of physical systems or processes have become crucial areas of active research. Increasing demands for reliable and detailed analysis of various practical problems has made numerical modeling and simulation of physical systems an important area of research. This is true for both analyses of the systems themselves through simulations, as well as for design of associated controllers for system or process control. Moreover, most practical physical systems are governed by Partial Differential Equations (PDEs) and are of high-dimensional in nature. They appear in various application areas such as thermal processes, chemical processes, agricultural & biological systems etc. These systems involve strong or weak interactions between different physical phenomena. Hence, lots of challenges are involved in modeling, simulation, prediction of the data from a physical system.

ANNs are biologically stirred categorization algorithms that have input layer with neurons as nodes, one or more than one hidden layers and one output layer. Every node in layer have equivalent node in the preceding layer, hence forming the stacking result [1]. ANNs are extremely flexible tools and are extensively worn to undertake numerous factors [2-5]. Feed forward neural networks are solitary admired structures among ANNs. These proficient networks are broadly used to resolve multifaceted troubles by modeling with difficult input and output relations [6, 7].

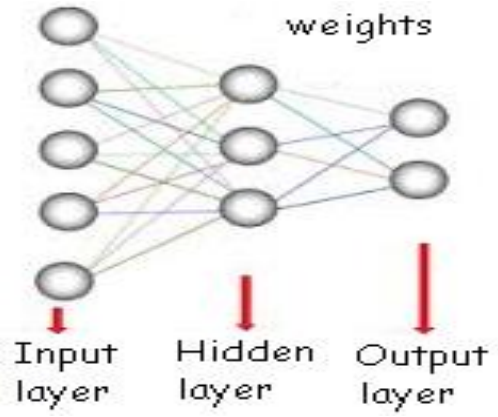

Fig.1 Artificial neural network

ANN frequently stops for being over trained. The learning procedure of ANN doesn't assure global optima, at times dropping the network to a local minima point. Thus back-propagation algorithm is a generally used for ANN learning in various applications. Thus back propagation implementation has a great benefit of easy implementation [8].

II. BACK PROPAGATION IN NEURAL NETWORK

Back-propagation (BP) in artificial neural networks is well-known learning algorithms amongst ANNs. In this process, the inexactness of ANNs is condensed by gradient decent search algorithm process [9]. The final output of every neuron is the sum of the every number of neurons of the preceding stage multiplied by the given set of weight. The input sets are transformed to sets of output signals with the help of the activation functions that are calculated. BP in ANNs has been generally applied in miscellaneous applications, like pattern recognition, selection of particular location in an area and routine evaluations. In additional, this BP algorithm acts similar with the given network weights, with error gradient descent method to calculate the error , that provides best impending function for relations between given sets of input data and the calculated outputs. But this method still faces troubles in convenient applications. During training

of the data the signal may reduce to the local minima point [10].

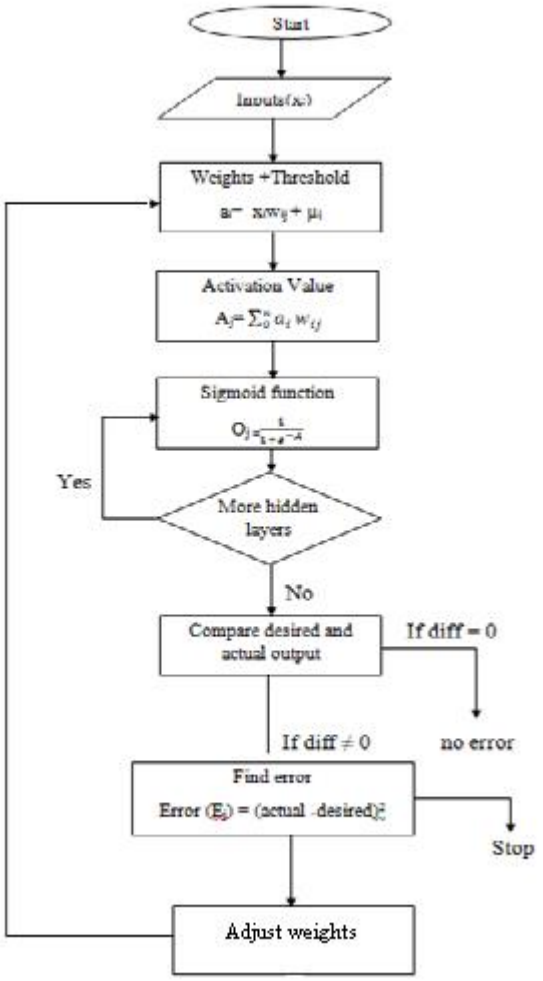

Fig.2 Flow Chart

Gradient descent method needs proper selection of several parameters like weights, bias values, value of learning rate, activation function. An inappropriate selection of such values may lead to slow convergence of data or even network may fail. Considering these situations, several variations in gradient descent learning algorithm with back propagation have been projected by many researchers to recover the training effectiveness. Variations in learning rate and momentum are done to accelerate the network convergence rate and to keep the network from getting caught in local minima [11]. The momentum coefficient is supposed to be changed regularly instead of keeping it fixed during the training [12].

III. GENETIC ALGORITHIM

Genetic Algorithms (GAs) is a searching algorithm which is based on the process of natural selection. The essential techniques of the GAs are intended to replicate the processes in natural systems for evolution [13]. In spite of this the canonical genetic algorithm technique, selects pairs of solutions of the given population, that are known as parents, and then combine them to form new population which are called children or offspring [14].

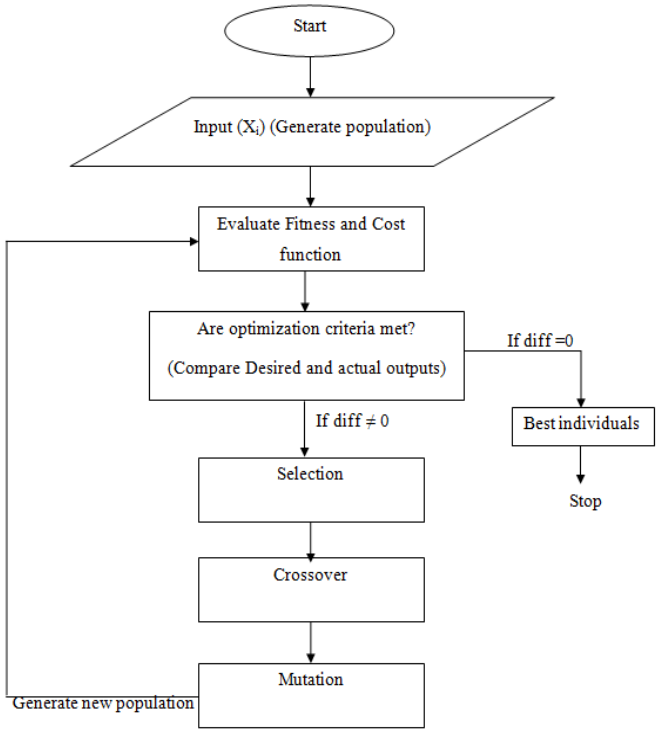

Fig.3 Flow Chart

In original the data that is represented as chromosomes is represented by a string of binary numbers. Every bit of each string is known as genes. A set of individual chromosomes is represented as population. The basic operators are reproduction, initialization, and crossover and mutation processes [15].

IV.DISCUSSION

The above study focuses on training an ANN by using a BP and GA. It has been concluded that BP is in fact slightly performers better than GA under some situations. Also, the BP performs more rapidly in training speeds than GA. But BP has one difficulty of getting over trained, while, GA do not. In terms of time required, the BP provides good outcomes than

GA. The learning rates in BP increases the speed of convergence also it depends upon derivative to modify the objective function whereas GA doesn't. The momentum coefficients also affect the mean square error (MSE) when its speed increases or decreases. Whereas when both these parameters are very small the MSE convergence. ANNs have learning and error acceptance characteristics. GAs provides finest solution in universal searches.

V. CONCLUSION

Both GAs and BP are search and optimization methods. The aim of this algorithm is to achieve weight modification to minimize the MSE among given data and target data. The experimental consequences show that BP provides better results than GA. So it is better to apply BP algorithm firstly during the training of the data, so that search space in GA can be reduced to perform better. Therefore the difficulty of the convergence at local minima can be eliminated. BP provides constant convergence of best solutions, but with greater number of learning cycles. Whereas GA needs lesser number of learning cycles to find out the best solutions, but with larger training time.

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