Comparative Approach of Optimization Algorithms for High Performance Routing using Neural Network

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Abstract- Packet switching network where the Routing is an important and a serious issue because of the significant impact on the computer and network overall performance. Hopfield neural network (HNN) is one of type of Artificial Neural Network (ANN). Because of Artificial Neural Network characteristics for example hardware implementation ability and the measurable computational speed there is a strong chances to consider it as problem solving factor of shortest path problem. Artificial Bee Colony(ABC) is nature-inspired meta-heuristic approach, it is performing on foraging behavior of real honey bees, becase of its robustness, simplicity and flexibility and robustness many research in optimization are been done using ABC. In this review paper, we will discuss the benefits of ABC and comparison with other optimization algorithms including Hopfied neural based algorithms too. The shortest path algorithms and review of application of ABC; advantages of ABC compare to other optimization algorithm, and hybrid ABC are also highlighted

Keywords - Hopfield Neural Network, Artificial Bee Colony Algorithm, Nature-Inspired Meta-heuristics, Optimizations, Swarm Intelligence

I. Introduction

Since long many of we have witnessed of several optimization algorithms developed basically based on nature-inspired ideas. Some examples of optimization algorithms include ant colony optimization [2], evolutionary algorithm [3], particle swarm optimization [2], Firefly optimization [4] etc. In context with the same, Artificial Bee Colony algorithm (ABC) was initially introduced by Karaboga in 2005 as a proper technical report basically for the numerical optimization problems [5]. These maximum of these algorithms are meta-heuristic based search techniques. They are also referred to as multipurpose optimization algorithms. It is very wide applicability in the many of the problems. Simulating the intelligent foraging behavior of real honey bees in their colony and its performance which was basically and initially calculate and measured using benchmark optimization function. There are many algorithms can be used as to optimized the ANN. And using this optimized ANN we will develop Hopfield neural network to optimized routing data.

The best part is that here we use ANN to solve simulation problem of optimization. Hopfield neural network (HNN). Firstly, HNN is introduced by Hop- field and Tank (1985) for solving Traveling Salesman Problem (TSP). HNN can be used to find the shortest path between two nodes. Here the node is considered as point or computer in a communication network was initiated by Rauch and Winarske (1988). Few scientist has basically focused on the same Ali and Kamoun (1993) has solve the problem of a prior knowledge of the network topology. This is require These Most of these algorithms are meta-heuristic based search techniques and generally referred to as multipurpose optimization algorithms because of their applicability to a wide range of problems like number of nodes in the shortest path. Also the problem of the weight matrix also been solved. Periodically, Bastos-Filho et al. (2007) proposed a new method to solve energy function faster.

II. ABC OPTIMIZATION AND COMPARISION

Foraging behavior of natural honey bee and swarms is rally inspired the ABC algorithms to take place. Initially the ABC was design to use unconstrained benchmark optimization functions [14]. Respectively the other well-known meta-heuristic algorithms and the extended Version of the ABC algorithm was then introduced to handle many

optimization problems. From 2005, ABC is continues to used by my many investigators from diverse disciplines across the globe [1]. Furthermore ABC result re compared with other optimization algorithm from all survey we found ABC is best still there are some limitation that is know as exploration and exploitation balancing. ABC is good at exploration but polor at exploitation. For this limitation is removed by using modified version of ABC [15].

Here now onward we see the comparison of different optimization algorithm and and also clear how ABC is more successful than said optimization algorithm

The scientist Karaboga and Basturk [11] in his work reasearched tand extended the ABC algorithm to handle constrained optimization problems. They use a set of 13 benchmark optimization problems. They have copare the result with other Differential Evolution (DE) and PSO algorithms. The specified the dimension of each function varying from 10 to 30 for the optimization function. But the result shows that the ABC is give efficient result than ACO(ant colony optimization) and PSO(particle swarm optimization). There is the reason why ACO is time to convergence is uncertain and sequence of random decision(not independent) and PSO is easily suffer from the partial optimization and it doesn't work out of scattering optimization[2]. The above limitation was removed by ABC. The particle swarm optimization algorithm invented in 1995. The scientist James Kennedy and Russell C. Eberhart [2]. The ACS mean ACO was proposed by Dorigo et al. (Dorigo and Gambardella, 1997) as a new heuristic to solve combinatorial optimization problems. Based on this ant chain, ant colony algorithm is defined, and its work mainly based on amount of pheromones. And find best optimum cost path.

The protein-folding problem is a challenging biochemistry based energy minimization task. That can be resolved experimentally or computationally. The result are accurate base on experiment. The mail problem with the same is that it is very costly and also time consuming. The scientist have [12] utilized the ABC algorithm to identify the Protein structure using AMC also compared the results to other techniques to train feed-forward neural networks. Three tests were considered: the Exclusive OR, 3-Bit Parity and 4-Bit Encoder-Decoder problems. The solutions obtained by the proposed algorithm and GA and Back Propagation (BP) techniques are been compared. The result shows that the scheduling ABC give better result than other algorithm like HGA, HDPSO [10].

Modified version of ABC was initiated with proposed in [1]. Named Modified ABC are used for real parameter optimization in that control parameter introduced like modified rate and scaling factor in that replacing the random initialization with the opposition based population initialization can get better initial solutions and then accelerate convergence speed.

There are other version of ABS know as Interactive ABC which is used for numerical optimization. Discrete ABC is enhancing the local search. The the smallest slack time on the last machine (LSL), Earliest due date (EDD) and the smallest overall slack time (OSL) rules for the starting population and also with definite diversity and quality were generated with an efficient initialization method. For scheduling purpose neighboring solutions food sources were produced using insert and swap operators, which will enable the DABC algorithm to work on discrete/combinatorial spaces, [1]. Parallel ABC and DistParallel ABC, in distributed entire colony are distributed into sub group communicating using message passing technique. A parallel ABC for security constrained economic dispatch using shared memory model, not only reduced execution time but also improve the quality of solution. MO-ABC (multi-objective ABC) is used for solve a real-world frequency assignment problem. To determine the direction of flight of a solution, this used external archive strategy to Preserve non-dominated solution vectors. Mimetic ABC is incorporated Deb's rule in the selection of food source employed and onlooker bees. Used for large scale global optimization. Four exploration stages are identified: 1.stochastic long-distance, 2.stochastic moderate-distance, 3.deterministic short-distance, and 4. random long-distance explorations.

III. HOPFIELD NEURAL ROUTING AND COMPARISION

A Hopfield network is a single layer fully connected internetwork in which each node is input as well as output they are called content addressable memories because we can access location by its content. It is also called as associative memories. Associative memory is a memory that is addressed through its contents. So we are storing the patters in content addressable memories and then identifying given input patterns based on that stored one or more patterns. Hopfield network checks the input against the patterns stored in the network and based on that matching it gives the activation to the neurons. In machine learning, artificial neural networks (ANNs) are a class of statistical learning algorithms inspired by biological neural networks and are used to estimate or approximate functions that can depend on a large number of inputs and are generally unknown. Artificial neural networks are generally presented as systems of interconnected "neurons" which can compute values from inputs, and are capable of machine learning as well as pattern recognition.

Fischer et al. [5] defined learning as follows: Learning is a process by which the free parameters of a neural network are adapted through a process of stimulation by the environment in which the network is embedded. The type of learning is determined by the manner in which the parameter changes take place. In other words an effective learning process has a close relationship with the interaction between environment and neurons, which are ideally part of the medium.

The comparison of the traditional vs Hopfield neural network is been identified here with. If we will talk about the complexity of Asynchronous distributed Bellman-Ford algorithms will be big O notation O(N3) where each node broad cast s to its neighbors of the latest route cost also the adaptation will be possible in the same. While we are talking about the Distra algorithms the complexity will be O(N2) where the each node will broad casts to all other nodes of its connectivity to neighbor nodes. It is also provide the adaptation facility. Compare to Hopfield neural network the complexity of the algorithms initially. The complexity of the algorithms is O(N3). Here message passing is require in learning phase only the detail data published in the next session.

IV. HOPFIELD NEURAL ROUTING OPTIMIZATION

In the further our work out is to perform optimization of the routing with the neural network formation. We would like to form the Neural Network with the optimum way using different optimization routing. To form the neural network we have to keep in mind the exploitation and exploration problem of optimization algorithms here with we are selecting the Proposed ABC to form the Neural Network base on following comparison. Here the table provide the data based on the same problem of basic ABC which can be identified in the different version of ABC too. In future we also will proposed new ABC will solve the problem of exploitation and exploration base on the following limitation of different version of ABC.

Table 1: Compressive survey of variants ABC with that Application, Benefits and drawbacks

Limitation / Problem of Algorithm	Algorithms	Advantages	Disadvantages
Optimization in Kernel	DABC (D-dynamic)	Global and Local search optimization and balancing	-------
Fault Identification	fireflies	Find fault in less time	Complex (lighting co-efficient)
Load Dispatch economically	Parallel ABC	Fast process	Complex in structure
Scheduling	DABC (D- discrete)	Optimal result in less cost for scheduling with ideal case	Not get optimal result in ideal case
MDGP (Reliability Redundancy)	ABC	In less time calculate optimal result of maximally diverse grouping and redundant component	Use crossover operator

Here with another table show the why we are using the Hopfield Neural Network for routing purpose.

Table 2: Compressive survey of variants ABC with that Application, Benefits and drawbacks

Complexity	Computation	Communication	Adaptation
Hopfield network	O(N3) Initially the number of Messages in learning phase	Post communication none	Possible
Bellman-Ford (Asynchronous Distributed)	O(N3)	Latest routing cost will be broad cast by Each node to respective neighbors	Possible
Dijkstra Algo	O(N2)	Latest neighbor connectivity will be broad cast by each node to all other node	Possible

V. CONCLUSION

The basic aim of this paper is to overview the basic research on the ABC algorithm and the identification of need to modify the basic ABC algorithms compare to available modified version of ABC. It is also important to use the ABC for developed neural network to optimized using ABC. The optimized NN will the after used in Hofield Neural Network to optimized the packet routing. We reach to conclude that the ABC algorithm having two parameters like CS and MCN to be adjusted. It is high emphasized to compare with other meta-heuristic algorithms. We find the ABC is compare to any other variant perform better in context with optimization. We also discuss the ABC comparision with other algorithms. We also discuss the Hopfield neural network and other routing algorithms so select best one. In future we will used modified ABC to optimized Hopfied neural netwok and used it in routing optimization.

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