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A Survey of various Routing Algorithms based on Shortest Path

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***Abstract* — Conventional optimization methods were needed huge computational attempts, which grow exponentially as difficulty dimension enhances with the networks of independent nodes. Researchers are continuously working upon the challenges like communication link failures, low memory, calculating constraints, and maximum valued energy. A lot of problems may formulated and approached through multidimensional optimization problems, in which most nodes are not neighbors of one another, but can be reached from every other by a small number of hops. Optimization problems under uncertainty are complex and difficult, and often classical algorithmic approaches based on mathematical and dynamic programming are able to solve only very small problem instances. For this reason, in the recent years meta-heuristic algorithm such as Ant Colony Optimization, Evolutionary Computation etc. are emerging as successful alternatives to classical approaches.**

***Index Terms* — Ant Colony Optimization (ACO), Particle Swarm Optimization (PSO), MANETs.**

I. INTRODUCTION

PSO is one of the latest swarm intelligence algorithms; consequently, when compared to previous sophisticated algorithms such as genetic algorithms and simulated annealing, the study of its properties and applications is still in its infancy. Particle Swarm Optimization (PSO) [1] [7] technique is applied to resolve the quality of services (QoS) routing problem. PSO is a stochastic, population based evolutionary computer algorithm for problem solving. It is based on socio-psychological principles and involves insights into social behavior.

The new thought to be appropriating intelligence which make possible the nodes to acquire choices and bring out the routing of the packets successfully. PSO has accomplished to find the optimal path with capable nodes. PSO is a method of optimizing the candidate results iteratively and trying to progress towards the final result. The resources involved in the implementation of such an algorithm is less and it can be easily used for a real-time environment. The maximization of quality properties is not seriously considered in today's network scenario for solving optimal path. The introduction of quality grading is found to be helpful in obtaining quality property maximization while generating routing optimization.

PSO has been practically used extensively in the function optimization, artificial neural network training, pattern recognition, fuzzy control and some other applications. Even though the fact that PSO is extended for uninterrupted optimization difficulty at the start, there have been some descriptive works focused on discrete problem in recent times. For example use of PSO algorithm to resolve network routing problems [2] [3], on the other hand PSO algorithms has low convergence rate in the afterward phase and is straightforwardly trapping in local optimum. Till now a little work has been done on use of PSO to work out for all type of casting routing problem (ARP) with multiple QoS constraints.

II. THEORETICAL BACKGROUND

On the rapid changes to sustain multimedia applications in wireless network, it is popular that such network maintains multicast connection for the whole session during connection establishment. Multicast routing is extensively making use of multimedia internet applications and for live video streaming. Hence we need an efficient implementation of this routing technique which has low computational cost and good performance. Genetic Algorithms (GA) and Ant Colony Optimization (ACO) techniques have been used to solve this problem. PSO can be easily used to handle a large number of test cases and possible solutions for a given problem.

On the other hand, GA has an affinity to come together in the direction of local optima or even uninformed points before the global optimum crisis. Furthermore, GA in actual fact cannot solve problems for which only the fitness function is either true or false, as there is no other way to converge on the solution. In these cases, a random search may get to find the

optimal solution as rapidly as a GA. For assured optimization problems, simpler optimization methods such as PSO may find better solutions than GA.

PSO moves towards the global optimal solution by taking into consideration the local solutions of the particles. The computational cost involved is very low and it is ideally suited for very large input cases. Thus, PSO can be easily used to solve the QoS etc.

III. Particle Swarm Optimization

The Particle Swarm Optimization (PSO) [4] is a heuristic universal optimization method and also an optimization algorithm in which is based on swarm intelligence that is behaviors of flock of birds, swarm of honey bees, colony of ants etc. PSO become skilled at the circumstances and has been used to explain optimization problems. In PSO each distinct clarification is a "bird" in the exploring space, which is known as "particle", each particle has its own fitness value which is evaluated by the fitness function used in optimization, and have velocities which expressed the flying of the particles. These particles fly all the way through the difficulty space by following the existing optimum particles.

PSO is initialized with a group of random particles (i.e. solutions) and then searches for optima by informing creations. In every iteration, each particle is updated by following two "best" values. The first one is the best solution (fitness) it has achieved so far and is also stored, this value is called pBest. Another "best" value that is tracked by the particle swarm optimizer is the best value, acquired to this point by any particle in the inhabitants. This best value is a global best and it is known as gBest. When a particle takes part in the population as its nearest neighbors, the best value is a local best and is called lBest. In PSO, each particle not only learns from its own best history record, but also learns from the existing global optimum record.

To the extent that particle swam optimization algorithm [4] is apprehension, explanation swam is evaluated to the bird swarm, the birds' moving from one place to another is equal to the growth of the explanation swarm, good information is capable to provide the most optimist result, and the food resource is equal to the most optimist solution during the whole course. Nearly each optimist result can be worked out in particle swarm optimization algorithm by the collaboration of each individual. The particle exclusive of quality and volume provides as each individual, and the simple behavioral pattern is standardized for each particle to illustrate the difficulty of the entire particle swarm. This algorithm can be applied to work out the difficult optimist problems.

Advantages of the basic particle swarm optimization algorithm:

Particle swarm optimization (PSO) algorithm is robust, simple in concept, and easy to implement. PSO algorithm also used to solve the TPS problem.

In addition, there is a lot of fraud in the network. Fraud is nothing more than reverse right and wrong, regard "good" nodes as "bad" and "bad" node as "good". Particle Swarm Optimization algorithm also used to find out the optimal path step by step. When the algorithm is running, it will look for the non-inferior solutions and eliminate inferior solutions, and therefore it can effectively prevent joint fraud.

In the trust network, the main difficulty in the optimal path selection is the selection of the utility function. In particle swarm optimization algorithm, each particle corresponds to a point set which is composed by a path, so the greatest trust value for the point set of possible paths can be a natural choice for utility function.

(1)PSO is based on the intelligence. It can be applied into both scientific research and engineering use.

(2)PSO have no overlapping and mutation calculation. The search can be carried out by the speed of the particle. During the development of several generations, only the most optimist particle can transmit information onto the other particles, and the speed of the researching is very fast.

(3)The calculation in PSO is very simple. Compared with the other developing calculations, it occupies the bigger optimization ability and it can be completed easily.

(4) PSO adopts the real number code, and it is decided directly by the solution. The number of the dimension is equal to the constant of the solution.

Disadvantages of the basic particle swarm optimization algorithm:

(1)The method easily suffers from the partial optimism, which causes the less exact at the regulation of its speed and the direction.

(2)The method cannot work out the problems of scattering and optimization.

(3)The method cannot work out the problems of non-coordinate system, such as the solution to the energy field and the moving rules of the particles in the energy field.

IV. Ant Colony Optimization

In computer science and operation research, the ant colony optimization algorithm (ACO) is a probabilistically techniques for solving computational mathematical problem which can be reduce to find good path through a graph. Ant Colony Optimization (ACO): a Swarm intelligence method. ACO algorithms have been applied to many combinatorial optimization difficulties, ranging from quadratic task to collapse protein or routing vehicles and a lot of derived methods have been adapted to dynamic problems in real variables, stochastic difficulty, multi-targets and parallel executions. The ACO algorithm [16] is a member of the ant colony algorithm group root family in swarm intelligence method and it constitute some meta-heuristic optimizations the 1st algorithms was aimed to search an optimal paths in a graph based on the behaviors of ants seeking a best path between their colony's and a sources of the food. The original idea has since diversified to solve a wider class of mathematical numerical problem, and as a result several problem have emerging drawled on various aspect of behaviors of ant. The ACO algorithm has been inspired from the food searching behavior of ant.

Fundamental of Ant Colony Algorithm: The basic idea of ant colony algorithms [16] is taken from food searching behaviors of ant. When ants are in search of their foods, they deposited the pheromone on the way which makes route for them. The pheromone is nothing but the liquid which evaporated with time. Therefore that pheromone concentration on the paths is nothing but indication of probability usage of the feasible path. As shown in diagram there are 3 routs from nest to destination. At intersection the 1 ant select path randomly. The path A is the minimum shortest one therefore the ants which takes paths A reached first to food.

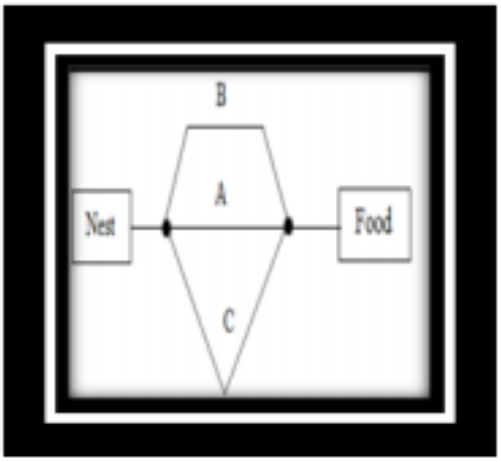

Figure: Ant Colony mechanism to find shortest path.

Now ant while coming back to nest again ant has to selects path. Here ants decided the path depending on pheromone concentrations and it is obvious that the pheromone is concentration in shortest path will be big or higher than the others. After sometime pheromone concentrations on shortest paths will be highest and all ant will take shortest paths only. This idea of finding the shortest paths is used in communication network. Due to its dynamically and probabilistically natured, this algorithm is used for MANET where topology changes frequently.

Ant Colony Optimization (ACO) is a recent meta-heuristic approach which aims at exploring the successful behavior of real ants of finding shortest path to source of food, used for solving combinatorial problems [5] [6]. In most of the real species ants have an effective indirect way to communicate each other which is the most promising trail, and finally the optimal one, towards food: ants produce a natural essence, called pheromone, which they leave on the followed path to food in order to mark it. The pheromone trail evaporates over time and it disappears on the paths abandoned by the ants. On the other hand, the pheromone trail can be reinforced by the passage of further ants: thus, effective (i.e., shortest) paths leading to food are finally characterized by a strong pheromone trail, and they are followed by most of ants. Ant colony optimization algorithms have been applied to many combinatorial optimization problems, ranging from quadratic assignment to fold protein or routing vehicles and a lot of derived methods have been adapted to dynamic problems in real variables, stochastic problems, multi-targets and parallel implementations. It has also been used to generate nearest optimal explanations to the traveling salesman problem.

V. Literature Review

Min Kong et al. [8] proposed a new ant colony optimization (ACO) approach, called binary ant system (BAS), to multidimensional Knapsack problem (MKP). Different from other ACO-based algorithms applied to MKP, BAS uses a pheromone laying method specially designed for the binary solution structure, and allows the generation of infeasible solutions in the solution construction procedure. A problem specific repair operator is incorporated to repair the infeasible solutions generate in every iteration. Pheromone update rule is designed in such a way that pheromone on the paths can be directly regarded as selecting probability. To avoid premature convergence, the pheromone re-initialization and different pheromone intensification strategy depending on the convergence status of the algorithm are incorporated. Experimental results show the advantages of BAS over other ACO-based approaches for the benchmark problems selected from OR library.

A web spam [9] is a deliberated manipulation of searching engine indexes. It involves some methods, such as repeated nonrelated phrases, to manipulate the relevant or prominence of resource index in a mannered inconsistent with the purpose of indexed systems search. That engine include determining whether the searching term appeared in this contents or URL on a webpage. We presented the spam host detection approaches. This content and linking features are extracting from the hosts to train a learning model based on ant colony optimization (ACO) with bee colony optimization (BCO) algorithm. The dataset algorithm has been collected the details from WEBSPAM-UK2008 and implementing by a java Environments. The optimal solution is different with the ant colony and bee colony optimization.

There are many challenges of quality of services (QoS) were faced during wireless sensor networks (WSN) application. Many QoS metrics, not only data packet delay and bandwidth efficiency, but power consumption should be considered in network design. QoS metric levels are greatly affected by network routing. Since the routing solution space grows exponentially with the size of the network, it is necessary to research efficient combinatorial optimization algorithms for routing. After studying intelligent particle swarm optimization (PSO) algorithm, a new routing algorithms based on PSO is described [10], which has the potential to address many QoS metrics together and has an outstanding searching ability. The approach is well founded theoretically as well as detailed algorithmically. Simulations and comparisons to some typical QoS routine methods show that particle swarm optimization based routing algorithm is effective.

Many variants of the original particle swarm optimization (PSO) algorithm have been proposed. In many cases, the difference between two variants can be seen as an algorithmic component being present in one variant but not in the other. Here they [17] propose new PSO, where first they presented the results and insights obtained from a detailed empirical study of several PSO variants from a component difference point of view. In the second part, proposed a new PSO algorithm that combines a number of algorithmic components that showed distinct advantages in the experimental study concerning optimization speed and reliability and call this composite algorithm Frankenstein's PSO. Frankenstein's PSO is composed of three main algorithmic components, namely,

1) A time-varying population topology that reduces its connectivity over time.
2) The FIPS mechanism for updating a particle's velocity.
3) The decreasing inertia weight.

These components are taken from AHPSO, FIPS, and the time-decreasing inertia weight variant, respectively. The first component is included as a mechanism for improving the tradeoff between speed and quality associated with topologies of different connectivity degrees. The second component is used because the analysis showed that FIPS is the only algorithm that can outperform the others using topologies of different connectivity degree. Finally, the decreasing inertia weight component is included as a mean to balance the exploration-exploitation behavior of the algorithm.

M.Reddy et al. [11] implemented ACO based heuristic approach for Location Routing Problem (LRP) in bill delivery services for the telecommunication company in Hong Kong. The proposed algorithm has statistically proven its effectiveness for solving the practical problem in LRP and the results obtained are comparable with the existing heuristics. In comparison with the existing solution methodologies for the problem considered, the uniqueness of the ACO-based heuristic lies in its constructive approach which exploits an indirect form of memory of previous performance to discover the best near-optimum solution efficiently. The new thing they found in the proposed ACO-based heuristic is that the ants carry out both allocations and routing simultaneously; whereas the existing algorithms perform the allocation using some other heuristics like TA and SA.

In Ad-Hoc network there are a lot of problems, which can be categorized as an optimization problem such as energy aware consumptions, routing protocol, localizations and nodes deployed. Many researchers done research to solve these mathematical problems and recently find new class of routing algorithm which is based on Swarm Intelligence. Ant Colony optimization algorithm is a survey process done on various ant colony optimization based on routing algorithm for Wireless Sensor Network (WSN) and Mobile Ad-Hoc Network (MANETs) [12]. Different type of comparison of various algorithm is made based on the performance measuring, pheromone functions to selected next node, simulating used, energy consumption awareness's, and etc.

In another paper [13], Gianni Caro et al. have described AntHocNet, a routing algorithm for MANETs which was inspired by ideas from Swarm Intelligence especially using framework of ACO. The algorithm combines reactive and proactive behavior to deal with the specific challenges of MANETs in an efficient way. Routing information is learned through Monte Carlo sampling of paths using repeatedly and concurrently generated ant agents, as is common in ACO routing algorithms. They have evaluated the algorithm in an extensive set of simulation tests and suggested that AntHocNet is more scalable than other routine technologies.

A novel Cooperative Bees Swarm Optimization (CBSO) algorithms [14] based on foraging behaviors of honey bee has been presented. On the Cooperative Bees Swarm Optimization (CBSO) employer's cooperative behavior of multiple swarms in optimization numerical function. The proposed approaches provided different type of patterns which is used by the bee to adjust their fly trajectory. The flyer pattern provided an efficient way to balance explorations and exploitations. Cooperation is obtained by sharing information between the swarm through a leading swarm. This is also a colonization process of performance between the swarm. In colonization process a portioning of an extinct swarm is replaced with their individual from a colonist swarms. The proposed algorithms were tested on the set of good well-known test functions. Result have shown that the proposed algorithm is efficient, robust, and outperformer then other genetics particle swarms, and bee's algorithm examined in this paper.

Multi-objective optimization formed realistic model for many more complex engineering problem. Different type of genetic algorithms solution having been providing to solve these problems. In [15] they fund a new particle Swarm Intelligence based on Genetic Algorithms (SIGA) to overcome the disadvantage faced in the previous approach. The example problem chosen is Multi-objective human resource allocation problems. This problem has already been solved by hybrid genetic algorithms. They find newly proposed SIGA outperformers the previous process one. The simulating result providing at the end of this paper process proved this works.

CONCLUSION

The review of the studies of the preexisting PSO algorithms has been provided in this paper. As per study PSO is good for two dimension approach rather than multidimensional till now, but Ant Colony Optimization is a metaheuristic approach initially defined to solve problems within the class of combinatorial optimization. The algorithms that were reviewed have been used to solve all sorts of problems, but mainly problems within the combinatorial optimization class. These algorithms can be further used for load balancing, image processing and clustering. Some of the algorithms have worked best for the searching quality path but time of search had been increased which ultimately increasing the cost of search. We can work upon improving the cost and time factors by choosing more specific decision criteria for next root. Possible this can be done by choosing some specific parameters.

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