Critical Review of Various Optimization Algorithms In Manet

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I. INTRODUCTION

Mobile Ad Hoc Network (MANET) is a collection of two or more devices or nodes or terminals with wireless communications and networking capability that communicate with each other without the aid of any centralized administrator also the wireless nodes that can dynamically form a network to exchange information without using any existing fixed network infrastructure.

In Mobile Ad Hoc Network (MANET), various routing protocols are there like AODV, DSDV, TORA, DSR etc. Various optimization techniques can be used to find out the best and optimal solution. Nature inspired algorithms are meta heuristics that mimics the nature for solving optimization problems opening a new era in computation.

Mobile ad -hoc network is a collection of wireless mobile host without fixed infrastructure and centralized administration (figure1).Communication in MANET is done via multi hope paths. Lots of challenges are there in this area: MANET contains diverse resources the line of defence is very ambiguous; Nodes operate in shared wireless medium, network topology changes unpredictably and very dynamically, Radio link reliability is an issue, connection breaks are pretty frequent more over density of nodes, number of nodes and mobility of hosts may vary in different applications, There is no stationary infrastructure. Each node in MANET acts as router those forward data packets to other nodes.

Reactive Routing Protocols discover routes only on demand basis and do not take initiative for finding a route. They do not update route tables constantly. E.g. AODV, DYMO, TORA, ARA. Proactive Routing Protocols maintain table of each node which contain the latest information of routes to nodes, to know its local neighborhoods. In this control messages are periodically exchanged. E.g. DSDV, OLSR, WRP. While the combination of Reactive and Proactive Routing Protocols fall into the category of Hybrid Routing Protocols. E.g. ZRP, FSR, HOPNET, DDR. By Optimization, we can find the desirable solution from all outcomes [2]. Various Optimization approaches can be used to find the optimal and best solution. For optimization biologically inspired algorithms is the category of algorithms that resemble with the performance of nature. By these algorithms various problems can be solved due to their advantages: First, to reach a solution, we don't have to follow any mathematical approaches. Second, results come very fast and are accurate . Optimization approaches which fall into the category of these algorithms are:

- Genetic algorithms
- Particle Swarm Intelligence
- Ant Colony Optimization
- Artificial Bee Colony Optimization
- Artificial Neural Networks
- Bacterial Foraging Algorithm

II. GENETIC ALGORITHMS

Genetic Algorithms (GAs) are adaptive heuristic search algorithm based on the evolutionary ideas of natural selection and genetics. As such they represent an intelligent exploitation of a random search used to solve optimization problems. Although randomized, GAs are by no means random, instead they exploit historical information to direct the search into the region of better performance within the search space. The basic techniques of the GAs are designed to simulate processes in natural systems necessary for evolution, specially those follow the principles first laid down by Charles Darwin of "survival of the fittest.". Since in nature, competition among individuals for scanty resources results in the fittest individuals dominating over the weaker ones.

It is better than conventional AI in that it is more robust. Unlike older AI systems, they do not break easily even if the inputs changed slightly, or in the presence of reasonable noise. Also, in searching a large state-space, multi-modal state-space, or n-dimensional surface, a genetic algorithm may offer significant benefits over more typical search of optimization techniques. (linear programming, heuristic, depth-first, breath-first, and praxis.)

III. PARTICLE SWARM INTELLIGENCE

PSO simulates the behaviors of bird flocking. Suppose the following scenario: a group of birds are randomly searching food in an area. There is only one piece of food in the area being searched. All the birds do not know where the food is. But they know how far the food is in each iteration. So what's the best strategy to find the food? The effective one is to follow the bird which is nearest to the food. PSO learned from the scenario and used it to solve the optimization problems. In PSO, each single solution is a "bird" in the search space. We call it "particle". All of particles have fitness values which are evaluated by the fitness function to be optimized, and have velocities which direct the flying of the particles.

The algorithm keeps track of three global variables:

- Target value or condition
- Global best (gBest) value indicating which particle's data is currently closest to the Target
- Stopping value indicating when the algorithm should stop if the Target isn't found

IV. ANT COLONY OPTIMIZATION

Ant Colony Optimization (ACO) studies artificial systems that take inspiration from the behavior of real ant colonies and which are used to solve discrete optimization problems. First introduced by Marco Dorigo in 1992. Originally applied to Traveling Salesman Problem. Natural behavior of ants has inspired scientists to mimic insect operational methods to solve real-life complex optimization problems. By observing ant behavior, scientists have begun to understand their means of communication. Ant-based behavioral patterns to address combinatorial problems - first proposed by Marco Dorigo.

V. ARTIFICIAL BEE COLONY OPTIMIZATION

Based on the behaviour of the bees in nature, various swarm intelligence algorithms are available. This algorithm is based on the foraging behaviour of honeybee swarm and was proposed by Basturk and Karaboga. These algorithms are classified into two; foraging behaviour and mating behaviour . In ABC algorithm there are mainly three groups of bees:

- Onlookers
- Employed
- Scouts

For a food source, bee waiting for making a decision is referred as onlookers. As it goes to the food source, which it visited before is named as employed bee. The bee carries out random search referred to as scouts.

VI. BACTERIALFORAGING OPTIMIZATION ALGORITHM (BFOA)

This algorithm is global optimization algorithm inspired by foraging behavior of bacteria named ac Escherichia Coli. BFOA is inspired by chemotaxis behavior of bacteria. These bacteria get the direction to food based on gradients of chemicals . The information processing strategy is achieved through series of processes.

Chemotaxis: Cells move along the surface one at a time. Reproduction: Best set of bacteria of is selected, so that it contributes to the next generation. Elimination and Dispersal: Cells are discarded and new samples are inserted.

VII. COMPARATIVE ANALYSIS

Survey of Optimization approaches

Applied Approach	Operators	Areas of Application
Genetic Algorithm	Crossover Mutation Selection Inversion	Web page classification system, Power System Optimization problems,
Particle Swarm Intelligence	Initialize Updater Evaluator.	Edge detection in noisy images ,balancing problem in production and operations management,
Ant Colony Optimization	Pheromone Update and Measure, Trail evaporation	Job-Shop Scheduling problem. dynamic problem of data network routing, a shortest path problem
Artificial Bee Colony	Reproduction Replacement of bee, Selection	Scheduling problems, image segmentation, capacitated vehicle routing problem.
Bacterial Foraging Optimization	Reproduction, Chemotaxis, Dispersion , Elimination	machine learning, an application of job shop scheduling benchmark problems,

VIII. CONCLUSION

A large number of different kinds of routing protocols are practiced in mobile Ad hoc networks. The use of a specific routing protocol in mobile Ad hoc network depends upon number factors including size of the network, load, mobility requirements, routing overhead and end-to-end delay. In recent years on-demand routing protocols have attained more attention in mobile Ad hoc networks as compared to other routing schemes due to their potential flexibility in deployment and efficiency in terms throughput. They are able to organize themselves dynamically with lower memory overhead and lower bandwidth requirement than table driven protocols.

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