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RESEARCH ARTICLE

Modelling of Multicast Tree Problems using Binary Discrete Particle Swarm Optimization

Vijayashree H.P[1]

[1]Department of Computer Science and Engineering, NHCE, Bangalore, India

[1] hp.vijayashree@gmail.com

Mrs. Leena Shibu[2]

[2] Department of Computer Science and Engineering, NHCE, Bangalore, India

[2] lina.shibu@gmail.com

Abstract: This paper introduce binary discrete particle swarm optimization (BDPSO)to solve the multiple destination routing problems(MDR) problems. The problem has been confirmed to be non-deterministic polynomial problem. The conventional heuristic algorithms (eg: the SPH and DNH)are ineffective in solving it. The particle swarm optimization (PSO) are efficient to solve complex problems. The main contribution of this paper extend PSO to a discrete PSO and uses binary discrete PSO (BDPSO) to solve the multiple destination routing problem. This maintains the better convergence speed and global search ability of the original PSO. Experiments are comprehensively conducted by comparing original PSO and BDPSO.

Key Words – Multiple destination routing problems (MDR), Particle Swarm optimization(PSO), Steiner tree problem(STR).

I. INTRODUCTION

Due to the advent of many new multimedia applications in high speed networks like interactive multimedia application, distributed data process, internet telephone etc... The issue of Multicast Routing Problem (MRP) has become more and more important. An MRP is a problem that defines, a source node, a set of destination nodes, a set of intermediate nodes and a set of edges that makes the network connected, finds a tree to the source node of destination nodes by multicasting.

The multicast routing problem in computer networks is also recognized as the Steiner tree problem which has been shown to be NP-complete. The most prominent characteristic of NP-complete problems is that not able to find faster solution. That is, the time needed to solve the NP complete problem using any known algorithm increases very fast as the size of the problem increases. Therefore deterministic algorithms are not suitable to solve. Whereas approximation or non-deterministic are used to solve the MRP.

II. BACKGROUND RELATED

With the improvement of evolutionary computation (EC), numerous studies have demonstrated that EC algorithms, for example, genetic algorithm (GA) , ant colony optimization (ACO) , particle swarm optimization (PSO) and others are promising to take care of different complex enhancement issues. These additionally persuade scientists to apply EC algorithms for communication and networking improvement. Case in point, GAs has been accounted for successful in comprehending MRP for quite a long time. ACO was likewise reported to illuminate a few sorts of MRP . Notwithstanding, the GA- and ACO-based routines may experience their inborn low convergence speed, which is criticized in the communication group on incompleteness in taking care of meeting huge demands of real time communication services. The existing solutions although promises to solve various types of complex optimization problems. But it costs more and the performance is degraded when network is large, they do not effectively deliver this promise.

III. PROPOSED EVALUATION

Binary discrete particle swarm optimization (BDPSO)

A. Particle Code

The MRP problem can be used to find a set of nodes (including the start node, all the end nodes, and some intermediate nodes) to create an finest multicast tree. Therefore, it is normal and sensitive to code the solution as a binary string, the length of the binary string is the same as the number of nodes in communication network, and all the end nodes are always coded with a bit 1 to indicate that they are should be always in the tree. , if any of the intermediate node has a value 1, means that which helps to find the node is used to construct the multicast tree; otherwise, the node is not used to construct the tree.

B. Velocity Update

BDPSO has some modification to the velocity update procedure as compare to original PSO in order to obtain better results.The following are the three modifications done based on the 0/1 code used in the BDPSO .

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1) *Velocity* = *Position*1 − *Position*2: Assume that *Position*1 is $\boldsymbol{X1}$ and *Position*2 is $\boldsymbol{X2}$, our BDPSO maintains the original PSO knowledge and modifies the *Velocity* ($\boldsymbol{V\,i} = \boldsymbol{X1} - \boldsymbol{X2}$) by considering the variation between $\boldsymbol{X1}$ and $\boldsymbol{X2}$, when $\boldsymbol{X2}$ learns from$\boldsymbol{X1}$.

2) *Velocity* = *Coefficient* × *Velocity*: This action is to multiply *Coefficient* ω, or $c \times r$ with every element of the existing *Velocity* to obtain every element of the last *Velocity*.

3) Velocity = Velocity1 + Velocity2: Assume that Velocity1 and V elocity2 are V 1 and V 2, respectively, then V i = V 1 + V 2 is the final Velocity.

C. Position Update

The normal procedure for updating position in the continuous domain of the PSO algorithm is to add current position and updated velocity to find out new position, but in discrete domain,BDPSO we are considering the alpha factor which is in between 0 to 1 and also present velocity and position to find out new position .

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D. Fitness Evaluation

Calculating the fitness for MRP problem is very important in binary discrete particle swarm optimization. Fitness can be calculated based on the 0/1 binary string, which indicates nodes which are used for constructing the multicast tree and also used for calculating the less cost of the tree. In order to find out tree with less cost we firstly do the pre-processing based on the cost complete graph which uses Floyd’s algorithm data structure. Then based the CCG procedure and using 0/1 string, we can find the multicast tree using modified prim’s minimum spanning tree algorithm. The deletion of the non destination nodes is also done after finding the multicast tree in order to reduce the redundancy. The prune procedure are described below

Prune Procedure: This procedure is easy to put into operation. Here we can find out the node in the multicast tree that has degree 1 and also which is not a destination node, delete that node and reduce the degree. Repeat the procedure for all the nodes until no non destination nodes are found with the degree 1.

Table I: comparative analysis of algorithms to find multicast routing problem

Algorithm Name	**Remarks**
Existing particle Swarm optimization	1. Gives the nearer optimal solution, but it takes more time to find out the solution and Accuracy is less. 2. convergence speed for finding the solution also more 3.cost for finding solution also more
Proposed Binary Discrete particle swarm optimization	1. it gives near optimal solution with less time and Accuracy is more. 2.faster convergence speed compared original PSO algorithm 3.cost for finding solution also less.

IV. CONCLUSION

This proposed BDPSO algorithm is aggravated by the considerations of provided that a very simple and also efficient technique for finding MRP with better accuracy than conventional heuristics and also with faster convergence speed than existing particle swarm optimization. For future investigation, we plan to find out the performance of BDPSO in solving the MRP with real time QoS constraints and various objectives similar to other communication network problems.

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