Interim Thesis Report on

Ant Colony Optimization

In

Wireless Ad hoc Networks Using Game Theory

by

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Chapter 1

Introduction

From last few years, world moves towards portable computers. These computers have wireless range. Those in the range of each other can communicate. Those not in the range of each other and any other node which is range of both can also communicate by this intermediate node. A group of such types of node call mobile Ad Hoc Network. So a mobile Ad Hoc network can define such that in network all the nodes are mobile and communicate with each other via wireless connection. There is no structured topology and no central control on the nodes.

Mobile device have less Battery power and communication range. Every node can not in every node communication rage. There are need some intermediate node to communicate whose not in the range of each other. So there is need for every node to work as router in the network. There is an extra work for network layer in ad hoc network. Every node should forward data packets towards destination. There need a routing algorithm which control all this work for network.

Some issue related to ad hoc network routing algorithm

- The algorithm will adaptive of mobility. Due to mobility links get breaks and connects frequently, so algorithm will handle it.
- Due to small hardware the battery has sort life, algorithm will aware of this.
- Less memory give less space for routing table, care of this.
- The bandwidth for the wireless is less and it can not give high data rate. So the utilization of the bandwidth should be proper. The overhead for routing should be less.
- Basic property of route, it should be looping free.
- They should be scalable with respect to network size.

1.1 Ant colony optimization [6]

This is a new aproach to sovle problem of optimization. This aproach based on Swarm intelligence. ACO is inspiration by the foraging behavior of some ant species. When ants walking to and from a food source they deposit a chemical on ground called pheromone. Through this mechanism, ants are able to transport food to their nest in a effective way. If there is two path form nest to destination then ant choose shorter path by this mechanism. On the shorter path ant reach first and get back. This improves pheromone value on the shorter path faster then longer path. More pheromone value attracts more ants to that path. This goes on and all ant follow shorter path which is optimal. On the basis of ant colony there is some optimization algorithms. These ACO has been applied to my optimization problem. For
example most popular Traveling Salesman Problem, assignment problems, schedules problems. This approach can use for network for optimal path.

1.2 Motivation

ACO has applied for the wired communication networks successfully. Ant behaviors match with node of Ad Hoc network. Ant colony is also a distributed system as ad hoc. Ants communicate indirectly by environment. There may be a possibility get solution for routing algorithm in ad hoc networks by ant colony optimization. There is some idea has been proposed, but they are not properly fulfill requirement of the MANETs. So there is a possibility to apply ACO on mobile Ad Hoc network considering all issues of MANETs.
Chapter 2

Related work

2.1 AntNet [1]

Aim of this algorithm is to implement ACO on wired network routing (in WAN). This is the first algorithm apply ACO in communication networks. This algorithm designs for packet switching network. This is a proactive approach. Every node maintains tables of pheromone value and maintains local model of network situation. The Pheromone table contents relation between all destinations of the network and neighbor node. Table gets update by sending an ant to particular destination. Ant moves in the network according to pheromone value at the node and network traffic situation. And for the goodness of the path pheromone and network situation table get updated by the backward ants.

This is an adaptive nature algorithm. Algorithm gets congestion avoidance. But this algorithm increase overhead in the network and the size of routing table is large.

2.2 ARA [3]

Aim of this algorithm is to reduce overhead and apply ACO in MANETs. This algorithm proposes an idea which is reactive based. When there a need of a route source first create a forwardant, broadcast ant in network. When forward ant move node to node it creates an entry in the routing table (pheromone table) with depositing some pheromone value and establish path towards source. Any intermediate node find duplicate request then deletes it. When Destination gets forwardant for them take source address form it and kill it. Destination creates backwardant. Backwardant have same job as forwardant.

When path from both side establish, data packet use this path. They also deposit pheromone value when using that node of path. This leads to optimal solution between multipaths, here ant optimization show work.

When link get break and local node have another entry of path to destination then it uses this path for forwarding packet otherwise sends this problem to node before it.

This algorithm reduces route packet request size, bits for request per data packet reduce, but this algorithm is on get multipath appropriately. Algorithm also loss scalability.
2.3 ARAMA [4]

Aim of the algorithm is to give high number of routes to destination, recover link break locally and control updating and broadcasting of table. This is a proactive approach. Every node maintains tables of pheromone value and probability table. These tables are between all destinations of the network and neighbor node. Node updates table according each entry of the network by sending ant towards destination and get update according to report give by backward ant. Report of backward ants depends on network energy on intermediate nodes.

In this algorithm need proper way of updating table. There is no solution for loop formation.

2.4 AntHocNet [2]

Aim of this algorithm is to give efficient algorithm for MANETs. It is a hybrid algorithm, which combines reactive path setup with proactive path probing. Broadcast forwardant when path is required. Duplicate forwardant may be forwarded if they mach the criteria, this give multipath. When destination finds forwardant take information of path which it followed. Then destination create backward ant and send it at same path as forwardant followed. Backward ant updates pheromone value of intermediate links for goodness of this path.

When data communication is going on a proactive forwardant sends toward destination for probing. Ant sending rate depend on data rate of the communication. This ant optimize path and find new path depend on probability set by parameters.

This algorithm is efficient but not scalable due to high overhead.

2.5 HOPNET [5]

Aim of this algorithm is to improve scalability for ant algorithms. This is a hybrid approach. In this algorithm they use zonal system. Network divides in zone and a node may be in multiple routing zones. Every node maintains a table for his zone. This table content pheromone value for each neighbor node correspond to all destinations. For best path to any destination a forward ant sends to that destination. This ant chooses the link first which is not visited until to explore new path. If there is no such link then choose link according to the pheromone value at that link. When fant reach to any node, the fant is an entry of path for that node to source.

If there is no node find in the routing table then route request send to boundary node of the zone. They look in there table. If find any entry then send route reply. If not find any entry then it sends to its boundary nodes. This goes on until node not find.

They don’t care for mobility.
Chapter 3

Problem Definition

To develop Routing Algorithm for Mobile Ad Hoc Network using Ant Colony Optimization.

3.1 Objective

- Analyze ant colony optimization for Ad Hoc network routing to get appropriate Relation between them.
- To achieve efficient algorithm considering all issue of routing algorithm of ad hoc network.

3.2 Outcomes

- Algorithm design
- Simulation results comparing the proposed algorithm with an existing one.
- Estimation of Algorithm parameters.
Bibliography


