E-ISSN: 2321–9637
Volume 1, Issue 5, December 2013
International Journal of Research in Advent Technology
Available Online at: http://www.ijrat.org

HYBRID EVOLUTIONARY CLUSTERING APPROACH FOR THE OPTIMIZED ROUTING IN MOBILE AD HOC NETWORK

Ashwini G. Mahajan [1], Prashant R. Deshmukh [2]
[1 2] CSE Department
[12] Sipna College of Engineering and Technology, Badnera, Amravati (India)
[1] Email- ashwinimahajan4@gmail.com

ABSTARCT:

Geographic ad hoc networks using position-based routing are targeted to handle large networks containing many nodes. Evolutionary Location Intelligence on implementing a position based routing, that make forwarding decision based on the geographical position of a packet's destination is concentrated in this paper. One distinct advantage of this model is not necessary to maintain explicit routes. Position based routing does scale well even if the network is highly dynamic. We use greedy forwarding approach with the hybrid evolutionary optimization provided to the spatial clustering algorithm. The results are demonstrated and it is appreciable.

Keywords: *PSO, ACO, Clustering and GA*

1. INTRODUCTION

In mobile ad hoc networks, system may move arbitrarily. Mobile ad hoc networks may be employed by the establishment of connectivity among handheld devices or between vehicles. Since mobile ad hoc networks change their topology frequently without prior notice, routing in such networks is a challenging task. We distinguish two different approaches namely topology based and position based routing. Topology based routing protocols use the information about the links that exist in the information about the links that exist in the network to perform packet forwarding. Position-based routing is based on the nodes position in space and their local neighboring node position.

Geographic ad hoc networks using position-based routing are targeted to handle large networks containing many nodes. Such networks are unsuited to use topology-based algorithms as the amount of resources required would be enormous. The advantage in geographic networks is the ability to deliver a packet from its source to the destination based as much as possible on local information without keeping network wide information [1]. The position-based approach in routing becomes practical due to the rapidly developing software and hardware solutions for determining absolute or relative positions of nodes in indoor/outdoor ad hoc networks [2]. Greedy schemes have a performance close to performance of optimal shortest path (weighted) algorithm for dense graphs, but have low delivery rates for sparse graphs.

A major issue in greedy routing algorithms is how to proceed when a concave node is reached. A concave node cannot be predicted in advance. The proposed approach is to cluster the network using PSO (Particle Swarm Optimization) and ACO (Ant colony Optimization). We use a hybrid technique the uses PSO to find the feature selection problem (FSP) and the fitness of each particle is calculated by the ACO to cluster the coverage area. Then the bridging will be done. Then the greedy routing is performed for the route discovery. While the dead end is deducted then we apply genetic algorithm to find the alternative routes.

The rest of the paper is organized as follows. Section 2 gives the description about the background and related work on position based ad hoc routing, the use of clustering algorithms and the application evolutionary algorithms to clustering problems. Section 3 formally defines the problem settings and discusses why existing methods are not appropriate for our problem. Section 4 describes the proposed hybrid evolutionary clustering approach for the optimized routing. Section 5 experimentally evaluates their effectiveness, efficiency and the applicability of the technique. Finally, Section 6 concludes with a discussion about future work.

2. BACKGROUND AND RELATED WORK

Geographic ad hoc networks using position-based routing are targeted to handle large networks containing many nodes. Position-based routing algorithms can employ single path, multi path, or flooding. Flooding protocols are usually restricted directional, such as DREAM [3] and LAR [4]; the flooding is done only in a section of the network, which is selected based on the source and destination node location. Multipath protocols such as c-GEDIR [5] attempt to forward the message along several routes toward its destination in order to increase the probability of finding a feasible path. Single path protocols, on the other hand, aim for good resource consumption to throughput ratio.

Most common among the single path protocols are those based on greedy algorithms. The greediness criteria can be distance, minimum number of hops, power (best usage of battery resources), etc. Greedy routing algorithm [6] is a memory less algorithms (only requires information about destination).When using greedy forwarding, a node selects for the next hop, the node that is closest to destination (including itself). It is easy to come up with examples where this algorithm does not converge, due to local minima that occur in regions void of neighbors.

Position based routing eliminate the limitation of topology based routing. It requires the information about the physical position of the participating nodes. Each node must be aware of its own location and location of the participating nodes. One distinct advantage is no establishment or maintenance of path required, and it is suitable for highly dynamic large networks.

A major issue in greedy routing algorithms is how to proceed when a concave node is reached, i.e., A Concave node is a node that has no neighbor that can make a greedy progress toward some destination (for the greedy routing algorithm in use). The simplest solution is to allow the routing algorithm to forward the packet to the best matching neighbor, excluding the sender itself. Such a solution can guarantee the packet delivery but can result in routing loops in algorithms that are otherwise loop free. Other solutions require switching to a recovery algorithm that guarantees packet delivery.

Since position-based routing uses local information for forwarding decisions, a concave node cannot be predicted in advance, based on the position of its neighbor nodes. Even using the information of the 2-neighborhood cannot prevent reaching concave nodes, though can improve decisions made during the algorithm.[21] proposes virtual repositioning of nodes that allows to increase the efficiency of greedy routing and significantly increase the success of the recovery algorithm based on local information alone

Spatial clustering has been an active research area in the data mining community. Spatial clustering is of two kinds, with obstacle constraint and with operational constraint [7]. Clustering a network consists of dividing that network into groups of nodes.

Usually, each cluster will have a “cluster-head” that will act as the representative of that group of nodes. The management of position and non-position-based routing algorithms becomes much simpler and most nodes send fewer control packets, thus reducing collisions and battery consumption. The drawback of clustering is that, often, some unlucky nodes will have more service than others. Greedy, MFR, GEDIR, Compass, Random compass, among many others, should have worse behavior on sparser networks, because they have fewer options there. On the contrary, face and hybrid routing algorithms benefit from clustering [8].

Geographical Adaptive Fidelity (GAF) algorithm [9] is used to conserve energy. GAF divides the space into equally-sized cells and nodes in a cell must always listen to any other node either in its own cell or in any adjacent cell. This restriction ensures that in most circumstances, the clustered network stays connected, as long as the initial network is also connected.

The clustering algorithm design or selection step is usually combined with the selection of a corresponding proximity measure and the construction of a criteria function. Genetic algorithms are used for clustering in

E-ISSN: 2321–9637
Volume 1, Issue 5, December 2013
International Journal of Research in Advent Technology
Available Online at: http://www.ijrat.org

[10],[11]. For applying PSO successfully, one of the key issues is finding how to map the problem solution into the PSO particle, which directly affects its feasibility and performance. Bird flocking optimizes a certain objective function. Each particle knows its best value so far (pbest) and its position. This information is analogy of personal experiences of each particle. Moreover, each particle knows the best value so far in the group (gbest) among pbests. This information is analogy of knowledge of how the other particles around them have performed [12]. A hybrid technique based on combining the K-means algorithm is discussed in [13]. Cluster validity analysis is the assessment of a clustering procedure's output. Effective evaluation standards and criteria are used in order to find the degree of confidence for the clustering results derived from the used algorithms [14]. Ant-based clustering and sorting was originally introduced for tasks in robotics by [15],[16] modified the algorithm to be applicable to numerical data analysis, and it has subsequently been used for data-mining [17]. Such ant-based methods have shown their effectiveness and efficiency in some test cases [18]. In this paper, the activated features are calculated by the PSO algorithm and the fitness (quality) of each particle is calculated by the ACO algorithm.

GA has been widely studied and experimented on many fields of engineering. GA provides alternative methods for solving problems which are difficult to solve using traditional methods. They perform well in problems with complex fitness. If the function is discontinuous, noisy, changes over time or has many local optima, then GA gives better results [19][20].We use genetic algorithm to find the alternative route when we meet the dead ends.

3. CLUSTERING FOR POSITION BASED ROUTING

In this section, we formally define the problem space on which we apply clustering and other settings. We then identify the peculiarities of the problem and discuss why existing clustering algorithms are inapplicable or inefficient for objects that lie on a network.

Many of the problems of position-based routing originate from the fact that the shape of the network is unknown a priori, and it is dynamically changing due to nodes mobility. Greedy methods have high delivery rates for dense graphs, and low delivery rates for sparse graphs (about half the messages at average degrees below 4 are not delivered).

Concave nodes flood their neighbors, and then reject further copies of the same message. Each neighbor then continues with greedy routing, except nodes that announce their concavity are ignored in forwarding decisions. For each message seen by a node, a list of concave neighbors to be avoided is memorized. If a node is left without a "willing" neighbor, it does not forward the packet further.

The use of the nodes‟ position for routing poses evident problems in terms of reliability. The accuracy of the destination's position is an important problem to consider. In some cases the destination is a fixed node (e.g., a monitoring center known to all nodes, or the geographic area monitored), and some networks are static. The problem of designing location update schemes to provide accurate destination information and enable efficient routing in mobile ad hoc networks appears to be more difficult than routing itself.

We use Evolutionary location intelligence for solving some of the above said problems.

4. PROPOSED HYBRID EVOLUTIONARY CLUSTERING APPROACH

Hybrid evolutionary clustering algorithm incorporates both repositioning and greedy forwarding approach that improves performance in ad hoc network containing dead-ends. It has several goals.

The first is to identify and mark concave nodes. Identifying a concave node is simple, as every node can do so locally by analyzing its connectivity by the PSO used for the feature selection process and ACO for the clustering problem.

A second goal is to improve greedy routing. Our greedy algorithm avoids using the floating nodes and thus does not get stuck in a concave area. This way, we can avoid switching to recovery mode in many cases.

The third purpose, which is derived from the implementation of repositioning by genetic algorithm, is to improve the recovery process. Though the algorithm improves greedy routing significantly, reaching a concave node is sometimes unavoidable. However, an immediate effect of the repositioning is that every peninsula in the network is elevated, and a smooth edge is surrounding the routing void.

4.1. *Proposed Algorithm*

Step 1: Create *n* number of dynamic random node generations. (eg:*n*{25,50,100})
Step 2: Set a coverage area for „*n*" nodes by the hybrid PSO & ACO based Spatial K Means Clustering.
Step 3: Bridge formation.
Step 4: Define source and destination.
Step 5: Greedy approach to find optimal route.
Step 6: Deduction of Dead-End.
Repositioning Algorithm
Step 7.Reposition helps to recover from Dead- End and find alternate route using genetic algorithm.

4.2. *Routing Algorithm*

Before the source emits a packet, proposed algorithm uses a location service such as those described in the introduction to obtain the destination position. The use of virtually repositioned nodes does not contradict the use of standard greedy routing algorithms. On the contrary, greedy routing is a basic element of proposed algorithm, each node forwards the packet to most suitable neighbor; can be the one who minimizes the distance to reach the destination. Greedy routing fails due to occurrence of Dead-Ends. It uses repositioning, as a mean to recover from dead ends.

4.3 *Repositioning Algorithm*

The node reposition algorithm is executed periodically by every node. The repositioning calculation is done locally, based on the node's neighbor positions and by the genetic algorithm to find the alternative route to avoid dead ends. If neighboring nodes remain static, no repositioning is required.

5. CONCLUSIONS AND FUTURE SCOPE

This work presented is a solution incorporating both repositioning and routing aspects to improve performance, based on local information alone. In the routing section, simulations results showed an improvement in greedy routing and a decrease in the number of concave nodes thanks to the use of repositioning. The case of concave nodes and recovery was also explained by the use of guaranteed traversing paths by genetic algorithm, which requires nodes.

REFERENCES

[1] M. Mauve, J. Widmer, and H. Hartenstein, "A Survey on Position-Based Routing in Mobile Ad Hoc Networks," IEEE Networks Magazine, vol. 15, no. 6, pp. 30- 39, 2001.
[2] J. Hightower and G. Borriello, "Location Systems for Ubiquitous Computing," IEEE Comp., Aug. 2001, pp. 57–66.
[3] S. Basagni, I. Chlamatac, V. Syrotiuk, and B. Wood, "A Distance Routing Effect Algorithm for Mobility (DREAM)," Proc. ACM MobiCom "98, pp. 76-84, 1998.
[4] Y. Ko and N.H. Vaidya, "Location-Aided Routing (LAR) in Mobile Ad Hoc Networks," Mobile Computing and Networking, pp. 66-75, 1998.
[5] X. Lin, M. Lakshdisi, and I. Stojmenovic, "Location Based Localized Alternate, Disjoint, Multipath and Component Routing Schemes for Wireless Networks," Proc. ACM MobiHoc "01, pp. 287-290, Oct. 2001.
[6] G. G. Finn, "Routing and addressing problems in large metropolitan-scale internet works," Institute for

Scientific Information, Tech. Rep. ISU/RR-87-180, March 1987.
[7] Xueping Zhang, Jiayao wang and fang wu, " Spatial Clustering with obstacles based on genetic algorithms and K-medoids", International Journal of Computer science and Network security, Vol. 6 No, 10, October 2006.
[8] F. Araujo, "Position-based distributed hash tables," Ph.D. dissertation, University of Lisbon, Lisbon, Portugal, 2005.
[9]Y. Xu, J. S. Heidemann, and D. Estrin, "Geography-informed energy conservation for ad hoc routing," in Mobile Computing and Networking, 2001, pp. 70–84.
[10] Maulik.U and bandyopadhyay.s, "Genetic algorithm based clustering technique", Pattern Recongnition, Vol.33,pp.1455 1465, 2000
[11]Liu.Y, Chen.K, Liao.X and Zhang W, " A genetic clustering method for intrusion detection", Pattern Recongnition, Vol.37,pp.927-942, 2004.
[12]. K. Premalatha, A.M. Natarajan," A New Approach for Data Clustering Based on PSO with Local Search", Computer and Information Science, Vol. 1, No. 4, 2008, pp 139-145.
[13] Tarsitano, A. "A computational study of several relocation methods for k-means Algorithms", Pattern Recognition, 2003,Vol. 36, pp.2955–2966.
[14] Marinakis, Y., Marinaki, M. and Matsatsinis, N."A stochastic nature inspired metaheuristic for clustering analysis", Int. J. Business Intelligence and Data Mining, 2008, Vol. 3, No.1, pp.30–44.
[15] Deneubourg J.L., Goss S., Franks, N. Sendova- Franks A.,Detrain C., and Chétien L. The Dynamics of Collective Sorting: Robot-like Ants and Ant-like Robots, In Proceedings of the 1st International Conference on Simulation of Adaptive Behavior: From Animals to Animats,.1991, MIT Press, Cambridge, MA, USA, 1:356-363.
[16] Lumer E., and Faieta B. Diversity and adaptation in populations of clustering ants. In Proceedings of the Third International Conference on Simulation of Adaptive Behaviour: From Animals to Animats.1994, MIT Press, Cambridge, MA, 3:501–508.
[17] Lumer E., and Faieta B. Exploratory database analysis via self-organization, 1995.
[18]Handl J., Knowles J., and Dorigo M. "On the Performanc of Ant-based Clustering", In Design and Application of Hybrid Intelligent Systems, Frontiers in Artificial Intelligence and Applications,. Amsterdam, the Netherlands,IOS Press, 104:204-213, 2003.

[19] K Vijayalakshmi and S Radhakrishnan, "Dynamic Routing to Multiple Destinations in IP Networkin using Hybrid Genetic Algorithm (DRHGA), International Journal of Information Technology, Vol 4, No 1, PP 45-52. 2008.
[20] Aluizio F. R. Araújo, Cícero Garrozi and André R.G.A. Leitão Maury M. Gouvêa Jr, "Multicast Routing Using Genetic Algorithm Seen as a Permutation Problem", Proceedings of the 20th International Conference on Advanced Information Networking and Applications (AINA‟06).
[21]www.eng.tau.ac.il/~shavitt/pub/NEAR.ps