A Soft Computing Approach to Analyse Aodv Routing Protocol

Rafia Kulsum, Santosh Anand, Somnath Sinha

Abstract*: Mobile ad hoc networks (MANETs) conceivably considered the latest model or framework for mobile wireless infrastructure - less systems. Mobile ad hoc networks are widely recognized, its mechanization has attracted a huge range of diverse software. The main challenge a MANET faces is routing, which is caused because of the arbitrary differences that occur with the structure of the topology, considering the lack of centralization that results in the generation of unsystematic and recurrent motion of the nodes. Use of NN within this field is very rare. We assess the capability of proactive and reactive routing protocols, and Destination Sequenced Distance Vector (DSDV) and Ad hoc on Demand Distance Vector (AODV) and Dynamic Source Routing (DSR)using soft computing. The performance is analyzed with respect to Distance, Density and System Throughput. A trained NN is used to analyze the performance of any given unknown communication protocol in MANET.

***Index Terms*: MANET, Neural Network, Back Propagation, AODV Routing Protocol, NS2**

I. INTRODUCTION

Mobile ad - hoc networks (MANETs), considered to be an independent self - organized network with no established substructure or centralization. The communication in a MANET takes place through wireless connections among the mobile hosts with the help of their antennas. Mobile nodes can either be satellite transmission or cellular or a group of laptops. The mobile nodes have no restriction and have the ability to move in any direction independently. Behaving both as a router and a host, are the two different roles portrayed by the nodes in the network. Every node in the network will forward packet to the other nodes. Research on this area is mostly based on simulation using Random waypoint method, a mobility model extensively used for simulation. Routing protocols in this network have to be agile, hence they are able to respond according to the different changes taking place in the topology. When two hosts are not in the communication range then they should communicate using the intermediate hosts that act as routers. This allows the hosts to move randomly in turn changing the topology of the network dynamically. The nodes have restriction in assets, for example, battery limit, data transmission, CPU limit, stockpiling limit and so forth., which cause MANET to confront few typical challenges. Routing is considered as the most underlying issue in MANETs for research purpose. Merits of a routing protocol can be analysed with the help of both qualitative as well as quantitative metrics. Desired subjective properties of a directing convention for MANETs can be viewed as Loop-opportunity, Demand-based task, Distributed activity, Security, unidirectional connection backing and rest period task. Quantitative metrics which is used to analyse the capability of the given protocol can be seen as the System throughput, End-End Delay, PDF, Route Acquisition Time, NRL and so forth. Route conventions for specially appointed systems must arrangement with confinements, for example, versatility, high blunder rates, nature of administration, security, vitality effectiveness, collection, multicast and hub collaboration and so forth.

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II. RELATED WORKS

Gangawar et al. [1] proposes a method for analyzing of proactive and reactive routing protocols, and Destination Sequenced Distance Vector (DSDV) and Ad hoc on Demand Distance Vector (AODV) and Dynamic Source Routing (DSR). It demonstrates a study under low, medium and high-density scenarios. It assesses the MANET's performance for high mobility case. Studying the notable effects that takes place while assessing the performance in the protocol is a higher priority. Performance of the routing protocol is judged based on its delay, route load, throughput and the packets delivered and is examined in detail. With regard to the results observed, considering throughput, DSDV is of low performance in comparison to AODV and DSR. While DSR is regarded the best under all three scenarios.Perkins et al. [2] presents a futuristic approach, the routing protocol, DSDV models a pathway for the routing of packets needed for communication between each other. The properties of wireless broadcast medium are very useful. This approach can be used in the network layer and it can also be used below the network layer yet it has to be over the MAC layer. Along with the routing information, other additional information should be added for more convenience and better client operation. The information present is similar to that of the distance vector algorithm and also comprises of the order the data is sent and the time taken to settle. Bhaduria et al. [3] use the OPNET simulator, performance analysis of the AODV protocol was performed over networks of various sizes. Total Traffic Received, Traffic Load and Throughput are the performance metrics selected for this analysis. Here, it is seen that AODV execution stays steadyin either of the conditions i.e.

low density and high density after several simulations. While there is an escalation in nodes within, packets received per second, LAN load and throughput increases, and they become stable for a given extent, as there is a raise in the end delay. With regard to the simulated results show that AODV for all forms of ad - hoc mobile networks are an effective and efficient routing protocol.Johnson et al. [4] provides a method for routing packets that take place among the non-wired hosts in wireless network. On contrary to a common algorithm such as the link state algorithms the distance vector, the algorithm that has been used here is the dynamic source routing which has potential to revamp quickly for any routing differences, while movement in hosts is recurrent and involves hardly any or no administrative costs while the hosts move less frequently. Seeing the results, the simulation of hosts done on the network, the protocol works well for various environment conditions, such as movement rates and host densities. The difference of length that is present between the optimal route length and the route used for all cases can be negligible, whereas the route lengths are in an average factor of 1.02 for most cases. Gulati et al. [5] provides a comparison of proactive and on demand protocols which is DSDV, AODV and DSR build on the Quality of Service metrics (packet ratio, end delay, throughput, jitter), standardized overhead route as well as standardized overhead MAC with help ofNS-2 simulation. Routing protocols will be compared with standardized routing load and standardized MAC load based on Quality of Service metrics by varying node mobility, network size and network load. The results of the comparison show that AODV does not perform the best of all the protocols studied. Lakshmikanth et al. [6] provides a study on every protocol that is considered, and based on the results it is concluded that the protocols perform relatively good in few scenarios while have inevitable pitfalls in few scenarios. For 40 number of sources, it is seen that the traffic that is produced by protocol cannot be handled by the network, hence drops packets to a large extent. DSR protocol performs well for all movement speed but increases the routing overhead bytes. In comparison to DSR, even AODV performs well for the given mobility rates as well as movement speeds which fulfills the objective to eliminate the source routing overhead although, this needs to transmit a large amount of routing overhead packets and at a higher mobility rate it seems to inculcate additional expenses than DSR. From the results we can conclude that DSDV is of low performance in comparison to AODV and DSR. Said et al. [7] provides with two different categories of simulations, which is executed to give a comparison of the ability of DSDV and AODV protocols with NS-2. The first performance standards are analyzed with the same simulation environment but different pause time whereas the second performance metrics is done with same simulation environment and zero pause time. Provided with both categories of simulations, by evaluating, we see that DSDV and AODV have uniquenessin sources, mobility and traffic. With application-oriented metrics i.e. throughput and end-to-end delay, AODV surpasses DSDV in more difficult conditions. Yet, DSDV continually provides with low NRL and greater packet delivery fraction in comparison to AODV. In conclusion, from the empirical results provided it clearly states AODV has lesser variation in the results, hence performs much better than DSDV Royer et al. [8] have provided with a comparison study about the two on- demand protocols, AODV and DSR. Both, AODV and DSR utilize route discovery when required and have two different approaches. DSR makes use of routing the source and caches in particular also, it is not relied on any time- build activity.DSR aggressively makes complete use of caching, using more routes for each destination. Whereas, AODV maintains a route table for each destination route, sequence numbers, a technique for preventing loop and determining route freshness. Performing a demonstration to assess the features of both the protocols, we used a detailed simulation model. A common review observed on doing simulation, DSR excels AODV in a less "stressful" environment, with less nodes and low load. While AODV outweighs DSR in the vice- versa. It is concluded that DSR produces low NRL consistently in comparison to AODV.Shobha Rani et al. [9] uses a convolution neural network to introduce a method for deformed character recognition. Training of degraded character image sample patterns is performed with Alex Network which is regarded as a distinctive convolution network. The convolutional layer, pooling layer, and fully connected layer are the three major layers that are comprised to construct a Convolutional NN architect. The performance reviews of this experiment also are subject to the data's that are written by hand are collected from different age group users such as 18-21, 25-30 as well as photocopy of data derived by Kannada poetry/literature's ancient document images. It results in an overall performance done by Alex net is reported as 91.3 percent in the classification of printed character samples with regard to the handwritten text, while 92 percent accurate reading is recorded. Reddy et al. [10] studies regarding with the capability of the protocols mainly applied in mobile ad hoc networks. It is considered with a high load scenario for low, high as well as medium density range. Here, nodes are varied for a range of 25 to 200 with an unchanged topology having 1000 x 1000 square meter. Random Waypoint Mobility Model is referred for this analysis for the generation of node mobility. Considering at most 10 random scenarios and assess the network to provide an elaborate analysis regarding the performance. From the results it is found, AODV gives the best performance as it is able to sustain the connection by exchanging of information at periodic intervals. When throughput is taken into consideration, we see that AODV and DSR performance excels DSDV for a network having large number of nodes. With regard to simulation outcome sit is distinguished that AODV outperforms the other protocols with more nodes whereas DSR outperforms the other protocols with less nodes. The Average End-to-End delay, for DSDV protocol is the lowest protocol, it also remains constant even when the nodes are increased.

From the analysis done, AODV is considered the best protocol for MANET, but when NRL is considered, it increases at a higher rate for AODV than that when compared to DSDV and DSR. Talooki et al. [11] compares and analyses these steering conventions AODV, DSDV and DSR which done utilizing NS2 test system. Using QoS metrics (packet delivery ratio, average end-to-end delay, throughput, jitter) the routing protocols are compared based on the normalized MAC load and NRL with differing network sizes, mobility speed and network load. From the simulation results we see that the proactive directing convention DSDV is most appropriate for predetermined number of hubs with low versatility because of the capacity limit of steering data in the directing table. The byte overhead increments in every bundle in DSR at whatever point the topology changes as it uses routing cache and source routing, due to this DSR is preferred for moderate mobility with moderate traffic. AODV performs the best among all the three routing protocols when there is robust traffic, the number of nodes is dense and the traffic is high. Based on the simulation results, AODV performs the best for all types of networks.

III. SIMULATION

Simulation of routing protocols is implemented on a Network simulator (version 2.35) is popularly referred to as NS2. It is clearly an event - driven simulation tool that has claimed to be functional in the study of communication networks of the dynamic type.

The use of NN in this field is very uncommon. Here, the on-demand protocols, AODV and DSR as well as table driven protocol DSDV will be analysed and compared based on their performance and the results is used to predict the best protocol for to be used to construct a network and the prediction is done utilizing the neural system. With respect to Distance, Density and System Throughput the the distance vector. A trained NN is used to analyse the performance of any given unknown communication protocol in MANET. First an AODV ad hoc network with fixed topology is designed, then the network parameters i.e. density and distance. These data are then fed in the neural network for training and the trained data will be utilized to judge the performance of the protocols.

Figure 1: Simulation scenario in NS2 with 100 nodes

Table 1: Simulation Parameters

Parameters	Values
NS2	Versions 2.35
Simulation area	1000x500, 1050x550, 2000x600, 2050x650, 3000x700, 3050x750
Mac Layer	802.11
Routing protocol	AODV
No of Nodes	30,40,50,60,70,80,90,100,120,130,140, 150,170,160,180,190,200

The system performance parameters have been observed in two scenarios like distance and density.

Distance: The distance between the nodes 5 and 6 is calculated. The distance is calculated using the Euclidean Distance formula.

$$\text{Distance} = \sqrt{((x2 - x1)^2 + (y2 - y1)^2)}$$

Density: The density can be characterized as the quantity of all out conceivable associations present for every hub.

The simulation is carried out for varying distances with varying nodes (i.e. 30 - 200). The distance is calculated for node 5 and node 6. The density for each node for a particular square distance is calculated. The Neural Network Model can be seen as,

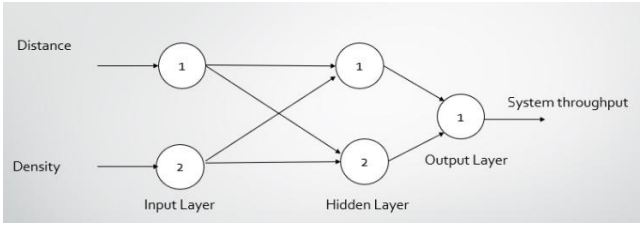

Figure 2: Neural Network Model

IV. RESULTS AND ANALYSIS

Neural network model is implemented using R and diagrammatically shown below (figure 3). The NN is trained by measuring the distance between source and sink and the density of the nodes and in the output the throughput is taken.

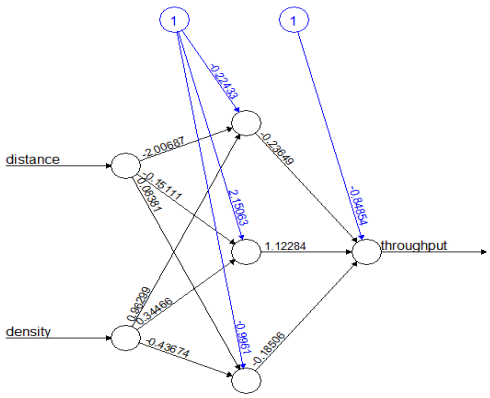

Figure 3: Simulation of NN Model

When trained NN is used for prediction of the throughput the following graph is generated (figure 4). The result is not exactly what is expected but the NN model is correct and the accuracy will depend on training data set.

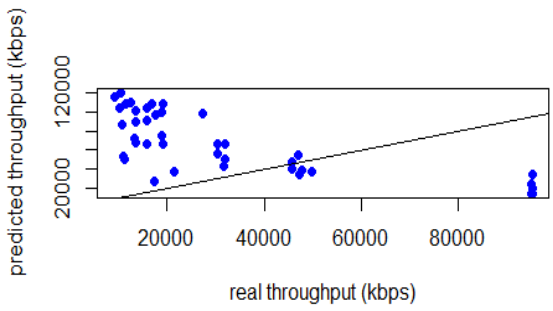

Figure 4: Real v/s Predicted throughput

Root mean square error (RMSE) for the 95 no. of training dataset is box plotted (figure 5).

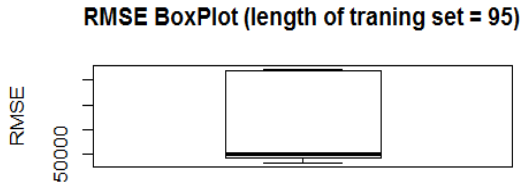

Figure 5: Root Mean Square Error Box-Plot

How the errors are going to be modified is described by the figure below (figure 6). It shows that errors largely depend on the length of the training data set.

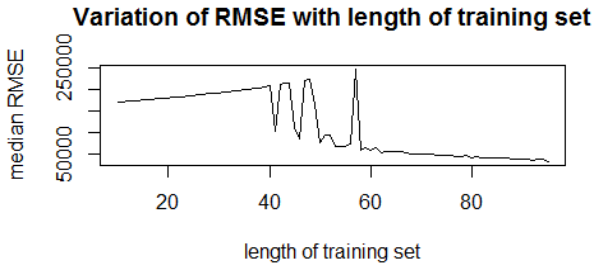

Figure 6: Root Mean Square Error Variations

V. CONCLUSION AND FUTURE WORK

In this paper we have implemented MANET and used AODV protocol for communication. We have measured the throughput and the dependency of this parameter on source to destination distance and the density of nodes. We design one NN model to judge the performance of AODV protocol. When we are havening this NN model we can predict the throughput from the NN model if we know the source to destination distance and the density. As a future work we will use this soft computing approach to judge the performance of the routing protocol without establishing the network and study the mostly effective parameter on the network performance.

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