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Artificial Neural Network Based Decision on Parameter Values in AODV to Enhance the Performance of Mobile Ad Hoc Networks

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Abstract— **Routing in mobile ad hoc networks is really a tedious task which should be performed in an intelligent way. The AODV routing protocol depends on fixed parameter values irrespective of the network behaviour in a dynamic environment. The IETF draft of AODV has highlighted that the choice of the default parameters values affect the protocol performance and their values should be determined considering the network behaviour. In this paper, an attempt is made to incorporate Artificial Neural Network decision on parameter values in AODV to enhance the performance of the mobile ad hoc networks. The Percentage of packet delivery ratio was significantly enhanced by 27.27 % in small network sizes and 9.09% in large network sizes through artificial neural network decisions.**

Keywords— **AODV, Artificial Neural Networks, MANETs, NNBNTTPEAODV, Performance.**

I. Introduction

A Self Configurable, easily deployable and highly adaptable network is a Mobile Ad hoc Network. The communication among the nodes takes place through a multi-hop path. The mobile nodes in the network move freely from one place to another in their own fashion leading to route failures. Routing[5] is a major challenging issue [15] in this kind of networks. Different routing protocols[6] were proposed working in their own principles to handle the routing in MANETs[7][11]. Recently the reactive routing protocol, AODV [14] gained a lot of attention in the communication era. The rest of the paper is organized as follows: Related work is illustrated in section 2. Methodology is described in section 3, Simulation parameter Environment is presented in section 4, results are shown in section 5 and finally concluded with section 6.

II. Related Work

Charles E. Perkins et.al [12] described that AODV routing protocol offers quick adaptation to dynamic link conditions a mobile ad hoc environment. AODV has low processing, memory overhead and low network utilization. AODV can also determine unicast routes between particular source and destinations.

Bagwari et.al [3] analyzed the performance of reactive routing protocol via increasing number of nodes and observed its effect on Quality of Service (QoS) in Mobile Adhoc Networks. They addressed that AODV protocol reduces network load and can be used to extend the network coverage.

Sibusisiwe Chiyangwa et.al [17] worked on the timing behavior of AODV. Their study has highlighted a dependency of the lifetime of routes on network size. They concentrated on the standard parameter NET *DIAMETER* (ND) value with respect to the network size.

Jyoti Prakash Singh et.al [8] have tried to apply artificial neural network for the prediction of end-to-end delay in the mobile ad hoc network environment. They considered path length and average number of neighbors between source destination as input parameters of the network during the calculation of delay.

S.k.shah et.al [16] proposed Artificial Neural Network based reactive AODV routing protocol in order to determine the frequency of hello interval thereby improve the performance of the mobile ad hoc network. Transmission power and Mobility of the node (speed) are considered as the inputs and the output of the system is hello interval. They observed that the application of ANN in AODV for hello interval has improvement than the traditional AODV.

III. Methodology

AODV works on the default configuration values described in the IETF draft standard[13]. Increasing or decreasing the Node Traversal Time value in AODV affect the performance of the mobile ad hoc network. Therefore it is necessary to determine the node traversal time value with respect to the network behaviour. The proposed method concentrates on the determination of node traversal time value for AODV using Artificial Neural Network .

The number of nodes which is a network size and the speed of the nodes are considered as inputs to design an Artificial Neural Network (ANN)[9]. The output for this network is a node traversal time. 'nntool' provided by the MATLAB software is used to model the network. Feed Forward Back Propagation (FFBP) with training function TARINLM is used as type of network. The adaptive learning function used is LEARNGDM. The determination of node traversal time values using artificial neural networks is termed as NNBNTTPEAODV.

IV. Simulation Environment

The performance evaluation of the existing AODV and the proposed NNBNTTPEAODV are done in various networks sizes namely, small network size, Medium Network size , large network size and very large network size using the network simulator ns 2.34[10]. The experimental setup parameters used in the simulation are described in Table 1. Simulation running scenario is depicted in figure 1.

Table 1 : Simulation Parameters used in the Experimental Evaluation

Routing Protocols / Approaches	AODV, NNBNTTPEAODV
Simulation Time	360 s
Area (sq.m)	1000 x 1000
Propagation Model	Two Ray
Traffic	CBR
Packet Size	512 bytes
Nodes	15,47,79,111
Antenna Type	Omni directional
Transmission range	250m
Receiver range	250m
Mobility Model	RandomWayPoint
Pause Time	0 s
Speed	10 m/s
Node Deployment Model	Random

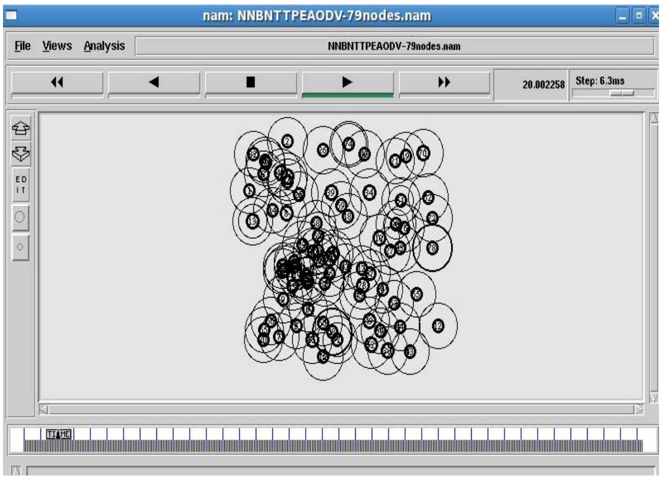

Figure 1 : Simulation running scenario of NNBNTTPEAODV for 79 nodes

V. Result And Analysis

The performance [1][2][4] of the proposed NNBNTTPEAODV and the existing AODV are evaluated in the metrics namely Percentage of Packet Delivery Ratio, Average Jitter, Average Throughput, Average end –to-end delay, Routing Overhead and Normalized Routing Load.

Assume the total number of data packets received by the destination to the total number of data packets sent from the sender is pdr then pdr x 100 describes the percentage of packet delivery ratio. Percentage of packet delivery in various network sizes is in the figure 2.

Average End-to-End delay describes the amount of time taken by the data packets to travel from the sender to a particular receiver over a path. Average end-to-end delay of the packets in various network sizes is in the figure 3.

Average Jitter is described as the observed variation in end-to-end delay between each consecutively received data packets. Average Jitter of the packets in various network sizes is in the figure 5.

Average Throughput describes the data received by a particular destination until the last packet received time. Average Throughput of the packets in various network sizes is in the figure 4.

Routing Overhead describes total number of routing packets required for data communication. Routing Overhead of the packets in various network sizes is in the figure 6.

Normalized Routing Load describes the number of routing packets required in order to send a data packets to the receiver. Normalized Routing Load of the packets in various network sizes is in the figure 7.

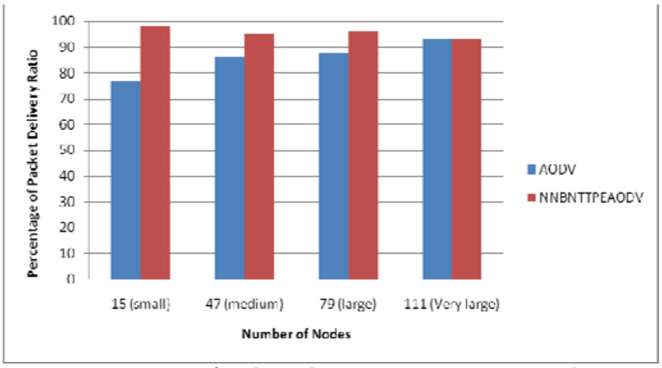

Figure 2 : Percentage of Packet Delivery Ratio in various network sizes.

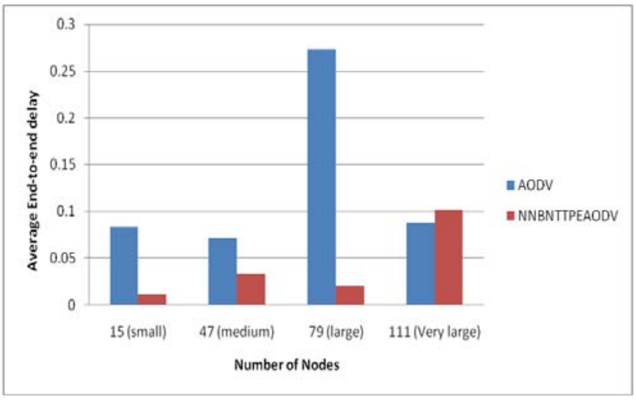

Figure 3 : Average End-to-end delay in various network sizes.

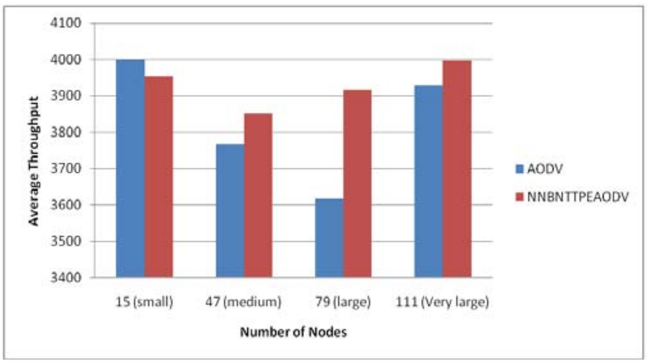

Figure 4 : Average Throughput in various network sizes.

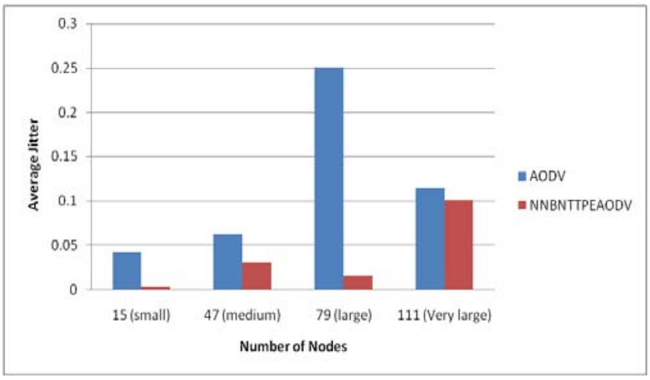

Figure 5 : Average Jitter in various network sizes.

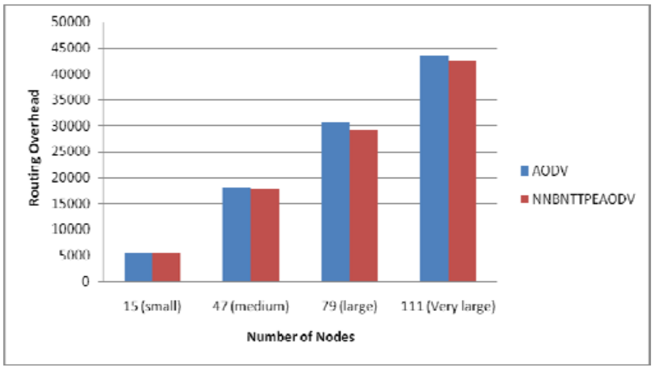

Figure 6 : Routing Overhead in various network sizes.

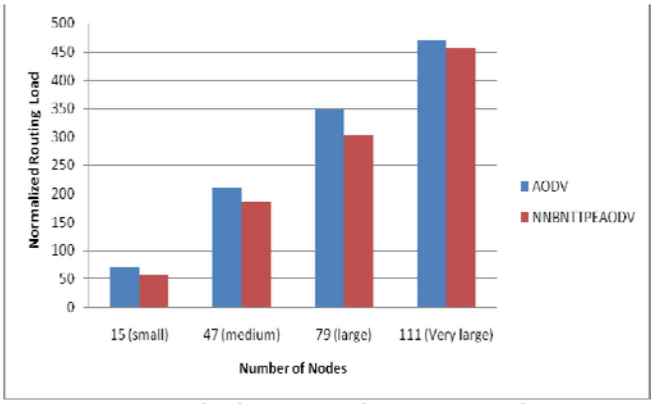

Figure7: Normalized Rouitng Load in various network sizes.

The Percentage of packet delivery ratio was enhanced by 27.27 % in small sized networks and 9.09 % in large networks through NNBNTTPEAODV than the traditional AODV. The Average throughput was enhanced by 8.28% through proposed approach in large network sizes. The Average end-to-end delay was reduced by 86.88 % in small sized networks and in large network sizes was reduced by 92.69 % through NNBNTTPEAODV than the traditional AODV.

The Average jitter was reduced by 93.06% in small size networks and it was reduced by 94.07 % through NNBNTTPEAODV than the AODV. In Small network sizes the Routing Overhead was reduced by 0.63 % , and in large network sizes the Routing Overhead was reduced by 4.42% through NNBNTTPEAODV than the fixed threshold AODV. The normalized routing load was reduced by 21.9% in small network sizes and it was reduced by 12.38 % in large network sizes using NNBNTTPEAODV.

VI. Conclusion And Future Scope

The proposed work suggests the adaptability of Node Traversal Time is highly desirable in AODV with network conditions to enhance the performance of MANETs. Artificial Neural Network decision approach is suitable for large network sizes and small network sizes. It is not suitable for very large network sizes. In future, the combination of fuzzy logic and neural networks can be applied to enhance the performance of mobile ad hoc networks in very large network conditions.

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