Hopfield Neural Network based Dynamic Call Admission Control for Quality of Service Provisioning in Mobile Multimedia Networks

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In mobile multimedia communication systems, the channel allocation schemes and computational model are becoming the topic of research interest. The computational model gives the faster processing time based on learning algorithm and neural network models. In wireless network the limited bandwidth is an issue of serious concern. However for the better utilization of available resources in a network, channel allocation scheme plays an important role to manage the available resources in each cell of cellular network. Therefore this issue should be managed to reduce the call blocking or dropping probabilities. This paper gives the new dynamic channel allocation scheme and extends the previous work, which is based on traffic mobility using Hopfield neural network. This neural network method develops the new energy function that allocates channel not only for new call but also for handoff calls on the basis of traffic mobility information. Moreover, we have also examined the performance of traffic mobility to enhance the overall Quality of Services (QoS) in terms of continuous service availability, inter-cell handoff calls and increasing traffic load. The prime objective of this paper is to decrease the handoff call dropping and blocking probability as compared to the other existing systems of static and dynamic channel allocation schemes.

Keywords: Call Blocking Probability, Call Dropping Probability, Dynamic Channel Allocation, Hopfield Neural Networks, Mobile Multimedia Networks.

1. INTRODUCTION

Recently, the demands of mobile users are varying everyday due to the portability and the availability of mobile system. But the radio spectrum is limited for this purpose as compared to mobile users. Therefore the most efficient utilization of the radio spectrum is the dynamic channel allocation schemes which improve the overall quality, capacity and performance of the wireless networks. The prime objective of the Dynamic Channel Allocation (DCA) is to improve the capacity of mobile multimedia communication networks where the traffic load is unpredictable i.e., randomly distributed, has been proposed and explain very well in [1–4]. So far several DCA schemes have been developed and proposed to use various techniques. In recent years, Hopfield neural network or HNN based dynamic channel allocation or DCA schemes have been discussed frequently [2],[5],[6]. HNN is fast and parallel optimizer which is very efficient neural network model for channel allocations. The optimization of the HNN can be seen in its energy function which minimizes the cost and channel allocation problem in mobile networks.

This paper uses the HNN model, which plays a very important role for the prediction of traffic mobility as part of DCA schemes. The literature survey shows that neural network based DCA schemes are normally focused only on the channel allocation of new call and to compute the time of convergence or blocking probability of new calls. But it doesn’t give more attention about the influence of traffic mobility on performance in mobile networks. From the above
Figure 4 shows the percentage result of handoff dropping probability based on the number of channels available in random traffic. It is not possible to completely eliminate the handoff dropping percentage but it can be controlled up to a certain threshold value. According to Figure 3 the percentage of handoff dropping call decreases when the numbers of channels are increased. Consequently our proposed model HNN-DCA keeps the percentage of handoff dropping calls between 3 to 5 percent.

Figure 4. Channels Vs. Handoff Call Dropping Probability

6. CONCLUSIONS

This paper focuses on mobility in dynamic channel allocation scheme using Hopfield neural network at different levels. It is carried out in two phases. First phase, gives the mobility prediction and performance estimation of the traffic load. In the second phase, dynamic channel allocation scheme has been implemented using neural network to improve the capacity of existing dynamic channel allocation schemes. This scheme predicts the uniform or non-uniform mobile users who usually move in the cellular networks. Further, a dynamic resource allocation model, based on traffic mobility, has been developed. The model not only enhances the resource utilization capability but also reduces the blocking and dropping probabilities significantly. Moreover, our approach is unbiased in resource sharing while considering acceptable QoS levels to the new and handoff calls. Our results show the significant effect in terms of reduction of blocking and dropping probabilities and ultimately increasing efficient channel utilization. Furthermore, In future our model might be implemented for other soft computing techniques or combination of these soft computing approaches like genetic-neuro, fuzzy-neuro, or fuzzy-genetic-neuro.

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