Vertical Handoff algorithms using Neural networks

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Abstract

4G systems are expected to rely on multiple wireless networks. These wireless network can be cellular,WLAN,WiMax etc. For switching amongst these different networks, vertical handoff is crucial .Integration of these multiple networks can be done using vertical handoff. Basically, handoff will be keeping the connection alive when the mobile terminal moves from one network to another.

In this paper, algorithms on artificial neural networks (ANN) are discussed. To achieve vertical handoff ,ANN is one of the tool which is explored. ANN helps in taking the handoff decision based on RSS(received signal strength), bandwidth, cost, network delay etc. ANN consists of input layer, hidden layer, output layer. In Proposed method mobile terminal performs periodical measurement of RSS & bandwidth samples of two different networks (e.g.:- cellular, WLAN) and vertical handoff decision is taken. Performance of ANN is measured in terms of mean squared error. More appropriate vertical handoff decision is taken as more number of parameters are considered (e.g.:-RSS, bandwidth)

Keywords: RSS,WLAN,3G,VHD

I. INTRODUCTION

Convergence of heterogeneous network is getting a lot of attention. To be precise, in 4G network, a mobile terminal incorporated with multiple interfaces will be able to choose the appropriate available access links. In 4G systems, handoff management is more complex, as it covers not only horizontal handoff but also vertical handoff. In horizontal handoff, where an MT moves between two different cells or access points within the same wireless communication system. While in vertical handover, MT moves from one wireless system to another wireless system, for example, from cellular network to wireless LAN system. In this paper, we do not address the horizontal handoff, as traditional RSS based algorithms which works good to support the horizontal handoff . RSS based handoff algorithm is generally applied to homogeneous network and can be extended to heterogeneous network. RSS parameter can be used for taking decision in case of horizontal handoff. But RSS cannot be only parameter for vertical handoff decision. Just, RSS as parameter will not suffice mature vertical handoff decision. Also, RSS based vertical handoff can be used for load balancing or your application demanding more bandwidth etc. ANN combine various parameters such as RSS, bandwidth, cost, delay etc.

In this paper, we will be focusing on ANN based vertical handover decision algorithms. We make an attempt to evaluate performance of the proposed method using Levenberg-Marquardt algorithm.

II. ANN BASED VERTICAL HANDOFF DECISION ALGORITHMS

In this, the handoff decisions are made by Combining various parameters such as RSS, Bandwidth, Network delay etc
After Combination of these parameters using neural networks, training is carried on some samples. After training the System is capable of taking the vertical handoff decision.

A) A Multilayer Feed forward Artificial Neural Network Based Algorithm

Nasser et al.[7] developed a VHD algorithm based on artificial neural networks (ANN). As shown in Figure of available wireless networks and sends them to a middleware called vertical handover manager through the existing links. These network features are used to help with handover decisions and include network usage cost, network security, network transmission range and network capacity. The vertical

handover manager consists of three main components: network handling manager, feature collector and ANN training/selector. A multilayer feed forward ANN is used to determine the best handover target wireless network available to the mobile device, based on the user's preferences.

The topology of the ANN is shown in Figure 1.1. It consists of an input layer, a hidden layer and an output layer. The input layer consists of five nodes representing various parameters of the handover target candidate networks. The hidden layer consists of variable number of nodes which are activation functions. The output layer has one node which generates the network ID of the handover target. All the neurons use sigmoid activation function . The authors have adopted the same cost function as in, and for ANN training they have generated a series of user preference sets with random weights. Then the system has been trained to select the best network among all the candidates. The authors report that by properly selecting the learning rate and the acceptable error value, the system was able to find the best available network successfully. However, the algorithm suffers from a long delay during the training process.
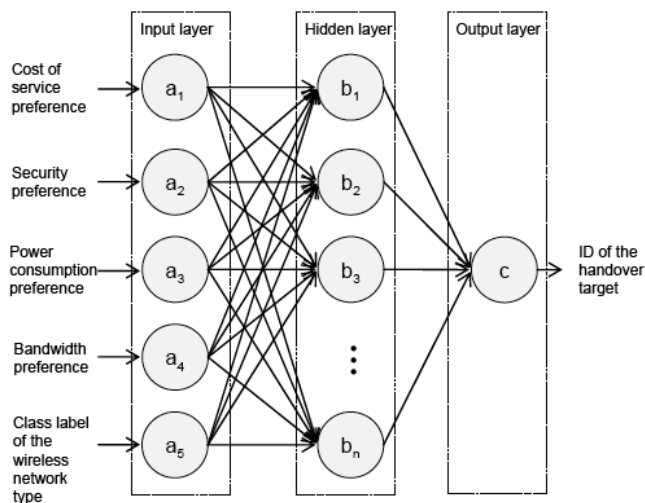
vertical handovers mechanism is discussed. In the method for vertical handovers, an ANN is used for handovers from the WLAN to the General Packet Radio Service (GPRS). The ANN, as shown in Figure 1.2, consists of an input layer, two middle layers and an output layer. Mobile node performs periodical RSS measurements, and five most recent RSS samples of the access point are fed into the ANN. The output is a binary signal: The value '1' leads to a handover to the GPRS, and the value '0' means that the mobile node

should remain connected to the access point. The ANN is trained before used in the decision process. Training is done by taking a number of RSS samples from the access point and, using a pattern recognition technique, selecting the most suitable network, while minimizing the handover delay and ping-pong effect. This algorithm can reduce the number of handovers by eliminating the ping-pong effect, but the paper lacks detail on how the neural network is trained and why the particular parameters are selected. This algorithm also has the disadvantage of the increased algorithm complexity and the training process to be performed before hand.
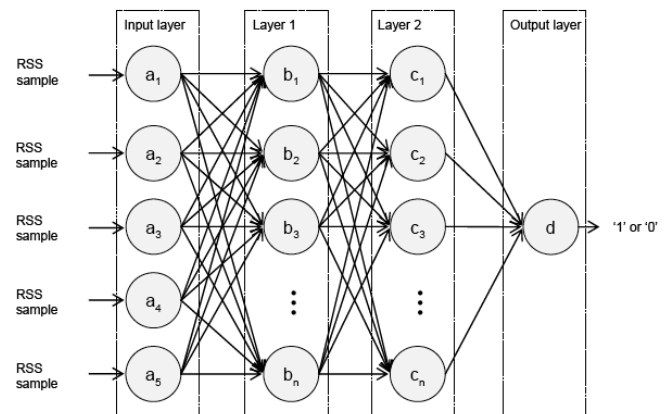

Fig 1.1 Topology of feed forward ANN

Fig 1.2 Structure of two layer ANN

III. PROPOSED METHOD:

B) A Method That Uses Two Neural Networks

Pahlavan et al [8] proposed two neural network based decision methods for horizontal and vertical handovers. Here, only the

In this method Neural network is used for handoff between WLAN and Cellular network. Here, two parameters are taken into consideration i.e. RSS and Bandwidth as a input for Neural network. The RSS samples for training neural network for both WLAN & cellular networks are -60dBm,-70 dBm,-80 dBm,-90 dBm .Similarly, Bandwidth samples for

WLAN are 54,30,10,1 Mbps. And Bandwidth samples for Cellular network are 14.4, 9.6, 4.5,2 Kbps. By using combination of RSS & Bandwidth parameters we could make 256 samples of input for ANN.256 samples of output samples for vertical handoff decision are also fed to ANN.

Using Levenberg-Marquardt method for ANN, 180 samples are used for training, 38 samples for validation and 38 samples for testing. Based, on ANN developed system it could take vertical handoff decision from cellular to WLAN and viceversa. As Levenberg-Marquardt method is fast, training period will be much reduced.
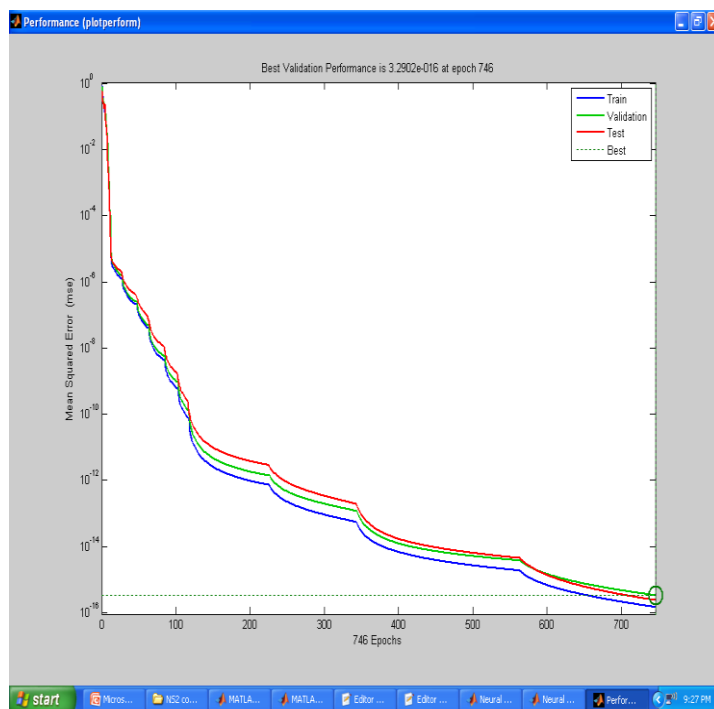

Fig 2.1 Peformance for Proposed method showing mse=3.29x10^{-16} at epoch 746

The performance for the method is measured in terms of mean squared error (mse),which is 3.29 x 10^{-16} .Using the method ping pong effect and training time is reduced.

IV. CONCLUSION:

As per the discussion above, we conclude that ANN based system can take more appropriate decision for vertical handoff can be taken. RSS based decision for vertical handoff will be taken on signal strength. If some Application demands more bandwidth, if traffic in cellular network is more, mere RSS based algorithm will not serve the purpose. Other parameters such as bandwidth, security, cost, power consumption etc can be considered for more appropriate vertical handoff decision.

In A Multilayer Feed forward Artificial Neural Network Based Algorithm, the system has been trained to select the best network among all the candidates. The authors report that by properly selecting the learning rate and the acceptable error value, the system was able to find the best available network successfully. However, the algorithm suffers from a long delay during the training process.

In Two Neural Networks method, can reduce the number of handovers by eliminating the ping-pong effect, but the paper lacks detail on how the neural network is trained and why the particular parameters are selected. This algorithm also has the disadvantage of the increased algorithm complexity and the training process to be performed before hand.

In Proposed method, training period is much reduced due to use of Levenberg-Marquardt algorithm. Also, unnecessary handoff can be avoided due to reduction of ping pong effect.

Load balancing , handoff for interactive application etc can be done using proposed method which uses ANN

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