IAES International Journal of Artificial Intelligence (IJ-AI)
Vol. 3, No. 2, June 2014, pp. 79~83
ISSN: 2252-8938

Handover Decision Mechanism in Interworking Technologies Using Radial Basis Functions

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Article Info

Article history:

Received Dec 23, 2013
Revised Mar 23, 2014
Accepted Apr 29, 2014

Keyword:

Base station
Handover
Radial basis function
Radio

ABSTRACT

As a mobile user travels between radio networks, a handover mechanism is required to vary its radio connection. The persistence of a call is one of the major quality measurements in wireless cellular networks. Handover mechanism permits a cellular network to offer such a facility by again allocating an ongoing call from one base station to another base station. To achieve handover neural network techniques can be used. In this paper, a handover decision mechanism is proposed using Radial Basis function (RBF) of neural networks.

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1. INTRODUCTION

Success of wireless communications has caused the creation of a huge variety of wireless technologies like 3G cellular, satellites, Bluetooth and Wi-Fi. Every technology is personalized to grasp a particular market, or a specific type of operator with a precise service need. The benefit of these diverse networks is that they provide many choices for growing bandwidth, accessing the Internet, and the coverage area for the average user [1]. In the future, the home and office interacting atmospheres are foreseen to be controlled by a diversity of interactive program services like wireless home entertainment, wireless HDTV and virtual wireless office [2]. In order to preserve these applications, the wireless network should deliver the user with transmission capacity of hundreds of Mbps using short-range Gbps technology and using techniques like sophisticated coding schemes, antenna diversity etc [2]. It is a significant and challenging matter to upkeep continuous handoff in this combined architecture. Handoff refers to the procedure of shifting a current call or data session from one network connected to the core to another. The procedure of handover needs a number of parameters e.g. how many channels are free, what is the handover pattern we are using. The handover process should maintain the quality of service up to the standard. Here, the matter of VHO in diverse wireless networks is investigated [3]. This paper illustrates the use of multicasting techniques aided by mobility calculation to improve handoff performance in wireless networks. Handoff grasps the key to define the performance of wireless networks. The Grey model has been used as the estimate method as it has been shown to give good forecast accuracy [4]. Worldwide wireless access refers to the capacity of a user to link anyplace at any period from any network. The change in joining may be introduced by the user or may he introduced by the network, clear to the user. For example, a user may elect access a wireless LAN to lead large files, but may elect the cellular network to take a voice call. On another hand, a network may choose to hand off a stationary data user to a wireless LAN in order to raise Bandwidth availability for mobile users in a 3G network. The wireless technology in the wireless network also decides the cell topology, cell size and the traffic model. Now a day's network may hire multiple wireless technologies at the same time such as: GSM, Bluetooth, WLAN and UMTS. This leads to a new need of handoff methods between diverse wireless technologies; this is known as vertical handoff. Because of the motion of users and the range of 3G and 4g uses, it is significant that the devices making use of UMTS should handoff to several other systems such as WLAN, GSM, WiMAX and Bluetooth. In order to keep consistent communication in a microcellular and interworking system new and improved handoff algorithms must be required to keep QoS as high as possible. Quality of service means providing reliable, expectable data sending service. Quality of service is allocated by providing real-time and non-real-time services. Real time services are needed to be leading over non real time for Quality of service prospective [9]. Handoff algorithms built on soft computing techniques such as Fuzzy Logic, Neural Networks etc. can be used for the similar purpose [8]. A simple handover technique between some hybrid networks is as shown in the figure below

Figure 1. Showing handoff between different wireless technologies

1.1. Introduction to Radial Basis Function

Artificial neural network (ANN) is a machine learning methodology that replicas human brain and contains a number of artificial neurons. Neuron in ANNs has a tendency to have fewer networks than biological neurons. Each neuron in ANN accepts a number of inputs. An activation function is given to these inputs which effects the activation level of neuron. Radial Basis Functions are first presented in the explanation of the actual multivariable interpolation problems. Broomhead and Lowe (1988), Moody and Darken (1989) were the first to exploit the usage of radial basis functions in the scheme of neural networks Radial basis function networks are feed-forward networks skilled by making use of a supervised training algorithm. They are usually organized with a single hidden layer of units whose activation function is carefully chosen from a group of functions called basis functions. Even though alike back propagation in many features, RBF networks have various advantages. They usually train much quicker than back propagation. They are not as much of prone to problems with non-stationary inputs because of the actions of the RBF hidden units. Radial basis function methods are modern ways to approximate multivariate functions, particularly in the non-appearance of grid data. They have been recognized, tested and examined for numerous years now and many optimistic properties have been recognized. In this paper, mainly the new results on convergence rates of interpolation with RBF are considered, along with some of the several attainments and the effective numerical calculation of interpolates for very huge sets of data [5]. The idea of RBF Networks derives from the theory of purpose approximation.

1.2. Structure of the RBF Networks

Radial Basis Function Networks consists of 3 layers named as:

a) an input layer
b) a hidden layer
c) an output layer

The structure of an RBF networks involves three entirely different layers as show in figure below:

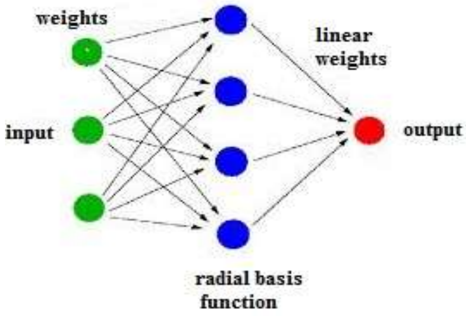

Figure 2. Radial basis functions

The hidden units give a set of functions that set up an arbitrary basis for the input designs [6]. Hidden units are called radial centres conversion from input space to hidden unit space is nonlinear and conversion from hidden unit space to output space is linear The RBF in the hidden layer produces an important non-zero response only when the input drops within a minor restricted region of the input space. Each hidden unit has its individual receptive field in input space. Their main features are [7]:

1. They are 2 layer feed-forward networks.
2. The hidden nodes give a set of RBF (e.g. Gaussian functions).
3. The output nodes give linear brief functions as in an MLP.
4. The network training has two stages: first the weights from the input to hidden layer are given, and then the weights from the hidden to output layer.
5. The training is very fast.
6. The networks are good at interpolation.

2. PROPOSED WORK

In this paper, a handover mechanism is provided based on neural networks. Here a data set of 2500 values is created out of which 2400 values are taken as input values whereas 100 are taken for test purposes. The data set is created using fuzzy inference system and each input value is evaluated in FIS and accurate results are taken to create the data set. The MATLAB R2009b version is used. In this paper, an RBF neural network tool of MATLAB is used to find out the accuracy of handover decisions and time taken by the network to train the input values. The following table shows the different parameters calculated using RBF networks.

Table 1. Showing different parameters calculated using RBF

Serial no.	number of neurons	accuracy%	mean sq. error	Time in minutes
1	50	58	0.14	0:60
2	100	64	0.11	0:64
3	150	68	0.088	0:70
4	200	71	0.07	0:80
5	250	78	0.05	1:25
6	300	81	0.047	1:55
7	350	85	0.04	1:57
8	400	86	0.035	2:00
9	450	88	0.032	2:05
10	500	91	0.03	2:50

3. RESULTS AND SIMULATIONS

The Figure 3 and 4 show the decrease in the mean square error as the number of neurons increases which is a desirable factor for system efficiency.

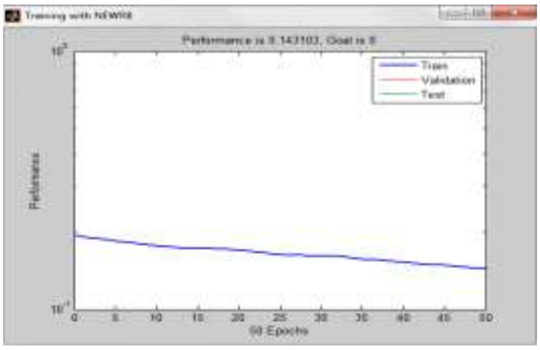

Figure 3. When number of neurons taken are 50

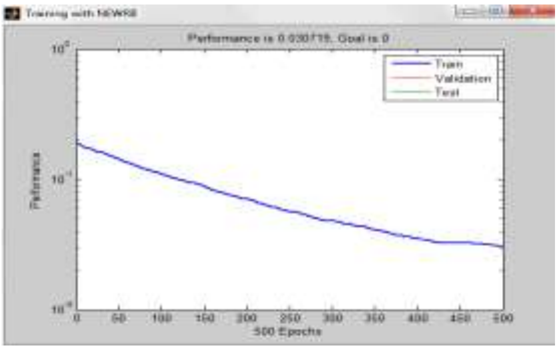

Figure 4. When number of neurons taken are 500

Similarly other graphs were drawn in RBF tool of MATLAB. As the number of neurons increases, time taken to train the network increases which reaches up to two minutes and fifty seconds when the number of neurons reaches to five hundred.

As the number of neurons increases, accuracy in handover decisions increases and it reaches up to 91% for 500 neurons which is again a desirable factor for the efficient performance of the system as shown in the following figure:

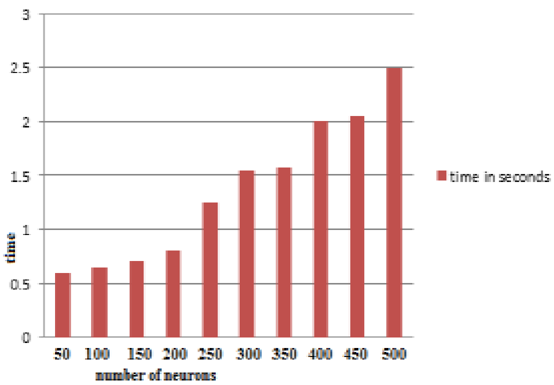

Figure 5. Graph between number of neurons and time taken

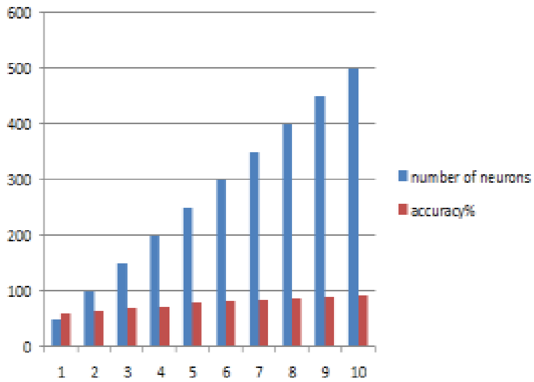

Figure 6. Graph between number of neurons and accuracy

With the increase in the number of neurons, mean square error decreases as shown in following figure:

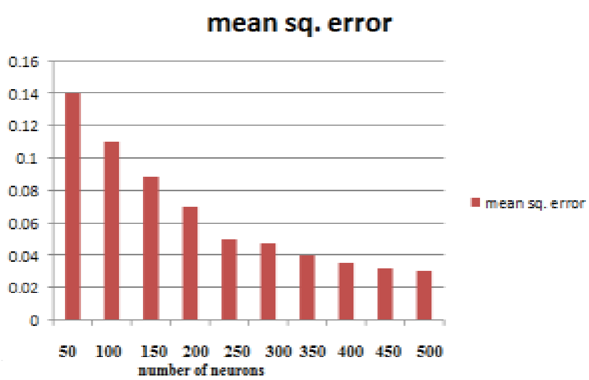

Figure 7. Graph between number of neurons and mean square error

4. CONCLUSION

The handover decision can be carried out using conventional sources or other neural network techniques but when the handover decision parameters are calculated using radial basis functions, it is seen that the time taken for making handover decisions is well under the practical limits also the accuracy drawn is more than other conventional techniques. So, in this paper, it is proposed that handover decisions can be taken using RBF tool of neural network in MATLAB for practical uses.

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