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Call Admission Control Using Neural Network and SVM

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Abstract: This research work introduces and conditionally look over a software based method for Call Admission Control using Neural Network and SVM. In this paper, Call Admission Control scheme using Neural Network and SVM is proposed for better QoS. THE rising demand for mobile communication services is increasing the importance of efficient use of the limited bandwidth and frequency spectrum. In recent years, considerable efforts have focused on the Channel Allocation and Call Admission Control (CAC) problems and many schemes that range from static to dynamic strategies have been proposed in the literature. Call Admission Control is a provisioning strategy used to limit the number of call connections into the networks in order to reduce the network congestion and provide the desired Quality of Service (QoS) to users in service. Traditional CAC schemes that mainly focus on the tradeoff between new call blocking probability and handoff call blocking probability cannot solve the problem of congestion in wireless networks. To overcome the problems arises due to traditional CAC schemes we propose a new CAC using hybrid technique i.e. SVM and Neural network.

Keywords: Call admission control, WCDMA, Offered traffic, Total carried traffic.

I. INTRODUCTION

The main function of call admission control algorithm is to limit the interference by controlling the number of new call accepted in the network. The admission control requirements must be fulfilled by each new user while entering into the system. For high-speed networks such as asynchronous transfer mode networks and wireless networks Call Admission Control has been intensively studied in the last few years. CAC becomes much more complicated in wireless networks Due to users, mobility.

The call dropping happens in the network in most of the case when, accepted call that has not completed in the current cell may have to be handed off to another cell. During the process, the call may not be able to gain a channel in the new cell to continue its service due to the limited resource in wireless networks. Thus, the new calls and handoff calls have to be treated differently with priority in terms of resource allocation. Since users tend to be much more sensitive to call dropping than to call blocking, handoff calls are normally assigned higher priority over the new calls. The objective of proposed work is “To improve the QoS i.e. Call Admission Control using Neural Network and SVM.”

II. LITERATURE STUDY

Call admission control provides the better Quality of Service (QoS). In literature, in call admission control mechanism, dropping of an ongoing call is less desired than blocking a new call. Thus, handoff calls have high priority than new calls. Due to the number of users and variable link quality, the CAC becomes more complicated in wireless networks. An accepted call which has not completed its service in the current cell may have to be handed off to another cell. During this process, the call may not be able to obtain a channel in the new cell to continue its service due to the limited available resources in wireless networks, which will lead to call dropping. Because users are more sensitive to call dropping than new call blocking, handoff calls are normally assigned higher priority over new calls. Thus, the new calls and handoff calls are usually treated differently in terms of resource allocation. New call blocking probability and handoff call blocking probability are two important connection level QoS parameters. A good CAC scheme has to balance the tradeoffs between new call blocking and handoff call blocking in order to meet the desired QoS requirements. One of the earliest call admission control schemes were first applied to ATM networks. These schemes were based on analytical methods like equivalent bandwidth, heavy traffic approximations and upper bounds on cell loss probabilities. The problem with these approaches was that they need to make simplifying assumptions about traffic distributions, as otherwise they would become analytically involved. This resulted in reduced accuracy and also to over provisioning of network resources.

III.EXPERIMENTATION

This research focuses on development of a model that that provides betterment in QoS. The Neural network Or SVM are responsible for deciding whether to admit or to block a new call. In this scheme, when a call arrives, load factor threshold for new calls and QoS requirements (in term of BER) are determined firstly.

Then the load increase of the arrived call and the current cell load factor before accepting the arrived call are calculated. After calculating the current load of the target cell, it is compared with the load factor threshold of the arrived call. If the current cell load factor plus the load increase is less than or equal the required load factor

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threshold for the arrived call, then arrived call can be admitted to enter the target cell. Otherwise, arrived call is waited for availability.

In other hand, if the calculated value of current load is greater than maximum the threshold value, then go for another call with another bandwidth. If the bandwidth of the call is at minimum level then call gets rejected. The bandwidth can be minimizing as shown in following tables:

TABLE I BANDWIDTH DEGRADATION RULES FOR NEURAL NETWORK

Rule no	Bandwidth		
	Voice	Data	Video
1	12.2	64	128
2	10.2	64	128
3	8.2	64	128
4	8.2	56	128
5	8.2	44	128
6	8.2	44	112
7	8.2	44	80
8	8.2	44	64

TABLE II BANDWIDTH DEGRADATION RULES FOR SVM

Rule no	Bandwidth		
	Voice	Data	Video
1	12.2	64	128
2	10.2	44	64

IV. PERFORMANCE ANALYSIS

A. Simulation Parameters:

In our proposed scheme, three services are simulated, voice, data and video. Characteristics of these services are listed in Table III:

TABLE III SIMULATION PARAMETERS

Parameter	Value
Radio Access Mode	WCDMA
Service classes	Voice, Data, Video
Required Eb /No	Voice: 5.6Kbps; Data: 4.4Kbps; Video: 3.2Kbps
Activity	Voice: 0.4 Data: 1 Video: 1
Fractional load	0.85 (85%)
Interference factor (f)	0.5
Chip-rate	3.84Mbps
Thermal noise	1.0 e-15 W
Call arrival rate(λ)	0.5
Channel holding time	180 sec

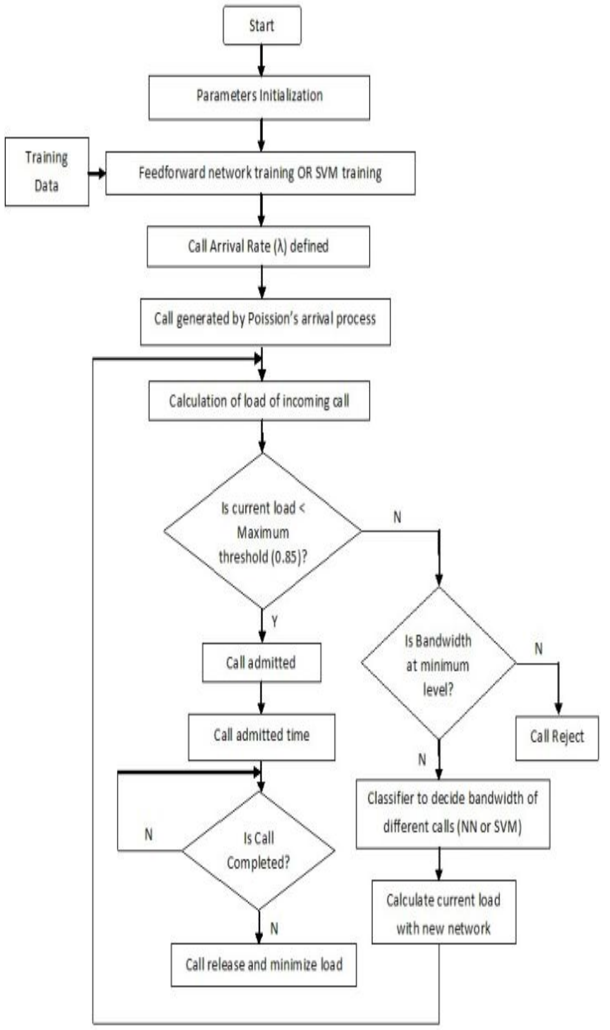

Fig.1. Flow chart using NN or SVM

B. System Performance:

Our proposed algorithm is as shown in fig, in which the important parameters are the estimation of offered traffic, blocking probability and carried traffic.

When a call arrives, it may be Voice, Data or Video with different bit rate (R), then we have to first estimate the bit error rate which is for bit energy to noise density ratio (E/N). And this is given by following equation:

$$Q\sqrt{2\left(\frac{E}{N}\right)} \approx \frac{e^{-\frac{E}{N}}}{2\sqrt{\frac{\pi E}{N}}} \quad (1)$$

Then the spreading factor which is the ratio of the chip rate to data rate is calculated

$$(C/R) = G \quad (2)$$

For all types of calls (Voice, Data and Video) separately simulate the offered traffic by using Earlang's-B formula for different Bandwidth as:

$$E = \lambda h \quad (3)$$

Where, λ- call arrival rate &
h- Call holding time.

By using the same formula, the blocking probability (The

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probability that a new call is not admitted into the system is called the blocking probability) can be calculated, which uses the Poission's arrival process, as below:

$$Pb = \frac{E^m/_{m!}}{\sum_{i=0}^{m}\frac{E^i}{i!}} \quad (4)$$

And finally the Total Carried Traffic is calculated as:

Total carried traffic = offered traffic (1 - Pb) (5)

C. Result Discussions

Every new call is treated differently. In proposed project no handoff considered. For every new call with corresponding bandwidth, the offered loads are calculated by keeping average holding time for all services is 180 seconds for both neural network and SVM.

Using Neural Network:

The following graphs shows the Blocking Probability for Voice, Data and Video Calls using Neural Network i.e. Offered data calls traffic (calls/sec) Vs. Blocking probability with channel holding time (call duration) is equal to 180 seconds. The call blocking probability is significantly reduced at heavy traffic i.e. 2 calls/sec. And, carried traffic using neural network i.e. Offered total calls traffic (calls/sec) Vs. carried traffic.

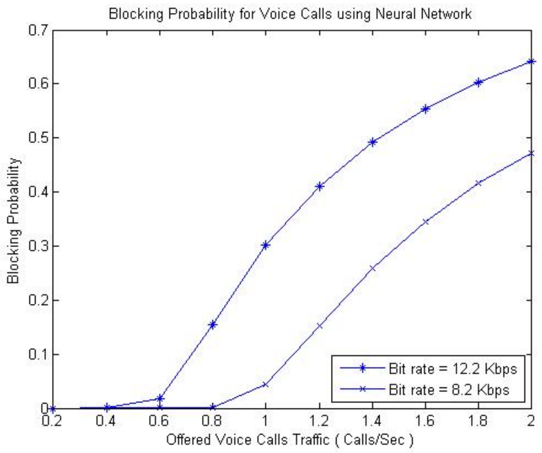

Fig 1. Blocking probability of Voice Call using NN

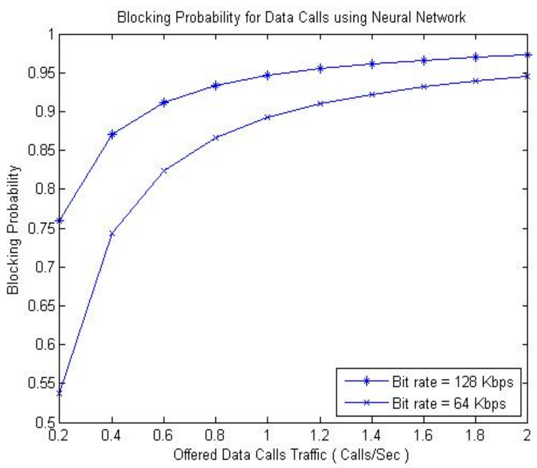

Fig.3. Blocking probability of Data Call using NN

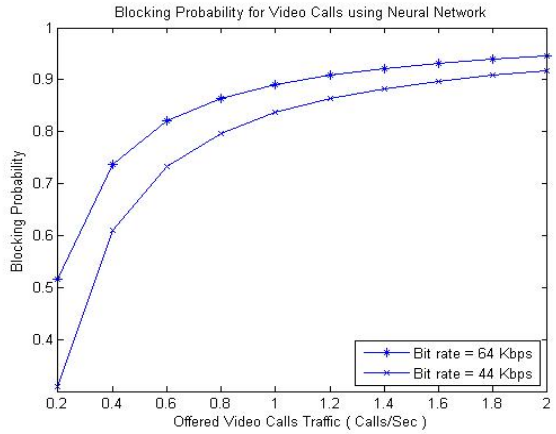

Fig.4. Blocking probability of Video Call using NN

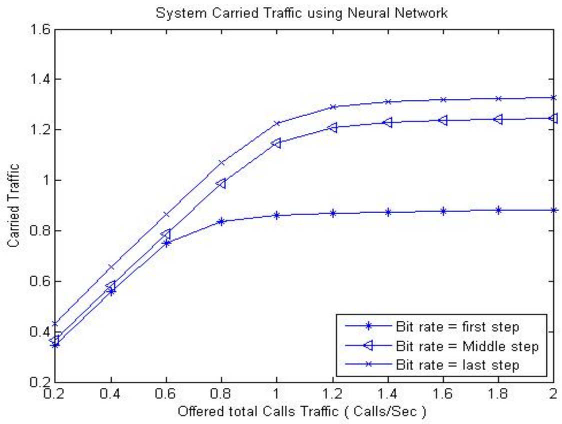

Fig.5. System carried traffic using NN

Using SVM:

The following graphs shows the Blocking Probability for Voice, Data and Video Calls using SVM i.e. Offered data calls traffic (calls/sec) Vs. Blocking probability with channel holding time (call duration) is equal to 180 seconds. The call blocking probability is significantly reduced at heavy traffic i.e. 2 calls/sec. And, carried traffic using neural network i.e. offered total calls traffic (calls/sec) vs. carried traffic.

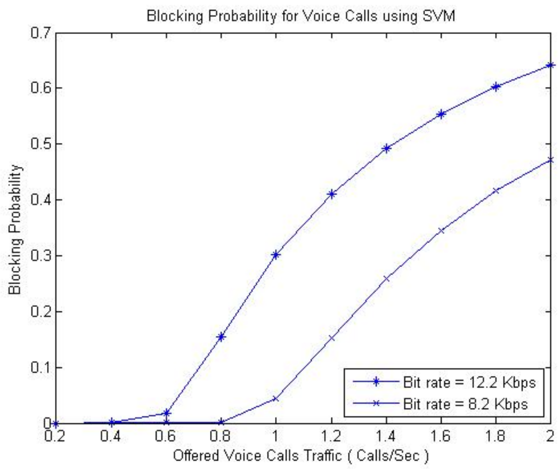

Fig.6. Blocking probability of Voice Call using SVM

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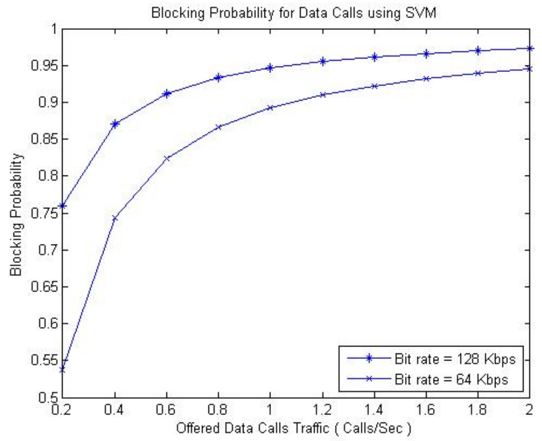

Fig.7. Blocking probability of Data Call using SVM

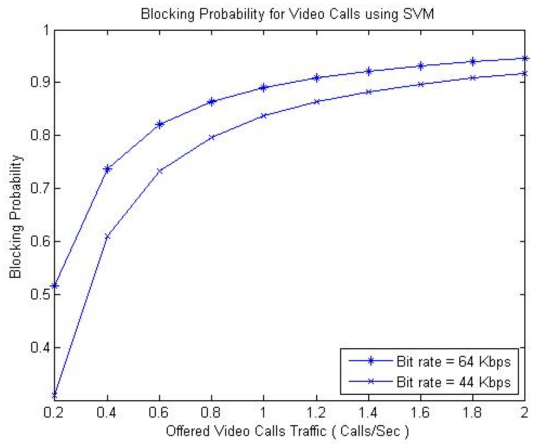

Fig 8.Blocking probability of Video Call using SVM

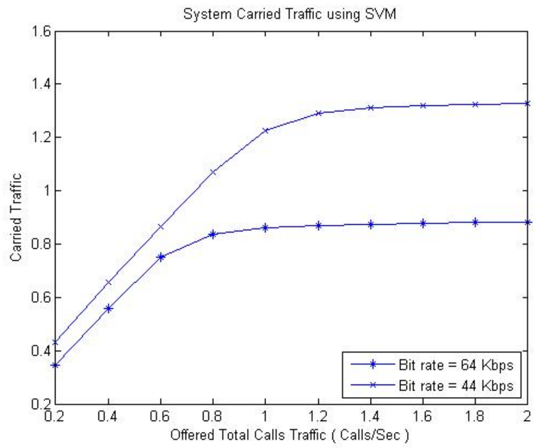

Fig.9. System carried traffic using SVM

It consists three cases, first is when all service calls have initial bit rate 12.2 Kbps for Voice call, 128 Kbps for data calls and 64 Kbps for video calls. The second case is when bit rate 8.2 Kbps for Voice call, 64 Kbps for data calls and 44 Kbps for video calls.

The total carried traffic is significantly increased at heavy traffic i.e. 2 calls/sec in SVM than Neural Network. When all service calls have initial bit rate 12.2 Kbps for Voice call, 128 Kbps for data calls and 64 Kbps for video calls the total carried traffic is 0.8809. And in last degradation when bit rate 8.2 Kbps for Voice call, 64 Kbps for data calls and 44 Kbps for video calls the total carried traffic is 1.3291.

V. CONCLUSION

Importance of efficient use and allocation of the limited wireless network resources is demonstrated.

Congestion is one of the most intense problems in the current wireless networks. With the emerging next generation wireless services, conditions will become even worse since users are allowed to use more bandwidth and transmit a large volume of data or even real-time video.

Traditional CAC schemes that mainly focus on the trade off between new call blocking probability and handoff call blocking probability cannot solve the problem of congestion in wireless networks.

All most all problems in traditional CAC schemes can be overcome by our new CAC using SVM and Neural network.

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