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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.**

Index Terms— **Call admission control, Load Estimation, 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. CAC need to perform separately for uplink and downlink transmissions as the traffic load offered by the uplink and downlink transmissions is different from each other. The uplink and downlink 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."

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II. BACKGROUND

Call admission control provides the service provider with a mechanism to enhance the Quality of Service (QoS). Due to the user's mobility 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. ABOUT PROJECT

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 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:

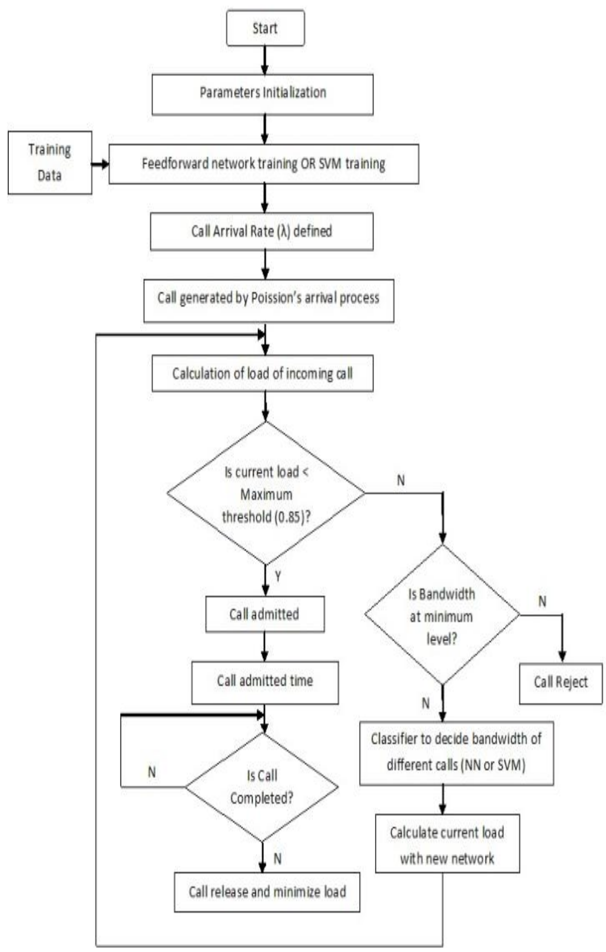
Rule no	Bandwidth		
	Voice	Data	Video
1	12..2	64	128
2	10.2	64	128
3	8.2	64	128
4	8.2	56	128
5	8.2	44	128
6	8.2	44	112
7	8.2	44	80
8	8.2	44	64

Table I: Bandwidth degradation rules for neural network

Rule no	**Bandwidth**		
	Voice	**Data**	**Video**
1	**12.2**	**64**	**128**
2	**8.2**	**44**	**64**

Table II: Bandwidth degradation rules for SVM

Basic system flow or system design of "Call Admission Control using Neural Network OR SVM" is shown as –



Flowchart For CAC using NN orSVM

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:

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

Table III: Simulation Parameters

B. *System Performance:*

This proposed Algorithm is evaluated based on three Quality of Service (QoS) metrics: The blocking probability for newly originating calls, the forced termination probability and the total system carried traffic. The blocking probability is the probability that a new call is denied access to the system, while the forced termination probability is the probability that a call that has been admitted will be terminated prior to the call's completion. When a call arrives, firstly initialized all the parameters (Bit rates for voice call, data call and video call (Ri)). The value of the bit-energy-to-noise-density ratio Eb / No corresponds to the signal quality, since it determines the bit error rate, BER. Let ρ be the target bit-energy-to-noise-density ratio required to achieve a particular BER, or equivalently a particular frame error rate (Eb / No ≥ ρ). That means the maximum bit (BER) or blocks (BLER) error rates, can be mapped into an equivalent Eb / No constraint denoted by ρ .If we assume perfect power control, then Eb / No= ρ . The resulting BER can then be approximated using:

$$Q\sqrt{2\left(\frac{Eb}{No}\right)} \approx \frac{e^{-\frac{Eb}{No}}}{2\sqrt{\frac{\pi Eb}{No}}} \qquad (1)$$

Spreading Factor is denoted as Gi by using the formula,

$$(W/Ri)i = Gi \qquad (2)$$

Offered call traffic is evaluated by using call arrival rate (λ) and call termination rate (μ) as follows:

To generate the call, the blocking probabilities for voice, data and video calls and by the poission's arrival process, the call arrival rate (0.5λ) are specified firstly. Then the load increase of the arrived call before accepting the arrived call is calculated. i.e. load of the incoming call, by using the following formula,

$$\eta = \frac{1}{\left(\frac{Gi}{\rho i}\right)+1} \quad (3)$$

And, now it is easy to derive the minimum required power (sensitivity), Pi:

$$Pi = \left[\frac{1}{\left(\frac{Gi}{\rho i}\right)+1}\right] * \text{Itotal} \quad (4)$$

The total load factor of such an interference system is the sum of the load factor increments brought by N active mobile users. Therefore,

$$\eta = (1+f)\sum_{i=1}^{N}\left[\left(\frac{Gi}{\rho i}\right)+1\right]vi \quad (5)$$

And from this, one can calculate the maximum number of simultaneously active users which can be permitted as:

$$N = \left[1+\frac{\eta G}{\rho v(1+f)}\right] \quad (6)$$

When the system is 100% loaded, it has reached pole capacity or the maximum theoretical capacity of WCDMA system. Letting the η = 1 above equation yields,

$$N_{POLE} = \left[1+\frac{G}{\rho v(1+f)}\right] \quad (7)$$

For all types of incoming calls (voice, data and video calls) load is calculated by using equation 4. For all types of calls (Voice, Data and Video) separately simulate the offered traffic by using above formula for different Bandwidth.

Offered call traffic is evaluated by using call arrival rate (λ) and call termination rate (μ) as follows:

Offered traffic = λ / μ (8)

If we denote PB is the blocking probability of a call in a cell, then the total carried traffic in the cell can be calculated as,

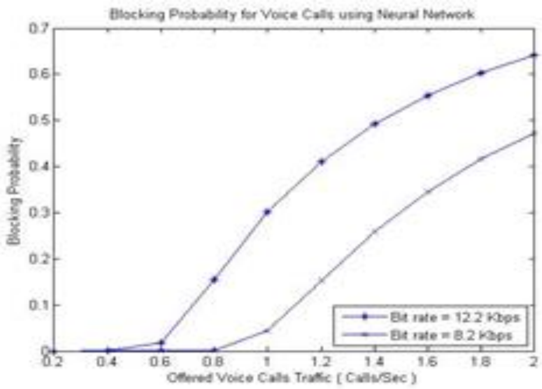
Total carried traffic = offered traffic (1 - PB) (9)

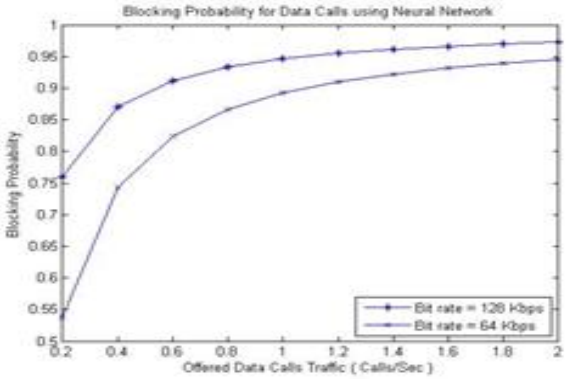
C. Result Discussions:

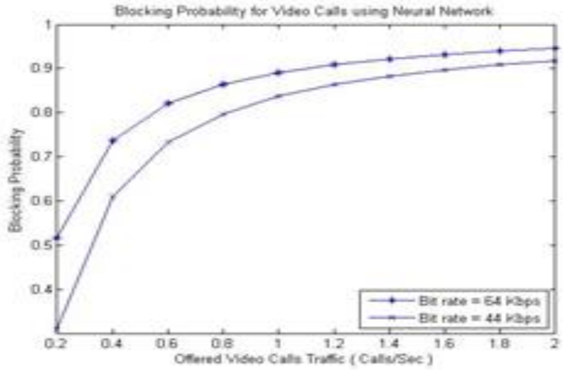
Every new call is treated differently. In proposed project no handoff considered. For every new call with corresponding bandwidth, the offered loads are calculated by keeping average holding time for all services is 180 seconds for both neural network and SVM.

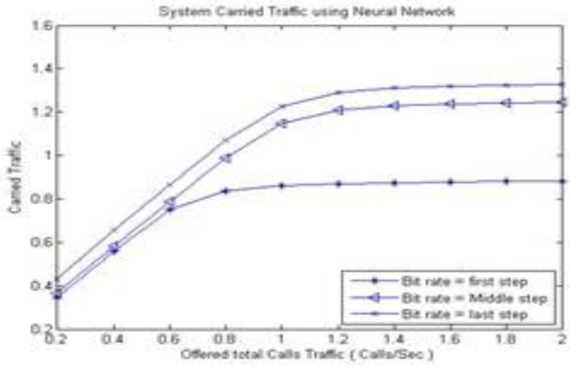
1) Using Neural Network:

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.



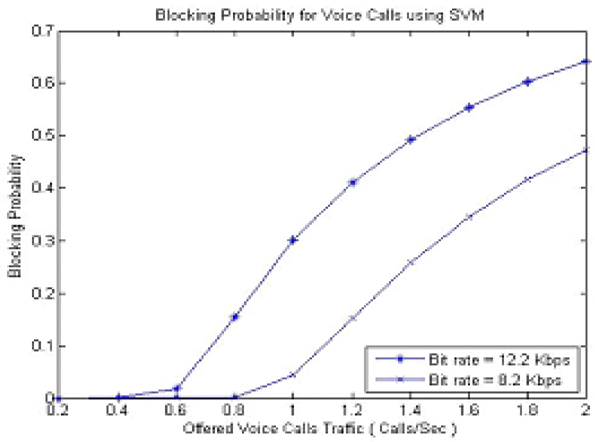


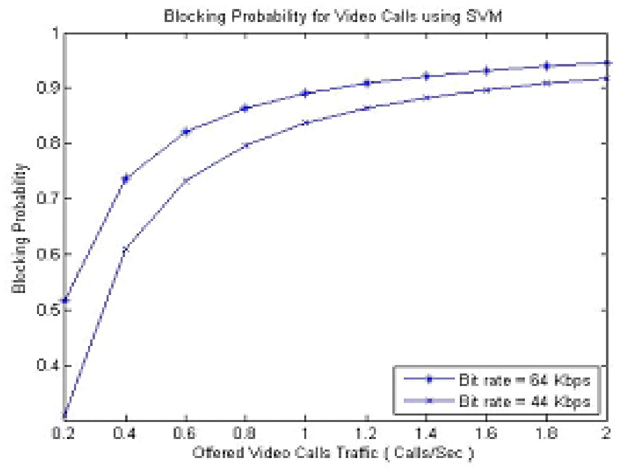


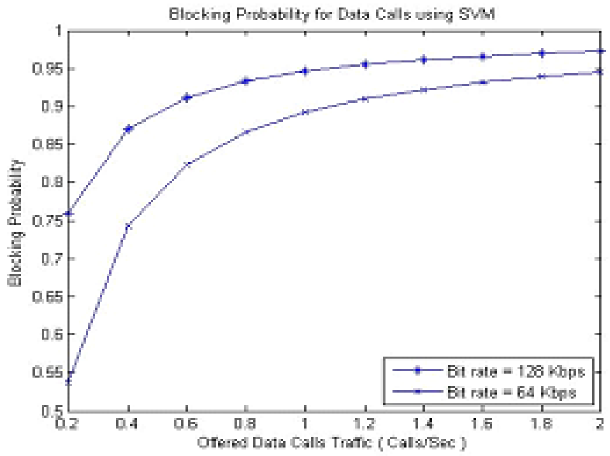


2) Using SVM:

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.



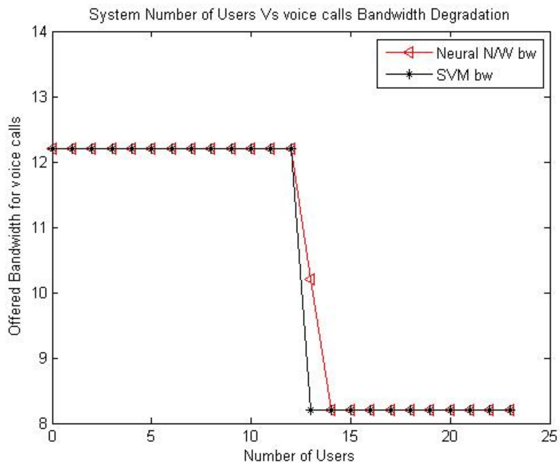


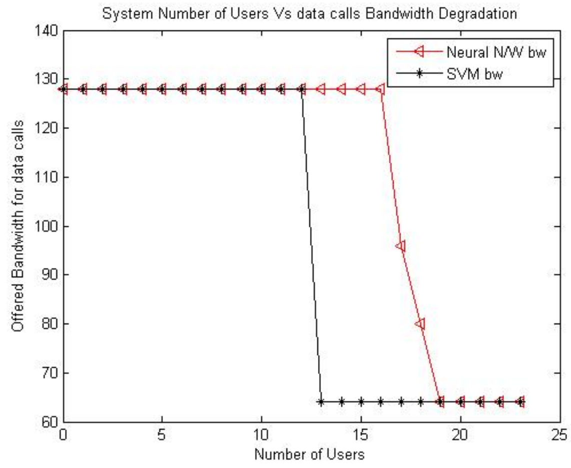


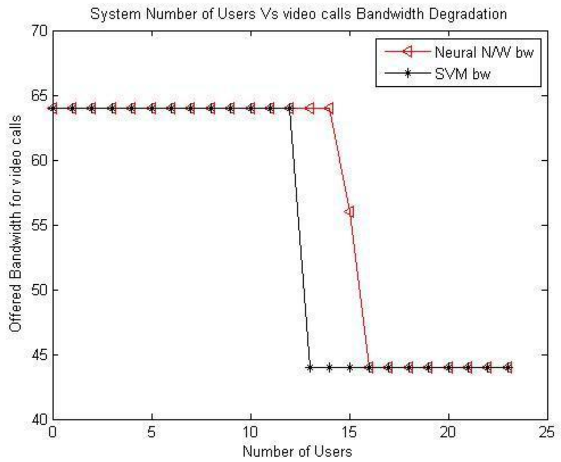
It consists three cases, first is when all service calls have initial bit rate 12.2 Kbps for Voice call, 128 Kbps for data calls and 64 Kbps for video calls. The second case is when bit rate 8.2 Kbps for Voice call, 64 Kbps for data calls and 44 Kbps for video calls.

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.

For best result we compare, neural network with SVM with reference to CAC. And results are shown in following figures.







In SVM, all the three services are degraded at the same time, while for neural network the degradation becomes late. As shown in Figures, it is observed that, after the 13th or 14th call, the bandwidth degradation occurred for Voice and Data call in SVM while, in Neural Network satisfies the 19 customers. And, for that Video calls, the Neural Network satisfies more 2 customers than SVM.

V. CONCLUSION

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

2) 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.

3) 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.

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

5) No any call is dropped.

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BIBLIOGRAPHY

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