ABSTRACT This paper presents a survey on different studies done in the field of Call Admission Control. Necessity of Call Admission Control is to provide better QoS. This paper provides an overview of different two techniques used for CAC. 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 scheme to reduce the network congestion and provide the desired Quality of Service (QoS) to users in service. This paper basically compared the call admission control using the Neural Network and call admission control using SVM.

Keywords: Call admission control, Load Estimation, WCDM, Offered traffic, Total carried traffic

1. INTRODUCTION

Call admission control is a very important measure in CDMA system to guarantee the quality of the communicating links. [1]. Many researchers considered CAC schemes combined with a bandwidth adaptation algorithm in adaptive multimedia wireless networks. CAC makes a decision on whether to accept or reject a call and bandwidth adaptation has two aspects: when the network becomes congested, the bandwidth allocated to some ongoing calls will be degraded to release bandwidth for carrying more incoming calls so that the call dropping and blocking probabilities can be maintained at the target level; on the other hand, when the network is favorable, the bandwidth of a call can be upgraded to a higher QoS quality. [2]. Due to the advances in the network architectures and the demand for multimedia rich services and applications, this problem has received much attention from the researchers. The solution to this problem assumes even more significance in the recent times because of the rapid deployments of IP-based Next Generation Networks (NGN) which promises guaranteed QoS to converged services that share the common transport layer. Call Admission Control (CAC) mechanism plays a proactive role in providing QoS by limiting the entry of traffic at the edges of the network.

However, as the number of services, their classes and size of the network grows, the CAC problem becomes difficult and intractable to solve through conventional analytical methods. Neural Network (NN) and Support Vector Machine (SVM) approaches have been successful in solving the CAC problem. Once appropriately trained, they can automatically estimate and predict future system behaviour and subsequently make admission decisions with high accuracy and speed. However, to our best knowledge, there is no research work which specifically compares the application of NN and SVM approaches to solve the problem of CAC. [3]. this paper is an effort to address the comparison between NN and SVM for application of CAC.

The rest of this paper is structured as follows. In Section II we provide the required background and survey the existing related work. In Section III we present the estimation of load. Simulation results and discussions will be presented in Section IV. Section V concludes the paper by suggesting possible future work.

2. BACKGROUND AND RELATED WORK

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 [4].

This led to ML based CAC schemes which had improved performance in terms of reduced Cell Loss Ratio and Delay. One of the solutions is based on NN, which used back propagation NN for learning relation between offered traffic and service quality [5]. CAC scheme has been developed based on combined use of Particle Swarm Optimization and Fuzzy logic for next generation mobile communication networks [6]. Support Vector Machine (SVM) based CAC algorithm utilizes service vector and network vector to predict admission state for admission decisions [7].

All the approaches mentioned above formulate the CAC process as a classification problem. Even though there is a paper which compares NN and BN for response time modeling in service-oriented systems [8], there is no evidence in the literature which compares the NN and SVM approaches for CAC problem. The uniqueness of this paper lies in the fact that, it compares two most prominent approaches, NN and SVM, for their accuracy for CAC decisions, using estimates of load, blocking probability, offered traffic and total carried traffic for CAC.

In [13] A CAC algorithm using total received power as thresholds when there exist multiple types of services is proposed. By setting the higher threshold to voice traffic, the voice traffic is given a higher priority than data traffic.
Multiple threshold schemes are investigated and their performance is compared with that of a single threshold-based scheme. Also In [10], a received power based algorithm is proposed, and when higher priority is desired for handoff calls, it allows different thresholds for new calls and handoff calls. In [11] an interference based admission control strategy with multi level threshold is analyzed. Different interference thresholds are employed for new and handoff calls. The interference threshold for handoff calls is higher than that for new calls.

Our algorithm differs from those algorithms in terms of using the cell load as an admission criterion with three services (voice, data and video). In addition, the capacity estimate of WCDMA systems is formulated. So, before presenting the description of comparison studied in this paper, the next section will present the capacity calculation and load estimation for the WCDMA system. This estimation provides the key criterion in designing the admission control.

3. CAPACITY AND LOAD ESTIMATION IN WCDMA SYSTEMS

In this section the load and capacity estimation of a loaded network will be presented. Furthermore, the analysis assumes perfect power control operation. Hence, a mobile station (MS) and its home base station (BS) use only the minimum needed power in order to achieve the required performance. The CDMA capacity has been subject to extensive research work, [9], hence only a short description is given here.

The resulting BER can then be approximated using:

\[
Q = \sqrt{\frac{2}{\pi}} \left(\frac{E_b}{N_0}\right) \approx \frac{E_b}{2\sqrt{N_0}}
\]

(W/ Ri) i _ Gi: is the spreading factor or the processing gain for MS i.

\(R_i\): The bit rate of MS i

\(W\): The chip rate of the WCDMA (3.84 Mcps)

\(i\)_i : The required Eb / No for the mobile i and for a certain service quality

\(P_i\): received power of the desired signals

\(P_j, j_i\): The power of unwanted signals

\(I_o\): The thermal noise (background noise power in the case of an empty cell relieved at base station).

\(I_{own}\): The power received from the MSs connected to the same BS as the desired MS (including the impact of wanted signals).

\(I_{oth}\): The power received from the MSs connected to the other cells, and

\(v_i\): the average voice activity factor indicating the portion of time when the user is actively transmitting. Using the above definitions, the total interference, \(I_{total}\), is the sum of \(I_{own}\), \(I_{oth}\) in addition to the thermal noise, \(I_o\). Finally, the ratio of \(I_{oth}\) to \(I_{own}\) is denoted by \(f\), i.e.

\[
f = \frac{I_{oth}}{I_{own}}
\]

The minimum required power (sensitivity), \(P_i\):

\[
P_i = \left[\frac{1}{(\frac{E_b}{N_0})+1}\right] \times I_{total}
\]

Where

\[
\frac{1}{(\frac{E_b}{N_0})+1} = \eta
\]

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

\[
\eta = (1 + f) \sum_{i=1}^{N} \left(\frac{E_b}{N_0} + 1\right)v_i
\]

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

\[
N = \left[1 + \frac{\eta \sigma_i}{\rho v(1+f)}\right]
\]

This algorithm has the following steps:

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

4. SIMULATION RESULTS AND DISCUSSION

In this paper, three services are simulated, voice, data and video. This proposed Algorithm is evaluated based on number of users, offered bandwidth.
Comparison of using Neural Network and SVM:

1. For Voice Calls

![Graph showing Number of users Vs. offered bandwidth for voice calls. The better bandwidth allocation for 13 users using neural n/w while 12 users using SVM.]

The figure shows Number of users Vs. offered bandwidth for voice calls. The better bandwidth allocation for 13 users using neural n/w while 12 users using SVM.

2. For Data Calls:

![Graph showing Number of users Vs. offered bandwidth for data calls. The better bandwidth allocation for 18 users using neural n/w while 12 users using SVM.]

The figure shows Number of users Vs. offered bandwidth for data calls. The better bandwidth allocation for 18 users using neural n/w while 12 users using SVM.

3. For Video Calls

![Graph showing Number of users Vs. offered bandwidth for video calls. The better bandwidth allocation for 15 users using neural n/w while 12 users using SVM.]

In short, comparing the results of Neural network with SVM, it shows that, 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. But, in both processes, no any call is being dropped. In general as shown in these figures, the system has a better performance under this proposed algorithm.

5. CONCLUSION

The rising demand for mobile communication services with various QoS requirements is increasing the importance of efficient use and allocation of the limited wireless network resources. 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 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 SVM and Neural network and comparison of this two.

The implementation makes few assumptions for the implementation. These assumptions hold well during algorithm evaluation but may deviate in its operation in real time scenario. An effort could be made to evaluate the performance considering these factors also. The proposed implementation is evaluated on apart of image and speech sample, an effort can be made to speed up the operation of this implementation in future.

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7. REFERENCES


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