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WIRELESS NETWORK TRAFFIC CONTROL USING NEURAL NETWORKSIN WAVELET DOMAIN

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ABSTRACT

For traffic prediction forecasting in WIMAX, generally the genetic algorithm were used ,but due to certain limitation of genetic algorithms, problems was created in the traffic prediction .So there is a need to proposed a new approach that is better than Genetic algorithm .this approach need to update the limitation of the Genetics algorithm. There is a need to enhance the prediction capability of AANs in the networks, As due to many limitation of Genetic algorithms there was problem in the traffic prediction , so GA a must be replaced by some other algorithms and lastly work should be done pn the combined data rather than divided it into sub part For better traffic prediction there is need to enhance the prediction capability of the AANs in the network By replacing the GA with MRPSO there is better traffic prediction The work should be done on the combined data instead of the breakdown data.

I INTRODUCTION

Network performance refers to measures of service quality of a telecommunications product as seen by the customer. Ensuring Quality of Service (QoS) over the Internet is difficult, especially in the case of real-time multimedia applications where the retransmission of packets is not a viable option. The occurrence of congestion can severely degrade the quality of transmissions due to packet losses, increased delay and jitter . Embedding forecasting algorithms into routing management systems can play an important role in guaranteeing QoS in IP networks. Traffic prediction enables proactive network management which improves the global performance of the network through congestion control and prevention. Initially, it was believed that adaptive routing protocols, such as OSPF (Open Shortest Path First) , can react to congestion. Unfortunately, congested links often remain undetected because of the way OSPF assesses link connectivity. If a link flaps constantly due to congestion, but at least 1 out of every 4 Hello messages is received, OSPF does not detect the problem. If the congestion is severe and no Hello messages are received from a neighbor, it is automatically considered down because OSPF makes no distinction between hardware failures and congestion. Thus, the involved router will not befurther used and all the traffic will be rerouted to a different link which in turn can also become congested. The solution adopted by OSPF does not resolve the underlying problem that of transmitting too much traffic on a single link. The following list gives examples of network performance measures for a circuit-switched network and one type of packet-switched network, viz. ATM:

Circuit-switched networks: In circuit switched networks, network performance is synonymous with the grade of service. The number of rejected calls is a measure of how well the network is performing under heavy traffic loads. Other types of performance measures can include noise, echo and so on.

ATM: In an Asynchronous Transfer Mode (ATM) network, performance can be measured by line rate, quality of service (QoS), data throughput, connect time, stability, technology, modulation technique and modem enhancements. There are many different ways to measure the performance of a network, as each network is different in nature and design. Performance can also be modeled instead of measured; one example of this is using state transition diagrams to model queuing performance in a circuit-switched network. These diagrams allow the network planner to analyze how the network will perform in each state, ensuring that the network will be optimally designed

Various performance parameters

Power: As the distributed router is composed by hardware components, each one supposed to manage a certain share of the overall forwarded traffic. Moreover, components are assumed to independently switch on different Power states, which provide a different tradeoff between performance and power consumption for each HW element. Every element is obviously supposed to increase its maximum forwarding capacity, as a more power intensive state is selected.

Stability: Stability of wireless networks is arrival processes of packets, and design efficient, distributed algorithms that achieve stability in the SINR (Signal to Interference and Noise Ratio) interference model.

Energy: energy is defined as the energy consumption of transmitting and receiving data between two sensors .

Traffic :Network traffic or data traffic is data in a network. In computer networks, the data is encapsulated in network packetsNetwork traffic means it is the no. of packets sent/received. It monitors the packets. Bandwidth is the simply the speed of the internet. The upload/download speed tells you the bandwidth. In computer networking, network traffic control is the process of managing, controlling or reducing the network traffic, particularly Internet bandwidth, e.g. by the network scheduler. It is used by network administrators, to reduce congestion, latency and packet loss. This is part of bandwidth management. In order to use these tools effectively, it is necessary to measure the network traffic to determine the causes of network congestion and attack those problems specifically.

A network flow comprises of data packets exchanged between communicating hosts on a network using transport layer protocols such as TCP, UDP and RTP. A transport layer protocol such as TCP is responsible for the reliable and inline delivery of data packets between two communicating applications. The inter-arrival time between two consecutive packets of a network flow transmitted by a host is a complex function determined by the application traffic generation rate, the transport layer protocol in use, queuing delays at the host and on the intermediate nodes in the network, the medium access protocol, and finally a random amount of jitter. The existing approaches to traffic prediction in the computer networking literature are based on probabilistic estimations of aggregated network flows. In the authors study the relationship between the maximum achievable TCP throughput and path properties such as available bandwidth, path loss and queuing delays. However, depending on the application in use, a TCP flow may or may not scale to its achievable throughput. Standard one step prediction models. The predictability of network traffic is of significant interest in many we can distinguish two categories of prediction: long and short period predictions. Traffic prediction for long periods provides a detailed forecasting of the workload and traffic patterns to assess future capacity requirements, and therefore allows for more accurate planning and better decisions. Short period prediction (milli-seconds to minutes) is relevant for dynamic resource allocation. It can be used to improve the Quality of Service (QoS) mechanisms as well as congestion and resource control by adapting the network parameters to traffic characteristics. It can also be used for routing packets. Traffic prediction has been extensively investigated since the acceptance of the self-similar and the long-range dependence nature of networks traffic While these peculiar characteristics cause dramatic effects on network performance in terms of loss and delay, several studies have shown that the self-similarity can be exploited to characterize or to predict the traffic in order to control the network resources assignment From the extensive work done in the field of prediction methods for network traffic, we draw the following conclusions. First, generalization about the predictability of network traffic is difficult to make since network traffic can change considerably over time and space. Traffic is self-similar and has a non-linear nature, and this makes it highly difficult to perform accurate prediction especially for linear models Thereby, the prediction model should be adaptive. Second, aggregation and smoothing appear to improve predictability Third, there are clearly differences in the performance of the various predictive models We can also classify prediction techniques into two categories: Training-Based (TB) techniques and Non-Training-Based (NTB) techniques. Specifically, the TB techniques need a training phase. The training phase consists of identifying model parameters based the history of the throughput measurements called the training dataset. The TB model is then fed by the last observations of the throughput called lags in order to predict the future value. Generally, the complexity of the training phase is not crucial since it is performed once. Contrarily, NTB techniques do not need training phase and calculate the predicted value using only the last lags. The number of lags is usually chosen lower than 10 for TB and NTB models in order to reduce the complexity of the model. The most used training-based models are the Auto regressive (AR) model and the Auto Regressive Moving Average (ARMA) model whereas the Linear Minimum Mean Square Error (LMMSE) is widely used as an NTB technique .We choose to investigate TB models since they achievebetter performance than NTB models .Thus,three TB prediction models are used namely the ARMA model the ARIMA model and the α SNF model .The α SNF model combines fuzzy logic which presentsthe model as a set of simple rules (if event then action) and neural networks which are the basic learner to capture the non-linear characteristic of network traffic. Neurofuzzy networks have been used to predict video traffic and Web server traffic. However, model parameters and their effects were not sufficiently the work focuses on the short period throughput prediction (i.e. the incoming input rate in Megabit persecond (Mbps)). All the performed experiments are using real traffic collected from two links having different characteristics (type of the link, traffic load etc.)

The work investigates the following issues:

• How much data are needed for the training phase,

• How many lags are needed to be used as an input for the prediction model to improve its accuracy?

• What is the effect of the considered traffic granularity i.e. the interval of time separating two measurementsof the traffic throughput?

• How to use exogenous variables as an input for the prediction model. Exogenous variables are variables which are different from the lags such as the number of packets or sampled data set.

One of the early applications of cognitive networking in wireless networks is the problem of dynamic channel selection in multi-channel wireless networks. Dynamic channel selection requires gathering past and current traffic across multiple channels and predicts future traffic loads on each of the channels for deciding best channel for the Access Point (AP) to operate on for serving wireless clients. Traffic prediction can be performed by employing Multi-layer Feed forward Neural Network (MFNN) models for learning the effect of spatio-temporal-spectral parameters on traffic patterns and predicting future traffic loads on each of the channels Prediction of the traffic flow in particular systems will expedite discovering of an optimal path for packet transmitting in dynamic wireless networks. The main goal is to predict traffic overload while changing a network topology. Machine learning techniques and process mining enables prediction of the traffic produced by several moving nodes. Several related approaches are observed. The idea of process mining approach is proposed. Network traffic prediction plays an important role in guaranteeing network QoS. It is important to note that algorithms should be constructed to work in real time and be based on a minimal amount of historical information. Let's observe several main traffic prediction methods.

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II TRAFFIC PREDICTION

Network traffic prediction plays a fundamental role in characterizing the network performance and it is of significant interests in many network applications, such as admission control or network management. Therefore, The main idea behind this work, is the development of a WIMAX Traffic Forecasting System for predicting traffic time series based on the daily and monthly traffic data recorded (TRD) with association of feed forward multi-layer perceptron (FFMLP). The quality of forecasting WIMAX Traffic obtained by comparing different configurations of the FFMLP that consist of investigating different FFMLP model architectures and different Learning Algorithms. The decision of changing the FFMLP architecture is essentially based on prediction results to obtain the FFMLP model for flow traffic prediction model. The different configurations were tested using daily and monthly real traffic data recorded at each of the two base stations (A and B) that belongs to a Libyan WiMAX Network. We evaluate our approach with statistical measurement and a good statistic measure of FMLP indicates the performance of selected neural network configuration. The developed system indicates promising results in which it successfully network traffic prediction through daily and monthly traffic data recorded (TRD) association with artificial neural network. A handover provides a continuous connection while a mobile station moves from one cell to another. A mobile station may communicate with multiple base stations (BSs) during a handover, for example during a soft handover. In this case, handover traffic can be an additional load on mobile systems. The portion of handover traffic to total traffic is approximately 12% considering only soft handovers in cdma2000 1x networks in mobile environments; each cell has a different spectrum requirement since traffic is unevenly distributed in a region. The spectrum requirement required to serve a region is not the average but the maximum demand of cells. This is the basic concept of previous methods. It is theoretically feasible but lacks the practical aspects of frequency reuse. Recent mobile technologies, including cdma2000 1x, WCDMA, and mobile WiMAX, support frequency reuse of one. All cells can operate on the same frequency channel, which allows splitting a cell into multiple cells to share the coverage and traffic of the original cell. As a result, we can reduce the spectrum requirements by using a cell split. Not considering frequency reuse may result in the overestimation of the spectrum requirements. On the other hand, even though users at the cell edge may suffer degradation in connection quality due to heavy cochannel interference in the cell split, the possibility of a cell split with a frequency reuse of one is theoretically clear In addition, cell splits are widespread in CDMA systems, which support a frequency reuse of one. For example, a mobile operator in Korea operated around 4,000 cdma2000 1x base stations in 2003, and that number increased to around 6,000 in 2009. The operator's network covered the whole country, even as far back 2000, implying that around 2000 cells are split. Previous research has paid no attention to self-similarity, handover, and frequency reuse, although these factors affect spectrum requirements significantly. However, a recent study did consider these three factors .The method used in however were simple and intuitive. It considered self similarity but merely used a parameter to reflect self similarity without analyzing it mathematically. The scheme of the cell split was not specific. In addition, the study did not consider when the data of the cell traffic is insufficient

2.1Traffic prediction algorithms

Prediction using wavelet neural networks the traditional prediction methods such as time series analysis, regression method etc. are difficult to put in practice because the WMN's traffic is complicated and lacks effective mathematical model. Moreover most of traditional prediction algorithms are resource-intensive. A multipath routing algorithm based on wavelet neural networks. Wavelet neural network prediction model adopts three-layer structure. There is input for input layer, namely one input containing values of the time series. There are offered equation shows that a function can be approximated by orthogonal function sets and thus can be implemented using a neural network.

2.1.1Clastering Approach

Besides communication between nodes there is a problem of load balancing between base stations in WMNs which provides access to external services like internet or telephony. A given geographical area consists of hexagonal cells each served by a base station (BS), The BS is a part of the wireless infrastructure that controls one or multiple cell sites and radio signals .The clustering approach to form clusters based on the traffic load. Clustering is used to classify the base stations into heavily loaded, moderately loaded and idle base stations. In case of heavy loaded BS group detection, radial stations with lesser load can intercept some part of the traffic.

2.1.2 Graph Mining

One more approach comes from road traffic load prediction. As wireless network load forecast is aimed to optimize routes, road traffic analysis is aimed to choose an optimal way considering arterial load.The basic model in algorithm is a graph where vertexes are cross-road and edges are streets. The main metric of each edge is speed. It is needed to mention that in general case of transport it is impossible to determine the end point of particular unit. But in case of networks destination node is always known. The main idea of presented in algorithm is to determine edges weights on some moment in near future.

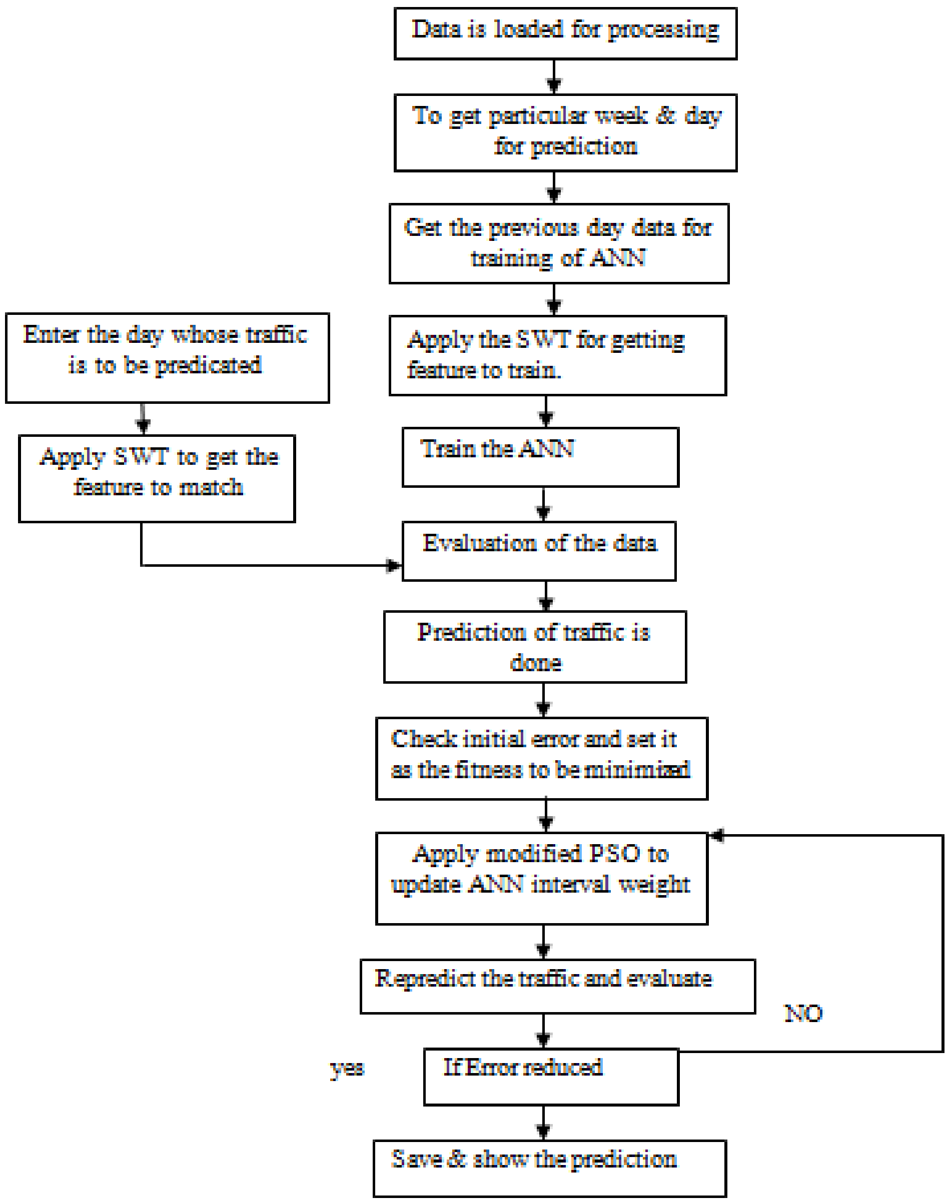
2.1.3 Time series analysis

Time series analysis is widely used in wired networks, but it needed to be modified to use in client wireless networks to decrease amount of information being analyzed. It is to consider only internal mesh-network traffic between nodes. The input is sequence of network load values (in bytes per hour for instance). After several filter steps and prediction algorithm authors achieved results which can be used in traffic prediction Analyze the uniformity of the traffic in a WiMAX network with the aid of a forecasting methodology. Taking into account the high volume of data transferred in a wireless network and the requirement of real time, we propose a forecasting methodology based on data mining. The theoretical basis of the proposed method is explained in detail. Its implementation is highlighted by diagrams, which explain each step of the algorithm. The method is applied on real data and the obtained results are discussed.

III MODIFIED PSO

Earlier for traffic prediction genetic algorithms (GA) were used, but due to certain limitation there was an need to update the GA .There is a need to enhance the prediction capability of the ANNs and to replace the GA with some other optimization algorithms. Many algorithms were studied and was found that there is need of a new approach that is better and more efficient than the Genetic algorithm (GA) .So a new approach is made in this thesis. In this thesis an approach is made which will enhance the prediction capability if the ANNs. In this MRPSO is used which is better than the Genetic algorithm (GA) and the traditional PSO .MRPSO works on the basis of velocity of the packets where as traditional PSO works on the basis of position of the packets .Also in this thesis SWT is used per old approach but in a changed way .in pervious approach it worked on the break down, whereas in this new approach it is working on the combined data.It is quite advantageous as the ANN will be better in learning as the most of the data will be given to it, by giving data in combined manner the prediction error which occur earlier due to the breakdown data will be less .The prediction of data will become more accurate as compared to previous method. In this proposed work, the main aim is to enhance weight values of the AAN using MRPSO and also to enhance the iteration in the prediction of the ANN about traffic in future days .The benefit of this is that it will help the telecom companies to send or to move traffic to free line and will manage it in a much better way. So in this approach the problem of traffic prediction in the networks is solved to great extent.

FLOW DIAGRAM



IV CONCLUSION

In this paper we implemented a technique that combines the wavelet analysis with the ANN model. The main challenge was to verify that using the ANNs in WT domain allow us to obtain better results. The forecasting technique in this paper can be effectivelyused for building prediction models for time series. However ,in order to have higher performance and to reduce theprediction errors, we would recommend to have more data for analysis, to take into consideration the localization of thegeographic area where the information has been taken from ,and to analyze what types of business is developed in the given region. These aspects represent the start points for our future work in this domain.

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