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# Congestion Control Analysis in Network: A Literature Survey

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***Abstract***— *with the emergence of wireless network the rapid growing traffic is starting to experience heavy utilization and network congestion. Congestion in network may arise when network node is carrying more data than it can handle and keep the load below the capacity. Several experiments and researches have been proposed for network traffic congestion analysis in the field of computer network. This paper provides an overview of category provided by congestion detection and congestion avoidance by using neural network. It also includes hoe neural network uses for congestion detection to avoid congestion or effortlessness congestion in network. Computer network have experienced a rapid growth over the past few years and with that growth have come stern congestion problems. This paper concentrates on analysis of congestion to reduce the chances of network failure. It explores the congestion detection and congestion avoidance techniques of various authors and their conclusion has been summarised.*

***Keywords— Congestion analysis, Congestion detection, Congestion avoidance, Neural network.***

## 1. INTRODUCTION

Congestion in network may occur when the load on the network is larger than the capacity of the network- the network is carrying more data than it can handle. Network congestion occurs when too many packets are present in part of subnet. Network congestion is unending situation in communication network that is depending on the available capacity of the network and demanded amount of data transmission. When the total demands for resources is greater than the total available capacity of resources then this situation is said to be in the state of congestion. When there is no congestion in network the operation of data transmission, file downloading, file uploading etc. are done in few minutes but at the time of congestion same operations take too much time. Drop Tel starts dropping of packet when the buffer isfull, with the multiple TCP flow it causes globalsynchronization problem. Newer technique for congestion control and avoidance required. So, in order to overcome this problem active queuemanagement (AQM) [12] has been designed whichnotifies about the initiatory congestion proactively tothe terminals. Active queue management (AQM) ismainly a technique based on router which is used tomagnify the performance of TCP.

Congestion affects two imperative parameters of the network recital, namely throughput and delay. The throughput can be distinct as the percentage utilization of the network ability. When offered load increases in network then throughput is affected. When utilization of the network increases, throughput firstly increases linearly with existing load. If obtainable load increases additional, a point is reached when not a single data is delivered to any destination, which is usually known as deadlock. The superlative one corresponds to the condition when the whole packet introduced is delivered to their destination up to the highest capacity of the network. The second one corresponds to the situationwhen there is no congestion control. The third one is the case when some congestion control technique

is used. This prevents the throughput collapse, but provides lesser throughput than the ideal condition due to overhead of the congestion control technique. Congestion in network has become very important factor this day. Typical effects of congestion are queuing,packet loss, decrease QoS, bandwidth utilization, unreasonable delays etc.

## 2. BACKGROUND

In the year 2013 Sachin Kumar Saxena, Dhaneshwar Kumar, Astha Sharma, Nikita Gupta, Radhika Kochhar in his paper [1], states that internet services require QoS for time sensitive applications and data transmission but at the time of network congestion, degrades QoS. By using TCP–Friendly congestion control algorithm provides better quality service to all types of different traffic network can be designed. This control technique designed neural network which must be trained to optimize a TCP network performance measure and other wireless parameters are used. In this paper BER (Bit error rate) and RTT (Round trip time) congestion control parameters are used for updating the network weights and biases in learning algorithm for the proposed network *to reach their optimal value.*

In year 2011 Tran Xuan Truong, Le Hung Lan, Nguyen Duy Vie and Mai Vinh Du in their paper [2], states that congestion reduces the forecasting quality of time sensitive applications that is problematic for voice and video. TCP/IP Differentiated service and RED is needed to control the congestion. The RED uses AQM (active queue management) technique that provides new strategy to remove the packets; started dropping packets earlier to notify the traffic source about the congestion early state. In router queue RED sets the threshold dropping limits of packets. Many RED variants -RED, adaptive RED, RIO, and BLUE are introduced for differentiated service control.

In year 2011 A. B. M. Alim AI Islam and Vijay Raghunathan in their paper [3], states that Novel neural network can be used for solving the problem of reliable data delivery in wireless mesh network and incorporate into TCP to create variant i. e. Intelligent TCP or iTCP. WMN has non-deterministic and lossy environment that inspired us to discover the use of artificial intelligent method for congestion control in network. i-TCP can improve total network throughput up to 59% and decrease average energy consumption per bit up to 50% in wireless mesh network compared to convention TCP.

In year 2007 Gong Changqing Zhao Linna and Wang Xiaoyan in their paper [4], states that at the time of data transmission these are two reasons of packet loss, first is network congestion and another one is link bit error but TCP doesn't find the right reason of packet loss and then they default consider the reason of packet loss is network congestion and reduces the data rate immediately but the correct reaction of TCP during packet loss should be resending the loss packets not reducing the data rate. To address this above problem back-propagation neural classifier is used for distinguishing network congestion and link bit error over adhoc network.TCP Vegas and TCP Westwood are used to compare the error of the classifier. In this paper, they take two error scenarios to evaluate back propagation network first is the probability that the BP Network classifier misclassify a congestion as a link error and the other is the probability that the BP Network classifier misclassify a link error as a congestion and also shows the results of comparing the errors of classifier and they test also TCP Vegas and TCP Westwood. The classification results indicate that, this classifier can be capable for a classifier of packet loss reason in ad hoc networks.

In year 2006 N. Xiong, Member, Y. Yang, Jing He and Yanxiang He published their work on the paper [5], In this paper the Novel Congestion Control scheme based on back-propagation neural network technique is used to designing an efficient congestion controller and solving the problem of disparity between the network resources and the amount of incoming traffic that arises due to large propagation delay in data transmission. In this paper feedback technique is used to reduce the delay in network by using Resource management packets (RM); feedback information is carried back to the source but after few operations it can't proceeds and feedback information to be outdated. To control the traffic in network dynamic evaluation are used that provides the evaluation and distribution function for each individual source to compute the rate distribution. In this paper, they contract with control loop delay through an efficient predictive technique by using neural network technique to enhance the quality of service.

In year 2005 George A. Rovithakis and Christos N. Houmkozlis published their work on paper [6], In this paper a neural network based rate control algorithm is used for controlling the congestion in network based on sending time. In this paper source has to transmit a pre-decided amount of constant size packet to a receiver at a user obligatory desired sending time and for calculatingdesired round trip time, a single packet is transmitted every round trip time. By using that

estimated round trip time an on-line model is derived with the help of source rate and congestion control level.

In year 2005 Hyun C. Cho, M. Sami Fadali, Hyunjeong Lee published their work on paper [7], In transmission control protocol (TCP) Active Queue Management technique are used for congestion avoidance in network.TCP has non-linearity and time deviation stochastic property then in TCP AQM doesn't capable of adequately adapting to TCP network dynamics. In this paper to solve this above problem they introduced an AQM technique based on a dynamic neural network using back propagation algorithm. In this paper back propagation algorithm is used to train the neural network and they applied the neural network and they applied the neural active queue management to a single bottleneck network for supporting multiple TCP flow. With the help of novel AQM technology using dynamic neural network they provide higher quality of service.

In year 2014 Parisa Bazmi, ManijehKeshtgary published their work on the paper [8], In this paper CCN (content centric network) aims to access content by a name not by location of information it is a new internet architecture CCN based on the request received from customers which is nearly a pull-based method and combined with the accessibility of in network caching. In CCN chunks may be served by multiple source resulting makes TCP based congestion control technique insufficient. To solve this above problem neural network introduced in each router to predict adaptively the existing of the congestion on the link given the current status of the network. This method improves network throughput.

In year 2011 Shilpikaura and A. K. Vatsa published their work in paper [9]. In today's world multimedia is very important part in our daily life and it requires high speed data transmission architecture for uninterrupted data service. Multimedia applications like voice and video transmission, generates a traffic which is classified according to bandwidth, latency and quality of service. In high speed network congestion occurs when unexpected fluctuations and burstiness of traffic flow so to reduce this congestion problem in network round trip sequencing method are used to manage out-link capacity, average queue size and sending data rate over a network which is more effective and efficient.

In year 2014 Dr.T.Karthikeyan and B. Subramani published their work on paper [10]. Fairness and robustness is very important issue in communication network which requires congestion free and effective queue management technique. AQM is used for detecting weaknesses and congestion control in network. To reduce the chances of packet loss due to network congestion, congestion control algorithm has been designed AQM and TCP and merged together which acts effectively in case of congestion occurs in network. Wireless network always suffers a problem of hands off failure and link bit error which reduces the performance of network. To solve above problem new AQM algorithm is proposed which improves both fairness and robustness.

In year 1994 Scott A. Starks, VladikKreinovich and Prakash Narasimhamurthy published their work on paper [10]. To improve the performance of network and to prevent congestion it is significant to animatedly tuned network parameters: size of a packet and the retransmission timeout. Tunning is basically done by applying some predefined linear transformation to the recent values of these parameters: add a constant, subtract a constant and multiply the current values by a constant. With awareness choices of parameters are very important to reduce the chance of network congestion. Nonlinear transformation tunning is introduced for congestion avoidance in network.

## 3. NEURAL NETWORK FOR CONGESTION DETECTION

Artificial Neural Network (ANN) is one of the techniques used in many areas to find linear and non-linear relationships in data without pre-defined model. The main characteristic of neural network is the facility of learning. NN sets the minimum and maximum threshold limits. An artificial neural network is a paradigm for solving a problem of linear and nonlinear complex problems. NN also has a bias value that allows changing the neuron threshold, set minimum and maximum points the point of depolarization at which the neuron fires. Since the power of the neural networks comes from the amendment of the thresholds and weights of each node's input, these values are significant for victorious learning.

### 3.1 Network Architecture

The neurons can be clustered together in many ways. Basically, a neural network is the grouping of neurons into layers. In order to train a neural network, learningalgorithms and network architecture should be linked together closely.

#### 3.1.1 Single-Layer Feed-forward Networks

The easiest form of layered neural network is a single-layer feedforward network in which there is an input layer of source nodes and one output layer of neurons. As it can be seen in the figure, single layer refers to the output layer of computation nodes.

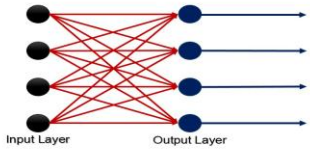


**Fig - 1:** Single Layer Feedforward

### 3.1.2 Multilayer Feed-forward

A distinctive multilayer feedforward neural network is the trendiest in the classification. Since every node in each layer of the network is associated to every other node in the forwarding layer, this network architecture is called fully interconnected formation.

As it can be observed in this picture, there is one distinguishable hidden layer with corresponding hidden neurons as working out nodes. A hidden layer is used to amplify the articulateness of the network.

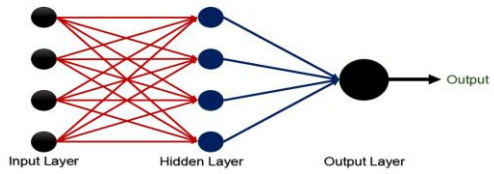


**Fig - 2:** Multilayer Feed-forward

### 3.2 Learning Paradigms

There are following types of learning processes first is supervised learning, unsupervised and reinforcement learning.

### 3.2.1 Supervised learning

Supervised learning utilizes an available set of pairs of input and desired output to adjust the weights. In supervised learning process, we have desired output then compare its resulting outputs against the desired output. During the training of a network the same set of data is processed various times as the connection weights are even developed. The set of data which enable the learning process is known as training set.

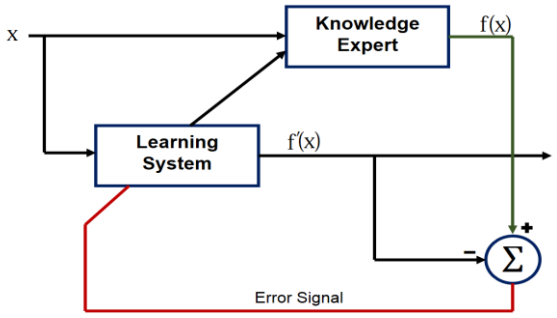


**Fig - 3:** Supervised Learning

### 3.2.2 Unsupervised Learning

In this learning process, we have no desired outputs. Unsupervised learning process utilizes only obtainable set of input data in adjusting weights to optimize a desired function. The system itself must then make a decision what features it will use to set the input data. This is over and over again referred to as self-organising or variation.

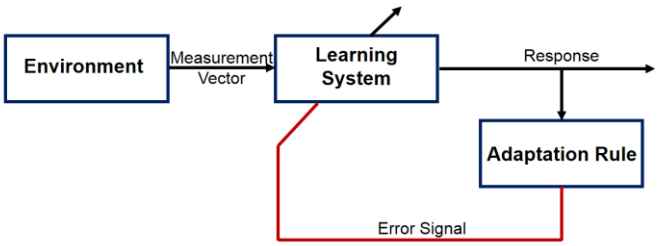


**Fig - 4:** Unsupervised Learning

### 3.2.3 Reinforcement Learning

In this learning process utilizes only current available inputs. In this learning method, the learner is a mediator that makes decisions and receives recompense or penalty therefore in order to solve a problem.

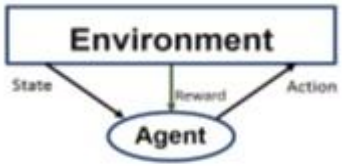


**Fig - 5:** Reinforcement learning

After these above steps testing process is performed with the help of above operations.

## 4. CONCLUSION

The amount of demanded data for transfer is greater than the available bandwidth of a network foremost to congestion. To achieve higher bandwidth, Low delay and batter quality of service, congestion detection is major issue in network. In this survey paper, we have studied about the neural network congestion avoidance and congestion detection techniques. With the help of above neural network congestion avoidance and congestion detection techniques we can reduce the chance of network failure. To achieve robustness and fairness in network congestion free environment is most important issue.

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