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An Approach for Traffic Prediction in SDN for Performing Routing

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Abstract: ***With the increasing use of smart devices for communications and an increased online mode of operation there is a rapid growth in the rate of traffic flowing through the network. This is driving today's network operation styles and hence there is a need for technology which can support the service providers in catering to the demands of its users in providing the required service. To be able to perform the above mentioned Software Defined Networks (SDN) has evolved over the years. SDN is an emerging paradigm that supports the network operations to be performed more dynamically and efficiently and hence providing seamless service to the users. In this paper, we propose a Traffic prediction approach. Traffic prediction is performed using Deep learning techniques which helps in performing routing dynamically and cater to the needs of the users.***

Keywords: SDN (Software Defined Network), Mean Square Error (MSE), Quality of Service (QoS)

1. Introduction

With the increase in network demands from just data transfer (in the form of text) to an era where there is communication taking place in lot of ways. Ranging from continuous text data flowing through different communication apps to audio, video streaming and many more. In such a scenario there is a huge amount of data flowing through the network along with varying volume data. Conventional routing algorithms are not sufficient to route these kind of data. two aspects are involved in it:

1) Routing algorithm should be intelligent enough to cater to the varying demand and
2) Service provider should be aware of expected traffic demands.

Internet applications and services have their own specific requirements that vary on numerous properties such as Band -
Width (BW), jitter, delay, and priority [1]. Conventional routing will not serve the varying requirements of the applications. SDN helps in serving the applications as per the demands as it has a global view of the network and it can also collect statistics from the devices periodically and also it can perform route calculation with the updated network resources data. In this paper we also propose Machine Learning based algorithm which also provides the traffic prediction which helps in network management activities along with routing. This paper is organized as follows: section II we discuss about the related work, Section III discusses about the proposed methodology and results, Section IV discusses about conclusion and future work.

2. Related Works

Survey in this section is done with respect to traffic prediction using machine learning and deep learning. There are various scenarios where Machine Learning is applied and in other situations Deep Learning is applied for Traffic prediction and inspection. This section presents an insight into the aspects related to these.

Conventional supervised classification methods classify any traffic flow into predefined classes, while cannot handle unknown applications without corresponding supervised data [2]. In [2] author addresses the problem of classifying the traffic coming from small number of real applications which is difficult to detect in supervised learning. Statistical flow features is used to detect and classify features.

In [3] author proposes a method to predict the next time series traffic for cellular towers for large city by feeding pre - processed time series signals into Elman Neural Network. This method uses multiple layers in the neural network to support the traffic prediction process. This paper uses a combination of both k means clustering and Elman Neural Network which poses a problem with higher values of k.

In [4] author discusses a hybrid model which comprises of Echo State Network and autoregressive integrated moving average model which forecasts mobile communication traffic. This paper is based on Recurrent Neural network where input is passed through a reservoir of nodes. One glitch into this approach is that use of hybrid models poses a challenge of data pre - processing.

In [5] author uses a non linear auto regressive exogenous model to predict the variable bitrate video traffic time series data sets. This model is used for long term data prediction. this model also employs a feedback loop into the entire layers as differing from other models where output is fed back only within hidden layer. This paper further proposes testing of model with more datasets.

3. Proposed Methodology & Results

In this paper we propose a methodology for performing traffic prediction based on Deep Neural Networks. Software Defined Networks is an emerging paradigm which provides a greater level of control over network operation with a global view of the network state. As there is a centralized control and there is a separation of control operations and

forwarding operations there is a greater flexibility in performing network operations. This makes easy to introduce the learning concept to be embedded into the network. As the network is dynamic there will be continuous changes in the paths that need to be followed by the flows from source to destination. Without having proper knowledge of the network and the traffic existing in the network it is very difficult to perform the routing and also managing the flows to make sure that they get desired QoS. In this paper we propose a Deep learning based neural network methodology which learns the traffic matrix with the help of current and past traffic matrix. Our proposed method is based on neural network with three layers: Input layer, hidden layer, output layer and the number of layers in hidden layers is what makes our proposed model efficient and overcome the shortfalls of existing models to some extent. To evaluate our proposed model it is compared with existing models on Support Vector Machine and K - Nearest Neighbors with a loss function considering Mean Square Error (MSE) and the following results have been obtained.

Algorithm:

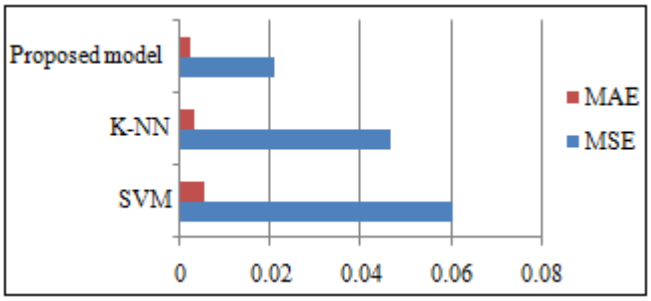
Step1: Network topology is created and integrated with SDN controller

Step2: Integrate SDN controller with proposed model

Step3: controller collects the statistics from the network and sends it to the proposed model for traffic prediction

Step4: proposed model predicts the traffic matrix and provides it as input to SDN controller for performing routing.

In our proposed model MAE and MSE has been used which acts as loss function and checks the prediction rate.



	MSE	MAE
SVM	0.06059	0.0052
K-NN	0.04658	0.0031
Proposed Model	0.02105	0.00226

4. Conclusion

In this paper deep learning model is proposed for traffic prediction in a time series model and the model is compared with standard models based on k - nn and svm and our model leads to less error rate. In further future work we have planned to compare the model with models based on existing neural network model and check the performance of our model and compare the results. As of now the proposed model on neural network is a promising solution which would prove to be good solution by still working on the layers in the proposed solution.

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