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Real Time Traffic Flow Prediction and Intelligent Traffic Control from Remote Location for Large-Scale Heterogeneous NETWORKING USING TensorFlow

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Abstract

Deep learning is an emerged technique to predict future and intelligent mechanism to monitor the process. Traffic Flow prediction is important function of collection traffic information and dissemination. Conventional intelligent approaches are used in large and small scalenetworks using supervised and unsupervised learning techniques.Traffic flow prediction and mitigating traffic control in remote location is an important factor in large scale networks. In this paper, we used Deep convolution neural network and Tensorflow is used to prediction of traffic flow using real time traffic data from various locations. Deep belief network is an intelligent traffic control mechanism for predicting traffic load, deep neural network and analyzing decision networks. The computer based Tensorflow is applied in deep neural networks demonstrates that our proposed supervised model is trained by deep learning approach. Our proposed model is able to achieve an improved performance in traffic flow, demonstrate large scale network traffic control using conventional l routing approach and the accuracy rate is 95% tested by Tensorflow.

Keywords: Traffic flow prediction, Intelligent Traffic Control, Tensorflow, Deep Convolution Network, Deep belief network

1. Introduction

Industry 4.0 is a recent revolution of next generation of heterogeneous networks such as 5G, Deep Learning, 3D modelling, Internet of Things, Data Analytics. The high volume of data and dynamic changes of technology are played vital role in rapid development in heterogeneous networks. The latency and high availability are the two important factors to measure traffic flow and traffic control. The exciting communication medium wired and wireless communications are used widely and increased large volume of data processing and prediction. The traditional routing mechanism and packet simulation are designed for large networks, traffic flow, traffic control and packet forwarding [1].

In recent research, the artificial intelligence are used several areas which includes speech recognition, image recognition and data analytics. Deep learning is an artificial convolution neural network can be classified into deep neural network, convolution neural network, Q-Learning and Deep belief networks. The deep learning can be implemented in various software such as AWS tools, Caffee, Keras, CuDNN and Tensorflow [3]. Tensorflow is an open source platform to implement deep learning network and analyze the prediction.

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Traffic control issues in small and large scale networks are analysed and proposed by using conventional routing protocols. The traffic control can be predicted by using convolution neural network from large scale heterogeneous networks. A supervised deep learning was applied to train the packet from incoming traffic flow and labelled for prediction. Unsupervised deep learning is also used for finding traffic paths and packet forwarding [4]. Zubai et al., the result shows that the traffic flow can be varies and measured by using increased network size, complexity in network flow and availability.

Tensorflow is dataflow based deep learning model which implements CNN, RNN and DNN models and accelerated by GPUs. TensorFlow used for analyze and estimate traffic flows and traffic controls. Hongsuk et al., the various deep learning tools like AdaGrad, Amazon Redshift and Alexa model are used prediction and evaluation. Bomin Mao et al, The number of network nodes are increased means the traffic pattern also changed. So the travelling time and routing can affect the network traffic at different intervals [5].

In this paper, we used Tensorflow software package for implementing CNN and DBN models to analyze and estimate traffic control and traffic flow. The suggested models show that the deep regression analysis and traffic performance index are applied for identifying accuracy [8]. The strength of supervised and unsupervised learning is a mixed deep learning approach and deals with large network problems such as traffic flow and traffic control. In addition that we used mixed algorithms so the result can be verified various time intervals and simulation results shows that the conventional traffic controls and flow in large networks [10].

2. Intelligent Data Analytics

The traffic flow is collected from various remote locations and Deep convolution neural network model are used for on-board service. Here we collected information for Global positioning System (GPS) in real time environment and collected traffic rate from Wi-Fi usage in college. We collect data from network administrator and the device collect average traffic flow rate [13]. The centralized server monitor all the process and we can set flow conditions around 2,45,675 links in every 30 minutes. The traffic data collected from 01/02/2019 to 28/02/2019 (28 days) and the values are aggregated for measuring traffic speed and round trip time measurement.

Sanghoon Bae et al., The network traffic can varies periodically based on number of in and bound requests as well as speed. The aggregated data rate can be noticed in the form of kilometres per hour and data can be verified every 30 minutes intervals. The central server traffic conditions can be monitored periodically and every 30 minutes dataset collected for finding accuracy and performance using Tensorflow [12].

The traffic can vary at different time and different dates so the conventional traffic is used for forecasting traffic conditions. In this work, every week Saturday the network database can use for calculating traffic performance index and link speed can be measured [11].

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3. System Model and Intelligent Flow Control

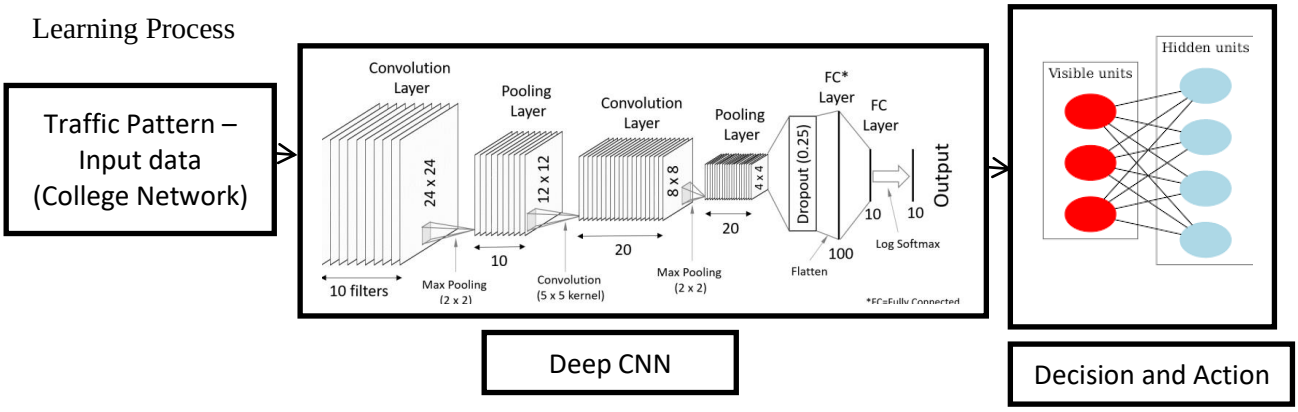

Figure 1: Learning Process – Input data from College Network Bandwidth

Considered Large scale heterogeneous network with wired and wireless communication with hybrid topological structure. We used fully connected graph G = {R, AP, N}, R – Routers, AP - Access Points, N – Nodes. The number connected components calculated by using CC = |R| + |AP|. The various deployment models are used for deep learning in the network and we used non supervised learning model for input and output learning systems. The Deep belief network is designed based on router and access points. So the intelligent agent can employ and big challenge to find the accuracy rate.

Here we designed combination of non-supervised learning structure and deep belief network model for path combination and working environment from remote locations data. In case we selected large and heterogeneous network so the combination of network nodes, incoming and outgoing packets, verifying speed and data rate, traffic flow and action space are tedious process for calculating accuracy rate. Because the action space is increased means we couldn't find traffic flow information and accuracy rate. So we used algorithm for complexity measurement and action space.

The above learning model the number nodes in the network is N and assumed the complexity is assumed as O(1) i.e single valued neural network model. Here we train one neural network model by using paths and nodes in the network. The number action or request can be recorded in action space so can easily monitor all the requests and traffic flow. So we increased the path based on the result in unsupervised learning results the complexity will be increased like N, N^2, N^3,...N^n. In this paper the next hop values also considered for finding accuracy for packet forwarding for destination. So the complexity can be set as O(N). The next hop information recorded from location factor and training process initiated in local machine.

4. Deep Learning Intelligent Traffic Control Approach

The learning model is described in figure 1 and trains the incoming traffic flow values. Final action matrix calculated based on traffic loads, formatted values, rewards and delays. The deep belief network designed based on action matrix and decision process. The supervised training part applied so the system intelligently collects the traffic flow and traffic patterns. We describe the learning models with decision making results and prediction factor. This is active space approach the data can be collected from multiple remote locations and we employ various trained neural network with intelligent agents. So our proposed deep convolution artificial neural network builds the action space with traffic flow and traffic control.

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The traffic performance index is calculated based on traffic flows is as follows

$$T_{pi} = (CC_{max} - CC_i)/CC_{max} \quad (1)$$

Where $CC_{max}$is maximum number of connected components in the network for measuring speed and average link speed can be set at different intervals i.

The $T_{pi}$is measured and the result values between 0 and 1. A traffic jam can be monitored based on speed and number of requests. Here CPU calculation is important based on memory and capacity. Tensorflow tool used with the input of traffic performance index result and time intervals. The test data applied with average speed of 500 links per day and classified the results with congested traffic flow, free flow and heavily congested traffic flow. In this paper, the following graphs shows that T_{PI} and labeled hours.

The 3-Dimenstional matrix input parameter R, AP, N with varies T - time slots. The output of connected components factor

$$CC(T_{pi},N) = (\sum_{i=1}^{n}(Ri + APi)/\sum_{i=1}^{n} Ri) * \% \quad (2)$$

Here the connected components calculated for accuracy value and R varies at difference router at T. With Deep CNN, the connection between router and access point can be set as temporal features.

The time complexity can be measured with respect to each iteration k.

$$T_{i,j,k}{}^{N} = \sum_{i=1}^{n}\sum_{j=1}^{n}\sum_{k=1}^{n}\frac{(CCi,j,n+Tpi,j,k+APi,j,k)}{N} \quad (3)$$

After convolution operation, the each connection layer values are used for calculating packet loss and throughput. Figure 2, shows that number of links in the network and Tpi values. The traffic flow conditions in each link can be verified using supervised learning results of 0 and 1. The following conditions are tested. If free flow – the values can be set as 0, in cased congested flow – the valued in between 0 and 1. Else the traffic flow heavily congested flow means the result is set as 1.

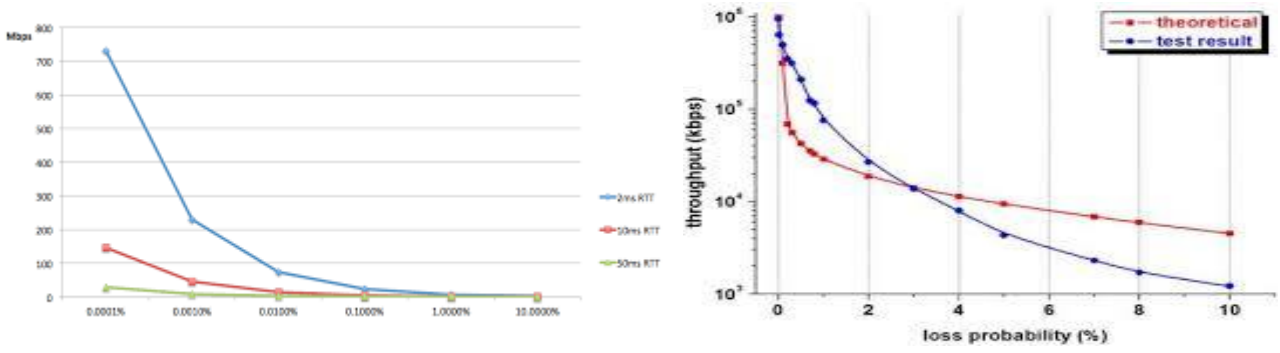

Figure 2: Packet Loss and Throughput using OSPF

5. Deep Neural Network Model Performance

The Tensorflow used to build the model and analyze the traffic flow. In this case, the traffic layer can be divided into 10,20,30,40,50 neurons. Sigmoid function is used for calculating artificial neural network models and calculated Deep Belief network values. The input data is action space

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matrix it ranges between 100 to 2000 packet rates. The linear regression analyze model used to categorize the date and logically analyze the binary result. The following are Python code for DBN node.

```
tfFlow. TensorFlowLimit();
layers = tfFlow.ops.dbn(X.[10,20,30,40,50], sigmoid(x,cc))
tfFlow.models.regression(layers,limit())
optimizer = 100 to 2000;
epoch = 2000;
Learning_rate = 0.01 to 0.05;
Batch_size = {5.10,15,20}
Dataflow = Tpi
```

The optimization algorithm used for minimize cost entropy cost. A separate data model used to each batches and TPI can applied for each link. The accuracy can be measured number of hidden layer results.

6. Performance Evaluation

In this model is evaluated on a personal computer running in windows and virtual box running with Fedora installed in same PC. TensorFlow and Python are installed in VM. The number of links is set as 500. The OSPF algorithm is used for routing and 30 routers, 110 access points and 650 nodes are used. The data rate can varied between 3Gbps to 5 Gbps. The decision process epoch is 2000 and deeper learning structure exhibits the packet loss rate and throughput. The log reports are recorded and following figure shows the tensor board results with incoming and outgoing packets values. The performance comparison can be set in between training steps and packet loss factors. In this case the proposed deep learning algorithm applied for both packet loss rate and throughput are calculated.

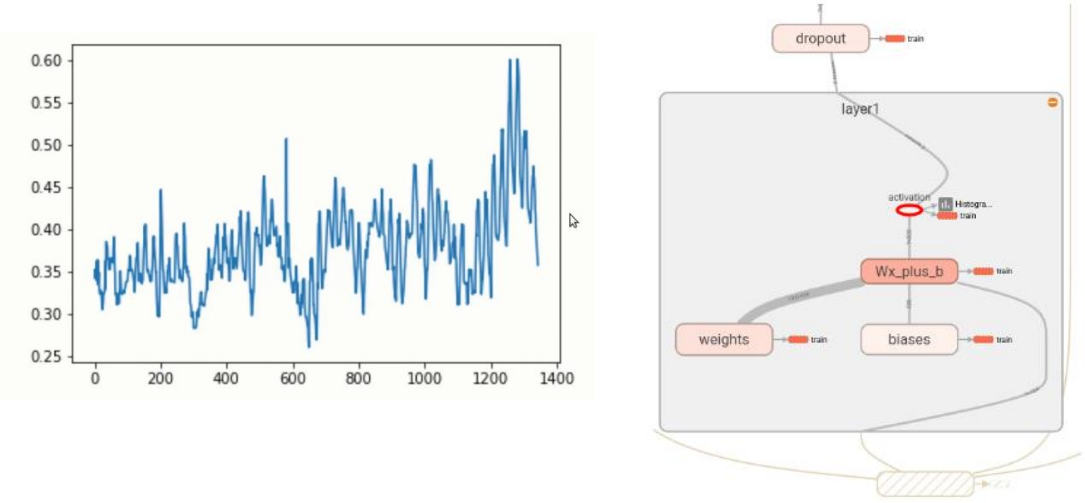

Figure 3: Tensor flow for layer system and accuracy rate

7. Conclusion

The deep learning algorithm is applied for various traffic control applications for small and large scale networks. In this paper we addressed deep learning structure which jointly perform traffic flow and traffic controls. The traffic control data are collected by intelligent agent and rewards sequence developed by TensorFlow. We designed Deep belief network of college management systems. Supervised learning models used to estimate traffic flow and links. The Traffic performance

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index was calculated at various intervals and layered designed is used to compute congestion with the accuracy is 95%. This research is a promising approach with Google TensorFlow for finding accuracy and prediction. Simulation results demonstrated and compared with large scale heterogonous networks.

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