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LSTM-Autoencoder 를 이용한 모바일 네트워크 트래픽 예측

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Mobile Network Traffic Prediction Using LSTM-Autoencoder

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Abstract

The growth of endpoint devices is sped up by network technologies like 5G, IoT, and cloud computing. Network traffic is expected to keep up with the exponential growth of network technologies. Therefore, modeling and forecasting network traffic is vital in ensuring optimal resource allocation by allowing bandwidth provisioning and sustaining maximum network utilization. The novelty of the proposed work is to develop a model that can help intelligently predict a load of traffic in the mobile network. In this paper, a model that combines the concept of autoencoder with long short-term memory (LSTM-AE) is proposed to predict mobile traffic. A publicly accessible LTE mobile network traffic dataset was utilized to evaluate the proposed approach. The experiment demonstrated that the validation loss of the proposed method was less than 0.022%. Also, It was found that the values predicted by the model were very close to the real traffic.

I. Introduction

Future networks will be dynamic, programmable, and reconfigurable. In the future, artificial intelligence and analytics will help build, manage, and improve wireless networks in many ways. For example, automatic prediction of network traffic could improve a network's ability to plan and its quality of service (QoS). Due to the increasing demand for the mobile network, it is crucial that the network's traffic and routing be planned promptly to guarantee a consistent flow of new users into the system, uninterrupted services in strategically critical locations, and the availability of all services for all users. This study collected mobile network traffic data from a real-world 4G LTE network, and a suggested LSTM-autoencoder model was used to predict cellular network traffic.

II. LSTM-Autoencoder for traffic prediction

Autoencoders are an efficient method for reducing the noise in input data, facilitating the development of deep learning models. In representation learning, autoencoders are typically used to learn an unsupervised representation of the data in a feature space. Since our dataset comprises time-series sequences, we employed a sequence-to-sequence [1] autoencoder.

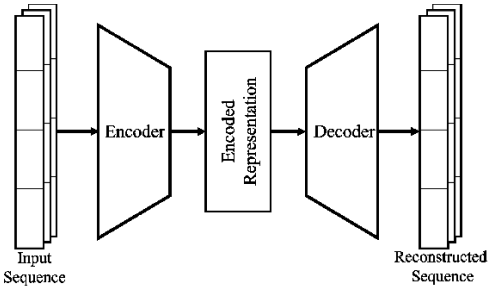

Figure 1: LSTM Autoencoder for traffic prediction

The goal here is to decode the input sequence and use that to rebuild the input traffic sequence. Encoder and decoder are the two principal components of an autoencoder. An encoder is a function in the feature space that is tasked with learning the prominent characteristics and creating an encoded version of the sample. The objective of the decoder function is to reconstruct the input from the model's internal representation [2]. Since long short-term memory (LSTM) cells (shown in Figure 1) are able to deduce the temporal relationships between sequences, we employ them to create the autoencoder. In order to solve the problem of traffic prediction, the autoencoder is trained without supervision using just traffic data.

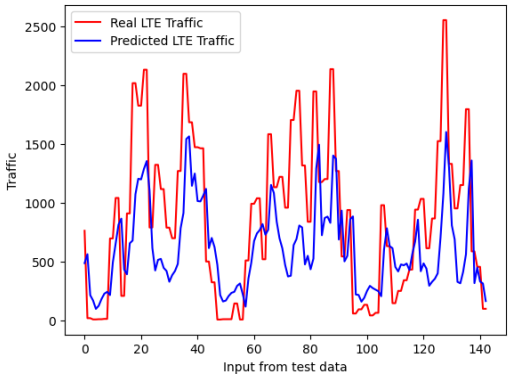

Figure 2: LSTM-AE-based model validation for Traffic Prediction

Figure 2 shows the simulation results by comparing the real traffic to the predicted traffic. The validation loss of the predicted traffic is less than 0.022%, and in some cases, the predicted output fully matches the real traffic. The conclusion that can be derived from Figure 2 is that this LSTM-AE model can predict future traffic with the same performance as its actual traffic, hence ensuring the quality of service in future networks.

III. Concluding Remarks

This paper proposed a novel concept of an LSTM-based Autoencoder for mobile network traffic prediction mechanism for ensuring the QoS in future networks.

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