Data-Driven Networking: Service Forecasting in WiFi6

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ABSTRACT

Given that WiFi6 has been newly released as a great enabler for today's overloaded and dense networks. QoS forecasting has gained more importance to satisfy the basic requirements of the new demanded traffic types: such as 4K/8K video streaming or VR traffic. We have studied the WiFi6-specific QoS forecasting engine, which considers both user mobility and long/short term heterogeneous traffics, using one of the promising machine learning approaches: Graph Convolution Networks (GCNs). Our results show that the GCN-based QoS management engine reveals both spatial and temporal information of the WiFi networks to predict several QoS parameters.

CCS CONCEPTS

• **Networks** → *Wireless access networks*; **Network management**.

KEYWORDS

IEEE 801.11ax, QoS forecasting, Data-Driven Networks

1 INTRODUCTION

With the emergence of the new traffic demands and dense networks, offloaded traffic from cellular data will account for 59 percent for smartphones and 72 percent for tablets by 2022 [1]. However, IEEE 802.11ax (also known as WiFi6) requires decision mechanisms to meet these heavy traffic requirements. Unlike the traditional machine learning and statistical methods, GCNs extract (i) the spatial information which is directly related with the user mobility and network topology and (ii) temporal information which uses historical QoS parameters. Because accurate QoS parameter forecasting depends on the network topology as well as the historical data.

2 PROPOSED APPROACH

We analyze the WiFi topology with a graph theory approach as seen from Figure 1. Handover behavior corresponds to edges and APs correspond to nodes in the Graph. Graph signals are obtained from QoS parameters measured by stations (STAs). We choose loss rate, link speed, throughput and round trip time as QoS parameters. Consequently, the obtained graph is given to the GCN approach [2] with historical graph structures to predict QoS parameters.

3 EVALUATION

As shown in Figure 2, our preliminary experiments give similar values with respect to simulated traffic trace. Blue line with the confidence interval shows the real-time traffic, and red line shows the our prediction results. Results show that this study gives promising results for WiFi6 self-organized networks.

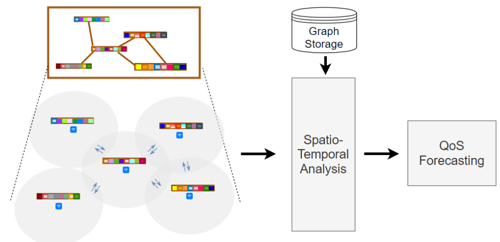

Figure 1: Proposed approach to predict QoS parameters

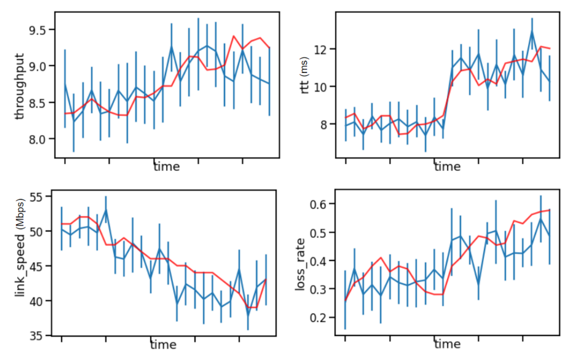

Figure 2: Prediction results of four QoS parameters

4 CONTRIBUTIONS

The findings presented in our work offer an insight into Graph Convolution Networks applications for the further machine learning-based network topology beyond the presented WiFi6 use case. Moreover,our research gives intuition for multidimensional QoS forecasting of the newly released WiFi6 networks. Although prior researches have studied QoS prediction, this study pays attention to current service requirements of emergent traffic types as well as user mobility, which is not covered well jointly in the current literature.

5 CONCLUSION

As a feature work, we are planning to consider user placements by using received signal strength (RSS) as well as the mobility when training the GCN model.

REFERENCES

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[2] M. Defferrard et al. 2016. Convolutional neural networks on graphs with fast localized spectral filtering. In *Advances in neural information processing systems*, (pp. 3844-3852).