



University of Cyprus

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"Machine Learning for Resource Allocation and Uncertainty-Aware QoT Estimation in Multi-Period Planning Optical Networks"

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Abstract. With the rapid growth of the Internet, services, and applications, demand for network capacity is increasing at an unprecedented rate. To manage this growing demand effectively, machine learning (ML) has emerged as a promising solution for efficiently planning and (re)optimizing multi-period optical networks by accurately modeling real-world traffic behavior. Additionally, in transparent optical networks, Quality-of-Transmission (QoT) estimation is of paramount importance when deciding whether to admit a connection to the network. In this context, ML has also proven capable of accurately modeling the non-linear nature of physical layer impairments.

This work focuses on ML for multi-step traffic prediction and network (re)optimization, as well as QoT estimation. First, a multi-step traffic prediction framework is proposed, leveraging an encoder-decoder deep learning model. These predictions are subsequently used to guide network (re)optimization, effectively reducing undesired service disruptions caused by connection re-allocations, compared to a baseline scheme using single-step traffic predictions.

Next, the ML-aided QoT estimation problem is addressed, with a particular focus on incorporating ML model and input uncertainty before accepting a connection to the network. Specifically, two uncertainty-aware frameworks are introduced. The first framework leverages quantile regression, and the second uses the Monte Carlo dropout technique. Both frameworks are shown to outperform baseline worst-case uncertainty-aware approaches in terms of margin reduction, successfully rejecting connections with insufficient QoT

Biography: Hafsa Maryam earned her M.S. degree in Computer Science from COMSATS University, Islamabad, Pakistan in 2017. From 2018 to 2020, she worked as a lecturer at the Computer Science Department of the Institute of Space Technology (IST), Islamabad, and BIMS affiliated with PMAS-Arid Agriculture University, Rawalpindi, Pakistan. Currently, she is a PhD candidate at the Department of Electrical and Computer Engineering, where she is conducting her research at the KIOS Center of Excellence, focusing on machine learning techniques for traffic engineering and resource allocation in elastic optical networks.