



Machine Learning based Time sensitive network traffic assignment

Description of Research Topic

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Title: "Machine Learning based Time sensitive network traffic assignment"

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Context

The efficient and real-time management of network traffic is crucial for the planning of industrial and automotive networks. Traditional traffic assignment models often fail to capture the dynamic nature of traffic flow, leading to suboptimal solutions and increased congestion. To address this challenge, this research aims to explore the integration of advanced machine learning techniques into traffic assignment models for time-sensitive networks. By leveraging the power of machine learning algorithms, the study seeks to enhance the accuracy and responsiveness of traffic assignment methods, allowing for more effective traffic management and improved overall network performance. The research will investigate various machine learning models, data representations, and optimization strategies to create a dynamic traffic assignment framework capable of adapting to rapidly changing traffic conditions and providing optimal routing solutions in real-time. The outcomes of this research have the potential to revolutionize traffic management systems, leading to optimal quality of service, reduced latency and jitter in industrial and automotive networks. The topic will involve the following tasks:

- Conduct an extensive review of existing traffic assignment methods and machine learning techniques.
- Identify the limitations of traditional traffic assignment models in handling time-sensitive networks and dynamic traffic conditions.
- Evaluate various machine learning algorithms suitable for traffic assignment in time-sensitive networks, such as deep learning models, recurrent neural networks (RNNs), or graph neural networks (GNNs).
- Compare the performance of different models based on criteria like accuracy, training time, and interpretability.
- Implement and develop a dynamic traffic assignment framework that integrates the trained machine learning models to provide real-time traffic routing solutions.
- Incorporate traffic flow dynamics and congestion factors to optimize traffic assignment considering time-sensitive conditions.
- Summarize the research findings and discuss the implications of integrating advanced machine learning techniques into traffic assignment for time-sensitive networks.

Requirements

- **Very good Python programming skills.**
- **Proficiency in various machine learning techniques, including supervised, unsupervised learning, and deep learning.**
- **Networking Knowledge: Familiarity with networking concepts routing, VLANs, and network protocols.**
- **Skill in evaluating machine learning model performance using appropriate metrics and methodologies.**
- **Strong research capabilities to conduct literature reviews, analyze existing research, and identify research gaps.**
- Independent and able to work with minimal supervision.
- Please note that while prior experience with computer networks and TSN is desirable, we also welcome candidates who possess a strong foundation in machine learning and are eager to learn and delve into the specifics of TSN technology during this topic.

Contact

If you are interested in this topic, please send your full application (CV, current transcript of records, research interests, possible start dates) to Rubi Debnath (rubi.debnath@tum.de).