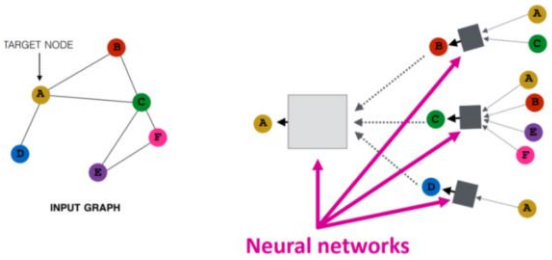


RouteNet - Deep Learning Network Performance Tool

Abstract

Mobile communication networks are subject to dynamics in topology, transmission rates, and clients' demands (in terms of transmission rates and latency), In order to manage such complex network and allocate its resources to maximize end user quality of experience, we need an optimization tool that will be able to predict the traffic bandwidth or the latency performance once the network topology changes or a new application starts running. Developing such a tool requires network modeling. Nowadays, network models are either based on packet-level simulators or analytical models (e.g., queuing theory). Packet–level simulators are very costly computationally, while the analytical models are fast but not accurate. Hence, Machine Learning (ML) arises as a promising solution to build accurate network models that are able to operate in real time and to predict the resulting network performance according to the target policy, i.e., maximum bandwidth or minimum end-to-end latency.

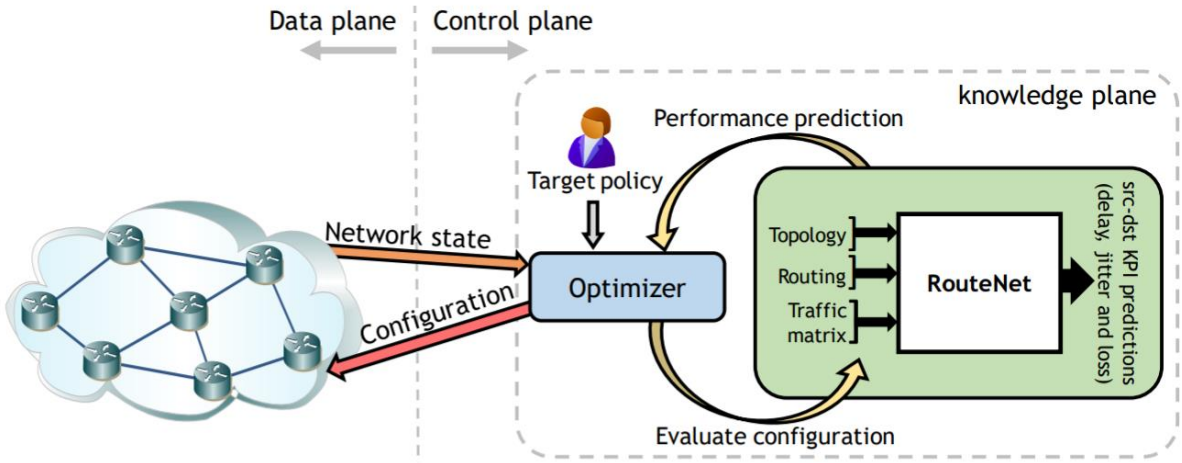
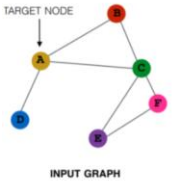
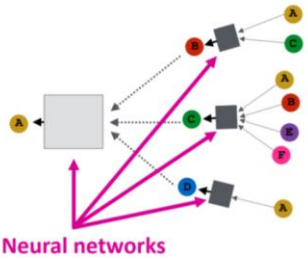


Fig.2: Architecture for network optimization in SDN [1]

Such an optimization tool is **Routnet** [3], a novel network model based on **Graph Neural Network (GNN)** that is able to understand the complex relationship between **topology**, **routing**, and input **traffic** to produce accurate estimates of the per-source/destination per-packet delay distribution and loss.





Objective

The purpose of this project is to validate the RouteNet project results and make the minimum required adaptations to the tool for using it in new networks.

Project Overview

1. Ramp-up on Deep Learning and Graph Neural Network theory background using [2] and other resources.
2. Install the RoutNet tool [3] and test it on a supplied data set.
3. Modify Routenet and adapt it to a new scenario that will be defined later on in the semester (Starting with the smallest change possible).
4. Define KPI (Key Performance Indicators), measure those KPIs and analyze the results.

General requirements for all LCCN projects are specified at the lab website: https://lccn.cs.technion.ac.il/lab-courses/

Notes

- The above list is an estimate. Goals and tasks might be modified during the first few weeks of the projects before the finalization of High Level Design Document.
- General requirements for all LCCN Projects are specified at the lab website: https://lccn.cs.technion.ac.il/lab-courses/

Prerequisites

1. Introduction to computer networks (236334)
2. Internet Networking (236341) (nice to have)
3. Background in Neural Networks and Deep Learning (Very nice to have)

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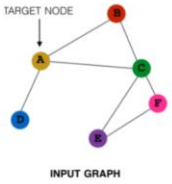
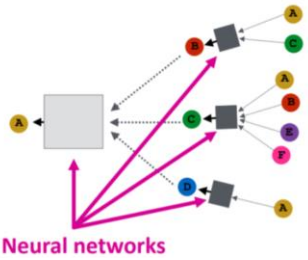
References

[1] RouteNet: Leveraging Graph Neural Networks for network modeling and optimization in SDN. IEEE Journal on Selected Areas in Communication (JSAC), vol. 38, no. 10, pp. 2260-2270, 2020

[2] https://neptune.ai/blog/graph-neural-network-and-some-of-gnn-applications





[3] “Knowledge-defined networking repository,” https://github.com/knowledgedefinednetworking/Papers/wiki/RouteNet:-Leveraging-GNN-for-network-modeling-and-optimization-in-SDN, 2019.