Research in Progress

Robust Decision-Making Framework for Sustainable Operations and Planning of MBTA Rapid Transit Vehicles

Research Need

There is an urgent need for decision support tools for effective and robust responses to disruption. These would allow planners at the MBTA's Energy and Environment division to predict energy and cost impacts of competing strategies to meet performance targets.

Goals/Objectives

- Enumerate and analyze high-level operational planning metrics to assist with planning for future energy needs.
- Estimate energy forecasting model based on train movement, ridership and weather.
- Develop a generative model to learn the mapping between high-level planning metrics and low-level train movement and operational variables (e.g. speed, acceleration, etc).
- Integrate generative and forecasting models into robust decision-making framework that evaluates energy outcomes of various planning strategies.

Project Information

This project is being conducted as part of the Massachusetts Department of Transportation (MassDOT) Research Program with funding from Federal Highway Administration (FHWA) State Planning and Research (SPR) funds.

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Project Start Date:
3/21/23
Expected Project Completion Date:
5/31/24

Methodology

The overall aim of this project is to develop an energy planning tool that the MBTA can utilize to provide detailed energy assessments of any given strategy given by a set of defined high-level planning metrics (HPMs).
Then using both the latest and historical data on train movements, ridership, weather, among others, we develop two models. The first will be an energy forecasting model that will predict system-wide energy. The second will be a generative model that can translate the HPMs into sequences of the low-level variables.
Finally, we will integrate both models into a decision-making framework, which we will refer to as the MBTA Train Energy Planner (MTEP) which can readily provide energy assessments on any given strategy as defined by a combination of HPM inputs. Secondly, we will develop a robust decision-making element of the MTEP which will assess vulnerabilities across a number of given strategies.

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