Traffic forecasting framework

Short-term traffic forecasting is increasingly based on deep learning models, yet many of these approaches remain difficult to use in day-to-day traffic management. They typically require large amounts of data from many locations, behave as black boxes, and may produce predictions that contradict well-established traffic flow theory. As a result, practitioners may find it difficult to trust and operationalize these models in real-world settings.

What is the product?

We propose a novel **traffic forecasting framework** that addresses these limitations by combining causal analysis, deep learning, and traffic flow theory into a single, coherent approach. The framework first identifies which parts of the network are causally relevant to a given location, ensuring that only meaningful inputs are included in the model. This reduces data requirements while preserving predictive relevance. The model then simultaneously predicts traffic speed and flow, allowing it to better represent the underlying dynamics of traffic systems. During training, theoretical constraints derived from traffic flow theory are incorporated to ensure that predictions remain realistic and interpretable.

Empirical results show that this approach improves forecasting accuracy while also enhancing transparency and trust in the model outputs. This makes it particularly suitable for operational use in traffic management contexts.

Who is it for?

The framework is particularly relevant for:

- **Traffic authorities and mobility solution providers** that require reliable, transparent, and explainable traffic forecasts to support real-time traffic management and short-term planning decisions.