CPS: Small: Intelligent Prediction of Traffic Conditions via Integrated Data-Driven Crowdsourcing and Learning

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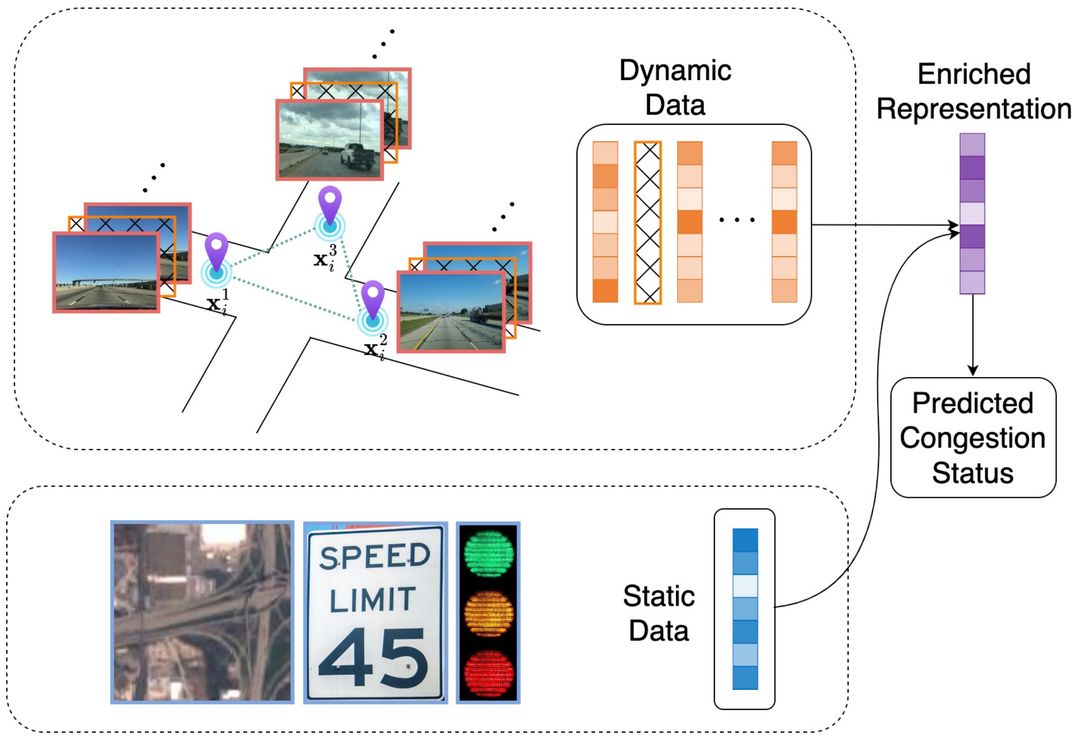
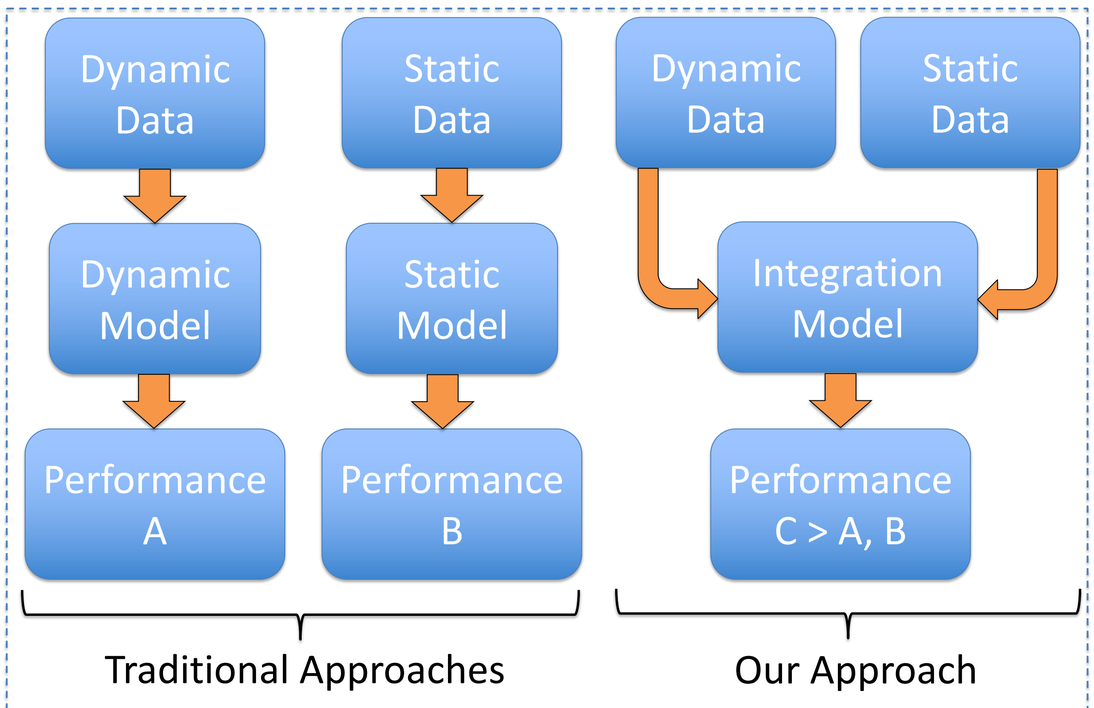
Mission: The aim of this project is to radically transform traffic management, emergency response, and urban planning practices via predictive analytics on rich data streams from increasingly prevalent instrumented and connected vehicles, infrastructure, and people.



Challenges: The variability in the size of traffic dynamic data presents challenges for its integration with static data. We propose to effectively condense both dynamic and static data into a uniform fixed-length vector for improved traffic prediction.



Scientific Impact: In the realm of machine learning tasks, the fusion of time series data with static information is prevalent. Our research significantly contributes to this domain, thereby enhancing performance metrics beyond what is achievable with either dataset independently.

Our Solution: Our model learns projection matrix $\boldsymbol{W}_i$ to enrich the i-th sample. It involves learning a group-structured representation from both dynamic and static data sources, which are then integrated using available data labels $\boldsymbol{Y}_l$ to form a modality-shared representation $\boldsymbol{G}$. This shared representation is connected back to the projection matrix through a temporal smoothness process, allowing traffic prediction models to fully exploit the dataset's capabilities.

Societal Impact

- Cities could **proactively** deploy assets and manage traffic
- Reduce emergency response time, save lives

Education and Outreach

- Graduate Student Participants: Hoon Seo, Chenyang Wang
- Undergraduate Student Participants: Micah Justman, Corey Schanker

Scientific Impact

- Developed an enrichment learning model to integrate spatial (static) and temporal (dynamic) data for effectively predicting traffic congestion status

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