SemCast: Adaptive and Explainable Traffic Forecasting Framework
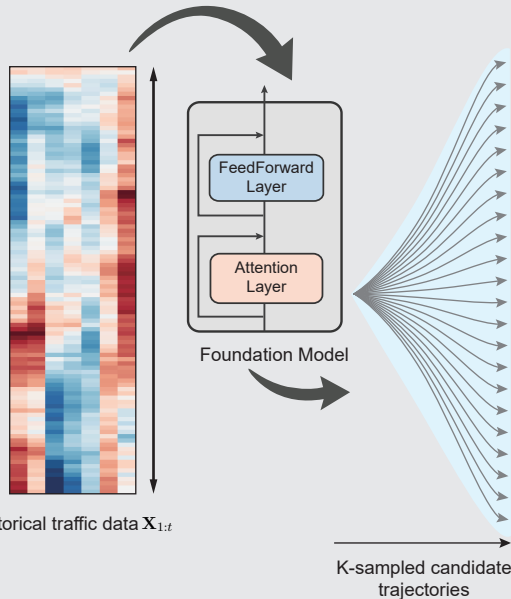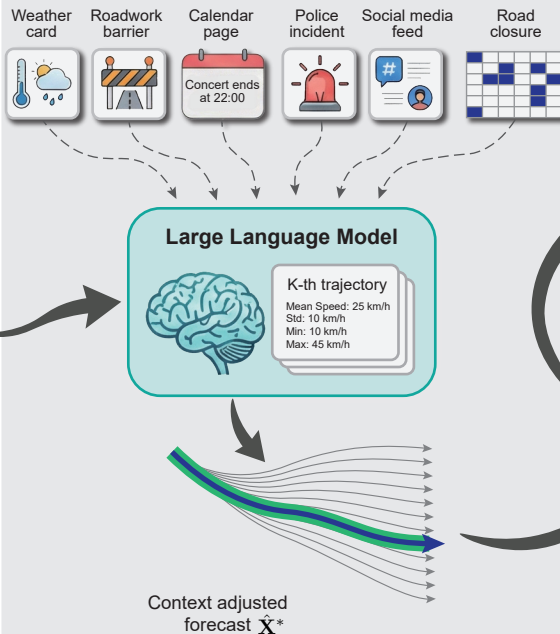

Stage 1 - Foundational Probabilistic Forecasting

Foundation Model

FeedForward Layer

Attention Layer

Historical traffic data $\mathbf{X}_{1:t}$

K-sampled candidate trajectories

Stage 2 - LLM-Enhanced Contextual Adjustment

Weather card · Roadwork barrier · Calendar page (Concert ends at 22:00) · Police incident · Social media feed · Road closure

Large Language Model

K-th trajectory
Mean Speed: 25 km/h
Std: 10 km/h
Min: 10 km/h
Max: 45 km/h

Context adjusted forecast $\hat{\mathbf{X}}^*$

**Stage 3 - LLM-Powered Reporting & Decision Support**

Readable Summary Report

Traffic is expected to be sianifcantly heavier than usual due to the concluding large-scale concert event and ongoing road works.

Congestion is predicted to peak around 22:30, with average speeds potentially dropping below 30 km/h on major arteries.

Commuters are advised to anticipate delays of approximately 20-30 minutes.

Actionable Recommendations

Deploy adaptive signal control to manage concert outflow.

Activate dynamic route diversion for non-event traffic.

VMS:"CONCERT TRAFFIC AHEAD - EXPECT DELAYS"

Push notifications for alternative transport options.