

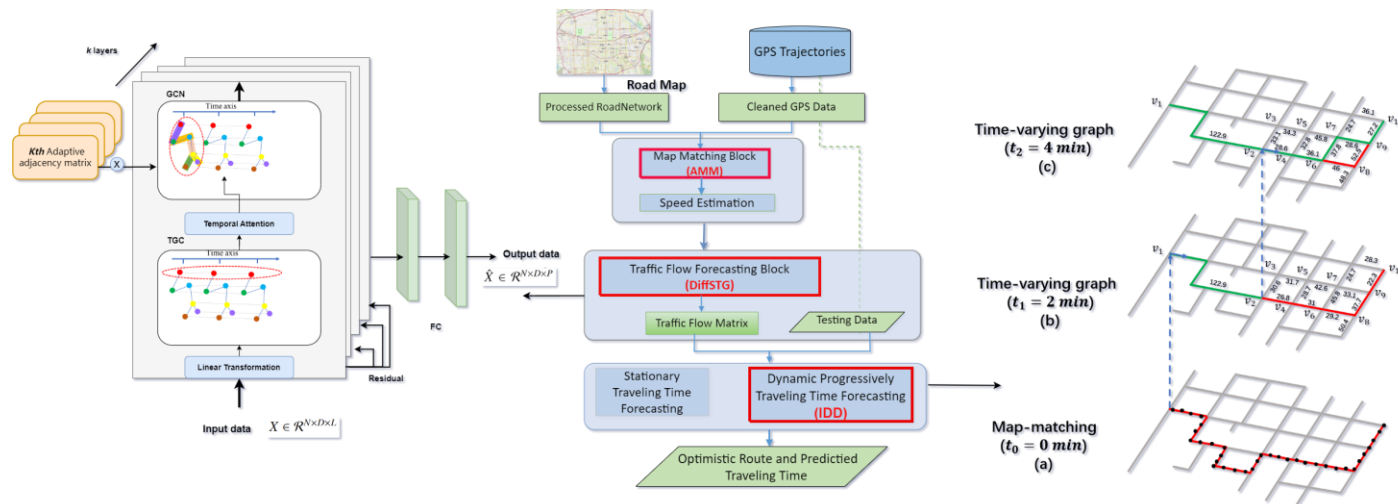
Dynamic Traveling Time Forecasting based on Spatial-Temporal Graph Convolutional Networks

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Frontiers of Computer Science, DOI: [10.1007/s11704-023-2704-x](https://doi.org/10.1007/s11704-023-2704-x)

Problems & Ideas

- Problems of existing traveling time forecasting approaches:
 - There are independent parts in map-matching, traffic forecasting, and route planning, which are not considered from a global perspective.
 - They are designed on static traffic conditions based on departing time, which may not meet dynamic and complex traffic conditions.
- Ideas: A consolidated framework based on Spatial and Temporal Graph convolution (DTT-STG) with full consideration of dynamics and proximity.

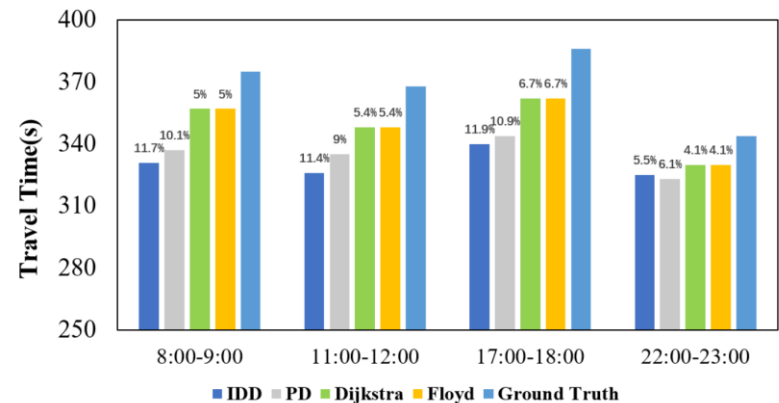
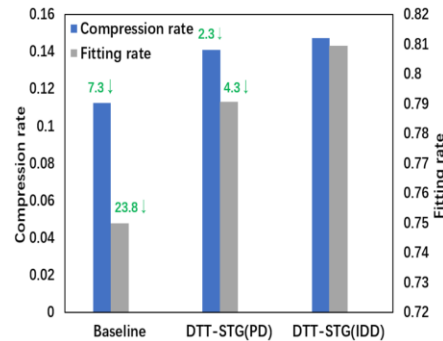
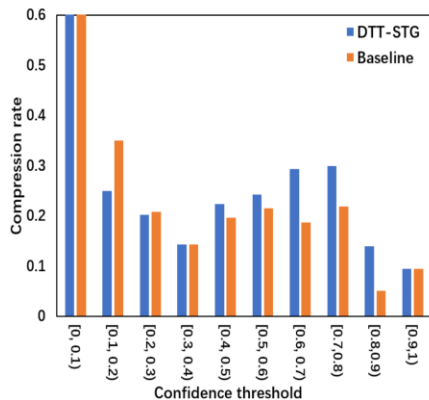


The middle is the processing flow of DTT-STG. First, multi-source road network data are collected from OpenStreetMap and GPS sources. Then, we designed a map-matching algorithm to project trajectories into the road network. Afterward, the historical road speed of each road is estimated. Next, DiffSTG is exploited to predict the road speed and construct the speed feature matrix. At last, DTT-STG dynamically forecasts the optimal route with the shortest traveling time. The left is the architecture of DiffSTG, The right is an example of dynamic route planning.

Main Contributions

- Contributions:

- Deliver a novel Dynamic route planning framework DTT-STG with consideration of the dynamic spatial and temporal dependencies;
- Investigate the influence of vehicle moving direction information in route planning and propose an angle-based map-matching algorithm AMM;
- Construct the temporal attention and spatial diffusion block to capture the features of nearby road segments for traffic speed forecast.
- Explore the progressive method to calculate the traveling time and plan the shortest route dynamically in continuously changing traffic conditions.



(a) Confidence threshold and compression rate

(b) Compression and fitting rate

Comparison of different route planning algorithms

The effectiveness of the DTT-STG framework. Left: Comparison of travel time compression for a given route of the framework under increasing confidence thresholds; Middle: Comparison of time compression and fitting rate for planning paths with different frameworks. (confidence of a given route is set to 50%); Right: Comparison of different route planning algorithms.