

Traffic modeling and simulation by sparse data recovery and refinement

CHALLENGES: Smart, green and integrated transport

PRODUCTIVE SECTOR: Traffic engineering in smart cities

PROBLEM DESCRIPTION

Given as initial data the map of the city is available, estimate and simulate fluctuations of traffic and its characteristics, consistent with aggregated measurements from loop-detectors, that is, the number of cars passing certain lanes in total during each hour.

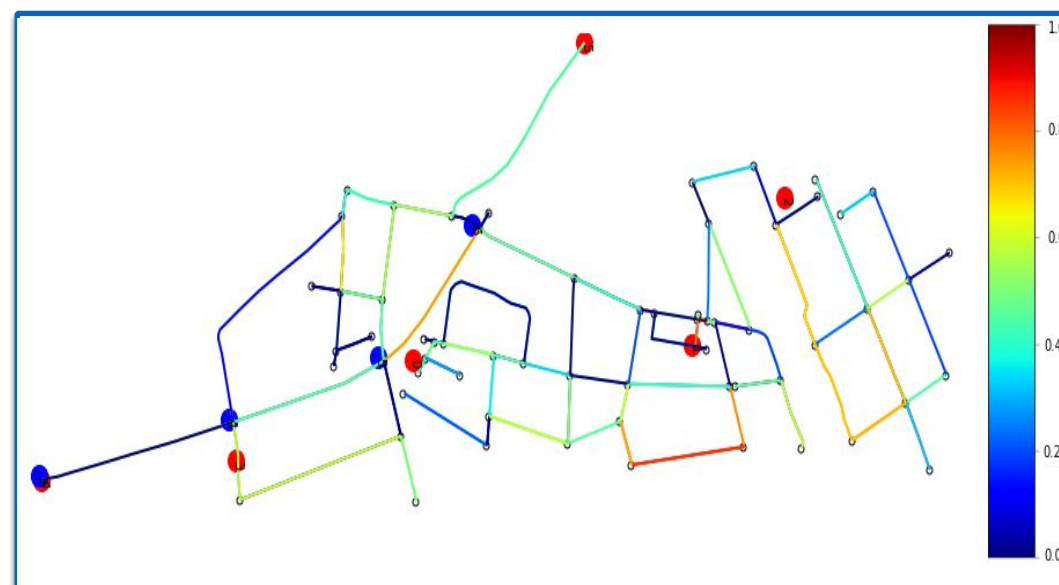
CHALLENGES AND GOALS

Dimension mismatch! The state of the traffic is much more detailed than the data available. The goal is to both develop a mathematical model and to find data assimilation methods to use with the measurements provided.

MATHEMATICAL AND COMPUTATIONAL METHODS

We constructed a system of partial differential equations, based on kinematic intuition and the ARZ model. This is extended by having different types of vehicles depending on their destination. We designed a semi-heuristic algorithm to infer priority rules at intersections from OpenStreetMap data.

For a simple data assimilation concept, a Bayesian method is used. The state vector is propagated using the dynamical model. At observation time, the traffic density is updated using the sensor data when available.



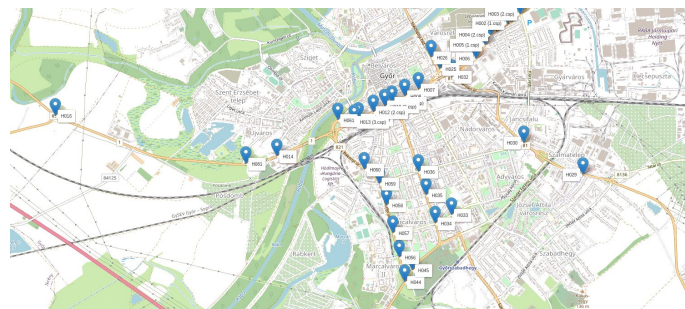
Traffic congestion simulation in Győr (Hungary). Edges are colored according to their relative saturation.

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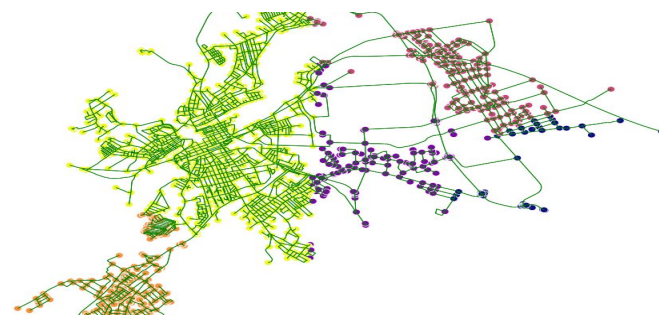
Results and Benefits

A vector-valued vehicular transport model is designed keeping track of destination describing the traffic on the whole road network taking into account the effect of traffic lights and priority rules. The formulation allowed decoupling of the equations allowing to use parallel solvers and thus taking the advantage of multi-core architectures in the future.

The prototype shows promising results on small smart cities of the city.



Traffic sensor locations in Győr (Hungary).



Clustering of Győr (Hungary).

move ahead on the road to get an insight on emission which needs knowledge on traffic with high precision. The current project and a possible sequel can support it as an input source for that endeavor.