technische universität dortmund

UNIVERSITÄT DUISBURG ESSEN

SFB 876 Providing Information by Resource-Constrained Data Analysis

Project B4

Analysis and Communication for Dynamic Traffic Prognosis

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Problem

Traffic Analysis: From Highways to the Inner City
- Complex network infrastructure
- Definition criteria for jam creation & lifetime
- Asymmetric lane changing behavior

Data Analysis: Compensate Incomplete Information
- Predictive methods
- Determination of the distribution function from measurements

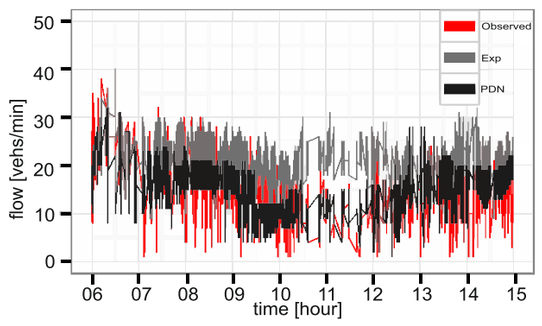
Reliable Communication of Car Data in Highly Dynamic Radio Channels
- Highly varying network quality
- Interference and resource competition with human cell users

Results & Methodology

Traffic Modeling

Dependence Network
- Gap filled by using information from all other sensors

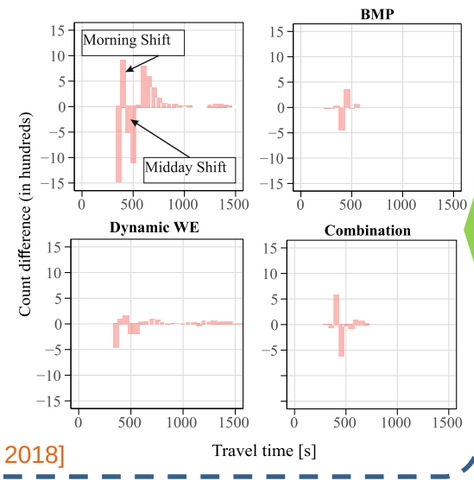
[Habel, Molina, Zaksek, Kersting, Schreckenberg, Traffic&Granular Flow, 2015]



Asymmetric Lane Changing Rules
- Creation of a Simulation and calibration with real world traffic data

[Habel, Schreckenberg, Journal of Cellular Automata, 2016]

Adaptive Network
- Routing restrictions for different types of vehicles can be Implemented and tested.
- Identification of critical bottlenecks
- Dynamic lanes have limited use in inner cities because of following bottlenecks.



[Vranken, Sliwa, Schreckenberg, Wietfeld, VTC-Fall, 2018]

Jamming Analysis
- Different density dependent behaviour for congestion duration and frequency
- 19% of the total jam hours are from jams with a lifetime below 10 minutes

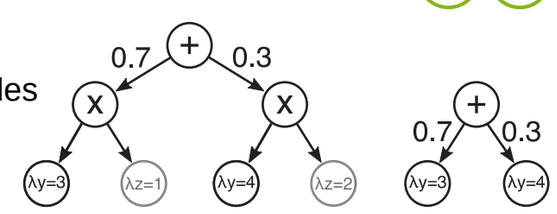
[Habel,Schreckenberg,Et al. Physical Review E,2017] [Habel,Schreckenberg,Et al.,EPL,2017]

Data Analysis

A6 C4

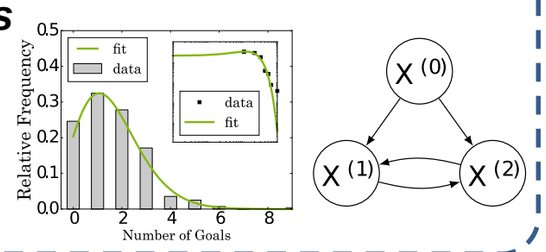
Poisson Sum-Product Networks
- Combines sum and product nodes
- Deep structure and tractable inference

[Molina, Natarajan, Kersting, AAAI]



Core Dependency Networks
- Guarantees for ϵ-approximations of Gaussian dependency networks
- Applicable on massive data

[Molina, Munteanu, Kersting, AAAI]



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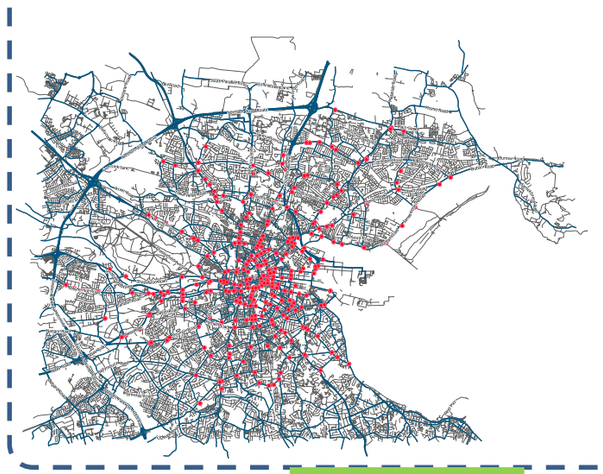
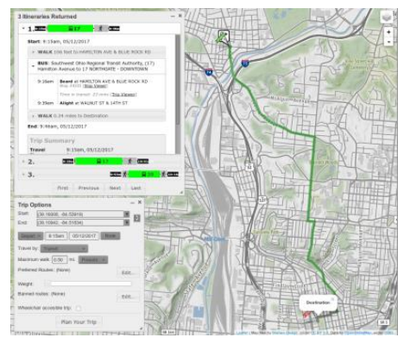
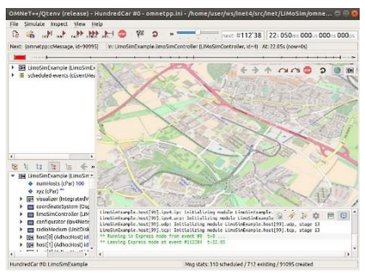
Situation-aware Routing
- Combines real-time sensor prediction with traffic imputation

[Liebig, Piatkowski, Bockermann, Morik, Information Systems, 2017]





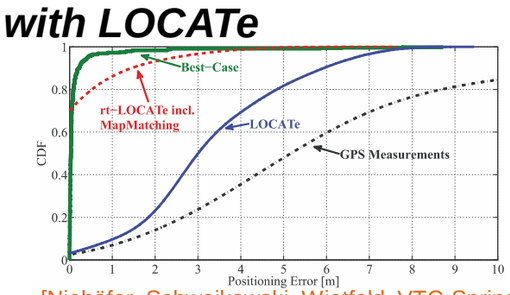
Integrated Joint Simulation with LIMoSim



- Shared codebase
- Open Source framework

[Sliwa, , Habel, Schreckenberg, Wietfeld, VNC, 2017]
[Sliwa, Pillmann, …, Wietfeld, OMNeT++ Community Summit, 2017, **Best Contribution Award**]
[Sliwa, Wietfeld, Submitted to Springer Publishing]

Lane-specific Positioning with LOCATe



[Niehöfer, Schweikowski, Wietfeld, VTC-Spring, 2016]

Resource-efficient Vehicular Communication

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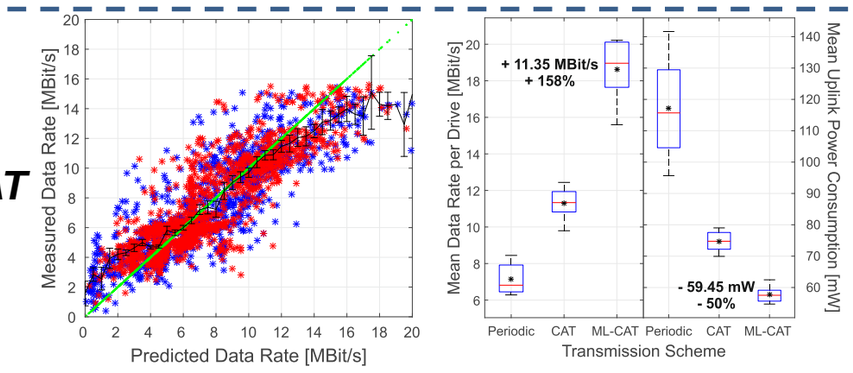
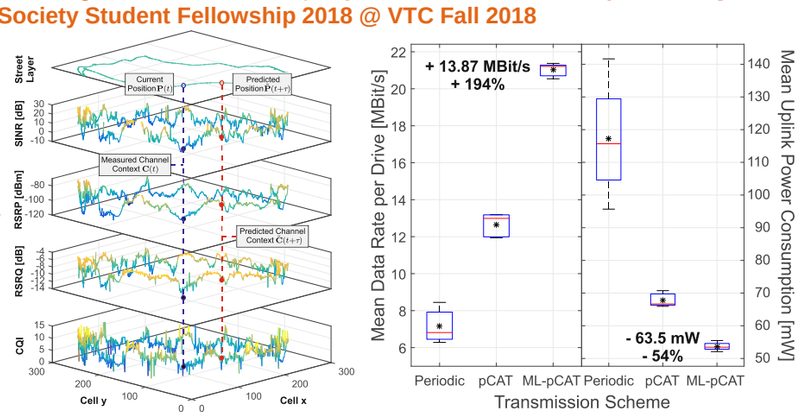


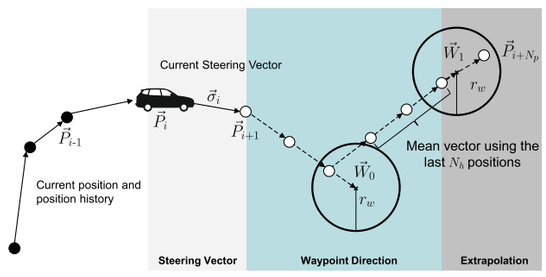
[Sliwa, Liebig, Falkenberg, …, Wietfeld, VTC Spring, 2018, **Best Student Paper Award**]
IEEE Vehicular Society Student Fellowship 2018 @ VTC Fall 2018

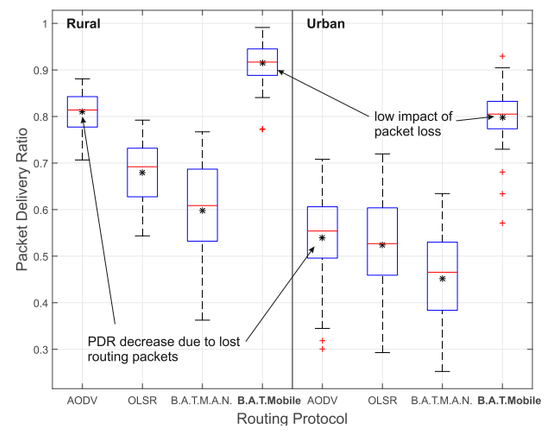
ML-pCAT A1 A4



[Sliwa, Liebig, Falkenberg, …, Wietfeld, VTC Fall, 2018]
[Sliwa, Liebig, Falkenberg, Piatkowski, Wietfeld, Submitted to IEEE JSAC]

B.A.T.Mobile
- Cross-layer approach for mobility-predictive routing





[Sliwa, …, Ide, Wietfeld, GLOBECOM Wkshps, 2016]
[Sliwa, Falkenberg, Wietfeld, VTC Spring 2017]

Artificial Intelligence Group

Physik von Transport und Verkehr

CNI Communication Networks Institute