中国科学院软件研究所学术年会’2018
暨计算机科学国家重点实验室开放周

学术论文

基于数据融合的高速公路交通状况感知

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Towards Adaptive Sensory Data Fusion for Detecting Highway Traffic Conditions in Real Time, **International Conference on Database Systems for Advanced Applications**, 2018, Accepted
Mining Spatial-temporal Correlation of Sensory Data for Estimating Traffic Volumes on Highways, **Mobiquitous** 2017, Best Paper Award Runner-up

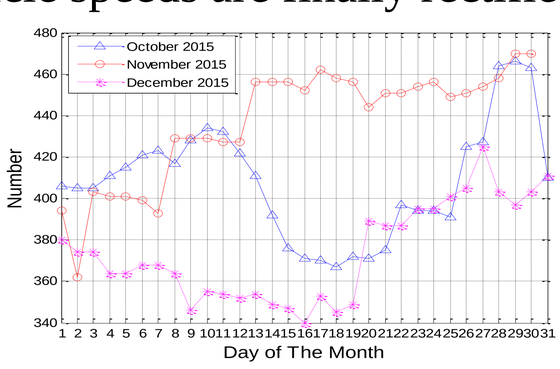
Motivation

- Real-time highway traffic conditions can be used for vehicle navigation and administration support of traffic guidance
- With the aid of wireless networks and various sensors, different sensory data can be obtained and used for detecting traffic conditions
- Inspired by the characteristics of data from different sources, we present data fusion approaches to detect vehicle speeds and traffic volumes on highways in real time

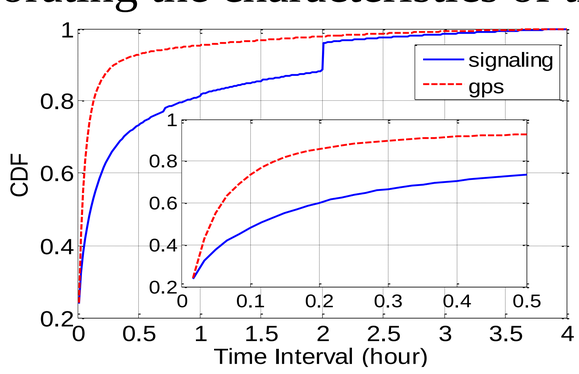
The Proposed Approaches

Vehicle speed detection (Megrez)

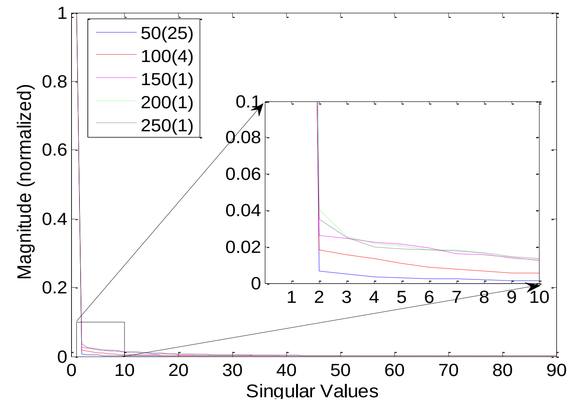
- A concrete function is proposed to get the first-cut estimates of vehicle speeds
- Missing vehicle speeds at certain road segments are completed using compressive sensing
- Vehicle speeds are finally rectified by incorporating the characteristics of traffic flows



Daily variation on silent coil sensors



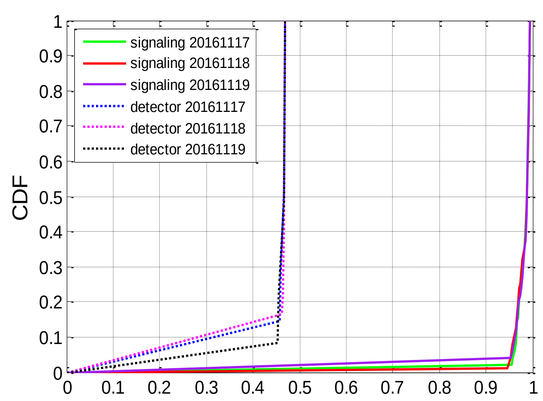
CDFs of time intervals of signaling data and GPS records



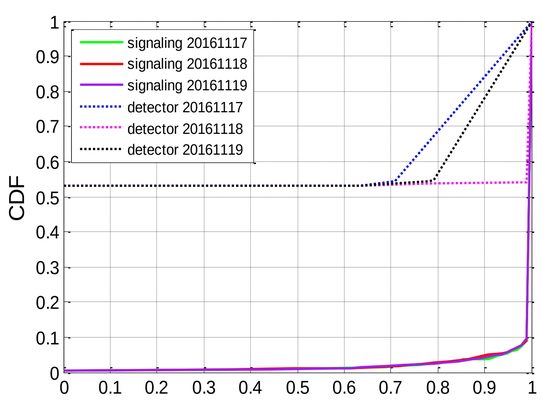
Magnitude of singular values of dense square submatrices in the Merged matrix

Traffic volume estimation (Polaris)

- A signaling trajectory is matched with road segments by an edit distance based method
- MLR models are constructed by analyzing the relationships between the signaling volumes on different road segments
- An optimization goal of traffic volume estimation is established in the light of compressive sensing

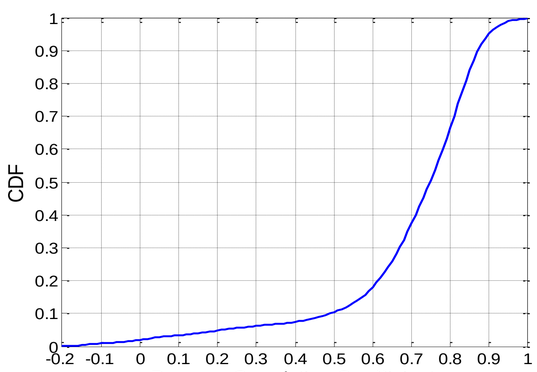


The Time Coverage

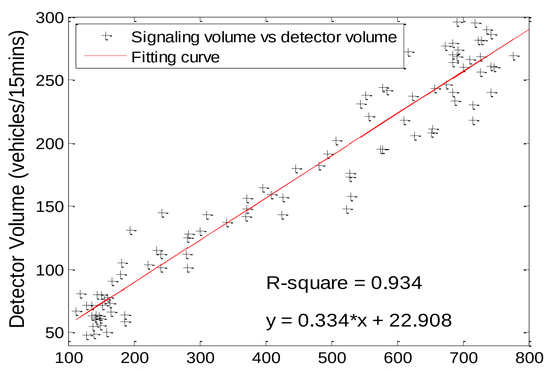


The Space Coverage

Time and space coverage of signaling data and loop detector data



CDFs of pair-wise road segment correlations

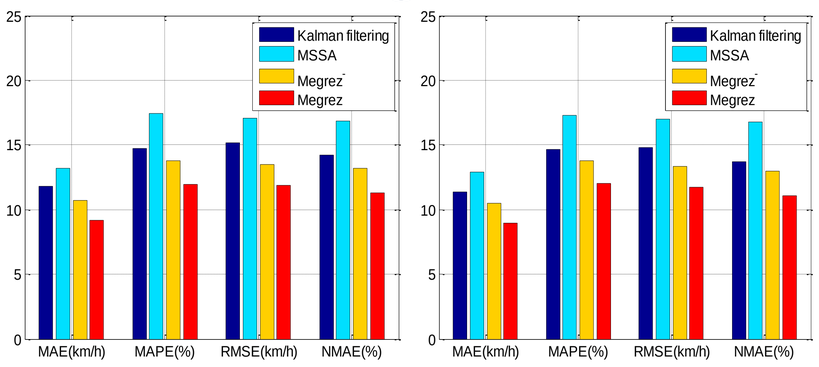


The fitting between the signaling volumes and the detector volumes

Evaluation & Results

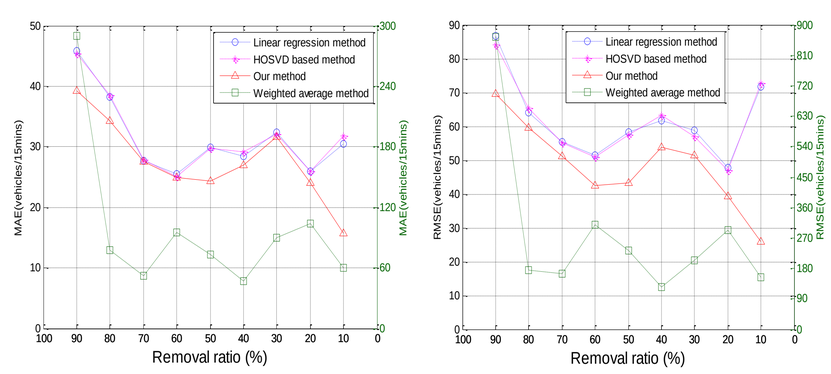
- Megrez: Using large-scale real-world data as input, we evaluate Megrez from different spatial granularities: segment-level comparisons, a highway as the granularity, all the highways as a whole
- Polaris: With the large-scale real signaling data and the loop detector data in Fujian Province, we compare our approach with the other three methods

Megrez



Speed errors under different methods

Polaris



MAEs and RMSEs under different methods