AMD TRAFFIC CAMERA MONITORING AT IITH

M2Smart NewsLetter

Vol.2

March 2019

AMD MEETING IN FEBRUARY 2019

The Multimodal Application

by Tsutomu Tsuboi

What's happening in Ahmedabad?

The Multimodal application (MMA) field test Phase 2 has been done from 23rd of February to 28th. The field test team at Phase 2 consisted of Metro company (MEGA: Metro Express Gandhinagar Ahmedabad) employee and 10 local University students. The 10 students invited additional monitors during the test. The total participants. In this test, some limitations and software errors are found, which will be fixed by the end of March.

There are two interview meetings with the students on 27th and 28th. According to their feedback, MMA is the first navigation application providing various transportations options, i.e., not only bus (BRT, City bus) but also taxi, rickshaw, private vehicle to their destination. And transportation choices are flexible based on interest such as economical way, time critical way, easy connection way, etc.

Once the MMA software limitations are fixed, mass release program will be started from April 2019.

Preparation meeting in Ahmedabad

भारतीय प्रौद्योगिकी संस्थान हैदराबाद
Indian Institute of Technology Hyderabad

自主創造
日本大学

Nagoya
NAGOYA ELECTRIC WORKS CO., LTD.

Vehicle sensing in CCTV video data

by C Krishna Mohan, Group 1 leader

Vehicle sensing aids in analyzing the traffic flow which includes tasks of counting number of vehicles, vehicle speed estimation, vehicle trajectory prediction, gap acceptance, accident detection, etc. Vehicle sensing relies on suite of sensors which produce CCTV video data, LiDAR data, etc. Several deep convolutional neural network architectures were explored to detect and track vehicles in dense Ahmedabad city traffic scenario. Vehicle tracking is formulated as decision making in Markov Decision Processes (MDPs), where the lifetime of a vehicle is modeled with MDP. Vehicle detection and tracking tasks are performed in real-time with a processing speed of 15-20 frames per second. Counting number of tracks of vehicles throughout the video feed yields vehicle count. Currently work is in progress related to vehicle counting and speed estimation from various traffic datasets of Ahmedabad in continuous fashion.

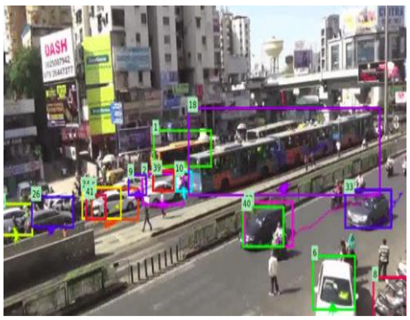


Fig: Demo of vehicle Tracking

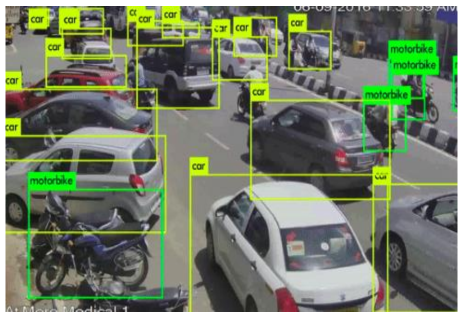


Fig: Demo of vehicle detection

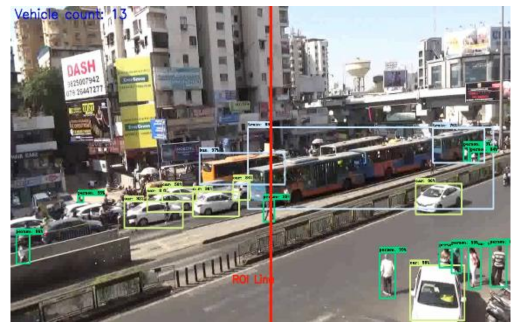


Fig: Demo of vehicle count

Vehicle sensing using LiDAR point cloud depth information

by P. Rajalakshmi, Group 1

LIDARs are becoming popular for traffic sensing because of their ability to sense the depth information. LiDAR point cloud contains a huge number of points. To make the segmentation faster a pipeline is implemented which works in a parallel fashion. Also, LiDAR data can be used to share the traffic information among vehicles or between a vehicle and Road Side Unit (RSU). To make the transmission of huge point cloud data possible, an implementation set up was created in the lab. Here point cloud is compressed to get text file of much smaller size which can be easily transmitted for analysis.

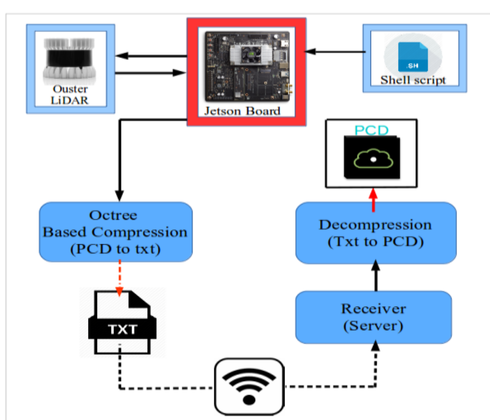
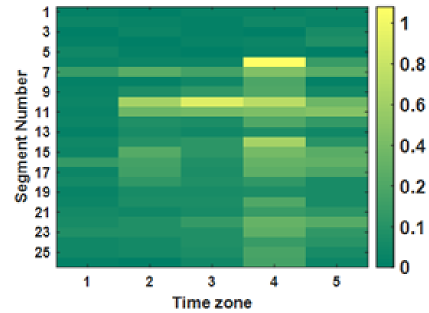


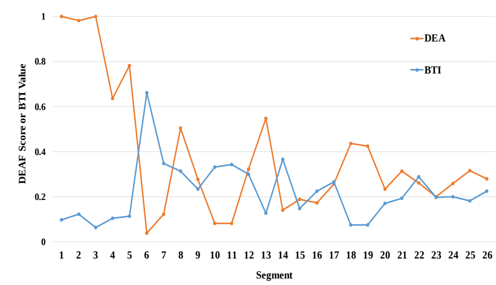
Figure: Setup of compression and transmission of point cloud data

Analyzing Route Segment Performance Based on Multiple Indicators Using DEA

by Tesuhiro Ishizaka, Group 2 Leader



It's important to calculate reliability as an index to measure the service level of public transportation. However, these service reliability metrics can't account for spatio-temporal dynamics. Further, comprehensive measure that can isolate inefficient location and temporal zones is necessary to strategize preventive measures. In this work, we analyzed the service reliability of Ahmedabad BRT across both space and time by diving the route into stop-to-stop level segments. Subsequently, a relative performance measure for each segment of a particular route which incorporated multiple metrics was obtained using data envelopment analysis (DEA). Measures including average travel time and peak deviation were used in this analysis. Based on the scores for each segment, the underperforming locations were identified and ranked. Finally, the DEA scores were compared against BTI (Buffer time index) to demonstrate its non-triviality and uniqueness. When the segments were ranked according to DEA and BTI, DEA indicated distinct ranks. Such DEA analysis can be used when interaction between factors contributing to reliability is unknown. Additionally, considering routes as a whole, relative performance of each route was also obtained.

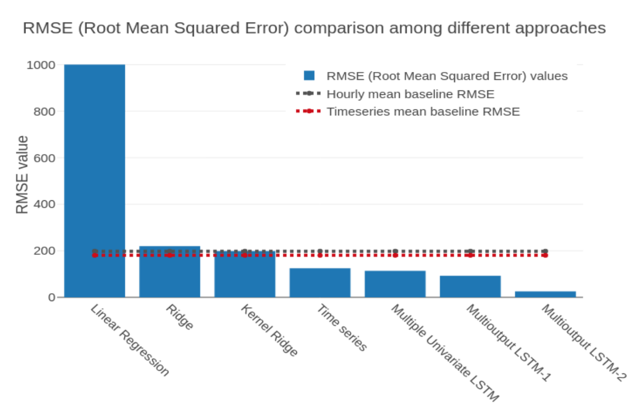


DEA scores and BTI values of all the segments

Predicting future traffic volume using Data Analytics

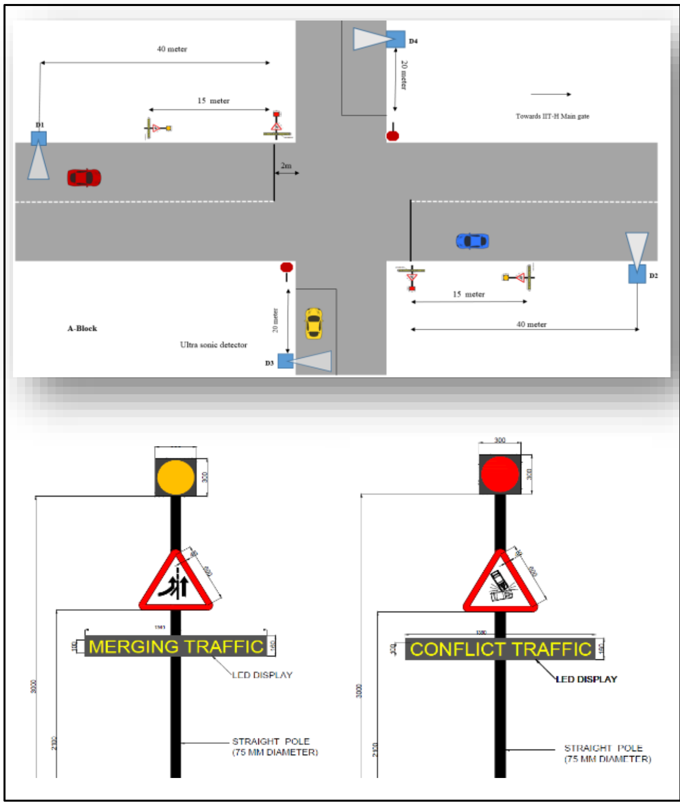
by Maunendra Sankar Desarkar, Group 2 Co-leader

Planning of travel is often important to avoid unforeseen delays while commuting. Such delays can result in anxiety, loss of business hours, etc. As part of this project, algorithms are being developed to predict the traffic volume at different junctions of the road network at future hours. This predicted information can be used for travel time estimation, route planning, taking decisions regarding traffic regulation, etc. The approaches assume the presence of past traffic data in the form of number of vehicles that crossed different junctions of the city to make the predictions. Several analyses were performed on available benchmark data from other cities to observe patterns in traffic across days, months and years, and also to understand the impact of traffic across junctions. Few machine learning and deep learning-based models such as regression, time series modeling (ARIMA), Long- Short-Term-Memory (LSTM), etc. were developed to predict the traffic volumes for future time steps. Detailed comparison was performed among the developed methods to understand their relative performances. In the comparisons, LSTM-based method was found to outperform other methods significantly for the vehicle count prediction task.



ITS Test bed for traffic safety and to reduce vehicle emissions

by Digvijay S. Pawar, Group 3 Leader



1) Intersection conflict warning system: The goal of the Intersection Conflict Warning System (ICWS) is to reduce fatal and serious injury crashes at un-signalized intersections by warning the drivers in real-time about the presence of conflicting traffic at the intersection. This system will also help to manage the traffic efficiently by increasing the throughput by avoiding unnecessary accelerations and decelerations and therefore reducing the vehicle emissions. The research team at IITH has designed several kinds for smart traffic signages that address the safety concerns at un-signalized intersections. As per the road accident statistics, around 70% of accidents are recorded at rural unsignalized intersections. The ICWS developed at IITH, if deployed at large scale on rural intersections, will tend to reduce the crashes by 50% thus dipping the congestion, travel time, and therefore reducing the emissions.

Benefits-

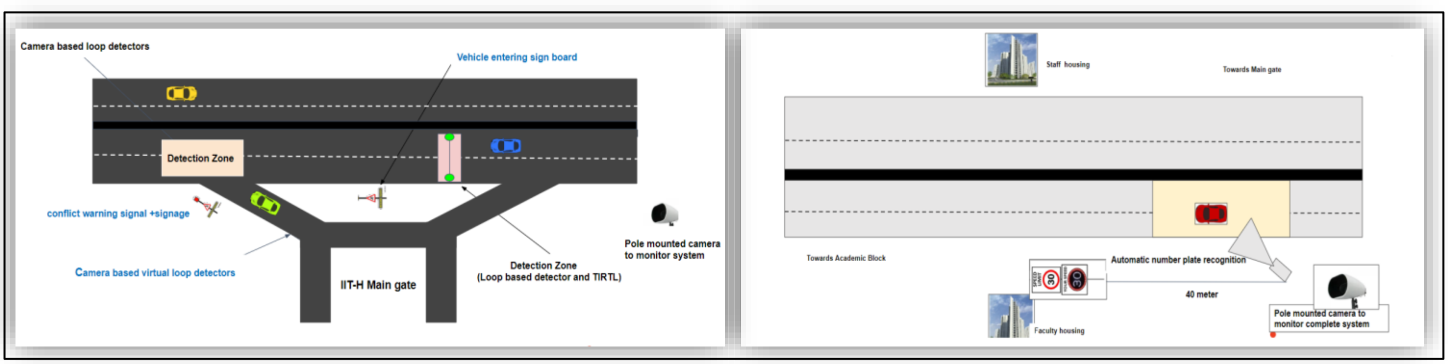
- Reduce right angle (T-bone) crashes.
- Real-time warning of traffic.
- Reduce traffic congestion, queue length and emissions.

Current status of the work:

- Critical gap analysis completed. Critical gap size is used to identify the location and placement of traffic detection zones and the respective sensor poles.
- Installation of poles is in progress at all test bed locations.

2) Advanced driver assistance system for safe merging: It is a traffic waring system designed to regulate the flow of traffic entering freeways according to current traffic conditions. This system will lead to a) Improved System Operation: Ramp metering essentially aims to control the access to a freeway to reduce congestion b) Improved Safety: Reducing the risk of accidents arising out of sudden driver decisions. b) Reduced vehicle operating expense and emission: Ramp metering essentially reduces the number of stops and delays for the freeway as well as the ramps.

3) Speed Enforcement and Warning System: - This system is designed to improve the driver compliance with speed limits on the highways. The fuel economy of a vehicle varies with the speed of the vehicle. The fuel economy of the vehicles is maximized at optimum speed, which will be ensured through this system. Observing/enforcing current highway posted speed limits or the calculated optimum speeds will result in the reduction of GHG emissions.



Measuring PM 2.5 in dense traffic areas

by Atsushi Fukuda, Group 4 Leader

PM2.5 profile at 2 PM

PM2.5 profile at 6 PM

Since WHO reported 14 of the world's polluted 15 cities are in India, it is important to clarify the contribution of roadside emission as the source of pollution. Even though the main task of M2Smart project is to propose multimodal strategies and estimate the resulting GHG emission reduction, development of the sensing technologies for roadside emissions will assist in such GHG measurements. Specifically, monitoring of emission and analyzing the spatial and temporal distribution of pollution will be very essential. Such monitoring can be efficiently made through mobile sampling. As a preliminary work, we choose a commercial area named Iskcon crossroads in Ahmedabad and sampled PM2.5 in a moving vehicle with a low-cost sensor at different times of the day.

Main observations include.

・Average PM concentration in the afternoon was less than that of evening time.

・Pollution reading dropped immediately as the vehicle moved far away from the intersections indicating a spatial trend

However, it was observed that measurements must be made extensively across space and time which shall be made in the future.

PUBLICATIONS

Conference papers

- Anjani Josyula, Bhaskar Anand, and P. Rajalakshmi, "Fast Object Segmentation Pipeline for Point Clouds Using Robot Operating System", IEEE 5th World Forum on Internet of Things, 15-18th April, 2019, Limerick, Ireland.

Workshop papers

- Bhaskar Anand, Vivek Barsaiyan, Mrinal Senapati, and P. Rajalakshmi, "Real Time LiDAR Point Cloud Compression and Transmission for Intelligent Transportation System", 1st International Workshop on Internet of Autonomous Vehicles (INAVEC), co-located with VTC2019, 28th April - 1st May, 2019, Kuala Lumpur, Malaysia.

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jica SATREPS

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