Video Based Machine Learning for Smart Traffic Analysis and Management

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Award Type (SCC), Solicitation Year (FY 2018)

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Community Partners

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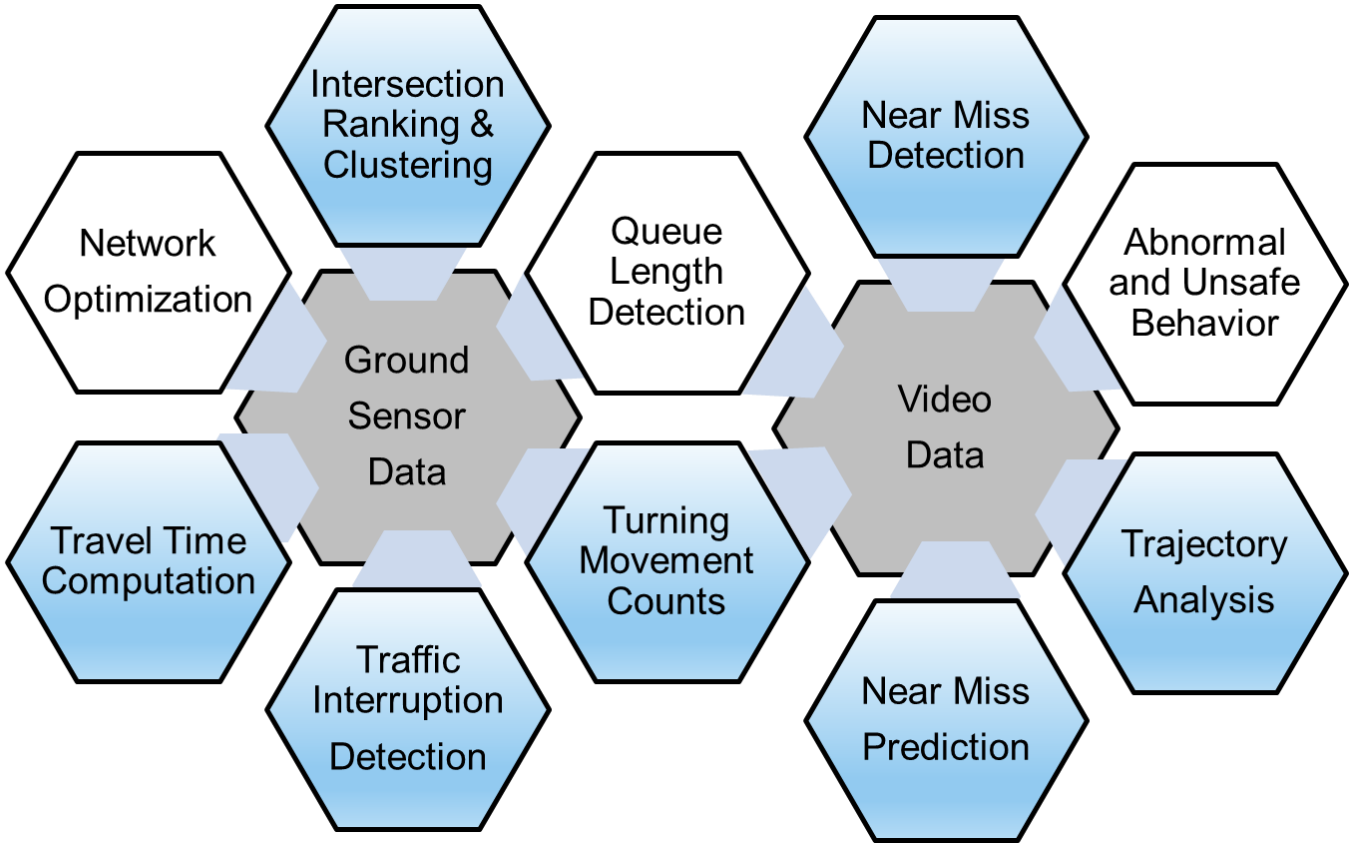
Suggested length: 15(s)

Project Overview



- ML based video-stream processing (using multicore and GPU processors) to convert video data into space-time trajectories of individual vehicles/pedestrians that are transmitted to a cloud-based system.
- Key information is then fused with ground sensor data leveraged to optimize intersection operations, manage network traffic, identify near-misses between various units of traffic and a host of other traffic safety and optimization applications.

Suggested length: 30(s)

Project Overview

Use-Inspired Research

We broadly address community safety and mobility understanding at an intersections and system level.

The data collected from multiple sources afford real-time measurements and decisions and are being used as part of an iterative approach to observe traffic and pedestrian mobility

Our approach has the potential to have a tangible impact on the USDOT goal of Vision Zero to minimize, and eventually eliminate motor vehicle related accidents.

(Community Partner: City of Gainesville)

Fundamental Research Contributions

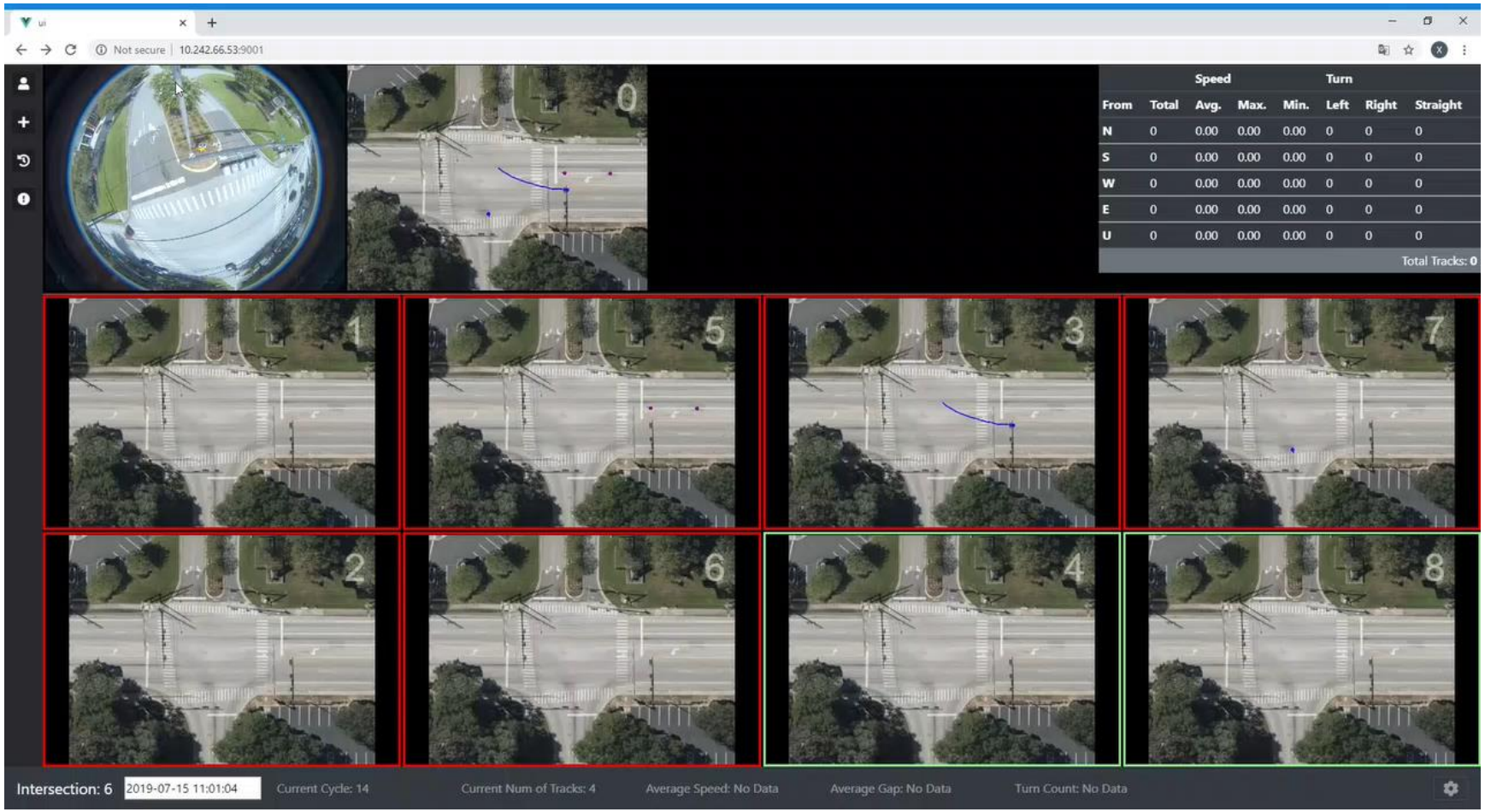
Multi-target tracking: We have developed real-time machine learning algorithms for object tracking using multiple fisheye cameras on intersections.

Integrated optimization and simulation for signal control: We are developing machine learning algorithms for modeling, simulating and optimizing traffic on a corridor. This includes cycle time, signal offset and barrier time optimization.

Real-time Edge Processing: We have developed real-time GPU-based algorithms for video and sensor data processing. We have developed an edge-cloud system for processing and storing the data.

Suggested length: 30(s)

Project Update

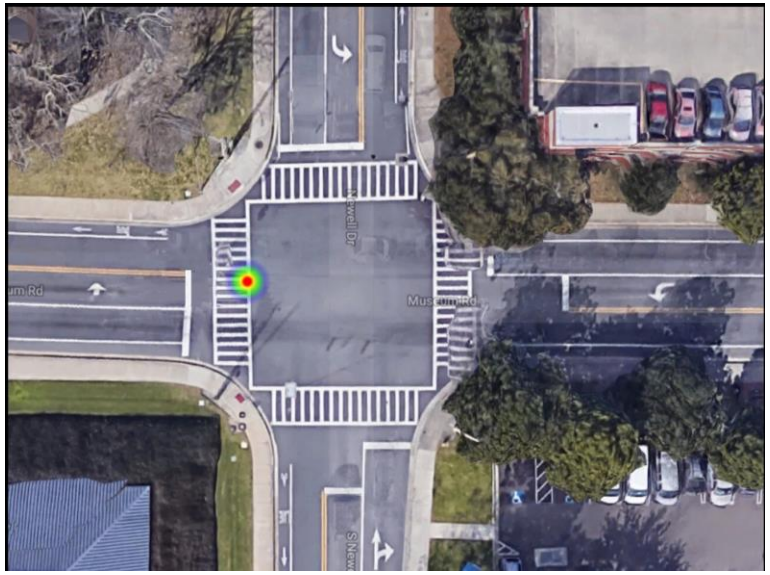


- Developed algorithms and software for real-time fisheye video processing.
- Processing video feeds from five intersections.
- Developed a storage, analysis and visualization system for real-time and historical analysis.
- Conducting Safety Studies with City of Gainesville.
- Published eight papers in major conferences and journals.

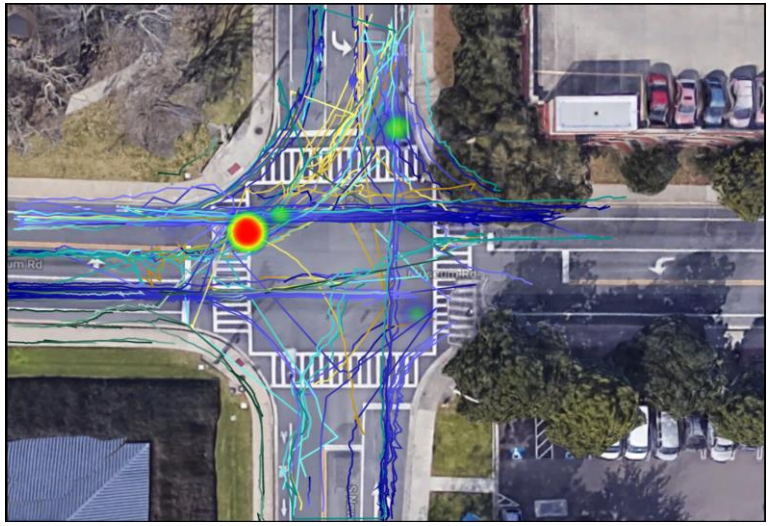
Suggested length: 90(s)

Project Update

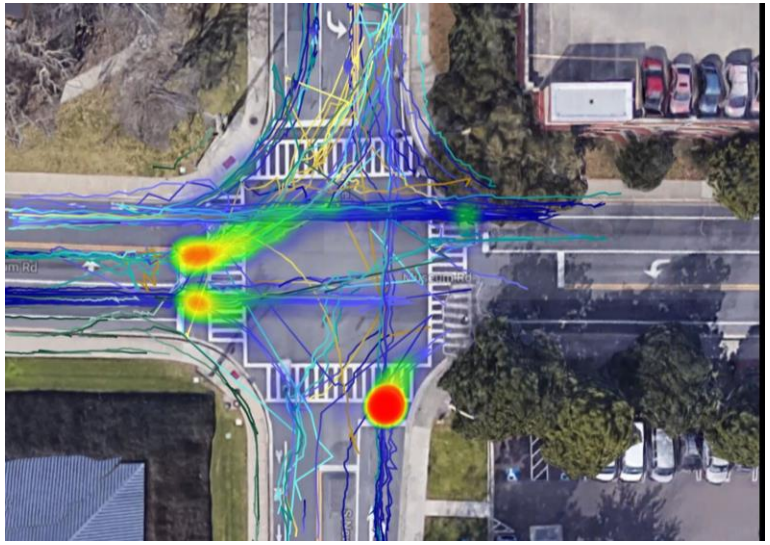
Intersection



Pedestrian to Vehicle Near Misses



Vehicle to Vehicle Near Misses (at Normal Speeds)



Near Misses because of Vehicles Yielding (at Low Speeds)

Project Evolution

- We learned that transportation engineers find existing analytics systems onerous as they are required to investigate each intersection separately. Using this feedback, we developed a dashboard that computes key measures and shows the current state of all the intersections in the city and their comparative ranking (based on congestion) in a few screens.

- We learned that the transportation engineers wanted to see the near-misses between pedestrians and vehicles separately for each phase of the signal timing. We developed fusion algorithms that could merge the video and signal timing data streams and provide this information per phase.

- We learned that current travel time computation systems were not real-time and required additional hardware to be installed. We developed a video-based tracking system that is real-time and significantly more accurate.

Suggested length: 45(s)

Anticipated outcomes & success measures for next year

- Develop machine learning based simulators that can encapsulate video data, ground sensor data and intersection geometry to predict traffic movement and near-misses at an intersection.

- Develop machine learning algorithms and software that use optical flow to improve pedestrian detection. **Demonstrate the usefulness of this approach for improved accuracy on several intersections.**

- Conduct extensive safety studies using the machine learning software. **Use video feeds from intersection in City of Gainesville.**

Suggested length: 30(s)