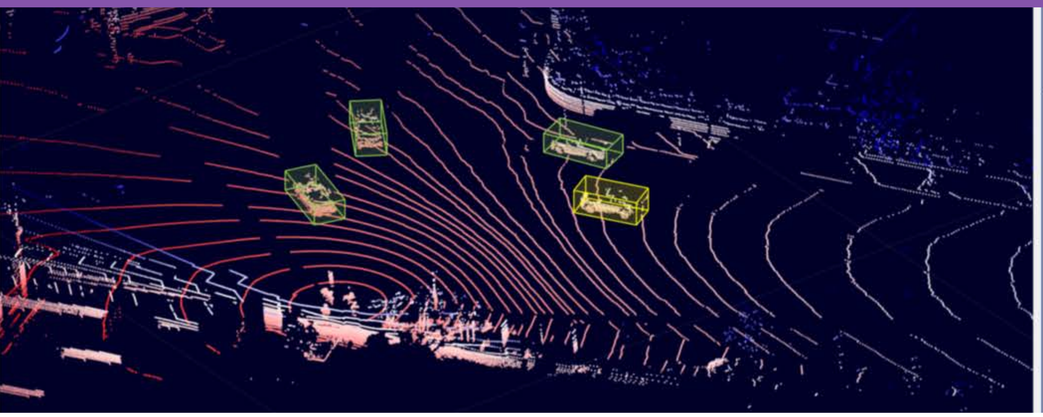
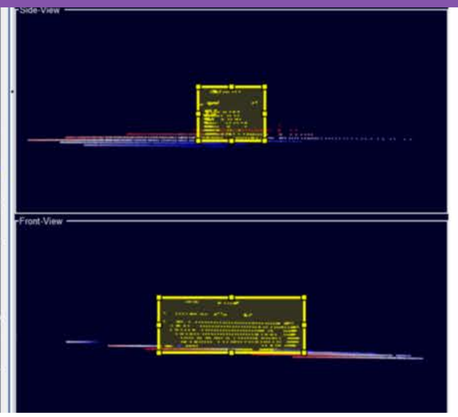
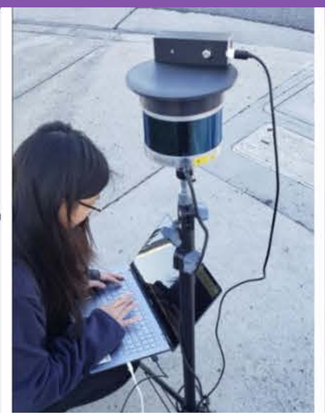
AUTONOMY RESEARCH CENTER FOR STEAHM

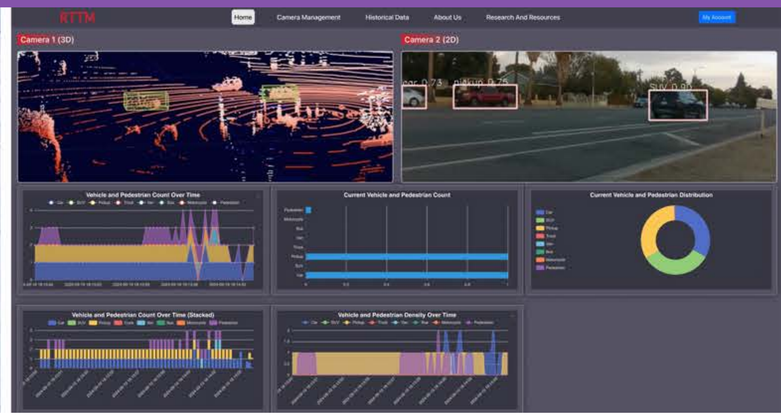
Trustable Autonomy

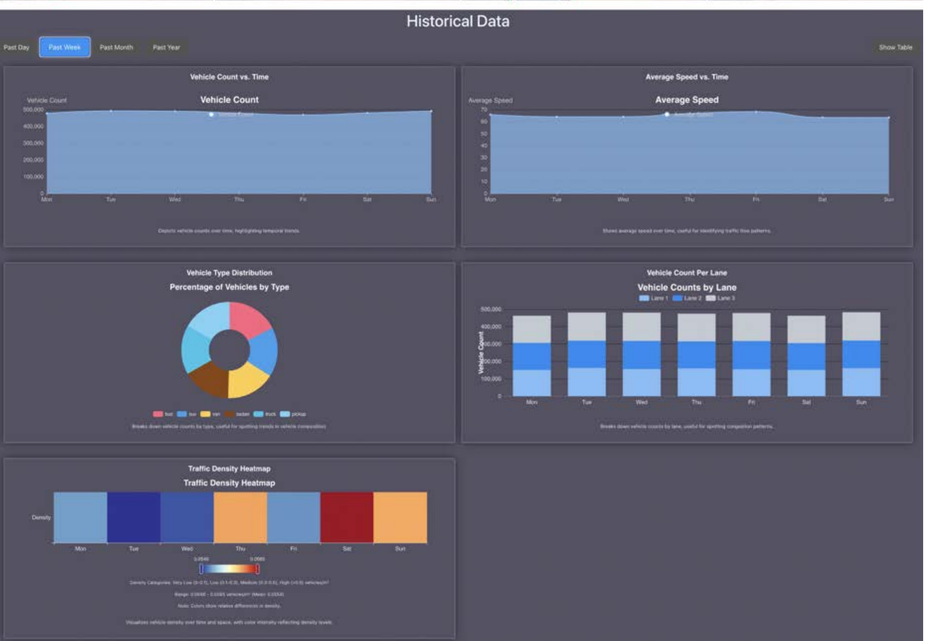
Real-Time Traffic Monitoring











Synopsis

- More accurate and comprehensive traffic information can improve urban planning, reduce congestion, and enable more timely road traffic management.
- Using data from a LiDAR (Light Detection and Ranging) camera and a stereo-based depth camera, machine learning algorithms can help to detect and classify vehicles.
- Data are processed in real time and visualized for traffic flow analysis.

Research Objective

- Present traffic statistical data through data visualization charts updated on the Real-Time Traffic Monitoring Website.
- Increase speed and precision of 3D vehicle classification models, trained on stationary, roadside data.
- Compile a dataset for further research, model improvement, and for other researchers working in traffic and transportation fields.

Research Approach

- Apply an automated approach to label vehicles in LiDAR data frames, recorded with stationary sensors at intersections.
- Filter out the irrelevant background LiDAR points to improve the precision and reduce the computation load of the PointPillars machine learning model.
- Integrate these models into an end-to-end traffic monitoring system, displaying the processed data and historical visualizations through a website hosted on CSUN's servers.

Research Results and Products

- Developed a Real-Time Traffic Monitoring system to provide 2D live stream object detection and classification.
- Achieved a precision of 0.944 in 2D vehicle detection and classification using YOLO-v8.
- Developed background filtering algorithm and improved Complex-YOLO algorithm that enables 3D detection and classification for more different types of vehicles.
- Established a dataset of labeled roadside LiDAR and depth camera data.

Commercialization and/or Societal Impact Opportunities

- **Application**: Traffic management systems for cities, integration with autonomous vehicle edge systems, traffic pattern analysis tools for traffic operation and management
- **Key Values**: Reduce congestion, improve urban planning decisions, increase road safety
- **Potential Customers**: Municipalities, smart city technology providers, researchers in transportation analytics

Team Names & Collaborators

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Faculty:

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Citations

A. Darwesh, D. Wu, M. Le, and S. Saripalli, "Building a smart work zone using roadside lidar," in 2021 IEEE International Intelligent Transportation Systems Conference (ITSC). IEEE, 2021, pp. 2602–2609.

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A. Jafari Anarkooli, I. Nemtsov, and B. Persaud, "Safety effects of maintenance treatments to improve pavement condition on two-lane rural roads—insights for pavement management," Canadian Journal of Civil Engineering, vol. 48, no. 10, pp. 1287–1294, 2021.

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