Making Micromobility Smarter and Safer

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Background and Objectives

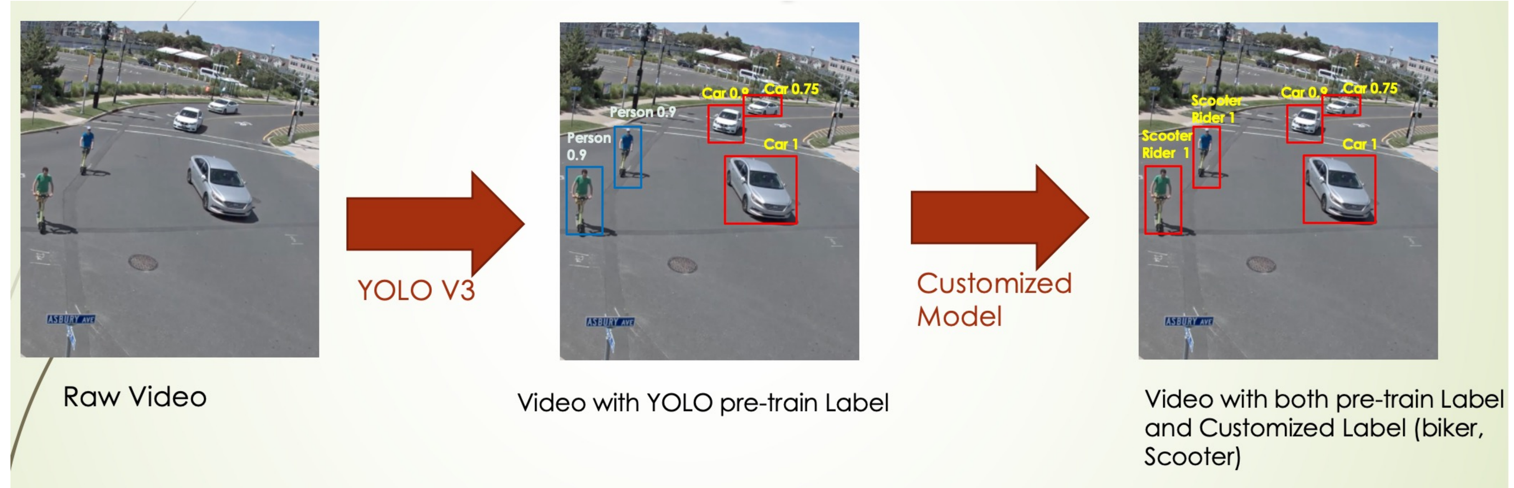
- Urban transportation is experiencing rapid changes with the introduction of new micro-mobility options. Within this mix of new modes, pedestrians face substantial and growing risks on American streets where road designs cater to drivers and automobiles dominate numerically.
- How do we increase the quality and quantity of data on pedestrian & micro-mobility risk?
- What factors increase the risk of vulnerable road user near-miss conflicts?
- How do we drive vulnerable road user fatalities to zero for all road users?

Intellectual Merit

- We developed a test bed equipped to evaluate social, technological, and integrated risk-reduction strategies for vulnerable road users. We did this by developing computer vision algorithms to more accurately detect pedestrians, micromobility vehicles, and motor-vehicles; to measure trajectories; to measure near-misses; and to distinguish key user attributes.
- We acknowledged the sequencing and layering of social and technological strategies as part of an integrated risk reduction portfolio. Explicit experiments to test the efficacy of social, technological, and integrated innovations were conducted.
- We engaged with communities to reveal insights about the efficacy of these approaches.

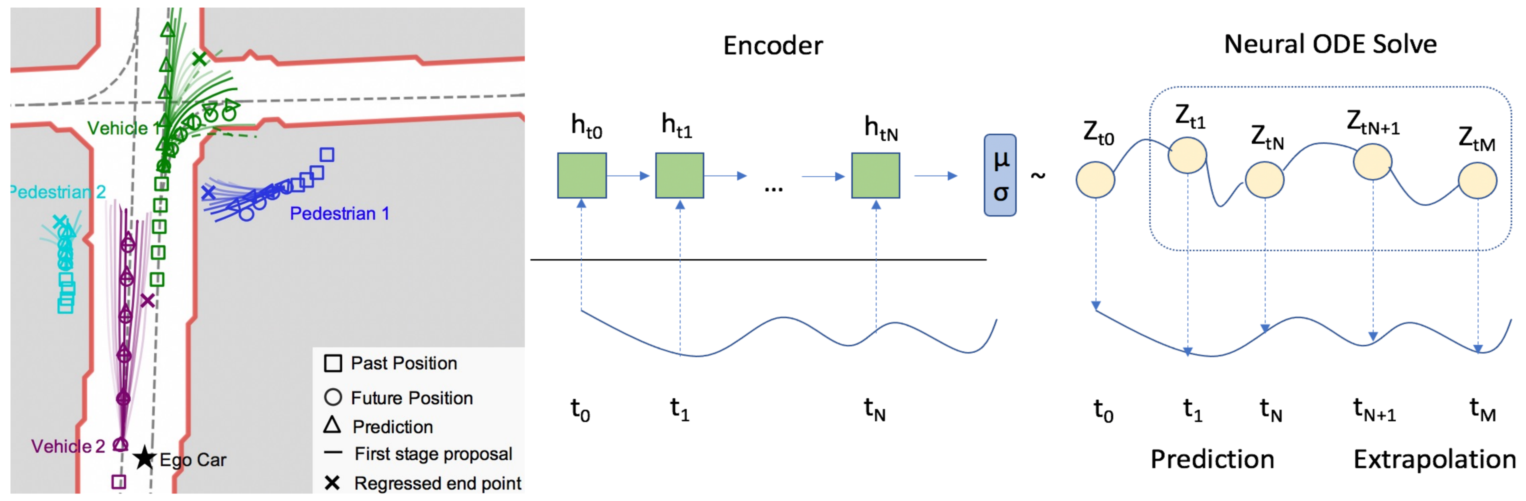
Detecting Near-Misses

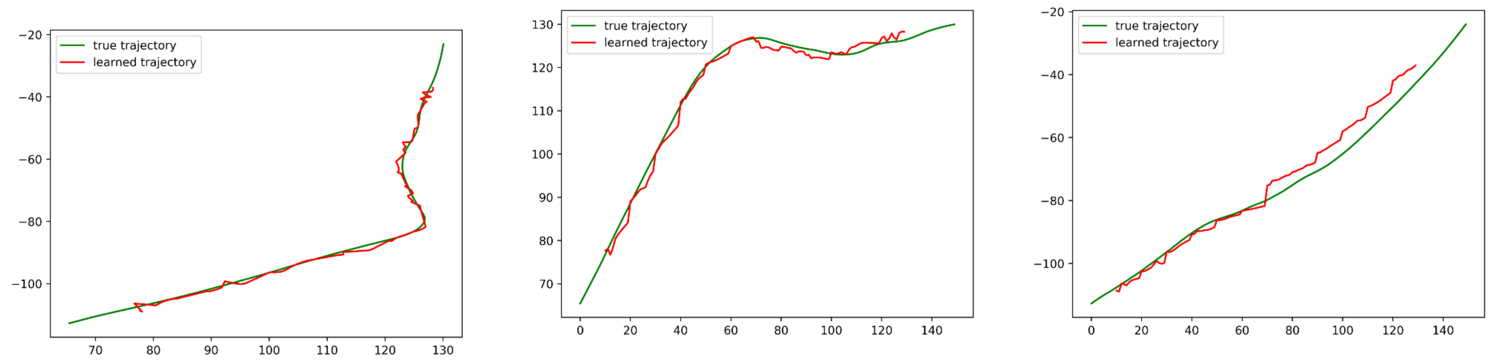
- Current models do not have the capability to identify e-scooters. We fill this gap by developing an algorithm that can discern between pedestrians and e-scooters.
- Our cascade model has an 83% accuracy of detecting e-scooters.



Technological Experiments

- Virtual Reality Simulations
- A connected app for road users
- We used machine learning to predict trajectories. Our proposed approach used multiple Ordinary Differential Equations (ODE).

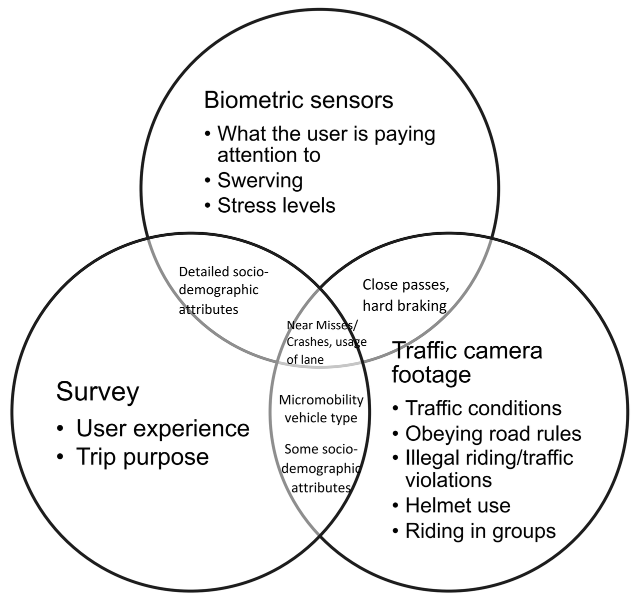


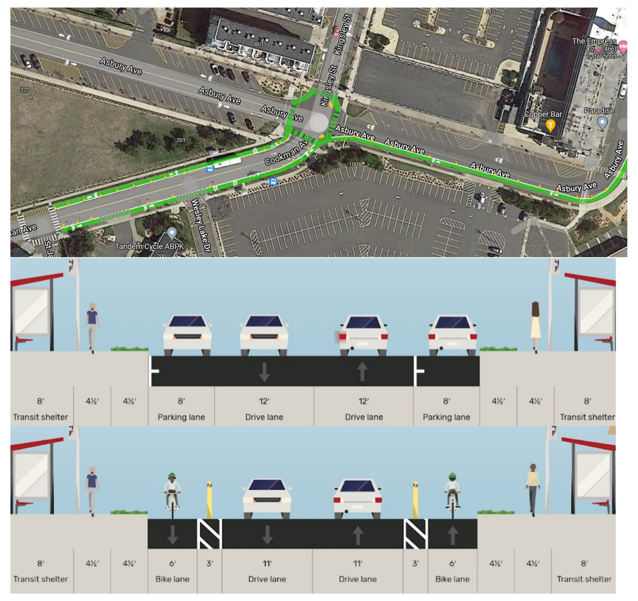


The green line is the ground-truth. The red line is our model's prediction (Input: 10 points sampled from 4s, Output Prediction: 10 more points over 4s).

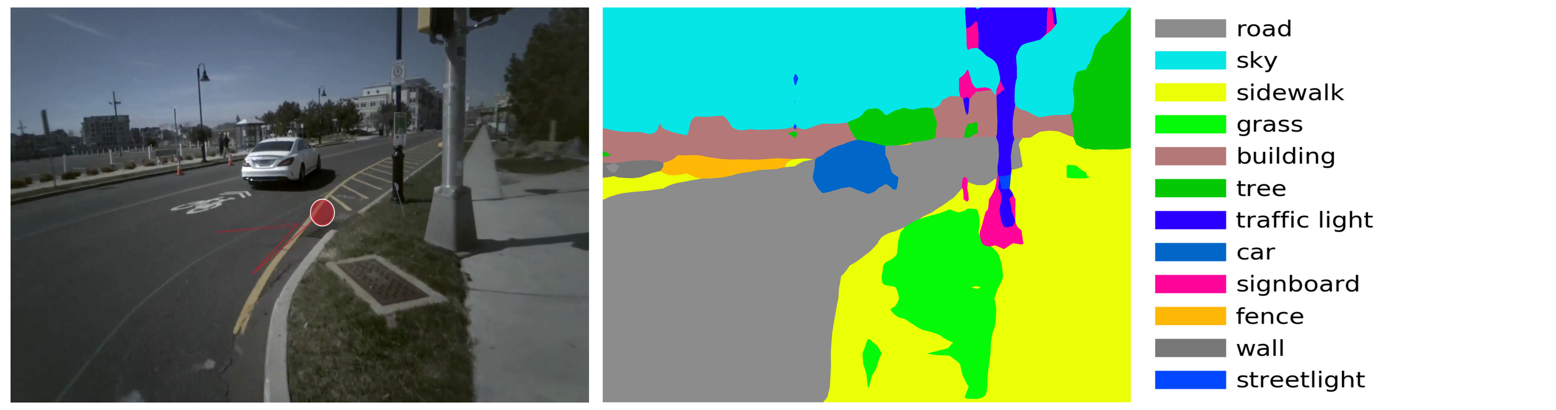
Social Experiments

- We conducted a tactical urbanism intervention by adding a temporary bicycle lane in the coastal town of Asbury Park, NJ.
- We used surveys, traffic camera footage, and biometric sensors to gauge the safety of the bicycle lane.
- Bike lanes have a traffic calming effect
- Behavioral differences between e-scooter and bicycle users





- The biometric sensors, including eye tracking glasses and Galvanic Skin Response (GSR) sensors, were used to gauge the stress levels and cognitive workload of the user.
- The user looked at road and/or traffic related objects around 93% of the time.



(a) Eye tracking glass world-view video, with eye fixation point labeled as the red dot

(b) Image segmentation result using PSPNet.

Broader Impacts

- The project directly affects the pedestrian and micromobility experience in NJ, and the tools and deliberative processes developed at these sites should be widely transferable to other jurisdictions.
- Vulnerable elderly, children, and under-represented minority pedestrians and cyclists will benefit because they are currently at disproportionate risk.
- In the long run, we envision that this project will lead to safer roads for all, fewer micromobility casualties, and better mobility for all.