A Feasibility Study for Increasing Pedestrian Safety

Researchers:
Airam Flores, aflores91@miners.utep.edu
Abdullah Imran, airman@miners.utep.edu
Shirley Moore, svmoore@utep.edu
Current Project Status

• Just submitted revised IRB study application
  • Recruitment of volunteers
  • Planned activities
  • Collecting, storing and protecting data
  • Specified use of Chameleon and CHI@Edge resources
  • Human subject training
• Learning to use CHI@Edge
  • Created project – “Edge on the Border”
  • Currently having some problems with authentication creating container or problems running the container once created
  • Some experience – have used AI containers on PSC Bridges-2 GPU nodes
• Pricing LiDAR devices
• Investigating data analysis and machine learning techniques for near-miss analysis
• Getting access to sample data sets
Motivation

- Across the city of El Paso, there have been 1,261 traffic incidents involving pedestrians and motorists since 2015, and roughly 10.5% were fatal, resulting in 119 deaths.
- Downtown El Paso and the Chihuahuita neighborhood have the highest density of collisions involving pedestrians.
- Across the U.S., the pedestrian death rate rose during 2020 despite fewer miles driven during the pandemic.
- 2019 pedestrian fatality total was the highest in 30 years, exceeding the previous 30-year high from 2018 and up nearly 50 percent over the past decade.
- It is crucial to determine the factors contributing to this increase, identify high risk areas, and develop mitigation strategies in order to save lives and prevent injuries.
Goals of this Study

• Determine requirements for the number and most effective placement of LiDAR sensors and video cameras needed to collect near-miss data.
• Devise a plan for procuring, installing, and maintaining LiDAR devices and video cameras and meeting associated computing and communication requirements, including costs and involvement of city government and stakeholders.
• Devise a plan for collecting, managing, and providing access to data for conducting near-miss analysis.
• Develop a strategy for optimizing where to carry out data processing and analysis – i.e., on edge computing devices vs. the cloud datacenter.
• Evaluate data analysis and machine learning techniques to determine best approaches for near-miss analysis.
LiDAR

• Stands for Light Detection and Ranging.
• LiDAR sensors work by transmitting a stream of laser light into the environment. When the light hits an object, it is reflected back to the sensor. As the laser scans, the sensor creates a three-dimensional rendering of the object by measuring the amount of time it takes for the reflected light to return.
• LiDAR systems can distinguish between cars, trucks, pedestrians and bicycles.
• Roadside LiDAR systems have no facial recognition capability and thus do not violate citizens’ privacy.
• Data can be converted into information about vehicle and pedestrian trajectories.
Near-miss Analysis

- A pedestrian-vehicle near-miss is defined as a situation in which a vehicle had to abruptly brake or swerve to avoid striking a pedestrian or a pedestrian had to take sudden evasive action to avoid being struck.
- Near-miss analysis on a much larger dataset allows crashes to be predicted more reliably than using crash datasets.
- Near-miss data can help identify where improvements such as additional crossings, reduced speed limits, speed bumps, or better lighting are needed.
Near-miss Analysis Literature


Sample Datasets

- ASU Pedestrian LiDAR Scenes (APLS) Dataset
  - https://asulidarset.github.io/
  - https://github.com/asulidarset/APLS-sample
  - Data collected using Velodyne HDL-32e device
  - Process using Velodyne Dataset Utilities
    - https://github.com/michaelsaxon/velodyne-dataset-utils
- Velodyne datasets and Veloview visualizer
  - https://velodynelidar.com/downloads/#software%20first
- Chattanooga MLK Smart Corridor
  - UT-Chattanooga collaboration with Chattanooga DOT
  - New NSF grant for expansion (LiDAR sensors, shared access)
Requirements and Plans for CHI@Edge Testbed

• Ideally would like to connect our LiDAR sensors and video cameras to the CHI@Edge infrastructure
• Orchestrate data and computation from edge to cloud considering
  • Performance optimization
  • Privacy constraints
• Evaluate different options for edge servers
  • Video analytics on the edge requires more computational power
  • Specialized processors for lower power consumption (e.g., GPUs or NPUs/TPUs for machine learning)
• Evaluate strategies for data transfer, storage, and access with respect to
  • Performance
  • Reproducibility
  • Privacy and confidentiality
  • Sharing with other researchers
Acknowledgments

• This research is funded by UTEP Startup Funds for new faculty.