

# UTC Spotlight

University Transportation Centers Program

The Mineta Consortium for Transportation Mobility



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## AI Pedestrian Traffic Safety System

According to the U.S. Department of Transportation (USDOT) and the National Highway Traffic Safety Administration (NHTSA), the number of traffic fatalities in the United States was **36,096** in 2019, which is more than 11.17 deaths per 100,000 population.<sup>1</sup> In 2019, more than **240 people** died in traffic accidents in the city of Los Angeles alone, with pedestrians accounting for more than half (55%) of these deaths.<sup>2</sup> These numbers underscore the criticality of improving national pedestrian and bicyclist safety.

**Figure 1. The AI Traffic Safety System automatically detects, tracks, and counts pedestrians and cyclists.**

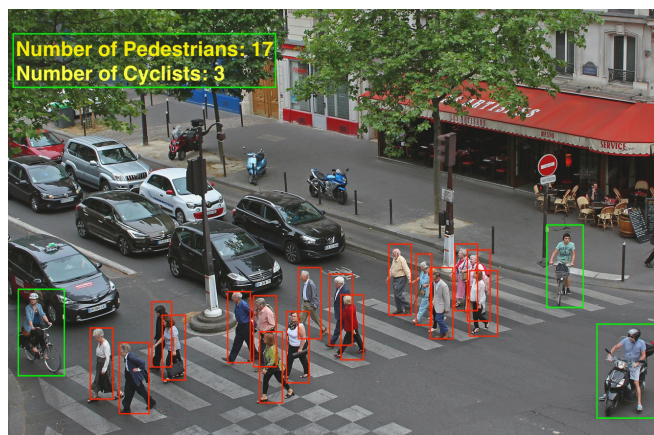


Image Source: Modified from Unsplash.com

Until recently, there was no effective automated system for monitoring the movement of these vulnerable groups, making it difficult to determine which safety interventions were most effective. Understanding the need for clear measurement, researchers from the Mineta Transportation Institute developed

<sup>1</sup> U.S. Department of Transportation (2020). "NHTSA Releases 2019 Crash Fatality Data." National Highway Traffic Safety Administration, <https://www.nhtsa.gov/press-releases/roadway-fatalities-2019-fars>.

<sup>2</sup> Fonseca, Ryan (2020). "Even With Stay-At-Home Orders, LA Traffic Deaths Are Keeping Pace With Last Year." LAist.com, <https://laist.com/latest/post/20200514/coronavirus-la-traffic-deaths-speeding-drivers>.

and implemented a new automated system using artificial intelligence (AI) and computer vision to monitor, track, and count the movement of pedestrians in major urban areas using existing traffic cameras. Led by Dr. Mohammad Pourhomayoun, the team created the AI Pedestrian Traffic Safety System, which collects and processes this data in real time to enable dynamic traffic control. The system is already being implemented and tested in downtown Los Angeles, and because it requires no new equipment, it can be cost-effectively scaled over time to improve safety in LA and beyond.

The AI Pedestrian Traffic Safety System—tested on 12 hours of traffic videos captured from existing traffic cameras in the city of Los Angeles—demonstrated more than 98% accuracy in counting pedestrians in real time. Previous automated traffic monitoring methods for pedestrian detection used inefficient techniques that failed to obtain accurate real-time data. Most of these systems relied on standard datasets and were frequently unable to overcome low resolution images and videos, making it difficult to accurately understand shifting traffic patterns and to improve safety with the accuracy and flexibility of real-time traffic control.

**Figure 2. Dr. Pourhomayoun (standing) working with his research team in AI and Data Science Research Lab at California State University, Los Angeles.**



Image Source: Captured from "Pedestrian Vision & Counting" available from [https://www.youtube.com/watch?v=oEBVoQT2Qkw&feature=emb\\_imp\\_woyt&ab\\_channel=ToyotaMobilityFoundation](https://www.youtube.com/watch?v=oEBVoQT2Qkw&feature=emb_imp_woyt&ab_channel=ToyotaMobilityFoundation).

**Figure 3. Developing and evaluating the AI Traffic Safety System.**

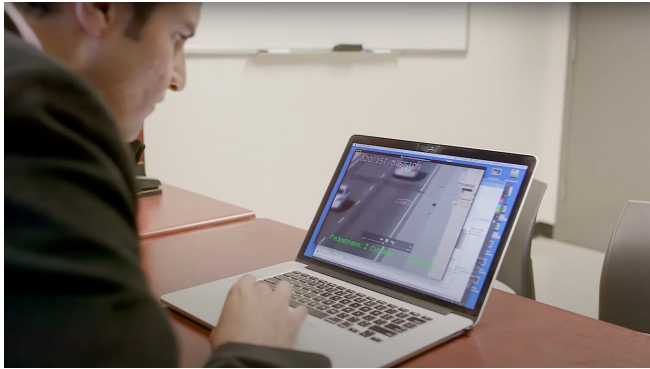


Image Source: Captured from “Pedestrian Vision & Counting” available from [https://www.youtube.com/watch?v=oEBVoQT2Qkw&feature=emb\\_imp\\_woyt&ab\\_channel=ToyotaMobilityFoundation](https://www.youtube.com/watch?v=oEBVoQT2Qkw&feature=emb_imp_woyt&ab_channel=ToyotaMobilityFoundation).

As an end-to-end system, the AI Pedestrian Traffic Safety System covers every part of the process from beginning to end, relying on a series of algorithms to receive, pre-process, and process video data, as well as detect, track, and count “objects”— with the “objects” in this case being cyclists and pedestrians. Using quality enhancement and adjustment of the raw video, the AI processes the video feed and then extracts the best set of computer vision features into usable data for object detection. This immediate processing allows in-the-moment identification of busy intersections, which enables real-time traffic control and the ability to prevent injury- and fatality-causing crashes.

System challenges include poor-quality videos due to low camera resolution, poor light, or less-than-ideal weather conditions that make processing the raw video footage more difficult. Other challenges include undesired angles, locations, or direction of the camera, inconsistent light, shaking cameras, and blocking objects. Even with these difficulties, the system’s pedestrian counting results for 12 hours of real video streams demonstrate on average an overall percent error of only 1.7%.

Significantly, unlike other systems that require entirely new cameras and equipment, this system uses existing hardware, so it is highly cost effective. With help from the research team, the Los Angeles Department of Transportation is continues to test and scale the AI.

This project occurred as part of LA’s public commitment to the [global initiative Vision Zero](#), which endeavors to reduce severe injuries and deaths in roadway collisions.<sup>3</sup> Los Angeles’s specific [Vision Zero goal](#) is to eliminate all traffic deaths and serious injuries by 2025.<sup>4</sup> To do this, it is essential to develop intelligent transportation systems and human-centered strategies.

Partnerships, such as those between the MTI researcher and the city of Los Angeles, enable the funding of crucial research. Today, more than half of the world’s population live in urban areas. This proportion is only expected to grow, reaching [66% by 2050](#).<sup>5</sup> Systems like the AI Pedestrian Traffic Safety System are critical to help reduce traffic issues, including critical dangers to pedestrians and cyclists in urban areas. At full scale, the system can cover all 56,000 miles of LA streets and in time, it can be used across the nation to save lives and create a future where everyone can reach their destination safely.

## Abstract

According to the U.S. Department of Transportation and the National Highway Traffic Safety Administration (NHTSA), the number of traffic fatalities in the United States was 36,096 in 2019. Without an effective automated system for monitoring the movement of pedestrians and bicyclists in major urban areas, traffic patterns cannot be understood, and safety cannot improve. Researchers from the Mineta Transportation Institute developed an automated system using artificial intelligence (AI) to monitor and count the movement of pedestrians, cyclists, and other traffic elements in Los Angeles. Tested on over 12 hours of videos captured from existing traffic cameras in Los Angeles, the system demonstrated more than 98% accuracy in identifying, tracking, and counting pedestrians and bicyclists in real time. The system is currently being tested further and implemented by LADOT using existing traffic cameras, which means the system can be cost effectively scaled to reduce injuries and save lives.

<sup>3</sup> Vision Zero Network, <https://visionzeronetwork.org>.

<sup>4</sup> Los Angeles Department of Transportation. “Vision Zero is Los Angeles’s commitment to eliminate traffic deaths by 2025.” <https://ladotlivablestreets.org/programs/vision-zero>.

<sup>5</sup> UrbanNet (2016). “The World Urban Population.” <https://www.urbanet.info/world-urban-population/>.

### About This Project

The Mineta Consortium for Transportation Mobility (MCTM), led by the Mineta Transportation Institute at San José State University, conducts research, education, workforce development, and technology transfer activities to improve mobility of people and goods. We ensure our nation’s transportation system is safe, efficient, accessible and convenient for all.

The Consortium supports cross-disciplinary and interdisciplinary activities that contribute to effective transportation decision making. MCTM works to increase collaboration between universities, broaden perspective through geographic diversity, and increase participation by minority-serving institutions.

MCTM unifies and focuses the efforts of four outstanding institutions that represent and support the geographical, cultural, racial, and socioeconomic diversity that makes our nation strong: Howard University; Navajo Technical University; San José State University; and the University of North Carolina Charlotte.

*This newsletter highlights some recent accomplishments and products from one University Transportation Center. The views presented are those of the authors and not necessarily the views of the Office of the Assistant Secretary for Research and Technology or the U.S. Department of Transportation.*

