

Center for Safety Equity in Transportation

If you have a right to get there, you have a right to get there safely.

June 2023

CSET Research Showcase

Drone-based Computer Vision-Enabled Vehicle Dynamic Mobility and Safety Performance Monitoring

The acquisition of traffic system information, especially vehicle speed and trajectory information, is of great significance to the study of the characteristics and management of the traffic system. The traditional method of relying on video analysis to obtain vehicle number and trajectory information has its application scenarios. Still, the standard video source is often a camera fixed on a roadside device. In the videos obtained this way, vehicles are likely to block each other, seriously affecting vehicle detection accuracy and speed estimation. Although there are methods to get high-view road videos utilizing aircraft and satellites, the corresponding cost will be high. Therefore, since drones can obtain high-definition video at a higher viewing angle and the price is relatively low, we decided to use drones to get road videos to complete vehicle detection.

Our proposed method uses convolutional neural network technology to overcome the shortcomings of traditional object detection methods when facing a large number of targets and complex scenes. We modified the YOLO v3 network structure and used a vehicle data set captured by drones for transfer learning. Finally, we trained a network that can detect and classify vehicles in videos captured by drones. At the same

time, a self-calibrated road boundary extraction method based on image sequences was used to extract road boundaries and filter vehicles to improve the detection accuracy of cars on the road. Using the results of neural network detection as input, we use video-based object tracking to complete the extraction of vehicle trajectory information. Finally, the number of vehicles, speed, and trajectory information of vehicles were calculated, and the average speed and density of the traffic flow were estimated.

The proposed model can achieve more than 98% detection accuracy in our experimental results under different weather, lighting conditions, and traffic flow scenarios. Based on the obtained vehicle trajectory data, we can also complete the estimation of the average speed and average density of the traffic flow on the test road. Concerning the Level of Service (LOS) measurement index for ordinary expressways and the actual speed limit of the test road, the average density of vehicles calculated can accurately reflect the degree of vehicle congestion on the road, which can provide a reference for the intelligent traffic management system. The data obtained from the experiment can be used as a reference data set for studying the safety index of freeway traffic systems and connected vehicles after manual calibration.



Above: Screenshot of the output video. The markers show positions of the detected vehicles.

Left: Hardware configuration for capturing video of the freeway.

Announcements

CSET has positions open for post-doctoral researchers, graduate and undergraduate students interested in RITI transportation equity and safety research. Please contact us at cset.utc@alaska.edu.

A CSET Webinar is scheduled for July 12, 2023 at 11 am PDT. The title is Expert Perspectives on School Transportation Safety

Please join us on zoom for the presentation at <https://alaska.zoom.us/j/88564946324?pwd=SFTRWg3Z0xMdkxqMUZjbGdZMFk5Zz09>

CSET has been funded through the 2016 University Transportation Center Program by the US Department of Transportation as part of the FAST Act at approximately \$1.4 million in each of the next five years.

CSET at NTICC

The Artic Infrastructure Development Center (AIDC), the Alaska Tribal Technical Assistance Program (ATTAP) and CSET are sponsoring 5 sessions focusing on tribal and rural communities at the National Transportation in Indian Country Conference (NTICC) in Anchorage, Alaska, September 24-28, 2023. The detailed agenda and other information about the conference is available online at <https://www.nticc.org/>. The CSET sessions are focused on different data collection methods as rural and tribal communities have identified the need for additional safety data as an ongoing concern. The ATTAP sessions are focused more narrowly on the future of transportation in Alaska and the needs of Alaskan tribes.

Ice Roads Training

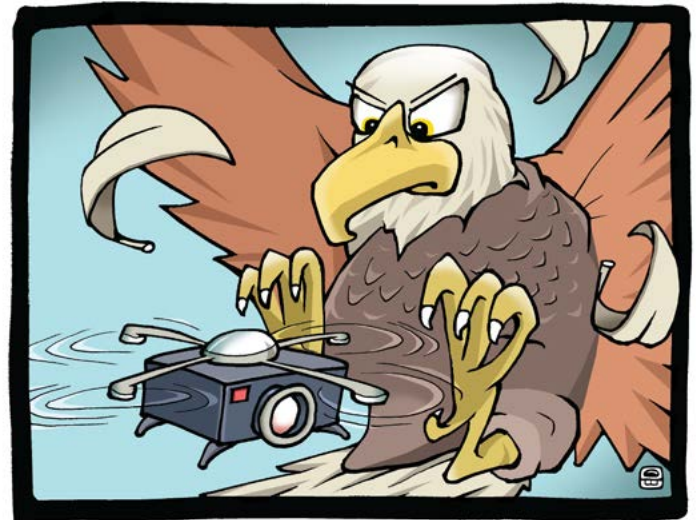
The Alaska Tribal Technical Assistance Program (ATTAP) invites you to a Workshop focused on Ice Roads in Alaska. The workshop will be held in Anchorage, Alaska on August 22, 2023 from 9 am to 4:30 pm in the Megan Room, 6591 A Street, Anchorage, Alaska. There is no charge to attend the workshop. Professional development credits are available. The primary purpose of the workshop is to discuss safe and efficient design, construction, maintenance and operation of an ice road. The AIDC recently completed writing a manual on the Design and Operation of Ice Roads that will be the focus of the workshop. Billy Connor, AIDC Director, will be the primary presenter. Specific topics to be covered include the bearing capacity of ice and how to measure it, hazards that can impact the integrity of the ice road, ice road construction, monitoring and maintenance activities, and vehicle control on the ice road. Please register to attend at <https://forms.gle/RcKRrob78h6VL3zAA>

CSET Webinars Available on YouTube

The CSET webinar series presents the research accomplished by the center. The presentations are recorded and made available through the AIDC YouTube channel at <https://www.youtube.com/channel/UC8MoM5IFHjIDcaKe6XniOVg/>.



In a 2020 CSET project, researchers at UAF worked with Alaska DOT&PF to establish a drone-based avalanche monitoring program in Atigun Pass, a remote location on the Dalton Highway above the Arctic Circle in Alaska. Photo by Nathan Belz.



Credit: Jamie Smith, CSET Project "Road Safety Nuggets"

UAF Come study with us!

The University of Alaska Fairbanks is actively seeking graduate students interested in research related to rural, isolated, tribal and indigenous transportation safety. Civil engineering is preferred, but also looking for interdisciplinary and Alaskan Native students. For more information contact Nathan Belz at npbelz@alaska.edu.