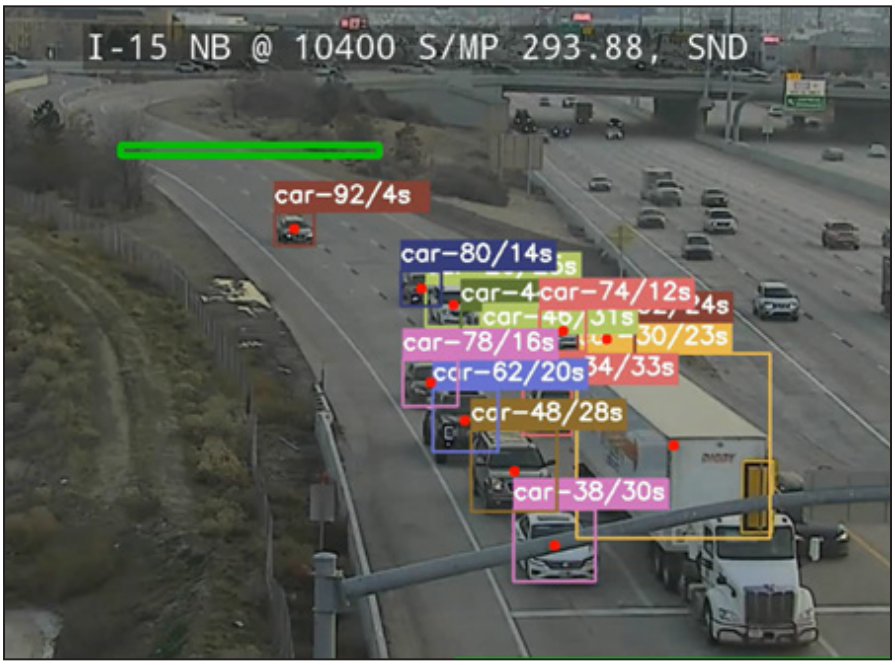
MOUNTAIN-PLAINS CONSORTIUM

RESEARCH BRIEF | MPC 23-507 (project 699) | November 2023

Evaluating Different Methods for Estimating Queue Length on Access Ramps



the **ISSUE**

Understanding queue length and queuing time on freeway entrance ramps is important for transportation agencies to manage and operate the ramps with optimum performance. Data collected with conventional sensors are prone to errors, especially during congestion. The increased deployment of cameras and recent advancements in artificial intelligence, such as deep learning and computer vision, provides an opportunity to employ traffic surveillance cameras for ramp management. The Utah Department of Transportation intends to utilize the video footage of existing traffic cameras to extract data on ramps. A control strategy for ramp metering using these new technologies is needed to optimize ramp performance.

the **RESEARCH**

Researchers used surveillance camera videos from four locations along Interstate Highway 15 in Utah to develop and evaluate the framework for using object detection and tracking algorithms. Researchers developed the framework by combining object detection and tracking to extract data from the access ramps. The framework uses the videos as input to the framework and determines the highway on-ramp queueing parameters such as queue length and queuing time, which is important information for optimizing signal timing. Additionally, this study provides a detailed implementation plan for the use of computer vision, identifies the optimum locations for camera installations, and defines hardware requirements.

MOUNTAIN-PLAINS CONSORTIUM REGION 8

A University Transportation Center sponsored by the U.S. Department of Transportation serving the Mountain-Plains Region. Consortium members:

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Project Title

Evaluating Different Methods for Estimating Queue Length on Access Ramps

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the FINDINGS

Leveraging computer vision, the framework successfully measured queue length and delay using existing traffic camera footage. Despite the trade-off between processing speed and precision, this study concluded that the 960 X 960 frame size was the most optimal. To validate their approach, results from a retrained object detection model were closely aligned with ground truth values, demonstrating an acceptable level of accuracy. The findings highlight the efficacy of image processing and computer vision in enhancing traffic monitoring systems.

the IMPACT

Utilizing image processing as traffic data extraction will help to eliminate in-road sensors like induction loops and coils. These in-road sensors have higher installation and maintenance costs, and their installation and maintenance often disrupt traffic. These sensors are also prone to errors during traffic congestion. Hence, replacing conventional in-road sensors with existing traffic cameras will minimize installation and maintenance costs and limit traffic disruptions.

For more information on this project, download the Main report at https://www.ugpti.org/resources/reports/details.php?id=1145

For more information or additional copies, visit the Web site at www.mountain-plains.org, call (701) 231-7767 or write to Mountain-Plains Consortium, Upper Great Plains Transportation Institute, North Dakota State University, Dept. 2880, PO Box 6050, Fargo, ND 58108-6050.

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