Researchers 'count cars'—literally—to find a better way to control heavy traffic

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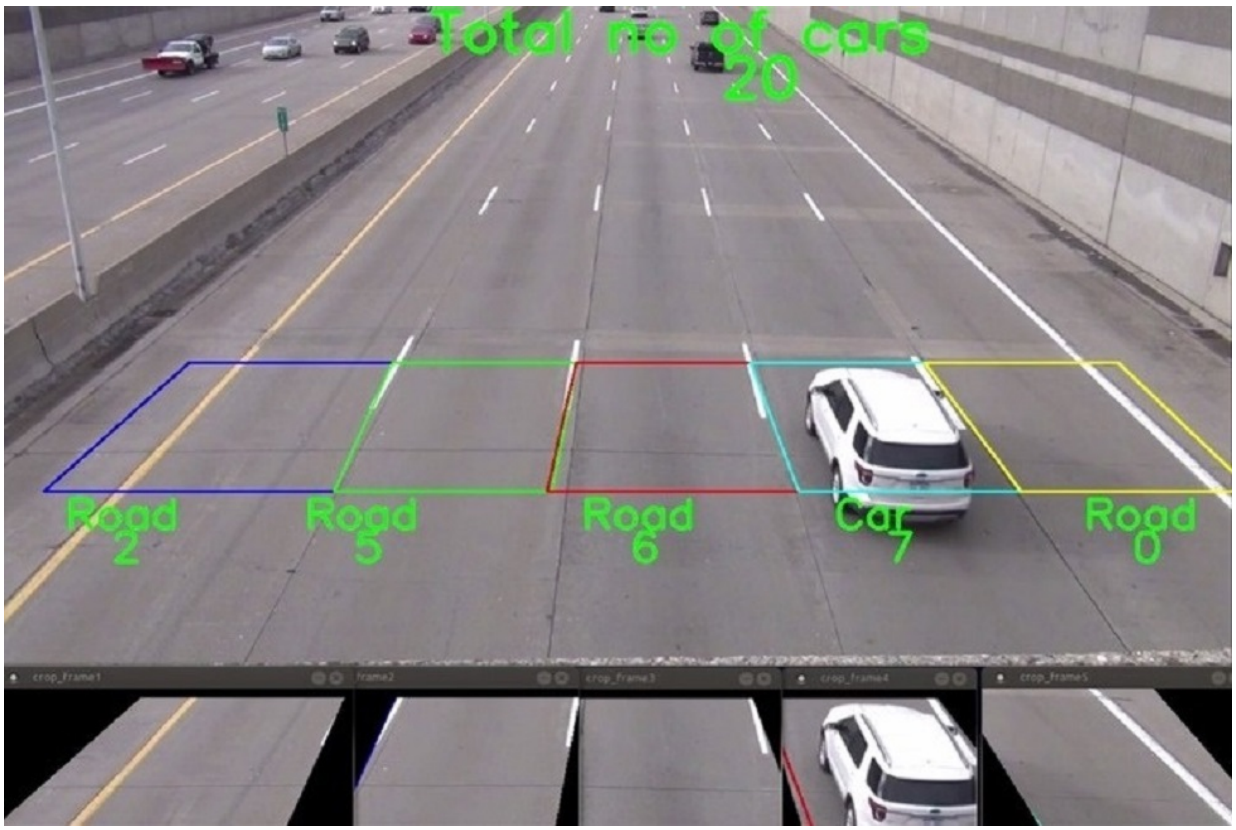

A high-resolution camera is placed under a bridge in South Florida, which contains five through lanes. The cars drive through the regions of interest to be counted. All of the cameras used for this research had a downward inclination and the sides and top were covered with a large camera housing to prevent any major complications with direct sun angles. Credit: Florida Atlantic University

There's "Counting Crows," counting sheep, counting blessings and now researchers at Florida Atlantic University have their own version of "counting cars"—literally—in an attempt to improve traffic flow on South Florida's and our nation's overcrowded roads. And with more than 263 million registered passenger vehicles in the United States and more than 14 million registered vehicles in Florida alone, this is no small feat.

Ensuring that traffic moves smoothly and without a lot of manual intervention requires automated car counting techniques, which are often tedious and cumbersome to perform. They also are not foolproof. Car counting techniques include radar, infrared or inductive loop detectors as well as the use of traffic cameras. A computer vision-based system also can be a suitable alternative for car counting, however, this method is limited to weather conditions and natural light.

In a new study, researchers from FAU's College of Engineering and Computer Science (COECS) set out to find a better way to monitor and estimate traffic flow using intelligent traffic surveillance systems. They wanted to develop an automated car counting system using infrastructure and cameras already in place that could perform well both day and night, and in sunny and cloudy weather conditions.

Results of their study, published in the journal *Sensors*, show that rain or shine, night or day, the system they developed significantly outperformed automated car counting methods currently used. Their system had an average accuracy rate of more than 96 percent, far above the accuracy rates of the old system.

The new program, which the researchers have named "OverFeat Framework," is showing great potential in the field of traffic monitoring and could provide an ideal solution for effectively "counting cars." OverFeat Framework is an effective combination of Convolution Neural Networks (CNN) and image classification and recognition techniques.

The research team, led by Hongbo Su, Ph.D., corresponding author of the study and an assistant professor in the Department of Civil, Environmental and Geomatics Engineering in the COECS, developed and implemented two algorithms for this new program: Background Subtraction Method (BSM) and OverFeat Framework using the Python language for automatic car counting. Su and first author of the study, Debojit Biswas, a Ph.D. student at the University, evaluated the accuracy of this new system by comparing it with manual counting.

"Understanding the physical traffic load is critical for managing traffic as well as for renovating roads or building new roads," said Su. "Counting cars is necessary in order to understand the density of cars on our roads, which ultimately helps engineers and decision makers in their planning and budgeting processes."

While developing and testing this new system, the researchers also took into consideration other factors that might affect the video cameras such as vibrations on bridges and other similar conditions. They studied buses (1,300 images), cars (1,300 images), taxis (1,300 images), trucks (1,568 images) and fire rescue vehicles (1,300 images) using six traffic videos located at some of the busiest roads in South Florida. They collected footage from these cameras at different times during the day.

It is estimated that there are more than 1 million video cameras placed along major roads such as highways, freeways, motorways, expressways as well as arterial roads throughout the U.S. In Florida, there are thousands of cameras placed on busy roadways to help drivers with their everyday commutes.

"The best part of this new system is that you don't need any extra infrastructure because the cameras are already placed at strategic locations on our roads and highways," said Aleksandar Stevanovic, Ph.D., co-author of the study, associate professor of FAU's Department of Civil, Environmental and Geomatics Engineering, and director of the University's Laboratory for Adaptive Traffic Operations and Management. "We are utilizing videos from these cameras to accurately count cars to give us better knowledge about congestion on our roads. Then, we will share this information with traffic management specialists so that they can figure out how best to address the issues to optimize driving, provide new routes and ultimately improve traffic flow."

Su and Stevanovic plan to work with local, state and federal government agencies as well as commercial enterprises to maximize the benefits of the system they developed and ultimately provide a new way of "counting cars."

Provided by Florida Atlantic University

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