Pacific Northwest
NATIONAL LABORATORY

TranSEC uses machine learning and computing to provide a big picture of city traffic to help alleviate congestion.

TRANSEC: TRACKING AND ALLEVIATING URBAN CONGESTION

Machine learning gives big picture of city traffic

PUTTING A CHOKEHOLD ON TRAFFIC BOTTLENECKS

Driving in city traffic can frustrate the most agile of drivers. Bottlenecks and chokepoints cost commuters both time and patience. It's a gut-punch to the economy in the form of millions of dollars in lost productivity. And vehicles stacked one behind the other in traffic, running idle engines, emit harmful pollutants.

Traffic engineers require reliable data to determine a transportation network's congestion state—where bottlenecks occur—and to inform their planning and mitigation response actions. However, publicly available traffic information is often sparse, incomplete, and primarily historical—received long after the fact—and is mostly limited to collision data and isolated traffic counts.

Now, the Pacific Northwest National Laboratory (PNNL) has developed a solution that will help traffic analysts and planners alleviate chokepoints that routinely snarl city traffic. The transportation state estimation capability technology, or TranSEC, is designed to help urban traffic engineers access actionable information about traffic patterns in their cities.

TECHNOLOGY FEATURES

- Full network coverage. Traffic data are obtained from machine learning and computing versus sporadic information, such as isolated traffic counts and collision statistics.
- Portable technology. TranSEC can be applied to any urban area where aggregated traffic data are available.
- Near real-time traffic analysis. The combination of machine learning and computing reduces traffic model creation from hours to minutes.
- Scalable. Used with high-performance computing for full-scale city models, or powerful desktop computers for smaller-scale modeling.

U.S. DEPARTMENT OF ENERGY

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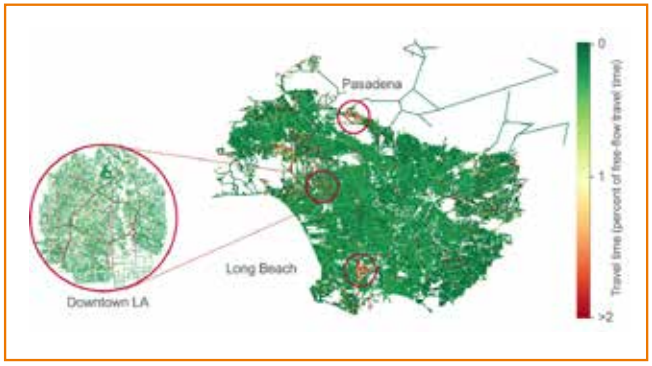

TranSEC's near real-time display of traffic state estimation in the entire Los Angeles Metro Area at 6 p.m. on a weekday. This display was computed in less than one hour. Green areas indicate traffic is flowing freely and yellow and red areas indicate congestion.

A MODEL APPROACH FOR REACHING YOUR DESTINATION

Maps on smart phones can help an individual driver navigate through city streets, pointing out chokepoints and suggesting alternate routes. But sometimes a route that appears efficient for one driver leads to too many vehicles trying to access roads that weren't designed to accommodate that volume of traffic.

Enter TranSEC, a licensable tool that uses public traffic datasets at multiple aggregation levels to estimate street-level traffic flow over time. The data create a big picture of city traffic using a combination of machine learning and computing techniques.

The technology is different from other traffic monitoring methods due to its ability to analyze and complete the state of a regional transportation network using sparse and incomplete traffic information.

It uses machine learning to connect segments with missing data, and that allows it to make near real-time street-level estimations over a large metropolitan area. The machine learning feature means that as more data are acquired and processed, the technology becomes more refined and useful over time.

Graph-based models paired with novel sampling methods and optimization engines provide data about travel times and routes. TranSEC can be easily extended to support users uploading new data and thereby obtain revised estimates. Engineers can use short-term forecasts to inform traffic management decisions. The approach is also extensible to include weather or other conditions that affect roadway's capacity.

The second piece, computing, is used to run the traffic estimation models. While commodity computing resources are required to run a full-scale city model, TranSEC is scalable—for example, a road network with only the major highways and arterials could be modeled using only a powerful desktop computer.

TranSEC is portable and can be used in any urban traffic scenario where aggregated data are available. In one study, the PNNL development team paired TranSEC with public data from the entire 1,200-square-mile Los Angeles metropolitan area. The result—a reduction of the time needed to create a traffic congestion model from days to a fraction of an hour.

INDUSTRY APPLICATIONS

TranSEC can be used by traffic engineers, analysts, and planners for assessing road conditions, such as traffic patterns, and making decisions to address traffic challenges and concerns.

Although TranSEC can be used by traffic operators to create timely transportation system-state estimates for increased situational awareness of real-time congestion and traffic patterns, it can also be used by, for example, the Department of Transportation (DOT) for traffic planning and management needs. With appropriate extensions, DOT can also use the tool for data-informed signal management optimization, incident response, and emergency management. TranSEC's advanced data fusion approaches would also improve situational awareness within transportation management centers.

Beyond roadway traffic, the technology can be extended to other modes of traffic, such as transit and freight traffic. The team is working to extend TranSEC to other metropolitan areas nationwide.

AVAILABLE FOR LICENSING

The core technology is available for licensing in all fields of use. You can view all of PNNL's market-changing intellectual property at pnnl.gov/available-technologies.

LET'S CONNECT

If you have questions, regarding this technology, please send inquiries to commercialization@pnnl.gov. You can view all PNNL technologies available for licensing at www.pnnl.gov/available-technologies.