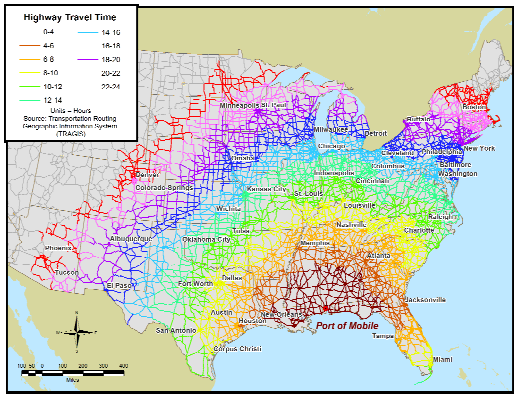
OAK RIDGE NATIONAL LABORATORY FACT SHEET
MANAGED BY UT-BATTELLE FOR THE DEPARTMENT OF ENERGY

Geographic Information Science and Technology

Transportation Security and Safety Assurance Based on Multi-sensor Anomaly Detection

According to a report entitled "*When trucks stop, America stops*" by the American Trucking Association, trucks account for 70% of all freight transported in the country, which translates to $671B worth of goods transported within the US alone, besides $295B and $195B in truck trade with Canada and Mexico respectively. Thus, assuring safety and security of trucks in the nation's highways is critical to our economic well-being. Truck weigh stations along the interstates offer an ideal venue for safety and security checks as long as decisions about each truck can be made in a fast and reliable manner. As test-cases, a few weigh stations have been equipped with multiple sensors ranging from static or weigh-in-motion scales to radiation detection portals as well as a wide array of cameras and RFID sensors. Law enforcement officers at the weigh stations make decisions regarding the plausible safety or security hazard posed by each truck, whether in terms of brake malfunctions or even illicit radioactive materials for dirty bombs hidden within naturally occurring radioactive materials. Missed detection may cause highway accidents or terror attacks, while false alarms may lead to disruption of commerce.



Highway travel times from Mobile, AL

We developed a set of novel knowledge discovery methods which used the heterogeneous information obtained from disparate sensors to produce multivariate characterization of trucks. The methods have demonstrable value for producing a baseline of usual behavior for the trucks and hence delineating unusual behavior or anomalies. An offline knowledge discovery component mined massive volumes of truck data to develop the baseline while an online discovery component probabilistically delineated a new truck as normal unusual. The data-guided probabilistic methods were complemented with known deterministic behavior (e.g., signatures of specific nuclear isotopes or known weight profiles). There was a provision for continuous improvement of the baseline and reduction of false alarms, both by online learning from data, as well as from human inputs following manual inspections. The knowledge discovery methodologies have general applicability for delineating anomalies or unusual behavior from disparate and multi-sensor data.

References

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Point of Contact:
Auroop R. Ganguly, Ph.D.
Oak Ridge National Laboratory, (865) 241-1305
gangulyar@ornl.gov; www.ornl.gov/gist

OAK RIDGE National Laboratory