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New Insights from Satellite Data Show the Impact Trucks are Having on Communities in Southern California

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Issue

The rapid growth in freight transportation, particularly heavy-duty trucks, poses significant environmental and public health challenges for communities near major ports and freeways. In areas such as those near the Port of Los Angeles and the I-710 corridor, communities are exposed to elevated levels of air pollution, noise pollution, and associated health risks. Traditional traffic data collection methods primarily concentrate on gathering traffic volume data for freeway segments or smaller areas, often overlooking heavy-duty vehicles across roadway networks and in local communities.

To better understand the environmental impact and spatial distribution of heavy-duty truck traffic, we employed a deep learning approach to analyze satellite imagery and publicly accessible spatial data. This approach allowed us to identify and categorize heavy-duty trucks and shipping containers along critical freight routes and analyze impacts on adjacent communities.

Key Research Findings

High resolution satellite data are useful in identifying on and off-road truck distribution. By using machine learning methods, truck types and their corresponding locations can be detected on satellite images with a 50 cm (20 inches) resolution with reasonable accuracy. This capability facilitates the detection of trucks along the entire roadway network, particularly surface streets, which have been underrepresented in research due to the scarcity of detailed data.

Heavy-duty truck density is significantly higher in disadvantaged communities. We integrated truck density estimates with the metrics of CalEnviroScreen, a tool used to measure pollution and other environmental hazards in communities. We found that disadvantaged communities around the Ports of Los Angeles and Long Beach have an average heavy-duty truck density approximately three times greater than non-disadvantaged areas, with values reaching 334.9 trucks per square mile compared to 88.5 in non-disadvantaged communities.

Truck density correlates with environmental pollution burden. We found moderate correlations between truck and container density and CalEnviroScreen indicators of environmental pollution, including pollution burden score, hazardous waste, underground water tank leaks, water pollutants, and solid waste. These correlations imply that regions with higher truck and container densities might face elevated exposure to adverse environmental risks. Additionally, areas with high unemployment rates also have more truck and/or container density, suggesting a link between truck-related activities and socioeconomic factors. These results, likely stemming from historical land use policies that led to the concentration of undesirable or environmentally hazardous facilities in these areas,

underscore the urgent need for targeted mitigation policies to reduce heavy-duty truck density and its impacts in disadvantaged communities.

More Information

For detailed findings and illustrative graphics, refer to the full report "A Deep-Learning Approach to Detect and Classify Heavy-Duty Trucks in Satellite Images" prepared by Jun Wu, Ph.D., with the University of California, Irvine. The report can be found at www.ucits.org/research-project/rimi-5i. For additional information or inquiries, please contact Jun Wu at junwu@hs.uci.edu.

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