

Predicting Bicycle Volumes Using Machine Learning

Sirisha Kothuri, Banafsheh Rekabdar, Joe Broach

In a series of research projects funded by the National Institute for Transportation and Communities (NITC), researchers have been developing new approaches that combine conventional and emerging data sources to estimate bicycle volumes. Having accurate bicycle volumes can help state departments of transportation (DOTs) and other agencies to prioritize projects, plan and design new bicycle infrastructure, and conduct safety analyses.

Traditional permanent and short-term counting methods have a high degree of accuracy but are limited to certain locations or short periods of time, while crowdsourced data (such as Strava or StreetLight) can cover a wider area but with less accuracy. Fusing the two methods together—potentially with the use of deep learning algorithms—is a promising way to get the best of both.

The latest report to come out of these efforts, by Sirisha Kothuri and Banafsheh Rekabdar of Portland State University, pushed the needle forward on using advanced techniques to extrapolate data over a large transportation network. Two PSU graduate students also worked on the project: Saba Izadkhah, who is working toward a PhD in computer science, and Andrew Wagner, a computer science masters student.

“These methods are still evolving, and it’s still in the research phase. But I think the time is not far off when we will start using these methods as more mainstream,” Kothuri said.

The techniques have been continually developed and refined since this work first began in 2018. At that time, NITC launched a pooled fund project with support from the DOTs of Oregon, Virginia, Colorado, Utah, and the District of Columbia, as well as Central Lane MPO and the Portland Bureau of Transportation. With matching funds from NITC, those

agencies came together to fund the initial project Exploring Data Fusion Techniques to Estimate Network-Wide Bicycle Volumes, with a research team led by Kothuri made up of researchers from PSU and the University of Texas at Arlington.

The new NITC report published this month, *Improving the Accuracy and Precision of Bicycle Volume Estimates Using Advanced Machine Learning Approaches* ([link](#)), shows that the latest models offer increased accuracy. A paper based on this work was presented at the Institute of Electrical and Electronics Engineers’ International Conference on Artificial Intelligence x Science, Engineering and Technology at the beginning of October.

“We know that for pedestrians, injuries and fatalities are at an all time high. Bicyclist safety is also of top concern. So these estimates are really critical for agencies right now,” Kothuri said.

HOW DOES IT WORK?

The researchers train the model on existing count data from certain locations, then use that trained model to predict volumes at locations where there is count data that the model hasn’t seen. They then compare the model’s predictions with the actual count data to see how accurate it is.

Using long short-term memory networks and deep neural networks, the method involves the combining of static variables—such as network characteristics, demographics, and land use— with dynamic crowdsourced data and count data from different regions.

The research has shown that crowd-sourced data alone cannot replace traditional count data. In order for this method to work, you need both.

Regional data is key to the success of the model: the more local count data you have, and the more you can train the model to predict based on the local data, the better the accuracy will be.

The model also fared better when using Monthly Average Daily Bicyclists (MADB) as a target, rather than Annual Average Daily Bicyclists (AADB), because breaking each counter down into monthly units gave it more data points.

“Basically, the more data it has, the smarter it gets,” said Rekabdar.

ABOUT THE AUTHORS


The research team consisted of Sirisha Kothuri, Banafsheh Rekabdar, Joe Broach, Saba Izadkhah, and Andrew Wagner of Portland State University.

ABOUT THE FUNDERS

This research was funded by the National Institute for Transportation and Communities.

THE REPORT and RESOURCES

For more details about the study, download the full report “Improving Accuracy and Precision of Bicycle Volume Estimates Using Advanced Machine Learning Approaches” at nitc.trec.pdx.edu/research/project/1614

 The National Institute for Transportation and Communities (NITC) is one of seven U.S. Department of Transportation national university transportation centers. NITC is a program of the Transportation Research and Education Center (TREC) at Portland State University. This PSU-led research partnership also includes the Oregon Institute of Technology, University of Arizona, University of Oregon, University of Texas at Arlington and University of Utah.

