

Road features that predict crash sites identified in new machine-learning model

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Issues such as abrupt changes in speed limits and incomplete lane markings are among the most influential factors that can predict road crashes, finds new research by University of Massachusetts Amherst

engineers. The study then used machine learning to predict which roads may be the most dangerous based on these features.

[Published](#) in the journal *Transportation Research Record*, the study was a collaboration between UMass Amherst civil and environmental engineers Jimi Oke, assistant professor; Eleni Christofa, associate professor; and Simos Gerasimidis, associate professor; and [civil engineers](#) from Egnatia Odos, a publicly owned engineering firm in Greece.

The most influential features included road design issues (such as changes in [speed limits](#) that are too abrupt or guardrail issues), pavement damage (cracks that stretch across the road and webbed cracking referred to as "alligator" cracking), and incomplete signage and road markings.

To identify these features, the researchers used a dataset of 9,300 miles of roads across 7,000 locations in Greece. "Egnatia Odos had the real data from every highway in the country, which is very hard to find," says Gerasimidis.

Oke, who, with Christofa, is also a faculty member in the UMass Transportation Center, suspects the findings may stretch well beyond Greek borders.

"The problem itself is globally applicable—not just to Greece, but to the United States," he says. Differences in road designs may influence how variables rank, but given the intuitive nature of the features, he suspects that the features themselves would be important regardless of location.

"The indicators themselves are universal types of observations, so there's no reason to believe that they wouldn't be generalizable to the US." He also notes that this approach can be readily deployed on new data from

other locations as well.

Importantly, it puts decades of road data to good use: "We have all these measures that we can use to predict the crash risk on our roads, and that is a big step in improving safety outcomes for everyone," he says.

There are many future applications for this work. For starters, it will help future research home in on the important features to study. "We had 60-some-odd indicators. But now, we can just really focus our money on capturing the ones that we need," says Oke. "One could dig deeper to understand how a certain feature actually could contribute to crashes," and then measure to see if fixing the issue would actively reduce the number of incidents that occur.

He also envisions how this could be used to train AI for real-time road condition monitoring. "You could train models that can identify these features from images and then predict the [crash risk](#) as a first step towards an automated monitoring system and also provide recommendations on what we should fix," he says.

Gerasimidis adds that this is an exciting, real-world application of AI. "This is a big initiative we are doing here, and it has specific engineering outcomes," he says.

"The purpose was to do this AI study and bring it up to [Greek] officials to say 'look what we can do.' It is very difficult to use AI and come up with specific results that could be implemented, and I think this study is one of them. It is now up to the Greek officials to utilize these new tools to mitigate the huge problem of car crash fatalities. We are very eager to see our findings lead to improving this problem."

"This work could serve as the roadmap for future collaborations between academics and engineers on other topics," he adds. "The mathematical

tools along with real data consist of a truly powerful combination when looking at societal problems."

More information: Dimitrios Sarigiannis et al, Feature Engineering and Decision Trees for Predicting High Crash-Risk Locations Using Roadway Indicators, *Transportation Research Record: Journal of the Transportation Research Board* (2024). [DOI: 10.1177/03611981231217497](https://doi.org/10.1177/03611981231217497)

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