How Toyota Research Institute is Working With Autonomous Technology With The Goal of Helping to Keep People Safe on the Road

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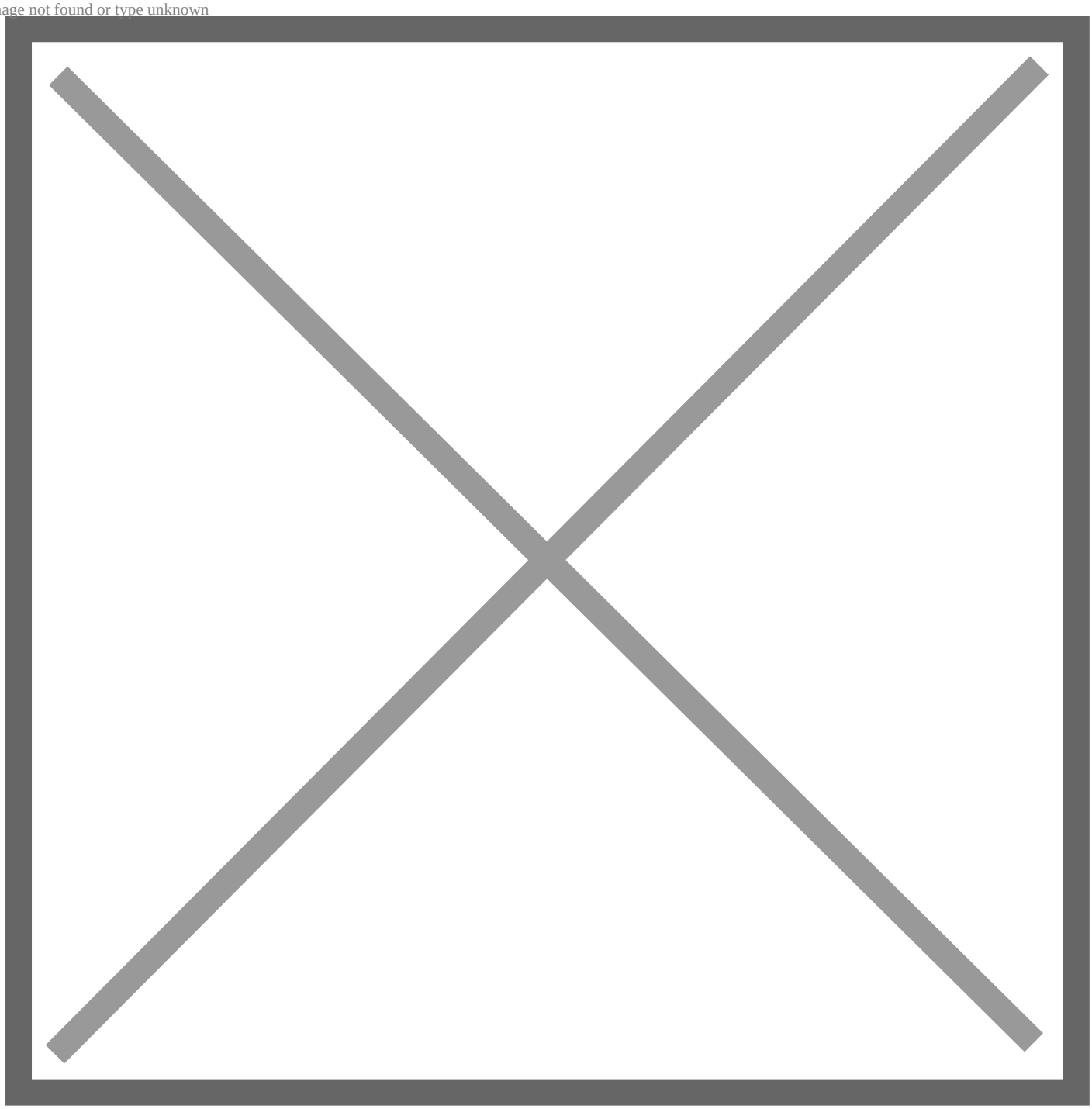
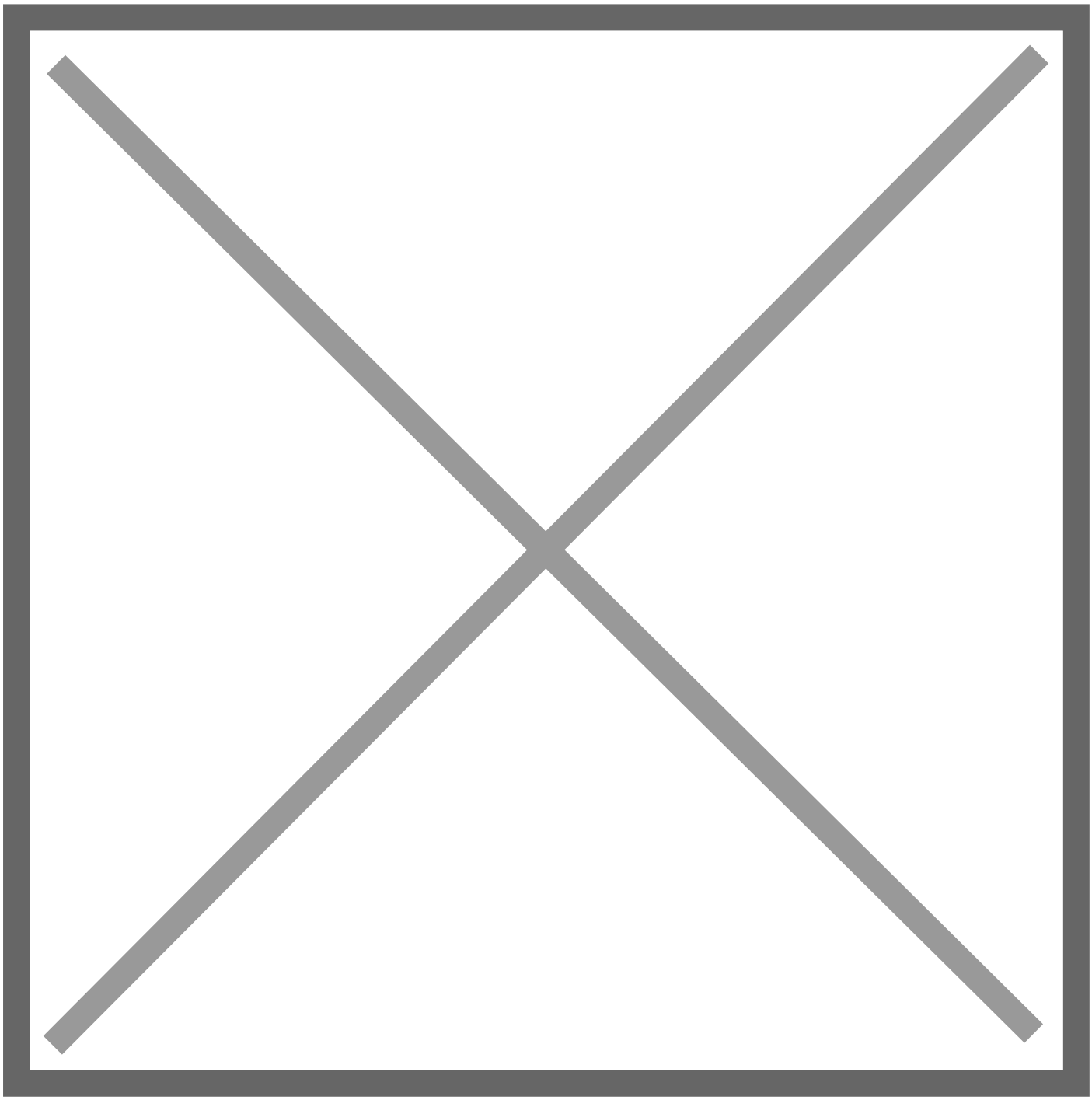


Professional drivers have a deep understanding of how to control a vehicle during critical moments on a closed course. But what if a vehicle came equipped with the technology to utilize techniques like controlled drifting to navigate obstacles or hazardous road conditions? That's the idea behind the latest innovation in autonomous technology by Toyota Research Institute (TRI).

"Through this project, we are expanding the region in which a car is controllable," says Avinash Balachandran, director of the Human Interactive Driving division at TRI. "The goal is to give regular drivers the instinctual reflexes of a professional race car driver to be able to handle the most challenging emergencies."

TRI successfully programmed a Toyota Supra to autonomously drift around obstacles on a closed course. Drifting occurs when the driver purposefully loses traction in the rear, destabilizing the vehicle. Mastering this skill could one day help in real-world situations when traction is instead lost due to difficult road conditions like black ice or swerving to avoid an obstacle.

"At TRI, our goal is to use advanced technologies that augment and amplify humans, not replace them," says Balachandran. "We're looking at how to control the car and the entire spectrum of its performance, and then really build technologies that incorporate expert-driver skills into how regular drivers drive."



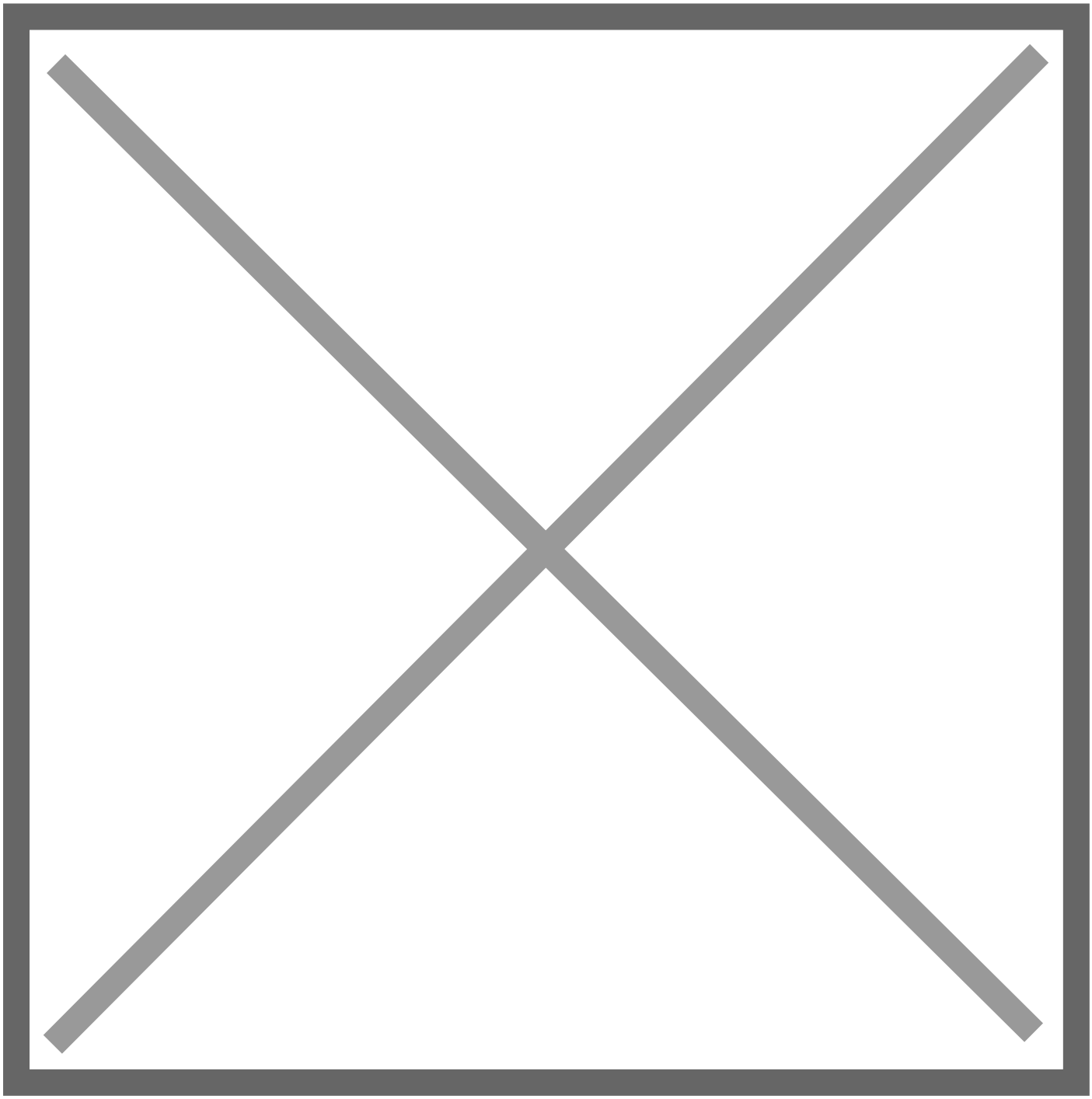
Catching the Drift

Each year, there are thousands of crashes in the U.S. and millions around the world. Avoiding an accident may need rapid maneuvers that take vehicles close to — or beyond — the traditional limits of handling.

However, learning to control a drift is quite difficult, and very different from normal driving. Most drivers may never face this situation, and even if they do, they won’t have the hours of practice and deep understanding of vehicle dynamics that the pros do.

Being able to handle a drift requires the ability to balance all these different objectives up to the very limits of a vehicle's capabilities. To give drivers that understanding, TRI engineered its vehicles with a control algorithm that enables it to plot a course around obstacles and autonomously drift around them.

"In many ways, the hardest aspect of controlling a car is when it's drifting," says Balachandran. "When the software takes over, the vehicle is actually fully in control even though it's doing a very aggressive and really hard-to-control maneuver."



Development Down the Road

The on-demand autonomy project began over a year ago, when TRI and the Dynamic Design Lab at Stanford University set out to establish a new level of active safety. Ultimately, research scientists at TRI like Jonathan Goh, working in collaboration with leading researchers at Stanford University, developed novel implementations of Nonlinear Model Predictive Control (NMPC) approach to extend the vehicle's operations to the very limits of its performance.

"We develop algorithms that can autonomously control the vehicle in critical-limit handling situations," says Goh.

According to Goh, every twentieth of a second, the vehicle calculates a new trajectory to balance the car gracefully as it goes around the track. In the future, the idea is for the software to be able to recognize difficult driving situations and help the driver react in real time.

"When it all comes together and the car does something truly impressive," Goh says, "it really seems like we're getting a glimpse into the future."

For more information on this research milestone, please visit here.