Parallel planning teaches self-driving cars to respond quickly to emergencies

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Video Abstract

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Abstract

Researchers have developed a new method for teaching self-driving cars how to respond to emergencies. Unlike other approaches, which teach cars to respond according to hard and fast rules, this new method trains onboard computers to react like humans do. That unique ability could make self-driving cars vastly quicker at recognizing and avoiding potential accidents. Human drivers react instinctively to road hazards—whether that’s a car that brakes suddenly or a cyclist who rushes into traffic. It’s an ability that comes from years of experience and one that’s often taken for granted. As AI experts have learned, teaching computers to do the same is notoriously difficult. Rule-based methods provide basic functionality. But they tend to be very time-consuming and can’t account for unforeseen emergencies—two tremendous liabilities for self-driving cars. To remedy that, the research team, with members hailing from China, Germany, and Canada, built a self-driving algorithm in three parts: a data-generation component, a planning model, and an emergency response model. The first part gathers real driving data from sensors mounted on a vehicle operated by a human driver and virtual data gathered from a driving simulator run in demo mode. The planning model is trained on all of the collected data, mimicking the movements of both the human driver and the simulator’s own AI. Initial steering tests showed that the model could well reproduce the AI’s driving performance along a stretch of virtual road. All the while, the emergency response model generates multiple emergency scenarios based on cues picked up during real or simulated driving. The model does so by creating video clips that play out an emergency caused by each object recognized as hazardous. Pre-trained on various scenarios, the model can choose the best course of action to evade danger. That information is then fed back into the planning model to complete the circuit. It’s an incredible amount of data to have to process on the fly. Fortunately, the onboard computer doesn’t have to do it all by itself. Part of the work is done in the cloud by a remote supercomputer. That allows for lightning-quick reflexes that other models don’t have. Tests on a real self-driving car are still needed to determine how this parallel planning approach will fair under actual driving conditions. But given its added emergency response functionality, the method could be more human-like and therefore safer than current self-driving algorithms.