Vehicle Action Prediction with Artificial Intelligence: An Innovative Way to Transform Advanced Driver Assistance Systems from Reactive to Proactive

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Each year, car accidents on United States roadways claim 37,000 lives and injure 2 million others. 47% of these incidents involve a combination of two critical pre-crash events: turning and changing lanes. Advanced Driver Assistance Systems (ADAS) that are currently installed in vehicles provide reactive protections that warn drivers of dangers up to 0.5 seconds ahead of collisions. However, rule of thumb suggests 2 seconds for safety in emergency reactions. Many lives could be saved even with a slight improvement to the warning time. This project develops an innovative artificial intelligence methodology that predicts drivers' actions before fatal collisions can occur. In a novel procedural flow, data is collected from sensors and devices installed inside and outside the vehicle including two cameras, a Global Positioning System (GPS) module, an Onboard Diagnostics-II (OBD-II) interface, and a gyroscope, preprocessed with a Convolutional Neural Network-based (CNN) computer vision model to extract facial movements and rotation, filtered and selected with the Classification and Regression Tree (CART), and modeled with a Recurrent Neural Network with Long Short-Term Memory (RNN-LSTM). The researcher-generated dataset totaled to 20 GB in size and will be available on GitHub for public research use. Results showed that the proposed methodology can predict driver actions up to 2 seconds ahead, which is an adequate amount of time for drivers to react in emergency situations. A piece of software was created to simulate real-time driver action predictions. This system, when integrated with existing ADAS, is estimated to be capable of saving an additional 8,000 lives per year.

Awards Won:
Third Award of $1,000
Association for Computing Machinery: First Award of $4,000
National Security Agency Research Directorate : First Place Award "Cyber Pioneer" of $1000