Project no.: 42045 **Confirmation no.: S249D7F**

Eyes on the Driver:
A Deep Learning Approach to Detecting Distracted Driving

Abstract

Distracted driving is dangerous and difficult to monitor. Timely detection of those behaviors is critical to mitigating injury and fatalities. But that is always a challenge. This project creates an AI model that allows distracted driving detection from an image of the driver alone, which provides a solution to let the car alert the driver of their dangerous behavior. The model is a lightweight Convolutional Neural Network that has been trained with over 13,000 images in 10 different categories. The model has classification accuracies of over 90% and has been fine-tuned to adapt to real world conditions to be as effective as possible in actual cars.

Purpose & Background:
The growing numbers of distracted drivers are becoming a heavy workload for human police to handle or detect on their own. That is why AI should step in. The purpose of this project was to develop an optimal well-trained convolutional neural network (CNN) that is able to detect when a driver is distracted by analyzing an image taken inside the vehicle, with considerable accuracy and efficiency.

Methodology & Data Collection:
The project was to create a prototype distraction detector using a CNN. The CNN has been designed, trained, fine-tuned, and tested with over 13,000 images in 10 categories that were captured with in-vehicle cameras by State Farm insurance company. The CNN has been designed in a way that it's relatively lightweight in terms of parameters and neural layers. In order to improve the CNN's reliability in real world settings, static, rotations, and shifts were added to the images to challenge and train the CNN.

Finding and Results:
The lightweight CNN was efficient in terms of speed and memory, achieving an accuracy of over 95%. While accuracy did drop when introducing static and rotation, it was still able to achieve 86% accuracy. My highly efficient model has a significantly lower number of parameters and layers yet produces image processing accuracy that is comparable to some other models. This also meant the model was very fast to train. While the CNN didn't always function perfectly, the project did succeed in delivering a prototype to monitor drivers and therefore issue warning when needed. In order to further understand how the model learned, various visualization techniques were applied. This procedure could be extended to achieve more optimal configurations in the future.

Summary and Conclusion:
The experimental CNN can detect distracted driving with high accuracy and efficiency. Even in challenging conditions, it still functions well, though with reduced accuracy. The lightweight design has great potential for implementation in real vehicles, in the hope that AI detection of distracted driving could help keep our roads safer.