SafeDriveAI: Real-time Distracted Driving Detection with AI-powered Facial Analysis

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VIP: Transformative AI for Transportation Safety

Abstract

Our project seeks to develop a deep learning model capable of detecting whether or not a driver is distracted and implementing it in a live feed camera which can give appropriate alerts to the driver.

Background

- In 2022, 8% of fatal crashes, 12% of injury crashes, and 11% of all police-reported motor vehicle traffic crashes were reported as distraction-affected traffic crashes (NHTSA).
- In 2022 there were 3,308 people killed and an estimated additional 289,310 people injured in motor vehicle traffic crashes involving distracted drivers (NHTSA).
- Drivers tend to respond better to bimodal alerts—alerts given in two modalities (e.g. tactile and auditory) (Bridget et al.).

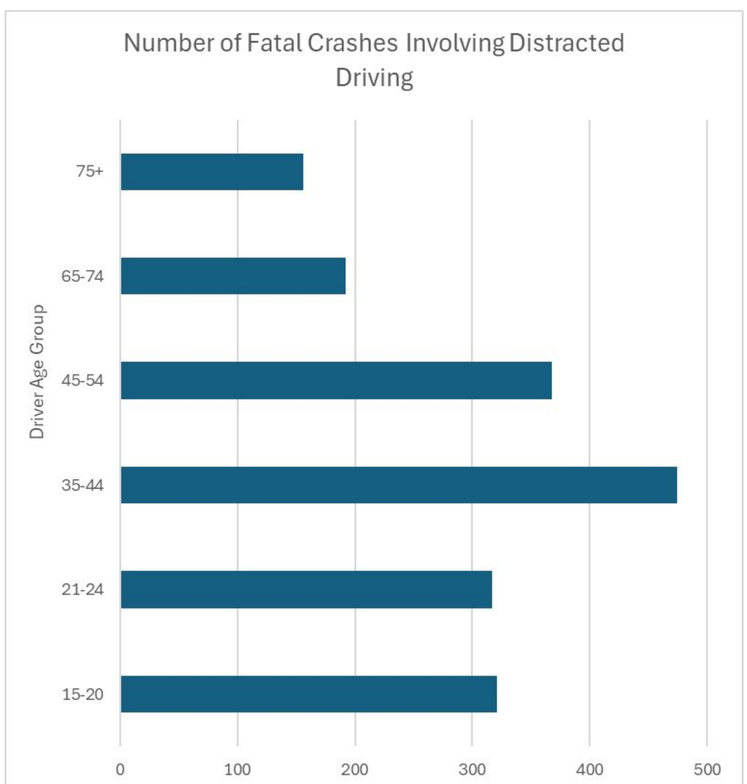

Figure 1: Age Distribution of Distracted Driving Fatalities in 2020

Figure 2: Sample pictures of distracted drivers from the dataset used to train the CNN model

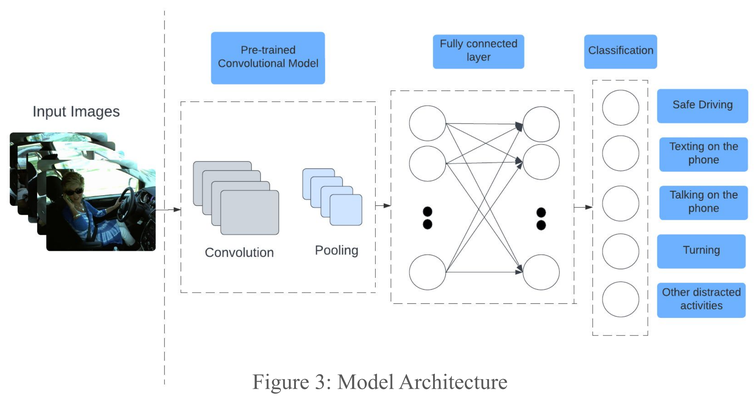

Figure 3: Model Architecture

Methodology

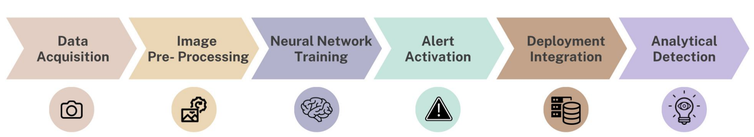

Figure 4: Methods

- **AI Model Framework:** Utilized TensorFlow and Keras to develop a Convolutional Neural Network (CNN) for real-time facial analysis, aimed at detecting driver distractions.
- **Data Processing:** Trained the CNN using a comprehensive dataset featuring diverse driving behaviors to ensure robust and accurate classification results.
- **Alert System:** Created a Python script that generates real-time safety alerts based on the AI model's classification, aiming to seamlessly integrate it into the vehicle's onboard system.

Conclusion

Our deep learning model classifies driver behavior into five distinct categories to accurately detect distraction levels. Depending on the severity of distraction identified, the system issues tailored alerts to the driver, ensuring immediate attention and corrective action. This proactive approach significantly enhances driver safety by mitigating risk behaviors in real time.

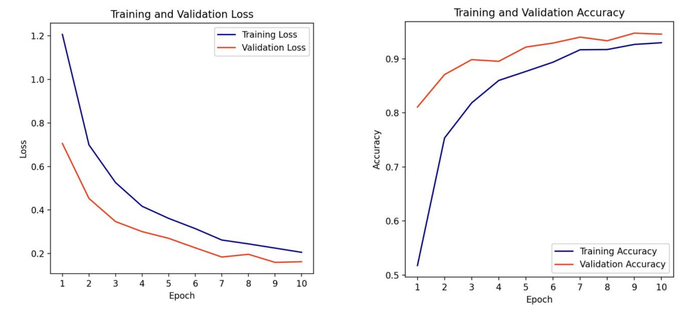

Figure 5: Training and Validation Loss and Accuracy of the Distracted Driver Detection Model

Future Plans

- **Dash Camera:** Implement algorithms to process live camera footage captured from BlackVue webcam's Cloud API.
- **Model Deployment:** Import model to analyze the images processed in the dash camera.
- **UI and UX:** Determine bi-modal feedback for active user attention and user-friendly display so not to harshly disturb driver.
- **Field Testing:** Collaborate with multidisciplinary team to test model in the field with listed driving behaviours and improve model performance.
- **Incentive Program:** Develop a rewards system to promote safe driving habits, incentivizing attentive and focused driving behavio

References

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