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AI Based Driver Fattigue and Distraction Detection

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Abstract: *This paper presents a novel and highly effective approach to AI-based driver drowsiness and fatigue detection, addressing a critical public safety issue that contributes significantly to traffic accidents worldwide. The methodology employs a specialized evolutionary optimization technique, where a genetic algorithm (GA) is utilized for Neural Architecture Search (NAS) to derive an optimal structure for a convolutional neural network (CNN). This architecture is initially optimized on the large-scale FER-2013 emotion recognition dataset. Subsequently, the model is fine-tuned for the specific task of drowsiness detection using transfer learning on a custom-generated dataset that was meticulously curated to capture diverse driver states.*

The core contributions of this research are multi-faceted: it demonstrates the efficacy of a GA-based architectural optimization for a highly specific, safety-critical computer vision task; it introduces a new, diverse dataset specifically designed to address shortcomings in existing data; and it leverages the principles of transfer learning to enhance model performance by building upon pre-existing knowledge. The results indicate that the proposed method surpasses other leading approaches, achieving a state-of-the-art accuracy rate of approximately 99.8%. Furthermore, the model demonstrates near-perfect performance on critical safety metrics, including 100% Sensitivity (True Positive Rate) and 100% Negative Predictive Value, when compared against several well-established pre-trained networks such as VGG, ResNet, MobileNet, and GoogleNet. This comprehensive analysis underscores the potential of this methodology to significantly enhance road safety.

Keywords: Driver Drowsiness Detection, Convolutional Neural Network (CNN), Neural Architecture Search, Genetic Algorithm

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