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Enhancing Road Safety for Motorcyclists: A Modified Helmet with Live Monitoring of Eye Aspect Ratio for Driver Drowsiness Detection

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Abstract

Driver fatigue and drowsiness contribute to more than 20% of reported road accidents worldwide, with motorcyclists being particularly vulnerable. To address this issue, this study proposes a modified helmet with innovative features aimed at detecting and preventing rider drowsiness. To estimate driver drowsiness, the study utilizes various techniques, such as monitoring biomedical signals, visually assessing the driver's bio-behaviour through facial images and observing the driver's performance. The proposed algorithm focuses on live monitoring of the Eye Aspect Ratio (EAR) using image processing techniques. High-definition live video is decomposed into continuous frames, and facial landmarks are detected with a pre–trained neural network based on Dlib functions, trained using the HAAR Cascade algorithm. The image processing library, OpenCV, plays a key role in this algorithm's implementation, which is carried out in Python. By calculating the EAR and continuously monitoring it against a predetermined threshold value, the algorithm can detect blinks and micro-sleep episodes. The detected blinks and the level of drowsiness are displayed on the monitor screen, accompanied by a vibration warning for micro-sleep detection. In conclusion, this study presents an effective algorithm that leverages live monitoring of the EAR through image processing techniques to estimate driver drowsiness. Its implementation demonstrates promising results in identifying blinks, assessing drowsiness levels, and providing timely warnings to mitigate the risks associated with driver fatigue and drowsiness, thereby enhancing road safety for motorcyclists.

Keywords: *Motorcycle accidents, Bio-behaviour analysis, Neural network, OpenCV, Eye aspect ratio*