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DrivEmo: A Novel Approach for EEG-Based Emotion Classification for Drivers

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Electroencephalogram (EEG) based emotion recognition approaches have proven to be successful with the latest technologies, and therefore, driver emotion recognition is also being widely discussed for enhancing road safety. This paper reveals a unique approach to driver emotion recognition for the calm, fear, sad, and anger emotional states where calm is the desired state of mind while driving. Emotiv EPOC X 14 channel EEG headset is utilised for the EEG collection, and ten subjects are involved in the experiment. EEG preprocessing of the collected EEG data is done using the EEGLAB toolbox in Matlab. EEG feature extraction is performed using Matlab, and feature selection and classification model training is done using the Classification Learner app in Matlab. ANOVA and ReliefF are employed as the feature selection algorithms, and Support Vector Machine (SVM) and Naïve Bayes classifiers are utilised for the emotion classification. The outcomes reveal that the highest mean accuracy of 95% is achieved from the Coarse Gaussian SVM classifier, while the lowest mean accuracy of 85% is obtained from the Fine Gaussian SVM classifier detecting the calm, fear, sad, and anger emotional states. In addition, all the other trained classifier models have an accuracy between 85% and 95%. Therefore, the findings suggest that the proposed EEG-based implementation approach of an emotion classification model for drivers is highly successful and can be employed in future research in the paradigm of driver emotion recognition as well. Besides, this research presents a critical literature review concerning critical aspects of EEG- based emotion recognition research.

Keywords: *EEG, emotion recognition, feature extraction, feature selection, road safety*