

ABSTRACT

Driver fatigue is still one of the main causes of increasing traffic accident risk frequency. Early detection of driver fatigue is essential to prevent the risk of accidents. However, conventional approaches in fatigue classification often have difficulty in capturing temporal patterns of facial expressions and are highly dependent on model configuration and data quality. This study aims to develop a driver fatigue classification model based on facial features using Long Short Term Memory (LSTM) with an attention mechanism and hyperparameter optimization through Optuna. Data is obtained through video recording of the driver's face in normal and fatigued conditions, then processed through landmark tracking extraction to produce features such as Eye Aspect Ratio (EAR), Mouth Aspect Ratio (MAR), gaze direction, head rotation, and PERCLOS. The model is developed and tested through four experimental scenarios: comparison of standard and attention-based LSTM models, with and without Optuna tuning, and compared to other baseline models such as CNN and Bi-LSTM. The experimental results show that the LSTM-Attention model tuned with Optuna achieves the highest validation accuracy of 97.84% and the lowest loss of 0.08, superior to all comparison models. This study proves that the integration of attention mechanisms and hyperparameter tuning significantly improves the performance and interpretability of the image-based driver fatigue detection system.

Keywords: LSTM, Attention Mechanism, Hyperparameter Tuning, Optuna, Driver Fatigue, Landmark Tracking