Canadian Association of Road Safety Professionals (CARSP)/La Prévention Routière Internationale (PRI) 2021 Joint Virtual Conference

Identifying Driver Drowsiness Caused by Mental Fatigue Using Convolutional Neural Network

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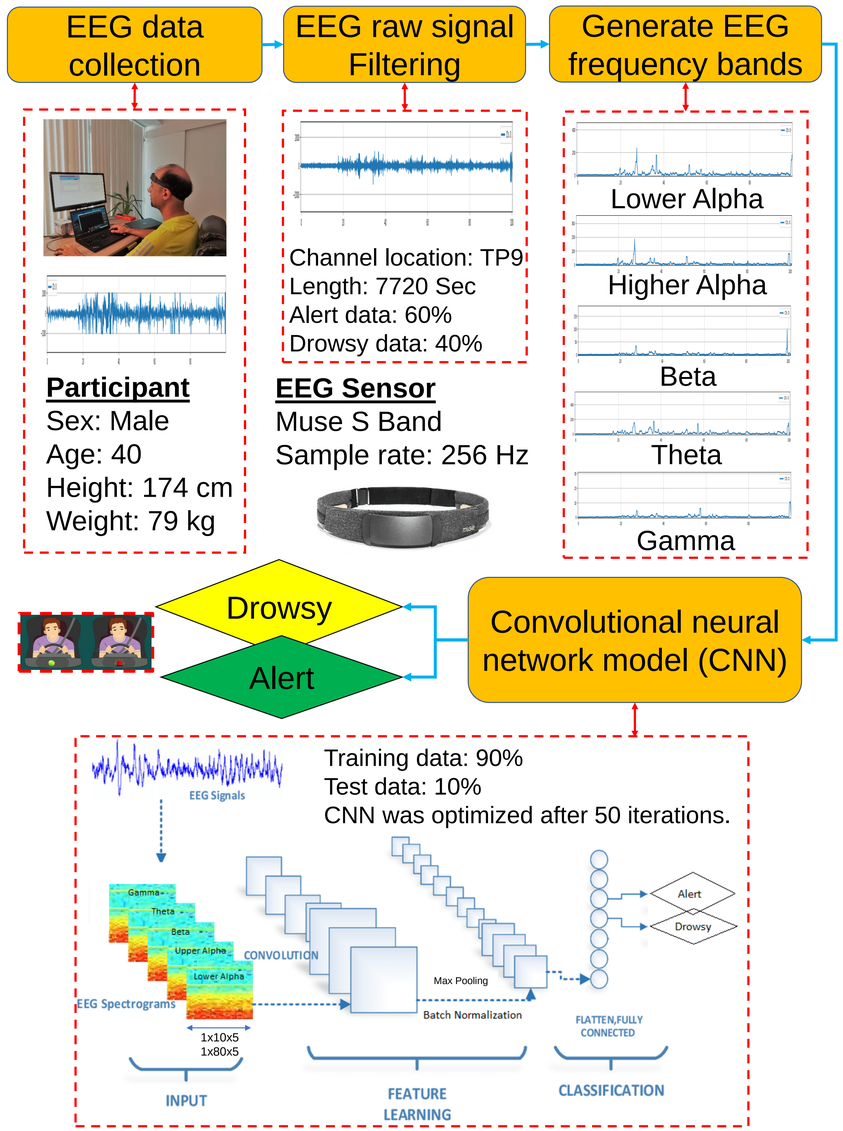
BACKGROUND

- Impaired driving is one of the leading causes of motor-vehicle crashes which may occur due to various reasons, including physical or mental fatigue, and alcohol or drug consumption.
- Various techniques have been explored to detect driver drowsiness including vehicle feature-based, physical feature-based, and physiological feature-based methods.
- Among these approaches, physiological feature-based methods are more promising.
- Electrocardiogram (ECG) and encephalogram (EEG) appear to be the most effective physiological measures to distinguish alert and drowsy states.

AIMS

- develop a methodology to identify the drowsy/alert states caused by mental fatigue using EEG signal analysis,
- Examine the proposed methodology by conducting a pilot study,
- evaluate the performance of EEG sensor for reliable data collection.

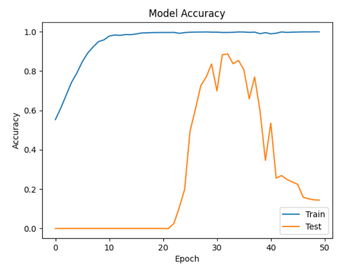
METHODS



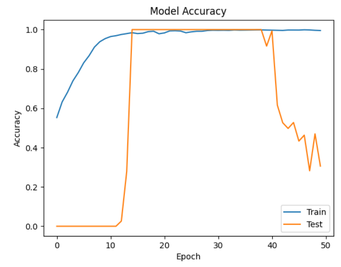
RESULTS/DISCUSSION/CONCLUSIONS

- Based on the obtained results, the proposed methodology was found accurate (>88%) to identify the alert and drowsy states by EEG signal analysis using the CNN algorithm.
- The optimal waveform segment lengths that led to the highest classification accuracy were equal to 10 seconds (with 88% accuracy) and 13.75 seconds (with 99% accuracy).
- The reliability of the EEG sensing device was verified for data collection at the sitting condition.
- Since this study used a small amount of data, the model cannot be generalized to other participants and conditions and may suffer from underfitting or overfitting. Therefore, future investigation needs to be conducted on the generalization of the obtained results.

Graph of EEG Classification Accuracy



Signal segment length: 10 Sec
Classification accuracy: 88%



Signal segment length: 13.75 Sec
Classification accuracy: 99%

Acknowledgement
The authors would like to thank Dr. Dengbo He from University of Toronto in Canada, Mr. Mohammad Hassan Ranjbar and Mr. Ali Abdi from University of Tehran in Iran for their technical support as well as Mitacs (Award Number: IT23989) for funding this project.

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