The Study of Time Domain Features of EMG Signals for Detecting Driver's Drowsiness

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Abstract Fatigue or drowsiness is one of the major causes of traffic accidents in Malaysia. Physiological signals such as EMG is a useful input to detect drowsiness in drivers. The time domain features are easy to compute and well researched in the field of EMG hand motion detection. The focus of this paper is to find the best set of time domain features to detect drowsiness in drivers' EMG signal from biceps brachii muscle. This study analyzes the time domain features of EMG signals in detecting the drowsiness in drivers during a 2 h simulated driving session. Nine time-domain features are applied to all 15 samples and classified using six classifiers. The best single feature for the long duration signal is the mean absolute value slope (MAVS) with 80% accuracy using Naïve Bayes (NB) classifiers. All features combined gives the highest accuracy of 85% using linear discriminant analysis (LDA) classifier.

Keywords Driver drowsiness · Time-domain features · EMG · Signal processing · Biceps brachii · MAVS · NB · LDA

1 Introduction

A driver's wakeful state during a driving session is very crucial to prevent unwanted road traffic accidents. Road traffic accidents depending on its fatality can cause death or severe injury to the drivers and passengers. Malaysia was ranked third highest death rate from road traffic accidents amongst its neighboring countries ASEAN [1]. One of the causes of road traffic accidents are fatigue as reported by the Inspector General of Police Tan Sri Muhamad Fuzi Harun [2]. Hence, there is a need to detect drowsiness during driving among drivers so that prevention measures can be enforced.

Most of the fatigue or driver's drowsiness studies are done in a driving simulator where inputs such as; physiological sensors, mechanical sensors and behavioral inputs are used to detect the level of drowsiness during a simulated driving. Physiological sensors are the more popular inputs because its highest accuracy compared to

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