Feasibility of Using Auditory Stimulus Counter Human Drowsiness

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Non-invasive devices involved in the detection of drowsiness generally include infrared camera and Electroencephalography (EEG), which sometimes are constrained in actual real-life scenario deployments and implementations in driving. The core of the proposed system is the closed-loop system: the system is able to create alertness while detecting drowsiness at the same time and updates accordingly. Due to the unavailability of an affordable driving simulator, I found an alternative solution. This study proposes an alternative method by simulating a monotonous bank transaction confirmation task to induce drowsiness. Simultaneously, the brain signals were collected throughout the whole duration of the experiment to find a relationship between brainwaves and drowsiness. To test the effectiveness of our sound stimulus at 1000Hz carrier frequency and 40 Hz amplitude-modulated, we separate the 1-hour task into two parts wherein the second half a sound stimulus is played. In our latest results, we used the Beta and Alpha band frequency to estimate the drowsiness level of a user. By using four features — alpha (class of 8-13 Hz brainwave signal) peak frequency, alpha peak amplitude, beta (class of 13-32 Hz brainwave signal)peak frequency, beta peak amplitude— we created a decision tree which yielded an f1 score of 0.9. Due to the COVID-19 situation, we were only able to obtain insofar 20 data points. With more data, we should be able to predict drowsiness at higher accuracy. I have not tested the effectiveness of our sound stimulus due to the aforementioned reason. I plan to test out further the efficacy of my sound stimulus across more subjects. I will also extend this research by testing my system in real-world applications.

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