UNIVERSITI TEKNOLOGI MARA

THE EFFECTS OF HUMAN BRAINWAVE SIGNALS DUE TO MOBILE PHONE RADIOFREQUENCY EXPOSURE USING ARTIFICIAL NEURAL NETWORK

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ABSTRACT

The frequency content of recorded electroencephalogram (EEG) signals plays an important role in describing the signals and also the state of the brain. It is found that the emitted of radiofrequency (RF) radiation energy due to the usage of mobile phones contributes to the changes of brainwave signals. Nevertheless, it is yet to be determined the effects of RF exposure to human's health that related to the brain based on EEG and intelligent approach. Therefore this thesis proposed a novel approach for recognizing the characteristics of brainwave signals due to mobile phone RF exposure using intelligent techniques. The presented thought recognition methodology utilises correlation and asymmetry features between EEG and RF exposure and integrated with feed-forward Artificial Neural Networks (ANN) for classification. The procedures involved EEG recording at the frontal; left and right head and have been conducted in three sessions namely Before, During and After RF exposure. The duration of each session is five minutes. Ninety five volunteers involved in this study and they are divided into three exposure groups, which categorised as Left Exposure (LE), Right Exposure (RE) and Sham Exposure (SE) group. The RF exposure used in the experiment is sourced from a mobile phone with operating bandwidth between 0.9 to 2.2 GHz with 0.69 W/kg SAR rate. Then, the analysis to observe the brain hemisphere dominance due to the mobile phone RF exposure has been carried out through the Power Asymmetry Ratio (PAR) features. It involves four major sub bands of brainwaves which are Alpha, Beta, Theta and Delta. Furthermore, ANN models have been developed for three sessions (Before, During and After) of RF exposure. The inputs consist of four sub bands of EEG asymmetry features, whereas the discrete output will be either LE, RE or SE for each of the model. The proposed method of PAR features achieves significant pattern for different exposure groups (LE, RE and SE) in Before, During and After RF exposure sessions. It is discovers that lower correlation but higher PAR score obtained in LE and RE groups due to the RF exposure. Hence, it indicates unbalanced brain cognitive function. The result also reveals that the ANN modelling can classified the significant PAR features correspondingly to the RF exposure groups. The result showed that ANN model for During session has excellent accuracy with 100% of training and 94.74% of testing data, which outperformed the Before and After session models. This finding established that using asymmetry features and ANN modelling, different and irregular behaviour pattern can be recognised between the EEG signals on the effect of RF exposure. To summarise, this study has successfully presented the classification of brainwave signals due to RF exposure via asymmetry and ANN modelling.

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