

Feature Scaling for EEG Human Concentration using Particle Swarm Optimization

K. G. Li, Mohd Ibrahim Shapiai
Dept. ESE, MJIIT,
Center of Artificial Intelligence and
Robotics (CAIRO),
UTM Kuala Lumpur, Malaysia
vayrence92@gmail.com,
md_ibrahim83@utm.my

Asrul Adam
Applied Control and Robotics (ACR)
Laboratory
Dept. of Electrical Engineering,
Faculty of Engineering
UM, Kuala Lumpur, Malaysia
asrul.adam@siswa.um.edu.my

Zuwairie Ibrahim
Faculty of Electrical and Electronic
Engineering
Universiti Malaysia Pahang
26600 Pekan, Pahang, Malaysia
zuwairie@ump.edu.my

Abstract—Electroencephalograph (EEG) is a one of recording technique that is widely used to measure human activities through brain signals. One of actively growing research in the past years is to measure human concentration using EEG. Obtaining relevant features for recognizing human concentration state becomes a challenging task due to the nature of EEG signals is a non-stationary. In the past research, various combinations of features have been employed. However, to improve the classification performance, determining the importance of each employed feature is crucially needed. In this study, feature scaling method is introduced to assign different weights for important features. Four different features are investigated in frequency domain using wavelet transform (WT). Then, particle swarm optimization (PSO) is used to scale the features while extreme learning machine (ELM) is used to classify between concentration and non-concentration states. The recorded EEG signals from Neurosky Mindwave are used to evaluate the performance of the proposed technique. The final results indicate that the proposed technique offers higher performance accuracy as compared to the methods without feature scaling.

Keywords—*Electroencephalogram (EEG), Wavelet transform (WT), Extreme Learning Machine (ELM), Particle Swarm Optimization (PSO), Human Concentration.*