Modeling Dynamic Brainwave Patterns Using Multi Agent Technology to Effectively Identify Human Emotions

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Declaration

I declare that this dissertation does not incorporate, without acknowledgment, any material previously submitted for a Degree or a Diploma in any University and to the best of my knowledge and belief, it does not contain any material previously published or written by another person or myself except where due reference is made in the text. I also hereby give consent for my dissertation, if accepted, to be made available for photocopying and for interlibrary loans, and for the title and summary to be made available to outside organization.

M.B.H.M.V. Dayarathne

Signature of Student

Date:

Supervised by

Prof. Asoka S. Karunananda

Signature of Supervisor

Date:

Dedication

…To my loving parents for their endless support, love and care given throughout my life and encouragement given to me to reach the goals and heights I dream of…

Acknowledgment

On the eve of completing a Masters degree in Artificial Intelligence, the research project undoubtedly gave me the opportunity to harvest knowledge along with the experience, and in my opinion it is a challenge offered to any individual.

It is very evident that to select, launch and complete a research project needs considerable guidance, encouragement and assistance. In this context, first and foremost my sincere gratitude goes out to my supervisor Professor. Asoka S. Karunananda for continuous guidance and assistance provided to make this project successful.

Next, I take this opportunity to extend my gratitude to all the lecturers at Faculty of Information Technology, University of Moratuwa who have supported me sharing their time and knowledge throughout the degree program.

Further, I extend my gratitude to all the staff members of at Faculty of Information Technology, University of Moratuwa for their help and service granted to me and colleagues for completing the degree program without a hassle.

I would also like to take an opportunity to mention all my colleagues who have been a great support to complete this project and the degree program successfully.

Last but not least, I will be failing in my duty if I do not record briefly, the importance of the contribution, guidance and encouragement given by my parents and my sisters.

Finally, my grateful thanks to all the others whose names I have not mentioned due to the limitations of space, who helped me in various ways.

Abstract

Research in interfacing silicon computers (typical computers) with carbon computers (human and animals) has recorded an exponential growth in the modern world. At present, these research ranges from implanting of micro chips inside brain, using brain waves for wireless communication with computers and introducing natural brain cells in silicon computers. Among these trends, use of the brain waves through Electroencephalography signals (EEG) has been a fascinating area of research in the field of computing. In general, EEG Signals are very weak signals with lots of noise unless they are filtered and amplified.

This project envisages the use of EEG signals for interfacing our minds with computers. As the primary objective, it has been investigated the nature of real world scenarios or systems for which we can apply the EEG technology for analysis and understanding. We proceed to use EEG in applicable scenarios and model selected real world scenarios, allowing persons to use our computer-based solution for monitoring and guiding people in similar scenarios. EEG patterns detected during a particular scenario have been modeled by Multi Agent Systems technology, which has a proven potential in modeling real world systems with large number of interconnected entities changing over time.

In a given scenario, EEG signals are detected from multiple channels with varying strengths. In our design, each channel of EEG signals has been assigned with an agent. Our experiments have shown that brain waves generated for scenarios such as typing in the keyboard, invoking a mouse action or watching television while eating are very noisy, hence it's difficult to analyze. This has been the case for activities at which people are not adequately mindful. In contrast, experiment shows that activities requiring considerable mindfulness generate sharp EEG patterns. Listening to a lecture, meditation and solving a mathematical problem are some examples for such scenarios. These experimental results have been used to bench mark EEG pattern for given scenario and analyze situations such as the extent a person is engaged in a task, how soon a person gets into the expected mood, at which points a person is distracted. The current system has been tested by considering scenario such as meditation and making a call. The system can be used by people such as those who are curious about their study skills, novice in meditations and those who wish to know about their mental behavior in certain tasks.

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