UNIVERSITI TEKNOLOGI MARA

ELECTRODE OPTIMISATION AND FEATURE EXTRACTION OF ELECTROENCEPHALOGRAM SIGNAL TO IDENTIFY DYSLEXIC AND NORMAL CHILDREN

CHE WAN NURUL FATIHAH BINTI CHE WAN FADZAL

Thesis submitted in fulfillment
of the requirements for the degree of
Master of Science

Faculty of Electrical Engineering

March 2018

AUTHOR'S DECLARATION

I declare that the work in this thesis was carried out in accordance with the regulations of Universiti Teknologi MARA. It is original and is the results of my own work, unless otherwise indicated or acknowledged as referenced work. This thesis has not been submitted to any other academic institution or non-academic institution for any degree or qualification.

I, hereby, acknowledge that I have been supplied with the Academic Rules and Regulations for Post Graduate, Universiti Teknologi MARA, regulating the conduct of my study and research.

Name of Student	:	Che Wan Nurul Fatihah Binti Che Wan Fadzal
Student I.D. No.	:	2010775685
Programme	:	Master of Science – EE780
Faculty	:	Electrical Engineering
Thesis Title	:	Electrode Optimization And Feature Extraction Of Electroencephalogram Signal To Identify Dyslexic And Normal Children
Signature of Student	:	.....
Date	:	March 2018

ABSTRACT

The Dyslexia is learning difficulties which cover reading, spelling and writing. Diagnosis of dyslexia in children at an early stage is very important because they are in the beginning of learning which will help them to cope with the situation very well. An investigation into the feature extraction of EEG signals with dyslexia using Fast Fourier Transform, Average Spectrum and Welch Power Spectral Density has been studied in this work. Before feature extraction was carried out, the optimum electrode was identified using Fast Fourier Transform. Two types of EEG signals were investigated, one from adults and the other from children. In the first stage, the EEG signals were recorded from 70 adults using electrodes C3, C4, P3, P4, O1, O2, T3 and FC5. In the second stage, the EEG signals were acquired from 8 normal and 8 dyslexic children using two optimum electrodes found from the first stage. The FFT was then performed on EEG signal from 70 subjects. Then, the EEG signals were analyzed using three methods; Fast Fourier Transform, Average Spectrum and Welch Power Spectral Density from eight subject normal and eight subject dyslexic. Four statistical parameters; minimum frequency, maximum frequency, mean frequency and standard deviation were calculated for each method. From the analysis results, it was found that P3 and P4 are the optimum electrode placement and thus parietal lobe is the active area of the brain during writing. This lobe play an important role in the process related to spatial cognition and in what have been described as quasi- spatial processes, such as used in arithmetic and reading. Therefore, P3 and P4 electrode placements were used in the second stage to identify the best feature extraction method. Results from the second stage showed that the Welch Power Spectral Density is the optimum method to differentiate between normal children with the mean frequency is the optimum parameter.

ACKNOWLEDGEMENT

In the name of Allah, the Most Gracious and the Most Merciful

Alhamdulillah, all praises to Allah for His blessings, for the wisdom He bestowed upon me, the strength and good health in completing this thesis. First of all, I would like to express my deepest appreciation to my supervisor, Associate Professor Datin Dr Wahidah Mansor, for her constant supervision, endless support, guidance, and also the time to consult my research work with patience and understanding. Her sincere guidance and suggestions throughout the work and thesis have contributed to the success of this research. In addition, my appreciation goes to my co-supervisor, Associate Professor Dr. Lee Yoot Khuan for her support to improve this thesis and persistent help regarding this topic.

I would like to express my appreciation to the Ministry of Higher Education, Universiti Teknologi MARA and Research Management Institute for the scholarship and grants to support my work. Heartiest thanks also go to my seniors, who guide with this project and involve to create programming in analyze data, Ms. Rohilah Sahak and Mr.Azlee Zabidi. My group member for this project, which help in processing data and give ideas that incessantly to this project, Mrs Noor Bariah Mohamad, Mr.Zulkifli Mahmoodin, and Mrs. Sabrina Mohamad. I also would like to thank fellow lab mates for their continuous support and co-operation, Nur Nabila Mohamed, and Raja Umi Kalsom.

Lastly, my deepest gratitude goes to my parents, ma Hjh Raja Rahmah Raja Sulong and abah Hj.Che Wan Fadzal Che Wan Abdullah, my Mother in law, umi Tuan Nor Shahara Tuan Ibrahim and also the siblings, who never stop praying and supporting me to go on completing this thesis. Do not forget also my late father-in-law who always gives support in whatever I do. Most importantly, I would like to give special thanks to my beloved husband Nik Mohd Farhan Bin Abd Wahab for his moral support, helping me a lot, understanding and taking care of our loving daughter, Nik Nurul Amni Azzahra. Now, I'm just delivered our second daughter, a cute baby girl, Nik Asna Naufal. Finally, to those who indirectly contributed in this research, your kindness means a lot to me.

TABLE OF CONTENTS