UNIVERSITI TEKNOLOGI MARA

SPECTRAL TEXTURE SEGMENTATION OF MAGNETIC RESONANCE IMAGING (MRI) BRAIN IMAGES FOR GLIOMA BRAIN TUMOUR DETECTION

ROSNIZA BINTI ROSLAN

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

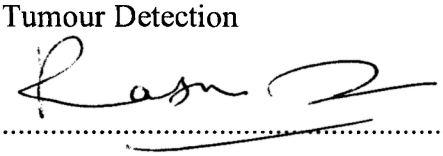
Faculty of Computer and Mathematical Sciences

June 2013

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 result 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 other degree of 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	:	Rosniza binti Roslan
Student I.D. No.	:	2009475756
Programme	:	Master of Science
Faculty	:	Computer and Mathematical Sciences
Title	:	Spectral Texture Segmentation of Magnetic Resonance Imaging (MRI) Brain Images for Glioma Brain Tumour Detection
Signature of Student	:	 .....
Date	:	June 2013

ABSTRACT

In 2009, statistics showed that five percent of Malaysians has been diagnosed with brain tumours with glioma being the most common type. Radiologist commonly used MRI image sequences to detect glioma clinically by examining the abnormalities on T1-Weighted, T2-Weighted and Fluid Attenuated Inversion Recovery (FLAIR) images. However, when the tumour cannot be detected visually, they will inject a contrast agent of gadolinium to enhance the image modality. However, this process delays acquisition of results at a higher cost and imposes side effects to the patients. Therefore, this thesis proposes utilizing spectral texture features of the MRI images in detecting the tumour in all three sequences of T1, T2-Weighted and FLAIR images. There are four phases involved in this research which are data collection, pre-processing (i.e. skull stripping), processing (i.e. texture feature extraction and segmentation) and post-processing (i.e. test and evaluation). For data collection, a total of 126 MRI images of adults ranging from 18 to 60 years old are obtained from Hospital Sungai Buloh and Hospital Tengku Ampuan Rahimah Klang in Selangor. Ninety MRI image sequences of T1-Weighted, T2-Weighted and FLAIR are used for skull-stripping experiments and results showed that mathematical morphology method outperformed region growing at an accuracy rate of 96%. A new double thresholding algorithm and a fully automated multiple seed points selection algorithm that works on all three MRI image sequences are also proposed. For texture feature extraction, we tested three features that are inverse Fast Fourier Transform (IFFT), texture energy and transformed IFFT. Experiments conducted on 64 MRI images of all sequences showed that texture energy is the best texture feature to be used in glioma segmentation. Fuzzy C-Means clustering algorithm is then used to segment texture energy features from 126 MRI brain images of all sequences. Results are then qualitatively evaluated by an expert radiologist and it showed that the glioma brain tumour is been detected. Therefore, texture energy features and Fuzzy C-Means clustering method are identified as promising methods of glioma brain tumour detection at an accuracy rate of 76%, 86% and 79% is detected as an abnormal of T1-Weighted, T2-Weighted and FLAIR images. The final chapter concludes with limitations and recommendations for further improvements of glioma tumour detection.

ACKNOWLEDGEMENTS

Alhamdulillah, praise to Allah S.W.T. for giving me strength and energy to complete my research.

First and foremost, I would like to express my sincerest gratitude to my supervisor, Associate Prof. Dr. Nursuriati Jamil, who has supported me throughout this study. I appreciate her guidance, co-operation, and good teaching, and without her this proposal would have not been successfully completed. I am also thankful to Prof. Dr. Rozi Mahmud and Prof. Dr. Norlisah Mohd Ramli, with their efforts to explain things clearly and helped me to complete this proposal. Thanks to all of them for their suggestions and opinions during the discussions which I gather the wonderful experiences during the times that we have worked together.

Special thanks to the Universiti Teknologi MARA for granting the Young Lecturer Scheme (TPM) scholarship for my Master Degree. My appreciation also goes to Dr Kamarularifin Abd Jalil as Course Coordinator for his useful guidance and advice. Also, special appreciation to the Faculty of Computer and Mathematical Sciences in providing seminar, student laboratory for postgraduate students and other facilities as well as Research Management Institute (RMI) for granting me the seminars, conference and other support during this study. Thanks to Institute of Graduate Studies (IPSis) for their continuous encouragement and contribution significantly throughout this research.

A huge appreciation goes to all my family members for their support and encouragement throughout my studies. Thanks to my beloved parents, Mr Roslan Osman and Mrs Zaida Awang as well as my husband, Mr Mohd Azlan Ayub who giving me valuable advice, comments, supports and motivation. And last but not least, special thanks to my former colleagues, Aznimah, Syamsiah and everyone who were particularly supportive and sharing the ideas and information throughout this study.

TABLE OF CONTENTS