

**UNIVERSITI TEKNOLOGI MARA**

**HUMAN BODY  
ELECTROMAGNETICS  
RADIATION: THE  
PHYSIOLOGICAL  
CHARACTERISTIC FOR  
POST STROKE PATIENTS**

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Thesis submitted in fulfillment  
of the requirements for the degree of  
**Doctor of Philosophy**  
**(Electrical Engineering)**

**Faculty of Electrical Engineering**

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## 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.

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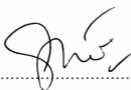
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## ABSTRACT

This thesis presents a novel analysis and classification of human body electromagnetic radiation (EMR) for post stroke patient and non-stroke participant. Presently, some researchers are investigating the human body EMR to characterize the physiological aspect of human being. Some methods include Kirlian photography, gas discharge visualization (GDV) and polycontrast interference photography. However, there are some drawbacks in the current techniques such as the images are not reliable and distorted. Moreover, the relationship between human body EMR and the health condition of post stroke patients has not been found. Thus, this research aims to scientifically establish a fundamental idea and new non-invasive technique to identify and to differentiate human body EMR of post stroke patients and non-stroke participants. The participants' body frequencies are captured at 16 points around the human body and 7 points of Chakra System using a frequency detector. The first part of the analysis concerned with the EMR of the whole body while the second part extended and zooming into specific body segments of chakra, left side, right side, upper body, middle body and lower body. Initially, the characteristics of frequency radiation are examined using statistical analysis to find the correlations between variables, to examine differences of frequency radiation characteristics between samples and to explore the relationship among variables. Next, the classification algorithm of k-nearest neighbor (KNN) and artificial neural network (ANN) are applied to discriminate between the samples and between their body segments. The classifiers are evaluated through analysis of the performance indicators of confusion matrix consisting of accuracy, precision, specificity and sensitivity. The findings of this research show that the EMR characteristics of the samples are different. A successful classification is produced in KNN and ANN classification for post stroke and non-stroke recognition, which is in line with the statistical analysis calculated. In general, the performance measure of training consisting of accuracy, sensitivity, specificity and precision for KNN classification achieved 100% while for ANN achieved 98% - 100%. In addition, for KNN performance measure of testing achieved 77% - 100% while for ANN achieved 75% - 92%. For body segment recognition, the classification results of both classifiers range between 69% - 100% for training accuracy and 64%-92% for testing accuracy. The outcomes of the classifier show that it is able to classify the human body EMR using KNN and ANN analysis. As a conclusion, the KNN classifier exhibit better results compared to ANN. This finding confirmed that the EMR of human body has different characteristics between samples of post stroke and non-stroke and between their body segments.

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# CHAPTER ONE

## INTRODUCTION

### 1.1 Background of the Research

Throughout human history [1], there has been a belief that all living objects, human body in particular, have their own radiation named bioenergy [2] or biofield [3] or aura [4] which surrounds their entire body. In the process of the diagnostics of human health, the common term used to describe this energy is also Bioenergy; energy emitted by biological system [5]. With the development in science and technology, this occurrence of bioenergy has been concluded as electromagnetic radiation (EMR) generated by the body itself. This radiation encircles the physical body and known as endogenous energy fields generated by and contained within the body [6]. This radiation also has been portrayed as luminous body that surrounds and penetrates the physical body and emits its characteristic radiation of frequency [7].

The radiation of EM field is the radiation of the frequency in terms of the electric and magnetic component with self-propagating wave. This electrical current, along with their magnetic field, can be found in the human body [8] which are complex and dynamic. It is associated with dynamical processes which involve heart and brain function, blood and lymph flow and many other biologic processes in different scales. The activities of living tissues in human body causes the changes of electrical properties, inducing extremely small electrical current, therefore generated the EMR emitted into the surrounding [9] [10]. The EMR varies with activities and health condition of the human body [11].

Some researchers in the biomedical engineering field have found that the EMR reveals information on many aspects of human's life including physical health, emotions and psychological condition [11] [12] [13]. Hence, the evaluation of the condition of EMR in human body is important for health care. Previous studies focus on the concept of energy medicine that involve subtle interaction such as biofield therapies, homeopathy, acupuncture, and bioelectromagnetic therapy [3]. However, the scientific establishment of the relationship between the human body EMR and physical disorder is inadequate. In particular, the relationship between the human body EMR and stroke disorder has not been found. Disturbance in the normal