UNIVERSITI TEKNOLOGI MARA

GENDER CLASSIFICATION BASED ON GAIT FEATURES FOR HEALTHY CHILDREN

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

Faculty of Electrical Engineering

October 2016

ABSTRACT

This thesis describes a representation of gait analysis for the purpose of gender classification of healthy children using the most significant gait features. In this study, the gait parameters were measured using 3D motion analysis system. In order to obtain the most significant gait features, numerical analysis using statistical method was performed. The three gait parameters which were spatiotemporal, kinematics and kinetics parameters were tested. From the result, it is noted that the most significant difference between genders only existed at kinematic parameter. Out of 36 gait features in kinematic parameter, only four were found to be the most significant gait features. These features were added into the ANN as an input to classify gender of healthy children. The ANN networks were optimized by adjusting the number of hidden neurons and thresholds. Since the size of the original gait features was too small due to small sample size of healthy children, the generation of synthetic data was performed based on the original gait features data. The result from the performance measures show that synthetic data obtained better accuracy compared to original data, since ANN performed better with large amount of data. The ANN network for this study is 4-6-1 with 0.3 thresholds. The performance measures show that this network achieved 76%, 87% and 91.3% of accuracy for training, validation and testing respectively.

ACKNOWLEDGEMENTS

Bismillahirrahmanirrahim. Bukankah Kami telah melapangkan dadamu (Muhammad)? Dan Kami pun telah menurunkan beban daripadamu. Yang memberatkan tanggunganmu, Dan Kami tinggikan sebutan (nama)mu bagimu. Maka sesungguhnya bersama kesulitan ada kemudahan. Sesungguhnya bersama kesulitan ada kemudahan, Maka apabila engkau telah selesai (daripada sesuatu urusan), tetaplah bekerja keras (untuk urusan yang lain), Dan hanya kepada Tuhanmulah engkau berharap. (Al-Insyirah).

Alhamdulillah, this research would have not been successful without the help and support of many people. I would like to express my deepest appreciation to my supervisor, Dr. Rozita Jailani for her invaluable guidance, motivation and advice. My appreciation extends to my co-supervisor Prof. Dr. Mohd Nasir Taib and Assoc. Prof Dr. Nooritawati Md Tahir for their priceless assistance and support.

I like to thanks to all ASP and PG RJ members for sharing their knowledge and assistance. May Allah reward them all. I extend my appreciation for the support provided by Research Management Institute for grants as well as Human Motion Gait Analysis Lab, IRMI Premier Laboratory UiTM Shah Alam for the provision of laboratory facilities and to my Faculty of Electrical Engineering, Universiti Teknologi MARA, Malaysia.

Last but not least, I would like to express my love and gratitude especially to *Mak, Ayah,* my family and colleagues. It would not be possible for me to complete this research without their moral support to complete the study.

Nur Khalidah Binti Zakaria
October 2016

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INTRODUCTION

1.1 RESEARCH BACKGROUND

Gait analysis is a study of human movement by measuring body motion, posture and muscle. Human walking is basically is a bipedal type of walking because a human walks with two feet. Walking is a repetitive action that moves both legs alternately, without having both feet touching the ground at same time to provide propulsion. In biped walking, the gait analysis is a well-known study applied in academics, physiology, clinical treatment, biometrics, rehabilitation and sports training [1-3]. In the studies of human walking, the walking gait pattern may differ from each person because the body movements, joints and walking speed is different for everybody [4]. Hence, by applying gait analysis, the difference can be measured numerically and statistically so that the difference in values can be evaluated [5].

There are two phases which occur during walking. The first phase is a stance phase where both feet have contact with the ground and the second phase is a swing phase where only one foot has contact with the ground. The normal stance phase usually covers 60% of the gait cycle, meanwhile the normal swing phase is between 40% of the gait cycle [1]. Spatiotemporal, kinematic and kinetic parameters are mostly used in gait analysis [6-13]. Spatiotemporal is an analysis of time and distance during walking. Kinematic analysis is the study of body joint angles during walking and kinetic analysis is a study of the resultant force when the foot comes into contact with the ground.

These days, many features can be used for gender classification. Recent studies have used facial information, finger prints, clothes, body shape, voice and gait as the features for gender classification [14-17]. Compared to other biometrics, gait overcomes the problem of getting high resolution data in facial information or iris. It is because human gait can be captured at far distance and offers great potential for classification of low resolution images or videos. Additionally, gait based gender classification can easily implemented without cooperation or information about subject and non-noticeable for