

How to cite this paper:

Alicia Cheong Chiek Ying, Hamimah Ujir, & Irwandi Hipiny. (2017). 3D facial expression intensity measurement analysis in Zulikha, J. & N. H. Zakaria (Eds.), Proceedings of the 6th International Conference of Computing & Informatics (pp 43-48). Sintok: School of Computing.

3D FACIAL EXPRESSION INTENSITY MEASUREMENT ANALYSIS

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ABSTRACT. This study used 3D distance vector measurements as the facial feature to classify six basic expressions and the distance vectors are chosen based on Facial Action Coding System (FACS) component, facial action units (AUs). The statistical values are calculated and analyzed to determine the AUs involved in facial expression and distance vectors to be taken into account to measure the intensity of each facial expression in a quantitative manner. As a result, 14 facial points are classified as significant in facial expression classification. Those facial points are in the eye, eyebrow and mouth region only. This work reveals that it is not necessary to rely on all facial feature points in estimating facial expression intensity. For Sad expression, the random mean and standard deviation of distance measurements do not indicate which AU should be taken into account to classify this expression.

Keywords: 3D facial distance, facial intensity measurement, action units.

INTRODUCTION

Facial expressions are defined as the resulting changes in facial appearance due to one or more facial features deformations. The mapping between facial features deformation and facial muscles is not one-to-one. Some facial deformations involve contraction of two different parts of the same muscle, while others involve contraction of multiple muscles. The analyses of facial expressions are beneficial in various fields such as education, communication, security, medicine and behavioral science.

Before the compilation of the Facial Action Coding Systems (FACS), most of the facial behavior researchers are dependent on the human observers who will observe the face of the subject and perform analysis on it [1]. These visual observations cannot be quantified. FACS is an observer-based measurement of facial expression that measures facial expression intensity qualitatively. Each observable component of facial feature deformation is called an Action Unit or AU. All facial expressions can be broken down into an AU.

Facial expression has levels of intensity which rely on the levels of intensity of each facial feature. When it comes to facial expression interpretation, there is no doubt that the intensity level of a facial expression is significant as it might lead to false impression of people's emotion if misinterpreted. [2] used four levels of intensity in their developed database, [3] presented five levels of expression intensity and [4] introduced three levels of intensity.

This paper presents an analysis of 3D facial expression intensity measurement based on the 3D facial distance vectors. Our objectives are: (1) to measure facial expression intensity