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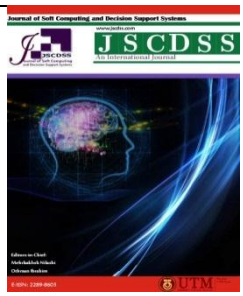

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Topographical Features for Senior Adult Age Estimation

Ghalib A. Salman Salih [a,*], Gazali Sulong [a]
[a] University Technology Malaysia, Media and Game Centre of Excellence (Magicx), Faculty of Computing, Skudai, Johor, 81310 Malaysia

*** Corresponding author email address**: ghlbethawi@yahoo.com

Abstract

Automatic age estimation provided efficient solution for many applications in our life. One of the most significant biometric in estimating a human age is the face; since it is the most captured biometric and it contains a lot of age information embedded in it. Senior adult faces contain the most obvious age progression signs such as, wrinkles, lines and skin roughness; such features are produced by skin sagging and providing a lot of information about age progression. Representing wrinkles using ordinary lines or edges loses significant information. In this paper we propose modelling the 2D polynomial for the face image in order to increase the quality of the extracted features, then topographical features are extracted to represent age signs on human faces in senior adult ages; the most efficient features are selected using proposed features selection technique. Proposed features provided noticeable increment in extracted information, and the classification accuracy. Compared to the state of art, proposed features yielded encouraging results.

Keywords: Age anticipation, Senior-adult ages, Age signs, Features optimization, Topographical features

1. Introduction

Automatic estimation of human ages attracted more attention recently because of the wide areas of social applications that require such estimation. Access controlling of under age kids is required to prevent them from accessing some goods like wines or cigarettes, or even some web-pages with adult contents; ages should be also estimated for victims or runaway criminals when identifications are missed.

As human face contains considerable amount of information about the age(Gadbail *et al.*, 2014), it is widely used in age estimation researches; yet age effects on these information vary from age period to another. (Todd *et al.*, 1980). Geometric effects are obvious in young ages due to the rigid changes in shape and size of face (Berry and Mcarthur, 1985). Less vitality is notices as the age moves to adult faces; vitality changes are combined by some geometric changes (Geng *et al.*, 2007). Senior-adult age period has significant set of age texture effects in form of wrinkles, jowls, hair colour, and less vitality in the skin; in addition, skin sagging and drooping produce new type of features in form of bigger forehead and chin areas, and smaller eyes areas (George and Hole, 2000).

According to the different age effects, specifying own features for each age interval may yield better results than generalizing set of features for all age periods. In this paper, senior-adult ages will be studied using topographical features that depend on image gradient supported by features selection technique. Topographical features are extracted from the 2D polynomial model for the face image; among the huge number of produced features, most efficient features are elected using features selection method.

The rest of this paper is organized as follows: Section 2 surveys the previous works in age estimation, Section 3 illustrates the wrinkles and face lines, Section 4 explains the 2D image polynomial, Section 5 illustrates topographical features, Section 6 illustrates features selection method, Section 7 discusses the results, and finally Section 8 includes the conclusions.

2. Literature Survey

The first study of age effects on human face was conducted several decades ago (Todd *et al.*, 1980); they provided set of age progression signs in form of wrinkles and head pose. After few years, baby faces were studied to represent age effects in childhood age period (Berry and Mcarthur, 1985). Effects of age progression were studied and represented as several types of features; in spite of previous studies on age progression effects, automatic age estimation were studied several years later. The first trial of estimating human age from face image was conducted in (Kwon and Da Vitoria Lobo, 1994), where the researchers classified human age into baby, young adult, and senior adult; they used positions of face components and distances between them as features for babies and young adults,