

21th International Conference on Knowledge Based and Intelligent Information and Engineering Systems, KES2017, 6-8 September 2017, Marseille, France.

4D Analysis of Facial Ageing Using Dynamic Features

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Abstract

Facial ageing analysis based on 4D data (3D plus time) is much more robust to pose changes and illumination variations than using 2D image and video. The purpose of this investigation was to measure the effects of age and gender related facial changes using dynamic 3D facial scans. Experiments were carried out on the subjects, who were divided into two groups by age (15-30 years and 31-60 years). Each group was further subdivided by gender. 3D scans of the subjects were processed to extract facial features which were tracked through the duration of the data capture. Subsequently, a set of dynamic features were computed from these facial features, as well as static features for comparison. Two-way multivariate analysis of variance (MANOVA) of these features demonstrated that statistically significant age and gender related differences could be detected. We show that 3D facial dynamics provide more useful information than static features for the characterisation of smiles.

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Peer-review under responsibility of KES International

Keywords: Smile; Dynamic Features; Age Grouping; Gender

1. Introduction

The human face conveys important information related to personal characteristics, including identity, gender, ethnicity and age. Age can play an important role in many applications such as age estimation in crime investigation, age-adaptive targeted marketing, age-invariant person identification¹ and is also the main risk factor for many complex diseases². As facial ageing is one of the most prominent and accessible phenotypes of human ageing, it is important for assessing the risks of age-related diseases and for designing individualised treatments³. Ageing is an inevitable process that leads to many soft tissues changes, and this process particularly affects the lips, causing many changes such as thinning, and an increase in length^{4,5}. Since the ageing process can change the characteristics of the smile, it is critical to acquire knowledge of age-related facial changes to inform the above applications. Automatic classification of faces into different categories based on gender, identity, age, ethnicity, facial expression and other

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