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Authors: Sajid Ali Khan, Muhammad Ishtiaq, Muhammad Nazir, Muhammad Shaheen



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Special Issue on Computational Intelligence Paradigms in Recommender Systems and Online Social Networks

Face Recognition under varying Expressions and Illumination using particle swarm optimization

Sajid Ali Khan^{a,b}, Muhammad Ishtiaq^a, Muhammad Nazir^c, Muhammad Shaheen^a

^aDepartment of Software Engineering, Foundation University Islamabad, Rawalpindi Campus, Pakistan

^bDepartment of computer Science, SZABIST, Islamabad

^cDepartment of Computer science and Engineering, HITEC University, Taxila, Pakistan.

Abstract

Social networks generate enormous amounts of visual data. Mining of such data in recommender systems is extremely important. User profiling is carried out in recommender systems to build the holistic persona of the user. Identification and grouping of images in these systems is carried out using face recognition. It is one of the most appropriate biometric features in such situations. Ever since the first use of face recognition in security and surveillance systems, researchers have developed many methods with improved accuracy. Face recognition under variant illumination is still an open issue and diverging facial expressions reduces the accuracy even further. State of the art methods produced an average accuracy of 90%. In this study, a computationally intelligent and efficient method based on particle swarm optimization (PSO) is developed. It utilizes the features extracted from texture and wavelet domain. Discrete Wavelet Transform provides the advantage of extracting relevant features and thereby reducing computational time and an increase in recognition accuracy rate. We apply particle swarm optimization technique to select informative wavelet sub-band. Furthermore, the proposed technique uses Discrete Fourier Transform to compensate the translational variance problem of the discrete wavelet transform. The proposed method has been tested on the CK, MMI and JAFFE databases. Experimental results are compared with existing techniques and the results indicate that the proposed technique is more robust to illumination and variation in expressions, average accuracy obtained over the CK, MMI and JAFFE datasets is 98.6%, 95.5%, and 98.8% respectively.

Keywords: Face Recognition, Face Expressions, Local Binary Pattern, Wavelets, variant illumination, particle swarm optimization.

1. Introduction

Face Recognition (FR) is a biometric solution that is used for the identification or authentication of a human from a video or image source. It has been successfully utilized in a variety of domains. Key application areas of facial recognition include augmented reality, retail marketing industry, gaming, security, forensics, video conferencing, smart meetings, visual surveillance and anti-terrorism. It is a process in which the unique facial characteristics of a person are matched with the templates stored in a facial database [1].

Finding an automated solution for the face recognition problem is not a trivial task due to various factors including variable lighting effects [2], different facial expressions and postures [3] in different images of the same person. Face recognition techniques can be classified into three groups; feature-based, holistic, and hybrid of these two [1].

In face recognition process, facial features' extraction process plays an important role and it involves a number of decisions like the selection of appropriate features, description, and

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