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Comparative Study of Illumination Pre-processing Techniques using Histogram Equalization and its Application in Face Recognition

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ABSTRACT

In the last decades, automatic face recognition has become more prominent in the wide range of applications including security, judicial investigations and law enforcement etc. For practical face recognition systems different challenges are lighting, posing, expression, ageing, occlusion etc. Changing the appearance of faces is due to various lighting conditions such as shadows and exposing the light on different parts of the face. Balanced illumination in face image helps to enhance its quality which is an important parameter to increase the rate of face recognition. A better quality image provides a better detection and recognition rate than poorly illuminated images. Extraction of features for face recognition is even more difficult with such images resulting in reduction of face recognition rate hence for overcoming this problem, illumination pre-processing techniques usually adopted before face detection and extraction of features from an image. In this paper the objective is to analyse performance of contrast enhancement techniques such as Histogram Equalization, Contrast Limited Adaptive Histogram Equalization and Contrast Limited Adaptive Histogram Equalization (CLAHE) with image entropy techniques for pre-processing of poor illuminated facial images. Further two basic techniques of feature extraction such as Principal Component Analysis and Local Binary Pattern and their hybrid approach for global and local feature extraction from images are utilized for evaluation on facial images. Yale B and extended Yale B datasets are used for experimentation. CLAHE with image entropy illumination pre-processing approach outperforms as compared to Histogram Equalization and CLAHE techniques. The very first noting is, initially face detection accuracy which is poor after applying illumination pre-processing improved, detection rate 81.66% is observed. Secondly using hybrid features of facial images and CLAHE with image entropy for illumination pre-processing has shown better recognition performance as 92% on cropped frontal faces of the same dataset.

KEY WORDS: ILLUMINATION, HISTOGRAM EQUALIZATION, PRE-PROCESSING, ENTROPY, FACE DETECTION, RECOGNITION.

INTRODUCTION

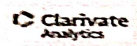
In the recent decades Automatic Face Recognition (AFR) has drawn a lot of attention because of the wide

applications ranging in the vast areas like security, criminological assessment, and law implementation. The framework of the AFR system needs to face difficulties like changing facial appearance, varying lighting conditions, posture, facial expression etc. Changing lighting conditions for example shadows, over and under exposure of light on face pictures are vital issues that a practical face recognition system has to address. In fact light variations cause significant changes in the appearance of face image due that intra-personal differences can be larger than inter-personal differences (Y. Adini et al., 1997).

ARTICLE INFORMATION

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