ABSTRACT

Over past decade, behavioral biometric systems based on face recognition became leading commercial systems that meet the need for fast and efficient confirmation of a person’s identity. Facial recognition works on biometric samples, like image or video frames, to recognize people. The performance of an automated face recognition system has a strong relationship with the quality of the biometric samples. In this chapter, the authors propose a quality estimation method based on a linear regression analysis to characterize the relationship between different quality factors and the performance of a face recognition system. The regression model can predict the overall quality of a facial sample which reflects the effects of various quality factors on that sample. The authors evaluated the quality estimation model on the Extended Yale Database B, finally formulating a data set of samples which will enable efficient implementation of biometric facial recognition.
INTRODUCTION

Biometrics is the science of recognizing a person based on the unique physiological or behavioral characteristics. Facial biometrics is one of the popular branches of biometrics which refers to an authentication technology that can recognize and verify human based on facial characteristics. One of the key advantages of facial biometrics over other biometrics is, it does not require the cooperation of the subject to identify. Sometimes the subject may remain fully unaware of the presence of the identification system. Hence, the significance of facial biometrics to ensure public security is high. This technology is mostly used in airports, mass gatherings, multiplexes, public places, and other crowded areas. Generally, the identification and verification are done based on the digital images or video frame obtained from video sources. Therefore, the quality of the digital images is closely connected with the performance of a face recognition system (Grother & Tabassi 2007) (Alonso-Fernandez et al. 2012) (Bharadwaj et al. 2014) (Khryashchev et al. 2018) (Yu et al. 2018) (Hernandez-Ortega et al. 2019) (Vignesh et al. 2015). However, in the real-time video surveillance scenarios, the face images may suffer from high distortion due to uncooperative users and uncontrolled environments. For example, the captured image can be of low resolution, blurry, noisy, etc. which may create a great challenge for the face recognition system. The performance of a face recognition system degrades with poor quality of data due to variations in lighting conditions, facial expressions, pose, resolution, camera movement, occlusion, and poor sensor quality (Sellahewa & Jassim 2010) (Abaza et al. 2012) (Abaza et al. 2014) (Punnappurath et al. 2015) (Khryashchev et al. 2018) (Vignesh et al. 2015).

The goal of the Biometric Quality Assessment (BQA) technique is to determine the capability of an image to qualify as a biometric sample. There have been previous attempts to structure face-based quality factors based on digital formatting of facial images, scenes, and photographs. Several techniques have been previously suggested to estimate data quality (Wang & Bovik 2002) (Abaza et al. 2012) (Abaza et al. 2014) (Sang et al. 2009) (Bosse et al. 2017) (Olsen et al. 2016). However, only very few researchers considered various quality factors jointly (Abaza et al. 2012) (Abaza et al. 2014). Thus, this book chapter describes effective quality estimation model, which can characterize the quality of the biometric image by integrating different quality measures into a single quality score which is an indicator of the overall quality of the facial image. The model also considers the effect of various quality factors on face recognition performance.

The overall quality score can be used to save preprocessing time and improve overall biometric system recognition accuracy. It will also reduce the number of poor-quality samples acquired during the enrollment process, thus saving time and improving matching performance. Selecting high-quality data samples for biometric recognition can improve the system robustness and reduce the false positive and false negative rates. This unified score can be used to assign weights in case of feature-level or score-level fusion of different modalities (Paul & Gavrilova 2015). Therefore, this chapter describes a general approach based on previously published journal paper (Zohra et al. 2017b) that will consolidate different quality scores into a single evaluation score to indicate the overall quality of the facial image. The proposed method considers different quality factors, such as illumination, contrast, brightness, and focus of the facial images, and generates a unified evaluation score. The method uses a linear regression-based approach to capture the relationship between various quality scores and the corresponding matching score of a facial image. The idea of using the logistic regression model was originally introduced and presented at the 2017 IEEE International Conference on Cognitive Informatics & Cognitive Computing ICCI*CC 2017 (Zohra et al. 2017a). The significantly extended result including new experimentation...
This title is available in Advances in Computational Intelligence and Robotics, InfoSci-Books, InfoSci-Computer Science and Information Technology, InfoSci-Science and Engineering, Science, Engineering, and Information Technology, InfoSci-Select, InfoSci-Computer Science and IT Knowledge Solutions – Books. Recommend this product to your librarian: www.igi-global.com/e-resources/library-recommendation/?id=77

Related Content

Automatic Classification of Decorative Patterns in the Minoan Pottery of Kamares Style

Intelligent Information Retrieval Using Fuzzy Association Rule Classifier

Time and Space Reasoning for Ambient Systems

Application of Soft Computing Techniques for Renewable Energy Network Design and Optimization