Face detection and face recognition based on discriminating features under lower illumination

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ABSTRACT

For recent years, the technique of face recognition has a significant influence on our daily life due to its broad applications such as public security, surveillance system, identity authentication, and access control. Because of its non-intrusive feature, face recognition has been widely accepted by most people among all the techniques of biometric identification. Moreover, this technique can be extensively applied to the research program of human and computer interface (HCI) because of its great potential for promoting the intelligent life of human being in the near future. Additionally, the developments of video conference, content-based image retrieval (CBIR) and medical image processing are also quite dependent on the progress of face recognition. The most two important issues of face detection are face tracking and localization. Face detection is often preceded by the extraction of skin-tone colors, since it is one of the most important cues of face features with invariance of the changes of face scales, poses, and facial expressions. However, the color-based approaches are quite difficult to robustly detect skin-tone color in the presence of complex background and varying illumination. To solve the problem of lighting variations, an adaptive skin color model switching combined with the AdaBoost method for face tracking is proposed. Possible skin clusters under illumination varying scenes are detected by an optimal skin color model, which is adaptively selected by a well-defined quality measure. The possible facial candidates are further validated by AdaBoost to determine whether human faces exist in video sequences or not. The tracking sequences reveal that good and robust results are obtained from dim- to profile- to back-light scenarios. The performance of the proposed method can achieve an average tracking time of about 60 ms per frame and a detection rate of 94.4%. To perform face recognition under lower illumination conditions, we use the method of histogram matching (HM) as a tool of image preprocessing. We also compare the results obtained using the facial feature of local binary patterns (LBP). Moreover, linear discriminant analysis (LDA) is a popular feature extraction method for dimensionality reduction of face images. Finally, face recognitions are performed by the three methods such as support vector machine (SVM), Euclidean distance (ED), and cosine distance (CD) that are used to measure the recognition results. The experiments are carried out using the Yale Face Database B. The darker face images after the processing of HM can effectively reconstruct their facial textures, and the recognition rate of 96% can be achieved using the SVM classifier.

Keywords: face recognition　face detection　skin color segmentation　support vector machine (SVM)

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