DOCTORAL THESIS

Face recognition using virtual frontal-view image

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Face Recognition
Using Virtual Frontal-View Image

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Abstract

In recent years, there is an increasing trend of using Biometrics information to strengthen the security measure of different electronic/embedded systems. Among the various biometric features, user authentication that uses the human face is the most suitable for commercial applications. In addition, automatic face recognition has been an active research area in the last decade.

Automatic face recognition is a very difficult task because the face image to be recognized may have many variations, which include facial expression, scale, orientation, makeup, aging and occlusion. Many recognition algorithms have been developed to tackle the variations on different facial expressions and small occlusions, and the results are encouraging. However, the variations due to different poses, facial make up and aging, are still not solved. This thesis focuses on the face with pose variations.

To recognize a face under different poses, one approach is to use a 3D model of human face. This approach is flexible but the equipment for acquiring the 3D face image is very expensive. The second approach is view-based. However, the complexity of the system will be very high, as it requires constructing a representation for each view. For a 3D rotation, construction of dozens of representations may be required. This thesis proposes a new idea to transform the face with different poses into frontal view for recognition.

To construct the virtual frontal view image, we have developed an algorithm for detecting landmarks, which are then used to estimate the orientation of the face. A generic 3D spring-based face mask is developed to transform the unknown face image into virtual frontal view image. Finally, a spectroface method, which is based on

wavelet transform and Fourier transform, is developed to recognize virtual frontal face image.

The proposed method has been tested by 1145 face images from 85 persons with different poses, facial expressions and small occlusions. The recognition accuracy for the best match is 84.7%. If we consider the top three matches, the accuracy increases to 92.9%. According to the FERET evaluation on current state of the art algorithm in 1998, the highest recognition accuracy for face images with poses is 64%. If the top three matches are considered, the accuracy increases to 67%. When comparing with these figures, the performance of the proposed method is obviously superior over the existing methods.

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