Feature Extraction and Recognition of Iris

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1 Objective

In this project we aim to recognize iris using DCT and DWT as methods for feature extraction. In the past, one of the common methods to recognize iris was through KLT (Karhunen-Loeve Transform) which was computationally heavy and it's performance was not satisfactory in real time scenario. This project aims to target the same problem using DCT/DWT, which are computationally less expensive.

2 Motivation

The uniqueness of biometric patterns found in the iris of an individual makes it suitable for various applications such as device authentication, biometric key cryptography etc. Iris recognition is currently a hot topic in research and the current state of the art technology faces challenges like consistent performance under variability, low speed of enrollment and recognition etc. which makes it unreliable for real time use. Recently some smart phone manufactures have started using iris recognition system as a security feature in devices, but they are not that reliable and one has to revert to other robust methods.

3 Previous work

- Shervin Minaee et al. [2] have investigated the application of deep features extracted from VGG-Net (which is a CNN trained on an unrelated data-set) for iris recognition. They treat the trained model as a feature extraction engine and use it for feature extraction from iris images, without any fine-tuning to see if the general features are applicable for biometric recognition. Then multi-class SVM is used to perform recognition. The proposed scheme has been tested on two well-known iris databases, and has shown promising results with the best accuracy rate of 99.4%
- Lye Wil Liam et al. [3] have proposed a system consisting of two parts: Localizing Iris and Iris Pattern Recognition. They used digital camera for capturing image; from the captured images Iris is extracted. Only the portion of selected Iris is then reconstructed into rectangular format. Iris patterns are then recognized using the trained self-organizing map neural network. The result of their implementation shows an accuracy of around 83%

- Li Ma et al. [4] have proposed a method consisting of three major components: image preprocessing, feature extraction and classifier design. A bank of circular symmetric filters is used to capture local iris characteristics to form a fixed length feature vector. The proposed algorithm gives an accuracy of 99.85% on a database containing 1088 iris images.

4 Intended approach

In this project we aim at following the undermentioned approach for extracting features and recognising an iris image:

- Extract iris from the eye images and normalize to a standard format (Rectangular using bi-linear interpolation from its four nearest neighbors) in order to remove variability.
- Estimate image background illumination, subtract the slowly varying background illumination, and equalize the gray-level histogram of the iris image
- Derive sub-feature vectors from the zero crossings of the differences between 1D DCT coefficients calculated in rectangular image patches
- Generate Iris code as a sequence of many such sub-features, and classify using a weighted Hamming distance metric (nearest neighbor method)

Along with this method we further plan to optimize DCT coefficients by extracting the most discriminating ones and discarding the rest and use the same algorithm with Haar and Daubechies wavelet transform in place of DCT for comparing accuracy and speed of the proposed solution.

If time permits, we will also experiment with the classification algorithm by using SVMs, random forests etc. in place of nearest neighbor algorithm.

5 Dataset

For training and validation purposes we will use two different data-set

- CASIA-IrisV4 [5] with total of 54,601 iris images from more than 1,800 genuine subjects and 1,000 virtual subjects
- The University of Bath (BATH) [6] iris image database, which contains over 16000 iris images taken from 800 eyes of 400 subjects

References

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