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Recognition of Sclera through probabilistic model

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***Abstract*— To propose a new approach for human ID: sclera recognition. Second, we developed a new method for sclera segmentation which works for color images. Third, we designed a Gabor wavelet-based sclera pattern enhancement method to emphasize and binarize the sclera vessel patterns. Finally, we proposed a line-descriptor based feature extraction, registration, and template matching method that is illumination, scale, orientation, and deformation invariant and can mitigate the multilayered deformation effects and tolerate segmentation error.**

Keywords- Image processing, sclera, probalistic model.

I. INTRODUCTION

Image Processing is a technique to enhance raw images received from cameras/sensors placed on satellites, space probes and aircrafts or pictures taken in normal day-to-day life for various applications. The term *digital image processing* generally refers to processing of a two-dimensional picture by a digital computer. In a broader context, it implies digital processing of any two-dimensional data. A digital image is an array of real numbers represented by a finite number of bits. The principle advantage of Digital Image Processing methods is its versatility, repeatability and the preservation of original data precision. *Machine Learning* is a field of study that gives computers the ability to learn without being explicitly programmed. Given a training set, we feed it into a learning algorithm (like SVM, Artificial Neural Network, Logistic Regression, Linear Regression etc). The learning algorithm then outputs a function, which for historical reasons is called the hypothesis.

Sclera Recognition

Sclera recognition is identification of a human using the sclera, the 'white of the eye.' It offers several benefits over other eye-based biometrics that make it well-suited for non-compliant recognition situations.

II. LITERATURE SURVEY

Face recognition is widely considered as one of the most promising biometric techniques, allowing high recognition rates without being too intrusive. Many approaches have been presented to solve this special pattern recognition problem, also addressing the challenging cases of face changes, mainly occurring in expression, illumination, or pose. On the other hand, less work can be found in literature that deals with partial occlusions (i.e., sunglasses and scarves).

III. PROPOSED SYSTEM

Recognition deals with establishing a person's identity from a set of identities. In recognition technique, the input feature data is checked against all the data stored in the database. The given test Sclera image was

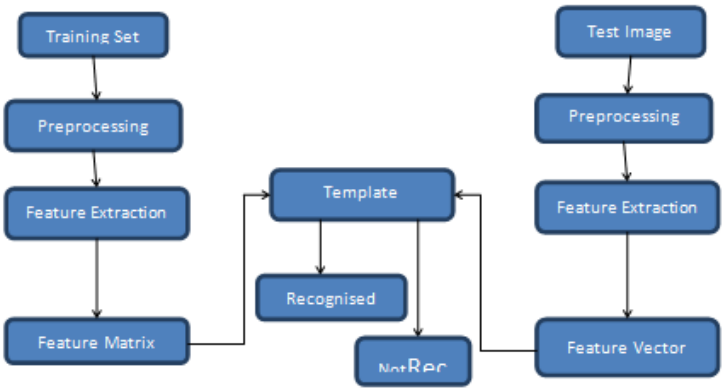
preprocessed to remove noise . Gabor wavelets of various scale and orientation were convolved with denoised sclera image for feature extraction and enhancement. Test feature matrix is checked with that of training feature matrix by means of naïve bayesianclassifier.Compute the accuracy of recognition.

Modules

1.Estimate sclera area by identification of non-skin area
2.Detect white area of the eye
3.Iris boundary detection
4.Refinement of eyelids and iris
5.Segment sclera using sclera mask
6.Feature extraction by gabor convolution
7.Feature matching & Decision

IV. IMPLEMENTATION

Block Diagram



Module Description

Estimate sclera area by identification of non-skin area

Compute the color distance map with the help of following 2 equations and then, calculate the sclera map.

$$CDM_1 = \begin{cases} 1, & R > 95, G > 40, B > 20, \\ & \max(R,G,B) - \min(R,G,B) > 15, \\ & |R-G| > 15, R > G, R > B \\ 0, & else \end{cases}$$

$$CDM_2 = \begin{cases} 1, & R > 220, G > 210, B > 170, \\ & \max(R,G,B) - \min(R,G,B) > 15, \\ & |R-G| \le 15, R > B, B > G \\ 0, & else \end{cases}$$

$$S_1(x,y) = \begin{cases} 1, & CDM_1(x,y)\ OR\ CDM_2(x,y) = 0 \\ 0, & else \end{cases}$$

Detect white area of the eye

The given test image is converted into HSI color space model. To obtain the sclera map concerning white part of eye, fix the threshold values in the corresponding color components.

$$S_2(x,y) = \begin{cases} 1, & if\ H(x,y) \le th_h \\ & and\ S(x,y) \le th_s \\ & and\ V(x,y) \ge th_v \\ 0, & else \end{cases}$$

Iris boundary detection

- Convert the given test color eye image into grayscale image and then find the edges by applying horizontal sobel filter upon it.
- Greedy angular search method is applied on the edge binary image to find the pupil and iris boundaries.

Refinement of eyelids and iris

- The iris and eyelid boundaries are refined using a Fourier representation.
- A dynamic programming approach is used to determine a globally maximal path.
- Describe the path by computing the Fourier expansion of the data.
- Truncate the number of coefficients used to describe the path, and re-computing the final boundary from the truncated coefficients

Segment sclera using sclera mask

- Having refined the upper and lower eyelids and the iris boundaries, the detected sclera region is segmented.
- The mask of the segmentation result is upsampled back to the original images size using a simple interpolation method.

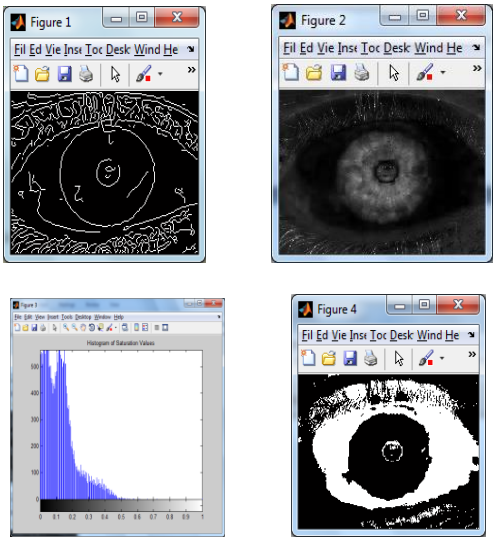
Feature extraction by gabor convolution

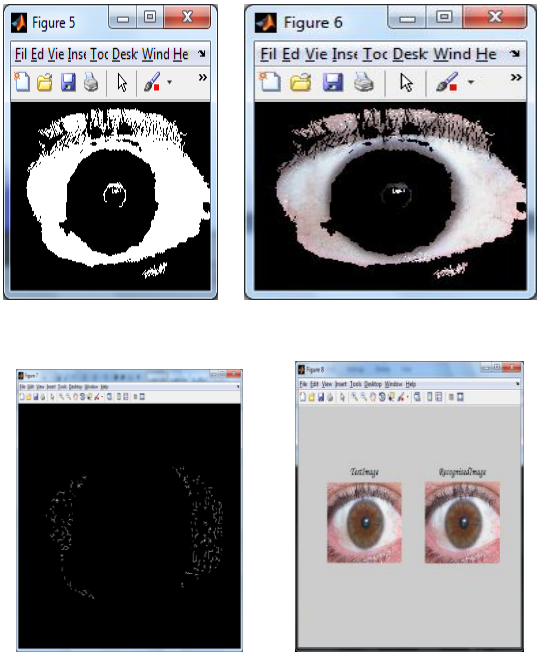
- The image is first filtered with Gabor filters with different orientations and scales.
- Design of Gabor filters is accomplished by tuning the filter with a specific band of spatial frequency and orientation by appropriately selecting the filter parameters; the spread of the filter σx , σy , *radial frequency f, and the orientation of the* filter θn.
- *After gabor convolution f*eatures will be extracted from the line segments.

Feature matching & Decision

- Each line segment in the test template is compared with the line segments in the target template for matches .
- Matching value lies in the range of 0 - 1

V. RESULTS





VI. CONCLUSION

Thus we proposed a new methodology for sclera recognition. In addition, sclera recognition can be combined with other biometrics, such as iris recognition or face recognition (such as 2-D face recognition) to perform multimodal biometrics rate.Weconclude that sclera recognition is very promising for positive human ID.

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