An Interactive algorithm for Iris Image capturing & detection for Secured Biometrics Authentication

Vijaysinh T.Jadeja [#1], Dr. J.G.Pandya [*2]

[#] *MCA Department, Murlidhar Group of Institutions, Rajkot, India*
[1] mgi.vijaysinh@gmail.com

[*] *EX. Manager*
BISAG
Gandhinagar, India
[2] pandyajg@yahoo.com

ABSTRACT RELIABLE DETECTION OF IRISES IS A NECESSARY PRECONDITION FOR ANY IRIS-BASED BIOMETRIC IDENTIfiCATION SYSTEM. IT IS ALSO IMPORTANT IN MEASURING THE MOVEMENT OF EYES IN APPLICATIONS SUCH AS ALERTNESS DETECTION AND EYE-GUIDED USER INTERFACES. THIS PAPER INTRODUCES A NOVEL ITERATIVE ALGORITHM FOR THE ACCURATE AND FAST LOCALIZATION OF IRISES IN EYE IMAGES.

Keywords: Biometrics, iris detection, Iris Recognition, Matching, Image Processing, Pattern recognition.

I. INTRODUCTION

Reliable biometric Identification of people has been an important research area for a long time. Due to the current political situation and new legislation, it has become increasingly important for example in access and border control. Computer vision techniques have been successfully utilized in fingerprint and iris recognition, and especially fingerprint-based systems are becoming ubiquitous. Even though iris is seen as the most reliable biometric measure, it is still not in everyday use because of the complexity of the systems.

One of the future challenges in the development of iris recognition systems is their incorporation into devices such as personal computers, mobile phones and embedded devices. In such applications, the computational complexity and noise tolerance of the recognition algorithm play an important role. This paper addresses the computational complexity of the necessary first step in iris recognition, namely iris detection.

The typical way of detecting the iris is to first detect the pupil and utilize the information in finding the iris. Even though a successful detection of the pupil constraints the search for the iris a lot, three independent parameters still need to be found. First, the concentricity of the pupil and the iris cannot be assumed. Therefore, the coordinates of the center of the iris must be found. The algorithm is based on the fact that relatively accurate initial guesses for the unknown parameters can be obtained based on the location of the pupil. Thus, an iterative algorithm only needs to run a few rounds to converge to the solution. Another advantage of the algorithm is that Eyelid detection is incorporated into the detection of the iris.

II. DETECTING THE IRIS

The algorithm is initialized with a circle whose center is at the center of the pupil. The radius of the circle is chosen to be “somewhat larger” than that of the pupil. The exact value affects practically nothing but the speed of convergence the idea is to impose a force to selected points on the circle. It Relies on image registration and image matching, which is computationally very demanding. All these algorithms are based on grey images, and color information was not used. Because grey iris image can provide enough information to identify different individuals. In our method, the groundwork is based on John Daugman work.

The iris identification is basically divided in four steps.

1. Capturing the image
2. Defining the location of the iris
3. Feature extraction
4. Matching

1. Capturing the image

A good and clear image eliminates the process of noise removal and also helps in avoiding errors in calculation. In practical applications of a workable system an image of the eye to be analyzed must be acquired first in digital form suitable for analysis.

2. Defining the location of the iris

The next stage of iris recognition is to isolate the actual region in a digital eye image. The part of the eye carrying information is only the iris part. Two circles can approximate the iris image, one for the iris sclera boundary and another interior to the first for the iris pupil boundary. In preprocessing we do the segmentation. The segmentation consists of binary segmentation, pupil center localization, circular edge detection and remapping.

3. Feature Extraction

The 2D Gabor filters used for iris recognition are defined in the doubly dimensionless polar Coordinate system(r, θ)

4. Matching

Comparison of bit patterns generated is done to check if the two irises belong to the same Person. Calculation of hamming distance (HD) is done for this comparison. [3] The Hamming distance is a fractional measure of the number of bits disagreeing between two binary patterns. Two similar irises will fail this test since distance between them will be Small.

A flow chart representation the algorithm is shown in Fig. 1

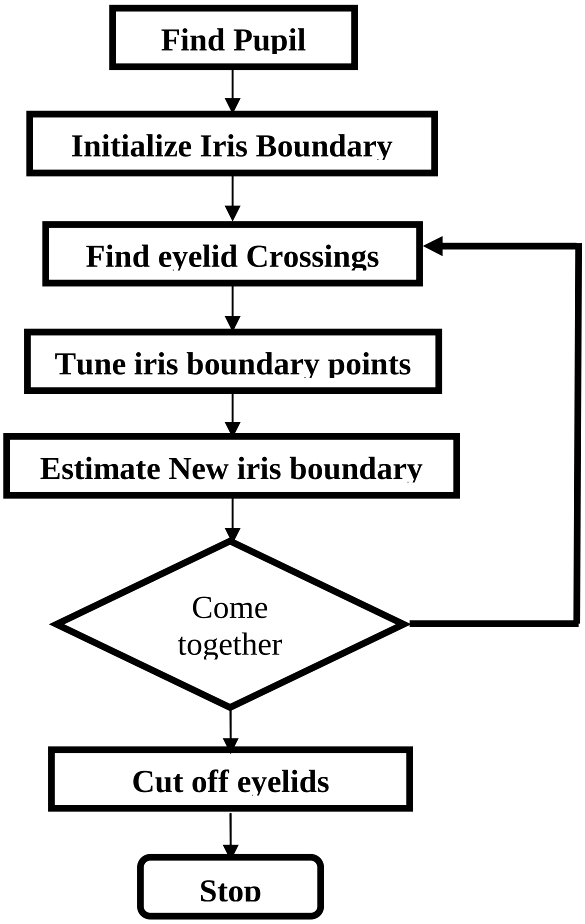

Fig 1. The iris detection algorithm as a flow chart.

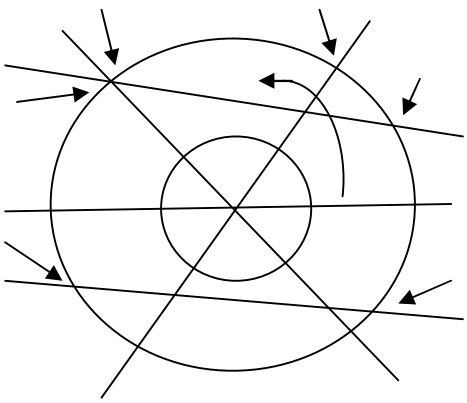

Fig 2. Significant points on the iris boundary

Each iteration of the algorithm starts with N points initialized on a circular boundary curve. These points are denoted by (x_i y_i), where $i = 0. . .N - 1$. $N/2$ points are uniformly distributed on both sides of the center of the circle within a 90◦ sector.

III. Detecting Eyelids

Eyelid detection is incorporated into the iris finding algorithm so that pixels on the eyelids are ignored. The locations of eyelid boundaries are estimated on each iteration. This approach has the advantage that no separate algorithm is needed in finding the eyelid. [6] Furthermore, a more accurate estimate of the iris location can be obtained by limiting the search to the sclera. To detect the eyelid, one only needs to inspect the gray profile of the current estimate of the iris boundary.

Fig. 3 B shows a schematic picture of the iris boundary. Since γ is measured counter-clockwise as shown by the curved arrow, the rightmost crossing of the upper eyelid (a) is found first in g(γ).

Once the iris boundary has converged to its final state, the last estimates of the iris boundaries can be used in removing the eyelids. A simple way of doing this is to cut off the circle segment bounded by the boundary points

RECOGNITION SPECIFICITY

Previous works had reported an almost infinitesimal probability of producing a false match in comparing signatures extracted from good quality data (e.g., [7], [4], [9] and [11]), which is due to the chaotic appearance of the iris texture and regarded as one of the technology's major advantages, when Compared to other biometric traits. This section goes one step beyond and analyzes the probability of producing false matches when comparing degraded iris samples (or from par-tial or non-iris regions due to failures on the eye detection and segmentation modules). [3]

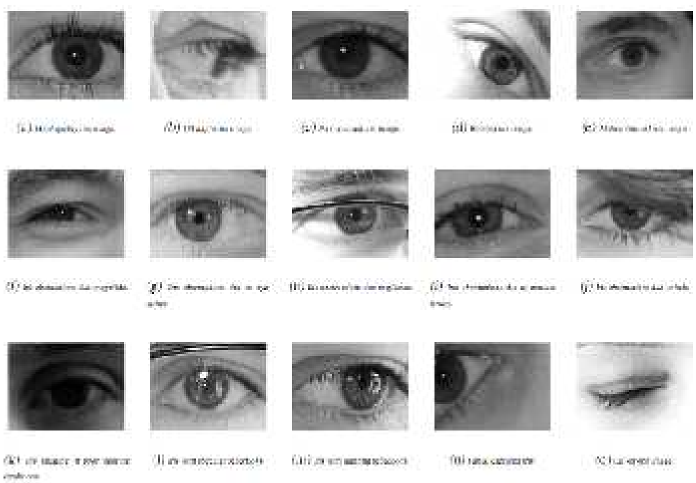

Fig 3. Comparison between a good quality image and several types of non-ideal images

- The possibility of finding an iris equal to another one is considered to be null, even the two iris of the same
- individual are different,
- The iris pattern does not change through the user's whole life,
- It is naturally isolated by the cornea,
- Modifying it surgically without any risk for the vision is nearly impossible,
- The physically response to light provides it a suitable way to test the aliveness of it. Iris recognition systems relays on a very similar architecture.

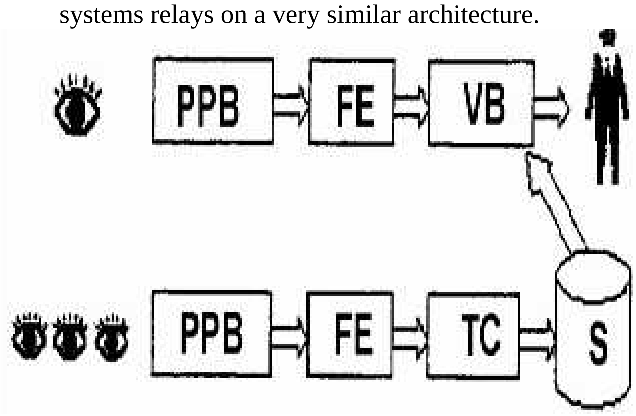

Fig. 4. Iris recognition system.

PPB – pre-processing block, FE – feature extraction, VB – measure verification block, TC – Template calculation, S – storage The firs block presents the image acquisition. This block is used to obtain from the real world the necessary data to process the biometric algorithm. These data can be just a digital image or something more sophisticated . In an iris recognition system, the image acquisition is done by a camera, it can be a high resolution photography camera or an infrared one. After that, preprocessing block takes these data and prepare it for the following block, improving the characteristics of the initial image, equalizating, taking out the useless information from the rest or emphasizing the parts of the image that contents more information.The feature extraction block is in charge of converting the data in a feature vector which makes it suitable to be measure, to be compared. The feature data should be univocal of each user. The data obtained before is used in different ways depending of the aim of the system at the moment. If the data want to be stored, the feature data is treated to create a template of the user and it is storaged with the rest of the user data. On the other hand, if the user belongs to the database of the system a verification block should determine if the physical characteristic belongs to the user he/she says to be, comparing the sample feature vector with the template stored. This block depends on the algorithms used before, as for the Gabor filters and wavelet transform, the Hamming distance, the Euclidean one and the zero-crossing distance have been studied.

IV. Discussion and Conclusions

The goal is to develop algorithms that can be used with cheap hardware so that iris recognition could one day be easily applicable to any application. As a first step, an iterative algorithm for the fast detection of irises was introduced. As a next step, the performance of the algorithm must be measured in a Recognition application. Furthermore, the algorithm needs to be evaluated with images containing artifacts such as secular highlights and eyeglasses.

We describe efficient techniques for iris recognition system with high performance from the practical point of view. These techniques are:

- A method of evaluating the quality of an image in the image acquisition step and excluding it from the subsequent processing if it is not appropriate.
- A computer graphics algorithm for detecting the centre of the pupil and localizing the iris area from an eye image.
- Transforming the localized iris area into a simple coordination system.
- A compact and efficient feature extraction method which is based on 2D multiresolution wavelet transform.
- Matching process based on Hamming distance function between the input code and the registered iris codes.

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