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ICU Security System Using Biometric Method

S. Geetha

Department of Bio Medical Engineering,
Bharath university, Selaiyur, Chennai-73, India

Abstract: This paper is based on biometrics which provides automatic identification of an individual based on a unique feature or characteristics possessed by an individual. Iris recognition is regarded as the most reliable and accurate biometric identification system available. The system has been effectively implemented for the intensive care units in the hospital as a security measure to prevent illegal access. Implementation of this algorithm is done in Matlab.

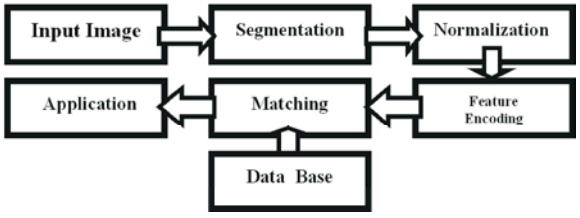
Key words: Canny edge detection · Interpolation · Thresholding · Hough Transform

INTRODUCTION

Object segmentation, Normalization, Encoding and matching are the building blocks of this biometric system. The goal of this is to match the acquired image with the database so that the ICU door is accessed when the image is matched [1].

The input image is fed to the iris recognition system which consists of an automated segmentation system that is based on the canny edge detection system and hough transform, which is able to localize the circular iris and pupil region, occluding eyelids and eyelashes. The extracted iris region is then normalized into a rectangular block with constant dimensions to account for imaging inconsistencies [2]. Finally, the phase data from 1D log gabor filter is extracted and quantized to encode the unique pattern of the iris in to a bit-wise biometric template. The hamming distance is employed for classification of iris templates. The two iris codes are found to match if the hamming distance is below 0.35, which is a fractional measure of the dissimilarity [3].

Basic Block Diagram:

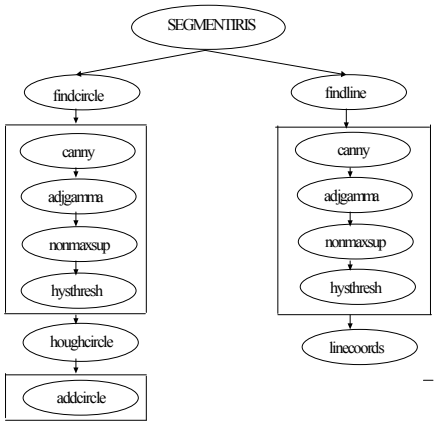


Description of Block Diagram:

Input Image: A black and white video image of the iris of the eye is needed to produce a digitized 512 byte iris code record. This project has its input image from the CASIA database [4].

Segmentation: In segmentation main aim is to isolate the actual iris region in a digital eye image. It is also used for the removal of artifacts from the image due to eyelids and eyelashes.

Flowchart of segmentation



Algorithm of Segmentation

Edge Detection Techniques: An edge is where the intensity of an image moves from a low value to a high value or vice versa. The edges of an image hold much

Corresponding Author: S. Geetha, Department of Bio Medical Engineering, Bharath university, Selaiyur, Chennai-73, India.

information in that image.Edge detection is often the first step in image segmentation. Image segmentation, a field of image analysis, is used to group pixels into regions to determine an image's composition [6].

Canny Method: The Canny edge detection algorithm is known to many as the optimal edge detector. It is optimal for step edges corrupted by white noise. Canny edge detection follows a list of criteria to improve current methods of edge detection.

Gamma Correction: A gamma function is used to correct the brightness profile of an image by multiplying each pixel by the value of the function. This is typically done in order to prepare the image for display or printing on a particular device. The brightness of an image can be adjusted with a gamma correction transformation [5].

Non-Maximum Suppression

Interpolation: Interpolation is the process used to estimate an image value at a location in between image pixels.

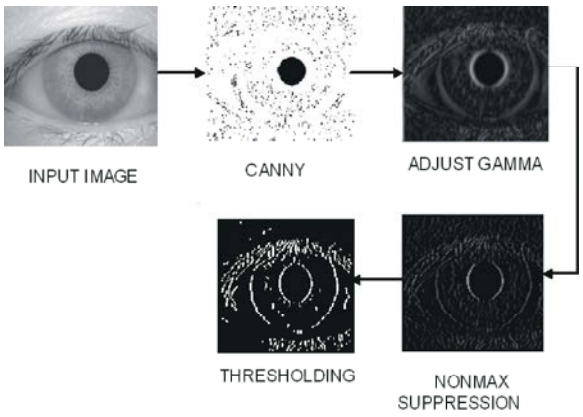
Image Thresholding: Image thresholding is a subclass of image segmentation. In the case of image thres holding, the objective is to divide an image into two segments only. The criterion for assigning a pixel to either segment is whether its value is less or larger than a prescribed threshold value. A binary image is obtained by marking pixels with values less than the threshold with zeros and the remaining pixels with ones [7].

Edge Linking Technique: The techniques described above detects intensity discontinuity. Ideally these techniques should yield pixels lying only on the boundary between regions. Thus edge detection algorithms typically are followed by linking another boundary detection procedures designed to assemble edge pixels into meaningful boundaries. The edge linking technique used here is hough transform [8].

Hough Transform: The Hough transform is a feature extraction technique used in digital image processing. The classical transform identifies lines in the image, but it has been extended to identifying positions of arbitrary shapes.

Segmentation of Iris:

Isolation of Top Eyelid:



Normalization: Normalization transforms the iris region in to a fixed dimension in order to allow accurate comparison. It produces an iris region with constant dimension so that two photographs of same iris under different condition will have same characteristic feature at the same spatial location.

Feature Encoding: In this stage the most discriminating information present in the iris pattern is extracted. The extracted features are encoded so that comparison between templates can be made.

Feature encoding was implemented by convolving the normalized iris pattern with 1 D Log-Gabor wavelets. The 2D normalized pattern is broken up into a number of 1D signals are convolved with 1 D gabor wavelets. Gabor filters are used mostly in shape detection and feature extraction in image processing. Gabor wavelets are specialized filters that extract information from a variety of locations and scales; they optimize the information in both spatial and frequency domains.

Matching: Matching-based segmentation localizes all image positions at which close copies of the searched pattern are located. These copies must match the pattern in size and rotation and the geometric distortion must be small.

In this Hamming distance is used to measure how many bits are the sam between two bit patterns. In comparing any two bit pattern, the hamming distance, HD, is defined as the sum of disagreeing bits (sum of the exclusive-OR between two bit patterns) over N, the total number of the bits in the bit pattern.

Both intra class and inter class comparisons should have values that are distinct and separate so that decisions can be made with high confidence.

Application Hardware: The output of the above process is given to an intensive care unit door. The signal of authentication or non-authentication either opens or closes the door respectively.

Implementation in Intensive Care Unit

Intensive Care Unit: Intensive care unit is defined as a separate, clearly designated service area which is maintained within a Hospital solely for the care and treatment of patients who are critically ill. This also includes what is referred to as an acute care unit.

It is a specialized part of the hospital designed for care of the critically ill whose conditions necessitate constant monitoring, characterized by high quality and quantity of continuous nursing and medical supervision and by use of sophisticated monitoring and resuscitative equipment.

ICU Security Management: ICU is an integral part of the hospital system and caters to the needs of seriously ill patients. The category of critically ill patients also encompass patient who are eyewitness to some illegal activity. The main motto of our project is to secure their lives, during their recovery period, incase of any life threat from criminals.

Iris recognition has been used as a tool to give shape to the above idea. For this project we are using CASIA database images. But for real time application a camera can be installed on the ICU door. The authorized person's iris image is kept in the database. This will allow him to access the room on subsequent visits, after his iris pattern is matched with the database. In case any unauthorized person tries to enter the ICU, his iris pattern has to match with the patterns stored in the database. If there is a mismatch the person will not be allowed to access the room [9].

Future Trends: Iris recognition can be used as the best option for physical and wireless arenas.

It can be used in authentication of funds transfer.

It can be used to provide signature verification.

Healthcare solutions based on iris recognition can protect access to patient medical records at hospitals.

CONCLUSION

Object segmentation, Normalization, Encoding and matching are the building blocks of this biometric system. The goal of this is to match the acquired image with the database so that the ICU door is accessed when the image is matched.

The input image is fed to the iris recognition system which consists of an automated segmentation system that is based on the canny edge detection system and hough transform, which is able to localize the circular iris and pupil region, occluding eyelids and eyelashes. The extracted iris region is then normalized into a rectangular block with constant dimensions to account for imaging inconsistencies. Finally, the phase data from 1D log gabor filter is extracted and quantized to encode the unique pattern of the iris in to a bit-wise biometric template. The hamming distance is employed for classification of iris templates.

The two iris codes are found to match if the hamming distance is below 0.35, which is a fractional measure of the dissimilarity.

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