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IMPLEMENTATING IRIS BASED SECURITY SYSTEM USING MATLAB BASED IMAGE PROCESSING

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ABSTRACT

Biometrics is technology of identifying human subjects by means of measuring & analyzing more than one intrinsic behavioral / physical traits. Iris recognition is method of biometric to be identify it's use mathematical recognition techniques on video images of one or both of irises of an individual eye, whose difficult random patterns are unique, stable, & could be seen from some distance. The performance of technical capability of iris recognition process far surpasses that of any biometric technology now available. Iris identification process is defined for rapid exhaustive search for very large databases: distinctive ability required for authentication today.

Keywords:- Authentication, Biometrics, Fingerprints, Irises, Recognition

I. INTRODUCTION

The iris-scan process begins with a photograph. A specialized camera, typically very close to subject, not more than three feet, uses an infrared image to illuminate eye & capture a very high-resolution photograph. This process takes 1 to 2 seconds.

Iris recognition is an automated method of biometric identification that uses mathematical pattern-recognition techniques on video image(picture) of one / both of irises of an individual's eyes, whose complex random patterns are unique, stable, & could be seen from some distance.

Not to be confused with other, less prevalent, ocular-based biometric technologies such as retina scanning, iris recognition uses video camera technology with subtle near infrared illumination to acquire images of detail-rich, intricate structures of iris that are visible externally. Digital templates encoded from such patterns by mathematical & statistical algorithms allow identification of an individual / someone pretending to be that individual. Databases of enrolled templates are searched by matcher engines at speeds measured within millions of templates per second per CPU & with remarkably low false match rates.

Iris as a powerful identifier

Iris is focus of a relatively new means of biometric identification. Iris is called living password because of its unique, random features. It is always with you & cannot be stolen / faked. Iris of each eye is absolutely unique. So no two irises are alike within their details, even among identical twins. Even left & right irises of a single

person seem to be highly distinct. Every iris has a highly detailed & unique texture that remains stable over decades of life. Because of texture, physiological nature & random generation of an iris artificial duplication is virtually impossible.

Applications

Biometric applications could be categorized into three main groups:

- **Forensic applications**: For criminal investigations: e.g. for corpse identification, parenthood determination, etc.
- **Government applications**: It includes personal documents, such as passports, ID cards & driver's licenses; border & immigration control; social security & welfare-disbursement; voter registration & control during elections.
- **Commercial applications**: It includes physical access control; network logins; e-Commerce; ATMs; credit cards; device access to computers, mobile phones, PDAs; facial recognition software; e-Health.

II. IMAGES IN MATLAB AND THE IMAGE PROCESSING TOOLBOX

The basic data structure in MATLAB is array, an ordered set of real or complex elements. This object is naturally suited to representation of images, real-valued, ordered sets of color or intensity data. MATLAB does not support complex-valued images.

Image Types in Toolbox

The Image Processing Toolbox supports four basic types of images:

1. Indexed images
2. Intensity images
3. Binary images
4. RGB images

Indexed Images

An indexed image consists of two arrays, an image matrix & a colormap. The colormap is an ordered set of values that represent colors in image. For each image pixel, image matrix contains a value that is an index into colormap. The colormap is an m-by-3 matrix of class double. Each row of colormap matrix specifies red, green, & blue (RGB) values for a single color:

color = [R G B]

R, G, & B are real scalars that range from 0 (black) to 1.0 (full intensity).

The pixels in image are represented by integers, which are pointers (indices) to color values stored in colormap. The relationship between values in image matrix & colormap depends on whether image matrix is of class double or uint8. If image matrix is of class double, value 1 points to first row in colormap, value 2 points to second row, & so on. If image matrix is of class uint8, there is an offset; value 0 points to first row in colormap, value 1 points to second row, & so on. The uint8 convention is also used in graphics file formats, & enables 8-bit indexed images to support up to 256 colors. In image above, image matrix is of class double, so there is no offset. For example, value 5 points to fifth row of colormap.

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III. MATLAB BASED IMPLEMENTATION

When we start MATLAB, desktop appears in its default layout.

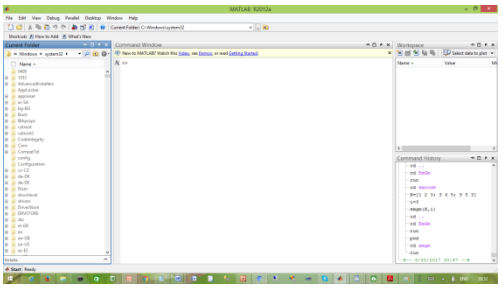

Fig 1 matlab default layout

Current Folder allows to access folder & files.

Command Window allows to enter commands at command line. It is indicated by prompt (>>).

Workspace explores data what has been created or imported from files.

Command History shows & rerun commands what user entered at command line.

When user work in MATLAB he issues commands which create variables. It calls functions. Eg define variable named x by typing following statement at command line:

```
x = 5
```

MATLAB adds variable x & show output in Command Window.

```
x =
    5
```

Create another variable.

```
y = 7
y =
    7
z = x + y
z =
    12
```

ARRAY CREATION IN MATLAB

MATLAB is abbreviation for matrix laboratory. Usually programming languages work with numerical value one at a time. But MATLAB has been designed to operate on complete matrices & arrays primarily.

Every MATLAB variables are considered multidimensional arrays. It does not matter which type of data. Matrix is known as two-dimensional array that is often used for linear algebra.

CONVERT IMAGE TO DOUBLE-PRECISION DATA

The Fuzzy Logic Toolbox software operates on double-precision numbers only. So, convert Igray, a uint8 array, to a double array.

I = double(Igray);

Because uint8 values are in [0 2^8-1] range, all elements of I are in that range too. Scale I so that its elements are in [0 1] range.

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classType = class(Igray);

scalingFactor = double(intmax(classType));

I = I/scalingFactor;

Alternatively, you could use im2double function in Image Processing Toolbox software to convert Igray to a scaled, double-precision image.

Obtain Image Gradient

The fuzzy logic edge-detection algorithm for this example relies on image gradient to locate breaks in uniform regions. Calculate image gradient along *x*-axis & *y*-axis.

```
Gx = [-1 1];
Gy = Gx';
Ix = conv2(I,Gx,'same');
Iy = conv2(I,Gy,'same');
figure; image(Ix,'CDataMapping','scaled'); colormap('gray'); title('Ix');
```

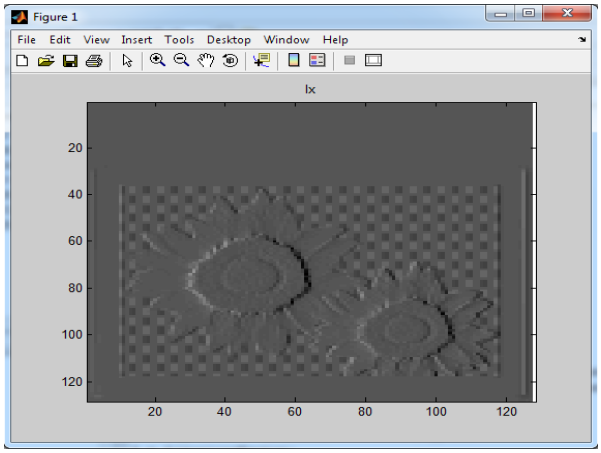

FIG 2 Obtain Image Gradient(X)

```
figure; image(Iy,'CDataMapping','scaled'); colormap('gray'); title('Iy');
```

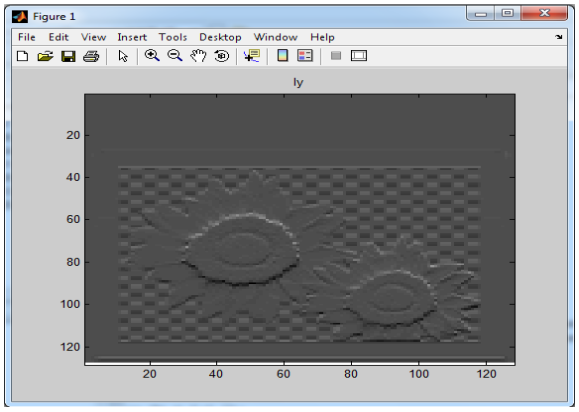

FIG 3 Obtain Image Gradient(Y)

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IV. RESULTS

Iris recognition implementation

Step 1: Acquisation of image of iris: Scan image of eye / take it by digital camera

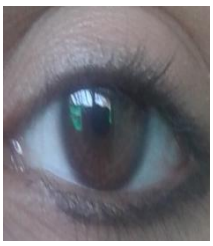

FIG 4 Acquisation of image iris

Step2: Before comparison we crop image of eye

FIG 5 After crop image

Step 3: Store image as matrix within i

>>i=imread('eye1.jpg')

Step 4

Apply canny to i matrix & store within ii

>> ii=canny(i,1,1,1)

Step 5

Create histogram using surf command

>>surf(ii)

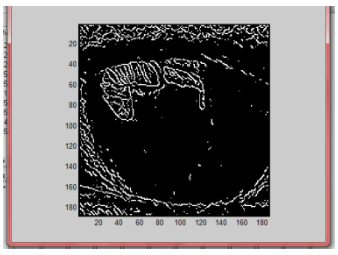

FIG 6 Histogram of crop image

Here we took sample of eye1 & crop it using image processing tool. Then we applied edge detection mechanism in order to reduce unnecessary part for comparison. The image is then stored in form of Matrix & a histogram is plotted.

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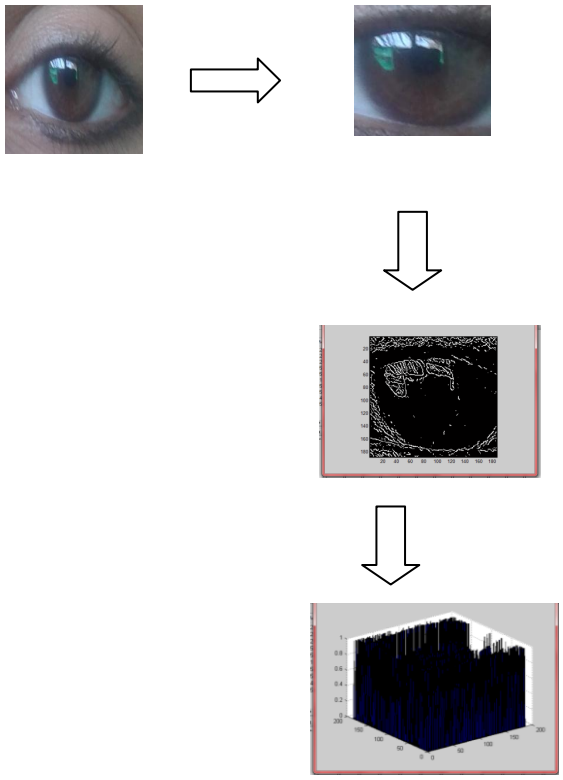

FIG 7 Eyes 1

Here we took sample of eye2 & crop it to eliminate unnecessary part using image processing tool. Edge detection mechanism to remove unnecessary part for comparison is applied afterward. The image is then stored in form of Matrix & a histogram is plotted.

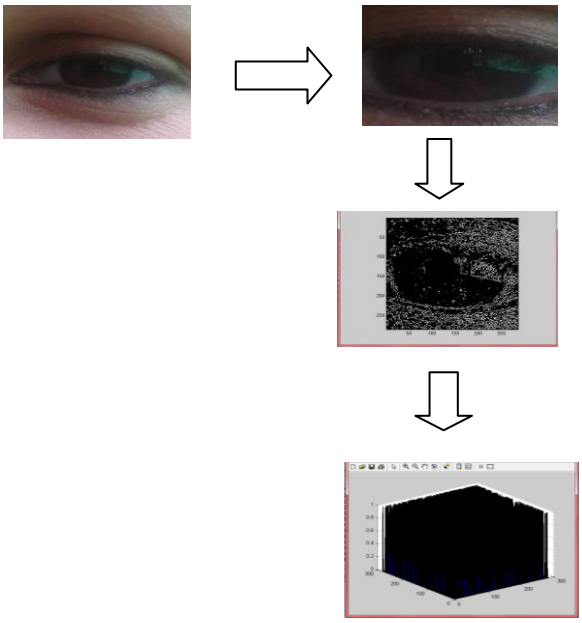

FIG 8 Eye 2

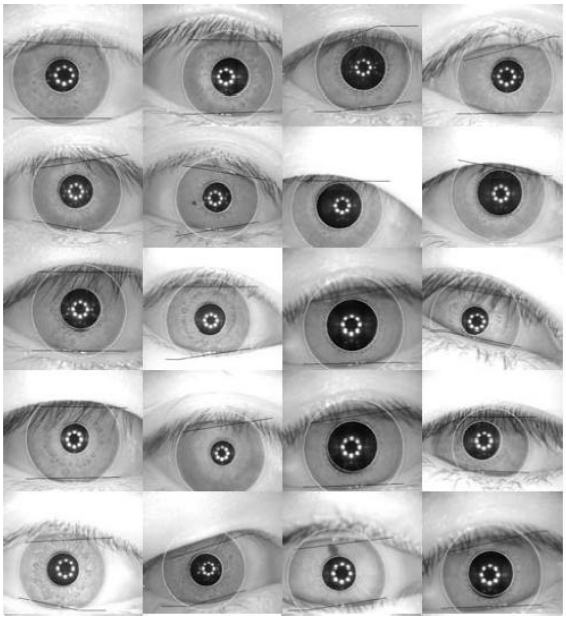

FIG 9 Iris boundaries localized for some eye images(pictures) (iris database:CASIA Iris Interval)

V. CONCLUSION

The technical performance capability of iris recognition process far surpasses that of any biometric technology now available. Iris identification process is defined for rapid exhaustive search for very large databases: distinctive capability required for authentication today. The extremely low probabilities of getting a false match enable iris recognition algorithms to search through extremely large databases, even of a national / planetary scale.

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