Project Report

on

Iris Recognition

Submitted In Partial Fulfilment Of The Degree Of

Bachelor Of Technology

by

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Certified that this Project Report entitled

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is a bonafide report of the Project presented by

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Abstract

This project work entitled - "IRIS RECOGNITION SYSTEM" is aimed at solving the security problem by checking the validity of persons.The main application of this project will be in security is assured on the basis of image identification. This project can be extended by using CCD(Change Coupling Device) camera either active or passive way. We can store the iris images for the identification. This method provides for a much more user friendly experience. We can use the iris as a living password. National border controls the iris as a living passport, telephone call, charging without case, cards or pin nos. secure access to bank case machine accounts.

Contents

1 Problem Definition

This project work entitled - "IRIS RECOGNITION SYSTEM" is aimed at solving the security problem by checking the validity of persons. As is properly known that the iris is found to be unique in case of each and every individual. This has been scientifically proved by the American Research Society. The main application of this project will be in security which is assured on the basis of image identification.Owing to sophistication and stringent requirements of the project, the images have to be taken with atmost care and perfection.

2 Motivation

The iris identification system is beteer than other applications of ANN like signature, face, fingerprint. The reason is that signature can be copied by others, also fingerprints can be changed by scratches and faces can changed by plastic surgery or by accident. But the iris remains unique and intact. Also a minor surgery can not change the pattern of the iris.

3 How It Works

1. A person stands infront of the iris identification system; generally on-three feet away, while wide-angle camera calculates the position of his/her eye.

2. The camera zooms in one of the eyes and takes the black and white image of the eye.

3. The scanning of iris consists of drawing circles of 100-pixels radius each. Thus, image is stored in the form of red, green and blue values of the pixels on the scanned circles, which are 10 in number for our project.

4. The histogram is a graphical representation of the RGB values of the scanned image. Histogram Equilization is the next step in which the concentrated areas of the histogram are averaged and spreadover equally.

5. Thresholding is the process of converting the image into binary input values.

6. The binary input values obtained be thresholding are fed to the feedforward backpropagation network. The input is checked with the samples stored.

7. It is then classified according to the classto which it matches. The class and the information of the person are displayed.

4 Literature Survey

4.1 Artificial Neural Networks

The back propagation network is probably the most well known and widely used among the current types of neural network systems available. The back propagation network is a multilayer feedforward network with a different transfer function in the artificial neuran and more powerful learning rule.

4.2 Neural Computing

The learning rule is known as back propagation, which is a kind of gradient descent technique with backword error propagation. The traning instance set must be presented many times in order for intrconnection weights between the neurans to settle into a state for correct classification of input patterns.

4.3 Fundamentals of Neural Networks

While the network can recognize patterns similar to those they have learned, they do not have the ability to recognize new patterns. This is true for all supervised learning networks.In order to recognize new patterns, the network needs to be retrained with these patterns along with thepreviously known patterns.

5 Biological Background

The eye is an organ in which patterns of light are brought into focus on the retina through the eye all and ensuing chemical reactions produces an electrical signals that propagates through the optic nerves. The eyeball essentially consists of three separate concentric layers. Which are modified anteriorly to admit and regulate the passage of light.

SCLERA :- The sclera is the outermost layer of the eye, which protects it. The fluid present in the eye gives the eye its characteristic shape it also serves to protect the delicate internal structures.

RETINA :- This is the innermost layer of the eye and is highly light sensitive. The images formed on the retina are inverted images. These images are converted into electrical pulses and are sent to the brain through the optic nerve.

UVEAL TRACT :- This is a interventing layer (between sclera and retina), it consists of choroids, nutrient vascular bed for the retina. The anterior rim of this layer continues forward forming the intraocular muscles which govern the pubillary moments.

THE IRIS :- The iris is in the uveal tract. It is separate from cornea by mashroom shaped anterior chamber. The iris encapsulates the pupil in the form of a disk. The pupil changes its size according to the intensity of the light incident on it. The ciliary muscles change the shape of the crystalline veins during the process of focusing.

The iris is composed of four layers :-

The anterior limiting layer is formed by the condensation of stroll cells. The stroma contains the blood vessels nerves sphincter embedded in the ground substance. The blood vessels are of low permeability and have thick endothelial collagenius layer. Posteriorly lies dialator muscles and a posterior epithelium. The iris pattern consists of pigmented spots and no two irises will have the same pattern. It is iris pattern once formed is complete and permanent. The layer of pigment is present at birth and develops into unique and complete pattern within few months.

6 Requirements and Specifications

The minimum requirements for the successful working of project are as following :

6.1 Visual Basic 6.0

6.1.1 About Visual Basic

Visual Basic is not just a language. It is an integrated Development Environment in which you can develop, run, test and test your applications. Visual basic applications can be viewed in three distinct states; design, execution and break. In design state, you can edit the user interface or add code to the application. In execution state, the application is running and in break state, the application's execution has been interrupted temporarily and can resume when you press F5.

6.1.2 Why Visual Basic?

Visual Basic lets you easily create Windows applications. It comes with all the tools you need to build mainstream windows applications. It includes advanced features such as tools to develop ActiveX and internet controls. ActiveX components are basic code building components that don't a visible interface and that can add special functionality to your applications.

6.1.3 Color Handling

Visual Basic has two methods for manipulating the pixels : Pset and Point. Pset turns on the pixel and point reads it's value. For defining colors. Visual Basic provides the RGB( ) function which accepts three arguments RGB (Red, Green, Blue). A long integer is made up of four bytes, three of it's store the values of RGB component and one stores zero. The following three statements extracts the values of the three color components from a color value stored in the pixel variable.

Pixel = Form1, Picture1 point (i, i)
Red = pixel Mod 256
Green = ((pixel And HFF00FF00)/256)
Blue = (pixel And HFF0000)/65536)
Where, I and I are the coordinates of the point which we are examining.

6.2 Microsoft Excel

The OLE (Object Linking Environment) lets VB applications access functionality of other applications in the Windows environment in Microsoft Excel, a workbook is a file in which you work and store your data. Because each workbook can contain many sheets. You can organize various of relnted information in a single file you can enter and edit data on several worksheets simultaneously and perform calculations based on data from multiple worksheets. You can create a chat and place on the worksheet.

6.3 Machine Requirements

In the Neural Network, the training requires higher speed and long for the weight calculations. The speed is also the important factor in scanning the image. That is why, the PIII is must.

7 Structured Analysis

Structured analysis (SA) is a model building activity. Using a notation that is unique to the structured analysis method, we create models that depict information (data and control) flow and content, we partition the system functionality and behaviorally, and we depict the essence of what must be built.

7.1 Data Flow Diagram

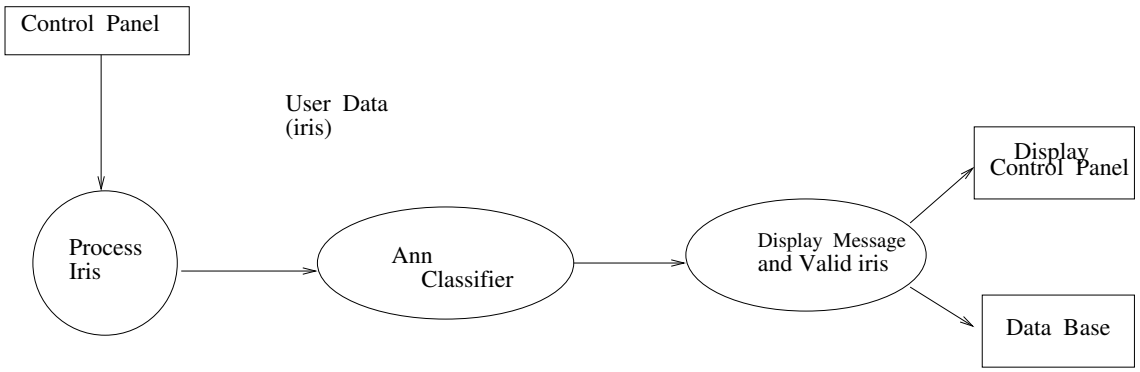

Figure 1: Data Flow Diagram

In the data flow diagram, the flow of data through different system modules is shown. In this system, the data is the iris pattern of the person which first goes to processing unit, then for training and then classification.

8 Neural Network Classifier

8.1 Introduction

Out project consists of a feedforward backpropagation network. A feedforward neutral network consists of layers of processing units -

1. Input Layer
2. Hidden Layer
3. Output Layer Each layer feeding input to the next layer in a feedforward manner through a set of connection strengths or weights. In our system, 360 input nodes, 10 hidden nodes and 2 output nodes have been used.

8.2 Learning

Learning is the process of adjustment of connection weights to get desired output. There are two types of learning.

1. Supervised
2. Unsupervised

8.2.1 Supervised And Unsupervised Learning

The distinction between supervised and unsupervised learning depends on whether the learning algorithm uses pattern-class information. Supervised learning assumes the availibility of teacher or supervisor who classifies the training examples into classes. Whereas unsupervised learning does not. Thus unsupervised learning must identify the patttern-class information as a part of the learning process in general, the task of unsupervised learning is more abstract and less defined supervised learning algorithms utilize the information on the class membership of each training instance. This information allows supervised learning algorithms to detect pattern misclassification as afeedback to themselves. In supervised learning, learning is done on the basis of direct comparison of the output of the network with known correct answers. In unsupervised learning, the desired outputs are not specified. The only available information s in the correlation's of the input data of signals. In our system, we have used supervised learning, in which the desired outputs are given with input data.

9 Look at the ANN

The artificial neutral networks aimed more towards modeling networks of real neurons in the brain. The first simplest model of neuron is McCulloch - Pitts - Model it works as follows: In is the threshold value for unit I. Wij represents the weight between neuron j to neuron i. The weighted sum of inputs must reach or exceed the threshold for the neuron to fire. The rule has the same principle as the delta rule. In that we will have an actual and desired output value. We will also have an error value for the whole network calculated for all the set of input patterns. The activity level for a unit is determined from the input it receives from the other units. This is weighted and compared against a threshold value. A unit will fire when the inputs received by that unit exceed some threshold value. The amount of error is found by looking at the output for a given input pattern, then comparing this value against the desired value. This will give us a value for the network. The rule has two-stage learning process involving two PHASES:

1. FORWARD PASS
2. BACKWARD PASS

9.1 FORWARD PASS

For each input/output pair, the input pattern is applied by setting by the states of the input units. A forward route taken through the network and the total input to a unit is defined as usual to be total of all input units. The layer are Delta in sequential order that is one after the other and the output for each unit is calculated and then used as input for subsequent units in next layer. Finally at the output layer we have result which in the majority cases, will not be one we are looking for, next comes he backwards pass through the network, phase two.

9.2 Backward Pass

In phase two, the process is reversed, starting at the output layer and armed with the actual and required output patterns, an error value can be found for each output unit. The procedure is worked through the layers and the error is used to apply the apprpriate weight changes to each unit in the network, the same sort of principle as used for Delta Rule. So to summarize the process, on the first time through the forward pass, the inputs produce an output. In the second phase, the backward pass then looks at hte errors and adjusts the weights in order to bring the result closer to the desired output.

9.3 Gradient Descent

The total error for the whole network can be minimized using a method called gradient discent, which involvesapplying a computation to each weight in the network in turn from the bottom. The simplest method is to change the weight by an amount proportional to the accumulated error as you go through the backward pass.

10 Steps Involved in Iris Recognition

10.1 Data Capture

A wide-angle camera takes the colour image of the eye. This colour image is converted into an 8 bit gray-scale image. This gray-scale image is stored in a BMP format.

10.2 Preprocessing

The preprocessing includes the following steps. Scanning of the image is done with the following steps. 1. From the center, take the circle of radius 100 pixels to be scanned. It has 468 pixels. We have to adjust it in 36 pixels so, taking average of per 13 pixels, adjust the circle into 36 pixels.

2. After scanning first circle, take another circle at 200 pixels radius from the center and it contains double the no. of pixels than first circle. Scan this circle in the same fashion as above but adjust the pixels into 36 by taking average of per 26 pixels.

3. In this way, take 10 circles with increasing radius of 100 pix is and scan the image. Thus, finally get 10 matrices of 36 elements each.

10.3 Image Histogram

The histogram of an image records the frequency distribution of gray levels in that image. The histogram of B bit image indexed from 0 to 255 in bin 0, we record the no. of times the gray level of occures. In bin 1, we record the no. of times a gray level of one occur and so on up to 255. Algorithm 1 shows how we can accumulate histogram from image data.

Algorithm 1 : Create array histogram with 2b elements
For all gray levels, 1, do,
Histogram (i) = 0
End for
For all pixel coordinates (x,y) do increments histogram f(x,y) by 1
End for

10.4 Histogram Equilization

We can use the histogram of an image to define a nonlinear mapping of gray levels. Specific to that, image that will yield an optimal improvement in contrast. This technique is known as "Histogram Equilization". This tends to increase contrast in the most heavily populate region of the histogram and often reveals previously hidden details. Calculating an image histogram closely related to the histogram of the image is its cumulative histogram which records its cumulative frequency distribution of a gray level in an image. The cumulative frequency of gray level I, it the no. of times that gray level less than or equal to I occurs in an image. Cumulative frequencies, Cj are computed from histogram counts, hi using.

Cj = sum (hi) from 1 = 0 to j Algorithm 2 :
Histogram Equalization
Compute the scaling factor, alpha = 255/no. of pixels
Calculate the histogram using algorithm 1
C (O) = alpha X histogram (O)
For all remaining gray level, 1, do
C (i) = c(l-1) + alpha X histogram (l)
End for
For all pixels coordinates X and y, do
G(x,y) = c[f(x,y)]

End for A flat histogram for n2, 9 bit image would need to have n2/256 count in each bin. Adjust bins in the input histogram which have fewer than n2/256 counts are amalgamated into a single output bin, thereby leaving some bins in output histogram unoccupied.

10.5 Thresholding

1. Create a database for a input patterns.

2. Randomly generate the weights for the first pattern.

3. Using the backpropogation algorithm, weights are adjusted and these are used as a seed to the next pattern.This process continues till we get the appropriate average pattern weight outs. In this way, the training is done in neural network.

10.6 Testing

The average weight outputs are given to the testing pattern. According to the result, it classifies the pattern and display its class.

11 Backpropagation

The feedforword backpropogation network is opular model in neural networks. It does not have feedback connections but errors are backpropogated during the trailing. Errors in the output determine measures of hidden layer output which are used as a basis for an adjustment of connection weight between a pair of layer and recalculating the output is an iterative process that is carried out on, until error falls below tolerance value. This algorithm gives a prescription for changing the weights Wpq in any feed forward network to learn a training set of input-output pairs. The back propogation algorithm is, 1. Initialize the weights to small random values.

2. Choose a pattern and apply it to the input layer (m=0) so that.

V( )k = 11k for all k

3. Propogate the signal forwards through the network using

Vim = g(hjm) = g(j Wijm Vjm-1)

For each I m until the final outputs Vim have all been calculated.

1. Computer the deltas for the output layer.

djm = g1 (hjm) [di11 - Vjm]

By comparing the actual outputs Vim with the desired for the pattern being considered.

2. Computer the deltas for the preceding layers by propagating the errors backwards.

djm-1 = g1 (hjm-1) (idji djm)

for M=m. m-1, ... 2 untill a deita has been calculated for every unit.

3. Use rWijm = hdim Vjm-1 To update all connections according to Wijnew = Wijold + Wij

4. Go back to step 2 and repeat for the new pattern. It is the straight forward to generalize back propagation to other kinds of networks where connections jump over one or more layers; such as the direct input to output connections. This produces the same kind or error propagation scheme as long as the network is feed forward, without any backward connections.

12 Future Extensions

This project can be extended by using CCD (Change Coupling Device) camera either active or passive way. We can store the iris images fo the identification. This method provides for a much more user friendly experience. We can use the iris as a living password national border controls the iris as a living passport, telephone call, charging without case, cards or pin nos. secure access to bank case machine accounts. Premises access control (home, office, laboratories, etc.) Driving licenses and other personal certificates, entitlements and benefits authentication.

References

[1] B.Yegnanayaran. Artificial Neural Networks. BPB Publications.

[2] Rolf Eckmiler and Christph Malsburg. Neural Computing. TMH Publications.

[3] web reference http://www.iriscan.com