Volume 5, Issue 9, September 2015 ISSN: 2277 128X
International Journal of Advanced Research in Computer Science and Software Engineering
Research Paper
Available online at: www.ijarcsse.com

Smart System for Person Recognition

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Abstract— In this paper, We are going to see a very smart system for recognizing persons in various conditions. This paper, proposes a recognition system by using different algorithm techniques. We are using R-Cascade, PCA (Principle Component Analysis), FJ-RC4 algorithms for building this system. The main goal of this system is to identify criminal in various places. Most probably we use this system in public places where we can monitor and identify criminal background persons. This system is helpful for police and security agencies.

Keywords— Criminal identification, FJ-RC4, IR Cameras, PCA, Haar Cascade.

I. INTRODUCTION

In this digital world as everywherecomputerized systems are working, we are taken initiative to help the security systems and policemen's for grabbing the criminals and criminal background persons. Smart System Person Recognition system is the improvement that has taken place in field of identifying and locating criminals in such public places like hotels, lodges, airports etc. This system is mainly usable for police head-quarters for identifying criminals that are searched for various crimes. Traditional method of finding criminals is very tough and hard working as policemen's has to go various places and have to cover lots of area in less time to trap the criminal. But by using this system it is very helpful for them to locate and trap the criminals that are wanted in their criminal lists.

In our system we are using IR cameras for recognizing criminals at the client side and the main system is in police headquarters. IR cameras capturing snaps of persons and then matching these images with the criminal database which is at server side located at headquarters. If these images matching more than 60% to 70% of criminal faces in databases then it generates an alert that criminal is found at xyz location where we are placed the IR cameras. So, our main moto is simply achievable by using this system. Now, we are going to see detailed description of this system.

II. SYSTEM DESCRIPTION

The designed system is used to transmit information about criminals which are identified by police criminal database. Criminal database is available in police headquarters and we are using that database for recognizing criminals. In this system we make some modules which are well compacted in a software. IR cameras placed in hotels, lodges are managed by DVR system and this DVR system can be access through internet anywhere anytime. So, at server side means in headquarters we make a web application and by using this web application we fetch live recording of IR cameras and matches this recording with criminal database which is already exists on server application. If any person matches with the database then an alert is generated at server end and then criminal can be grabbed quite simply.

III. RELATED WORK

For developing this system we are using three algorithm techniques which are mainly based on face recognition. These algorithm techniques are widely used for face recognition and it gives very efficient result at the end.

A. The Haar Cascade Algorithm

The face detection algorithm looks for particularHaar features of a human face. When any of these feature is found, the algorithm allows the face candidate for the next stage of detection. A face candidate is simply a rectangular section of the original image known as sub-window. Generally these sub-windows have a fixed size (about 24×24 pixels). This sub-window is fixedin order to obtain a different type and size of faces. The algorithm scans the whole image and denotes each particular section of a face candidate. The algorithm uses an integral image in to process Haar features of a face candidate in specific time. It includes cascade of stages which are used to remove non-face candidates. Every stage consists of different Haar features. Each feature is classified by a feature classifier. The feature classifiers generate an output and then the output is provided for next stage which can then be provided to the comparator. The stage comparator takes the outputs from the Haar feature classifiers and compares it with a stage threshold to check ifthe stage ispassed or not? If all stages are passed successfully then the face candidate is concluded to be a face. These terms will be discussed in detail in the below sections.

3.1 Integral Image

The integral image means the summation of pixel values of the original image. The value at any location (x, y) of the image is the sum of the image's pixels and to left of location (x, y).

Figure 1 illustrates the integral image generation.

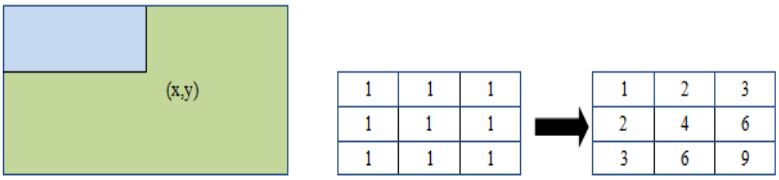

Fig 1. Integral image generation. The shaded region represents sum of pixels up to position (x, y) of image. It shows 3x3 image and its integral image representation.

3.2 Haar Features

Haar features are composed of either two or three rectangles. Face of candidates are scanned and searched for Haar features. The weight as well as size of every feature and the features themselves are generated by using a machine learning algorithm. The weights are constants. There are various forms of features as shown in Figure 2. Each and every Haar feature contains a value that is calculated by taking the area of each rectangleand multiplying eachby their their own weights, and then adding the results. The area of each rectangle is easily calculated using the integral image. The coordinate of the corner of a rectangle may be used to get the sum of all pixels above and to the left of location using the integral image. By using each and every corner of a rectangle, the area is computed quickly as denoted by Figure 3. L1 is subtracted twiceand it must be added back to get the correct area of the rectangle. The area of the rectangle denoted by R,can be computed by using the locations of the integral image: L4-L3-L2+L1.

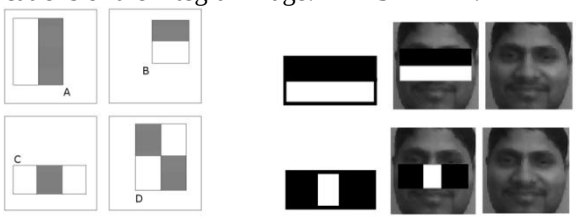

Fig 2.Example of Haar fatures, Area white and black multiplies by their respective weights and then summed in order to get Haar feature value.

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3.3 Haar Feature Classifier

The rectangle integral is used by Haar feature classifier, to calculate value of a feature. By multiplying weight of each rectangle with its area and the results are added together. Several Haar feature classifiers found a stage. A stage comparator adds all the Haar feature classifier results in a stage and compares the summation with a stage threshold. The threshold is a constant which is obtained from the AdaBoost algorithm. Each stage are not having a set number of Haar features. Based on the parameters of the training data, different stages can have a varying number of Haar features. For example,Viola and Jones'algorithm uses 2 features in the first stage and 10 in the second. All together they are using total of 38 stages and 6060 features .

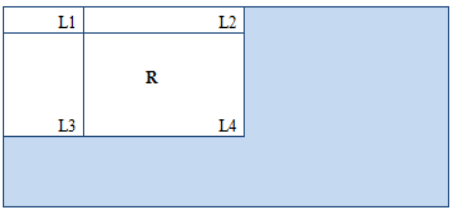


Fig 3.Calculating are of Rectangle R, is done using corner of rectangle : L4-l3-L2+L1.

3.4 Cascade the Viola and Jones face detection algorithm removes face candidates using a cascade of stages. The cascade removes candidates by making hard requirements in each and every stages with later stages being much more difficult for a candidate to pass. Candidates exit the cascade if they either pass all stages or fail any stage. A face is detected only if a candidate passes each and every stages. This process is shown in Fig 4

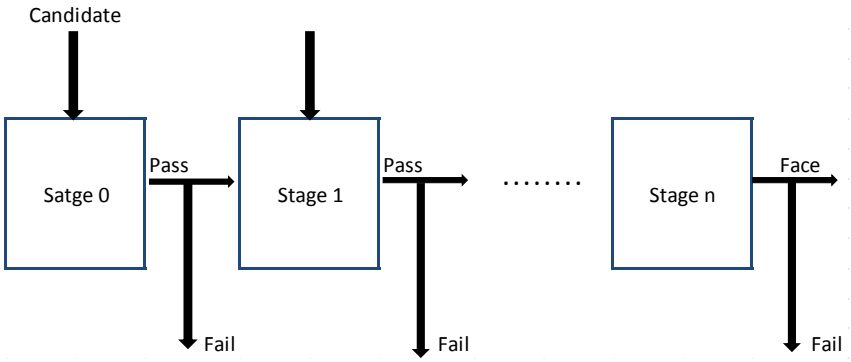


Fig 3. Cascade of stages. Candidate must pass all stages in cascade to be concluded as face.

B. The Fj Rc4 Algorithm

Key Schedule Algorithm

The key mechanism in FJ-RC4 is similar to RC4, with the little distinction that Key needs to be initialized as well as Algorithm must be initialized. The basic of RC4 algorithm remains same here. That is the encryption and decryption stages are same as RC4 which is simple and quick. However, to prevent attacks through key scheduling, we have made a strong algorithm for KSA. In FJ-RC4 at first, the main key is divided into three equal parts to make three sub-keys. Here if the length of main key is not divisible by three, then we use zero padding to make it divisible by three.

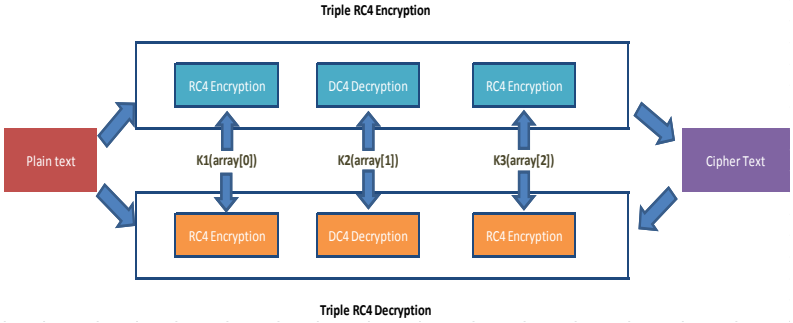


Fig 4. FJ-RC4 Encryption and Decryption Algorithm

C. The PCA Algorithm

The PCA algorithm consists of 5 steps:

1. Subtract the mean first: subtract the mean from every data dimensions. The subtracted mean is the average of all the dimension. This produces a data set with mean zero.
2. To Calculate the covariance matrix:
   $$C^{n\times n} = (c_{i,j}, c_{i,j} = cov(Dim_i, Dim_j))$$
   Where $C^{n\times n}$ is a matrix which each entry is the result of calculating the covariance between two separate dimensions.
3. Calculate the eigenvectors as well as eigenvalues of the corresponding covariance matrix.
4. Select these components and found a feature vector: when eigenvectors are found from this matrix, the second step is order them by eigenvalue, as highest to lowest. Sort components in order of significance. The number of eigenvectors chosen will be the number of dimensions of the new data set. The main goal of this step is construct a feature vector (matrix of vectors). From the list of eigenvectors take the selected eigenvectors and form a matrix with in the columns:
   FeatureVector = (eign_1, eign_2,eign3. ...,eign_n)
5. Prepare the new data set. Exchange the FeatureVector and multiply it on the left of the original data set, transposed:FinalData = RowFeatureVector x RowDataAdjusted
   Here RowFeatureVector is the matrix with the eigenvectors in the columns transposed (the eigenvectors are in the rows and the most significant are in the top).Here RowDataAdjusted is the mean-adjusted data rearranged. (the data items are in column, and each row holds a separate dimension).

IV. PROPOSED MODEL

In this paper, using Haar-cascade, PCA and FJ-RC4 algorithmswe are proposing a smart system interface for person recognition. By using IR cameras we can grab the criminals is our main goal. Criminals can be anywhere anytime , so basically we points towards public places like lodges, hotels etc. Main system is at another side which is a one type of web application and this application takes snaps of IR cameras and then continuously matching these pictures/images with available databases of criminals. If any pictures is matching then a system alert is generated and it will be the indication for Policemen's that identified person will be the susceptible one. This system is very helpful and advance for our security agencies. It is also saves time, money, travelling expenses of police vehicles.

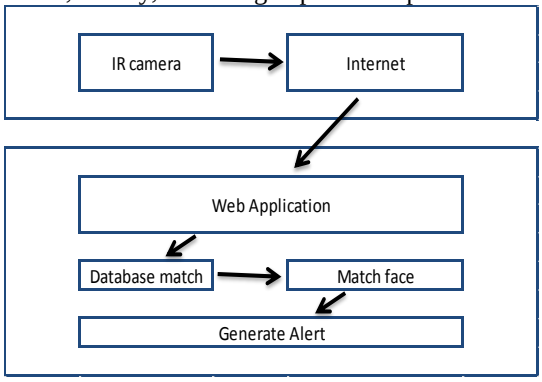


Fig 5. System Architecture for Smart System Recognition.

V. MATHEMATICAL MODEL

Module 1) capture image &send File To system

Let S1 be a set of parameters for Selecting File

S1= {Image_Size ,Image_Upload}

Uploading File data rate:- R=((N-NP) S/L)/N=S/L

where, R is Binary data rate, N is Size of file, NP is size of data which carries the parameters, S is Small positive integer and L is size of binary data in file data.

Where, Image_Size = Actual size of file

Image_Type = Type of File

Condition/Parameter	Operation/Function
If Image_Type==Allowed	f1:Proceed()
Else..	Discard Operation

If imagetype is valid then proceed Else discard operation

2) Image classification

Let's S2 be a set of data

S2={Image_Size}

Where,

Image_Size = Actual size of Data

Condition/Parameters	Operation/Function
If(Image_Size>= KB)	F2:Proceed()
Else	Data not accepted

If Data size is less than or equal to KB(Kilo Bytes) then only proceed Else data is not accepted

Venn Diagrams :-

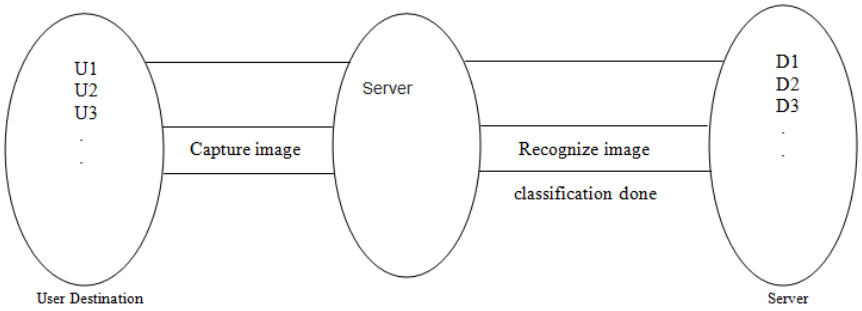
Let M be the Mathematical Model which Consists Of User set, Server And Destination Set

M=0 {U, S, D};

U = {U1, U2 , ----- , Un} ---Set of users

S - Server

D- {D1, D2, D3, ----, Dn}—Destination



Let U1, U2, U3, …Un be the set of capture images and then they Upload the image and send to the Destination with image .

Let D1,D2, D3, …. Dn be the set of Destination where image is store, and after only recognition attendance is increment. And S- Be the server, If the image is recognized then server will verify and update in database.

VI. CONCLUSION

This paper presented a smart system for person recognition which is a best solution for criminal identification. By using this system security agencies and policemen's working will be somehow simplify. The successful solution for person recognition is achieved by this system. By using this system criminal database is centrally managed and used for systematic identification of criminals.

ACKNOWLEDGEMENT

We wish to thanks Prof. Pravin Nimbalkar Sir for his useful support and guidance for completing this paper. We also want to thanks Head of Computer Department Prof. Todmal S. R. for theirvaluable guidance and also encouragement.We also take an opportunity to thank all the staff members of our department.

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