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Analysis of Implementation of Image Recognition Of Student Faces in College Campus

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Abstract-
In this paper, we are going to develop real time application on college student for automatic detection and recognition of student during academics, followed by display of personal information of students. This application makes proper use of CCTV camera for real time face detection of students of particular college. The proposed application can be divided into four major steps. In first step, each person in the image is detected. In the second step, a face detection algorithm detects faces of each person. In third step, we use a face recognition algorithm to match the faces of persons in the captured image with the database of students' faces which also stores personal as well as academic information of each student. In final step, the face of student along with his/her personnel information will be displayed on screen to the user when the image captured by CCTV camera contains any student image of present college. The college administrator as well as faculty members can use this application to identify students and also to distinguish students from outsiders.

Keywords- Real time face detection; face recognition; denoising

I. INTRODUCTION

Now-a-days identification of students in college campus is very necessary to identify outsiders from college campus. So we decided to make an automatic device which identifies students of college. Also the identification of each student through automatic device will help faculty as well as administrator to make record of entered students in the college daily. Implementation of the system has to be carried out on accordance of some techniques named as face detection and recognition. The system is going to work by some techniques such as the picture is taken by camera then processed towards the detection as the detected face image is obtain face recognition has to be done which is divided into further parts, denoising, face matching where the image get compared with database images and the result has to be seen. This has been done by viola and Jones algorithm. This technique is consider to be one of most successful for image processing or analysis.

Student face detection by denoising the image is based on image processing technique. For detecting the student with the help of image can be done by the image taken by camera and the image which is stored in database.

Sometimes, when we want to detect the face which contains the noise then it will fail to show perfect result. In this paper, we use some features of base paper to denoise the real time images to get the correct denoised image. After denoising we can find the details of that particular student by comparing that denoised image to the image in database.

This system will be used in library for management of student data who are entered in library for the different purposes. As this system can capture the image of student then face detection process is applied on captured image by viola and Jones algorithm. Then it get compared with database image. If comparison is found in database then it shows the information of captured student.

The system will be used for security purpose in offices, banks, industries also in public places such as hospitals, temple. Our project will be extended for all above mentioned sectors as security is one of the most important aspects for these sectors. This system shows information regarding persons to only admin of this system thus security is provided ultimately. There is more scope for denosing images in surveillance system, thus this project also gives us brief idea about face capturing and denoising in public places.

II. PROPOSED METHODOLOGY

The student face detection is somewhat similar to player detection on ground. In this paper we are going to capture images from distant places such as from various departments of college campus. In this paper we are going to make a real time application on students studying in colleges. The architecture of our proposed method will be given as follows,

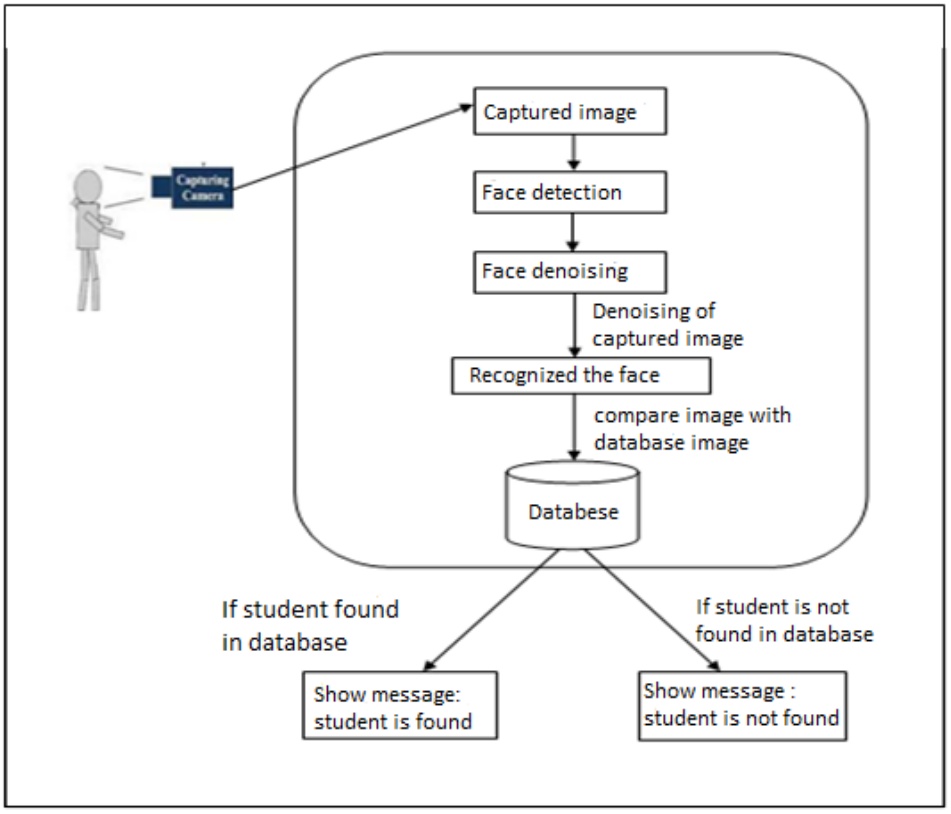

Figure. Architecture of Proposed Methodology

Here we will make proper use of CCTV cameras which are usually applied everywhere in college campuses in various colleges. Now-a-days the security of students plays a very important role for college administrator. That's why we focus on to make such technology which solves the problem of college administrator regarding students' security.

A. Face detection

The CCTV captures footage of various incoming persons in college campus. In first step of our work, we apply face detection method that is AdaBoost with Haar function on one of the image captured from cameras. This will give only the faces of persons in the image.

B. Face denoising

In second step we apply denoising technique to remove the noise of the facial images of the first step using AdaBoost algorithm.

C. Face recognition

In third step we apply face recognition method on each facial image obtained from second step. Here the face will compare to the database images of students.

D. Database

Here we need one additional tool that is database of students which contains student information such as name, address, and phone number, academics information such as studying class, section, roll number and one passport size image of student.

E. Display results

In fourth step the information of student get displayed to administrator. If the comparison of student face in database and image in third step match then information above specified regarding student will be displayed. If the comparison does not match that is the image captured by CCTV does not of student. In this case the message will be displayed on screen that the specified captured image is not of college student.

The flow diagram of our proposed method is represented as follows,

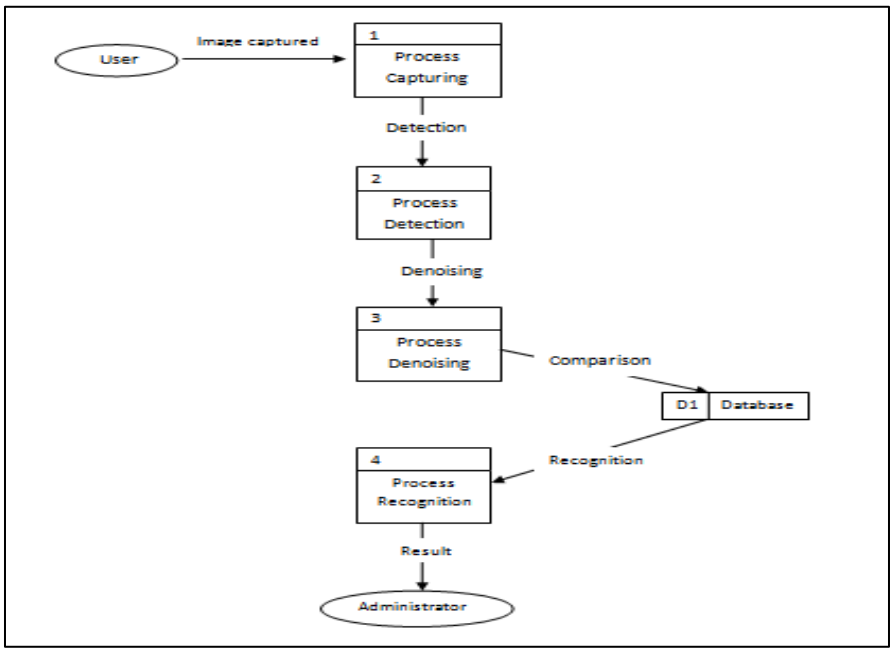

Figure. Data Flow Diagram of Proposed Methodology

In Data Flow Diagram of our project there are two entities user and administrator. The administrator entity can only have the access to this application. Here user plays the role as input to application. User may be student or outsider or unknown person who enters the college campus. There are four processes P1 capturing, P2 detection, P3 denoising and P4 recognition. The capturing process captures the image of user. Detection process removes the unwanted portion of captured image and picks only the facial portion. Then denoising process applies some denoising steps to facial portion.

There is one store D1 which contains excel database of students used to compare faces of student. After comparison the result

is given to recognition process which finalizes student's identity with respect to college. The final result is given to administrator entityin the form of information regarding student such as name, address, contact number,email id, class or semester, branch etc. the administrator entity includes admin of thisapplication who are may be staff members or college administrator.

III. ALGORITHM USED

A. Face detection algorithm: Viola and Jones face detection

For Viola and Michael Jones in their 2003 article titled "Robust Real Time Face Detection", proposed the face detection methods. They describe how one can use machine-learning technique to construct sets of meaningful feature that encode image properties and will detect faces. It is quite fast method but optimization can further speed up the detection. Viola and Jones had made three key innovations: the first was the new representation of image call the "integral image", for faster feature computation, the second was the use of the AdaBoost (Adaptive Boosting) machine learning algorithm for selecting simple and efficient classifiers and the third and last was a method of combining classifiers into a "Cascade" that quickly eliminates background regions and focus computational attention on more promising areas of the image.

1) Haar like feature

Haar-like features are rectangular digital image that provide a method for encoding the properties of the image in a form that can be computed much more quickly as compared to individual pixels. Simple Haar like features are composed of two adjacent rectangles, located at any scale and position within an image, and is referred to as 2-rectangle feature. The feature is defined as the difference between the sum of image intensities within each rectangle. Viola and Jones also extended this set by defining similar features composed of 3 and 4 rectangles. This types of features are quite course when compared to alternatives such as steerable filters, however, there computational efficiency more than makes for their limitations.

Haar features are composed of either two or three rectangles. Face candidates are scanned and searched for Haar features of the current stage. The weights are constants generated by the learning algorithm. There are a variety of forms of features. Areas of white and black regions are multiplied by their respective weights and then summed in order to get the Haar feature value.

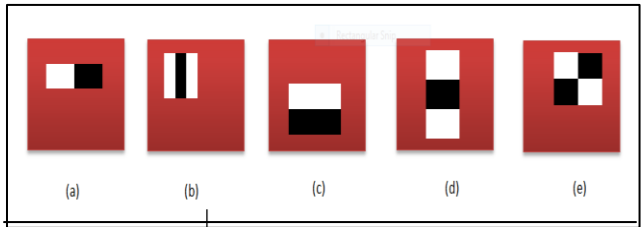

Figure. Examples of Haar Features

Each Haar feature has a value that is calculated by taking the area of each rectangle, multiplying each by their respective weights, and then summing the results. The area of each rectangle is easily found using the integral image. The coordinate of the any corner of a rectangle can be used to get the sum of all the pixels above and to the left of that location using the integral image Since L4 is subtracted off twice it must be added back on to get the

correct area of the rectangle. The area of the rectangle R, denoted as the rectangle integral, can be computed as follows using the locations of the integral image: S1 - S2 - S3 + S4.

2) Integral image

Haar-like features can be calculated quickly by using an image representation known as integral image. It is an application of summed area tables. The integral image can be calculated in single pass. Each feature can be calculated in a constant time by using it.

The integral image is defined as the summation of the pixel values of the original image. The value at any location (x, y) of the integral image is the sum of the images pixels above and to the left of location (x, y). Figure illustrates the integral image generation. The shaded region represents the sum of the pixels up to position (x, y) of the image. It shows a 3 x 3 image and its integral image representation.

3) Feature selection

Viola and Jones hypothesized and discovered through experimentation that a very small number of features can be form into effective classifier. For a classifier to be effective the set it is trained on must contain a good range of facial variation. No single feature can be used as an effective classification function. The AdaBoost algorithm creates the striner classifiers by searching the set of all weighted combinations of weak classifier and selective the most successful combination. The newly obtained strong classifier is combined with the optimal threshold which enables it to best separate faces from non faces.

A Haar feature classifier uses the rectangle integral to calculate the value of a feature. The Haar feature classifier multiplies the weight of each rectangle by its area and the results are added together. Several Haar feature classifiers compose a stage. A stage comparator sums all the Haar feature classifier results in a stage and compares this summation with a stage threshold. The threshold is also a constant obtained from the AdaBoost algorithm. Each stage does not have a set number of Haar features. For example, Viola and Jones data set used 2 features in the first stage and 10 in the second. All together they used a total of 38 stages and 6060 features. Our data set is based on the OpenCV data set which used 22 stages and2135 features in total. Area of a rectangle R is calculated using the corner of the rectangle: S1 - S2 - S3 + S4.

4) Attentional cascade

The advent of the attentional cascade is the most important innovation of Viola and Jones methods. Its focuses first on removal of negative regions of the image while including all positive ones. The method was to use two neural networks: the algorithm first uses the faster neural network to select regions of interest before running the slower neural network which is from complex then first network and is used to pick out the faces from the image. The initial stages are created by adjusting the AdaBoost by latest staged use more complex classifier to reduce overall falls positive weights.

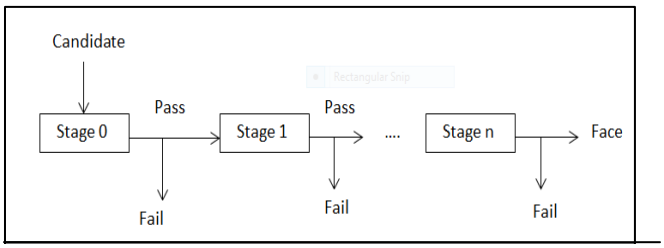

Figure. Cascade of Stages

5) Algorithm implementation

By the above steps the training process is completed and a classifier cascade has been created with desire properties. The detection algorithm simply scans all possible sub windows of an image at a range of scales, running the cascade on each window. If a sub window passes the final level of the cascade then the sub window will contain a face. In some steps normalization may occur. Firstly the image intensities of both the images (training and test images) must be normalized to the same scale. Then, while running the cascade on the sub windows, the rectangle sums within each feature must be scaled accordingly. Lastly training is done on variance normalized images and therefore, the test windows must be variance normalized as well.

B. Face recognition algorithm: Principal Component Analysis (PCA)

Principal Component Analysis (PCA) algorithm[2] is used to recognize the faces in the image. It is mathematically defined as an orthogonal linear transformation that transforms the data to a new coordinate system. It involves the procedure that transforms the number of possibly correlated variables called Principal components. It involves the calculation of the Eigen value decomposition of a data covariance matrix or singular value decomposition of a data matrix, after mean centering the data for each attribute. The results of PCA are in terms of component scores and loading. PCA is theoretically the optimal linear scheme for compressing a set of high dimensional vectors into a set of lower dimensional vectors and then reconstructing the original sets. PCA algorithm is as follows:

1) A data matrix (m x n) for each image is created which is then converted into an m * n x 1 matrix having rows equal to the product of number of rows and columns of the original matrix.

2) A mean matrix is created for all the different image matrices. The mean matrix is calculated by adding all the columns of data matrix divided by the total number of columns.

3) The mean subtracted data matrix is obtained by subtracting the mean image from all the image matrices.

4) The covariance matrix is obtained by multiplying the mean subtracted matrix by its transpose to make it a square matrix in next phase.

5) The system then finds the Eigen vectors and Eigen values. For N dimensional vectors there will be N Eigen values and Eigen vectors

6) Then the Eigen image is created by multiplying mean subtracted data matrix with the Eigen vectors.

7) Eigen vectors with highest Eigen value is the principal component of the data set having maximum information.

8) The weight matrix is then calculated by multiplying the transposed large Eigen image with the mean subtracted data matrix. After these steps the system can recognize any face image by comparing it with the main weight matrix.

IV. CONCLUSION

In order to obtained information about the student we propose the feasibility of real time based application for college campus. The system can display the information like name, branch, and semester for college student which varies according to institute. The system can be used in library for collecting the information of student entered inside the library for different purposes.

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