Robust face detection and person recognition using gabor texture and multi block LBP features.

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Abstract— By means of increasing security concerns, surveillance cameras are have an important role in the society and face recognition in mass is gaining more importance than ever.To identify people in unconstrained video, one has to come across at the identity information in multiple frames and the additional dynamic signature. These identity cues including face, body, and motion. The proposed project approach is based on video-data base due to the huge application available for large intra person variation in video and limited information content in still images. Video-data base is to completely encode temporal, pose, and lighting information. In order to make a fully automated system that analyzes the information in face images, there is a need for robust and efficient face detection algorithms. The proposed work is divided into two phases, i.e. Training and testing. In training phase, preprocess the extracted frames which include resize and color conversion. These extracted features are stored in a database. In testing phase, by taking input video and extract the frames followed by preprocessing. For face part detection, from the extracted frame using adaboost approach and extract the features from the detected image. These features are stored using Support Vector Machine (SVM). Finally recognize the person using stored features. The proposed work deals with video based face recognition and person identification, using adaboost technology to extract feature of the person and identification. Also adapting a gabor coefficient filter to get effective results.

Index terms— AdaBoost, Face Detection, Gabor Features, Haar-like Features.

I. INTRODUCTION

In the past decades, many researchers have begun with the aim of teaching the computing device to admire human faces and facial expressions. The need to extract information from images is enormous. Face detection and extraction as computer vision tasks have many purposes and have direct relevance to the face-recognition and facial expression recognition problem. Face detection is the primary stage in the direction of automated face recognition. Potential applications of face detection and extraction are in human computer interfaces, surveillance systems, census systems and etc. This research is mainly interested in the face detection issue, which means how to find, based on visual information, the entire occurrences of faces in spite of who the person is.Face detection is likely one of the most challenging problems in computer vision and no solution has been achieved with performance similar to humans each in precision and speed. High precision is now technically achieved by building systems which learn from various information sources in the training set in order to minimize errors on the test sets. In most cases, the increase in precision is achieved at the expense of decline in run-time performance (computational time) and, in major applications, high precision is demanded, and hence dealing with computation to reduce processing time is now a problem with hard constraints.

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The face of a human conveys a lot of information about identity and emotional state of the person. Face awareness is an exciting and challenging problem, and impacts major application in many areas such as identification for law enforcement, authentication for banking and security system access, and personal identification among others. Our work mainly consists of three phases; particularly face recognition, feature extraction and classification. Face representation represents how one can model a face and determines the successive algorithms of detection and recognition. Probably the most valuable and the face and is used to measure similarities between mages. Facial expression is one of the strongest, common and on the spot approach for human beings to communicate their emotions and intensions. Face recognition is an interesting and challenging issue, and impacts important applications in many areas such as identification for law enforcement, authentication for banking and security system access, and also personal identification amongst others [1]. The face

plays an important role in our social intercourse in conveying identification and emotion. The human capability to recognize faces is remarkable. Modern Civilization closely depends upon character authentication for couple of features. Face recognition has always a major focus of research considering of its non-invasive nature and because it is peoples predominant method of person identification.

II. RELATED WORK

We have studied many previous works done in this field by different researchers. There are many approaches that were followed by different researchers.

Santhy Mol T and Neethu Susan Jacob [2] presented a video based face recognition algorithm. And it generates a video signature by combining large information available from frames of a video. It accepts this information as a rank list of face images from a dictionary. The algorithm is generated using the ranked list of frames in the video using level-1 features. Deepti Yadav and Ms. Antara Bhattacharya [3] overviewed variety of techniques. An overview of some of the distinguished methods in each of this category is provided and some of the benefits and drawbacks of the scheme mentioned therein are examined. Furthermore, a discussion outlining the reason for using face recognition, the applications of this technology, and some of the difficulties plaguing current system with regard to this task has also been provided.

Valentina, S Sathish Kumar and M. Varatharaj [4] proposed a video based face recognition system thecompute a discriminative video signature as an ordered list of still face images from large dictionary.

Prachi S Vispute, Charushila U Mahale and Nisha D Sonawane [5] proposed a 3-stage approach which is used for optimizing ranked lists across multiple video frames and fusing them into a single composite ordered list to compute the video signature. This signature involves intra-personal variations and facilitates in matching two videos with large variations.

M.Gopi Krishna and A. Srinivasulu [6] presented methodology for face detection based system on AdaBoost algorithm using Haar features. They describe here design techniques including image scaling, integral image generation, pipelined processing as well as classifier, and parallel processing multiple classifiers to accelerate the processing speed of the face detection system.

Yousra Ben Jemaa and Sana Khanfir [7] presented in this paper a biometric system of face detection and recognition in color images. To achieve the face recognition, we use neural networks and we study its performances for different inputs.

III. PROPOSED SYSTEM

In our proposed work, we divided the work in 2 phases i.e. training and testing. In the training phase we pre-process the extracted frames which includes resize and color conversion. Features will be extracted from the pre-processed images and store it in database. In the testing phase, we take input video and extract the frames followed by pre-processing. We will detect the face part from the extracted frames using adaboost approach and extract the features from the detected image. Finally we recognize person using stored features.

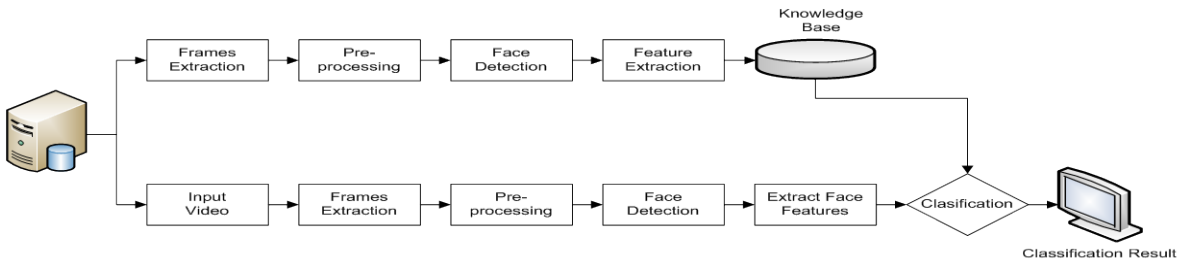


Figure 1: Proposed Architecture

A. Pre-processing:

Pre-processing is stage where frames are extracted and converted to grey color if obtained frames are in RGB color

scale and resized to 200X200. A grey scale image is an information matrix whose value represents shades of grey. The factors of gray scale matrix have integer values or integer values range between 0 and 255.

B. Face Detection:

Viola and Jones developed a reliable method to detect objects such as faces in images in real-time. An object that has to be detected is described by a combination of a set of simple Haar-wavelet like features shown in Fig. 1. The sums of pixels in the white boxes are subtracted from the sum of pixels in the black areas. The advantage of using these simple features is that they can be calculated very quickly by using "integral image". An integral image II over an image I is defined as in (1):

$$II(x,y) = \sum_{x^1 \le x, y^1 \le y} I(x', y') \quad (1)$$

Also it is shown that every rectangular sum within an image can be computed with the use of an integral image by four array references. A classifier has to be trained from a number of available discriminating features within a specific sub window in order to detect an object. The possible positions and scales of the five different feature types as shown in Fig. 1 produce about 90,000 possible alternative features within a sub window size of 24x24 pixels. This number exceeds largely by the number of pixels.

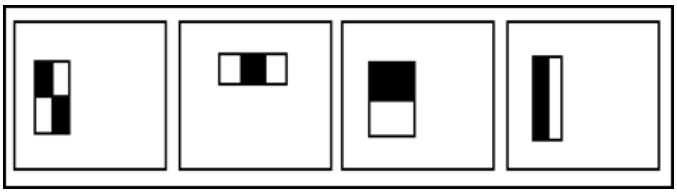


Figure 2 Four Different Basic Types of Rectangular Features

Therefore, a small set of features which are the best describe of the object, has to be selected. Adaboost is a technique to select a good classification functions, such that a final "strong classifier" will be formed, which is in fact, a linear combination of all weak classifiers [8]. In the general context of learning features, each weak classifier $hj(x)$ consists of one single feature $fj(x)$ as seen in (2) where θ_j is a threshold and p_{ja} a parity to indicate the direction of the inequality.

$$h_j(x) = \begin{cases} 1 & p_j f_j(x) < p_j Q_j \\ 0 & otherwise \end{cases} \quad (2)$$

The Adaboost algorithm iterates over a number of T rounds. In the each iteration, the space of all possible features is searched exhaustively to train weak classifiers that consist of one single feature.

C. Feature Extraction:

The Gabor filter (Gabor Wavelet) represents a band-pass linear filter whose impulse response is defined by a harmonic function multiplied by a Gaussian function. Thus, a bi-dimensional Gabor filter constitutes a complex sinusoidal plane of particular frequency and orientation modulated by a Gaussian envelope. It achieves an optimal resolution in both spatial and frequency domains.

Our approach designs 2D odd-symmetric Gabor filters for face image recognition, having the following form of eq.(3):

$$G_{\theta_k, f_i, \sigma_x, \sigma_y}(x,y) = \left(-\left[\frac{{x_{\theta_k}}^2}{{\sigma_x}^2} + \frac{{y_{\theta_k}}^2}{{\sigma_y}^2} \right] \right) \cdot \cos\left(2\pi f_i f_i x_{\theta_k} + \varphi\right), \quad (3)$$

where x_{θ_k} =xcos θ_k + ysin θ_k , y θ_k =vcos $\theta_k - x sin\theta_k, f_i$ provides the central frequency of the sinusoidal plane wave at an angle θ_k with the x-axis, σ_x and σ_y represent the standard deviations of the Gaussian envelope along the two axes, x and y. We set the phase $\varphi = \pi/2$ and compute each orientation as $\theta_k = \frac{k\pi}{2}$ where $k = \{1, \ldots\ldots, n\}$.

The 2D filters $G_{\theta_k, f_i, \sigma_x, \sigma_y}$ given by relation (3), represent a group of wavelets which optimally captures both local orientation and frequency information from a digital image. Each face image is filtered with $G_{\theta_k, f_i, \sigma_x, \sigma_y}$ at various orientations, frequencies and standard deviations. So, the design of Gabor filters for facial recognition needs an appropriated selection of those filter parameters.

LBP Features:

There exist several methods for extracting the most useful features from (preprocessed) face images to perform face recognition. One of these feature extraction methods is the Local Binary Pattern (LBP) method. With LBP it is possible to describe the texture and shape of a digital image.

This is done by dividing an image into several small regions from which the features are extracted.

These features consist of binary patterns that describe the surroundings of pixels in the regions. The obtained features from the regions are concatenated into a single feature histogram, which forms a representation of the image. Images can then be compared by measuring the similarity (distance) between their histograms. Because of the way the texture and shape of images is described, the method seems to be quite robust against face images with different facial expressions, different lightening conditions, image rotation and aging of persons.

This operator works with the eight neighbors of a pixel, using the value of this center pixel as a threshold. If a neighbor pixel has a higher gray value than the center pixel (or the same gray value) than a one is assigned to that pixel, else it gets a zero. The LBP code for the center pixel is then produced by concatenating the eight ones or zeros to a binary code (figure 3).

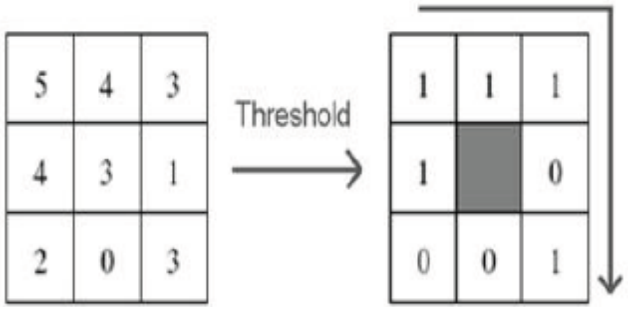
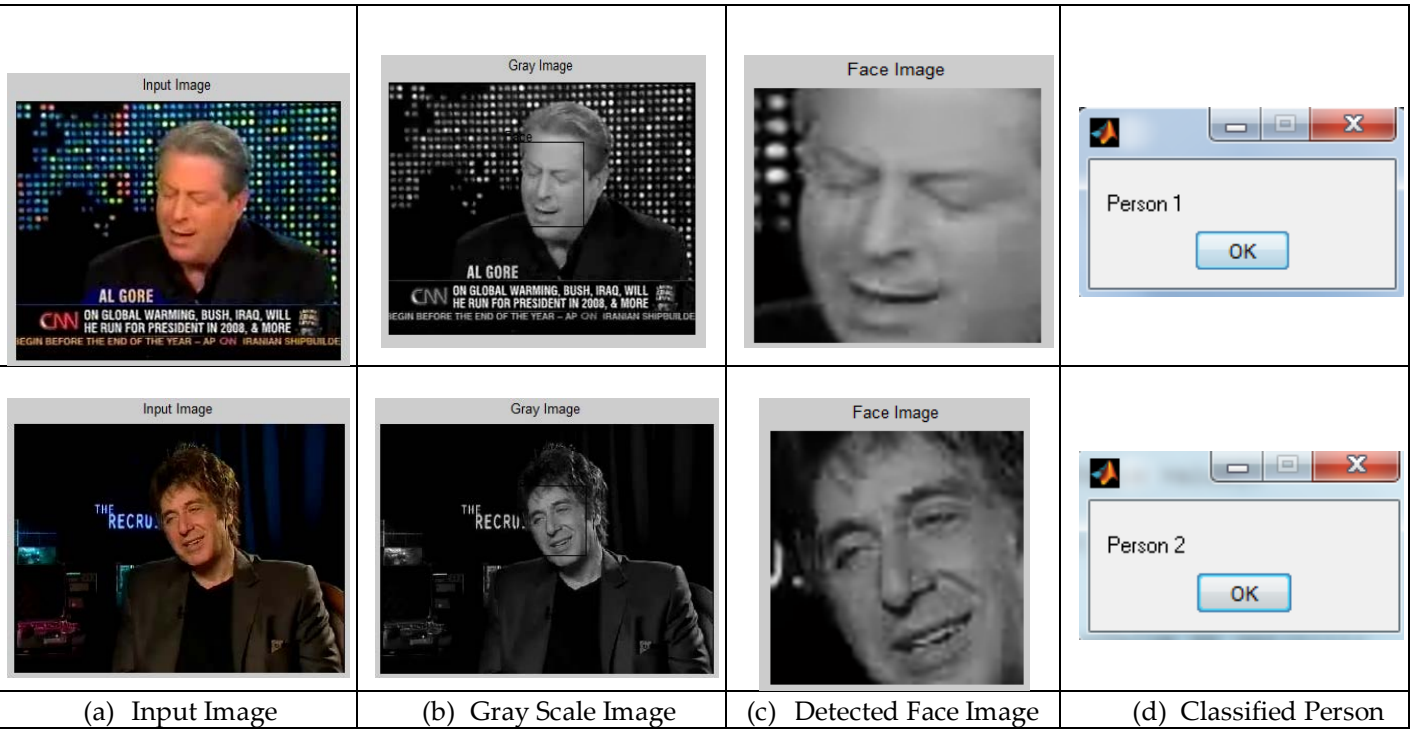


Figure 3: The Original LBP Features

Binary: 11101001 Decimal: 233

IV. EXPECTED RESULTS

Figure 4 shows the results of our proposed work, (a) is input image that we taken in our proposed work and (b) is the gray image, (c) is the Face detected image, face is detected using adaboost algorithm, and support vector machine has been adapted to classify the result and (d) is the classified Result .



(a) Input Image (b) Gray Scale Image (c) Detected Face Image (d) Classified Person

Figure 4 Result Analysis of Proposed Work

V. CONCLUSION

In this paper we presented an approach to recognize the person based on the face detection. In order to detect the face from the video we adapted ad boost method which is more efficient and accurate in detecting face in images.

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