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Design of a Face Recognition System for Visually Impaired Persons

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ABSTRACT

In this paper the face recognition is done for the visually challenged people. Visually challenged people faces lot of problems in day to day life. Our goal is to make them lead a life which is of security and safety for their own wellbeing. This makes them confident to lead their life normally. The face detection helps them to recognize faces of people known to them within a certain distance. This paper reduce the difficulty in identifying face of the person used. The face recognition is done using the haar feature base cascade classifiers using Eigen face algorithm. In addition to the face recognition this paper also enhances the process by providing audio output through the e speak software which converts the text to speech. The whole process is designed to run efficiently on a raspberry pi B+ module on open cv platform.

1 INTRODUCTION

Visual impairment afflicts approximately 285 million people worldwide according to recent estimates by the World Health Organization (WHO) [1] and, without additional interventions, these numbers are predicted to increase significantly [2]. One of the many challenges faced by this population is their inability to recognize the faces of known individuals when they encounter them in their daily lives. One consequence of this is that whenever a visually impaired individual arrives in a social setting (e.g., in a conference room or at a dinner party), the conversation has to be interrupted to announce which people are already present on the scene which may result in some social awkwardness. The importance of being able to view faces in social interactions is also confirmed by several studies which indicate that most of our communication takes place not through words but via non-verbal means, the majority of which consist of facial expressions [3]. Furthermore, the ability to determine if an approaching person is a friend or a stranger is essential from a security perspective and also contributes to a person's general awareness of his context and surroundings.

The exponential increase in computing power per volume coupled with the decreasing size of computing elements and sensors in recent years has opened up the possibility of running computationally demanding applications on wearable electronic devices. These advances, in conjunction with the needs specified above, have fueled research into developing wearable face recognition aids for the visually impaired in the past few years. This area of research is still in its infancy with only a few prototype systems being implemented for this purpose so far. These solutions are characterized by their emphasis on portability, convenience, intuitiveness, and cost-effectiveness. The objective of this paper is to provide an overview of the state of the art in this domain, highlighting the strengths and weaknesses of different solutions, to discuss some of the issues that need to be addressed and resolved to expedite the practical deployment and widespread acceptance of such systems, and to facilitate and inspire further research in this realm.

2. RELATED WORK

Automated face recognition has been the focus of extensive research for the past four decades (see [4] for a detailed survey). The approaches for this task can be broadly divided into two categories: 1) Feature-based methods [5, 6], which first process the input image to extract distinctive facial features, such as the eyes,

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mouth, nose, etc., as well as other fiducial marks and then compute the geometric relationships among those facial points, thus, reducing the input facial image to a vector of geometric features. Standard statistical pattern recognition techniques are then employed for matching faces using these measurements. 2) Appearance-based (or holistic) methods [7], which attempt to identify faces using global representations, i.e., descriptions based on the entire image rather than on local features of the face. Though face recognition methods traditionally operate on static intensity images, in recent years, much effort has also been directed towards identifying faces from video as well as from other modalities such as 3-D and infra-red. Several computer vision-based solutions have been developed lately to assist the visually impaired in their daily activities .Most of these systems focus on navigation and obstacle detection: e.g., vision based simultaneous localization and mapping (SLAM) has been recently proposed to support blind mobility. Extensive research has also been conducted on printed information and web access mainly by harnessing the power of OCR. Relatively less attention has been directed towards application areas such as generic object recognition and face recognition but research in these domains has started gaining momentum in the past few years.

3. OVERVIEW OF FACE RECOGNITION SYSTEMS FOR THE VISUALLY IMPAIRED

We will now present an overview of some of the most innovative solutions that have been developed in recent years to assist the visually impaired in recognizing faces.

iCare Interaction Assistant

Krishna et al. [3] have developed the iCare Interaction Assistant, an assistive system that acquires video from a pinhole aperture analog CCD camera embedded in a pair of eyeglasses, digitizes it and then transmits it over a USB cable to a tablet PC. The video is analyzed to detect faces using adaptive boosting which are passed to a face recognition module that utilizes the Principal Components Analysis (PCA) and Linear Discriminant Analysis (LDA) algorithms. If a face is recognized in 5 consecutive frames, the name of the identified individual is converted from text to speech and transmitted to the user via head phones. One main concern expressed by Krishna et al. is that even though some publicly available face databases contain images captured under a range of poses and illumination angles, however, none of them use a precisely calibrated mechanism for acquiring these images, nor is each image explicitly annotated with this information. Krishna et al. have therefore, put together their own database called FacePix [29] which contains face images of 30 people with pose angles and illumination angles between -90 and +90 degrees annotated in 1-degree increments. These two methods were, therefore, selected for the face recognition module of the system. The system was tested with 10 known individuals and PCA's performance was found to be better than (or similar to) LDA. Since PCA's computational complexity is also lower than that of LDA, hence it is the preferred algorithm for future development work on this device.

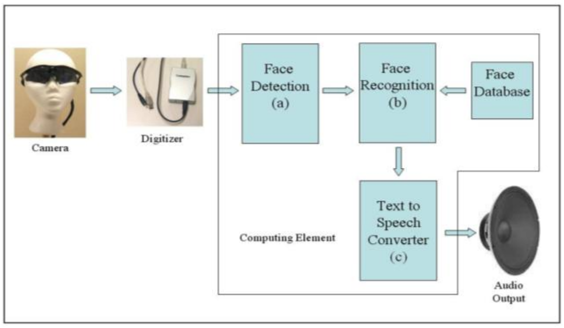

Figure 1. Block diagram of the wearable face recognition

4 PROPOSED SYSTEM

The core basis for Haar classifier object detection is the Haar-like features. These features, rather than using the intensity values of a pixel, use the change in contrast values between adjacent rectangular groups of pixels. The contrast variances between the areas. Two or three adjacent groups with a relative contrast variance form a Haar-like featureFirst we need to load the required XML classifiers.

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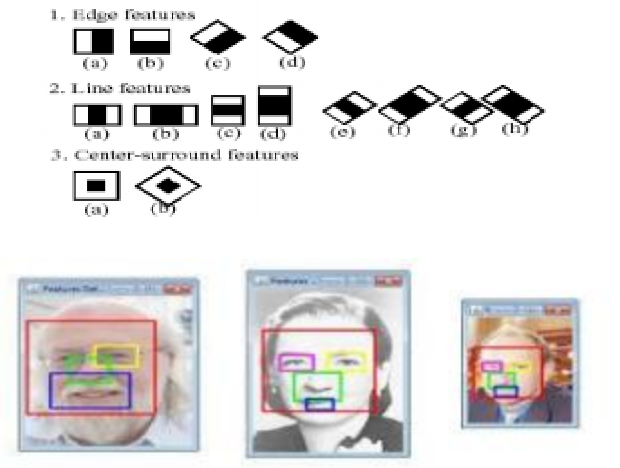

Fig2. Common Haar features

Haar-cascade Detection in OpenCV:

OpenCV comes with a trainer as well as detector. OpenCV already contains many pre-trained classifiers for face, eyes, smile etc. Those XML files are stored in opencv/data/haarcascades/ folder. Steps to create face and eye detector with OpenCV

- Load the required XML classifiers.
- Then load our input image (or video) in grayscale mode.
- Find the faces in the image.
- If faces are found, it returns the positions of detected faces as Rect(x,y,w,h).
- Once these locations are obtained, create a ROI for the face and apply eye detection on this ROI

To create a set of eigen faces:

1. Prepare a training set of face images. The pictures constituting the training set should have been taken under the same lighting conditions, and must be normalized to have the eyes and mouths aligned across all images. They must also be all re sampled to a common pixel resolution (r × c). Each image is treated as one vector, simply by concatenating the rows of pixels in the original image, resulting in a single row with r × c elements. For this implementation, it is assumed that all images of the training set are stored in a single matrixT, where each column of the matrix is an image.

2. Subtract the mean. The average image has to be calculated and then subtracted from each original image in T.

3. Calculate the eigenvectors and eigen values of the covariance matrixS. Each eigenvector has the same dimensionality (number of components) as the original images, and thus can itself be seen as an image. The eigenvectors of this covariance matrix are therefore called eigen faces. They are the directions in which the images differ from the mean image. Usually this will be a computationally expensive step (if at all possible), but the practical applicability of eigen faces stems from the possibility to compute the eigenvectors of S efficiently, without ever computing S explicitly, as detailed below.

4. Choose the principal components. Sort the eigenvalues in descending order and arrange eigenvectors accordingly. The number of principle components k is determined arbitrarily by setting a threshold ε on the total variance. Total variance $v = n*(\lambda 1+ \lambda 2+\ldots+ \lambda n)$, n= number of data images.

5 BLOCK DIAGRAM OF PROPOSED SYSTEM

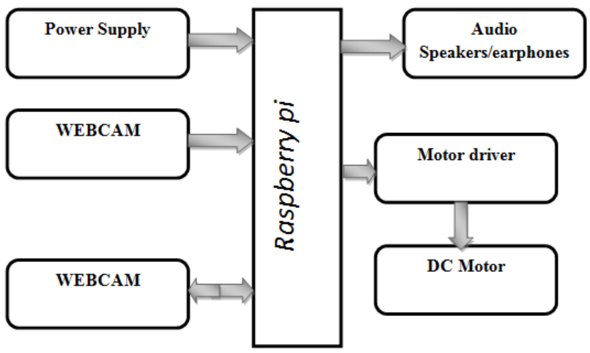

Fig3. Block diagram of proposed system

Working:

Here the prposed system will continuosly capture the video from web camera and identify the faces in the video with the help of Raspberry pi processor. The also recognize the faces by comparing with database and announce the names recognized or unauthorized in the form of audio output through speakers. An the

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system also provide the access to authorized persons by opening the motor.

6 RESULT ANALYSYS

Firstly in facial feature detection is detecting the face. This requires analyzing the entire image. The second step is using the isolated face to detect each feature.

Since each portion of the image used to detect a feature is much smaller than that of the whole image, detection of all three facial features takes less time on average than detecting the face itself. It also has the text speech conversion to provide audio output to the visually impaired peoples. The screenshots of the output are as shown in the figure bellow.

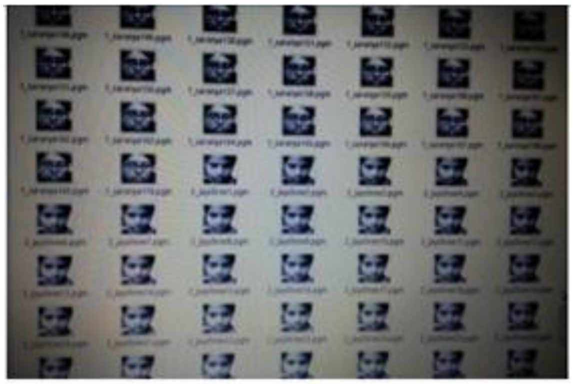

Fig4. Training images

Fig5. Face detection

7 CONCLUSSION AND FUTURE SCOPE

This paper gives a contribution for the development of new human-machine interfaces for mobile visually impaired based on computer vision techniques. The article presented an approach for real-time face recognition and tracking which can be also very useful in human robot interaction environment this system starts with a very fast real-time learning process and then allows the robot to follow the person and to be sure it is always interacting with the right one under a wide range of conditions including: illumination, scale, pose, and camera variation. The face tracking system works as a preprocessing stage to the face recognition system, which allows it to concentrate the face recognition task in a sub-window previously classified as face. This abruptly reduces the computation time.

The introduction of a position predictive stage would also reduce the face search area driving to the creation of a robust automatic tracking and real-time recognition system. This paper also presents a Pre-Learnt User Recognition System which works in almost real-time and that can be used by the human to create a set of known people that can be recognized anytime. The processor has a certain number of people in the database and once a known face is found it can start following and interacting with it. Of course this system can also be used in security applications since it has the ability of tracking a set of known people

8 FUTURE SCOPE

With the detection of facial features, the next goal is to research the ability for more precise details, like some individual points, of the facial features to be gathered.

Those will be use to differentiate general human emotions, like happiness and sadness and other emotions. Recognition of human emotions would require accurate detection and analysis of the various elements of a human face, like the brow and the mouth, to determine an individual's current expression. The expression can then be compared to what is considered to be the basic signs of an emotion in all human beings. This research will be used in the field human-computer interaction to analyze the emotions one exhibits while interacting with a user interface which was not yet experimented before in the world of science and advancement.

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