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Human Identification SystemFor Blind Using Raspberry Pi And OpenCV-Python

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Abstract

Speech and text is the primary medium for human communication. One needs the power of vision to access the information in a text. However, those who have poor vision can gather information from another medium which is voice. This system is a camera based assistive human identification device to help a visually impaired person in recognizing the people of the same organization the former is working in. The faces are detected when a person enter into the frame of the camera. The proposed idea involves face detection using Haar feature-based cascade classifier. The system is provided with a camera that captures the image. The captured image is then processed by using algorithm for the detection of face(s) and then comparison of the processed image with the image stored in the database is done using the PCA algorithm. The scope of this database (in this system) will be limited up to a particular organization like office or workplace of that person. Once the face-recognition is completed and match is found then, the name of the person recognized (stored in database as filename) is converted into speech signal to give it as output through speaker or headphones. The algorithm is implemented using OpenCV in Python language. OpenCV is basically a software that trains the algorithm to minimize the stages to identify the positive image (Image containing face).

Keywords- *OpenCV, Python, Haar-cascade, PCA, Face recognition, Feature extraction.*

I. INTRODUCTION

The World Health Organization (WHO) reported in October 2019 that there are 2.2 billion visually-impaired people worldwide. Among these individuals, there are 1.2 billion who are totally blind. However, According to National Programme for Control of Blindness (NPCB)India is now home to the world's largest number of blind people around 12 million people are from India. So, with a vision to contribute to their convenience we are presenting our system "Human Identification Assistant for blind using Raspberry Pi and OpenCV-Python". There have been a number of systems that are designed to support visually-impaired people and to help to improve the quality of their lives. Unfortunately, most of these systems have limited capabilities. In this paper, we present a portable assistive device for visually-impaired people in order to show the progress in assistive technology for this group of people. As we are not unaware of the fact that a blind person face a lot of difficulties in their daily life as they are devoid of the ability of vision. We are designing this system. This system will help such people in recognizing a person with whom he is not so familiar with but works within the same organization. As a result, this system would identify the person with the help of face recognition using Haar-Cascade and PCA Algorithm and would inform the blind person who is standing in front of him. Hence, he would be aware of his surroundings at least at his workplace.

II. LITERATURE SURVEY

Methodology for Human face detection and recognition theory is discussed by Bhupendra Vishwakarma, Pooja in [1].As we know human face detection and recognition play important roles in many applications such as video surveillance and face image database management. Here they have worked on both face recognition and detection techniques. The user wears glasses with camera and

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system speaks the saved person's name when his face comes in view of the camera. The whole system is simply based on face detection and recognition only. The algorithm for face detection Haar feature-based cascade classifier is used. Which involves detection of face(s) from the captured image by eliminating the background with higher accuracy and less time consumption. In face recognition PCA (principal component analysis) algorithm is used. This systemrecognizes an unknown test image by comparing it with the known training images that are stored in the database as well as give information regarding the person recognized. These algorithms are simulated in MATLAB successfully for real-time application.

Fateh Cherfaoui and Si Nabil Yacini proposed the system to locate face region, instead of locating the crucial points in the face region, they have proposed an end-to-end framework, in which spatial transformer network is applied (prior to the classification network) to learn face alignment parameters in [2]. The spatial transformer network learns spatial transformation for an image or a feature map. The transformation here includes operations like scaling, cropping, rotation and non-rigid deformation. In this system face recognition is done by well-known algorithm called Principal Component Analysis (PCA) developed by Turk and Pentland which is also known as eigen faces, which drastically reduces the dimensionality of the original image and face detection and identification are carried out in the reduce space. For the purpose of feature extraction Fisher's Linear Discriminant (FLD) Method is used here.

Further in [3], Marko Arsenovic, Srdjan Sladojevic in their research named FaceTime – Deep Learning Based Face Recognition Attendance System. The whole method of building up a face acknowledgment part by joining state of-the-craftsmanship techniques and advances in profound learning is portrayed. It is resolved that with the more modest number of face pictures alongside the proposed technique for increase high exactness can be accomplished. Creating a particular ordering answer for this undertaking could possibly prompt accomplishing higher exactness on a littler dataset. This profound learning constructed arrangement does not depend with respect to GPU in runtime. Along these lines, it could be material in numerous different frameworks as a primary or a side part that could keep running on a less expensive and low-limit equipment, even as a universally useful Internet of things (IoT) gadget. Face-Time Deep Learning-based Face Recognition Attendance System.

III. METHODLOGY

At the heart of this system is a Raspberry Pi which is provided with a camera module and a speaker. It also consists a SD card which would be used to store the database of images for the purpose of comparison during face recognition. First step would be done by the Raspberry Pi camera by capturing the image and the captured image is passed to the raspberry pi for processing the image and perform the face recognition with the help of Haar-cascade and PCA algorithm. Once the face has been recognized, the name mapped to the respective image will be converted into speech which will be given as an output to the speaker/headphone. Hardware implementation is one of the most important part of the system in a precise way. The system's electronic components are easily understood, and it includes connection to the raspberry pi and various other available ports without the need to solder the wires for connection. The system proposed includes Raspberry pi, camera, SD card etc.

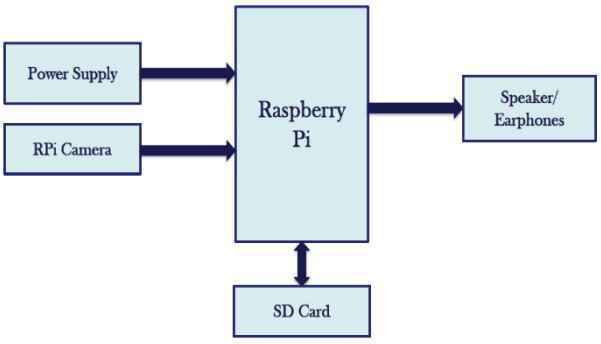

Figure 1. System Architecture

The flow of this whole system can be used with the help of following diagram.

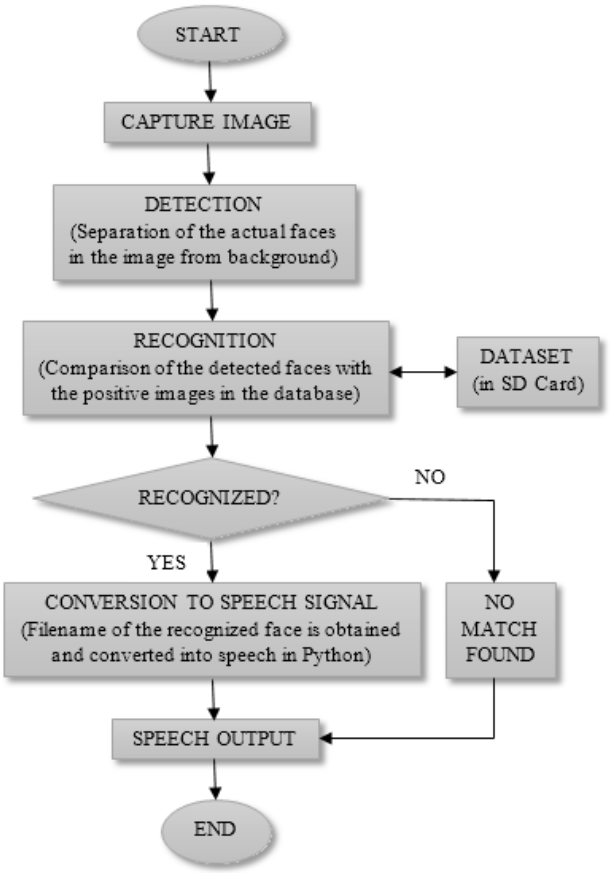

Figure 2. Workflow of system

Now coming to the next important part, the algorithm and software part, we have mainly three sections and they are described as follows:

A. *Face Detection using Haar-Cascade Classifier:*

Haar-Cascade is a machine learning object detection algorithm which is generally used to identify objects in an image or video and based on the concept of features proposed by Paul Viola and Michael Jones. Initially, this algorithm needs a lot of positive images which are nothing but theimage of faces and negative images which images without faces to train the classifier. Then we need to extract features from it. Haar-like features are represented below. Each feature is considered as a single value which is obtained by subtracting sum of pixels under white rectangle from sum of pixels under black rectangle.

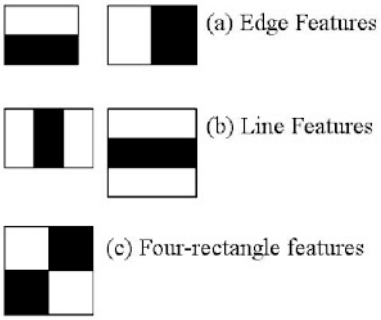

Figure 3. Haar-like features

Hence, using this classifier, we can detect the face from an image with the nature or other things in the background. That is nothing but the separation of the positive image from the negatives.

B. Feature Extraction for Recognition using PCA:

The main idea of Principal Component Analysis (PCA) is to reduce the dimensionality of a data set which consists of many variables correlated with each other, either heavily or lightly, while the variation present in the dataset are retained, up to the maximum extent. The same is done by transforming the variables to a new set of variables, which are known as the principal components (or simply, the PCs) and are orthogonal, ordered such that the retention of variation present in the original variables decreases as we move down in the order. So, in this way, the maximum variation that was present in the original components are retained by the first principal component. The principal components are the eigenvectors of a covariance matrix and hence, they are orthogonal.

Hence, using this algorithm we perform the process of feature extraction which can be further used to perform the face recognition.

C. Text-to-Speech Conversion using Library:

Once the recognition process is done, the next stage involves converting the name mapped to the images into speech signal so that it can be obtained as output through speaker or headphones. In Python, this conversion can be done with the help of inbuilt library as well as using the Google speech API and another library which is preferred for this operation is the E-speak library.

D. Dataset to be used:

Since, the scope of this system is limited within an organization or work place of the user, as a result, the dataset will also be a limited one for this case. Here we have considered a dataset of limited number of positive images while a large number of negative or random images. For this system, we have considered a dataset with 30 positive images approximately, which can be further expanded.

IV. Experimentation And Results

The experiments are conducted on a machine running on Windows 10 version 10.0.18362 having specification Intel(R) Core(TM) i5-8265U CPU @ 1.6 GHz with 8 GB RAM. Programs for the required operations are written in Python 3.8.0.

In the figure4 , the sample output represents the image with the detected faces from a pre-stored image which is already present in the dataset.

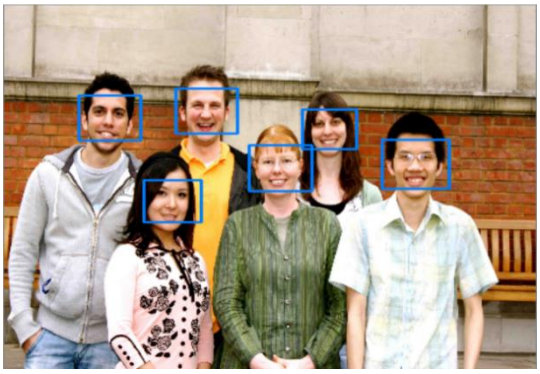

Figure 4. Sample output on stored image

While in figure 5, the face detection operation is performed on real-time captured image which can be obtained with slight variation in the program.

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Figure 5. Sample output on real time image

We perform face detection using the Haar-Cascade algorithm. Basically, for feature extraction, we find the mean of the images and then, find the difference between the mean image and each of the images in the database. Next we need to find the covariance matrix of the matrix obtained from the previous step. Further, some more steps like finding the Eigen values and the Eigen vectors are calculated as well as the Euclidian distance is calculated. Finally, after all these steps, the features are extracted and now, recognition is to be performed. The above shown images represent the segregation of faces from the background which is nothing but the method of face detection.

V. CONCLUSION

This system will help the visually disabled people to identify people he is working with. The popular Haar-Cascade algorithm and PCA algorithm together are used for face detection and recognition. This system can detect faces with an accuracy of 100% with the help of separation of the positive and negative images. Finally, after detection and recognition of the face with an approximate accuracy of 90% for the given dataset, the name of the recognized person is converted into speech and given as output to the speaker/earphones.

REFERENCES

[1] Bhupendra Vishwakarma, Pooja Dange, Abhijeet Chavan, Akshay Chavan, " Face and facial expressions recognition for blind people", International Research Journal of Engineering and Technology (IRJET),2017

[2] Fateh Cherfaoui and Si Nabil Yacini and Amine Nait-Ali, "Fusion of face recognition methods at score level", International Conference on Bioengineering for Smart Technologies (BioSMART),2016

[3] Priya Pasumarti, P. Purna Sekhar, "Classroom Attendance Using Face Detection and Raspberry-Pi", International Research Journal of Engineering and Technology (IRJET),2018

[4] Marko Arsenovic, Srdjan Sladojevic, Andras Anderla, Darko Stefanovic, FaceTime Deep Learning Based Face Recognition Attendance System, IEEE 15th International Symposium on Intelligent Systems and Informatics September 14-16, 2017.

[5] Ishita Gupta, Varsha Patil, Chaitali Kadam, Shreya Dumbre, “Face Detection and Recognition using Raspberry Pi", IEEE International WIE Conference on Electrical and Computer Engineering (WIECON-ECE), 2016.

[6] DiajengTyasPurwaHapsari, CindykiaGustiBerliana and Putri Winda “Face Detection Using Haar Cascade in Difference Illumination", International Seminar on Application for Technology of Information and Communication (iSeman- tic), 2018.

[7] Jun Nishimura and Tadahiro Kuroda,” Versatile Recognition Using Haar-Like Feature and Cascaded Classifier", IEEE SENSORS JOURNAL, VOL. 10, NO. 5, MAY 2010.