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FACE RECOGNITION SYSTEM USING OPENCV

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***Abstract*— The ability to detect the face and recognize the people is one of the major work for our eyes. For blind and visually-impaired people, especially if the blind's eye veins and retina are damaged, it becomes impossible. The technology has been growing drastically and every new invention of science and technology reduces the man effort but hardly used to overcome the man's inability. Developing a tool for the blind and visually-impaired people is not a newly evolved problem. Still, developing a computer aided tool for such purpose is developing area. The computer vision area is on way to reach its peak in providing vision for robots but not a replacement for human eye. The aim of this systems is to help the user to recognize the people without the help of a second person or without the people being introduced himself. There are several works using computer vision techniques. But there is no existing method that solves all the basic needs for a blind person. All existing systems are designed only for a specific purpose. In this paper, we propose new theoretical idea which combines the important basic capabilities and added some extra capabilities for assisting blind people. This new system may solve some of major problems of blind persons that are still existing. Also, we give a difficulties we are facing during the current research which require further research and development. We have developed an face recognition application in android with integrated support for audio input/output and report the results to the blind, which suggest that the proposed approach is promising for real-time implementation for blind persons.**

Keywords: Face Recognition, Blind, Android

1.INTRODUCTION

There are over 3.5 million blind or visually-impaired people across India with 30000 new cases being added each year and many more in the world. The leading causes of blindness are cataract, uncorrected refractive errors, glaucoma, and macular degeneration. The inability to identify people during group meetings is a disadvantage for blind people in many professional and educational situations. Many people who are

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seriously vision impaired use a white cane and/or a guide dog to avoid obstacles. Yet, recognition of people before them is hardly possible until they introduce themselves. Some of the hardest challenges for independent living of the blind and visually impaired people are recogniztion of known people, objects and independent navigation. In order to navigate safely, blind people must learn to detect obstacles on the way. While recognizing, the blind must detect that there is someone is infront of them. The people before the blind could cheat them as if he is someone else. Anyway the blind people should trust the people's words. Recognizing people with their voice is not possible all the time. The blind people will feel achieved or independent if they could recognize the people they meet day to day.

II. RELATED WORK

The problem of detecting the face and recognizing them was studied by many researchers working in the field of Computer vision and assistive technologies for blind people. Most of the previous proposal uses image processing to detect the presence of different faces in the camera frame and perform image processing to match the detected faces against the face database to recognize it. The major limitations of some of the previously proposed approaches is their capability on a low-portability computation device for the necessary image processing which requires at least a computer with good amount of speed and yet some others are lacking the universal design principle by limiting their training data to a specific set and not able to add new datasets making it a static application which could recognize only the existing faces. These approaches also require the user to take a picture/do a video recording at the faces and then process it to recognize them, although the picture taken by a blind user may not be able to capture the image with any device.

III. FACE RECOGNITION CHALLENGES

The most difficulty of providing real-time face recognition to blind users is the fast image processing required for locating and detecting the faces in the frame and process the faces to recognize it before detecting the next face. As real-time image processing is demanding in terms of computational resources, mobile devices with limited resources fall short in achieving accurate and timely detection. Nowadays, mobile phones posses equal configuration with a computer system, sometimes even more than that. Hence it would be easy to process the face in a live streaming camera and it would not be time consuming.

IV. PROPOSED SYSTEM

The android face recognition system architecture we propose is one-tier architecture as seen in Figure 1. The main components are the mobile device with good configuration to perform the image processing efficiently in minimum time, which could be any smart phone device in the market and the external camera which would act as eye that gives live streaming video to

the android device to perform functions over it. The mobile device is responsible for detecting and recognizing faces obstacle detection and avoidance as well as interacting with the user. The input name of the new face will be the voice input from the blind user and the output result of the recognized face willbe the audio output of the android i.e., Google TTS Engine.

Fig. 1 Interaction between the blind user and android device

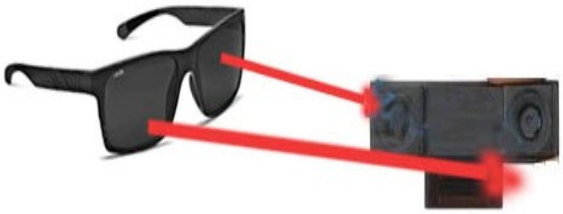

Fig. 2 External camera will act as eyes

The following sub-components provide a detailed description of the major components of the proposed system:

A. Android Device

Android is the mobile platform we have chosen to build face recognition functionality on. Because of its open architecture and support for multi-tasking and accessibility features, android is preferred to perform good face recognition with less time consumption.

Android based devices comes with integrated camera and speech recognition and text-to-speech engines, which with some improvements can be made of easy input and output. It will be easy to develop a good user interface for blind which would be good enough to be used by the blind users. Face recognition on an Android device makes it more universal, accessible and applicable all over the world. Another advantage of Android platform is that the system comes with support to 3G internet connectivity which could be used in future improvements. This can also be used in the navigation of blind people which is going to be our next improvement in the system.

B. External Camera

During the implementation of the current system, the native Android camera was used to live stream the faces in the camera frame. However, in future work we will be employing camera modules integrated into glasses to be worn by the user, considering the fact that the placement of the camera is of vital importance for better collection of faces and to get good angle of faces so that it can be recognized easily. Time-of-flight (TOF) range cameras are a new technology of great use in real-time three-dimensional imaging. The technology has been utilized successfully in several fields

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including curb and ramp detection for safe parking, mobile service robots for collision free manipulation of particular classes of objects and obstacle detection for autonomous ground vehicles and graffiti detection. We also have ideas to implement the same with TOF camera which produces a 3D image so that the more amount of features of face could be gathered and produce a more accurate results. A TOF camera module will not only enable us to detect nearby objects, but also those at a distance, with that we could extract various results such as person approaching you or the person is just crossing away over you.

C. Face Recognition algorithm

In our system, Opencv, the open source standard library developed by Intel corporations are used as a wrapper up to detect and recognize the faces from the camera frame in android device. Opencv is written in C++ and its primary interface is in C++, but it still retains a less comprehensive though extensive older C interface. There are bindings in Python, Java and MATLAB / OCTAVE. The API for these interfaces can be found in the online documentation. Wrappers in other languages such as C#, Perl, Ch, and Ruby have been developed to encourage adoption by a wider audience. All of the new developments and algorithms in Opencv are now developed in the C++ interface. It works on different platforms including Windows, Linux, Mac and also Android. Local Binary Pattern (LBP) is the algorithm used here to retrieve the features of the face and to match them against the stored values to recognize the faces.

The LBP feature vector, the features or details of a face is created in the following manner:

- Divide the detected face window into cells (e.g. 16x16 pixels for each cell).
- For each pixel in a cell, compare it with each of its 8 neighbors (on its left-top, left-middle, left-bottom, right-top, etc.). Follow the pixels along a circle.
- Where the center pixel's value is greater than the neighbor's value, write "0". Otherwise, write "1". This gives an 8-digit binary number
- Compute the histogram, over the cell, of the frequency of each "number" occurring (i.e., each combination of which pixels are smaller and which are greater than the center). This histogram can be seen as a 256-dimensional feature vector.
- Optionally normalize the histogram.
- Concatenate (normalized) histograms of all cells. This gives a feature vector for the entire window and this is considered to be the feature of the face which will be matched against the stored value for recognition.

The feature vector can now be processed using the Support vector machine or some other machine-learning algorithm to classify images. Such classifiers can be used for face recognition or texture analysis. A useful extension to the original operator is the so-

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called uniform pattern, which can be used to reduce the length of the feature vector and implement a simple rotation invariant descriptor. This idea is motivated by the fact that some binary patterns occur more commonly in texture images than others. A local binary pattern is called uniform if the binary pattern contains at most two 0-1 or 1-0 transitions. For example, 00010000(2 transitions) is a uniform pattern, 01010100(6 transitions) is not. In the computation of the LBP histogram, the histogram has a separate bit for every uniform pattern, and all non-uniform patterns are assigned to a single bit. Using uniform patterns, the length of the feature vector for a single cell reduces from 256 to 59.

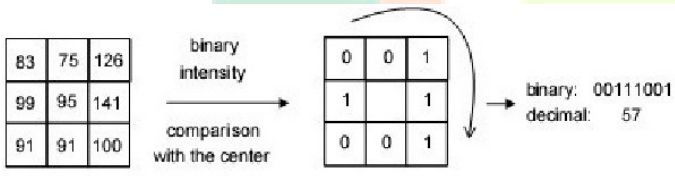

Fig. 3 the simple representation of LBP working

VI. EXPERIMENTAL EVALUATION

The two most important aspects of the face detection and recognition problem are timeliness of response and the accuracy of the result. The real time working of the problem works on the response times of less than 2 second, while high accuracy of recognition should be achieved to ensure the blind user is correct about the information of the people before them. Experiments were performed to test the response time of the face recognition application developed. Test data was performed in native android camera with live streaming and image processing meanwhile. The timing response of the application increases with higher end android phones with at least 2GB RAM and 5 MP cameras. The accuracy of the predicted results improves if more number of datasets are stored for a single face. Hence more number of datasets, more speed and accurate the system works. The experiment needs to test against different number of faces on a single frame to test. The system's performance decreases when more number of faces is detected at same camera frame since it takes time to process every faces to recognize. Also there is a overlap between the audio output and the next recognition process. i.e., the two process overlap on each other. Since, the process is continuously running over a time, it drastically reduces the device's battery.

VII. CONCLUSION AND FUTURE WORK

In this paper we proposed a mobile based face recognition application for the blind and visually impaired using Android device and opencv libraries. We also conducted experiments on this application to test the functionality and limitations of the developed system for real-time implementation and the results are promising to be applicable in wide possible ways.

Our future work will involves the integration and experimentation of a system using an external camera module placed on the eye glasses instead of using the native

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android camera for more accurate and comfortable system. Also we planned to make additional functionalities such as emotion detection and navigation system.

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