FACE DETECTION AND RECOGNITION FOR VISUALLY IMPAIRED : A SURVEY

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Abstract - Face recognition technology is a biometric technology that uses a person's facial features to identify them. Face images are collected by people, and all the recognition equipment processes them automatically. In the absence of audio or haptic cues, the visually challenged's ability to identify recognised people greatly restricts their social experiences and puts them at risk from a security standpoint. Several prototype devices have been built in recent years to assist this population with face recognition. This paper aims to provide an overview of the current state of the art in this domain, outlining the benefits and drawbacks of various solutions and discussing some of the problems that need to be addressed and resolved in order to expedite the realistic implementation and broad adoption of such systems.

Key words : **CNN, Kernels, openCV, Haar cascade classifier, LBPH**

I.INTRODUCTION

Globally, 285 million people are believed to be visually impaired, with 39 million blind and 246 million having poor vision. Around 90% of these people live in developed countries, and 82 percent of blind people are over the age of 50. In this project, the visually impaired will be able to recognise people using face recognition and will receive an audio message stating, "This is so and so individual," and the blind will be able to communicate with them without having to wait for someone on the other side to approach him and talk to him; all he has to do is identify the person (provided the person details saved in system database).The new faces can also be added to the database.

The main goal of this application is to make progress in bridging the communication gap between sighted and visually impaired users by designing the application in such a way that visually impaired people can use it easily. As we all know, identifying individuals is a daunting task for the visually impaired. It has the potential to cause some disturbance in a social interaction. Also it is quite risky from a security perspective as someone can misguide them by faking their identity. Our motivation for this idea came from this place . So to make their lives a little easier and safer we have developed this project.

II. METHODOLOGY

Face recognition algorithms used simple geometric models in the beginning, but the technique has indeed matured into a science involving rigorous statistical representations and matching processes. The face recognition system automatically recognizes faces in photographs and videos. It is divided into two types: 1. Face Detection and 2. Face recognition

A. FACE DETECTION

The very first task we perform is detecting faces in the image or video stream. We remove this face for further processing now that we know the exact location/coordinates of the face. Many face-related technologies, such as face recognition or verification, start with face detection. Face recognition, on the other hand, can be extremely useful. Image taking is likely to be the most effective application of face detection. When you take a snapshot of your mates, your digital camera's face recognition algorithm detects where the faces are and adjusts the focus according to the frame .

B. FACE RECOGNITION

Face recognition is a technique for recognising or confirming an individual's identity by looking at their face. Face recognition algorithms come in a variety of forms, with varying degrees of accuracy. Face is being recognized by comparing the data with the dataset. In this process the person's facial features are matched with the existing data of the dataset .If the data matches then the recognition is done successfully. Then the name of the recognized person appears on the screen. Otherwise he/she is declared as unknown. The flowchart of the system is as follows.

In our project we have followed the spiral model to effectively design and develop the entire project.The spiral model is similar to the incremental development for a system with more emphasis on risk analysis.Spiral model helps to efficiently plan and build the entire project The spiral model has four phases - Planning , Design , Construct and Evaluation .The exact number of phases needed to develop the project can be varied by the project manager depending upon the project complexity and risks.

The system flowchart of our project is shown in Fig.1 below.

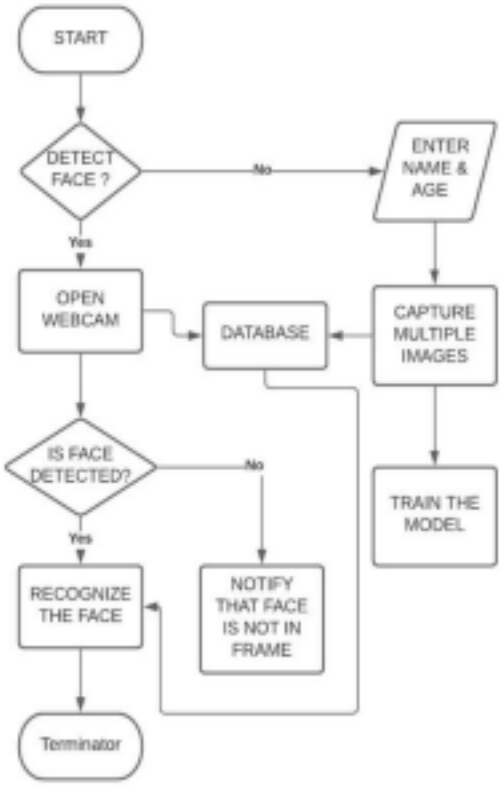

Fig. 1: SYSTEM FLOWCHART

III. FACE RECOGNITION

TECHNIQUES

There are various technologies available for face recognition. To use face recognition many algorithms are present in python using machine learning , deep learning also there are some packages libraries present in python itself. In the next section, we'll look at a few of them.In the next section, we'll look at a few of them.

A. CNN (Convolutional Neural Network)

A Convolutional Neural Network (CNN) is a Deep Learning algorithm which can take in an input image, assign importance (learnable weights and biases) to various aspects/objects in the image and be able to differentiate one from the other. With the development of deep learning, face recognition technology based on CNN (Convolutional Neural Network) has become the main method adopted in the field of face recognition. CNN is a mathematical construct that is typically composed of three types of layers (or building blocks): convolution, pooling, and fully connected layers.The first two layers, convolution and pooling, extract features, while the third, a completely connected layer, maps those features into final production, such as classification. As one layer feeds its output into the next layer, extracted features can

hierarchically and progressively become more complex. The process of optimizing parameters such as kernels is called training.CNN also follows the concept of parameter sharing. A single filter is applied across different parts of an input to produce a feature map.

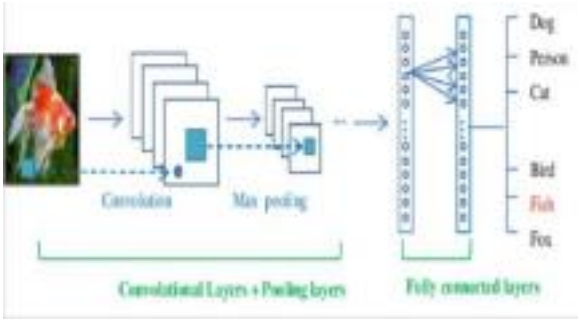

Fig. 2: IMAGE PROCESSING FLOW IN CNN

B . FACE RECOGNITION LIBRARY

This is the easiest face recognition library present in python language. First it requires dlib already installed in python bindings. Then we have to install this module from python with some requirements that the library needs. Face recognition and manipulation from Python or the command line is done in it .It is Built with dlib's cutting-edge face recognition also Deep learning was used to create this. Using this library we can identify people and store the data like faces in our database. On the Labeled Faces in the Wild benchmark, the model has a 99.38 percent accuracy rate. This package also includes a simple face recognition command line tool that allows you to perform face recognition on a folder of images directly from the command line.Also it has many interesting features like it gets the locations and outlines of each person's eyes, nose, mouth and chin. Finding facial features is extremely useful for a variety of purposes.It makes finding facial features a much easier task and saves a lot of lines of code needed to find each separate feature present on the face. This package also includes a simple face recognition command line tool that allows you to perform face recognition on a folder of images directly from the command line.

C. OPEN CV LIBRARY

OpenCV was started at Intel in 1999 by Gary Bradsky, and the first release came out in 2000. OpenCV-Python is a library of Python bindings designed to solve computer vision problems.To find faces in an image, OpenCV employs machine learning algorithms. Since faces are so complex, there is no easy test that will tell you whether or not it found a face. OpenCV is a large open-source library for image processing, computer vision, and machine learning. Python, C++, Java, and other programming languages are supported by OpenCV. It can analyse images and videos to recognise objects, faces, and even human handwriting. As it's paired with other libraries, such as Numpy, a highly optimised library for numerical operations, the amount of arms in your arsenal grows, as many of the operations that Numpy can do can be combined with OpenCV. In our project we have used this library to recognize faces.In computers everything videos, documents, images etc. are all converted and stored in the form of numbers. Pixel value converts images into numbers. OpenCV works in BGR format (blue, green, red). OpenCV has a number of significant abilities as well as utilities which appear from the outset. The OpenCV helps in recognizing the frontal face of the person and also creates XML documents for several areas such as the parts of the body. It also includes three non-face XML files - one for full body (pedestrian) detection, one for upper body, and one for lower body .Face features are abstracted from the input images and are used to train the classifiers, modify weights as mentioned . OpenCV uses a type of face detector called a Haar Cascade classifier. In 2001, Viola et al. first introduced the haar-like features. The haar-like features are rectangle features and the value is that the sum of pixels in black district subtracts the sum of pixels in white district. Rainer Lienhart has done an extended set of haar-like features which significantly enrich the basic set of simple haar-like features, and can get a better hit rate.

D. LBPH

The Local Binary Pattern Histogram(LBPH) algorithm is a simple solution to the face recognition problem, which can recognize both the front face and side face. To solve this problem, a modified LBPH algorithm based on pixel neighborhood gray median(MLBPH) is proposed.Local Binary Pattern (LBP) is a simple yet very efficient texture operator which labels the pixels of an image by thresholding the neighborhood of each pixel and considers the result as a binary number. It was first

described in 1994 (LBP) and has since been found to be a powerful feature for texture classification. It has further been determined that when LBP is combined with histograms of oriented gradients (HOG) descriptors, it improves the detection performance considerably on some datasets. Using the LBP combined with histograms we can represent the face images with a simple data vector. As LBP is a visual descriptor it can also be used for face recognition tasks.

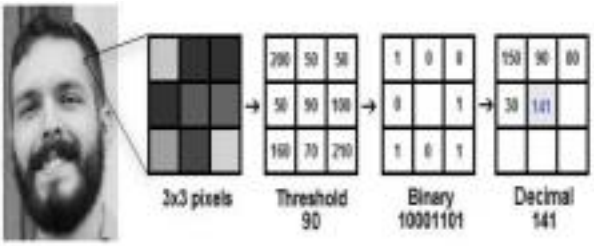

Fig. 3: FACE RECOGNITION USING LBPH ALGORITHM

IV. RESULT

A. CNN

In image recognition systems, CNNs are often used. In 2012, the MNIST database registered a 0.23 percent error rate.

We will see some merits and demerits of CNN. MERITS -

It is easy to understand and fast to implement.

It has the highest accuracy among all algorithms that predicts images.

DEMERITS -

High computational cost.

If you don't have a good GPU they are quite slow to train (for complex tasks).

It needs a lot of training data.

B. FACE RECOGNITION LIBRARY This model has an accuracy of 99.38% on the Labeled Faces in the Wild benchmark. We'll look at some advantages and disadvantages of this framework

MERITS -

It is fully automated.

It has a high accuracy level.

DEMERITS -

Since face_recognition depends on dlib which is written in C++, it can be tricky to deploy an app using it to a cloud hosting provider like Heroku or AWS.

According to face recognition library python documentation it performs well with upto 40 degree angle of picture or camera only.

C. OPENCV LIBRARY

According to research published in April 2020 by the Center for Strategic and International Studies (CSIS), FRT systems have nearly absolute precision in ideal conditions, reaching a 95.97% recognition accuracy level. The advantages and disadvantages are listed below.

MERITS -

It has low RAM usage (approx 60–70 mb)

It is portable since OpenCV can run on any platform that can run the C programming language.

DEMERITS -

When compared to other models, OpenCV does not have the same level of ease of use.

OpenCV has its own flann library. When you try to use the OpenCV library with the PCL library, this creates problems.

D. LBPH

According to I.J. Cox et al. this algorithm has a minimum 82.3% accuracy rate it can be improvised by adding more datasets .

MERITS -

Without any major low-level or mid-level processing, raw intensity data is used directly for learning and recognition.

It can recognize both the front face and side face.

DEMERITS -

The negative light exposure and high noise level have a greater effect than the others who use a statistical approach.

Based on the above findings of various models and our own analysis, we can conclude that the CNN model is the most efficient. With 2500 variant images in a class, it has a 98.5 percent accuracy rate. Because of its hierarchical layering structure, it produces the best outcomes in complex projects. Opencv and face recognition libraries, on the other hand, provide good results for small projects.

V. CONCLUSION

The project proposes a device that allows the visually impaired to be more involved in social interactions, thus increasing their participation. In this paper, we used the OpenCV library and LBPH algorithm in it to propose a face recognition framework for the visually impaired. We also conducted tests on this system to evaluate the functionality and scope of the established system for real-time operation, with positive results that can be applied in a variety of ways.

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