

A Novel Face Detection Technique Using OpenCV

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Abstract: Identifying and recognizing a person through virtual mode or mass media become an important and essential thing in order now-a-days to provide sufficient privacy and security. In this paper, we intend to implement a real-time Face detection from video and images using Haar Classifier using Python programming. OpenCV libraries are used for detecting face. The experimental result computed by using computer vision OpenCV framework libraries by which we obtained accurate and speediness for face detection and tracking the head poses position. The proposed technique is predicated on the utilization of Python programming for correct classification and identification of the face. In this paper we shall implement a Har-Classifier for Face Detection and Tracking method supported by the Har features.

Keywords: Face detection, Face recognition, Open-CV, Numpy, Eigenfaces.

1. Introduction

Face detection and recognition is a technology that is used to identify a human faces in digital images or a video. In 1960s face recognition was introduced by Woodrow Wilson Bledsoe. This model is based on machine learning is a popular research direction in the field of computer vision. This technology is getting advanced with the help of python and open-CV library in deep learning is the most sufficient way to detect the face of the person. By the help of this technology, one can easily detect the face among the dataset of similar matching appearance of a person. The concept of Open-CV has a large number of abilities, it helps in recognizing the frontal face of the person and also creates extensible markup language documents for several areas like the hole parts of the body. beside this open-CV uses a face detector algorithm called a Haarcascade classifier. Haarcascade classifier is used for detection only. Face detection and recognition technology is used in various applications like smart phone unlock, find missing person, for security in corporate sectors, banking sectors, verification of government voter list and many more in daily life. It can also be helpful in catching the thieves or the terrorists in the country. This technology is attached with a strong python programming, so this technology works easily and give a right result.

2. Problem Definition

Over the past decade face detection and recognition have gone beyond from backstage to popular areas of research in computer vision and algorithm based understanding. Because of the idiosyncratic nature of the problem, computer vision is not only a computer science area of research, but also the object of neuro-scientific and psychological studies also, mainly due to the general opinion that advances in computer image processing and understanding research will provide insights into how our brain work and vice versa. A general statement of the face recognition problem can be formulated as follows: One or more than one still or video images are given to find out one or more persons in the scene and it is done by using a stored database of faces. Generally two stages are required in Face recognition.

Face Detection: Face detection is AI based Computer technology which is used find human faces in digital image there are application off face detection such as including security law enforcement and personal safety to provide surveillance and identifying of person in real time

Checking of the positive and negative image is done by the algorithms which are used in face detection technic. For accomplishing this accurately, the algorithms must be trained on huge datasets containing hundreds of thousands of face images and non-face images.

In face analysis, face detection helps to find the parts of an image or video which should be focused on to determine age, gender and by using facial expressions we can determine human emotions. [1]

Face Recognition: Facial recognition is the category which falls under the biometric software that maps one's facial features mathematically and stores the data as a faceprint. Deep learning algorithms are used in the software to make a comparison between a live capture or digital image and the stored faceprint in order to verify one's identity

Eighty nodal points gets identified by the software. In this context, nodal points are basically the endpoints which are used to measure variables of the face of a person: like the length and

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width of the nose, the depth of the eye sockets, the shape of the bone below the eye. The function of the system is conduct by capturing data for nodal points on a digital image of one's face and storing the resulting data as a face print. Now this data which is stored as face print, is used as a basis for comparison with data captured from faces in an image or video [2].

Face detection is a broader term than face recognition. Face detection just means that a system is able to identify that there is a human face present in an image. Face recognition is much less reliable than face detection, with an accuracy of 30-70% in general.

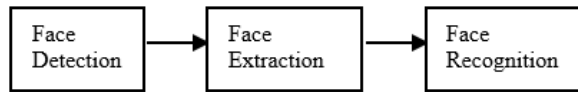


Fig. 1. A generic face recognition system

OpenCV is huge open-source library which is used for computer vision, machine learning, and image processing. A wide variety of programming languages like python, C++, Java etc., are supported by OpenCV. Different types of images and videos can be processed by OpenCV to recognize faces or even the handwriting of human. For performing numerical operations, OpenCV is integrated with various libraries, such as NumPy. Any kind of numerical operations one can do in Numpy can be combined with OpenCV [3].

Open-source computer-vision library which was started at Intel in 1999 by Gary Bradski has various advanced capabilities like face detection, face tracking, face recognition etc. The features of OpenCV are - Multiple interface, Program function library, Community Forums.

OpenCV is cross platform and very highly rated because it adds state of the art computer vision and algorithms of machine learning. OpenCV has various kinds of application such as, street view image stitching, medical image analysis, robot and driver-less car navigation and control etc. OpenCV v3. 2.0 release can use Intel optimized LAPACK/BLAS included in the Intel Math Kernel Libraries for acceleration [4].

CV namespace consists of Image processing and Camera Calibration methods [5].

NumPy which was created in 2005 by Travis Oliphant, is a library which is combined with OpenCV and used for Numerical operation and It also has functions for working in domain of linear algebra, fourier transform, and matrices. It is an open source project and can be used freely [6].

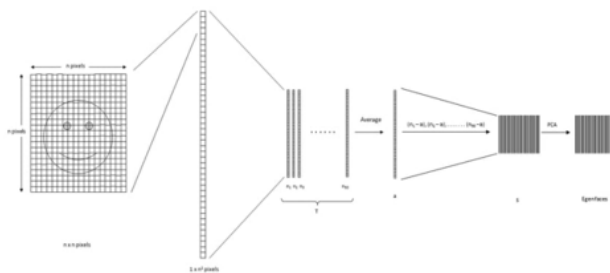


Fig. 2. Recording image's pixels for performing the calculation of Eigenface

One of the easiest way for face recognition is Eigenfaces. For identifying human face, an eigenface is the name given to a set of eigenvectors which is used in the computer vision problem. This approach for face recognition was developed by Sirovich and Kirby in 1987 and is used by Matthew Turk and Alex Pentland in their work for face classification. The eigenvectors are formed from the covariance matrix of the probability distribution over the high-dimensional vector space of face images. These eigenfaces themselves form a basis set of all images that leads to the construction of the covariance matrix. This results in dimension reduction as it allows the smaller set of basis images to represent the original training images. In this method we can classify faces by comparing how these faces are represented by the basis set [7].

3. Proposed Methodology

At first we will have to process the datasets to create that system. Firstly, if image quality is up to the mark different methods and steps will be made in this face recognition system using the python queries "python encode_faces.py". It is very important to apply the respective image processing techniques to make the image perfect for face recognition. Most of the face recognition algorithms are light sensitive. It will be difficult to recognize a person in extremely dark or extremely bright surround. So in system precision formatting will be applied to each face. "encodings.py" will receive the respective data sets from which the input will be taken. Secondly, to identify the face of the person in the given image of the data set, it will be passed through the required face recognition method and techniques, which are contained in a file called "recognize_face_images.py". A python command "python recognize_faces_image_py_encodings" will execute the given file. Photo resize or paper editing will enhance the exactness of the output. The correctness can be enhanced by the present classifier along with Open-CV. Gray Scale images eigen faces the face recognition system presented in this paper. This paper depicts the easiest way to convert color images to gray scale and there after Histogram Equalization is applied to bring exactness to the brightness, contrast of facial images. Color face recognition (Histogram fitting in HSV or other color space) or contour detection, edge enhancement, motion detection can be applied. Haar Cascade classifier can be used by Open-CV as a type of face recognition [8].

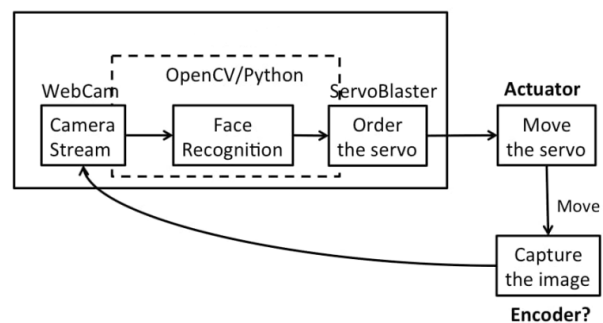


Fig. 3. Face recognition system design using python and OpenCV

The short description of flow chart: At first an image/video having one or more than one face is taken. After that haar-cascade face & eyes are imported and are checked whether the face/faces are present or not. If present, then the image will be copied & if not the input must be wrong. After this it will check if the eyes are present or not. If present, then the box is drawn around the face otherwise we need to check the image again.

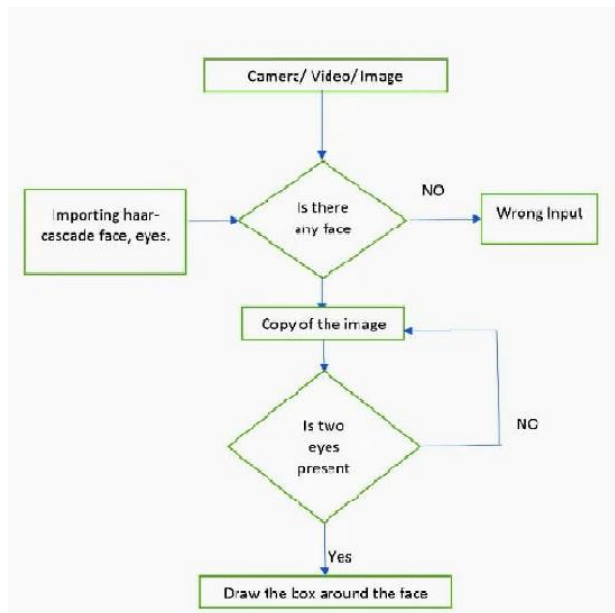


Fig. 4. Flowchart of detecting face

The algorithm of face detection technique using Open-CV in Python:

- Step 1: Import computer vision Library (cv2) in this code.
- Step 2: Create face object and apply cascading filter.
- Step 3: Loading an input image from disk.
- Step 4: Convert color space from BGR to gray
- Step 5: Detect multiscale method is applied to detect objects of different size of input image.
- Step 6: Detected objects are returned as a list of rectangle
- Step 7: cv2.rectangle method is applied to draw a rectangle on face with starting and ending coordinates.
- Step 8: Imshow method displays displays the image in a window.

4. Advantages and Disadvantages

A. Advantages

The biggest advantage of the face detection or face recognition is that it is the faster processing, automatically identifying, privacy policy, large number of data Storage, best results, improved security, real time face detection of students in schools and colleges, employees at offices, unlock of the smart phone and many more in day to day life.

It's one of advantage is that face detection improves surveillance efforts and it helps to track down criminals and terrorists.

One surprising use of face detection, in some cases, this software can determine how specific mutations caused a

particular syndrome. This technology may be less expensive and faster than traditional genetic testing [9].

B. Disadvantages

As with any technology, facial recognition also have potential drawbacks.

One of it's disadvantage is that there are inherent dangers in false positives. Face detection software could improperly identify someone as a criminal and resulting in an arrest.

There is also a concern about the storage of facial recognition data as these databases have some potential to be breached.

Other factors also can effect the ability if the technology to detect faces of the people including angles of the camera, quality of the image or video, levels of lighting. People wearing disguises or slightly changing their appearance can throw off recognition of face by this technology too [10].

5. Project Output



Fig. 5. Project output that detects some famous faces



Fig. 6. Project output that detects our faces

6. Discussion

After running the system upon 3 images, the results that we got are quite satisfactory. The figures of the final result is like that, Success rate: 86.66%, Repeat rate: 0%, Failure rate: 6.1%. The system has taken an average time of 62 seconds. The small rate of failure was expected because in order to bring 100% accuracy, it should overlap the eigenface in condition of box size and center location. Sometimes the small size of the face and image quality also affects the result. Otherwise, the system performed satisfactorily by detected almost 90% of the number of faces in an image.

7. Conclusion

Face detection in one of the fundamental applications which is used in face recognition technology. It is the process in which

algorithms are developed and trained to locate faces properly. Face detection systems are currently associated with many top technology companies and industries to make the work of face detection easier.

The use of python programming and OpenCV makes it an easier and handy system or tool which can be made by anyone according to their requirements. The proposed system which is discussed in this project will be helpful for many as it is user friendly and cost effective system. Hence by the use of python and openCV the face detection or face recognition system can be designed for various purposes.

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