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Face Detection and Recognition using OpenCV and Python

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Abstract – *This research paper gives an ideal way of detecting and recognizing human face using OpenCV, and python which is part of deep learning. This report contains the ways in which deep learning an important part of computer science field can be used to determine the face using several libraries in OpenCV along with python. This report will contain a proposed system which will help in the detecting the human face in real time. This implementation can be used at various platforms in machines and smartphones, and several software applications.*

Key Words: Python, OpenCV, Deep Learning, Face detection, etc…

1. INTRODUCTION

Face recognition is the technique in which the identity of a human being can be identified using ones individual face. Such kind of systems can be used in photos, videos, or in real time machines. The objective of this article is to provide a simpler and easy method in machine technology. With the help of such a technology one can easily detect the face by the help of dataset in similar matching appearance of a person. The method in which with the help of python and OpenCV in deep learning is the most efficient way to detect the face of the person. This method is useful in many fields such as the military, for security, schools, colleges and universities, airlines, banking, online web applications, gaming etc. this system uses powerful python algorithm through which the detection and recognition of face is very easy and efficient.

1.1 Motivation

The most useful area in which face recognition is important is the biometrics that is used for authentication process which makes the work mor easier. Face recognition is one of the widely used technologies or systems in which it has the potential to perform tasks such as to have records provided in by the dataset in many areas such as the school and colleges attendance systems, it can also be helpful in catching the thieves or the terrorist, can be helpful in the security of common people and the much needed security areas in the country. Face recognition can be used by the government to verify the voters list, find missing persons, find the population or census, immigration process, also provide security over internet scams protecting Ecommerce and highly used in the medicine and healthcare range. This brings in a very high demand or a real time face recognition system for several uses for the people and government. Providing such excellent systems there would be ease in several activities.

1.2 Problem Statement

The main aim or objective of this paper is to provide or develop a system that will use the camera of the computer or the system that would detect and recognize the person's face or the face of the individual using the tool in OpenCV called as the Open Face and python programming language in deep learning domain.

2. Literature survey

This section is a basic overview of the major techniques used in the face recognition system that apply mostly to the front face of the human being. The methods include neural networks, hidden Markov model, face matching done geometrically and template matching.

Eigenface is one of the most widely used methods in face recognition and detection which are broadly called as the principle components in mathematical terms. The eigenvectors are ordered to represent different amounts of the variations in the faces.

Neural networks are highly used in the face recognition and detection systems. An ANN (artificial neural network)
Was used in face recognition which contained a single layer
Which shows adaptiveness in crucial face recognition systems. The face verification is done using a double layer of WISARD in neural networks.

Graph matching is other option for face recognition. The object as well as the face recognition can be formulated using graph matching performed by optimization of a matching function.

Hidden Markov Models is the way by which stochastic modeling of nonstationary vector time series based on HMM model applied to the human face recognition wherein the faces gets divided into parts such as the eyes, nose, ears, etc
The face recognition and correct matching is 87% correct as it always gives out the best and right choice of face detection through stored dataset. Or else the relevant model reveals the identity of the face.

The geometrical feature matching is the technique which is based on the geometrical shapes of the face. The geometrical face configuration has sufficient dataset for face detection

and recognition system. This is one of the commonly used method of the face recognition and detection. This system apparently gives satisfactory results.

Template matching is one of the techniques through which the test image is represented as a two- dimensional array of values which can be compared using Euclidean distance with single template representing the whole face. This method can also use more than one face template from different points of view to represent an individual face.

3. Methodologies

The concept of OpenCV was put forth by Gary Bradski which had the ability to perform on multi-level framework. OpenCV has a number of significant abilities as well as utilities which appears 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.

Deep learning evolved lately in the process of the recognition systems. Hence deep learning along with the face recognition together work as the deep metric learning systems. In short deep learning in face detection and recognition will broadly work on two areas the first one being accepting the solidary input image or any other relevant picture and the second being giving the best outputs or the results of the image of the picture. We would be using dlib facial recognition framework that would be the easy way to organize the face evaluation. The two main significant libraries used in the system are dlib and face_recognition.

Python being a very powerful programming languages and one of the programming languages that are being used all over the world has proven to give best results in the face recognition and detection systems. Together face recognition and detection becomes very easy and fruitful with the help of the python programming language and OpenCV.

3.1 Need of an automated system

Due to the rising need for the systems which can help in the areas such as surveillance as well as security this kind of individual authentication can no longer be done using simple handmade methods hence there is a rising need of the automated systems that can easily rectify the faults and process the human face recognition. When the work is done by machines it can perform tasks efficiently in very less duration of time and cuts off the major mistakes occurred by humans. A real time GUI based face recognition system built can ease this work of face detection and can be achieved in various ways.

3.2 Graphical User Interface

The graphical user interface (GUI) is the platform that will allow the inputs from the user ends a kind of interaction with the system. GUI's are used in mobiles, media players, games and many others. We can design visual composition and the temporal behaviour of the GUI in any of the software application as well as programming in the areas of the human computer interaction. The GUI for this project will be widely based on the training and the testing phase which in turn will allow the capture and train of the image.

The minimum requirements for the software would be python along with OpenCV and the required dataset. The minimum requirements for the hardware would be intel i3 or any processor above it and 4 core CPU. Operating systems of windows 10 will be sufficient and random access memory 8GB required. From the user end a computer or laptop active internet connection and a scanner optional.

4. Proposed Arrangement for system design

In order to create this system first we will have to make the datasets. When the image quality becomes favourable different procedures will take place in the face recognition system the tasks are performed using the python queries "python encode_faces.py". The input will be taken from the dataset which will be received in the "encodings.py". There will be precision formatting in the system wherein face embedding for each face will occur. Secondly a file "recognize_faces_images.py" will contain all the required methods and the techniques for the process of identification of the face of the person from the given image of the dataset. The given file will be executed by the python command "python recognize_faces_image.py-encodings". We can resize or turn the image for approximity with the goal for getting the desired output. The present classifier along with OpenCV libraries will enhance the outcome or results in the face recognition system.

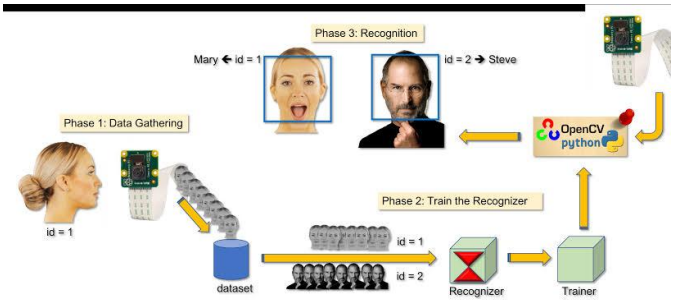

Figure 1: face recognition system design using python and OpenCV.

5. Advantages and Disadvantages

The advantages of the face recognition system include faster processing, automation of the identity, breach of privacy, massive data storage, best results, enhanced security, real time face recognition of students in schools and colleges, employees at corporate offices, smartphone unlock and many more in day to day life.

Few disadvantages in this system include the costing, or the funding, very good cameras of high definition are required, poor image quality may limit the effectiveness of this system, size of the image will matter because it becomes difficult to recognize the face in small images, Face angles can limit the face recognition reliability, massive storage is required for this system to work effectively.

6. Conclusions

Face recognition systems are currently associated with many top technological companies and industries making the work of face recognition easier. The use of python programming and OpenCV makes it an easier and handy tool or system which can be made by anyone according to their requirement. The proposed system discussed in this project will be helpful for many as it is user friendly and cost_ efficient system. Hence by the use of python and OpenCV the face recognition system can be designed for various purposes.

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