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Face Recognition using Deep Learning

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Abstract - *One of the most successful application of images analysis and understanding, face recognition has recently received significant attention, especially during the past few years. Facial recognition technology (FRT) has emerged as an attractive solution to address many contemporary needs for identification and the verification of identity claims. It brings together the promise of other biometric systems, which attempt to tie identity to individually distinctive features of the body, and the more familiar functionality of visual surveillance systems. It develops a social political analysis that bridges the technical and social scientific literatures on FRT and addresses the unique challenges and concerns that attend its development, evaluation, and specific operational uses, contents, and goals. It highlights the potential and limitations of the technology, noting those tasks for which it seems ready for deployment, those areas where performance obstacles may be overcome by future technological developments or sound operating procedures, and still other issues which appear intractable. Its concern with efficiency tends to ethical considerations. Face recognition technology may solve this problem since a face is undeniably connected to its owner expect in the case of identical twins. It is nontransferable. The system can then compare scans to records stored in a central or local database or even on a smart card.*

1. INTRODUCTION

Face is most commonly used biometric to recognize people. Face recognition has received substantial ttention from researchers due to human activities found in various applications of security like airport, criminal detection, face tracking, forensic etc. Compared to other biometric traits like palm print, Iris, _finger print etc., face biometrics can be non-intrusive. They can be taken even without users knowledge and further can be used for security based applications like criminal detection, face tracking, airport security, and forensic surveillance systems. Face recognition involves capturing face image from a video or from a surveillance camera. They are compared with the stored database. Face biometrics involves training known images, classify them with known classes and then they are stored in the database. When a test image is given to the system it is classified and compared with stored database. Face biometrics is a challenging field of research with various limitations imposed for a machine face recognition like variations in head pose, change in illumination, facial expression, aging, occlusion due to accessories etc.,. Various approaches were suggested by researchers in overcoming the limitations stated.

1.1 Haar Cascade Classifier

The process of face recognition is categorized into 2 steps: Face Detection and Face Recognition. The main aim of it is to make the machine aware of what a face looks like. Face detection is primarily governed by few rules like positon of nose, space between eyes and others. Information regarding the face, i.e. position and size of the face from an image or video stream, is collected and noted

A. Face Detection

The detection of face is a process carried out using Haar cascade classifiers due to its speed. Haar Classifier is a supervised classifier and can be trained to detect faces in an image. It may be seen as a

funnel where each region of any given image is processed using a set of classifiers termed as Haar-features. They behave as a funnel called the Haar Cascade. Classifiers at the top of the cascade are very fast and their false negative rate is very low. They discard regions of an image that does not contains any face. The features become more complex further down the cascade and images are rejected immediately if the features do not resemble a face. The integral of a grayscale image is calculated by the e right of the corresponding pixel. Thus, calculation of average intensity of any rectangular portion of an image may be calculated with the help of only 4 pixels at a time.

1.2 LBPH

Human beings perform face recognition automatically every day and practically with no effort.
Although it sounds like a very simple task for us, it has proven to be a complex task for a computer, as it has many variables that can impair the accuracy of the methods, for example: illumination variation, low resolution, occlusion, amongst other.
In computer science, face recognition is basically the task of recognizing a person based on its facial image. It has become very popular in the last two decades, mainly because of the new methods developed and the high quality of the current videos/cameras.

In this section, it is shown a step-by-step explanation of the LBPH algorithm:

1. First of all, we need to define the parameters (radius, neighbors, grid x and grid y) using the Parameters structure from the lbph package. Then we need to call the Init function passing the structure with the parameters. If we not set the parameters, it will use the default parameters as explained in the Parameters section.
2. Secondly, we need to train the algorithm. To do that we just need to call the Train function passing a slice of images and a slice of labels by parameter. All images must have the same size. The labels are used as IDs for the images, so if you have more than one image of the same texture/subject, the labels should be the same.
3. The Train function will first check if all images have the same size. If at least one image has not the same size, the Train function will return an error and the algorithm will not be trained.
4. Then, the Train function will apply the basic LBP operation by changing each pixel based on its neighbors using a default radius defined by the user. The basic LBP operation can be seen in the following image

1.3 Result

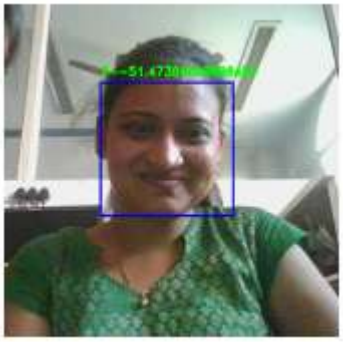

Fig.1 Result using Machine Learning.

Fig. 2 Another one using Machine Learning

Fig. 3 Result using Deep Learning.

3. CONCLUSION

Firstly, the face detection is carried out using Haar-classifier which produces an accuracy of around 80.2 percent. Using Eigenfaces algorithm, an accuracy of 83.8 percent and 85.1 percent from still images. While LBPH face recognition algorithm produces has an accuracy of 89.6 percent for still images. Thus, it can be concluded that LBPH algorithm for face recognition produces better recognition accuracy than Eigenfaces algorithm. And to achieve more accuracy, CNN is the one which is used. CNN gives around 99 percentage accuracy. Today, one of the ends that used facial recognition the most is security. Facial recognition is very effective tool that can help law enforcers recognize criminals and software companies are leveraging the technology to help users to access their technology. This technology can be further developed to be used in other avenues such as ATMs, accessing confidential _les, or other sensitive materials. This can make other security measures such as password and keys obsolete. Another way that innovators are looking to implement facial recognition is within subways and other transportation outlets. They are looking to leverage this technology to use faces as credit cards to pay for your transportation fees.

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