Face Recognition using Shape Invariant Features

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Abstract

Face recognition is a traditional trend that is necessary for security measures. It may be utilized for detection and authenticating to affirm a person's identification and to recognize persons, respectively. But the cost and maintenance of the ideas vary to the idea of logic. This paper reviews the face recognition process with different approaches and related studies as well as some practical implementations, types, methods, and other details. Fundamentally Histogram of Oriented Gradients (HOG) is the basis of the face detection and the classifier used is the linear support vector machine (SVM) which instantly determines these methods' respective weights, and the Deep Convolutional Neural Network is trained on a picture used in the background to create 128 measures for each face to decrease the time of detection.

Keywords. Face Detection, Face Recognition, HOG, SVM, Neural Networks

1. INTRODUCTION

Facial recognition algorithms attempt to identify a human face based on its two-dimensional representation, which is three-dimensional and modifies appearance depending on lighting and facial emotion. Kelly completed the first piece of work pertaining to automatic facial recognition to identify the same individual among a group of photos recorded by a television camera [1]. Due to their unpredictable look and the variety of stances they might take, humans can be difficult to identify in photographs. The first need is a strong feature set that enables clean human form discrimination even in cluttered backgrounds with poor lighting. Biometrics recognition system which is one of the applications of face detection [2,3,4,5,6,7,8]. There are several different approaches with which we can detect a face and recognize it. Some of them are Eigen space: Among the most effective approaches for computational recognition of faces as in digital pictures is Eigen space-based high accuracy face recognition [13] [22]. Holistic face recognition identifies people by using global information from their faces [21]. The global characteristics of the pattern are considered by holistic methods [9,10,11,12,13,14,15,16,17,18,19,20,21,22,23]. According to [19] the influence of facial feature dislocation under position changes is eliminated to achieve posture tolerance.

In this work, we introduce a novel algorithm for face alignment that runs in milliseconds and delivers face detection. Since the key elements of earlier face alignment algorithms were identified, they were then streamlined and added to a series of high-capacity regression functions that were learned via gradient boosting, which resulted in speed improvements over existing techniques. The organization of the paper is as follows: section II discusses the related work; section III discusses preliminaries and covers basics of HOG and Cascade of Regressors. The section IV explains the proposed technique. Results and discussion are discussed in section V. A conclusion is given in section VI.

2. PRELIMINARIES

2.1. Histogram of Oriented Gradients (HOG)

An image is just a discrete function of (x, y), the gradient of an image may also be determined. Images have a horizontal (x-direction) and a vertical (y-direction) gradient that is computed at each pixel. Values for gradients are assigned to 0-255. The [7][8]and [9] have depicted how a face and human gestures can be detected with the help of HOG. The orientation (magnitude) is provided in [10].

2.2. Cascade of Regressors (COR)

In this work, which should simulate facial changes under different head postures and facial expressions, is too difficult to resolve in a single step of regression. Therefore, rather of regressing in a single step, an adaptive cascade regression model [6] is used that learns the frontal-profile connections in a cascade fashion and gradually approaches the optimum. x represents shape of frontal face and non-frontal is $x_{0.}$ Where regression can be expressed as $R(x_0)$. Here $x - x_0 = \Delta x$, $x_0 + \Delta x = R(x_0)$, Given in Figure 2.21.

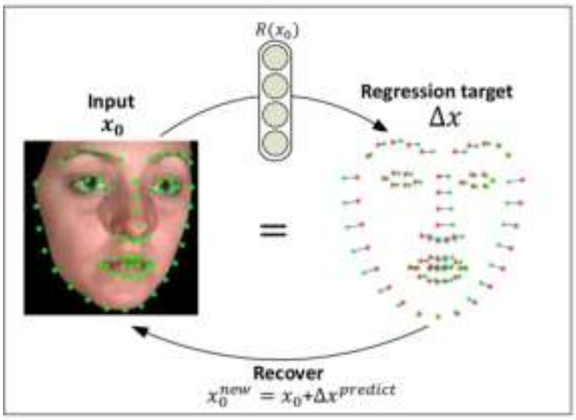

Figure 2.21. Cascade regression process

This technique is used for finding 68 markers on each face.

3. PROPOSED METHODOLOGY

Step1: To create a condensed version of an image, encode the image using the HOG algorithm [7]. Find the region of the image that most closely resembles a general HOG encoding of a face using this simplified version. (Given in Figure 2.21)

Step2: A series of regression functions can be used to tackle the problem of facial alignment [15]. By identifying the key facial landmarks, determine the facial position. Use those markers to warp the image once we've located them so that the eyes and mouth are in the middle.

Step3: Use a deep neural network architecture that is trained to measure facial traits to run the centred face image. The 128 measurements should be saved.

Step3: Find the individual whose measurements are the most like our face's measurements among all the faces we have previously measured. That's our opponent shown in Figure 3.1.

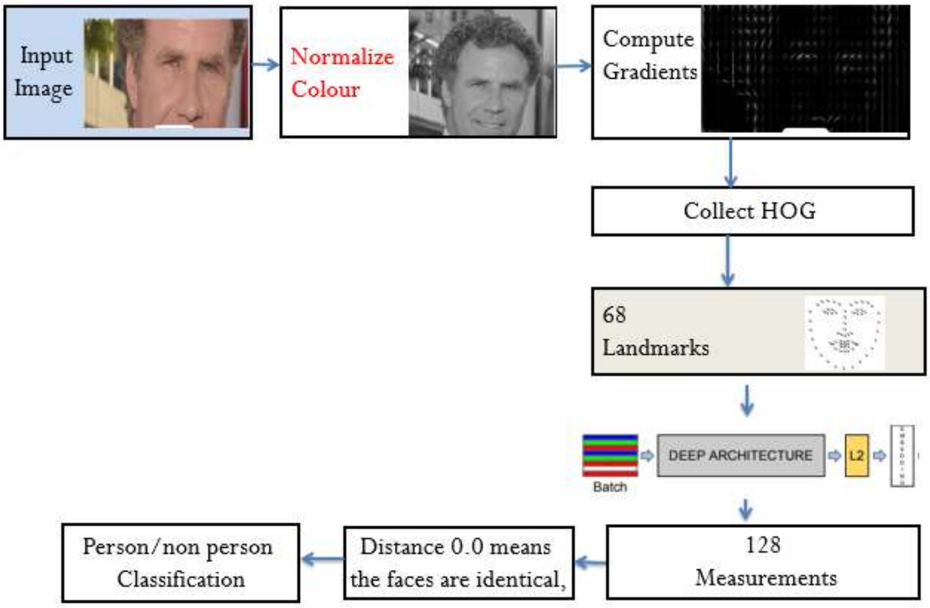

Figure 3.1 Proposed Methodology

4. EXPERIMENTAL AND RESULTS

We have taken 60 sample images from Kaggle dataset for experimental work. These images are a collection of different facial expression of Elon Musk. Experiments have been performed on the data set of images "Elon Musk" Each image is RGB image and convert it into binary image. All the experiments have been performed on PYTHON 3.10- and 64-bit version for windows. Table 4.1 shows the experimental results.

Table 4.1. Results

 Figure 4.1 Image A	 Figure 4.2 Image B
 Figure 4.3. Blur image 1	 Figure 4.4. Blur image 2
 Figure 4.5. Output image1	 Figure 4.6. Output image2

In accordance with [7] and [15] we learned to use HOG and face alignment to decrease the detection time. In this experiment Figure 4.1. i.e., Image A is the train image for encoding and Figure 4.2. i.e., Image B is the Test image for comparison which shows the result that it is the matching image of Elon Musk and the distance between the face locations is 0.43. The less the distance between the face distance, more precise the face matching is done. In the images above we have seen the input images are blurry or may be taken from a low-quality camera, despite the fact still the results shown in the output images are matched with the input images in most of the cases which are output image 1 with 0.50 face distance, image 2 with 0.47 face distance and image 3. with 0.51 face distance as shown in Figures 4.1, 4.2, 4.3, 4.4, 4.5 and 4.6.

5. CONCLUSIONS

We have calculated the 128 measurements and based on that we can tell that our face matched or not. To check how similar is the face matched, for that we have calculated the face distance (the Euclidian distance) for each comparison face and the distance tells how similar the face is. Out of all other complex models this technique is very effective for a simple cost-effective purpose and suggests for the face extraction from a mass group to detect the terrorist/culprits from that group. There are other approaches to face recognition that we have seen, but CNN and HOG serve as the foundation for face recognition as well as various alternative methods.

6. REFERENCES

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