Automated Personalized Face Detection using Viola Detector

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Abstract

In correspondence with rapid population magnification all over the map the survival, facial detection technology plays a more preponderant paramount and inductively authorizing role in our circadian lives, namely in a well-kenned aspects as antihero investigations, notarize systems, ingression systems, etc. Face detection perspicuity is influenced by antithetical variations in relegating a target repine in an image; this manage include pose variation and facial occlusion. The overall aim of this research is to design a strategy to increment the efficiency & optimize the results to detect the region of culled face in an image. The performance of Automated Personalized Viola Detection Algorithm in terms of efficacy and time taken to find the desired position will be analyzed.

Keywords: *Face detection, Haar featureViola-Jones, Integral image, OpenCV, Adaboost*

I. INTRODUCTION

Face detection algorithm is used to determine and display the region of the face in applications such as video surveillance, security, smart card application etc. In latest technology the vogue and interest of face detection play a consequential role in terms of amended detection speed and precision due to its demand and latest applications. In particular, the essential work by Viola-Jones has made face detection virtually achievable with high detection speed by utilizing a well-trained classifier [1]. Paul Viola and Michael Jones presented a technique for face detection which doesn't consume much computation time. This method implements face detection techniques which decrease computation time than any other antecedent methods.

The algorithm divided into mainly 4 Process:

- Haar like Features Selection
- Representation of Integral image for feature extraction
- Ada-Boost for face detection
- Cascade classification for fast rejection of non-face sub-windows.

The projected technique of face detection in this paper is divided into two steps. In the first step, Viola and Jones algorithm is used to detect faces in the image that is stored selected from hard disk drive, and the result of this step will be the applicant face in the image [2].

So face detection process takes more time when is a time the size of the image to be processed increases.

II. RELATED WORK

Face Detection activities have increased popularity since the tardy nineties. To improve detection rate many researchers presents different techniques for identifying human faces. But Viola-Jones face detection using Adaboost algorithm has shown a better outcomes with15 frames/second (fps) on images of resolution 320×288 as compared to precedent technique while retaining the detection rate. [1]. Software technique which work with multi-threading in the optimized OpenCV implementation [7] in CPU centered system is efficient to achieve 1.78 fps on VGA size images [8] and 14.2 fps on preferably minuscule images of resolution 256x192 [9].Besides that, Cho et al. [10] aside from shown a FPGA-predicated face detection system with Haar classifiers utilizing buffers and distinctive frame grabbers to expedite the processing, which is capable of work with 6.55 fps for VGA image. Viola using KNN classifier algorithm show the accuracy of the projected face and emotion reorganization system is 94.5 to 97 % [5].A framework of occluded face detection based on Adaboost and Haar features enhances the detection rate at about 99%, which meets the desires for in ATM security applications [4].

A. *Haar Features*

The Haar features are the impuissant features predicated on the gray image. The features are used for image intensity expression of rectangular region adjoining some location in the image, and calculate the intensity difference. Haar-like features treated as digital image a feature that is used in object recognition. These features were used in the first time face detector. Viola and Jones [8] developed Haar-like features by adapting the idea of using Haar wavelets. The size of these rectangular features is not fixed, but the black and white square shape and size are always the same. The conception of Haar-like feature is to consider the nearby rectangular regions at a definite location in a detection window, sums up the pixel intensities in each region and compute the distinction between these sums. This difference is then utilized as a feature replication to categorize subsections of an image. Figure 1 *A.* shows three kinds of rectangle Haar features. The measure of a two-rectangle feature is the distinction between the sums of the pixels within two rectangular sections [15]. These rectangular sections have the similar size and shape and formed either horizontally or vertically adjacent. A three rectangle feature measures the sum within two outer rectangles subtracted from the sum in a center rectangle. Conclusively a four-rectangle feature measures the distinction between diagonal sets of rectangles [3].

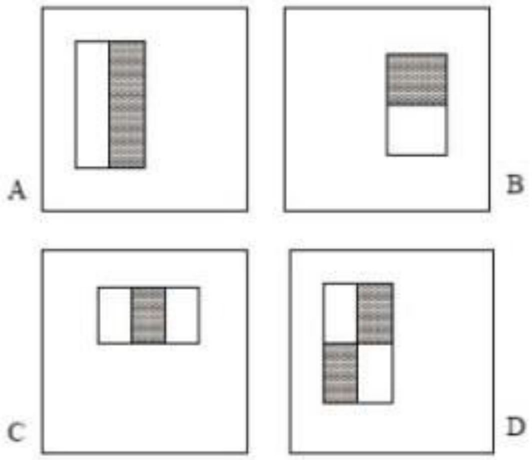

Figure 1: Haar like feature

All human faces contain specific related properties. These properties are used to build definite features called as Haar Features.

The related properties for a human face are:

- The eyes region is blacker than the upper-cheeks.
- The nose bridge region is brighter than the eyes.

Useful domain knowledge:

- Location - Size: eyes & nose bridge region
- Value: darker / brighter
- Rectangle features:

Computed result = Σ (pixels in black region) - Σ (pixels in white
region)

Figure 2: Extracting Haar feature from image

B. *Integral Image Representation*

In an integral image we can measure the value at pixel(x,y) is sum of pixels above and to the left of (x,y). Integral image is used to calculate sum of all pixels inside any given rectangle using only four values at the corners of the rectangle.

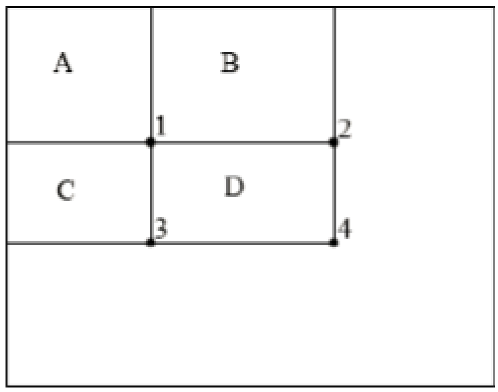

Figure 3: Integral Image Representation

The sum of the pixels for rectangle D can be computed as shown below. The value of the integral image

For location 1 is the sum of the pixels in rectangle A.

For location 2 is A+B

For location 3 is A+C

For location 4 is A+B+C+D.

The sum of values for D can be computed as 4+1-(2+3).

D=A+(A+B+C+D)-(A+B+A+C)

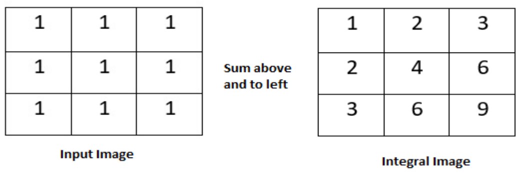

Figure 4: *image* with corresponding result of integral image

C. Adaboost for aggressive feature selection

As indicated that there can be nearly 16000+ feature values contained by a detector at 24x24 base resolution which need to be measured. But some features are relevant and irrelevant so we need to discard irrelevant features. Only relevant feature will be used to identify a face.

So we use Adaboost algorithm to find only the best features among all these 16000+ features. Then a weighted combination of all these features is used in identifying and deciding any given window has a face or not.

These features are also called as weak classifier. Adaboost constructs a strong classifier as a linear combination of these weak classifiers.

$$F(x)= \alpha_1 f1(x)+ \alpha_2 f2(x)+ \alpha_3 f3(x)+\ldots$$

Where f1(x), f2(x)…is a weak classifier and F(x) is strong classifier. The term α_1, α_2, α_3 is distributed weight over image [3].

An image should contain one or more faces; it is confirm that an extreme large amount of the assessed sub-windows would still be non-faces. So the algorithm should focus on discarding non-faces rapidly and expend more on time on possible face regions. Therefore a single strong classifier designed from linear combination of all best features.

D. Cascade Classifier

Viola-Jones algorithm works with cascaded classifiers. Cascade classifier performs operations in several stages each containing a strong classifier. The function of each stage is used to identify whether a sub window is face or not. A given sub window is instantly discarded as not a face if it fails in any of the stage [3].

If the input region fails to pass the threshold of a stage, the cascade classifier will immediately reject the region as a face. If a region passes all stages successfully, it will be classified as an applicant of face, which may be distinguished by further processing. So Cascade classifier performs operation in several stages to identify a face image and discarded irrelevant images.

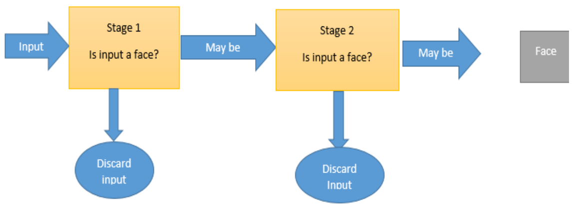

Figure 5: Cascade classifier process

III. METHODOLOGY

The fundamental quandary to be solved is to implement an algorithm for detection of faces in an image. This quandary can be facilely resolved by human beings. However it is very arduous for a machine to solve this task prosperously in facile manner. In order to make this arduous task more facile Viola Jones limits them to complete view frontal upright faces. That is, with the aim of detecting the whole face must point towards the camera and it should not be tilted in any side. **Conventional Viola Jones has several problems which are mentioned below:**

- In terms of speed and accuracy existing Viola Jones algorithm is quite slow.
- Existing Images does not work well with tilde images and distortion images.
- Viola Jones does not detect Black Faces.
- It does not work well with illuminating conditions.
- Feature Selection for calculating of Integral Image need to be optimized.
- Multiple detection of faces(Due to overlapping sub windows)

To solve these problems, we will implement an Automated Personalized Viola Detector.

IV. PROPOSED METHOD

In this proposed method an image consist of multiple or single face will be taken as input. In terms of speed and reliability for face detection from an image we will calculate ratio of sum of black rectangle and sum of white rectangle and with this I will utilize some better features except those which are utilized in precedent algorithm. These features are better in identifying ebony and skewed faces. They additionally work for tilde faces in some images.

To implement the haar cascade classifier, Open Source Computer Vision Library (OpenCv) [11] will be used. It is formerly presented by Paula voila and Michael jones [12]. Haar features are the important part of the haar cascade classifier for the face detection process. Haar features are used to identify the presence of feature in input image. Each features is calculated by subtracting the sum of pixels under white rectangle from the sum of pixels under black rectangle and produce a single value. The integral image approach is used to compute rectangle features.

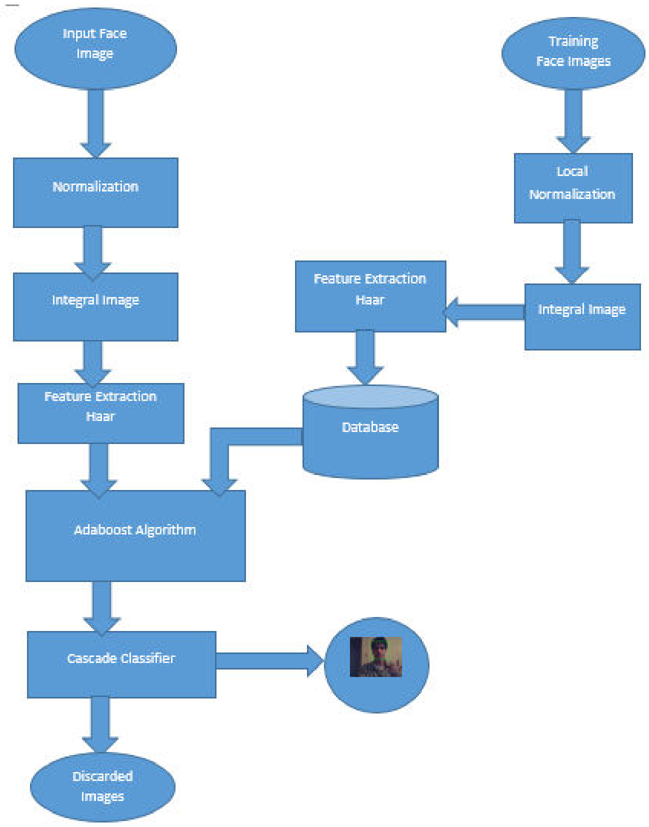

Figure 6: Automated Personalized Viola Process

V. CONCLUSION &FUTURE WORK

In this work, an incipient modified Viola Jones Algorithm has been proposed to detect black and distorted faces in an image which can work in any of the illuminating conditions. The face detection approach predicated on" Automated Personalized Viola" which uses incipient pixel predicated features which are different from subsisting Viola Jones predicated methods. Face database called as CMU typically contain grayscale images and it is not well for colorful algorithms. Databases such as FERET, grimace, face only have images with single face and it is more useful for face recognition and forms our classifier. Now we are searching for a database that contains colorful and complex images to run our program to implement Automated Personalized Viola Detector.

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