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Real Time Face Detection

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ABSTRACT

Face detection which is the task of localizing faces in an input image is a fundamental part of any face processing system. The aim of this paper is to present a review on various methods and algorithms used for face detection etc. Three Different algorithms i.e. Haar cascade, adaboost, template matching were described finally it includes some of applications of face detection.

In this paper, we represent a methodology for face detection robustly in real time environment. Here we use Haar like classifier and adaboost algorithm.

Keyword: adaboost, application. ,Face Detection, Face detection in computer vision area, features – haar like feature,

I. INTRODUCTION

Face detection is a computer technology that determines the locations and sizes of human faces in arbitrary (digital) images. It detects facial features and ignores anything else, such as buildings, trees and bodies. One of the unique features of our brain is that it can think only in images not in words. Face is the most important part of our body, so that it can reflect many emotions of a person. From a long year ago, we are using non-living thing (smart cards, plastic cards, PINS, tokens, keys) for authentication and to get grant access in restricted areas like ISRO, NASA, and DRDO etc. There are two types of biometric as physiological characteristics (face, fingerprint, finger geometry, hand geometry, palm, iris, ear and voice) and behavioral characteristics (gait, signature and keystroke dynamics).

The configuration will determine how the application should behave based on the desired security and operational consideration. The face detection methodology is shown in the Figure 1.

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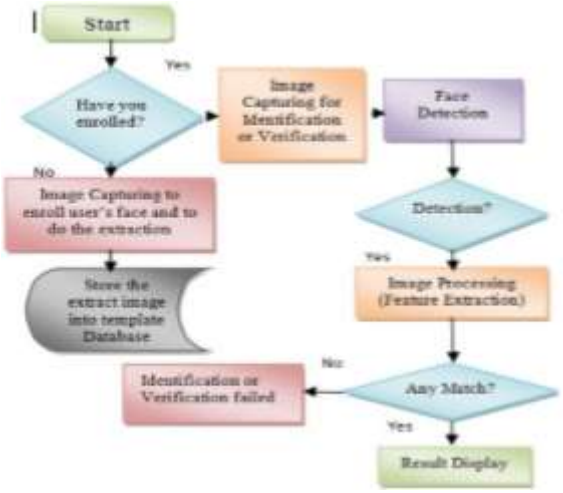

Figure 1. Flowchart of face detection system

II. FACE DETECTION IN COMPUTER VISION AREA:

2.1 Face Detection: Given an arbitrary image, the goal of face detection is to determine whether or not there are any faces in the image and if present, return the image location and extent of each image.

2.2 Face Localization: It aims to determine the image position of a single face; this is a simplified detection problem with the assumption that an input image contains only one face [2], [3]. As our main purpose of face detection is finding a search area for eye detection, we need a fast face detection method independent of the structural components of face such as beard, mustache. Human vision system can easily detect and recognize faces in images. The performance of the human vision system is so high that it can detect not only a single face but multiple faces in the same scene having different pose, facial expression, lightening conditions, scales, orientation etc. Also faces do not have to be complete that is; a partial view of a face is enough for humans to detect them in images.There are about 150 different techniques for face detection in images although they share some common methods through their ways. A detailed survey about various face detection methods is given in Yang's survey [1] and classified into four categories. Also in [4],

III. FEATURES:

3.1 Haar like feature for face detection: The simple features used are reminiscent of Haar basis functions which have been used by Papageorgiou et al. (1998). More specifically, we use three kinds of features. The value of a two-rectangle feature is the difference between the sum of the pixels within two rectangular regions. The regions have the same size and shape and are horizontally or vertically adjacent (see Fig. 2). A three-rectangle feature computes the sum within two outside rectangles subtracted from the sum in a center rectangle. Finally a four-rectangle featurecomputesthedifferencebetweendiagonalpairsof rectangles.The rectangular masks used for visual object detection are rectangles tessellated by black and white smaller rectangles. Those masks

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are designed in correlation to visual recognition tasks to be solved, and known as Haarlike wavelets. By convolution with a given image they produce Haar-like features.[5],[6].

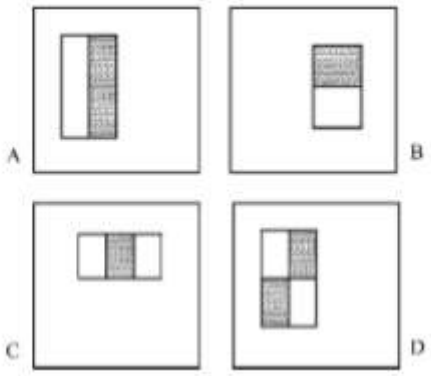

Figure 2. Example rectangle features shown relative to the enclosing detection window. The sum of the pixels which lie within the white rectangles are subtracted from the sum of pixels in the grey rectangles. Two-rectangle features are shown in (A) and (B). Figure (C) shows a three-rectangle feature, and (D) a four-rectangle feature

Haar like features are digital image feature used for object detection but here we used it for face detection. The biggest advantage of it over most other features is its calculation speed. Fig. 2 shows the types of Haar like feature. Generally eye region is darker than other region from the face.

Figure 3: HaarLike Feature for Face Detection

Figure 4 shows how Haar like feature is used for face detection purpose.

- Edge feature
- Line feature
- Center-surround feature

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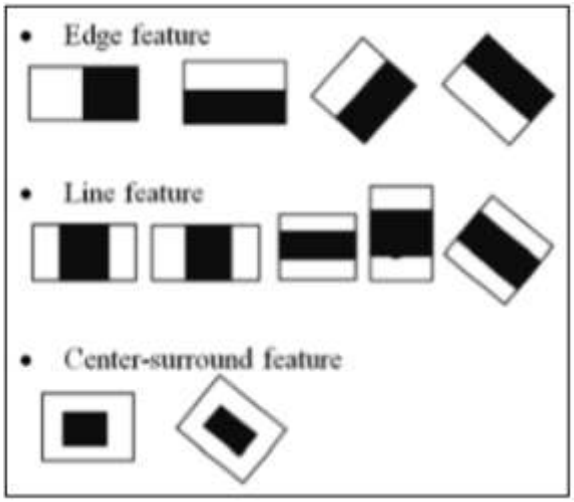

Figure 4: Types of HaarLike Features

3.1.1 Integral Image:

Rectangle features canbe compute dv eryrapidlyusinganintermediaterepresentationfortheimagewhich we call the integral image. The integral image at location x, y containsthesumofthepixelsaboveandtotheleft of x, y, inclusive:

$$ii(x, y) = \sum_{x' \le x, y' \le y} i(x', y'),$$

Where ii(x, y)isthe integral image and *i*(x, y) isthe originalimage(seeFig.5).

Using the following pair of recurrences:

$$s(x, y) = s(x, y-1) + i(x, y) \qquad (1)$$
$$ii(x, y) = ii(x-1, y) + s(x, y) \qquad (2)$$

(Where s(x, y)isthe cumulative row sum, s (x, −1) = 0, and *ii*(−1, y) = 0) the integral image can be computed in one pass over the original image.

Usingtheintegralimageanyrectangularsumcanbe computed in four array references (see Fig. 6). Clearly the difference between two rectangular sums can be computed in eight references. Since the two-rectangle features defined above involve adjacent rectangular sums they can be computed in six array references, eight in the case of the three-rectangle features, and nine for four-rectangle features.

One alternative motivation for the integral image comes from the "boxlets" work of Simard et al. (1999)

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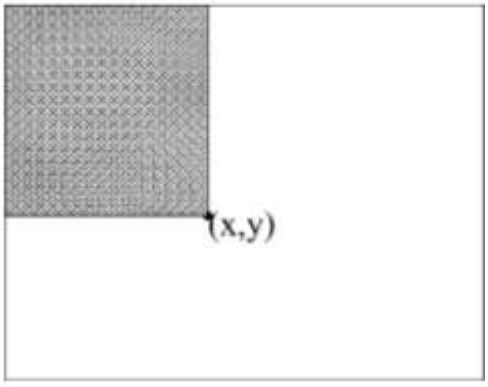

Figure 5. The value of the integral image at point (x, y) isthe sum of all the pixels above and to the left.

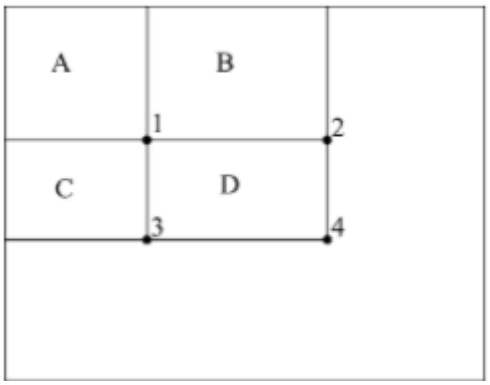

Figure 6. The sum of the pixels within rectangle *D* can be computed with four array references.The value of the integral image at location 1 is the sum of the pixels in rectangle A. The value at location 2 is A+B, at location 3 is A+C, and at location 4 is A+B+C +D. The sum within D can be computed as 4+1−(2+3).

3.2 Adaboost:

- Adaboost was invented by Freund and Schapire in 1997.

  Y. Freund and R. E. Schapire. A decision-theoretic generalization of on-line learning and an application to boosting. Journal of Computer and System Sciences, 55(1):119–139, 1997.
- They won the Gödel prize for this contribution in 2003.
- Adaboost was applied to face detection (with some modifications) by Viola and Jones in 2001.

  P. Viola and M. Jones. Robust real-time object detection. International Journal of Computer Vision, 57(2):137–154, 2004.

Adaboost is an algorithm for constructing a"strong" classifier as linear combination. Adaboost, short for Adaptive Boosting, is a machine learning algorithm, formulated by Yoav Freund and Robert Schapire[7]. It is a meta-algorithm, and can be used in conjunction with many other learning algorithms to improve their performance.

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IV. RELATED WORKS

Real-time face detection place a vital role in many of the application scenarios like access control, surveillance scenarios, gaming, human-computer interaction, etc. Viola and Jones devised an algorithm, called Haar Classifiers, to rapidly detect any object, including human faces, using Haar classifier cascades that are based on Haar –Like features. Haar-like features and not pixels. Different types of methods are available for detecting the face and recognition: Principal Component Analysis (PCA), Linear Discriminate Analysis (LDA), Support Vector Machines (SVM) Independent Component Analysis (ICA), Local Binary Pattern (LBP), and more recently Sparse Representation (SR) based methods. A recent survey on face recognition algorithms can be found in. Different algorithm are existing for performing and analysis of face detection with each of its own weakness and strengths related to use of flesh tones, some use contours, and other are even more complex involving templates, neural networks, or filters few of these algorithm are computationally expensive. There has been little work in the literature during the last years about real-time face detection at HDTV resolutions. Face detectionalgorithm using Haar-like features was described by Viola and Jones [8] and now it and a range of its modifications are widely spread in many applications. One of these modifications [9] was implemented in OpenCV library [10]. The OpenCV implementation compiled with OpenMP option provides only 4.5 frames per second on 4-core CPU. It's too slow to process HD stream in real time. As a solution to this problem a parallel modification of OpenCV algorithm for GPU has been developed.

Some parallel versions of face detection algorithm using Haar-like features [11, 12, 13]. The algorithm introduced by Hefenbrock [10] was the first realization of a face detection algorithm using GPU we could find.

V. EXPERIMENTAL RESULTS:

Figure 5. Face detection system

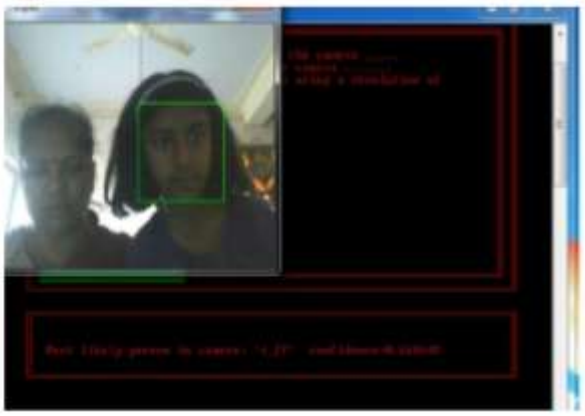

Figure 6: Performance criteria: Confidence

VI. APPLICATION

Face detection is used in biometrics, often as a part of (or together with) a facial recognition system. It is also used in video surveillance, human computer interface and image database management. Some recent digital cameras use face detection for autofocus. Face detection is also useful for selecting regions of interest in photo slideshows that use a pan-and-scale Ken Burns effect [14]

REFERENCES

[1] A.-A. Bhuiyan and C. H. Liu. On face recognition using gabor filters. In Proceedings of World Academy of Science, Engineering and Technology, volume 22, pages 51–56, 2007.

[2] BIOID. Bioid face database. http://www.bioid.com/support/download s/software/bioid-facedatabase.html.

[3] V. Blanz and T. Vetter. A morphable model for the synthesis of 3d faces. In Proc. of the SIGGRAPH'99, pages 187–194, Los Angeles,USA, August 1999.

[4] D. Bhattacharjee, D. K. Basu, M. Nasipuri, and M. Kundu. Human face recognition using fuzzy multilayer perceptron. Soft Computing – A Fusion of Foundations, Methodologies and Applications, 14(6):559–570,April 2009.

[5] Lae-Kyoung Lee, Su-Yong An , Se-Young Oh, Aug 2011. "Efficient. Face Detection and Tracking with extended camshift and haar-like features". International Conference on Mechatronics and Automation (ICMA), 2011. Pohang, South Korea, pp. 507-513.

[6] Duan-Sheng Chen ,Zheng-Kai Liu, Aug 2011. "Generalized Haar-like features for Fast Face Detection". Conference on Machine Learning and Cybernetics, 2007. Hong Kong, pp. 2131-2135.

[7] Pu Han Jian-Ming Liao,"Facedeection based on adaboost" Apperceiving Computing and Intelligence Analysis, 2009. ICACIA 2009. International Conference on, 23-25 Oct. 2009,pp. 337 – 340.

[8] Open Computer Vision Library [Electronic resource], 2012, Mode of access: http://sourceforge.net/projects/opencvlibrary. – Date of access: 25.06.2012.

[9] J .Owens, "GPU architecture overview," International Conference on Computer

[10] Graphics and Interactive Techniques (SIGRAPH'07), 2007.

[11] Whitepaper NVIDIA's Next Generation CUDA Compute Architecture: Kepler GK110 [Electronic resource], NVIDIA, 2012, http://www.nvidia.com/content/PDF/kepler/NVIDIA-Kepler - GK110-Architecture-Whitepaper.pdf.

[12] Daniel Hefenbrock, "Accelerating Viola-Jones face detection to FPGA-level using GPUs," Proceedings of the 2010 18th IEEE Annual International Symposium on Field-Programmable Custom Computing Machines, 2010, pp.11-18.

[13] Anton Obukhov, "Haar Classifiers for Object Detection with CUDA", GPU Computing Gems. Emerald Edition, 2011, pp.517-544.

[14] H Drewes, "Eye Gaze Tracking for Human Computer Interaction", A Dissertation submitted in the partial fulfilment of the Ph. D. Degree, 2010. www.ndltd.org