ISSN (Print) : 2320 – 3765
ISSN (Online): 2278 – 8875

International Journal of Advanced Research in Electrical, Electronics and Instrumentation Engineering

(An ISO 3297: 2007 Certified Organization)

Website: www.ijareeie.com

Vol. 6, Issue 6, June 2017

A Review of Various Face Detection Systems

Dr.Vipulsangram.K.Kadam [1], Deepali G. Ganakwar [2]

Professor, Department of Electronics Engineering, P.E.S. College of engineering, Nagsenvana Aurangabad, Maharashtra, India[1]

PhD Student, Department of Engineering and technology, Dr. Babasaheb Ambedkar Marathwada University Aurangabad, Maharashtra, India[2]

ABSTRACT: Face detection is one of the most studied topics in computer vision literature, not only because of the challenging nature of face as an object, but also due to the countless applications that require the application of face detection as a first step. The goal of this paper is to present a critical survey of existing literatures on human face detection systems. Face detection is a difficult task in image analysis which has each day more and more applications. We can define the face detection problem as a computer vision task which consists in detecting one or several human faces in an image. It is one of the first and the most important steps of Face analysis. In this paper we presented three methods of face detection, which are commonly used. As the number of proposed techniques increases, survey and evaluation becomes important.

KEYWORDS*:* Face detection, integral image, adaboost algorithm, artificial neural networks

I. INTRODUCTION

Face detection is becoming an active research area spanning several disciplines Such as image processing, pattern recognition, computer vision, neural networks, Cognitive science, neuroscience, psychology and physiology. It is a dedicated process, not merely an application of the general object recognition process. It is also the representation of the most splendid capacities of human vision.

Automatic face detection is the cornerstone of all applications revolving around automatic facial image analysis including face recognition and verification, face tracking for surveillance, facial behaviour analysis, facial attribute recognition, gender/age recognition [11] etc.

The goal of face detection is to determine whether or not there are any faces in the image and if the image is present then it return the image location and extent of each face. While this appears as a trivial task for human beings, it is an extremely tough task for computers, and has been one of the top studied research topics in the past few decades.

In this paper we provide a critical review of three methods used in face Detection

II. FACE DETECTION

It is basically an image segmentation problem as the image is to be segmented into two parts: one containing faces and the other representing non-face regions. Face detection takes images/video sequences as input and locates face areas within these images. This is done by separating face areas from non-face background regions. Facial feature extraction locates important feature (eyes, mouth, nose and eye-brows) positions within a detected face.

In General face detection system input image is passed to the system for pre-processing. Image may vary in format, size and resolution and can include frames of video. In the next step pre-processing is done, which normalized the image and also remove noise. The classifier decides face and non-face class based on information learned from during training. Finally, the output locates face region.

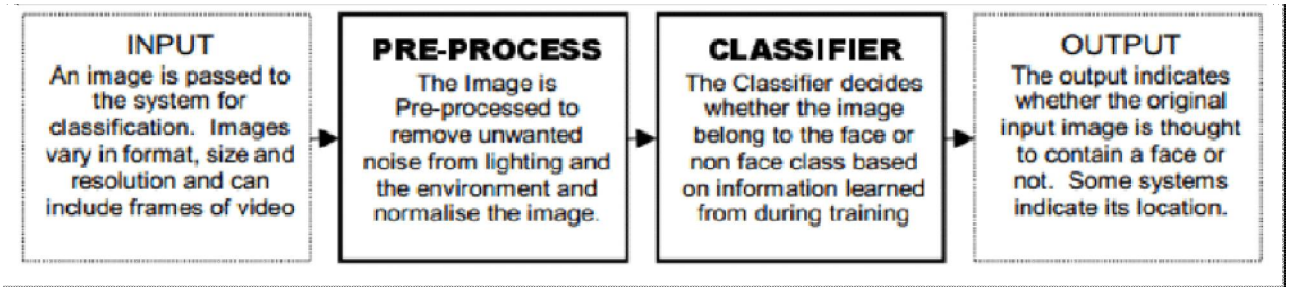
ISSN (Print) : 2320 – 3765
ISSN (Online): 2278 – 8875

International Journal of Advanced Research in Electrical, Electronics and Instrumentation Engineering

(An ISO 3297: 2007 Certified Organization)

Website: www.ijareeie.com

Vol. 6, Issue 6, June 2017



. Fig.1. General face detection system

III. METHODS OF FACE DETECTION

A) Shape based Face detection Method:

In this method, a special template containing directional information of edges [4] is used along with previously used shape based face detection method [5][6][8]. Extensive experiments show this is very efficient when processing images with a simple background regardless of variations on size, head pose (moderate head rotation) and lighting condition The basic flowchart of proposed system is given in Figure2

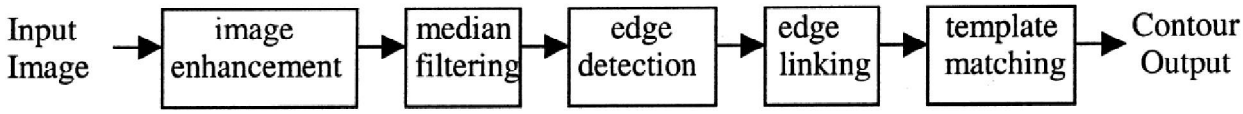


Fig.2.Basic flowchart of the algorithm [4]

1. Image enhancement: In this system histogram equalization is used to improve the contrast of the original image because input images may be of very poor contrast because of the limitation of lighting conditions.

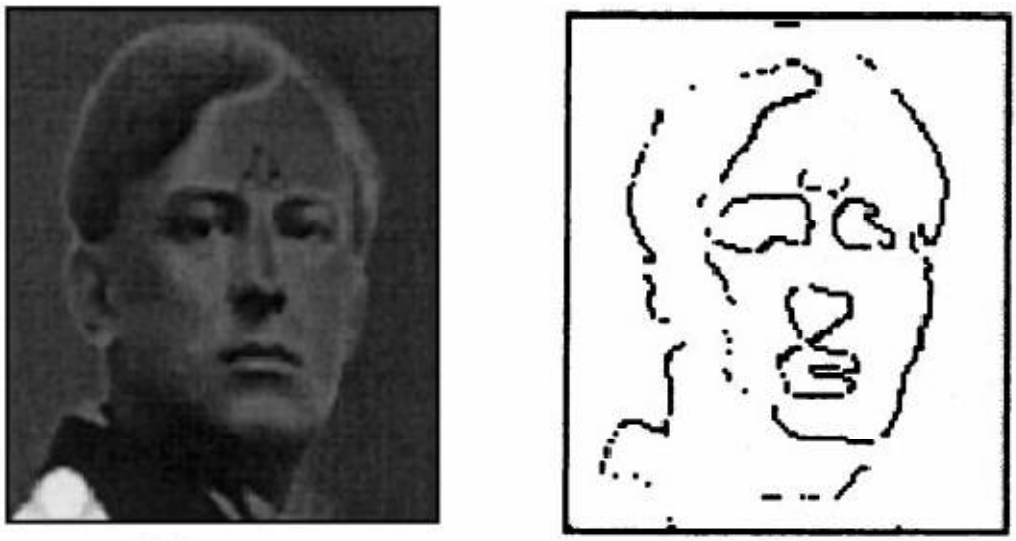


Fig.3.Effectiveness of histogram equalization

2. Median filtering: median filter is used to remove noise.
3. Edge detection: Considering computational cost and performance, zero-crossing detector is used [7].
4. Edge linking: In this step edges linking is carried out to improve the information of the face contour. Noise is also reduced.

ISSN (Print) : 2320 – 3765
ISSN (Online): 2278 – 8875

International Journal of Advanced Research in Electrical, Electronics and Instrumentation Engineering

(An ISO 3297: 2007 Certified Organization)

Website: www.ijareeie.com

Vol. 6, Issue 6, June 2017

5. Template matching: The various methods have not sufficiently used the global information of face images in which edge direction is a crucial part, so JianguoWang,Tieniu Tan present a deformable template based on the edge information to match the face contour [4].

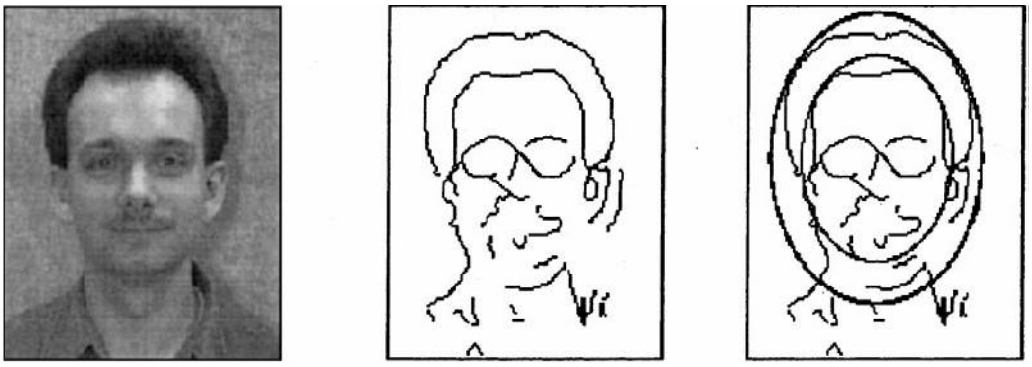


Fig.4.Deformable template

1. Advantages:
   - The algorithm is able to correctly detect all faces in the images with Simple and complex backgrounds
   - More robust to noise and shape variations.

2. Disadvantages:
   - For multiple face detection the number of faces should be known before.
   - The detection faces do not overlap each other in images
   - Templates used in this method does not include enough information to distinguish faces in very complex backgrounds this is why the false rate is high in test set with complex backgrounds.
   - It cannot accurately locate faces with large rotation angles

Fig.5.Face detection output of images with complex background [2]

B) Viola Jones Face Detection system

The Viola–Jones object detection framework [3] is an object detection framework which provide robust and competitive object detection rates in real-time proposed in 2001 by Paul Viola and Michael Jones. Even though it can be trained to detect a variety of object classes, it was motivated mainly by the task of face detection. This face detection framework is capable of processing images extremely rapidly and achieving high detection rates. There are three main stages of face detection framework.

ISSN (Print) : 2320 – 3765
ISSN (Online): 2278 – 8875

International Journal of Advanced Research in Electrical, Electronics and Instrumentation Engineering

(An ISO 3297: 2007 Certified Organization)

Website: www.ijareeie.com

Vol. 6, Issue 6, June 2017

1. Integral Image: It is a new representation of an image [3], which allows the features used by detector to be computed very rapidly. Once integral image is computed, Harr-like features can be computed at any scale or location in constant time. The integral image at location (x,y) is the sum of the pixels above and to the left of (x,y), inclusive[1].

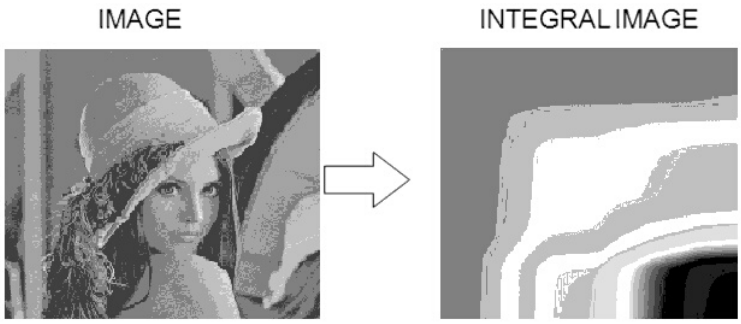


Fig.6.conversion of image into an integral image

2) Adaboost Algorithm: In this stage classifiers are constructed by selecting a small number of important features (rectangle features) using Adaboost algorithm. From vast number of features computed in stage 1 we are interested in only selected few features that would enable us to detect face with great accuracy. For this, we use Adaboost Algorithm [9] to select principal features and to train classifiers that would be using them. Aim of this algorithm is to create strong classifier from linear combination of weak classifier.AdaBoost provides an effective learning algorithm

3) Cascading: The third major stage of this method is a combining successively more complex classifiers in a cascade structure [10] which dramatically increases the speed of the detector by focusing attention on promising face like regions of the image. This cascade structure consists of classifiers. It works in a manner that initial classifiers are simpler and they are used to reject majority of sub-windows and at end complex classifiers are used to achieve low false positive rates.

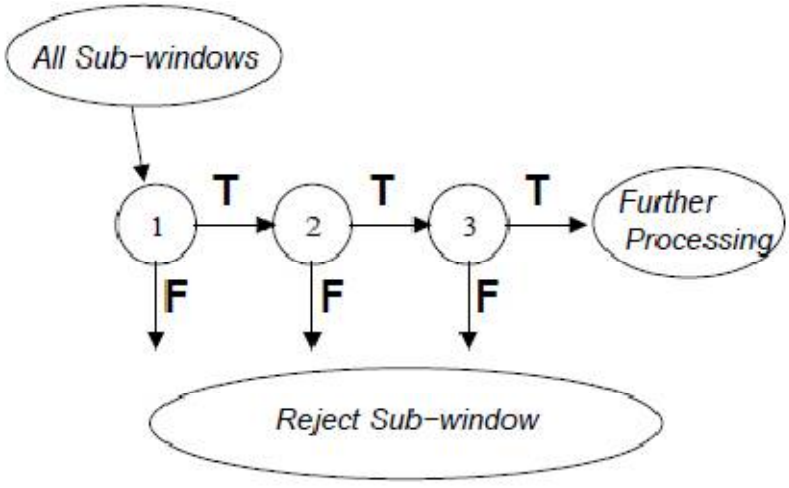


Fig.7.Cascading

1. Advantages:
   - Rapid image processing with high detection rates.
   - High accuracy
   - Very low false positive rate
   - This method also can be used to detect other objects.

ISSN (Print) : 2320 – 3765
ISSN (Online): 2278 – 8875

International Journal of Advanced Research in Electrical, Electronics and Instrumentation Engineering

(An ISO 3297: 2007 Certified Organization)

Website: www.ijareeie.com

Vol. 6, Issue 6, June 2017

2. Disadvantages:
   - Less effective on non-frontal face
   - Very long training time

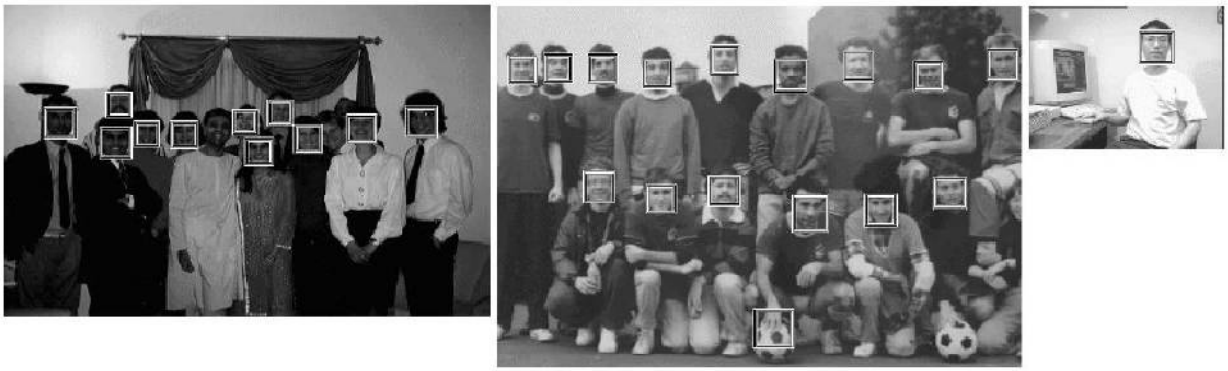


Fig.8.Output of Viola Jones face detector system [3]

C) Face Detection system based on retinal connected neural network (RCNN)

In the recent years, different architectures and models of ANN were used for face detection. Rowley, Baluja and Kanade [2] presented face detection system based on a retinal connected neural network (RCNN) that examine small windows of an image to decide whether each window contains a face. Figure shows this approach

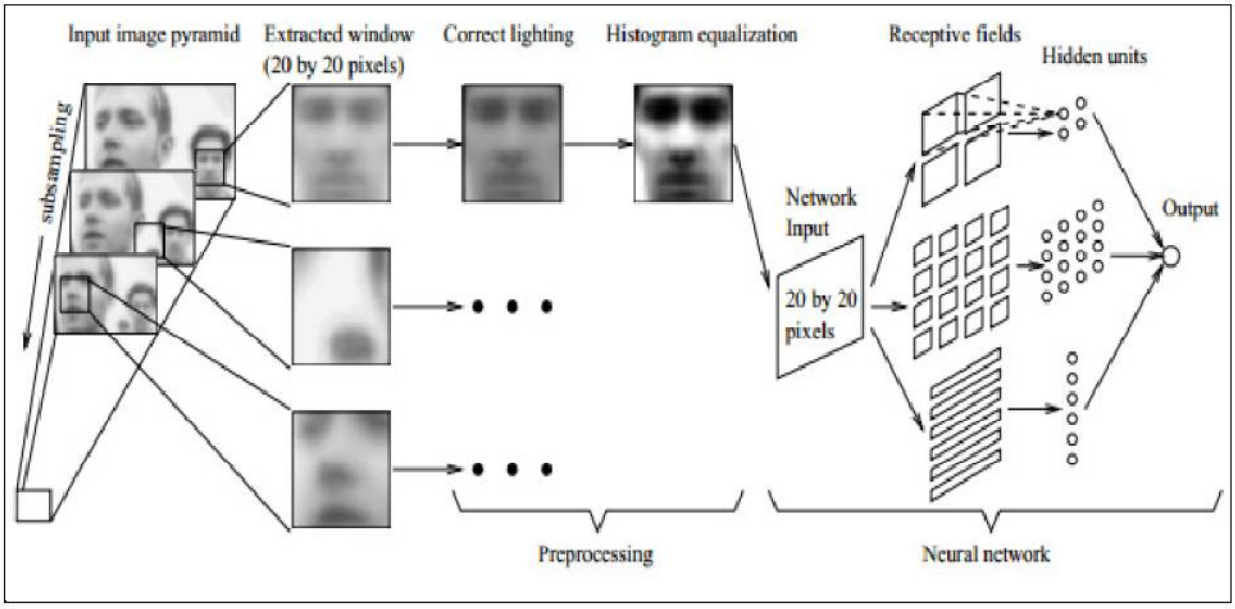


Fig.9.RCNN for face detection

This system operates following steps:
1. It first applies a set of neural network-based filters to an image.
2. It uses an arbitrator to combine the outputs.
3. The filters examine each location in the image at several scales, looking for locations that might contain a face.
4. The arbitrator then merges detections from individual filters and eliminates overlapping detections.

ISSN (Print) : 2320 – 3765
ISSN (Online): 2278 – 8875

International Journal of Advanced Research in Electrical, Electronics and Instrumentation Engineering

(An ISO 3297: 2007 Certified Organization)

Website: www.ijareeie.com

Vol. 6, Issue 6, June 2017

1. Advantages:
   - This method produces good detection rates (77.9% and 90.3%) with an acceptable number of false positives.
   - Depending on the application, the system can be made more or less conservative by varying the arbitration heuristics or thresholds used
   - We have also applied the same algorithm for the detection of car tires and human eyes,
2. Disadvantages:
   - it only detects upright faces looking at the camera
   - The methodology is complex.

Fig.10.Output of RCNN system [2]

ISSN (Print) : 2320 – 3765
ISSN (Online): 2278 – 8875

International Journal of Advanced Research in Electrical, Electronics and Instrumentation Engineering

(An ISO 3297: 2007 Certified Organization)

Website: www.ijareeie.com

Vol. 6, Issue 6, June 2017

IV. CONCLUSION

On referring various methods we come to understand the challenges faced in Face Detection. From this Literature Survey we have conclude that, it is very important to remove background information. Removing irrelevant information, such as noise, non-face part and background would make face detection less complicated.
We also conclude that following things make face detection more complicated.

1. Different Facial poses
2. Complex background
3. Varied facial expression
4. Overlapping Faces

Viola jones presented an approach for face detection which minimizes computation time while achieving high detection accuracy. The Haar like features used in this method are very simple and effective for frontal face detection, but they are less ideal for faces at random poses.
RCNN method gives good result with an acceptable number of false detections rate. Depending on the application, the system can be made more or less conservative by varying the arbitration heuristics or thresholds used.
Shape based Face detection system gives the effectiveness of used algorithm in the images with simple or complex background. The algorithm is able to correctly detect all faces in the images with simple backgrounds. Compared with other similar algorithms, this algorithm appears to be more robust to noise and shape variations.

REFERENCES

[1] Binesh T.R and P. Simon, Fast Pedestrian Detection using smart ROI separation and Integeral image based Feature Extraction, IJCSE, Volume-3, No.-11, 2012
[2] H.A. Rowley, S. Baluja, and T. Kanade, ―Neural Networks Based Face Detection,‖ IEEE Trans. Pattern Analysis an Machine Intelligence, vol. 20, no. 1, pp. 22-38, Jan. 1998.
[3] P. Viola and M. Jones, ―Rapid object detection using a boosted cascade of simple features‖. In Proc. of CVPR, 2001.
[4] JianguoWang ,Tieniu Tan-A new face detection method based on shape information, Pattern Recognition Letters 21 (2000) 463-471
[5] Saber, E., Tekalp, A.M., 1996. Face detection and facial feature extraction using color, shape and symmetry-based cost functions. In: Proceedings of the ICPR, Vol. 3, pp. 654-658.
[6] Sobottka, K., Pitas, I., 1996. Extraction of facial regions and features using color and shape information. In: Proceedings of the ICPR, Vol. 3, pp. 421-425.
[7] Ma, S., Zhang, Z. Computer Vision, Chinese Scientific Press.1997
[8] Govindaraju, V., 1996. Locating human faces in photographs, International journal in Computer Vision 19 (2), 129-146.
[9] R. E. Schapire, Y. Freund, P. Bartlett, and W. S. Lee. Boosting the margin: a new explanation for the effectiveness of voting methods. *Ann. Stat.*, 26(5):1651–1686, 1998.
[10] Y. Amit, D. Geman, and K. Wilder. Joint induction of shape features and tree classifiers, 1997.
[11] M.H. Yang, D. J. Kriegman, N. Ahuja, Detecting faces in images: A survey, IEEE Trans. on PAMI 24 (1) (2002) 34–58