Efficient Real Time Attendance System Based on Face Detection Case Study "MEDIU Staff"

HUDA.H.Mady [1], Shadi M.S. Hilles[2],

[1] *Computer Science department,* Faculty of Computer and Information Technology, Al-Madinah International University
alnors_oho@yahoo.com, shadihilless@gmail.com

Received 1 May 2017; accepted 15 July 2017

Abstract

Recently, using biometrics applications for person's authentication has received more attention by computer vision researchers. Biometrics applications play an important role in reliable person authentication for recording the attendance of employees in the large organizations. Face detection is considered as an optimal solution for enrolment attendance among all biometrics applications such as Fingerprint. The main objective of this paper is to instigate a develop attendance system automatically in Al-Madinah International University (MEDIU) and achieve higher both accuracy and performance. To develop system of face detector under challenging of face the proposed system accuracy using real life videos by establishing Data Base for MIDIO staff. This paper suggests a combination detector based of voila Jones which deals with challenges in real time of video. In the conducted study the system was capable of determine one face or more in real time extremely rapidly while achieving high detection rates with accurate and effective performance. The detection results of 100 frame per video from the data base was satisfying, with the highest result was 96% and the lowest one was 63%.

Keywords: (face detection, voila Jones, challenging of face, MEDUE, Video Database)

1. INTRODUCTION

Biometrics-based techniques have emerged as a promising approach in recent years to identify and verify individuals because of manual labour in traditional conservation and management. The attendance sheets are boring because they consume a lot of time for the lecturer. Recognition techniques are existent, such as fingerprint and iris Recognition. These techniques are intrusive, and their success depends highly on user cooperation because users must position their eyes in front of an iris scanner or put their fingers in a fingerprint device.[1]

Enrolment real time automated attendance due to Human face determination and recognition by face detection and recognition algorithm is a vital research area in the computer vision community which are non-intrusive, inexpensive technique, can be captured at a distance and in a covert manner[2]. However, localizing and recognizing face are challenging in facial appearance because of the significant variations in intrinsic factors, e.g. facial expressions, variations in Illumination, scale, poses, occlusion, complex background, and different. Human race; [3] .Various efforts have been exerted in computer and vision and pattern recognition, but the reliability significantly affects performance. Nowadays, Human face determination is a vital research area in the computer vision community. It can be widely used for video indexing, human computer interaction, surveillances, and robotics. There are several related difficulties in human face perception.

The face detection and recognition process represents a number of advantages compared to different other biometric technologies e.g. the fingerprint or iris as it has become as a natural process and nonintrusive. Along with that, this process can be done from a distance and in a disturbed environment. It usually involves the following three steps: first step is detection and pre-processing of a face in a complex background, and localization of its exact position. Second: extraction of facial features, such as eyes and nose, followed by normalization to align the face with stored face images. Thread: face classification or matching.

Localization and detection of faces' identity are challenging demands due to facial appearances variations considering fundamental factors, such as facial expressions, and makeup. External factors include form changes, lighting conditions, and partial blockage. These factors cause difficulties in developing a good model face. Significant efforts were exerted in the field of computer vision and pattern Recognition, but the results were good only in constrained settings and challenges emerged [4]. A combination of simple to complex classifiers based on cascade detector was proposed to overcome this problem [5].

2. RELATED STUDIES

Recently, face detection has attracted significant attention and its researches have rapidly developed by computer engineers, since this field has many possible applications in computer vision communication and automatic access control system. Face detection is a vital part of face recognition as it is the first step of automatic face recognition. However, face detection in attendance system videos is not a simple step due to presence of many facial appearance variations, such as occlusion, pose variation (front, non-front), illuminating condition, image orientation and facial expression.[6]

K.-K. Sung and T. Poggio [7] Obtained an example-based learning method for detecting of human faces vertical frontal views in complex image background, in which contain a face and non-face distributed through it. The classifier has been trained to detect the non-face and distance metric in the image, in different features vector measurements to ensure the success of the proposed system.

P. Viola and M. J. Jones [5] Described a framework for face detection, which can process images at a high speed while achieving high detection rates. Three main contributions are presented in the current study. The first contribution is an introduction that represents a new image called 'integral image 'which is computed quickly. The second one is a simple and effective classifier that is built using the AdaBoost learning algorithm to identify a few critical visual features from a large set of potential features. The third contribution is an approach to combine classified features in a 'cascade; which allows the deposition of the background regions of an image quickly. This method allows the face detection system to be approximately 15 times faster than previous approaches.

The Viola Jones algorithm has four stages: Haar Feature Selection, Creating an Integral Image, Adaboost Training and Cascading Classifiers. [8]. In a face detection stage, must use a delicate numerical descriptive such that it sets of human face apart from other objects in a given image, this algorithm called Adobos. A conclusive element of the Viola Jones algorithm is a technique to compute a rectangle features very speedily. This technique uses an intermediate representation of the image, that so called an integral image. The cascade object detector uses the Viola& Jones algorithm to detect people's faces, noses, eyes, mouth, or upper body. Nevertheless, the Training Image samples can be used to train a custom classifier to be used within this System. More importantly, the classifications of cascade which is considered as a specified model and a character vector that sets the classifications for the detector, [8]. The cascade classifications model which is considered as the main nine designed classifications. Cascade Classifications Model such as Frontal Face (CART), Frontal Face (LBP), Upper Body, Eye Pair, Single Eye, Single (CART), Profile Face, Mouth, Nose.

There are different researched that found a number of solutions recently with a wide and sophisticated techniques to detect faces. Starting from the simple edge-based algorithms to complex level as the composite high-level. The use of algorithms has presented a classified features for the process of face detection and manage a great number of challenges and uncertainties in the process. And due to the lack of standardized experimental work there is no a comprehensive or comparative assessment or evaluation. As the comparisons can be only made when data is provided. [3]. Face detection challenges from Image or videos are still not overcome yet. Difficulties range from dealing with intense real time different face appearance to handle variations factors. Various approaches are utilized to detect faces, such as Artificial Neural network ANN based on back-propagation and self-organizing feature map SOFM as presented [21, 22] which used vector quantization for image compression, SVM, and boosting. The vast majority of processed patterns do not include faces; thus, single of classifier-based systems, such as PNN [9] and SVM [10, 11].

Thus the main problem in face detection Algorithm is the classification between non-face and face, which has the following two characteristics: the number of face is much lesser than that of non-face and the distribution of non-face pattern is very prevailing, so it's difficult to classify non-face and face by one method the companion between two method or more affective performance; furthermore the computing capacity is high and large demand for real time is required[12].

This research used Viola and Jones algorithm based of Group of classification model, which are trained using boosting to detect a specific type of object the profile face used and frontal face CART classifiers to detect faces from query images. These tow classifiers are trained by extracting features from a set of defined image based on Haar-Like feature extractor. These cascade detectors are trained to identify the faces and reject non-face [13]

Y. Muttu [14] Suggested Viola Jones algorithm was applied for face detection and modified the LBP algorithm to increase algorithm performance (reduce the time) in the feature extraction stage. Viola Jones algorithm was applied for face detection. Radical basis function NN presented better classification accuracy than back propagation. However, further work is needed to improve the accuracy of facial expression Recognition.

H. Yang and X. A. Wang [12] Implemented Face Recognition system based on viola and Jones face detection method, histograms of oriented gradients (HOG) to feature extraction and support vector machine (SVM) as applied as classifier. This paper designed multi stage cascade to detected face, the result showed better performance with CMU/MIT database that was 94% of detection rate. This paper applied support vector machine (SO-SVM) which is trained off line to detect specific faces to break the self-learning loop typical in tracking. In this experimented Deformable Part Model DPM landmark detector was used to evaluate the accuracy of the face detection output. This system has achieved great tracking execution with different scenarios on an online video.[15]. This system has achieved great tracking execution with different scenarios on an online video.

B. Du, S. Shan, L. Qing, and W. Gao [16] studied histogram equalization (HE), histogram specification (HS), logarithm transforms (Log), and Gamma intensity correction (GIC), and self-quotient image (SQI) were compared and analysed. These methods were evaluated on three different database which are CAS-PEAL, FERET and CMUPIE database. The results depicted that the three methods: HS, HE and GIC improved authentication performance with

different degree of illuminations variations. On the other hand, it was found that Log and SQI might reduce the authentication rate for facial images without much illumination variations.

Contrast Enhancement In the process of the contrast enhancement the techniques do expands the real range of the brightness of values in the image itself. The image can effectively work in a manner that needed for the analysis to be made. However, the values of density in the scene have to be pulled for the farther apart in the expanding for a better and higher range of process. The effect to do that will increase the contrast visually between the two different areas in the densities, and that will empower the analysis to differentiate between these areas initially and having a better difference of density [17].

The histogram equalization methods used for gray-scale transform defined to be as a known method for the image processing in order to contrast adjustment using the method of the histogram. Consequently, often used as the illumination pre-processing. This method is significantly affecting the process of making the needed and useful image for the background and for the foreground even though both are dark or light. The main advantage of this method is that it works directly and fairly on the technique and use the invertible operator. Therefore, the histogram works on Equalization Function is very well known as it is easily can be managed to recover and the calculation effect is not to be computationally intensive in the process function.(B. Du, [16], [18].

[1] Proposed attendance system for the student to improve the method of the educational system. Facial detection is performed by the Jones Viola algorithm to detect and manage objects under environments, which are uncontrolled and controlled. The result in proposed attendance system showed 100% accurate under controlled environment, By contrast, the effect under uncontrolled environment is quite low 60 %. This approach can be effective in automatically recording student attendances in actual

It is clear that, a significant progress in the Automated Attendance Management System in real-time is one of the most challenges associated with person's detection, this area many novel methods of face detection and modeling systems have been proposed to resolve each variation listed above However, accurate and robust face detection still offers a number of challenges which are variations in illumination, scale, Occlusion, facial expression, pose problems .Thus, methodologies need to be deeply studied in order to overcome the face recognition problems with considering accuracy and performance balancing.[19] [8][11].

3. RESEARCH METHODOLOGY

This paper presents progress toward an integrated, robust, real-time face detection and system. Faces are detected and extracted using the fast algorithm recently proposed by [20]. Therefore, combining two detectors based of Viola and Jones are presented combines estimates from many facial detections in order to reduce error rate. Effective and robust design face detection system must be able to handle face challenges like cluttered scenes, face size mutation, face modification, location, orientation, diversity in illuminations, facial expressions, pose, occlusion, different backgrounds and variations among different, occlusion, different backgrounds and variations among different nationalities and races. In this chapter the suitable algorithms have been used to evolve and expand the face Recognition system for the achievement of better accuracy with more advance performance. For this the created MEDUE Staff Database (MEDUE-S-V-DB) has been creation and used as a case study. Proposed Flowchart of MEDUE-S-V-DB creation showed in figure (1).

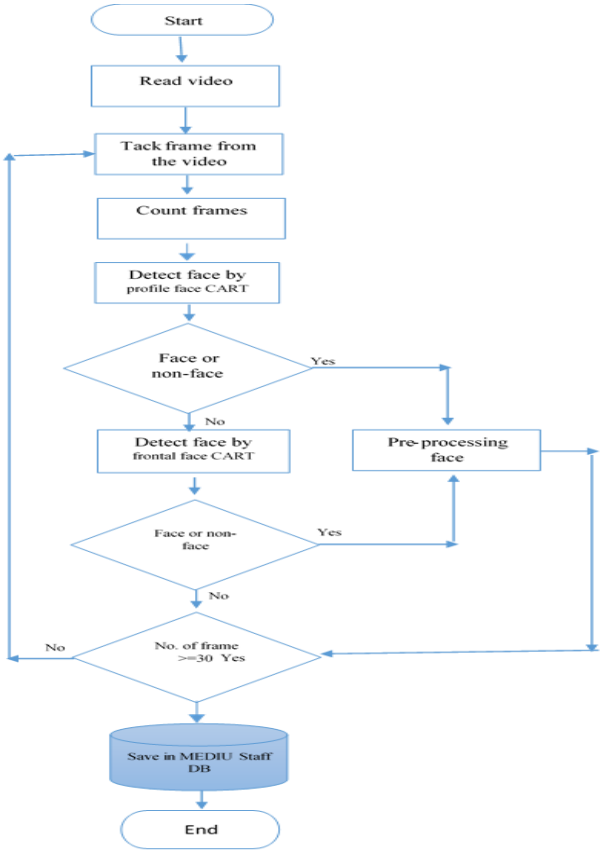

Fig. 1.flowchart of MEDUE-S-V-DB creation

Create MEDUE-S-V-DB:

MEDUE-S-V-DB has been for the administrations of experiments in face Recognition and detection system under real time and in order to study the effect of different factors to execute definiteness and performance. MEDUE-S-V-DB was designed under continuous motion effects, and variations in term of pose, illumination conditions, facial expressions, orientation and occlusion. As a matter of consideration during this study the nationality variation of the staff were taken. MEDUE-S-V-DB contains 20 videos

for 10 peopl.Two videos were recorded for each person. In idition,one video was created included three person . Figure 2. Is showed bellow the flowchart of MEDUE-S-V-DB creation.

Fig. 2. MEDUE-S-V-DB

Video Acquisition (for training and testing):

The training videos contain the various faces with different poses (B), illuminations (C), facial expressions (D), orientations (A) and occlusions (C). Then for the current study, the nationality variation of staff (E) was taken into the consideration to train classification algorithm. The testing videos were testing videos frames that contained one face or more, which were compared to a database to find the most suitable match. The training video is divided into 100 frames which offer the services of cropping and resizing of the faces for training the classifier to match faces of the unknown person. The figure (3) below shows the alteration among the faces of MEDIU-S-DB. Testing videos is divided into 30 frames; these frames are selected every 1 second, to evaluate the system efficiency for identify the people. Figure (3) is showed Variation Faces from MEDIU-S-DB. Testing videos is divided into 30 frames; these frames are selected every 1 second, to evaluate the system efficiency for identify the people.

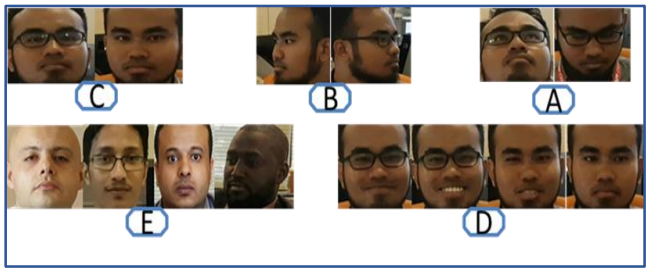

Figure 3. Variation Faces from MEDIU-S-DB

Face Detection by Viola-Jones Algorithm:

Face detection is an advance technology that determines the position and variance of the sizes among human faces in digital images or video frames. In this research the cascade detector uses the Viola-Jones algorithm to detect faces and a trained classification model for detection was proposed. Frontal CART and Profile face classifiers was used,.

Viola Jones Algorithms is applied for fast and easy face detection in real time. Cascading can be performance: In trained the cascade of classifiers, a false positive rate of a cascade showed in Equations (1 & 2). The characteristics of Viola Jones algorithm that indeed considered as a useful algorithm for face detection are as follow: robust which is very-high detection rate the true-positive rate, The opposite one is the very-low false-positive rate and Real time which is for a practical application at least two frames per-second and this is must be processed and only Face detection with no recognition- The main aim is to distinguish faces from non-faces. Cascade architecture is object detector uses the Viola Jones algorithm to detect people's faces, noses, eyes, mouth, or upper body. Slow but accurate classifiers are used in the later stages for classifying face-like patterns. Thus, the complexity of classifiers can be adapted to correspond to the increasing difficulty of the input patterns. Several techniques are employed to compute various features under varying scales and locations effectively, which are crucial in real-time performance.

Image Pre-Processing:

Pre-Processing is applied typically to transform a source image into a new image, which is fundamentally similar to the source image, to overcome problems due to low-quality image. In the Pre-Processing stage, colure images may be converted into gray scale images, and images are resized to the required size and filtered using a low-pass filter to Illumination normalization can be conducted using histogram equalization .In below Figure 4 is shown Pre-Processing facial images.

The pre-processing stage will be executed for every detected face as shown in figure 12 in original frame (A). For the pre-processing purpose, the detect faces were cropped (B), then converted all images to grayscale(C), after that, resized the images of faces to remove the noise. (D). (HE) have been used for normalization (E). Pre-processing one frame is showed in figure (4).

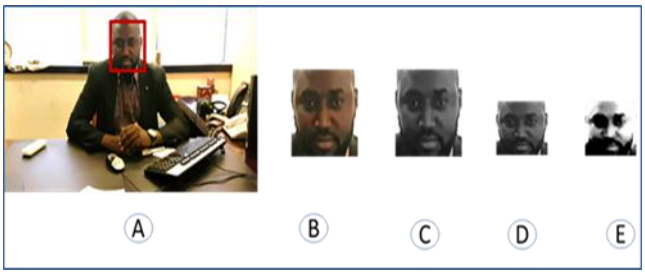

Fig. 4 Pre-processing a frame

Research Procedure:

Face detection is the process to determen people in photographs, figures, images or video frameworks by comparing the appearance of face in video frame (Query frame) to a faces data set .Figure 6 showed the suggest Digram of Face detection System and this process can be done as the following:

Procedure 1. The data was obtained from created MEDIU-S-DB, as twenty videos were taken for 10 members (2 videos for everyone) in different face recorded with variation of affecting factors.Every single video was divided into a hundred frames.the other 10 videos were used to evaluate the proposal .

Procedure 2. Face detection by Viola-Jones algorthem To achieve the required aims to design a robust real - time face detection system under continuous motion, and variations in term of pose, illumination conditions, facial expressions, orientation, occlusion and nationality variation, Frontal CART and Profile face classifiers were coupled based on Viola&Jones algorithm. system started with detect face from video frames.this system ued MATLAB 2016b Toolboxes was used for coding the desired system, data set based of videos and images.

Procedure 3. Pre-processing the images of faces such as (cropping, convert image from color to gray-scale, resizing faces and normalization the faces by histogram equalization).

4. RESULTS AND DISCUSSION

Experiment 1: Accuracy of detection system:

The preliminary experiment was testing of the accuracy of system detection; seven videos from MEDUE-S-V-DB were tested as a sample and observed it under continuous motion, and variations in term of pose, illumination conditions, facial expressions, orientation, occlusion and nationality variation. Then, every video was divided to 100 frames to find the percentage of detection to show the robustness of the proposed detection system. The results show the efficincy of the system to detect face with different challenges as shown in figure (5)

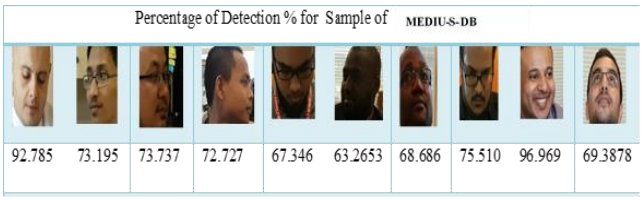

Fig. 5. Detection with different challenges

Experiment 2: develop a Face Detection system:

were applied to achieve one of the main aims using three staff members in one video, then this video inserts into the system to detect three faces and recognize them at the same time.The results showed that the system was abled to detect more than one faces crosponding person as shown in figure (6).

Fig. 6. Detect three faces

5. Equations

Whosesoever F is the false positive rate for the cascade

$$F = \prod_{i=1}^{K} f_i \quad (1)$$

classifier, K is the number for classifiers, and fi is the false positive rate of the i classifier in this examples that get through to it. Rat of detection is:

$$D = \prod_{i=1}^{K} d_i \quad (2)$$

Where D is the rate of detection in the cascaded classifier, K is the number of classifiers, and di is the rate of detection in the i classifier on the examples that get through to it. [5].

6. Conclusion:

Face detection is a very vital topic in computer and in the world of information technology, during the last few years among the researchers 'community. It has bound the researchers together due to different reasons but leading towards the same interest. The utmost reasons are that it can be used in commercial life, law enforcement and security applications that require Recognition. The other possible reason could be its convenient and universal procedure as compared with Biometric applications. To achieve the required aims to design a robust real - time face detection system under continuous motion, and variations in term of pose, illumination conditions, facial expressions, orientation, occlusion and nationality variation, Frontal CART and Profile face.

7. References:

[1] N. D. V Santhi, *Studies in Computational Intelligence 660 Intelligent Techniques in Signal Processing for Multimedia Security*. .

[2] L. Introna and H. Nissenbaum, "Face Recognition Technology - A Survey of Policy and Implementation Issues," *Lancaster University Management School*, 2010.

[3] D. Hutchison, *Biometric Recognition*. 2015.

[4] X. Zhang and Y. Gao, "Face recognition across pose: A review," *Pattern Recognition*, vol. 42, no. 11, pp. 2876–2896, 2009.

[5] P. Viola and M. J. Jones, "Robust Real-Time Face Detection," *International Journal of Computer Vision*, vol. 57, no. 2, pp. 137–154, 2004.

[6] Y. Mao, H. Li, and Z. Yin, "Who missed the class? - Unifying multi-face detection, tracking and recognition in videos," *Proceedings - IEEE International Conference on Multimedia and Expo*, vol. 2014–September, no. Septmber, 2014.

[7] K.-K. Sung and T. Poggio, "Example-Based Learning for View- Based Human Face Detection," *IEEE Trans. Pattern Analysis and Machine Intelligence*, vol. 20, no. 1, pp. 39–51, 1998.

[8] E. Multimedia, *No Title*. .

[9] L. Huang, A. Shimizu, Y. Hagihara, and H. Kobatake, "Face detection from cluttered images using a polynomial neural network," *Test*, vol. 51, pp. 197–211, 2003.

[10] C. Zhang, Z. Zhang, O. M. Way, and R. Wa, "Improving Multiview Face Detection with Multi-Task

Deep Convolutional Neural Networks," pp. 1036–1041, 2014.
[11] Q. Tao, S. Zhan, X. Li, and T. Kurihara, "Author ' s Accepted Manuscript Robust face detection using local CNN and SVM based on kernel combination Reference : To appear in : Neurocomputing," *Neurocomputing*, 2015.
[12] H. Yang and X. A. Wang, "Cascade face detection based on Histograms of Oriented Gradients and Support vector machine," in *P2P, Parallel, Grid, Cloud and Internet Computing (3PGCIC), 2015 10th International Conference on*, 2015, pp. 766–770.
[13] S. Zafeiriou, C. Zhang, and Z. Zhang, "A survey on face detection in the wild: Past, present and future," *Computer Vision and Image Understanding*, vol. 138, no. March, pp. 1–24, 2015.
[14] Y. Muttu, "Effective Face Detection , Feature Extraction & Neural Network Based Approaches for Facial," pp. 102–107, 2015.
[15] . Comaschi, S. Stuijk, T. Basten, and H. Corporaal, "ROBUST ONLINE FACE TRACKING-BY-DETECTION Eindhoven University of Technology , The Netherlands TNO Embedded Systems Innovation , Eindhoven , The Netherlands," 2015.
[16] B. Du, S. Shan, L. Qing, and W. Gao, "Empirical comparisons of several preprocessing methods for illumination insensitive face recognition," in *Acoustics, Speech, and Signal Processing, 2005. Proceedings.(ICASSP'05). IEEE International Conference on*, 2005, vol. 2, p. ii-981.
[17] A. . Fallis, *Guide To Image Preocessing Ebook*, vol. 53, no. 9. 2013.
[18] G. Hemalatha and C. P. Sumathi, "Preprocessing techniques of facial image with Median and Gabor filters," *2016 International Conference on Information Communication and Embedded Systems, ICICES 2016*, pp. 1–6, 2016.
[19] V. Pali, S. Goswami, and L. P. Bhaiya, "An Extensive Survey on Feature Extraction Techniques for Facial Image Processing," in *Computational Intelligence and Communication Networks (CICN), 2014 International Conference on*, 2014, pp. 142–148.
[20] M. J. P. Viola, "Rapid Object Detection Using A Boosted Cascade of Simple Features," *Proceedings of the 2001 IEEE Computer Society Conference on Computer Vision and Pattern Recognition*, no. 1, pp. 511–518, 2001.
[21] Hilles, S. M., & Maidanuk, V. P. (2014). Self-Organization Feature Map Based On Vq Components To Solve Image Coding Problem.
[22]Майданюк, В. П., Мазін-Хіллес, Ш., & Мельник, С. В. (2004). Кодування зображень з використанням SOFM. Інформаційні технології та комп'ютерна інженерія, 1(1), 49-52.