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### **FACE DETECTION AND RECOGNITION BASED E- LEARNING FOR STUDENTS AUTHENTICATION: STUDY LITERATURE REVIEW**

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## Face Detection and Recognition Based E-Learning for Students Authentication: Study Literature Review (Conference Paper)

Rabiha, S.G.<sup>a</sup> , Kurniawan, A.<sup>b</sup> , Moniaga, J.<sup>b</sup> , Wahyudi, D.I.<sup>c</sup> , Wilson, E.<sup>c</sup> , Sasmoko<sup>d</sup>

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### Abstract

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The Authentication process is highly dependent on Face Detection and Face Recognition during learning activities. In addition, in the E-Learning learning system we must also provide accurate and accurate information. The research method used is literature study and analysis. Literature study was carried out on the face of face detection and recognition in real-Time conditions carried out by various previous studies. Furthermore, analysis was carried out in a literature study studio to find suitable methods for the E-Learning environment. From the results of existing literature studies we recommend face detection using Face Countour and the Adaboost Algorithm added to CNN (Convolutional Neural Network) to normalize the facial contour function and normalize lightning in the surrounding environment where a face detection is located. The process is carried out, we use the 3WPCA-MD (Three-Level Wavelet Decomposition Principal Component Analysis with Mahalonobis Distance) method which is able to produce calculations, that is, face recognition that is faster when compared to ordinary PCA (Principal Component Analysis) methods. Thus the process can be carried out in face detection and face recognition. © 2018 IEEE.

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# Face Detection and Recognition Based E-Learning for Students Authentication : Study Literature Review

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**Abstract**—The Authentication process is highly dependent on Face Detection and Face Recognition during learning activities. In addition, in the E-Learning learning system we must also provide accurate and accurate information. The research method used is literature study and analysis. Literature study was carried out on the face of face detection and recognition in real-time conditions carried out by various previous studies. Furthermore, analysis was carried out in a literature study studio to find suitable methods for the E-Learning environment. From the results of existing literature studies we recommend face detection using Face Countour and the Adaboost Algorithm added to CNN (Convolutional Neural Network) to normalize the facial contour function and normalize lightning in the surrounding environment where a face detection is located. The process is carried out, we use the 3WPCA-MD(Three-level Wavelet Decomposition Principal Component Analysis with Mahalonobis Distance) method which is able to produce calculations, that is, face recognition that is faster when compared to ordinary PCA (Principal Component Analysis) methods. Thus the process can be carried out in face detection and face recognition.

**Keywords**—*face detecton, face recognition, e-learning*

## I. INTRODUCTION

Distance learning model that we know as E-Learning started to become a fairly popular means. The spread of E-Learning is supported by the increasing number of internet users and the need for efficient and effective learning especially in higher education [1]. In addition, educational institutions must face challenges in anticipating cheating by online students, especially when the exam is in progress[2]. E-Learning model is expected to present the intensity and capacity of the real learners through online student authentication in the e-learning platform. Student authentication is done by using Image Processing. The Authentication process relies heavily on Face Detection and Facial Recognition during the learning

activities. In addition, in the E-Learning learning system we must also consider the problems regarding the accuracy and speed of the system in executing an image.

Face detection and recognition also require high-level image processing of difficult tasks such as variance in lightning, orientation, color, texture, size and expression can easily be fixed [3][4]. To make the system more efficient and reliable, it is necessary to build effective algorithms that can perform face detection and recognition [4]. There are several methods that can be used to reduce image dimensions, for example using PCA (Principal component analysis). PCA can be defined as an orthogonal transformation that converts data to a new coordinate system. Variations of each projection data that come to remain at the first coordinate, the second highest variant at the second coordinate, and so on[5].

This paper presents a brief overview of real-time face detection and recognition techniques. From the results of the existing literature study we found that Face Countour and the Adaboost Algorithm added with CNN (Convolutional Neural Network) can normalize the function of face contour and normalize lightning in the surrounding environment where a face detection is located. Whereas in the face recognition process, from the existing research it can be seen that the 3WPCA-MD(Three-level Wavelet Decomposition Principal Component Analysis with Mahalonobis Distance) method is able to produce faster facial recognition results compared to ordinary PCA methods. So that the results of this research can be used as a reference in developing previous research on Image Processing models in E-Learning[1] with a focus on methods that will be used in the face detection and face recognition stages.

## II. LITERATURE REVIEW

The general method for face detection and recognition for Students Authentication follows the following framework:

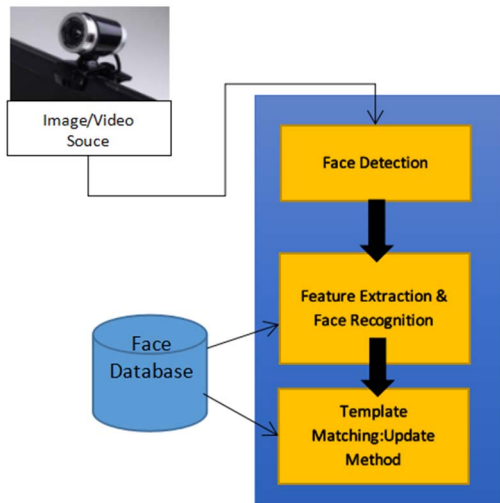


Fig. 1. Face Detection and Recognition Framework Based E-Learning

### A. Face Detection

Face detection is an early stage before doing recognition where face detection will determine whether or not the face shape is also not focused on background background, because this system will be trained previously to find the location of the face and that is not the face. Face detection was previously created in the 1970s and is still being developed up to now with the addition of several new methods in order to work in real time [6].

To detect target faces and the number of people present in the surveillance area, there are many types of software that are useful for detection and recognition, segmentation, filtering and feature extraction. The software is also very helpful for biometric analysis systems, pattern matching such as fingerprint matching [7][8]. The best software useful for this operation is Image processing is handled easily using MATLAB.

### B. Face Recognition

Face recognition is a process that functions to identify the presence of a human face from an image or video. Real time recognition and timing recognition rate is one of the major challenges that must be developed. Face Recognition in E-Learning is shown to authenticate whether a user is a genuine user or an imposter trying to become a real user.

### C. Template Matching

Template matching aims to continually and transparently authenticate online students in the e-learning platform. In this

stage, the system will re-validate the face detection process to find errors that occur due to illumination or suspected cheating during the ongoing learning process.

### D. Face detection for E- Learning

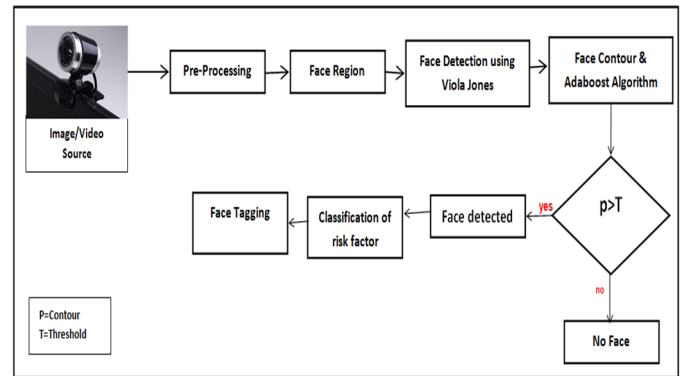


Fig. 2. Face Detection

In Figure 2 describes the steps performed in the face detection process. Viola jones here are used to help face detection in real time which is developed again algorithm using adaboost and haar feature. The adaboost algorithm is used as performance enhancement and the haar feature is the basis of viola jones. Haar feature can count the number of pixels including white rectangles and gray rectangles [9]. Because of the existence of the vector value of the mapping on the face, and the viola jones will be added again with face contour.

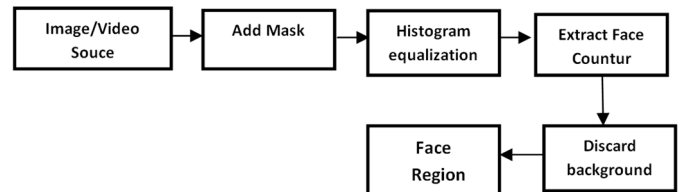


Fig. 3. Pre- processing face detection

Figure 3 describes the early stages performed on face detection. First, the addition of a mask is used in order to eliminate the background noise from around the face area, then based on the brightness distribution, mask area normalized through the histogram equation. Furthermore, the face contour must be extracted to produce a face region by deleting the background using the regional connectivity filter method.. In this case Face contour will distinguish facial lines from each pose, because there is the possibility of each pose will be different vector values, and will be normalized with face contour. Face contour can also form a mapping with 3D so that it facilitates during the process of recognize so that if the detection process is not successful then it will not be continued to the process of recognize so it will not perform unnecessary processes [7]. However, there is a weakness in the haar feature where in a certain environment with the pose and lighting will weaken the process and can be increased with CNN [8]. In the adaboost algorithm is a selection feature which will determine the allocation of the rescue and also

additional for how it will receive the color image at the time of learning. If you combine adaboost with haar features it will be able to detect color images and rules and the search process with a fairly fast level of performance[10].

Farfate et al, in his research on multi-face face detection method, said that a CNN can produce a pose and landmark on a face detection with good results and also has been tested for performance can produce a good detector [11]. On CNN can also be tested using DPM. DPM is a deformable part model which also becomes part of CNN, DPM produces a graphical model that is used to generate from feature extraction [12].

CNN can produce feature extraction which also calibrates in high resolution with good performance when in real-time use for face detection because it can normalize from face contour function and normalize lightning in the environment where a face detection is located. On adaboost itself is still in the testing phase which is also combined with viola jones and until now face detection is still a topic that is quite challenging because it has been 15 years face detection is developed and now will process data with capture is not limited or also called 'in the wild "which results can also be applied to face detection on E-learning systems [13].

### E. Face Recognition for E-Learning

Face Recognition has been implemented into many aspects, such as human computer interaction, Artificial Intelligence and so on[5]. In E-Learning, FR (Face Recognition) can be used as a login system and as a verifactor, so the system can authenticate an account that is logged in as an original or a person who imitates the original user.

Figure 4 describes the steps performed in the facial recognition process using 3WPCA-MD (Three-level Wavelet Decomposition Principal Component Analysis with Mahalonobis Distance) which is a technique where the extraction feature occurs between PCA with three levels of wavelet decomposition, while the classification feature uses Mahalonobis Distance [14]. The results of this method are quite good, in an experiment by Edy et al [14] the level of accuracy produced reaches 95.7%. average and produces faster face recognition calculation results when compared to the usual PCA method. The average computational velocity value obtained using the 3WPCA-MD method is 5-7 millisecond (ms) for each facial recognition process. This is because of the support of Mahalanobis Distances Classification, Mahalanobis distance is a prominent approach that is used to improve the results of classification result by exploiting the data structure [15].

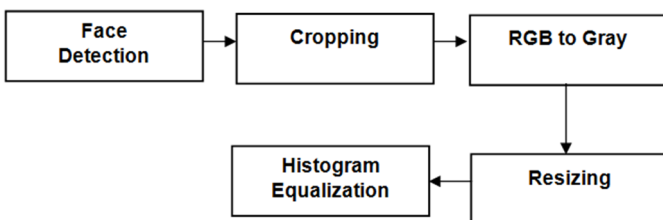


Fig. 4. Face recognition

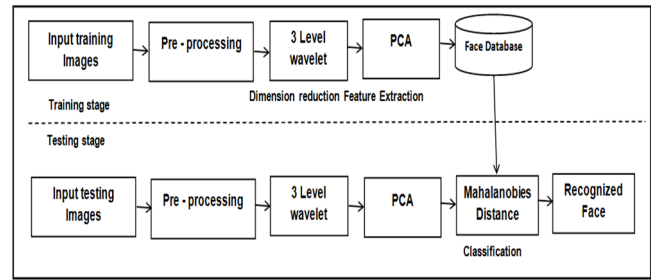


Fig. 5. Pre- processing face recognition

In another study conducted by Winarno[16]explained that 3WPCA can be used to anticipate face data forgery with recognition accuracy up to 98% and produce a good attendance system based on face recognition

### F. Critical Analysis

The following is a comparison of the results of a literature review explaining the benefits of the proposed research relating to real-time face detection and face recognition:

TABLE I. LITERATURE REVIEW COMPARISON

Proposed Sytem/ Method / Algorithm	Result
Multi-biometrik system[2]	This system is able to capture raw data from facial properties, sound properties, touch behavior, mouse dynamics, and keystroke patterns during utilization of the e-learning platform
Skin grabbing, Gabor filter and PCA [4]	Accuracy can be improved easily by using hybrid techniques for face detection and recognition in real time. This also reduces operating time, even though the system is complicated
Adaboost algorithm and a set of haar wavelet like features [9]	Produces a high level of accuracy in terms of face detection and can minimize the risk of false detection errors. In addition in this study also added a command to display pop-ups as a warning of the process of not finding a defective human face. This is the basis of e-learning in real-time
CNN [8]	Can evaluate input images at low resolutions to immediately reject non-face areas and carefully process challenging areas at higher resolutions for accurate detection
3WPCA-MD[14]	Shows that the resulting accuracy reaches 96% and 3WPCA-MD method is able to increase speed in the Face recognition process with an average of 5-7 milliseconds (ms)
3WPCA [16]	In this study explained that 3WPCA is able to produce facial recognition accuracy up to 98% by implementing it into the attendance system based on face recognition. So that it can be used to anticipate fake face.



### III. METHODOLOGY

The research method used is literature study and analysis. Literature studies are carried out on the use of face detection and face recognition in real-time conditions proposed by various previous studies. The information obtained is the method used in face detection and face recognition as well as related information in real-time. In this study we reviewed methods from six literature studies relating to face detection and face recognition.

Furthermore, the analysis is carried out on the study of literature studies to find methods that are suitable for the E-Learning environment. This study aims to develop the System architecture design of the Image Processing Model in E-Learning[1], that has been carried out in previous research using methods used in face detection and face recognition, so as to improve the accuracy of user authentication

### IV. RESULT AND DISCUSSION

In this study, we reviewed several methods that could be used to improve student attendance authentication. Especially in terms of face detection and recognition. This paper not only reviews accuracy issues in face detection and recognition, but also tries to revisit methods that can be used to improve the speed of detection and facial recognition in real time.

From the results of the existing literature study we propose research to improve the performance of facial detection process using Face Countour and Adaboost Algorithm needed with CNN to normalize from facial contour function and normalize lightning in the surrounding environment where a face detection is located. At the time of face recognition, from the existing research, the 3WPCA-MD method was able to produce faster calculation results when compared to the usual PCA method. In addition, the 3WPCA process produces a good face-based recognition system and can be used to find facsimile data with an accuracy of up to 98%[16].

This paper is the development of the proposed system architecture in previous research[1]. In accordance with the exploration results from the literature review, we focus on developing the Face Detection and Recognition Framework Based E-Learning described in the following figure:

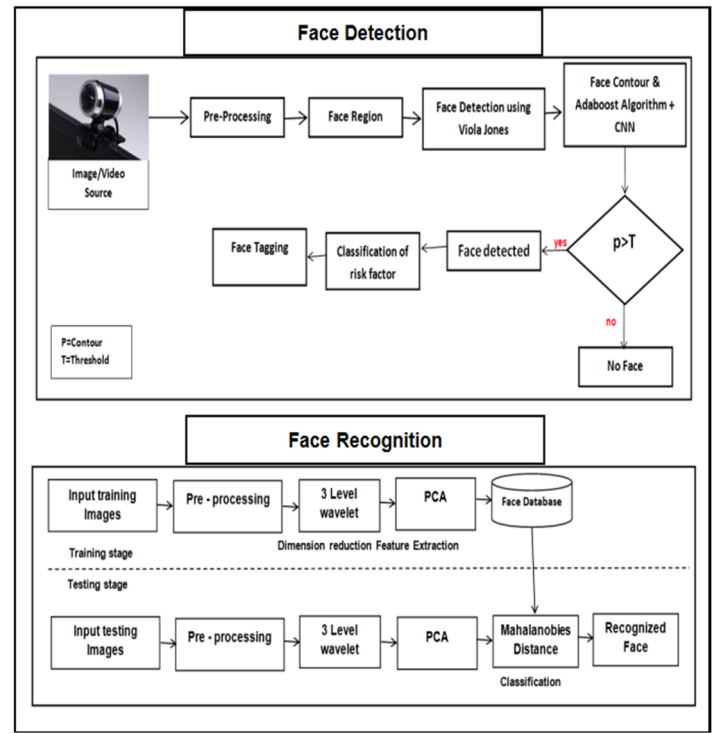


Fig. 6. Process Design of Face Detection and Face Recognition

### V. CONCLUSION

From the above observations can be concluded that the accuracy of facial authentication on E-Learning can be improved by using hybrid techniques for face detection and recognition in real time. It is also expected to reduce the operational time of the operation, although the system is complicated. The main obstacles observed are about face orientation, background images and brightness-related issues where the system can not detect faces.

The purpose of this study is to review several methods that can be used on face detection and recognition processes in real time condition. Thus in the next study we can test the methods used in face detection and face recognition as the basis for the development of previous research on Image Processing models in E-Learning. So that an appropriate model can be obtained to be implemented into the E-Learning environment.

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