Robust Face detection based on Viola-jones Algorithms

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Abstract. This paper describes the experimental methods of using face detection based on MATLAB software. The important things are that interesting in the movement, this face detection are accepted to use four general face detection internationally. We also need to use the Viola and Jones principles in MATLAB for face detection because of its ability to process that image quickly and very accurate. And this paper aims to study principles and algorithms for active development and improvement.

1. Introduction  
Now today using the computer software for object detection and tracking is significant. We used the MATLAB software to detect a human face, eyes and upper body. That is simple for the human to detect face but not for computers. They are considered by someone that is more complicated to use computer vision the human's face due to the type of the faces are different when feeling change such as expression of face. So the result is the picture at that time is not the original image. Eight years ago, there has been a development in image processing. Eight years ago, there has been a development in image processing. New generation computers are becoming smarter and faster to process terabytes of data. There are two types of detection that are "face and non-face" in the face detection. Face detection can detect the face in the 2D frame, so finding the human's face that is possible and there are many methods to develop the face detection.

2. Literature review  
Over the years, many contributions to the field of face detection and recognition. G. Yang came up with a Multiresolution rule method. This knowledge-based method used the structural nature of the face for detection [2]. The Feature-based process used the facial features [3, 4], skin color [5, 6]. It combined multiple elements [7] of the face for better accuracy and detection speed to increase the detection speed, and the accuracy is scarification. For this, steady and uniformly scaled images using a template matching method. Predefined face templates [8] and deformable templates [9] were incorporated, which was based entirely on the model (a predefined structure) without using learning.

3. MATLAB Software  
The Real-time face detection program is developed depend on MATLAB software, cover by version R2018a. R2018a includes the Predictive Maintenance Toolbox for situation monitoring and predictive maintenance algorithm design and testing, and the Vehicle Dynamics Block set for modeling and simulating vehicle motion in a virtual 3D environment. This release includes 94 products with new updates and bug fixes. In addition, new features products in MATLAB and Simulink.
4. Methodology

The face detection has methods following in figure 1:

![Face detection process chart](image)

**Figure 1.** The face detection methods process chart.

4.1. Feature-based

The property of face recognition is the property concerning the facial structure. The position of property is conform to the face characteristics such as eye, nose. The step topology in the system can be used fully in order to get in the real-time experiment results for image 128*128 having very little noise.

4.2. Knowledge-based

The model of connection is to show the common knowledge and the using of reason the ability of the system has three steps: the processing in advance, the pull of facial components and the final decision.

![Face detection methods](image)

**Figure 2.** A typical face used in knowledge-based top-down methods

4.3. Appearance-based

The technique of facial appearance is very interesting. The recognition of face is easy but the creation of facial recognition system automatically is very important by using computer.

![Facial feature recognition](image)

**Figure 3.** Facial feature recognition for classification

4.4. Template matching

It is the structure to define in advance the size and shape in order to compare with the real object. The template matching will research the relation between the coming image a video and the shape of face shown in the template for face detection.
5. Viola-Jones approach

In 2003, Viola and Jones proposed Simulate a new Haar-like format to solve restrictions. Of the previous method introduced in 2001 is a picture of a face that will must be in the form of a front-facing photograph. (Not the face to the side) and is upright (not Face, tilt, left or right) by simulating the Haar-like the proposed model will use the original Haar-like model. Together, as shown in Figure 5, which the experimental results show see that the face can be detected, including the front face and the side as well as being able to detect the face at an angle Can also be tilted (not upright).

Figure 4. A template for face detection

Figure 5. The algorithms flows process chat data

This approach is used to detect the objects to combine four approaches:
1. Simple rectangular features, Haar-like features.
2. Integral image for rapid feature detection.
3. Adaboost machine- learning method.
4. Cascaded classifier to combine many features efficiently.

6. The result of simulation:

This is a real-time face detection program, in which it recognizes important parts of the face, eyes, and the upper body, with improved accuracy using MATLAB software, via the switch button.

Figure 6. Face detection
Figure 7. Detection of Eyes
Figure 8. Detection of Upper Body

7. Conclusion

In this research, we had explained the principles and the face detection method. This method is essential and useful for the different work; it is the dynamic method which can develop for the real and accurate face detection. The usage of the Viola and Jones principles of face detection is to increase the efficiency of technical calculation and to increase Focus point in detail by the properties of Haar and Adaboost.
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