

Facial Image Identification Using The Viola-Jones Method

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Abstract— Identification technology using digital images has developed rapidly. Some things that are identified from digital images include fingerprints, palms, and human faces. Face identification is easier to do because it only requires a digital image with a human face which is easier to obtain compared to getting someone's fingerprints or palms. This research was conducted to explain the process of identifying faces using the Viola-Jones method which has high accuracy with a fast calculation time. The Viola-Jones method uses the haar function as a descriptor and then combines Integral Image and AdaBoost to find and select key values to form a cascade classifier. The face detection system implemented using the Python programming language managed to get 90.9% accuracy and required an average time of 15 seconds for all samples tested from the method used.

Keywords—viola jones, face detection, haar feature, cascade classifier

I. INTRODUCTION

Identification technology using digital images has developed rapidly. Some things that are identified from digital images include fingerprints, palms, and human faces. Face identification is easier to do because it only requires a digital image with a human face which is easier to obtain compared to getting someone's fingerprints or palms. Therefore, in this paper the author will only identify faces using the Viola Jones method.

Previous research has been carried out by Yi-Qing Wang [1] with the title "An Analysis of the Viola-Jones Face Detection Algorithm" which aims to describe the Viola Jones algorithm as the first face detection system in real time. In this study, it was said that there were three ingredients for fast and accurate face detection, namely integral images, adaboost, and attention cascades.

In another study entitled "Face Detection System Based on the Viola-Jones Algorithm", a face detection process was carried out from direct images using the Viola Jones algorithm and the Adaboost algorithm from the haar feature was used to extract facial areas from images. In addition, this research also uses cascading of stages to make the process run faster [2].

In this research, the author will explain the workings of the Viola Jones method and the form of its application into a simple system using the Opencv library and the Python programming language. When the system has been

completed, it will then explain how face detection works starting from image acquisition, image processing, pattern recognition, and image analysis. Then the last test is done on facial characters that can be detected.

II. RELATED WORKS

In a study entitled "Wider Face: A Face Detection Benchmark" has introduced a WIDER FACE dataset, which is a face dataset that can be used to train and evaluate face detection algorithms and has 32,203 images with 393,703 labeled faces, the number is ten times more larger than the currently available facial dataset. The WIDER FACE dataset has rich annotations, including occlusions, poses, event categories, and face bounding boxes. The facial images in the proposed dataset are very challenging because they have a large amount of variation. This research shows an example of using WIDER FACE using a multi-scale two-stage cascade framework that uses a divide and conquer strategy to deal with large-scale data variations. A set of convolutional networks with various input sizes used in this framework is trained to handle facial images with a certain scale range. Four representative algorithms were compared and evaluated at different settings and analyzed the conditions under which a method failed [3].

Another study entitled "Facial Parts Detection Using Viola Jones Algorithm" performs face detection and searches for facial features in an image by involving the viola jones cascade object detector algorithm which provides various combinations of filters and methods to detect facial expressions. The face detection process is carried out on parts of the face such as the eyes, nose, mouth, and the whole face. In this study, a face database called the Bao database was used and it gave an accuracy of 92%. The Bao database has more variations and a higher level of complexity than the AR-Face and Yale Face databases [4].

III. SYSTEM DESIGN

Face detection is a technology that is often used and is always being developed in line with developments in computer technology. Face detection can be seen as a pattern classification problem where the input is the input image and the output will be determined in the form of a class label from the image. Most of the face detection techniques used so far use the assumption that the available facial data have the same size and uniform background. Meanwhile, in this world, faces

can appear in various shapes and positions. The most frequently used face detection system is the Viola Jones method.

A. Research methods

The Viola Jones method is a face recognition method with high accuracy and fast calculation. The Viola-Jones method uses the haar function as a descriptor and then combines Integral Image and AdaBoost to find and select key values to form a cascade classifier [5]. Viola Jones has a deficiency in determining face detection, namely when the face image is not straight at the camera. The position of the face is very influential when using the Viola Jones method.

The Haar feature is a feature used in the Viola Jones method. This feature consists of one high interval value and one low interval value. For a two-dimensional image it is referred to as the light area and the dark area [5].

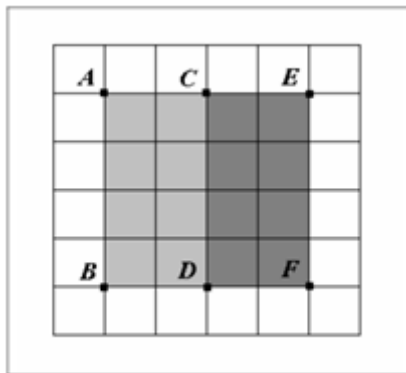


Fig. 1. Fitur haar

Cascade classifier is a classification method whose job is to delete non-face images using a strong classifier that has been trained by AdaBoost at each classification level [5]. Viola Jones uses the machine learning method, AdaBoost. AdaBoost combines several weak filters into a powerful classifier. AdaBoost as a series of filters that are efficient in classifying image areas. The Viola Jones process with a cascade classifier is shown in Figure 2.



Fig. 2. Viola jones process with cascade classifier

B. System

The process flow of the face detection system can be seen in Figure 3. The first step taken is to enter the desired image data. Then, the existing features will be classified gradually by the Cascade classifier. The dataset used is taken from the haar cascade file.



Fig. 3. Process flow of the face detection system

The haar feature is assisted with the help of the openCV library, namely `haarcascade_frontalface_alt.xml`. This library feature helps face detection by calling several Haar features. In selecting specific haar features, use the AdaBoost feature. AdaBoost combines several classifiers into an efficient AdaBoost classifier for classifying image regions. If there is one filter that fails, then the area will be considered not a face. When the filter passes through an image area and passes through all the filter processes, that area will be considered a face. Then the next stage is the cascade. The order of the filters will depend on AdaBoost, that is, the filter with the largest weight will be placed first with the aim of removing non-image areas first. The last is displaying image objects that are detected as faces and those that are not faces.

IV. RESULT AND DISCUSSION

In this section the image samples will be processed by the system and produce a test of the approach used in the research. The image sample is a human photo downloaded from the internet. The results of testing the Viola Jones approach consist of images detected by faces. The sample images used in this study are shown in Figure 4.



Fig. 4. The image used for testing

It can be seen in the picture above that in general the image samples are photos with an upright or frontal face position. The image sample must have sufficient brightness so that it can be detected accurately by the system and can increase the percentage of accuracy. The following is an image result of face detection using the Viola Jones method.

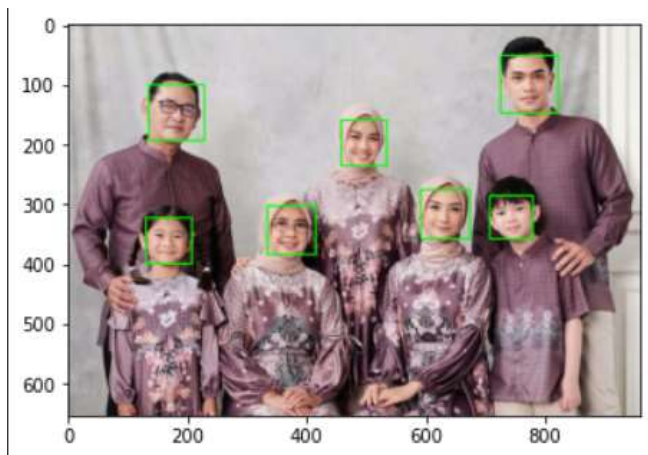


Fig. 5. Face detection results

V. CONCLUSION

This research succeeded in implementing the Viola Jones method into a face detection system using the Python programming language. Researchers designed a system to detect faces in an image using the Viola-Jones method. The method in this study has the advantage of a fairly high level of accuracy, reaching 90.9%, making it more suitable to be applied than other face detection methods. However, this face detection system has a weakness, namely that it cannot

determine faces in images that have faces that are not upright or frontal. The position of the face that is upright/not upright greatly determines the success of this face detection. By using this method, face detection only uses an average time of 15 seconds for all samples tested.

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