Viola Jones Algorithm for Face Detection using Wider Face Dataset

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***Abstract*— For the last several years, face detection has been one of the most explored issues in computer vision. Using the WIDER FACE dataset, this research investigates how the Viola Jones method may be used to identify faces in 179 photos, and how it performs in comparison to other face detection algorithms. Viola Jones' approach has a 100 percent success rate. These approaches will be used to a Matlab algorithm for face identification in an effort to get better results than those now available. An experiment with two courses had promising outcomes.**

Keywords—face detection, widerface, face segmentation

I. INTRODUCTION

As one of the most researched and prominent technologies in this decade, computer vision is expected to remain so for a long time. There are several uses for this technology, which attest to its widespread acceptance, and it continues to improve in terms of sturdiness and security over time. Using this technique, computerized systems can quickly and reliably identify a person and his characteristics [1]. Face identification is at the core of computer vision. In the beginning, it all began with the detection of faces by machines. Later on, the system was able to recognize a person's face [1]. Face detection and recognition are increasingly being used in a wide range of applications, including the verification of identity by each application face scanning, the monitoring system of the bank self-service cash machine, the face unlocking of the mobile phone, and the new face-brushing technology of Alipay. The face detection and recognition technology must be passed by everyone[2]. Some previous researchers also built a system on face detection by paying attention to the surrounding environmental conditions, paying attention to the light intensity factor, the camera quality factor where the capture image is required to have proportional quality and size[3].

The face detection function has been used in a number of applications now. The Viola-Jones approach, which is a combination of support vector machines, boosting methods, and cascade classifiers, may be used for face identification. The locations of the faces in a picture may then be determined using this approach, which can be applied to any digital image. Using this approach, you'll receive results that are quick, accurate, and cost-effective. When it comes to facial recognition software, the Viola-Jones approach is by far the most popular choice. After a prior classifier is constructed using training data, a picture is classified for use in face detection [2], [4]–[6]. The goal of this research is to put the Viola Jones method algorithm into practice and develop improvements that should enhance system performance.

The Viola-Jones approach was used to construct a face detection system in this work. There is a lot of variation in the size, position, and occlusion of the faces in the WIDER FACE: A Face Detection Benchmark Dataset used in this work, which yields a large number of human picture samples. The 61 event classes that make up the WIDER FACE dataset serve as the foundation for its organization. Randomly choose 40 percent, 10 percent, and 50 percent of the data for each event class to serve as the training, validation, and testing sets. Face-forward (frontal), not partly obstructed by other objects, not substantially cropped, stationary, and delimited are some of the characteristics of the sample picture.

II. DATA SOURCES AND METHODS

As a first step in detecting human full frontal faces, Paul Viola and Michael J. Jones published their object detection model in 2001[5], [7]–[9][10]. Face detection is accomplished via the use of three distinct phases in the model. The first approach is to look for traits in the picture that resemble those found in Haar. Haar features are tiny rectangular features estimated at the pixel level to detect the many facial traits present on a face. Haar features are like this. In order to confirm the presence of a face, it is necessary to verify certain characteristics [1]. Create an integrated picture in step two. Detecting Haar-like features for a large number of pixels is not possible, thus an integral picture is constructed that makes the detection of Haar-like features simple. Cascading classifiers is the last phase. Cascading weak classifiers into a strong classifier is what it includes. Each level represents a weak classifier. The cascade's primary purpose is to eliminate unnecessary faces in order to save time. The next parts of the paper go into further depth on each of the stages listed above. Several studies using the viola jones framework have obtained excellent accuracy including: Putro at all in research to detect the results of images that are detected as faces and undetectable as faces. The results of this study obtained a face detection system accuracy value of 90.9%. Another result obtained is that the upright/non-upright position of the face determines the success of the face detection[3]. Syafira and Ariyanto From the test results using K-fold cross validation for face detection using Viola jones, the highest

accuracy results were obtained at 90.9% for face images and 75.5% for non-face images[11]. Hidayatullah et all 2013 In this study, the detection of female breast nipples on pornographic imagery using the Viola and Jones algorithm which is known to be reliable in object detection. Average accuracy of 83.75%, precision rate of 88.20% and recall rate of 90.21%[12]. Some of the studies above still do not have good accuracy in face detection, especially those who use datasets for that researchers try to use the dataset that is already available on the WIDER FACE: A Face Detection Benchmark Dataset. In order to get an idea of whether this viola jones algorithm can also be applied to the dataset [13] [14].

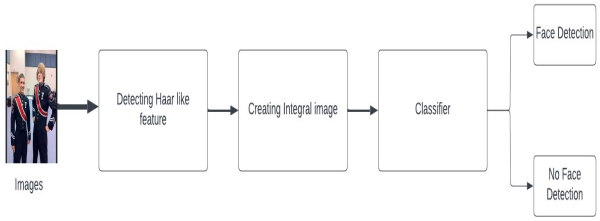

Fig. 1 Face detection process of Viola Jones Algorithm

Detection of Haar-like Features

The eyes, nose, and lips are just a few of the distinguishing characteristics of the human face. As a result, in order to recognize a face, we look for the specific characteristics that set the face apart from the rest of the body. Faces may be seen in a grayscale picture with certain sections that are brighter or darker than others. Eyes are darker than the nose bridge, for example. The difference in intensity between certain areas and others aids in the detection of facial characteristics, and Haar-like features are used to perform this job. As an example, Haar features are rectangular clusters of pixels, which are often depicted in terms of white and black. On various sections of the face, these rectangular Haar characteristics may be applied, and the size of these boxes can also be changed. 255 (white) and 0 (black) are the brightest and darkest values assigned to individual pixels in the white and black regions, respectively (black).

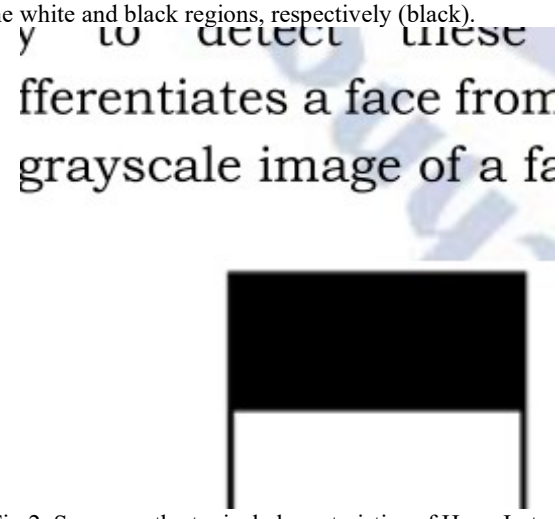

Fig.2. Some are the typical characteristics of Haar. In terms of detecting edges, the A, B, and C methods are employed, while the D method is used for horizontal features[1].

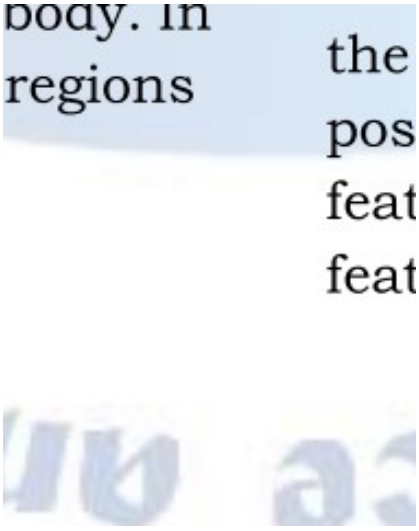

Fig.3. A person's facial characteristics may be distinguished by the presence of several Haar traits [1].

Calculating these numbers for all possible configurations of rectangular features is impossible.

Real-time competitive face recognition relies on a framework called viola-jones, which can be trained to recognize a wide range of objects, including faces, in datasets that are mainly used for detecting the difficulty of face identification. Classification of meetings (33 images) and groups was evaluated using collected data (146 images).

III. Result And Discussion

The system takes input using the WIDER FACE dataset and is processed using a built application. The output of our face detection system based on the viola jones algorithm is presented below:

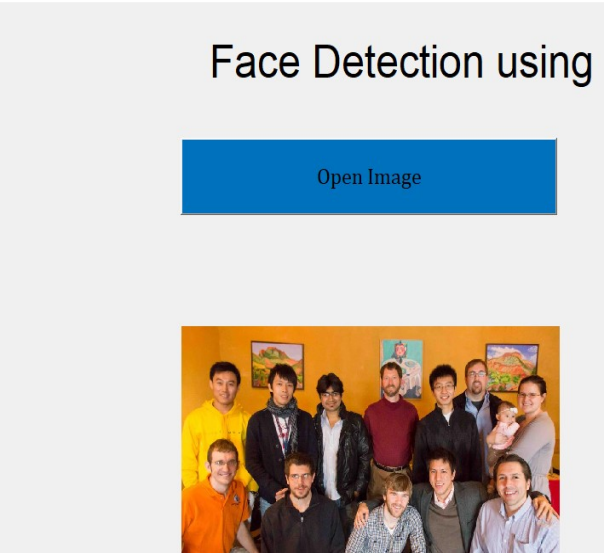

Fig.2. Face detected successfully in Group.

Using the MATLAB vision cascade detector and the viola-Jones and segmented algorithms, we were able to successfully execute the suggested face detection method and get the following results: Inserting a picture of the face may be done by clicking the "Insert Image" button once the yellow square square box has been used to identify the faces. Finally, the segmented face is presented.

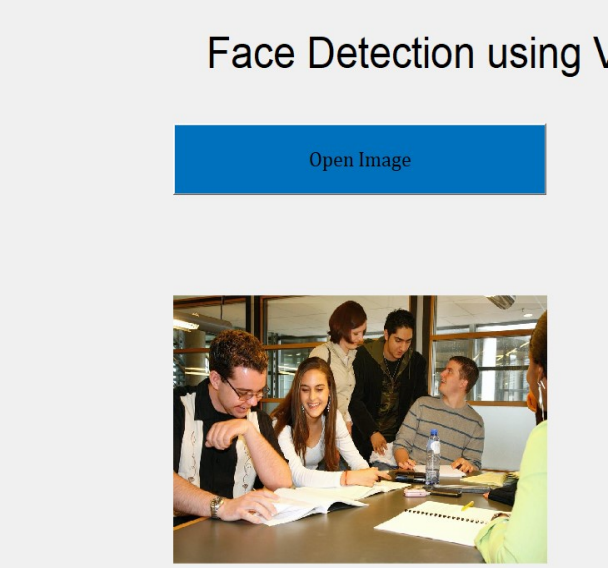

Fig.3. Face detected successfully in meeting.

In figure 3 there is 1 face that cannot be detected due to the oblique position of the face so that the detection of the location of the eyebrows and eyes is not perfect.

EVALUATION

To conduct face detection experiments using the WIDER FACE dataset, withtrials that have been carried out for 2 classes of 179 images. Accuracy may vary with the number of faces detected in the image database. Accuracy measurement using confusion matrix and Accuracy is calculated as follows:

Table 1: Overall result table

The Result		Face detection	No Face detection
Group	Face detection	146	0
	No Face detection	0	146
Meeting	Face detection	33	0
	No Face detection	0	33

Based on the experiments in Table 1, it can be concluded that the highest results obtained from testing using K-fold cross validation for face image detection are 100% and for non-face image detection is 100%. Based on the results of the face detection test that cannot be detected is when the face position is tilted. Or covered by hair.

IV. CONCLUSIONS

Face detection and location in photos is the focus of this study, which employs a variety of methods. Skin segmentation in color-scale photographs, accomplished by different Image Processing Techniques, has been used to discern faces. Binary changes in various parts of the face were analyzed to uncover facial regions. Afterward, facial recognition is done using the global classification method, which classifies faces based on the standard deviation of their difference from the average face. These approaches will be used to a Matlab algorithm for face identification in an effort to get better results than those now available. An experiment with two courses had promising outcomes.

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