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Face Detection Using Haar Cascade in Difference Illumination

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***Abstract*-In this era of advanced technology, camera which has equipped with hi-tech features is no longer a new invention. It has the capability to recognize each of face parts as an object, the major development of biometric system. Face detection is still enthusiastically developed by identifying an individual object in digital image, analyzing and comparing its pattern. As we know that face is a real object which reflects self-identity and differentiates mankind from one another. Face detection can be used to find and index pictures and videos with background, size and position. There are some methods of face detection. One of these is haar cascade. It allows the system to recognize people's face with varied illumination.**

Keyword-face detection, haar cascade, TF-IDF

I. INTRODUCTION

Mankind is unique creature with face characteristics besides their mindset and behaviour. Human recognition with picture as an image object is an interesting study to be investigated further. Technology and its rapid shift is closely related to computer image processing. It starts with analog and now has shifted to digital technology.

Image processing is a system that processes the image-based input and produces the image-based output. The system produces a better quality image as the user's intention. In brief, it is aimed to improve the result of the image. [1] Human face is a dynamic object with varied shape and color [2], yet that causes more problems compared to another image object [3]. Object detection discover presence of an object within an image or video frame[4]. In this case, the labelled-class images are positive (the face is detected) and negative (the face is not detected) The purpose of face detection is to determine the existence of face in a picture and if it is positive, the location and size of each of faces will be detected and spotted as face. For most of computer vision observer and researcher, face detection system is a promising opportunity both commercially and governmentally that has to be improved.

The use of feature haar significally enriches simple features [5] and can be processed efficiently [6]. Haar feature is association function of two dimension (2D) completed haar that codes the image of local object [7].

II. REVIEW OF RELATED LITERATURE HAAR FEATURE

A. RELATED REVIEW

Kritika Shrivastava proposed an automated attendance system with recorded output of classroom session by which the lecturer or faculty can record student's attendance with minimum human interface (less human error) or student proxy attendance. This system increases its efficiency and reliability toward recognition of faces of the students to provide a secure system.

Om Patil proposed a gesture recognition with Haar-like features and the AdaBoost learning algorithm. The Haarlike features can effectively describe the hand posture pattern with the analytically computed. The AdaBoost learning algorithm can greatly speed up performance and construct a strong classifier by combining many weak classifiers. This structure can achieve satisfactory real-time performance and high classification accuracy. This paper tries to give solution to the communication problem faced by many people across the globe. This system may use most of the processing power of the processor.

K.J. Raman proposed In the research area of computer vision and image processing, face recognition is a challenging portion that has received a great deal of consideration and demands over the last few years because of its applications in various domains. This research can be expanded by using other features such as sensor motion in different aspects to reduce road acciden.

B. RELATED WORK

In this paper I want to analyze system performance using the Haar cascade method for face detection in various lighting conditions of the sun and lights. Face detection is the segmentation process of the face of the background image with the varied illumination as one of the comparative factors. The principle of the process is the parameter of the image is detected whether it has face characteristic or not. If it has the separation stage of face and background, the image will be processed.

For testing this algorythm an image input will be pre-processed before the face detection process.

Pre-process in face detection process includes changing in image size and color to grayscale. If in this process face image is found, then the system will determine the best version of the face image. Object detection will improve the image orientation until the best version of the face image is taken as the improvement of the image orientation by rotating to the right direction. After that process we used confussion matrix to measure the level of accuracy.

C. PROPOSED METHOD

1. HAAR FEATURE

Haar feature is a wavelet-based feature that decomposes image. The word "haar" refers to mathematics function that has rectangle shape [8]. Wavelet Haar is a single rectangle wave (one high interval and one low interval). For two dimension (2D), it has one light side and one dark side. The function of cascade classification is to combine more feature efficiently.

In the beginning, the image process of haar is only based on RGB value of each pixel, then process the image in rectangle shapes with some pixel in every shape. Each of the shapes is processed and the limit level (threshold) is occurred after that which shows dark and light area. The formula of haar feature is the average value of the result is above the threshold, it means the haar feature exists.

2. GRAYSCALE IMAGE

One of the pre-processes in face detection of mankind object is the change of the real image room into grayscale. That is occurred since generally facial object in grayscale image has consistent pattern such as eyes color is darker than cheeks or nose color. Here is the formula to turn color (RGB) into grayscale [9]

Grayscale = α*RED + β*GREEN+ γ*BLUE

The image that is produced in this stage later will be processed in characteristic extraction stage of the image and face recognition.

3.. Confussion Matrix

Confussion matrices as a means of counting the cases in hypothesis agress or disagree with the teacher signal. The first measure one is usually intersted in is "precisenss". Preciseness means not making a wrong predictionin the first place[10].

4. Cascade Adaboost Classifier

Cascade AdaBoost classifier is a model of classification with some levels. Each of the classifications is formed by adaboost algorithm. Principally whether the framework of classification model is categorized as good or not depends on three things as follows, number of classification level, number of feature, and threshold value at each classification level, but all of them are obtained based on input parameter which are the number of feature, detection rate and false alarm rate. Furthermore, the contents of model cascade adaboost classifier are some feature harlike and threshold value. A sample is valued positive as object (the feature value is higher from threshold) if it passes on all classification levels, otherwise it is negative (the sample is not valued as an object). Whether or not this classification method cascade adaboost in term of reducing computation when this method is used for face detection in an image.

III. ANALYSIS AND RESULT

A. DATA SET

In this paper we use webcam to crawl the data, which is take size

B. FACE DETECTION AND TESTING

Face detection is segmentation process of face area against the background of the input image with the varied illumination as one of the comparative factors. The principle of the system of this process is the parameter of the image is detected whether it has the face characteristic or not. If it has the separation stage of face and background, image will be processed. Here is the diagram of face detection:

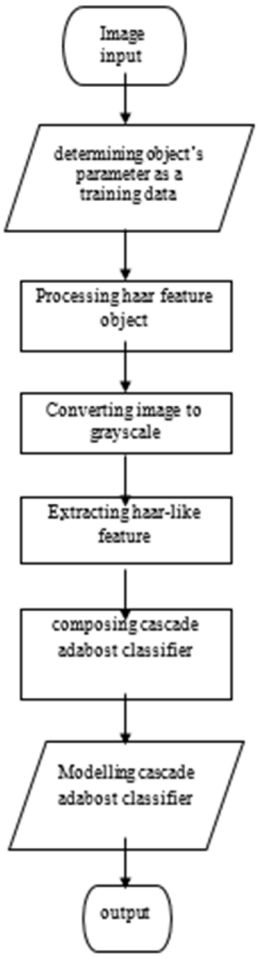

Figure 1. Flow diagram of pre-face detection

Figure 1 is flow diagram of a training process that shows a classification model, while

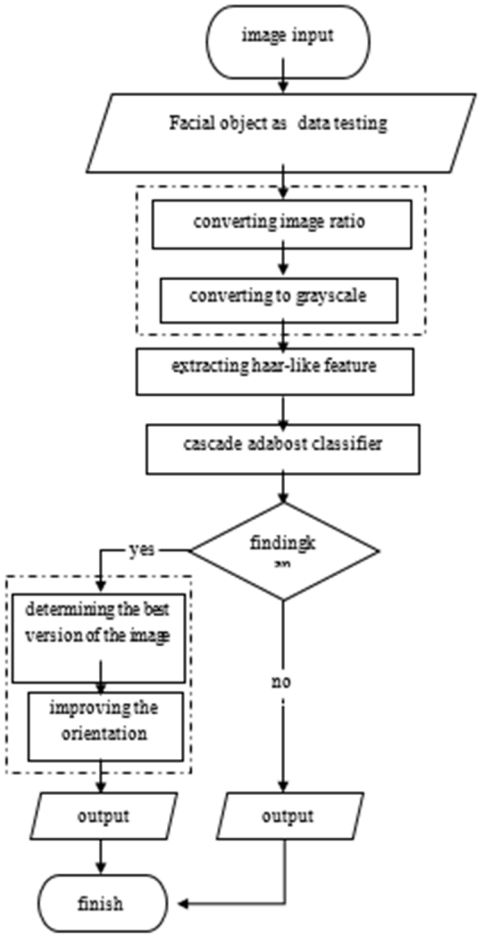

Figure 2. Flow diagram if face testing

figure 2 is the testing. In testing stage, an image input will be pre-processed before the face detection process. Pre-process in face detection process includes changing in image size and color to grayscale. If in this process face image is found, then the system will determine the best version of the face image. Object detection will improve the image orientation until the best version of the face image is taken as the improvement of the image orientation by rotating to the right direction.

FACE TESTING ON BRIGHT, MEDIUM AND DIM CONDITIONS

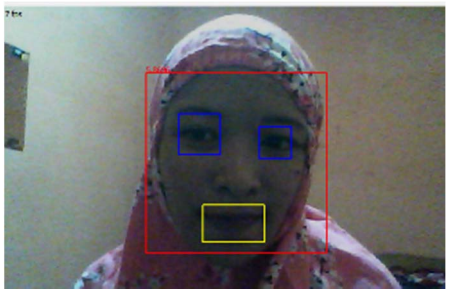

Figure 3. Face detection on dim condition

In figure 3, the eyes are detected as the darkest part of the object

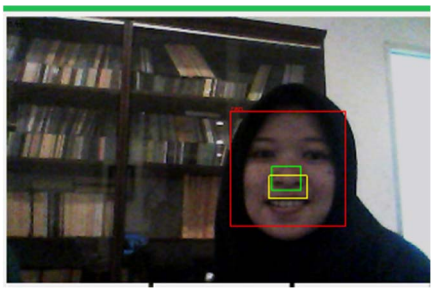

Figure 4. Face detection on medium light condition

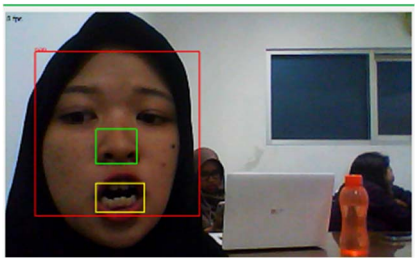

Figure 5. Face detection on bright condition

In figure 3 the value is 7fps, while figure 4 and 5 each has value 3fps

Detection still gets its best performance since it uses distance that provides optimal value that are at 30 cm to 70 cm.

Table 1. Lamp illumination

Object	TF							IDF
	D1	D2	D3	D4	D5	D6	D7	
Eyes	1	1	1	1	1	0	0	0,54
Nose	1	1	1	1	1	0	0	0,24
Lips	1	1	1	1	1	0	0	0,36
Face	1	1	1	0	1	1	1	0
W								
D1	D2	D3	D4	D5	D6	D7		
1,54	1,54	0	0	0	0	0		
1,54	1,54	1,5	1,5	0	0	0		
1,54	1,54	1,5	0	0	0	0		
1,54	1,54	1,5	1,5	1,5	1,5	1,5		
Weight								
6,16	6,16	4,5	3,0	1,5	1,5	0,5		

In Table 1 the last experiment mengalai weighting decline as more away from the webcam face objects thereby reducing the accuracy of detection.

Table 2. Solar illumination

Object	TF							IDF
	D1	D2	D3	D4	D5	D6	D7	
Eye	1	1	0	0	0	0	0	1,54
Nose	1	1	1	1	1	1	0	1,06
Lip	1	1	1	1	1	1	0	1,06
Face	1	1	1	0	1	1	1	0
W								
D1	D2	D3	D4	D5	D6	D7		
1,54	1,54	0	0	0	0	0		
1,06	1,06	1,06	1,06	1,06	1,06	0		
1,06	1,06	1,06	1,06	1,06	1,06	0		
0	0	0	0	0	0	0		
Weight								
3,66	3,66	2,12	2,12	2,12	2,12	0		

In table 2 the last experiment weighting has decreased as more faces from webcam objects away so as to reduce the detection accuracy in the detection of this solar light on face detection performance decreases more than detection using light bulbs.

From the test above, the result is that face, nose and eyes detection got optimal performance from the lamp illumination, depending on the light that captured by the camera. Sufficient light captured by the camera will allow the system to identify eyes, nose and mouth well. The difference is very contrast when tested on sufficient light.

IV. CONCLUSION AND SUGGESTION

Dim light affects the system performance, therefore it cannot detect the image completely. On

average, the detection speed of the system on moving object is good in every condition.
When the result is calculated with TF-IDF, the highest value is when the testing used the light from the lamp.
On TF IDF weighting 62.7% for lamps and 37.2% of the Sun's light. Making light of a lamp which could prove that face detection can work well if using light bulbs.
Good illumination will help and improve face detection in order to get good value and performance with TF-IDF.

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