IJARCCE

ISSN (Online) 2278-1021
ISSN (Print) 2319 5940

International Journal of Advanced Research in Computer and Communication Engineering
ISO 3297:2007 Certified
Vol. 6, Issue 2, February 2017

Face and Eye Gaze scenario for person Identification using Circular Hough transform

Rupali .S.Wagh[1], Prof. S.G. Kole[2], S.S. Savkare[3]

Student, Department of Electronics & Telecommunication Engineering, JSPM Narhe Technical Campus Pune, Savitribai Phule, University Pune, India[1]

Department of Electronics & Telecommunication Engineering, JSPM Narhe Technical Campus Pune, Savitribai Phule University Pune, India[2,3]

Abstract: This paper presents system based on recognition algorithm for face recognition and Circular Hough transform is used to localize circular iris and pupil region Eye Gaze Tracking (EGT) and face recognition allows us to estimate the way of eye gaze and the Point of Regard (POR) on the screen and also recognize the face of the person which is stored in database. This method has been successfully use in different discipline, but more technical improvement are still required to make EGT suitable to be useful in wider range of real world applications or research tools. In this paper a review on recent issues associated with EGTs is conducted and presented. Four issues are: accuracy, comfort ability, reaction time, and cost; but accuracy and comfort ability are the most two difficult problems which are discussed here. At the end, based on the conducted review, new orders for future research are stated. This technique has been effectively used in special disciplines, but more technical development are still required to make EGT suitable to be applied in broad range of real world applications or research tools. In this paper a review on recent issues associated with EGTs is directed and accessible. Four properties are: accuracy, comfort ability, response time, and cost; but accuracy and comfort ability are the most two inspiring problems which are discussed here. At the end, based on the conducted survey, new guidelines for future researches are stated.

Keywords: Eye Gaze Tracking (EGT), face detection, face recognition Human Computer Communication (HCC), Eye Tracking.

I. INTRODUCTION

In the last few years there has been a rising interest in Human Computer Communication (HCC) systems due to need of users to interact with computers, and usually programmed devices, in a comfortable and friendly way.

Eye Gaze Tracker (EGT) systems are a very effective method.

Eye tracking data is collected using either a remote or head-mounted 'eye tracker' connected to a computer.

While there are many different types of non-intrusive gaze at trackers, they generally include two common components: a lighting source and a camera. The light source (usually infrared) is directed toward the eye.

The camera tracks the mirror image of the illumination source along with marked visual features such as the pupil.

Presently, significant concentration has been paid to non-intrusive techniques in view of the fact that they are cost-effective, easy to setup, easy to use, and with more range of applications in wide range of disciplines such as cognitive studies, medical research, human factors, computer usability, fatigue detection, vehicle simulator, virtual reality, etc.

II. SYSTEM DEVELOPMENT

This face and eye gaze tracking helps for security purpose system is developed for various applications like person identification, security system space etc. The systems main focus is to detect users focus on monitor and map it in the X and Y coordinates in system and face recognized both are helps for identification of person. The system is divided into various different steps and these are as Follows:

- Face extraction
- Face recognition
- Eye detection
- Eye center calculation
- Eye center mapping

III. PROPOSED METHOD

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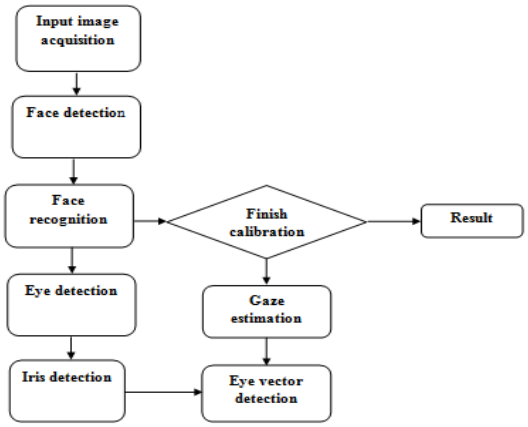

Fig: Block diagram of face and eye gaze Tracking

A. Face detection

Knowledge of the position and pose of the face is an important thing in determining the position of gaze. Detection and tracking of the face help in obtaining candidate regions for eye detection. This reduces the false positive rate as well as computation time prior to operating, the eye-tracking applications; the eye gaze System must learn several physiological properties of a user's eye in order to be able to project his gaze-point entirely. The structure learns these properties by performing a calibration formula. The user calibrate the structure by fixing his gaze on a small yellow circle displayed on the screen, and following it as it moves around the screen. The calibration procedure usually takes about 15 seconds, and the user does not need to re calibrate if he moves away from the eye gaze System and returns later.

Changing the way we speak, play and application where eye gaze is used as a complement to other controls, a single-mode interface where eye gaze is the only control method has been designed for users with mobility impairments, (iii) EGT in moving: Eye tracking is also suitable part of other human-machine interface. In cars and trucks, it's being incorporated with advanced driver-assistance systems to recover safety and the user knowledge, and (IV) specialized interface: Like hands-free screen interaction in hospital environments. Industrial work stations controlled by gaze and gestures. Or process support for operator based on their attention duration.

1. Algorithm used :

A. The Viola-Jones face detector

This algorithm describes the work carried out relating to the execution of the Viola-Jones face detection algorithm. The first part elaborates on the methods and theory behind the algorithm.. Secondly motivating aspects of the actual execution are emphasized and presented together with results and comments on performance.

This structure is preferred since many intermediate results have affected implementation decisions and vice versa. Methods The basic principle of the Viola-Jones algorithm is to scan a sub-window capable of detecting faces across a given input image.

B. Face Recognition

Face recognition has long been a goal of computer vision, but only in recent years reliable automated face recognition has become a realistic target of biometrics research. Face Recognition is the mission of identifying the detected face as a known face or not. Linear Discriminant Analysis (LDA) has been successfully applied to face recognition which is based on a linear projection from the image space to a low dimensional space by maximizing the between class scatter and minimizing the within-class scatter. LDA allows objective evaluation of the significance of visual information in different features of the face for identifying the human face

2. Algorithm used:

3. Linear discriminant analysis (LDA Algorithm)

Following steps to discriminant the input images:

LDA is closely related to PCA, for both of them are based on linear, i.e. matrix multiplication, transformations. For the case of PCA, the transformation is based on minimizing mean square error between original data vectors and data vectors that can be estimated from the reduced dimensionality data vectors.

And the PCA does not take into account any difference in class. But for the case of LDA, the transformation is based on maximizing a ratio of "between-class variance" to "within-class variance" with the goal of reducing data variation in the same class and increasing the separation between classes

C. Eye Detection

There are two purposes of eye detection. One is to sense the existence of eyes, and another is to accurately put eye positions. Under most situations, the eye position is calculated with the pupil center. Current eye detection methods can be divided into two categories: active and passive eye detection. The active detection methods use unique types of lighting. Under IR illumination, pupils show physical properties which can be utilized to localize eyes the advantages of active eye detection methods are that they are very correct.

D. Iris Detection

Actual iris identification can be broken down into four fundamental steps. First, a person stands in front of the iris identification system, generally between one and three feet away, while a wide angle camera calculates the location of their eye. A second camera zooms in on the eye and takes a black and white image. After the iris system has one's iris in focus, it overlays a circular grid (zones of analysis) on the image of the iris and identifies where areas of light and dark fall.

DOI 10.17148/IJARCCE.2017.6261

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The purpose of overlaying the grid is so that the iris scheme can recognize a pattern within the iris and to generate points within the pattern into an eye print.

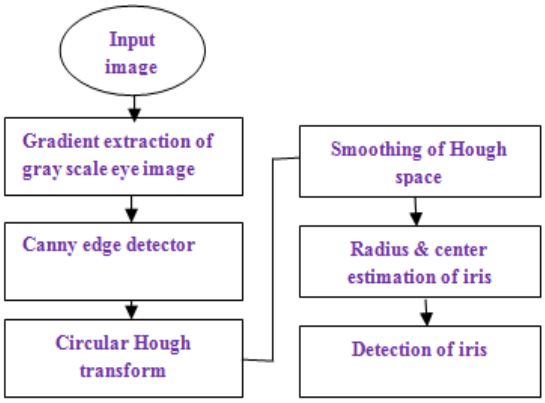

Fig: flow of Iris Detection

The eye-gaze system is a direct-select vision-controlled contact and control method. The system i.e. Eye Gaze, a real time gaze purpose software that controls a computer marker by next the user's gaze. Only requirements to operate the Eye gaze are control of at least one eye with good vision & skill to keep head fairly still. Its primary users can be adults and children with cerebral palsy, spinal cord injuries, brain injuries, ALS, a number of sclerosis, Brainstem stroke, etc. Eye gaze can be used in homes, offices, schools, hospitals, and extensive term care conveniences. By looking at control keys displayed on a screen, a person can create speech, control his surroundings (lights, appliances, etc), type, operate a telephone, run computer software, function a computer mouse, and access the internet and as well e-mail.

Eye pupil location detection:

The following methods have been reported in the literature for eye pupil position detection: Cumulative distribution function (CDF) algorithm, Projection function (PF) algorithm Edge analysis, Integral projection and Gaussian model, Iris shape feature similar Circular Hough transform, Harris corner detector, Isophotes twist estimation

Gaze estimation:

How to Find X-Y co-ordinate

A person can see in a wide range by moving only his eyes, making it important to know the direction of a person's eye gaze to estimate his overall gaze. There are several methods to achieve a reliable estimation of eye gaze. This can be done through the use of head mounted devices [Noris et al., 2008] or by using the corneal reflection of infrared lighting to determine the gaze direction of the pupils [Yoo and Chung, 2003].The method used for this report is by using the position of the pupil relative to the inner eye corner. This relative position can be represented by the vector between the two positions. An example of such vectors can be seen in figure 3.

Having found both the pupil center and the eye corner for both eyes, the representing vector can be computed. This is achieved by finding the horizontal and vertical location differences between the two points. In this vector, the eye corners are the anchor points, because these do not move relative to the face. Thus, the vectors can be represented as follows

$$\boldsymbol{Xscreen = \alpha 0 + \alpha 1x + \alpha 2y + \alpha 3xy}"$$
$$\boldsymbol{Yscreen = \beta 0 + \beta 1x + \beta 2y + \beta 3xy}$$

In these equations,

X screen and Y screen denote the x and y coordinates on the screen, the coefficients and X and Y denote the eye vector values. In order to know where a certain gaze vector is directed, calibration is necessary. A set of known points on the screen are shown to a user. For each of these points, the user has to move their eyes towards them. This results in a set of points on the screen and their corresponding eye vectors. Having collected the eye vectors for these calibration points, a set of coefficients can be found that best translate the eye vectors to the screen points. X screen and Y screen denote the x and y coordinates on the screen, the coefficients and X and Y denote the eye vector values .In the application created for this report a set of twenty-five calibration points was used

Discussion

The purpose of this paper is to promote eye based human computer interaction. Different methods of eye tracking have been reviewed in this paper. The choice of an eye tracking method in any study should be based on the particular demands of the application. None of the current methods is the common best for all applications. The deciding factors in choosing equipment can be reduced to sequential and spatial accuracy, appropriateness for operational circumstances, invasiveness, and cost. The temporal and spatial accuracy should be considered in relation to the objectives of the study.

Higher sequential accuracy means massive data sets, whereas high spatial accuracy tends to require exact stabilization of the subject's head, or the use of more invasive methods. ready conditions limit the choice of a system in freedom of progress for the subject, ambient lighting necessities, and the necessities imposed by special environments, such as a functional magnetic resonance imaging (fMRI) laboratory used in brain imaging.

RESULTS

The result of the system is represented in the X and Y coordinates. The result of the system is represented in the X and Y coordinates and face recognition by using LDA algorithm. By using Voila Jones algorithm we can achieve the good accuracy to detect the user's focus on monitor in X and Y coordinates. Voila Jones computes the image processing very faster than other techniques.

The eye gaze coordinates are calculated with respect to a screen the person is looking at, and also face recognized

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for the purpose of security .in this project we use both system for strong security are represented by a pair of (x, y) coordinates given on the screen coordinate system.
In the following results window 1 shows input video which capture the video with the help of camera. figure shows that the detection of iris boundaries.

Fig.results

ACKNOWLEDGEMENT

This work was supported in part by a grant from the National Science Foundation.

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