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GAME CONTROL USING EYE GAZE

Tripti Vimal1, Rushali Shelke2, Sneha Metkari3, Pooja Kunwar4,Prof. Arati Deshpande[5]

1UG Student, Dept. of Information Technology, JSCOE, Hadapsar, Pune, India,

Vimal.tripti.singh@gmail.com

2 UG Student, Dept. of Information Technology, JSCOE, Hadapsar, Pune, India,

shelke.rushali27@gmail.com

3 UG Student , Dept. of Information Technology, JSCOE, Hadapsar, Pune, India,

Snehametkari13@gmail.com

4 UG Student, Dept. of Information Technology, JSCOE, Hadapsar, Pune, India,

Poojakunwar12@gmail.com

5 Prof. Arati Deshpande Assistant Professor, Dept. of Information Technology, JSCOE, Hadapsar, Pune India,**darati04@yahoo.com**

Abstract: Human Computer Interaction (HCI) is an uprising technology and Eye gaze technique is one of the very significant techniques of HCI. Eye tracking is a technique that allows deciding where an user is constantly staring at a given time. The gaze direction indicates where people fix their attention. The aim of this paper is to develop a desktop based Game for physically impaired users who cannot handle the traditional input devices such as keyboard, mouse. Eye movements or blinks are the only way for the person to communicate .For this eye-gaze is an input mode for the system which has the potential of an efficient computer interface and assumes that the camera and the head position are fixed. It controls mouse-moving by automatically moving the position where eyesight concentrates on and imitates mouse-click by affecting blinking action.

Keywords: Human–computer interface; Eye-blink detection ; Face detection; *Haar classifier; image processing; AdaBoost;Eye Gaze*

INTRODUCTION:

As Human-Computer-Interface is need for developing alternative methods of communication between human and computer that would be suitable for the persons with impairments and would give them the opportunity to become a part of the Information Society. HCI based systems are being developed for easy, effective, efficient, safe and enjoyable learning usage.

FACE DETECTION

Face detection techniques include the facial extraction features like forehead, chin, eyebrows, eyes, nose, mouth and hair line etc.

The face detection method can be organized in two categories:

FACE DETECTION TECHNIQUES:

FEATURE BASED TECHNIQUES:

A feature based approach to face detection in which the features are derived from the intensity data without assuming any knowledge of the face structure is shown. The feature extraction model is biologically motivated, and the location often corresponds to salient facial feature such as eyes, nose etc. This analysis will eventually lead to localization of the face and the features that it contains [1].

IMAGE-BASED TECHNIQUES:

The second method is based on scanning the image of interest with a window that looks for faces at all scales and locations. This category of face detection implies pattern recognition, and achieves it with simple methods such as template matching or with more advanced techniques such as neural networks and support vector machines [1].

LITERATURE SURVEY

An eye-gaze interface seems to be a favorable prospect for a new interface technique, which may be more convenient than the ones we use. Commonly, disarmed people who cannot move anything except their eyes use eye gaze interaction. These entity is designed to direct the computer merely by the eyes. Such systems work well and are a great help for the people who required them, but for others they are inconvenient and less efficient than keyboard and mouse. This contradicts the fact that viewing is an easy task and that eye movements are fast.

Consequently, eye-gaze interfaces for the masses need a different representation to bring benefit to the average user.

1.ELECTROOCULOGRAM:

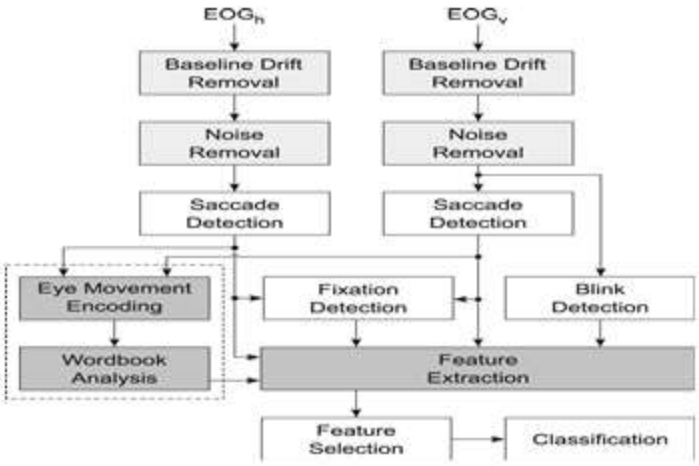
First is a biological measurement technique called an Electro-Oculogram (EOG). The device consists of pairs of electrodes attached around the eye (often either right and left or top and bottom). Inside of the eye is an area called the retina, which carries an electric charge gradient.In this method, sensors are attached at the skin around the eyes to measure an electric field exists when eyes rotate. By recording small differences in the skin potential around the eye, the position of the eye can be estimated. By carefully placing electrodes, it is possible to separately record horizontal and vertical movements. However, the signal can change when there is no eye movement[2].

ALGORITHMS:

1.EOG Signal Categorization.

The proposed algorithm has two advantages as compared to other publication algorithms for a classification of eight-directional movements based on EOG signals. Firstly, the proposed algorithm provided a high accuracy. The algorithm was not affected by various noises and involuntary movements, that is, single blinking (SB), double blinking (DB) and involuntary eye closing (IEC).

ARCHITECTURE:



2.INFRARED LIGHT

An IR image of the human face presents its unique heat-signature and can be used for recognition. The characteristics of IR images maintain advantages over visible light images, and can be used to improve algorithms of human face recognition in several aspects. The main findings of this research are that IR face images are less effected by changes of pose or facial expression and enable a simple method for detection of facialfeatures. In this paper we explore several aspects of face recognition in IRimages[3]. First, we compare the effect of varying environment conditions over IR and visible light images through a case study. Finally, we propose a method for automatic face recognition in IR images, through which we use a preprocessing algorithm for detecting facial elements, and show the applicability of commonly used face recognition methods in the visible light domain[6].

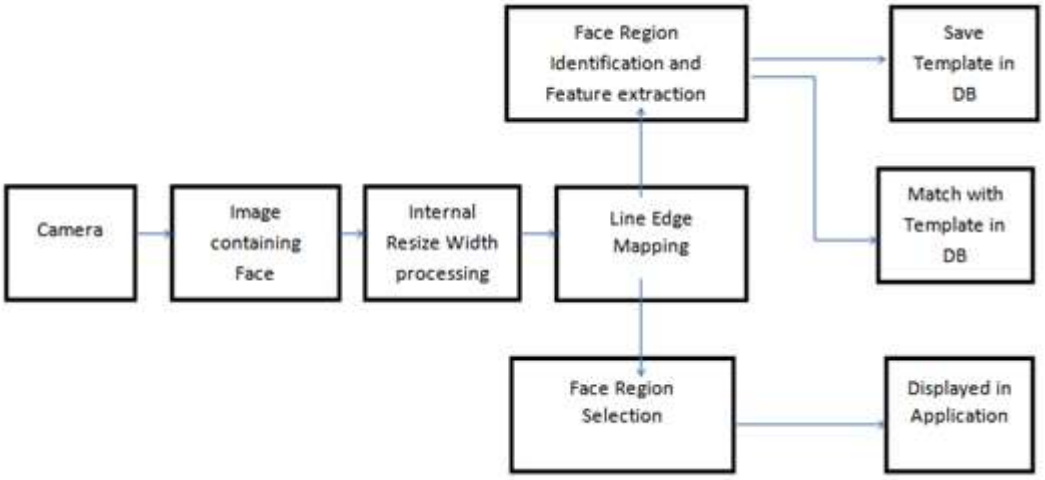
ALGORITHMS:

1.Adaboost

Boosting is an approach to machine learning based on the idea of creating a highly accurate prediction rule by combining many relatively weak and inaccurate rules.

AdaBoost is adaptive in the sense that subsequent weak learners are tweaked in favor of those instances misclassified by previous classifiers. AdaBoost is sensitive to noisy data and outliers. In some problems, however, it can be less susceptible to the overfitting problem than other learning algorithms.

ARCHITECTURE:



PROPOSED SYSTEM:

Previously there was need of heavy wearable pointing device, like head mounting device, sensors where used to track the location of eyes, electronic method like placing skin electrodes around the eyes and measuring the potential differences in the eyes, mechanical method like placing the contact lenses in the eyes, single point video based methods like placing video camera in the front of the eye and two point method which includes infrared light placed in front of eyes. This system aims to introduce an application that would replace the traditional mouse with the human face as a new approach to connect with the computer. The user operates the computer with the help of Eye Gesture and place the mouse pointer simply by looking at the desired position with an eye blink or by staring at the webcam for some time[4]. User who is disabled cannot use hand but can easily operate the computer with the help of Eye Gaze.

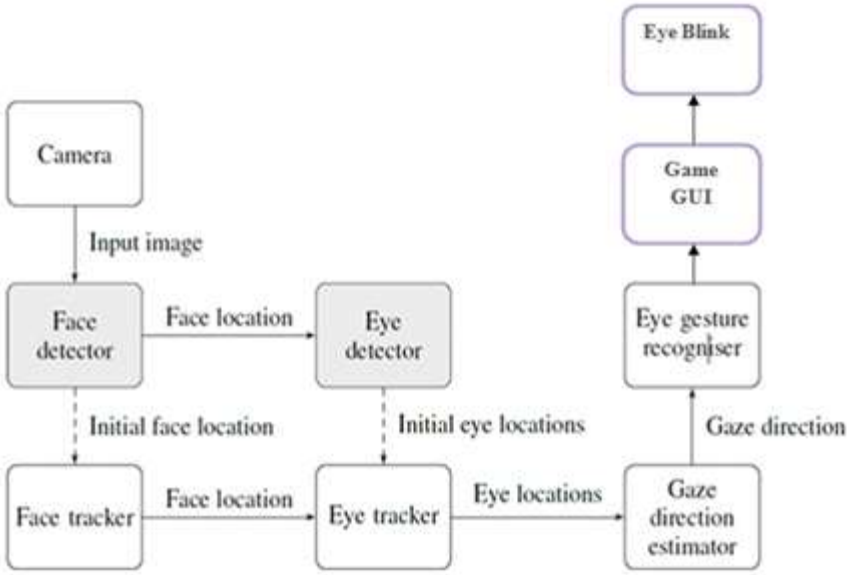


fig:System Architecture

ALGORITHM: Viola- Jones Algorithm

The **Viola–Jones object detection framework** is the first object detection framework to provide competitive object detection rates in real-time proposed in 2001 by Paul Viola and Michael Jones.

The algorithm has four stages:

Haar Feature Selection

Creating an Integral Image

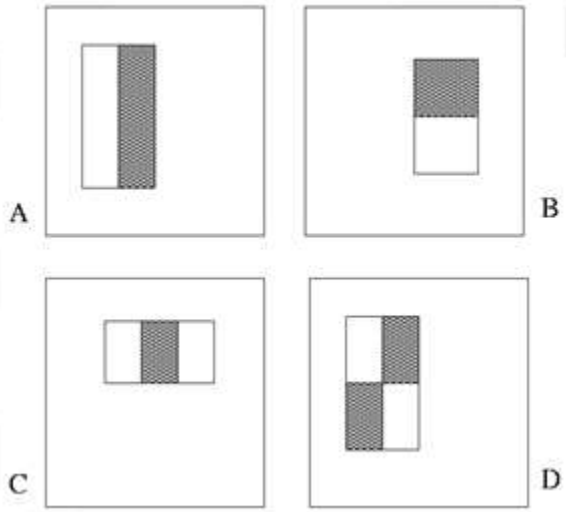
Adaboost Training

Cascading Classifiers

Chart Area t "1150"
(1150, 0.3846)

"Haar-Like" feature representation:

"Rectangle Feature"



$$Value = \sum (pixels\ in\ white\ area) - \sum (pixels\ in\ black\ area)$$

2.Fast computation with integral images:

The *integral image* computes a value at each pixel (x,y) that is the sum of the pixel values above and to the left of (x,y)[5].

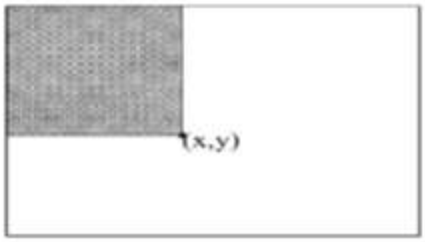


Fig: Integral Image

IMAGE

0	1	1	1
1	2	2	3
1	2	1	1
1	3	1	0

INTEGRAL IMAGE

0	1	2	3
1	4	7	11
2	7	11	16
3	11	16	21

Integral image allows for the calculation of sum of all pixels inside any given rectangle using only four values at the corner of the rectangles.

The sum of the pixels within rectangle D can be computed as 4 + 1 - (2 + 3), where 1-4 are values of the integral image.

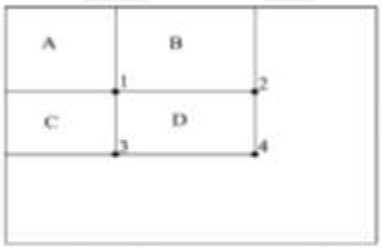


Fig:Calculation example

3.AdaBoost learning algorithm:

The AdaBoost algorithm was introduced in 1995 by Freund and Schapire.AdaBoost is used to improve classification results of a learning algorithm by combining a collection of weak classifiers to form a strong classifier. The algorithm starts with equal weights for all examples. In each round, the weight are updated so that the misclassified examples receive more weight.

$$F(x) = \alpha_1 f_1(x) + \alpha_2 f_2(x) + \alpha_3 f_3(x) + \ldots$$

Weak classifier

Weight

Image

Strong classifier

4.Training the cascade:-

- Set target detection and false positive rates for each stage
- Keep adding features to the current stage until its target rates have been met
  - Need to lower AdaBoost threshold to maximize detection (as opposed to minimizing total classification error)
  - Test on a *validation set*
- If the overall false positive rate is not low enough, then add another stage
- Use false positives from current stage as the negative training examples for the next stage

The key advantage of the AdaBoost over its competitors is the speed of learning. For each feature, the examples are sorted based on a feature value. The optimal threshold for that feature can be then computed in a single pass over this sorted list.

EXPECTED OUTPUT

Priorly, the image is captured through the webcam and then the face and eyes are detected using Viola Jones algorithm and stored in the database. A game is created on which there is the interaction of eyes where, user can play game through his eyes.

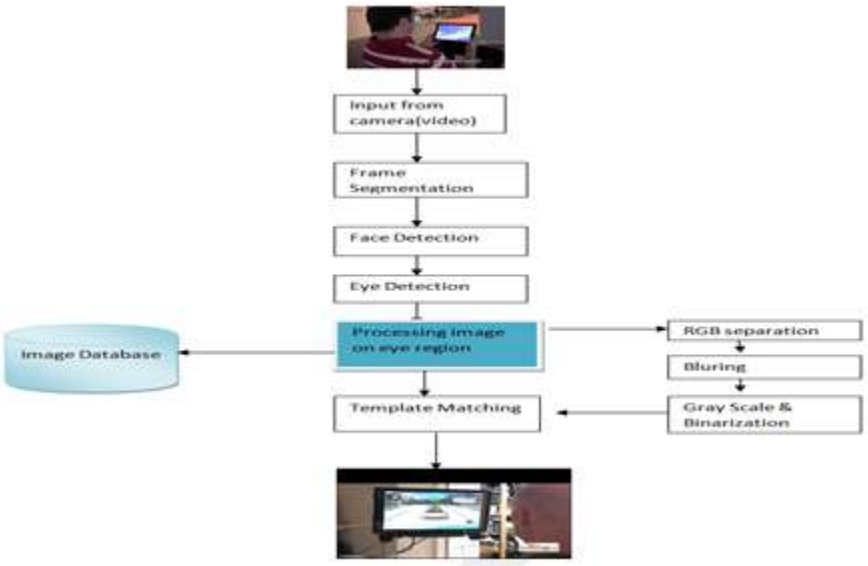


Fig Expected Outcome

FUTURE SCOPE:

- The eye-tracking equipment should be able to identify the tracked persons, most likely by iris pattern recognition.
- Somewhat Remote control devices for Home appliances like TV sets, Refrigerator, washing machine etc which is controlled through eye.
- GUI which is totally controlled by Eye Blink of player.

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CONCLUSION:

The Game Control Using Eye Gaze system is designed for physically impaired people, to easily interact with the desktop based game without any external hardware like (mouse, keyboard, joystick, trackball).This game has the feature of moving in all directions having left, right, up, down movement control which increase independency of physically impaired people. This system is cost effective (not using external devices) so it can also be used by the Regular user.

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