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RESEARCH ARTICLE

A Face as a Mouse for Disabled Person

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Abstract—This paper is used for an application that it's capable of swapping mouse with human face for interaction with PC. In paper there is one web cam. It's an external device, which detect the human face or we can say that tracking and detecting the facial expressions of human being. This is our theory paper and in this we explained – in what way we detect our facial expression. Facial features (eyebrows, nose and eyes) are detected. We are trying to compensate those people who have hands disabilities prevent them from using the mouse.

Keywords—Eye detection, Eye movement, Face detection, Human-Computer interaction, Support Vector Machine (SVM), Motion detection, Blink detection

I. INTRODUCTION

Eyes and their movements are important in expressing a person's desires, needs and emotional states. The significance of eye movements with regards to the perception of and attention to the visual world is certainly acknowledged since it is the means by which the information needed to identify the characteristics of the visual world is gathered for processing in the human brain. Hence, robust eye detection and tracking are considered to play a crucial role in the development of human-computer interaction, creating attentive user interfaces and analyzing human affective states [1]. Recently digital cameras have begun to incorporate real time face tracking technology. This new technology can be used to improve subject focus, image exposure and potentially image composition by providing user feedback. As the capabilities of digital imaging devices continue to improve it is clear that even more detailed analysis can be applied to the tracked faces within a digital image. In particular the occurrence of undesirable eye-blinking or partially closed eyes is the cause of many spoiled photographs [2]. This technology is intended to be used by disabled people who face a lot of problems in communicating with fellow human beings. It will help them use their voluntary movements, like eyes and nose movements: to control computers and communicate through customized, educational software or expression building programs. People with severe disabilities can also benefit from computer access and take part in recreational activities, use internet or play games. This system uses an USB or inbuilt camera to capture and detect the user's face movement. The proposed algorithm tracks the motion accurately to control the cursor, thus providing an alternative to computer mouse or keyboard [3]. A vision-based system for detection of eye movements is presented, together with its implementation as a Human–Computer Interface for people with disabilities. The proposed work includes face detection, face tracking, eye-blink detection, and interpretation of a sequence of blinks in real time to control a non-intrusive human–computer interface To replace the traditional mouse with the human eye movements to interact the Computer. It is to assist the physically challenged persons without hands to use the computer efficiently and also easily [4].

II. RELATED WORK

Eye tracking and head movement detection are widely investigated as alternative interface methods. They are considered to be easier to use than other methods such as voice recognition or EEG/ECG signals. They also have achieved higher accuracy and performance. In addition, using eye tracking or head movement detection as alternative interface, control or communication methods is beneficial for a wide range of severely disabled people who are left with minimal ability to perform voluntary motion. Eye and head movements are the least affected by disabilities because, for example, spinal cord injuries do not affect the ability to control them, as they are directly controlled by the brain. Combining eye tracking and head movement detection can provide a larger number for possible control commands to be used with assistive technologies such as a wheelchair it [1]. A statistical Active Appearance Model (AAM) is developed to track and detect eye blinking. The model has been designed to be robust to variations of head pose or gaze. In particular we analyze and determine the model parameters which encode the variations caused by blinking. This global model is further extended using a series of sub-models to enable independent modeling and tracking of the two eye regions. Several methods to enable measurement and detection of eye-blink are proposed and evaluated. The results of various tests on different image databases are presented to validate each model [2]. This technology is intended to replace the conventional computer screen pointing devices for the use of disabled or a new way to interact with mouse. the system we describe is real time, on-intrusive, fast and affordable technique for tracking facial features. The suggested algorithm solves the problem of occlusions and is robust to target variations and rotations. It is based on novel template matching technique. A SSR Filter integral image, SVM is used for adaptive search window positioning and sizing [3]. Camera mouse has been widely used for handicap person to interact with computer. The utmost important of the use of camera mouse is must be able to replace all roles of typical mouse and keyboard. It must be able to provide all mouse click events and keyboard functions (include all shortcut keys) when used by handicap person. In this method, the camera mouse system with timer as left click event and blinking as right click event. Also, we modify original screen keyboard layout by add two additional buttons and change behavior of CTRL, ALT, SHIFT, and CAPS LOCK keys in order to provide shortcut keys of keyboard [7]. A vision based human–computer interface is presented in this paper. The interface detects eye movements and interprets them as cursor control commands. The employed image processing methods include webcam for detecting the face, and template matching method [1] based eye region detection. The Haar feature technique is used for eye feature extraction. SVM classification method is used for classifying the eye movements. The classification of eye movements such as eye open, eye close, eyeball left, and eyeball right movements are used for cursor top, bottom, left and right movement respectively. The interface is based on a notebook equipped with a typical web camera and requires no extra light sources. In Hough transform, circular method is used to control the cursor movements. This method is used for physically challenged persons to operate the computers effectively with their eye movements [4]. Eye tracking system is the system which tracks the movement of user's eye. The handicap people with several disabilities cannot enjoy the benefits provided by computer. So, the proposed system will allow people with several disabilities to use their eye movement to handle computer. This system requires only low-cost webcam and personal computer. The proposed system has five stage algorithms that is used to developed estimate the direction of eye movements & then uses the direction information to manipulate the computer. The proposed system can detect eye movement accurately eye movement in real time[10].

III. OUTLINE OF THE WORK

A. Face Detection

The Face detection is a computer technology that determines the locations and sizes of human faces in digital images. It detects facial features and ignores anything else, such as buildings, trees and bodies. A simple face tracking system will be developed.Face detection has always been a vast research field in the computer vision world. Considering that it is the back bone of any application that deals with the human face. The face detection method can be organized in two categories:

1) Feature-based method:

The first involves finding facial features (e.g. noses, eye brows, lips, eye pupils) and in order to verify their authenticity performs by geometrical analysis of their locations, areas and distances from each other. This analysis will eventually lead to localization of the face and the features that it contains. The feature based analysis is known for its pixel-accuracy, features localization and speed, on the other hand its lack of robustness.

2) Image-based method:

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. Before over viewing the face detection algorithm we applied in this work here is an explanation of some of the idioms that are related to it.

B. Eye Region Detection

The position of the eyes in the face image is found on the basis of certain geometrical dependencies. The image of the extracted eye region is further preprocessed for performing eye-movement detection. The located eye region is extracted and further eye tracking by means of template matching. The extraction of the eye region is performed only at the initialization of the system. Template-Matching is a well-known method for object detection. In our template matching method, a standard eye pattern is created manually and given an input image, the correlation values with the standard patterns are computed for the eyes. The existence of an eye is determined based on the correlation values. This approach has the advantage of being simple to implement. However, it may sometimes be inadequate for eye detection since it cannot effectively deal with variation in scale, pose and shape.

C. Eye Region Detection

The different eye-movements are classified by using the support vector machine classifier. The eye-movements are eye open, eye close, eyeball left and eyeball right. SVM can be used for classifying the obtained data. SVM are a set of related supervised learning methods used for classification and regression. In SVM, the multi class training file is used.

C. Support vector machines[SVM]

SVM are a new type of maximum margin classifiers: In "learning theory" there is a theorem stating that in order to achieve minimal classification error the hyper plane which separates positive samples from negative ones should be with the maximal margin of the training sample and this is what the SVM is all about. The data samples that are closest to the hyper plane are called support vectors. The hyper plane is defined by balancing its distance between positive and negative support vectors in order to get the maximal margin of the training data set.

D. Eye Movement Interaction

The Hough transform is a feature extraction technique used in image analysis, computer vision, and digital image processing. The purpose of the technique is to find imperfect instances of objects within a certain class of shapes by a voting procedure. The transform was popularized in the computer vision community. If the control movement is detected by the system, the action assigned to the highlighted button is executed.

E. Face Tracking

Now that we found the facial features that we need, using the SSR and SVM, Integral Image methods we will be tracking them in the video stream. The nose tip is tracked to use its movement and coordinates as them movement and coordinates of the mouse pointer. The eyes are tracked to detect their blinks, where the blink becomes the mouse click. The tracking process is based on predicting the place of the feature in the current frame based on its location in previous ones; template matching and some heuristics are applied to locate the feature's new coordinates.

F. Motion Detection

To detect motion in a certain region we subtract the pixels in that region from the same pixels of the previous frame, and at a given location (x, y); if the absolute value of the subtraction was larger than a certain threshold, we consider a motion at that pixel.

G. Blink detection

We apply blink detection in the eye's ROI before finding the eye's new exact location. The blink detection process is run only if the eye is not moving because when a person uses the mouse and wants to click, he moves the pointer to the desired location, stops, and then clicks; so basically the same for using the face: the user moves the pointer with the tip of the nose, stops, then blinks. To detect a blink we apply motion detection in the eye's ROI; if the number of motion pixels in the ROI is larger than a certain threshold we consider that a blink was detected because if the eye is still, and we are detecting a motion in the eye's ROI, that means that the eyelid is moving which means a blink. In order to avoid multiple blinks detection while they are a single blink the user can set the blink's length, so all blinks which are detected in the period of the first detected blink are omitted.

H. Eyes Tracking

If a left/right blink was detected, the tracking process of the left/right eye will be skipped and its location will be considered as the same one from the previous frame (because blink detection is applied only when the eye is still). Eyes are tracked in a bit different way from tracking the nose tip and the BTE, because these features have a steady state while the eyes are not (e.g. opening, closing, and blinking) To achieve better eyes tracking results

we will be using the BTE (a steady feature that is well tracked) as our reference point; at each frame after locating the BTE and the eyes, we calculate the relative positions of the eyes to the BTE; in the next frame after locating the BTE we assume that the eyes have kept their relative locations to it, so we place the eyes¨ ROIs at the same relative positions to the new BTE. To find the eye's new template in the ROI we combined two methods: the first used template matching, the second searched in the ROI for the darkest5*5 region (because the eye pupil is black), then we used the mean between the two found coordinates as the new eye's location.

I. Combining eye tracking and head movement detection

Some research has been done on using a combination of eye tracking and head movements presented a head and eye tracking system which uses the epipolar method along with feature point matching to estimate the position of the head and its rotational degree. The feature points are high brightness LEDs on a helmet. For eye tracking, it uses an LED for constant illumination and a Kalman filter is used for pupil tracking. Their presented work needs more theoretical proof. In addition, there is no mentioned optimization for the algorithm and the required CPU time analysis is not reported. There are a lot of hardware requirements for the system which makes it relatively expensive to implement. Iwata and Ebisawa [51] introduced a good flexible eye mouse interface which is the pupil mouse system combined with head pose detection. The system detects pupil motion in the video frames by finding the difference between the bright and dark pupil images. Head direction is detected by tracing key feature points (nostrils). The nostrils were detected as the darker areas in the bright and dark images. The information obtained is mapped into cursor motion on a display. Using head pose detection to support the pupil mouse is a good idea which improved the overall performance. However, the head pose detection part increases the complexity of the pupil mouse algorithm which causes a need for a lot of optimization techniques, which may not be suitable for real world applications.

IV. PROPOSED

In proposed system, there is an external web cam that is connected to the system. Then this web cam track and detect the human facial expression like nose, eyes, and eyebrows. We will apply their Clustering algorithm for find out clusters and it includes SSR Filter, with the help of that we will find out BTE (Between the eye), ROI (Region of interest), Find nose tip, Find Eye pupil. After that, When RGB cam detect human face pixels which is in form of RGB format that is called as human face recognition. Then RGB pixels convert it into grey pixels and afterward it is in the form of binary format. According to ROI (Region of interest) action performed called as events of mouse. Then finally action performed method is done.

V. EXPECTED RESULT

VI. APPLICATIONS

A. It can be used to track faces both precisely and robustly. This aids the development of affordable vision based user interfaces that can be used in many different educational or recreational applications or even in controlling computer programs.

B. The real life situation of eye tracking system. Eye tracking is test usability of software, interactive TV, video game, advertisement and other such activity. Eye tracking are used for reading techniques. Eye tracking uses to examine usability of websites where user will focus their attention on. The motivation from image viewing behavior, expectation of regarding web site and how use view web site.

C. On execution the application makes the cursor move with the help of the eye independent of the desktop.

CONCLUSION

In this paper, an eye motion based on low-cost eye tracking system is presented. In this system we proposed face detection algorithms. The user with several disabilities can use this system for handling computer. A real time eye motion detection technique is presented. In this, paper proposed a face detection algorithm and clustering algorithm using image captured by a single web camera attached to the system. By using mouse cursor movement with the proportional eye and nose movement.

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