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Iris Moment Detection to Operate the Computer using Bayesian Learning

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Abstract - Human-computer interaction (HCI) is a multidisciplinary field to focusing on the design of computer technology and, in particular, the interaction between humans and computers. The motion capturing system can able to create this human computer interaction. This process is completed by applying a digital signal processing system which takes the live video feed input from the users by using web-camera, and then the raw data is converted it into informative data in the form of digital signal. In existing work, the cognitive based knowledge processing system is designed to get the feedback and improve the tone of the neural schema. The cognitive technology-based software must have the capability to derive a dynamic situation and needs to perform a necessary task which is related to the decision taken by the system. The flow of information between the human and computer is defined as the loop of interaction. It deals with the design, execution and assessment of computer systems and related phenomenon that are for human use. The system observes the movement of human face, eye and operates the mouse input by recognizing the pattern of the movement. The processing system is carried out in four phases: Observing the iris movement, Identification of input operation, based on the input operation the prediction of task to be performed, Executing the task and produce the output and gather the feedback from the user regarding the carrying into action, to improve the cognitive power of the system. The cognitive ability is derived using the Bayesian learning. On performing the training procedure in the learning model which required for each session, scores based on variance projection as well as the relative positions of the iris are analyzed and interpreted to perform the various mouse functions accordingly. The proposed system identifies the eye movement to control and operate the input device by identifying the pattern of iris movement and enables click and double click operation based on eye blinking operation.

Index Terms – Human Computer Interaction (HCI), Cognitive technology, Iris, Learning Model.

I. INTRODUCTION

HCI focus on interfaces between people and computers and how to design, evaluate, and implement interactive computer systems that satisfy the user. The human–computer interface can be described as the point of communication between the human user and the computer. The flow of information between the human and computer is defined as the loop of interaction. It deals with the design, execution and assessment of computer systems and related phenomenon that are for human use. HCI process is completed by applying a digital signal processing system which takes the analog input from the user by using dedicated hardware (Web Camera) with software.

II. SYSTEM DEVELOPMENT

Existing System:

In the existing system, the software architecture is developed to translate movements into switch events. It also includes the head mounted camera to monitor the eye movement. The architecture comprises low pass and derivative filters, an unsupervised classifier that adapts continuously to the strength of the user's movements and a

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finite state machine which sets up a timer to prevent in-voluntary movements from triggering false positives. Technology has always lent a helping hand for people with disabilities such as visual impairment, speech impairment, people with motion disabilities or disorders etc. Assistive Computer Technology is any piece of equipment that is customized to make life easier for a person who has a disability.

Proposed System:

The movement of a user's eyes can provide a convenient, natural, and high- bandwidth source of user input. The proposed algorithm is initialized on detecting a face from the USB camera feed, under satisfactory illumination. Eye tracking is the process of measuring either the point of gaze or the motion of the eye relative to the head. When the position of the user is sufficiently constant, the system for detecting and analyzing blinks and mouse movements is initialized automatically, depending on the involuntary blink of the user. The relative positions of the eye and iris are analyzed and interpreted to perform the various mouse functions accordingly using the Bayesian learning.

The accurate measurement of three- dimensional eye movements is desirable in many areas, such as in oculomotor and vestibular research, medical diagnostics, and photo-refractive surgery. The three main ways to measure three-dimensional eye movements are to use scleral search coils, electro--oculography, or video-oculography. Video-oculography is the only one of these options that is suited for clinical practice, since scleral search coils can be uncomfortable and electro- oculography has low spatial resolution. Using video-oculography, horizontal and vertical eye movements tend to be easy to characterize, because they can be directly deduced from the position of the pupil. Torsional movements, which are rotational movements about the line of sight, are rather more difficult to measure; they cannot be directly deduced from the pupil, since the pupil is normally almost round and thus rotationally invariant. One effective way to measure torsion is to add artificial markers (physical markers, corneal tattoos, scleral markings, etc.) to the eye and then track these markers. However, the invasive nature of this approach tends to rule it out for many applications. Non-invasive methods instead attempt to measure the rotation of the iris by tracking the movement of visible iris structures.

III. SYSTEM IMPLEMENTATION

The proposed system is implemented with the following modules.

1. Live Video Feed Capturing and Detection of the Face, Eye and Iris.
2. Identification of input operation,
3. Based on the input operation the prediction of task to be performed using artificial neural network
4. Executing the task and produce the output (click and double click operation)
5. Performing Keyboard operations

Live Video Feed Capturing:

Embedded systems using input capture will record a timestamp in memory when an input signal is received. It will also set a flag indicating that an input has been captured. This allows the system to continue executing without interruption while an input is being received while still having the capability to trigger events based on the exact time when the input was received. The corresponding capability to trigger an output at a specified time, based on a timestamp in memory, is called output compare.

There are many programmable interrupt controllers that provide dedicated input capture pins and a programmable counter along with it. These pins generate interrupts to the controller, which then executes an interrupt service routine. The interrupts can be programmed to occur at the rising or falling edge of the input signal, depending on requirements.

An image sensor or imaging sensor is a sensor that detects and conveys the information that constitutes an image. It does so by converting the variable attenuation of waves (as they pass through or reflect off objects) into signals, the small bursts of current that convey the information. The waves can be light or other electromagnetic radiation. Image sensors are used in electronic imaging devices of both analog and digital types, which include digital cameras, camera modules, medical imaging equipment, night vision equipment such as thermal imaging devices, radar, sonar, and others. As technology changes, digital imaging tends to replace analog imaging.

Early analog sensors for visible light were video camera tubes. Currently, used types are semiconductor charge-

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coupled devices (CCD) or active pixel sensors in complementary metal–oxide–semiconductor (CMOS) or N-type metal-oxide- semiconductor (NMOS, Live MOS) technologies. Analog sensors for invisible radiation tend to involve vacuum tubes of various kinds. Digital sensors include flat panel detectors.

The proposed algorithm is initialized on detecting a face from the USB camera feed, under satisfactory illumination. When the position of the user is sufficiently constant, the system for detecting and analyzing blinks and mouse movements is initialized automatically, depending on the involuntary blink of the user. A local template of the open eye is used for the subsequent tracking of the eye. On performing the training procedure required for each session, scores based on variance projection as well as the relative positions of the iris are analyzed and interpreted to perform the various mouse functions accordingly. This analysis is performed at each frame. It is assumed that a frontal face is initially detected and tracked using an appropriate procedure. Once the face is detected and stabilized, it is necessary to locate the eyes in order to track the iris and analyze blinks. An involuntary eye blink triggers the eye localization process. To accomplish this, the deference image of the head region of consecutive frames is created and then thresholding is applied with a suitable threshold value. Some room for head movement should be accounted for without resulting in errors in mouse cursor movement. It is necessary to distinguish head movements from iris movements. Thus tracking of the head to a small extent is necessary. The predefined pattern is commonly known to be as the default pattern. The default pattern technique is normally applied to all experimental purpose and this is to ensure that the absolute or the required data is obtained at the user end. Generally, the predefined pattern technique is carried out for comparative study, where before an execution of any task the data's, more precisely the current data are compared with the predefined pattern and are then subjected to implementation. The way of obtaining the predefined pattern can vary from different manufactures. In this page processing technique, the predefined pattern is obtained by making use of the angle calculation. To be more detailed, the user who has been sensed by the camera is asked to focus at four different points from the page provided. The points that are to be focused are namely, the center point, the top of the page, the bottom of the page, the left and right corner. The system is trained in such a way that , it can calculate the angle based on the obtained reference points ($\theta1$,$\theta2$,$\theta3$,$\theta4$,$\theta5$).

Steps To Capture Input:

1. CCD sensor / Web Camera is used capture the live feed from the user.
2. Face and eye detection algorithm is used to identify and recognize the user input.
3. Camera is activated to capture the live feed provided from the user.
4. From the captured input, ROI is identified by checking face pattern.
5. Captured input is stores as image and the pixel point values are normalized to recognize the face input and eye input.
6. By using edge detection and shape detection, the eye pattern is recognized and the input is filtered from the image.

Identification of Input Operation:

Depending upon the area over which the users place their line of sight, the predefined pattern calculation is varied. Once the pattern is recorded for one single user, it remains the same throughout the page. And every time the user reads a line the current angle is compared with the predefined angle and then the line is read. The angles that are calculated are placed as an array matrix in the memory that are then used for comparative study. The lines in the page can be read with or without the use of the mouse pointer. The case in which there is a demand for the cursor is that when a random pattern is recorded. In this case the user is advised to make use of the mouse pointer. The same may be applied for closing a tab. In all other cases the use of mouse pointer is not a demand. The user input is captured by camera. The input image undergoes image enhancement technique to extract the iris movement. The enhancement technique such as sharpening and segmentation. Sharpening is done to neglect the background of the image this in turn gives the accurate pixel value of iris. Second technique is segmentation this is done for grouping similar pixels this in turn helps to split the iris from the input image.

Then the image is given to the motion sensor. Motion sensor is used to detect the movement of iris. It will detect only pixel point and its coordinate. Using this coordinates the movement of iris is calculated.

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Iris Movement Updating And Performing Mouse Movements:

To validate the correctness of our methodology, we check whether it works on a video of a human eye by comparing its torsional estimates with estimates obtained through visual matching. Then, we check to see whether the three-dimensional eye positions from a standard nine-point calibration obey Listing's law. Sensors and their placement are never perfect; therefore most systems incorporate a delay time before switching. This delay time is often user-selectable, but a typical default value is 15 minutes. This means that the sensor must detect no motion for the entire delay time before the lights are switched. Most systems switch lights off at the end of the delay time, but more sophisticated systems with dimming technology reduce lighting slowly to a minimum level (or zero) over several minutes, to minimize the potential disruption in adjacent spaces. If lights are off and an occupant re-enters a space, most current systems switch lights back on when motion is detected. However, systems designed to switch lights off automatically with no occupancy, and that require the occupant to switch lights on when they re- enter are gaining in popularity due to their potential for increased energy savings. These savings accrue because in a space with access to daylight the occupant may decide on their return that they no longer require supplemental electric light. The input image undergoes image enhancement technique to extract the iris movement. By comparing the continuous video frames, the movement of the eye is identified and the corresponding movement is generated at mouse. The movement of mouse is done in all possible directions with the continuous validation using ANN.

Steps for Pattern Matching and Mouse Movement:

Pattern matching algorithm is used to compute the pattern related to the mouse movement.

1. From the continuous images, the ROI is identified and filtered from the images.
2. The pixel points of the ROI is compared in each images
3. The movement pattern is identified by checking the same pixel of the detected shapes.
4. From the movement of The pixel values, pattern of mouse movement is detected.
5. Mouse control is selected and the move operation is executed.
6. Supervised learning with back propagation is used to identify the input type and click operation on the particular action event.

Click and Double Click Operations:

The absolute difference is less than difference coordinates than the user is reading the same line. If the absolute difference is greater than difference coordinate then scroll operation has to be performed. The obtained pattern has to be matched with pre-defined pattern. Then the required action has to be performed. Then the task has to be executed. The same set of input sequence is used to detect the blink operation for click event in mouse. Based on the continuous blinking operation in the form double tab, the click events are executed as single click and double click. The system is also able to provide the keyboard input based on the eye movement.

Performing Keyboard Operations:

The keyboard operations are performed by creating the virtual keyboard environment. The selection of letters and typing operation is performed with the help of head movement and eye blinking operations. The combination of these operations will take long time to complete and hence the suggestion-based typing is created in this system. In the suggestion-based typing, based on the user typed character, the suggested words are displayed to select the words with the minimal time.

IV. CONCLUSION

Eye movement can be regarded as a pivotal real-time input medium for human-computer communication, which is especially important for people with physical disability. In order to provide the high-quality system which is employed to help the disabled people there is a requirement to manage the dynamic situations. The proposed system focuses on providing a simple and convenient interactive mode by only using user's eye. Based on the face and eye movement, the user input in both keyboard and mouse can be generated. The quality of the model has to be measured in metric related to the knowledge processing system, such as, improvement ratio of the cognitive system, number of dynamic situations handled and time required to dispatch the procedure.

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