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Cursor tracking by sensory organs for handicapped people

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ABSTRACT

A vision primarily based Human-Computer interface is conferred during this paper. The utilized image process ways embrace digital cameras for investigation the face, and example matching method-based eye region detection. SVM classification methodology is employed for classifying the attention movements. The classification of eye movements like eye open, eye closed, eyeball left, and eyeball right movements area unit used for indicator high, bottom, left and right movement severally. The interface relies on a notebook equipped with a typical internet camera and needs no further lightweight sources. All of these devices need manual management and can't be utilized by persons impaired in movement capability. There's a necessity for developing different ways of communication between humans and laptops that might be appropriate for the persons with motor impairments and would provide them the chance to become a section of the knowledge Society. In Hough rework, circular methodology is employed to regulate the indicator movements. This technique is employed for physically disabled persons to work with computers effectively just by their facial movements.

Keywords— *HAAR technique, Image Processing, SVM classification*

1. INTRODUCTION

The computer has influenced our life in such a way that it's terribly troublesome to sustain while not a laptop. For physically disabled persons, particularly persons while not hands and legs. Keyboard and mouse area unit the foremost essential input devices to figure with a laptop. By the utilization of on-screen keyboard, an inform device like a mouse is sufficient to work a laptop with user interface computer code. The fundamental actions of a mouse area unit Mouse Movement and push-button Click. This methodology is on developing associate degree helpful technology that replaces the mouse movement by head movement exploitation OpenCV. The push-button Click is enforced by any facial features like blinking eye, gap mouth, and head movement. This methodology describes associate degree eye-control methodology supported Electro oculography (EOG) to develop a system for power-assisted quality. The system consists of a regular electric chair with associate degree on-board laptop, sensors and a graphic interface pass by the pc. An impact system is conferred that permits the unfit, particularly those with solely eye-motor coordination, to regulate a chair and, in general, to measure additional severally. This methodology introduces a unique camera mouse driven by 3D model primarily based visual face chase technique. Whereas the camera becomes a normal configuration for private laptop (PC) and laptop speed becomes quicker and quicker, achieving human-machine interaction through visual face chase becomes a possible resolution to hand-free management. Supported the calculable rigid and non-rigid facial motion parameters, three mouse management modes:

- Direct mode
- Joystick mode and
- Differential mode area units enforced for mouse management.

Gaze positions will give vital cues for natural pc interfaces. During this technique, a replacement gaze estimation technique supported a three-dimensional analysis of the human eye which may be utilized in Head-Mounted Show (HMD) environments. There are already many industrial merchandises that use gaze detection technology during this technique, a replacement method of estimating gaze purposes is given during which the user is merely needed to stare upon one point for the needs of standardization. This technique aims to gift associate degree application that's in a position of commutation the standard mouse with the face as a replacement thanks to acting with the pc. Face expression nose tip and eyes are detected and caterpillar-tracked in a time period to use their actions as mouse events. It is applied to a large variety of face scales. Our basic strategy for detection is the quick extraction of face candidates with a Six-Segmented Rectangular (SSR) filter and face verification by a support vector machine. The left/right eye blinks hearth left/right depression events to implement scale-adaptive face detection and trailing system mistreatment JAVA (J2ME) for face candidate detection. Camera mouse has been widely used for handicap person to act with pc. The utmost vital of the utilization of the camera mouse is should be ready to

replace all roles of typical mouse and keyboard. It should be ready to give all depression events and keyboard functions (include all road keys) once utilized by handicap persons during this technique, the camera mouse system with a timer as left-click event and blinking as right-click event. Also, we have a tendency to modify original screen keyboard layout by add 2 further buttons and alter the behavior of CTRL, ALT, SHIFT, and CAPS LOCK keys so as to produce road keys of the keyboard.

Eye detection and gaze estimation play a very important role in several applications, e.g., the eye-controlled mouse within the aiding system for disabled persons. During this technique, we have a tendency to propose a time period eye-gaze estimation system. During this technique, the methodologies of eye detection and gaze trailing supported a general low-resolution digital camera, that sight eyes and track gaze accurately in real-time while not high-ticket and specific instrumentality.

2. SYSTEM ARCHITECTURE

2.1 Face Detection

HAAR cascade algorithmic rule is employed for face detection. The face is recognized by HAAR cascade feature. This feature considers adjacent parallelogram at a selected location in an exceedingly detection window. The common HAAR feature for face detection has 2 adjacent rectangles that lie on top of the attention and therefore the cheek region. HAAR cascade algorithmic rule perpetually captures positive pictures similarly as negative pictures for face detection. In face detection edge detection and line detection are administered. The algorithmic rule has four stages:

(a) HAAR Feature choice
(b) Making associate degree Integral Image
(c) Adaboost coaching
(d) Cascading Classifiers

2.2 Eye Detection

A digital process conception guide matching is employed for detection of little elements of image with templates. CV2.The matching guide operate is employed in OpenCV. A guide means that loading associate degree input image and a patch image. In guide matching it compares the patch of input image below the guide image.

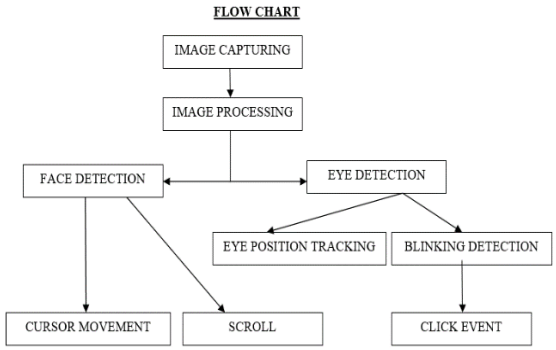


Fig. 1: Flow chart

3. METHODOLOGY

This HCI (Human-Computer Interaction) application in Python (3.6) Version will allow us to control the mouse cursor with the facial expressions; it works with the regular built-in webcam in the Laptop. No wearable gadgets or sensors are needed. The Actions that include the facial expressions are

- Winking of eyes
- Squinch eyes (To peep/ look with the eyes partially closed, similar to as looking too bright sunlight.
- Moving Head Around (Pitch and Yaw)
- Opening the mouth (To Activate and Deactivate the Cursor movement)

4. CODE REQUIREMENTS

These are all the packages available in python.
NumPy - 1.13.3
OpenCV - 3.2.0
PyAutoGUI - 0.9.36
Dlib - 19.4.0
Imutils - 0.4.6

4.1 NumPy

NumPy is the major bundle for logical processing with Python. NumPy Consists of

- An amazing N-dimensional cluster object
- Sophisticated (broadcasting) capacities
- Tools for coordinating C/C++ and Fortran code
- Useful direct polynomial math, Fourier change, and irregular number abilities

Other than its conspicuous logical uses, NumPy can likewise be utilized as a productive multi-dimensional compartment of conventional information. Subjective information types can be characterized. This permits NumPy to consistently and rapidly coordinate with a wide assortment of databases.

4.2 OpenCV

OpenCV presents another arrangement of instructional exercises that will control you through different functions accessible in OpenCV-Python. OpenCV bolsters a wide assortment of programming dialects, for example, C++, Python, Java, and so on. And is accessible on various stages including Windows, Linux, operating system X, Android, and iOS. Interfaces for fast GPU tasks dependent on CUDA and OpenCL are additionally under dynamic improvement. OpenCV-Python is the Python Programming interface for OpenCV, consolidating the best characteristics of the OpenCV, C++ Programming interface and the Python language.

4.3 PyAutoGUI

The reason for PyAutoGUI is to give a cross-stage Python module for GUI mechanization for people. The Programming interface is intended to be as basic as conceivable with reasonable defaults. PyAutoGUI can recreate moving the mouse, tapping the mouse, hauling with the mouse, squeezing keys, squeezing and holding keys, and squeezing console hotkey blends. PyAutoGUI has no conditions (other than a cushion and some different modules, which are introduced by pip alongside PyAutoGUI). It needn't bother with the pywin32 module introduced since it utilizes Python's own C type's module

4.4 Dlib

Dlib is a broadly useful cross-stage programming library written in the programming language C++. Its structure is vigorously affected by thoughts from a plan by agreement and segment based programming designing. Subsequently, it is, as a matter of first importance, a lot of autonomous programming parts.

4.5 Imutils

A progression of accommodation capacities to make essential picture handling capacities, for example, interpretation, pivot, resizing, skeletonization, and showing Matplotlib pictures simpler with OpenCV and both Python 2.7 and Python 3.6.

5. GOMS MODEL

- **Goals:** Face Detection, Cursor Movement, Scrolling
- **Operators:** Facial Movements, Eye, Mouth
- **Methods:** Mouse, Hand, Face, Wireless Mouse, Key Board, Joystick
- **Selection Rules:** Detecting the Face, Recognizing the Eye, Recognizing the Mouth, Using Facial movements to move the cursor, Using Mouse to move cursor.

6. WORKING

This project is focused on predicting the facial landmarks of the face. The Code will accomplish a lot of things exploitation of facial landmarks. To notice the eye blinks in real-time to predict emotions of the face. The applications, outcomes, and prospects of facial landmarks are very huge and intriguing. Dlib's prebuilt model, that is basically associate in nursing implementation of, not solely will a face detect fast and even allow to precisely predict 65 2D Facial Landmarks as mentioned below.

Fig. 2: 2D Landmarks of the Face

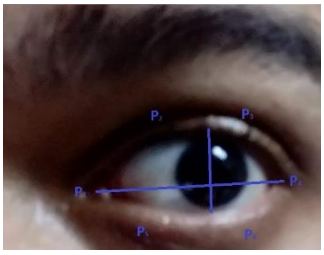
Using the above landmarks of the face, we are able to build applicable options that may any permit to sight sure actions, like victimization the Eye-Aspect-Ratio (more on this below) to sight a blink or a wink, victimization the Mouth-Aspect-Ratio to sight a yawn, etc. or even a pout. During this project, these actions square measure programmed as triggers to manage the mouse indicator. PyAutoGUI library was wont to management the mouse indicator.

6.1 Usage of the Project

Action	Function
	Activate/ Deactivate of Cursor Movement
	Right Click
	Left Click
	Activate/ Deactivate Scrolling
	Scrolling/ Cursor Movement

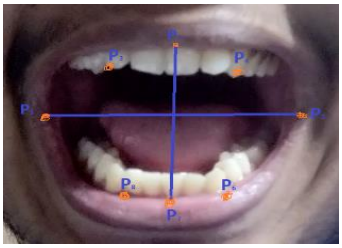
6.1.1 Eye-Aspect-Ratio (EAR): You will see that Eye-Aspect-Ratio is that the simplest and therefore the most elegant feature that takes smart advantage of the facial landmarks. E.A.R helps us in police work blinks and winks etc. You can see that the E.A.R price drops whenever the attention closes. We are able to train a straightforward classifier to sight the drop. However, a standard if condition works simply find one thing like this:

```
if EAR <= SOME_THRESHOLD:
EYE_STATUS = 'CLOSE'
```



$$E.A.R = \frac{|P_2-P_6|+|P_3-P_5|}{2|P_1-P_4|}$$

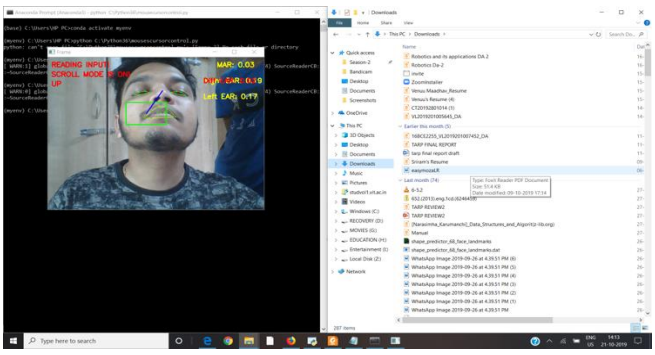
6.1.2 Mouth-Aspect-Ratio (MAR): Highly impressed by the EAR feature, I tweaked the formula a bit to bit induce a metric that will sight open/closed mouth. Stale however it works. Similar to EAR, MAR's price goes up once the mouth opens. Similar intuitions hold true for this metric still. The formula for automatic detection of voluntary eye movements was utilized within the development of a program. The Hough model is a feature extraction technique utilized in image analysis, laptop vision, and digital image processing. The aim of the technique is to search out imperfect instances of objects among a definite category of shapes by a picked procedure. The remodel was popularized within the laptop vision community. If the management movement is detected by the system, the action assigned to the highlighted button is dead.

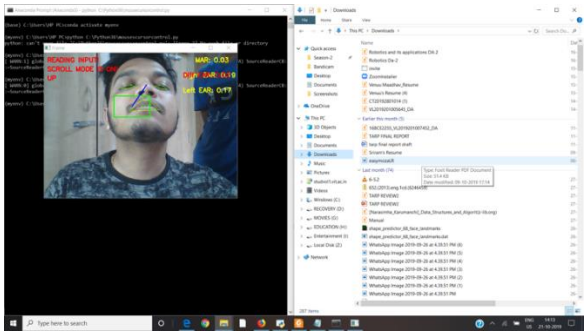


$$M.A.R = \frac{|P_2-P_3|+|P_3-P_2|+|P_4-P_6|}{2|P_1-P_5|}$$

In the proposed system, to supply the various eye movements for management the indicator movements. This methodology is incredibly simply won't activate the indicator movements. During this methodology, the face detection and eye extraction square measure necessary steps in human-computer interaction. Sample of face detection and eye extraction.

7. RESULTS





8. CONCLUSION

This system focused on the analysis of the development of controlling mouse cursor movements using human face, eyes, and application in all aspects. Our system's aim is to control the mouse motions and events hands-free by using face, eye blinks and voice. And our system is able to give the output as expected. Initially, the problem domain was identified and existing commercial products that fall in a similar area were compared and contrasted by evaluating their features and deficiencies. The usability of the system is very high, especially for its use with desktop applications. It exhibits accuracy and speed, which are sufficient for many real-time applications and which allow handicapped users to enjoy many computing activities.

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