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EYE CLICKED MOUSE

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Abstract

In this article we have tried to replace click events of the mouse with blinking of user's eyes. It is an idea to cope up with physical disability of the user. A mouse has minimum two buttons (left button and right button). We have replaced left button of the mouse with left eye and right button of the mouse with right eye. Requirements for implementation of the logic are:

- a web camera, and
- a device driver for a virtual device.

A web camera is used to take user's image at a predefined rate and sent it to the driver of the **eye clicked mouse** (virtual device). The driver processes the image keeping main focus only on the eyes in the image. If any of the eyes is found closed a click event, correspondingly to left or right button, is issued to actual mouse driver. Next is the role of the application currently active in the environment or on the desktop.

Keywords: Eye click, Virtual Mouse Driver, Coping with Physical Disabilities, Image Processing.

1. Introduction

Eye Clicked Mouse is a virtual device to cope up with physical disabilities of the user. It is useful in applications in which a user will interact with the system for very short duration e.g. shopping mall, enquiry system of banking systems, ATM machines etc.

This system is not only useful for physically challenged users but also for the users whose both the hands are engaged in carrying some articles.

Here we have tried to implement only click events of the mouse. The other functionalities of mouse like pointer movements can be implemented later on.

2. Principle

Working of Eye Clicked Mouse is based on image processing. Two successive images in the chronological order, obtain from a web camera at a predefined rate, are processed and compared. A list of their differences is prepared. If there is no difference no action is taken and in case of differences an appropriate action based on the differences will be taken.

3. ALGORITHM

It is assumed that the input data is of type monochrome. Main algorithm is divided into following phases.

3.1 Phase I – Preprocessing

In this phase the input image is cleaned and transformed to make it ready for processing. In it first the image is divided into fundamental regions (square or circle) of predefined size. A fundamental region is restricted to be populated either only by black pixels or only by white pixels. If a fundamental region in the image does not obey this restriction it will be processed to become a black or white region.

Process of preparing fundamental regions is very simple. Simply count the frequency of black and white pixels. The color whose frequency cross a threshold value will be applied to the whole region.

3.2 Phase II – Filtration

In this phase abstraction of image segments will take place. Here only important segments will be considered and rest part of the image will be discarded. **A segment** is group or set of basic regions which have some semantics in the image. The useful segments in our case are eyebrows and eyes. We have taken help of statistical data about the eyebrow and the eye for the purpose of abstraction. The properties considered are:

1. Area
2. Length and breadth
3. Color
4. Relative positions

Unit of measurement of all these properties of a segment is pixel. It must be noted that within a segment color of all the basic regions must be same.

Various variable used in abstraction are:-

Ael – Lower limit of area for eye

Aeu – Upper limit of area for eye

Lel – Lower limit of length for eye

Leu – Upper limit of length for eye

Ce – Color of eye (BLACK)

Abl – Lower limit of area for eyebrow

Abu – Upper limit of area for eyebrow

Lbl – Lower limit of length for eyebrow

Lbu – Upper limit of length for eyebrow

Cb – Color of eyebrow (BLACK)

Following variables are used to provide range of relative distance between eyes and eyebrows, considering closest extreme pixels.

LeLb – Left eye and left eyebrow

LeRb – Left eye and Right eyebrow

ReLb – Right eye and left eyebrow

ReRb – Right eye and Right eyebrow

LbRb – Left and right eyebrow

LeRe – Left and right eye

A deviation variable 'D' is used to set relative distance range for all above variables e.g. range of LeLb is from LeLb-D to LeLb + D

On receiving a sequence of image data from phase I. The image for which all the variables get satisfied, will be considered the arrival of a user and a Flag will be set for a minimum time interval T.

Based on above mentioned variables following Boolean variables will be set to a value True or False:

Lefteye – True if conditions for left eye are met otherwise **False**

Righteye – True if conditions for right eye are met otherwise **False**

Leftbrow – True if conditions for left eye brow are met otherwise **False**

Rightbrow – True if conditions for right eyebrow are met otherwise **False**

We will proceed to next phase only when a user is detected.

3.3 Phase III – Event Generation

In this phase we maintain four additional Boolean variables, as shown below:-

Leo – left eye old

Len – left eye new

Reo – Right eye old

Ren – Right eye new

These Boolean variables hold status of two successive images taken from chronological order.

Setting values of Boolean variables:

```
Leo = Len
Reo = Ren
If (found missing left eye)
    Len = False
Else
    Len = True
If (found missing Right eye)
    Ren = False
Else
    Ren = True
```

Based on values of these variables following mouse click events will be generated:-

```
If (Flag = = True)
{
    If ( (Leo = = True) and (Len = = False))
        Generate Left click
    If ( (Reo = = True) and (Ren = = False))
        Generate Right click
}
```

4. LIMITATIONS

Major limitation of the project work is that it is only for naïve users which interact with the system for very short duration. Another limitation is that multiple users in front of the camera will result in system failure. A bare face user is the primary need of the system. Another big problem is the natural phenomenon of shutting the eyes.

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