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Open CV based Eyeball Cursor Movement

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Abstract

Some peoples cannot be able to operate computers because of an illness. The idea of eye controls of great use to not only the future of natural input but more importantly the handicapped and disabled. Moreover, implementing a controlling system in it enables them to operate computer without the help of another person. It is more helpful to handicapped peoples. Those are needed to operate computers without hand this one is most useful those can operate cursor by movement of eye. In this paper Camera is capturing the image of eye movement. First detect pupil center position of eye. Then the different variation on pupil position gets different movement of cursor. What all these applications have in common is that the use of personal computers is mostly based on the input method via keyboard and mouse. While this is not a problem for a healthy individual, this may be an insurmountable bound for people with limited freedom of movement of their limbs. In these cases, it would be preferable to use input methods which are based on more abilities of the region such as eye movements. To enable such substitute input methods a system was made which follows a low-price approach to control a mouse cursor on a computer system. The eye tracker is based on images recorded by a mutated webcam to acquire the eye movements. These eye movements are then graphed to a computer screen to position a mouse cursor accordingly. The movement of mouse by automatically adjusting the position were of eyesight. Camera is used to capture the image of eye movement.

Keywords: Eyeball cursor, eye tracker, OpenCV.

1. Introduction

Nowadays personal computer systems are carrying a huge part in our everyday lives as they are used in areas such as work, education, and enjoyment. What all these applications have in common is that the use of personal computers is mostly based on the input method via keyboard and mouse. While this is not a problem for a healthy individual, this may be an insurmountable bound for people with limited freedom of movement of their limbs. In these cases, it would be preferable to use input methods which are based on more abilities of the region such as eye movements. To enable such substitute input methods a system was made which follows a low-price approach to control a mouse cursor on a computer system. The eye tracker is based on images recorded by a mutated webcam to acquire the eye movements. These eye movements are then graphed to a computer screen to position a mouse cursor accordingly. The movement of mouse by automatically adjusting the position were of eyesight. Camera is used to capture the image of eye movement. Recently there has been a growing interest in developing natural interaction between human and computer. Several studies for human-computer interaction in universal computing are introduced. The vision-based interface technique extracts motion information without any high-cost equipment from an input video image. Thus, vision-based approach is taken into account an effective technique to develop human computer interface systems. For vision-based human computer interaction, eye tracking is a hot issue. Eye tracking research is distinguished by the emergency of interactive applications. However, to develop a vision-based multimodal human computer interface system, an eye tracking and their recognition is done. Real time eye input has been used most frequently for disabled users, who can use only their

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eyes for input. There are different reasons for which people need an artificial of locomotion such as a virtual keyboard. The number of people, who need to move around with the help of some article means, because of an illness. Moreover, implementing a controlling system in it enables them to move without the help of another person is very helpful. The idea of eye controls of great use to not only the future of natural input but more importantly the handicapped and disabled. Camera is capturing the image of eye movement. First detect pupil center position of eye.

Real-time driver distraction detection is the core to many distraction countermeasures and fundamental for constructing a driver centred driver assistance system. While data driven methods demonstrate promising detection performance, a particular challenge is how to reduce the considerable cost for collecting labelled data. This paper explored semi-supervised methods for driver distraction detection in real driving conditions to alleviate the cost of labelling training data. Laplacian support vector machine and semi supervised extreme learning machine were evaluated using eye and head movements to classify two driver states: attentive and cognitively distracted. With the additional unlabelled data, the semi-supervised learning methods improved the detection performance (G-mean) by 0.0245, on average, over all subjects, as compared with the traditional supervised methods. As unlabelled training data can be collected from drivers' naturalistic driving records with little extra resource, semi-supervised methods, which utilize both labelled and unlabelled data, can enhance the efficiency of model development in terms of time and cost. Research carried out in this technical paper suggests an application of the widely implemented eye tracking techniques. Traditionally, HCI uses mouse, keyboard as an input device but this paper presents hand free interface between computer and human. Here providing a novel idea to control computer mouse cursor using human eyes movement. It controls mouse moving by automatically affecting the position where eyesight focused. The project mainly comprises of three sections namely Image Capture, Image Processing, and Cursor Control. After capturing image from webcam, the shape of pupil is recognized using Hough Transform and the center coordinate help to determine the exact point on the screen where the user is looking also coordinate will instruct the computer mouse to move specific location. This system is very helpful for solving the HMI problems of the disabled so that it can provide a way for them to communicate with the outside world.

Facial based interfaces have been explored in the past [1]. The facial images are captured using a 2D camera and then translated to certain input commands. The reliability of 2D facial input method depends largely on the environment lighting quality. It is quite difficult to get the correct results when working in low lighting conditions. Over the past few years, depth-sensing cameras are widely integrated into mobile phone devices [2]. The 3D facial geometry information that can be obtained from the depth cameras provides detail data of users faces. This 3D information is more reliable than 2D images and can be utilized as input methods to the system [3].

2. Literature survey

Thomas Treal et. al [4] complements the existing human-machine interaction literature aiming to disentangle how realism consistency between appearance and behavior of a CG character may affect the way we interact with it. Our results showed, for the first time, that both non-communicative and emotional body motion combined with facial expression made the avatar's pain perception seem more accurate, and in some cases provoked a greater emotional arousal than facial pain expression with a still body.

Deepateep et. al [5] presented a facial based interface as a possible alternative way to control mobile devices applications. The 3D facial movements are obtained using a depth-sensing camera available on many mobile devices. These 3D animation data are analyzed into the form of blend shapes and face direction to determine input actions. These input actions are the conventional touch input actions

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such as tap, drag, pinch-in, and pinch-out. For this reason, our proposed facial based input methods can be integrated into the existing mobile applications that used touch interface. Through our user studies, we conducted experiments with several subjects on the practical usability of facial movement interface for mobile applications.

Biele et. al [6] focuses on face movement in the context of human–computer interaction. Although face movement is discussed mainly in the context of expressing emotions, it can also be analyzed independently from emotional processes. The first section of this chapter outlines the brain processes responsible for the processing of emotions and generating facial expressions, and offers general information on surface electromyography. Later sections focus on computer based facial movement recognition and explain the differences between two main approaches to this problem—one based on video signals, and the other on measurement of muscle activity. Additionally, the two methods are analyzed with regard to their potential applications.

Kubacki et. al [7] describes design process of a controlling an electric DC motor based on Electrooculography (EOG). In first paragraph authors presented information about Electroencephalography (EEG) and Electrooculography (EOG). Authors performed a literature overview concerning on those two techniques. In the next step, authors implemented simplified mathematical model of DC motor and PID controller. The system was built with used of the bioactive sensors mounted on the head, which was triggered by the signal from eyes movement and facial expressions. The built interface has been tested. Three experiments were created. In all three experiments, three people aged 25–35 was involved. Each of them conducted from 5 to 10 attempts each scenario. Between attempts respondent had a 1-min break. Each scenario was more difficult than before. The investigators attempted to enter a virtual red dot into the green square using only eyes movement and blinking.

Bisen et. al [8] addressed on the idea of building up a model to control computer systems by utilizing facial landmarks like eyes, nose and head gestures. The face recognition systems mainly detect and recognize eyes, nose and head gestures to control the movement of the mouse cursor in order to operate computer system in real time. This paper proposes the facial landmarks-based human-computer interaction model in which histogram of oriented gradients (HOG) has been taken for global facial feature identification and extraction that is considered as HOG descriptors. Furthermore, pre-trained linear SVM classifier gets extracted features to detect whether it is a human face or not, including use of pyramid-based images and sliding window algorithm. Moreover, pre-trained ensemble of Regression Trees algorithm is applied to recognize facial landmarks such as eyes, eyebrows, nose, mouth, and jawline. The main purpose is to effectively utilize facial landmarks and allow the user to perform activities mapped to explicit eye blinks, nose and head motions using PC webcam. In this model, eye blinks have been detected through estimated value of eye aspect ratio (EAR) and newly proposed β parameter. Accordingly, classification report has generated for both estimation and analysed best results for β parameter in terms of accuracy with 98.33%, precision with 100%, recall with 98.33% and F1 score with 99.16% under good lighting conditions.

MARIN et. al [9] proposes a work on how drones could be controlled using brainwaves without any of those devices. The drone control system of the current research was developed using electroencephalogram signals took by an Emotiv Insight headset. The electroencephalogram signals are collected from the user's brain. The processed signal is then sent to the computer via Bluetooth. The headset employs Bluetooth Low Energy for wireless transmission. The brain of the user is trained in order to use the generated electroencephalogram data. The final signal is transmitted to Raspberry Pi zero via the MQTT messaging protocol. The Raspberry Pi controls the movement of the drone through the incoming signal from the headset. After years, brain control can replace many normal

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input sources like keyboards, touch screens or other traditional ways, so it enhances interactive experiences and provides new ways for disabled people to engage with their surroundings.

Gupta et. al [10] developed a digital personal assistant for handicapped people which recognizes continuous Bangla voice commands. We employed the cross-correlation technique which compares the energy of Bangla voice commands with pre-recorded reference signals. After recognizing a Bangla command, it executes a task specified by that command. Mouse cursor can also be controlled using the facial movement of a user. We validated our model in three different environments (noisy, moderate and noiseless) so that the model can act naturally. We also compared our proposed model with a combined model of MFCC & DTW, and another model which combines cross correlation with LPC. Results indicate that the proposed model achieves a huge accuracy and smaller response time comparing to the other two techniques.

Gawande et. al [11] consider all the techniques of face recognition and also Human Computer Interaction. Detecting and normalizing human faces from live video streams is the first crucial step in a face verification/recognition system. The contributing disciplines include computer science, cognitive science, human factors, software engineering, management science, psychology, sociology, and anthropology. Early research and development in human-computer interaction focused on issues directly related to the user interface.

3. Proposed system

- OpenCV is a Python library which is designed to solve computer vision problems. OpenCV was originally developed in 1999 by Intel but later it was supported by Willow Garage.
- OpenCV supports a wide variety of programming languages such as C++, Python, Java etc. Support for multiple platforms including Windows, Linux, and MacOS.
- OpenCV Python is nothing but a wrapper class for the original C++ library to be used with Python. Using this, all of the OpenCV array structures gets converted to/from NumPy arrays.
- This makes it easier to integrate it with other libraries which use NumPy. For example, libraries such as SciPy and Matplotlib.
- Next up on this OpenCV Python Tutorial blog, let us look at some of the basic operations that we can perform with OpenCV.

Convolutional neural networks have been one of the most influential innovations in the field of computer vision. They have performed a lot better than traditional computer vision and have produced state-of-the-art results. These neural networks have proven to be successful in many different real-life case studies and applications, like:

- Image classification, object detection, segmentation, face recognition.
- Self-driving cars that leverage CNN based vision systems.
- Classification of crystal structure using a convolutional neural network.

And many more, of course!

The convolution layer computes the output of neurons that are connected to local regions or receptive fields in the input, each computing a dot product between their weights and a small receptive field to which they are connected to in the input volume. Each computation leads to extraction of a feature map from the input image. In other words, imagine you have an image represented as a 5x5 matrix of values, and you take a 3x3 matrix and slide that 3x3 window or kernel around the image.

4. Conclusion

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This method proposed a system which follows a low-price approach to control a mouse cursor on a computer system. The eye tracker is based on images recorded by a mutated webcam to acquire the eye movements. The eye movements are then graphed to a computer screen to position a mouse cursor accordingly. The movement of mouse by automatically adjusting the position where of eyesight. Camera is used to capture the image of eye movement.

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