Survey Paper on Eye Gaze Tracking Methods and Techniques

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# Abstract

Eye movement tracking is a technique use for checking the usability problems in the context of Human Computer Interaction (HCI). Initially they are present tracking technology and key elements. Eye movement tracking technique based on the behavior of the user when they are looking. It can use for different kinds of techniques i.e. “electrodivided into two types selective and Gaze contingent. Selective systems use the point of gaze as to a pointing device such as the mouse. The selective system can be use in handicapped users. Gaze-contingent systems exploit knowledge of the user’s gaze to facilitate the rapid rendering of complex displays.

# Scholarcy Synopsis

Researchers have used smartphone data to investigate the relationship between pain and weather conditions, and found that there is a small but significant relationship.

In ‘How the weather affects the pain of citizen scientists using a smartphone app’, Dixon and colleagues (2019) noted that higher relative humidity and wind speed, and lower atmospheric pressure, were associated with increased pain severity in people with long-term pain conditions.  
The effect of weather on pain was not fully explained by its day-to-day effect on mood or physical activity.  
The study app was downloaded by 13,207 users over the 12-month recruitment period.  
A total of 10,584 participants had complete baseline information and at least one pain entry.  
The ‘worst’ combination of weather variables would increase the odds of a pain event by just over 20% compared to an average day.  
  
The study involved 2658 patients.   
  
Discussing potential shortcomings, “There are potential limitations to this study.  
It is possible only people with a strong belief in a weather–pain relationship participated.  
Rain and cold weather were the most common pre-existing beliefs, authors say,” they say.

# Scholarcy Highlights

* Eye tracking is the measure of eye movement and gaze tracking is the analysis of eye tracking info and head movement info
* Eye tracking helps the neuroscience Eye movements, such as saccades, fixation and smooth pursuit, Visual processing, interaction between eye movements, vision, and performance tasks Object-by-object search mechanisms in attention studies, Eye movement patterns in visual neglect, Neurological functions involved in perceptual decision making
* The different types of methods are used in eye tracking. [2]
* VOG techniques have been used to wide field of scientific research related to visual development and cognitive science as well as to pathologies of the eyes and of the visual system
* The main aim of this method is to find out latest growth in non-contacting video based gaze tracking

# Scholarcy Summary

## INTRODUCTION

Face is the key of mind and eyes are the window to the person.

Eye movements provide rich information to a person.

The study of eye movement helps to determine people where they are looking.

The gaze tracking applications like in robotics, psychological studies, cognitive science.

In psychological studies, they are used to measure the behavioural responses.

The main application of neuroscience is Eye tracking and is well-organized time and effectual cost, as well as low problem and compare with other neurological methods.

Eye tracking helps the neuroscience Eye movements, such as saccades, fixation and smooth pursuit, Visual processing, interaction between eye movements, vision, and performance tasks Object-by-object search mechanisms in attention studies, Eye movement patterns in visual neglect, Neurological functions involved in perceptual decision making.

## METHOD OF EYE TRACKING

The recording of the eye position and eye movement is called occulography. The different types of methods are used in eye tracking. [2].

The horizontal and vertical eye movements are recorded separately by placing electrodes

This technique is not compatible daily use, since it is used by clinicians.

It is a cheap, easy and invasive method of recording large eye movements.

Nearest neighbourhood algorithm is use in EOG method

It has three parts of EOG: EOG acquisition and amplification, EOG pattern recognition, and control command output.

Disadvantages: 1. Large eye movement are not produced bioelectric amplitude that is proportional to eye position

## Sceleral Search Coils

A coil of wire moves in magnetic field this field are induces a voltage in a coil.

This coil is attached to the eye, and the signal is produced to the eye position.

By using modified contact lens, it is possible to measure.

## Infrared oculography

This system measures intensity of infrared light which is reflected from Scelera of eye.

The reflected infrared light collects information about eye position.

The information will get vary with different eye position.

The difference between these positions gives information about eye position changes

It is invasive method because spherical glass to be used to place light source & sensor.

As these rays are www.irjet.net p-ISSN: 2395-0072 invisible to eyes it will not create any distraction.

3. Movement before between blinking can be measured.

1. For Horizontal movement it can measure upto 35degrees only.

2. For Vertical Movement it can measure upto 20 degrees only.

## Video-based oculography

Video-based oculography is a non-invasive or invasive method. Each two methods are split into the other categories are depending on light used: visible light and infrared light.

Head mounted system is used for one or more cameras.non – invasive system is known as remote eye tracking system.

Video based eye tracking method is used for commercial eye tracker.

Video based eye tracker is very complex and expensive task [7].

A. Single camera eye tracker: The single camera systems can capture limited field images that are fixed at a point in high resolution.

The video-based eye tracker is work by illuminating the eye with an infrared light source.

This light produces a glint on the cornea of the eye this is called as corneal reflection.

The several commercial systems base their technology on one camera and one infrared light.[10].

Recording with closed eyes is not possible and cannot measures eye torsion

## Model-based approaches

Model based methodologies utilize an express geometric model of the eye to gauge 3D look bearing vector.

Most of the model-based technique takes after a typical system: first the optical pivot of the eye is recreated in 3D: the visual pivot is remade : at long last the purpose of look is evaluated by converging the visual hub with the scene geometry.

By characterizing the look course vector and incorporating it with data about the articles in the scene, the purpose of look is evaluated for 3D demonstrate based methodologies; look headings are assessed as a vector from the eyeball focus to the iris focus.

Obtained from eye region & head position, from image data we detect eye location.

Eye gaze tracking methods are analysis of image data.

This method classified into Feature based & Appearance based gaze estimation

## Interpolation based approaches

These strategies accept the mapping from picture elements to look co-ordinates (2D or 3D) have a specific parametric frame, for example, a polynomial or a nonparametric shape as in neural systems.

Alignment information are utilized to ascertain the obscure coefficients of the mapping capacity by methods for a numerical fitting procedure, for example, different straight relapses.

As another option to parametric expressions, neural system based eye trackers accept a nonparametric shape to execute the mapping from picture elements to look facilitates.

In these approaches, Neural network is used to locate the Gaze point where the output is the coordinates of this gaze point.

The neural network is first trained by the extracted coordinates of certain facial points

## Appearance based method

Appearance based method detect and track on the photometric appearance.

The appearance based techniques are used in image content.

The image content to estimate the gaze direction by mapping image data to the screen coordinates.

The Appearance based methods are morph able model, gray scale unit, manifold, Gaussian interpolation and cross ratio.[16] Appearance based methods are not require calibration of camera and geometry data.

2. More robust than feature based gaze estimation

## CONCLUSION

VOG techniques have been used to wide field of scientific research related to visual development and cognitive science as well as to pathologies of the eyes and of the visual system.

The main aim of this method is to find out latest growth in non-contacting video based gaze tracking

# Builds on previous work

Also, different processing signals are used such as analysis of variance, principal component analysis and classification techniques such as KNN. **Y Kuno, T Yagi and Y Uchikawa [4] in this paper present the design an EOG based HCI system**

# Contributions

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