ORIGINAL RESEARCH PAPER

Computer Science

STUDY OF EYE MOVEMENT CHARACTERISTICS FOR GETTING FOCUS POINT OF HUMAN EYE

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ABSTRACT

Eye movement recognition is still an area under research to achieve higher accuracy. As technology has advanced many device allows human to pass mouse based actions in form of eye movement. This paper presents a study of three main eye movement characteristics: blinks, fixations and saccades. This paper also presents different fixations features and saccades features.

1. CHARACTERISTICS OF EYE MOVEMENT

There are various types of eye movement features. Three main types of eye movement characteristics are fixations, saccades and blinks. Now a day, eye movement recording is a new technique to interact with visual display. Various features of eye movement are derived from data recorded using various device that capture eye movements. Various extracted features are used to identify behavioral and physiological properties of eye movements. The movement of eye can differ significantly from one person to another. Blinking is the natural behavior for person and it effects to record data for eye movement. Eye movement features analysis is a new rich technique for interaction (Ioannis , Lee , & Oleg , 2018). It is very necessary to understand three main characteristics saccades, fixations and blinks for analysis purpose.

1.1. FIXATION

Eye movement means where a person is looking at any given time. And sequence, in which their eyes are shifting from one location to another. When the eyes stop to focus something is called fixation. Fixation can also be referred to as time between two saccades. It is a static state of eyes during gaze is held on a specific location.

1.2. SACCADES

Saccades refer to rapid eye movements that are used to reposition the fovea to a new location in the visual enviro nment. Movements between fixations are saccades. So the saccades mean simultaneous movement of both eyes.

1.3. BLINKS

The cornea's frontal part is coated with a liquid tear film. To spread this liquid on corneal surface regular closing and opening of eyelids is required and it is called blinking process. Blinking is the natural behavior for human. 12 to 19 blinks per minute is average blink rate in normal condition (Andreas, Gerhard , Hans, & Jamie, 2009).

Figure 1. Fixations, saccades and blinks over screen

2. ANALYSIS AND CLASSIFICATION OF STATISTICAL FEATURES

2.1. FIXATION FEATURES

The word fixation is just used to define the state when the eyes are stopped and focused on a specific location. During this state, the eyes are not totally stop but they perform various micro movements like slow ocular drifts, small saccades.

The rate and duration of fixations are two basic fixation characteristics that define temporal behavior. A sequence of fixation performed during driving, reading and watching on screen is in variations. A simple model for fixation cannot provide information of fixation drift characteristics. (Slow movement of eye around fixation area). So, for getting information of fixation drift, computational modeling for fixation drift is used. Fixation drift is also device dependent and fixation drift can be useful for inspection of eye tracking quality and visual display interaction (Gresty, Hess, Leech, & Rudge, 1977).

Fixation velocity and acceleration are also effective features for calculate fixation. Velocity and acceleration are generally affected by noise. Almost all characteristics are extracted and calculated via statistical modeling. Only fixation position and drift type characteristics are calculated and extracted using computational modeling of profiles.

2.2. SACCADE FEATURES:

Saccades refer to rapid movement of eye from one position to another. Saccade generates neural circuitry process that makes an estimation of difference between starting and target locations. During reading process, generally slow saccades are performed.

The rate and duration of saccades are two basic saccade characteristics that define temporal behavior. Duration of saccades is in range of 20-40ms during reading. Saccadic duration analysis during human computer interaction is an important consideration. Behavioral disorders like autism increased saccadic rates (Ioannis , Lee , & Oleg , 2018).

The amplitude feature of saccades is generally used to describe their size. It is generally identified by peak velocities and durations. Mostly amplitude characteristics define the size of saccade but it cannot identify the curvature characteristics of saccade. For behavioral studies like saccades curvature the modeling of saccade curvature is important. Velocity characteristics of saccade have been described as indicator of activation. We can easily extract peak velocity feature from velocity (Canas, Catena, Di Stasi, Macknik, & Martinez-Conde, 2013).

The acceleration characteristic of saccades is related to underlying forces moving the eye ball. For getting inform
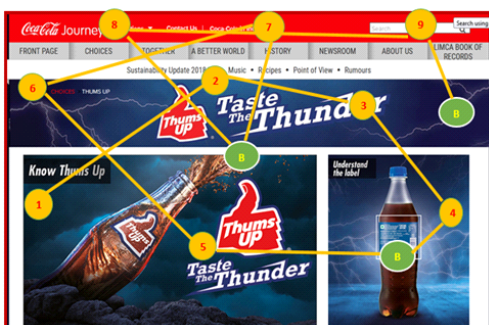
ation related to dynamic properties of eye movement acceleration characteristic of eye movement is very important. But in the case of spectrum disorders, an abnormal characteristic of saccades has been reported (Cook, Mosconi, Schmitt, & Sweeney, 2014). Ratio of saccade characteristic feature can be used to provide robustness against abnormal effects. Collective model is generally used to describe the relationship between main saccadic characteristics. 'main-sequence' characteristic of saccade is described the relationship of feature pairs of peak velocity-amplitude and amplitude-duration. The main-sequence property has been reported in situation of mental-workload (Antoli, Canas, & Di Stasi, 2011),(Canas, Catena, Di Stasi, Macknik, & Martinez-Conde, 2013). Peak velocity-amplitude data and amplitude-duration data are easily modeled by fitting linear curves.
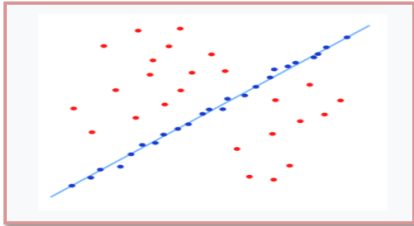

Figure 2. Saccade linear regression fits

3. CONCLUSION:
In this paper, we have presented various eye movement related characteristics. These characteristics are fixation, saccade and blinks. Fixation features, saccade features and blinks characteristics used for examine the physical and behavioral properties of eye movement.

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