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A robust eye gaze tracking method based on a virtual eyeball model

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Abstract

Gaze positions can provide important cues for natural computer interfaces. In this paper, we describe a new gaze estimation method based on a three dimensional analysis of the human eye which can be used in head-mounted display (HMD) environments. This paper presents four advantages over previous works. First, in order to obtain accurate gaze positions, we used a virtual eyeball model based on the 3D characteristics of the human eyeball.

Second, we calculated the 3D position of the virtual eyeball and gaze vector by using a camera and three collimated IR-LEDs. Third, three reference frames (the camera, the monitor and the eye reference frames) were unified, which simplified the complex 3D converting calculations and allowed for calculation of the 3D eye position and gaze position on a HMD monitor. Fourth, a simple user-dependent calibration method was proposed by gazing at one position based on Kappa compensation. Experimental results showed that the eye gaze estimation error of the proposed method was lower than 1°.

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