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REAL TIME EYEBALL TRACKING VIA DERIVATIVE DYNAMIC TIME WARPING FOR HUMAN-MACHINE INTERFACE

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Abstract. *In this paper, a real time, user independent eyeball tracking approach is presented. The system is implemented by using a low cost webcam. The robustness of the system is measured by several criteria such as users of different age where some of the users are wearing glasses under varying lighting condition, pose, eye orientation and distance from camera. The size and location of the region of interest which contains both eyes are made adaptive. Derivative Dynamic Time Warping is chosen as the classifier for this experiment since it can match patterns from data sequences with different lengths. Finally, the results, advantages, limitations and future works of the proposed method are reported. The online eye tracking procedure shows good accuracy and robustness when processing online image sequences at 50 frames/s on a 253 GHz Pavilion DV4 HP notebook.*

Keywords: Eyeball tracking, Adaptive region of interest, Derivative dynamic time warping, Varying illumination condition

1. **Introduction.** The disabled community require special equipments to perform daily chores and other tasks. Human-computer interface (or interaction) technology may provide a means to assist them to lead a more independent life [1]. Common methods that realize human-machine interaction make use of brain, speech or visual signals as inputs to a computer or machine to perform specific tasks. For example, relative iris positions can be used as a cue to a vision system indicating which direction to go. In this paper, a real time eyeball tracking approach is presented wherein the position of the irises is located.

Table 1 summarizes some of the works involving facial feature recognition by comparing the databases, image processing techniques and classifiers used. In some of the works, images are obtained from well known facial image databases [2-9], while in others, the images are captured online by using compound eye imaging [10], cameras [11-14] and CMOS digital imaging sensor [15]. Other approaches proposed by Ohno et al. [16] used scanned images as input while Tsai [17] utilized captured gray scale images as compared to databases. For our proposed method, the input is acquired via online USB webcam.

In the majority of the methods in Table 1, the data (images) are treated as two dimensional (2D) arrays and thus 2D operations are performed on them [3-17]. However, in the work of Wijaya et al. [2], the image undergoes discrete cosine transformation and then the result is subjected to one dimensional analysis which consists of row and column operations. From Table 1, it can be observed that common image processing techniques