Simulating virtual reality robots with human-like eye fixations on areas of interests in the virtual world through an automated and optimized eye fixation detection algorithm

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Current VR robots, or simulated avatars, often lack lifelike qualities, particularly regarding eye fixation behaviors. Enabling VR robots to mimic humans' naturalistic eye fixations on objects or areas of interest within the VR environment might greatly enhance human users' immersion and engagement, particularly in simulated VR training scenarios where human users interact with VR robots. Abundant and accurate human eye fixation data, especially visual scan path (i.e., time-order of eye fixations) data, are needed to effectively train VR robots to mimic naturalistic eye fixations. However, we currently lack standardized and automated algorithms to process humans' raw stochastic eye gaze data to obtain accurate time-ordered sequences of eye fixations. Elbow/knee detection algorithms were adapted to automate the process of discovering the optimal eye fixation identification threshold. The optimal eye fixation threshold value is discovered by accommodating multiple eye-tracking metrics, such as the number of eye fixations in objects or areas of interest, and the number of gaze samples per eye fixation, among others. Evaluation of the proposed algorithm on existing experimental data obtained from three hundred participants showed that the discovered optimal threshold produced the most accurate eye fixations as well as the associated visual scan paths. The results show promise in defining a standard and automating the process of obtaining accurate human eye fixation data that can be used to train VR robots to better mimic naturalistic eye fixation behaviors within the VR environment.

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