Imaging System for the Recovery of Head and Body Motion for the RIT Wearable Eye Tracker

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Research in visual perception and attention using eye movements has moved from signal detection paradigms and the assessment of the mechanics and metrics of eye movements to the study of complex behavior in natural tasks. In such tasks, subjects are able to move their head and body and interact in a purposeful way with a changing environment. Under such circumstances, the analysis of the eye movements is more difficult, because the eye tracker does not record the subject's head movements. Recovering the head movements can give additional information about the type of eye movement that was carried out, the overall gaze change in world coordinates, and insight into high-order perceptual strategies.

The aim of this senior project was to develop a system that could make it possible to recover the head movements of a subject during natural tasks. The proposed solution utilizes an omnidirectional vision sensor consisting of a small CCD video camera and a hyperbolic mirror. The camera is mounted on an ASL eye tracker and records an image sequence at 60 Hz. Several algorithms for the extraction of rotational motion from this image sequence were implemented and compared in their performance.

Using data from the eye tracker together with the data obtained by the omnidirectional image sensor, a new algorithm for the classification of different types of eye movements based on a hidden-Markov-Model was developed. Preliminary results from this algorithm will be presented.

Constantin Rothkopf is a senior in the Imaging Science program at the Chester F. Carlson Center for Imaging Science. Originally from Cologne, Germany, he will be graduating this May and pursue a PhD in the Brain and Cognitive Science department at the University of Rochester. Also active as an artist, his works have recently been taken into the permanent collection of the Museum of Applied Arts, Frankfurt.