A New Eye Movement Simulation System for the Evaluation of Balance Disorders

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Video camera based eye measuring systems are gaining more importance for their non-invasive nature and convenience of operation. In diagnosing and managing (e.g., rehabilitation) of balance disorders and other health problems, such eye measurement systems may play a key role. However, it is still difficult to evaluate and compare the performance of eye measurement systems in terms of their accuracy, robustness, and capability to handle artifacts including occlusion and illumination changes. Comparing the performance of video-based systems with the search coil systems is one way for evaluation, but this can be expensive and cumbersome.

This paper presents a new eye movement simulation that system can be used to evaluate the performance of different video-oculography (VOG) systems, and measure eye motion in horizontal and vertical directions, as well as the torsion involved. The developed simulation system generates synthesized video sequences based on real eye images. The simulation system is capable of modeling artifacts such as reflections, illumination changes, eyelid drops, and eye shape estimation errors. It provides a cheap, yet powerful and convenient way to evaluate the performance of eye tracking systems. To demonstrate the simulator's performance, the paper also presents the results of a test conducted via two different torsion measurement algorithms on the same video sequences: namely, the prevalent iral signature cross correlation algorithm and *a new robust template matching algorithm* we have recently designed.