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Recording fixational eye movements with a new AOSLO: simulation, measurement and evaluation

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Abstract

Adaptive optics scanning laser ophthalmoscopy (AOSLO) produces high-resolution images of the retinal mosaic. These images contain distortions due to eye motion, which can be used for high speed and resolution eye tracking that is referenced to the photoreceptor mosaic. Patch-based registration methods employ either a) cross-correlation or b) a map-seeking circuit. Both techniques compare images to a reference frame, which may itself contain motion and so provides only a relative measure. We have developed a method for generating motion-free reference frames and use it to compare techniques a) and b) to a modified method using feature (cone) tracking. We present a comparison of these algorithms under variations in image quality, retinal structure and types of eye movement. We discuss the implications for psychophysical experiments, which require accurate measurement of eye movements and cone density/arrangement, as well as for clinical experiments, in which sub-optimal image quality can affect such measures.

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