

Studying the Impact of Exposure Duration on the Quality of High-Resolution Retinal Images

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Diseases of the retina begin at the cellular level, but unfortunately go clinically undetected until significant spreading has occurred. Recent advances in electro-optics technology, most notably a technique coined adaptive optics, have dramatically increased the sensitivity of research-grade retina cameras, and have enabled retinal cells as small as a few microns in size to be observed in patients for the first time. The high magnification of these cameras, however, makes them highly sensitive to retina motion blur, which is present even in a well fixated eye. Shorter exposure durations would reduce motion blur, but at the expense of reduced signal-to-noise ratio. The optimal duration that would generate negligible blur while maximizing signal-to-noise has not been determined. To this end, a prototype retina camera equipped with adaptive optics acquired images of individual retinal cells (cone photoreceptors) on two subjects using a range of exposure times (1/3,000 to 1/10 second). For each exposure time, power spectra were computed from the retinal images and then averaged to increase signal. Comparison of the average power spectra permitted a simple means to quantify the impact of motion blur. The power spectra for both subjects noticeably dropped for exposure durations above 20 msec, indicating the presence of significant motion blur. Exposures less than 10 msec yielded very similar power spectra, suggesting negligible movement of the retina at these short times. Based on these findings, high-resolution retina cameras should operate with an exposure of about 10 msec to minimize motion blur, while maximizing signal-to-noise ratios.

Edgar Alvarez is currently enrolled at DeVry University. He is a sophomore and is majoring in Electrical Engineering. He is the oldest of two brothers in a family of four. He is the first in his family to go to a university. He plans to pursue a career in aeronautics.

