

基于自适应光学的视网膜单细胞光学相干层析成像技术

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介绍了一种基于CCD相机的并行光学相干层析成像技术，将所建立的层析成像系统和自适应光学视网膜相机结合。利用一维光学相干层析系统对人眼视网膜进行追踪并控制相干门在视网膜内的位置，利用基于CCD相机的二维光学相干层析成像系统记录视网膜的干涉图像。用眼模型和牛眼视网膜组织对系统进行了测试，通过将4幅干涉图像的获取时间控制在7 ms以内来减少视网膜运动对成像的影响；系统的轴向点扩展函数和灵敏度分别达到10 μm 和76 dB。实验结果表明，所建立的基于自适应光学的视网膜光学相干层析成像系统的空间分辨率和灵敏度远远高于其它基于自适应光学的视网膜成像技术。

SINGLE CELL IMAGING OF THE LIVING HUMAN RETINA USING ADAPTIVE OPTICS AND OPTICAL COHERENCE TOMOGRAPHY

An en face coherence gated camera for optically sectioning the in vivo human retina was constructed. Coherence gating is generated by a free-space Michelson interferometer employing a superluminescent diode for illuminating the retinal tissue, voice coil and piezo-electric translators for controlling the optical path length of the reference channel, and a scientific-grade CCD camera for recording 2-D retinal interferograms. A conventional 1-D OCT is incorporated for tracking the axial motion of the retina and controlling the gating position. En face slices of test objects and retinal tissue were obtained using a four-step ($\pi/4$) phase shift method. Ultrafast acquisition of four interferograms in less than 7 ms has been achieved to mitigate eye motion blur. The axial width of the point spread function and the sensitivity of the camera were measured near 10 μm and 76 dB, respectively, which is substantially better than current flood-illuminated and confocal scanning laser ophthalmoscopes equipped with adaptive optics.

关键词