

硕 士 研 究 生 读 书 报 告



题目 空间局部适应模型

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Research of a Model of Local Adaptation

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摘要

人眼视觉系统在观察自然世界时会持续适应不同的亮度等级。视觉适应是许多视觉模型的关键因素。虽然视觉适应的时间过程已经得到了充分的研究，但是我们对相应的空间过程还了解得不多。在本文中，我们提出一个可以预测适应信号在视网膜上整合过程的局部自适应的基于经验的新模型。此模型采用在高动态范围（HDR）显示领域中的心理物理学测量方法。我们在构建模型的过程中采用了新的方法：利用经过优化的模拟实验信号来发现预测性最佳的模型。此模型不仅可以用来预测适应过程的稳定状态，也可以用来保守估计复杂图像中可感知的最小临界对比度值。我们通过一系列使用场景来说明此模型的用处，例如检测基于物理的渲染过程中的可见误差范围，确定高动态范围图像的背景光照，测量自然场景中的最大可见动态范围，模拟人眼视觉残留，和基于视点位置的色调映射。

**关键词**：感知，局部自适应，色调映射，视觉度量，高动态范围

Abstract

The visual system constantly adapts to different luminance levels when viewing natural scenes. The state of visual adaptation is the key parameter in many visual models. While the time-course of such adaptation is well understood, there is little known about the spatial pooling that drives the adaptation signal. In this work we propose a new empirical model of local adaptation, which predicts how the adaptation signal is integrated in the retina. The model is based on psychophysical measurements on a high dynamic range (HDR) display. We employ a novel approach to model discovery, in which the experimental stimuli are optimized to find the most predictive model. The model can be used to predict the steady state of adaptation, but also conservative estimates of the visibility (detection) thresholds in complex images. We demonstrate the utility of the model in several applications, such as perceptual error bounds for physically based rendering, determining the backlight resolution for HDR displays, measuring the maximum visible dynamic range in natural scenes, simulation of afterimages, and gaze-dependent tone mapping.

**Keywords：**perception, local adaptation, tone mapping, visual metric, high dynamic range

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