Bayesian Time-of-Flight for Realtime Shape, Illumination and Albedo*

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Abstract

Humans have a remarkable ability to understand their environment through their visual sense but in recent years computers have made rapid progress and approach or exceed human-level performance on some tasks such as optical inspection, motion tracking, and image classification. One recent technology that enabled much of this progress are depth cameras which reconstruct in real-time the scene geometry independent from light and texture, thus simplifying high level tasks such as recognition and 3D reconstruction.

In this talk, I will give an accessible overview to non-experts about a fully Bayesian model behind a recent state-of-the-art depth sensing system. This system is based on the principle of time-of-flight, that is, timing light pulses as they are reflected of surfaces. This sensing modality is not used by any animal and requires interesting design considerations which we address using a principled decision-theoretic framework. Furthermore significant challenges exist in real-time implementation and in addressing systematic model violations due to multiple light bounce phenomena.

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