limitless photons: Energy Propagation, Imaging, and Inverse Problems

Trillion Frames per Second Imaging
A camera fast enough to create movies of light in flight. We use ‘light in motion’ to understand reflectance, absorption and scattering properties of materials.

Looking Around Corners
Using short laser pulses and a fast detector, the device can look around corners with no imaging device in the line of sight using scattered light and time resolved imaging.

Compressive Light Field Camera
A frugal camera design exploiting the fundamental dictionary of light fields for single-shot capture of light fields at full sensor resolution.

Multi-Depth Time-of-Flight Cameras
We repurpose a time-of-flight camera using coded illumination to recover time profiles of large-scale scenes to acquire multiple depths per pixel.

Unbound HDR
A framework to extend the dynamic range of image capturing called Unbounded High Dynamic Range (UHDR) with our novel modulo imaging sensor.

Time-of-Flight Fluorescence
We repurpose a time-of-flight camera to record nanosecond dynamics of fluorescent materials, and perform fluorescence imaging through turbid layers.

Reading Through a Book
The combination of pulse-echo detection and Terahertz waves (between infrared and microwaves) enables the location of the pages of a book and the extraction of the content of each page.

Flutter-Shutter
A camera that codes exposure time with a binary pseudo-sequence to deconvolve and remove motion blur in textured backgrounds and partial occluders.

Eyeglass-Free Tablets
A display that frees the viewer from using glasses and optical corrections.

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**Health & Wellness**

**Cellphone Microscopy**
A platform for computational microscopy and remote healthcare.

**Imaging Through Skin**
A device that utilizes high spatio-frequency patterns with state-of-the-art dictionary learning algorithms to enhance vein structures under the skin.

**Skin Perfusion Photography**
Using computational photography to recover in-vivo blood flow speed in skin tissue.

**Retinal Imaging and Electroretinography**
A device with simplified optics, clever illumination, and electrophysiology that visualizes images of the retina in a standalone device easily operated by the end user, enabling disease diagnosis.

**NETRA/CATRA**
A low-cost cell-phone attachment that measures eye-glass prescription and cataract information from the eye.

**High-speed Tomography**
A compact, fast CAT scan machine using no mechanical moving parts or synchronization.

**Theory of Light Propagation**

**Spec Trans**
A new surface classification technology of exotic materials such as glass, transparent plastic, and metal. It extracts the materials optical property by employing laser and multi-directional, multi-spectral LED illumination.

**Real Time / Big Data Visual Learning**
A method to compress big data for learning using real-time object detection and tracking.

**Statistics of Non-Rigid Observations**
Statistics of non-rigid stretchable structures (Heart, Kidney, Brain etc) for high level inference.

**Streetscore**
A computer vision algorithm, trained using crowdsourced data, that can predict the perceived safety of streetscapes.

**Mental Health from Visual Cues**
A device that uses remote physiological measurement to detect a person's emotional state using machine learning and compressive sensing.

**Dental Imaging**
Portable low-cost imaging tools for oral diagnostics by monitoring and tracking the health of teeth, gum, tongue and more.

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