Future Trends

Amit Agrawal

Mitsubishi Electric Research Labs (MERL)
Cambridge, MA, USA
## Schedule

<table>
<thead>
<tr>
<th>Introduction</th>
<th>Srinivasa, 10 mins</th>
</tr>
</thead>
<tbody>
<tr>
<td>Assorted Pixels</td>
<td>Srinivasa, 20 mins</td>
</tr>
<tr>
<td>Coding and Modulation in Cameras</td>
<td>Amit, 45 mins</td>
</tr>
<tr>
<td>Break</td>
<td>10 min</td>
</tr>
<tr>
<td>Light Fields and Applications</td>
<td>Ankit, 60 mins</td>
</tr>
<tr>
<td>Break</td>
<td>10 min</td>
</tr>
<tr>
<td>Computational Illumination</td>
<td>Srinivasa, 45 mins</td>
</tr>
<tr>
<td>Future Trends</td>
<td>Amit, 15 mins</td>
</tr>
<tr>
<td>Discussion</td>
<td></td>
</tr>
</tbody>
</table>
Future Directions

- Computational Imaging outside Photography
  - Tomography, Schlieren Imaging
- Smart Optics
  - Liquid Lens, Origami Lens, GRIN lenses
- Smart Sensors
  - HDR Cameras, Line-scan Cameras, 3D Cameras, Multi-perspective
- Smart Lighting
  - Pico projectors, Light stages
- Social Impact
  - Social Networking, Privacy, Developing Countries
Schlieren Photography

http://www.mne.psu.edu/psgdl/FSSPhotoalbum/index1.htm
Time-resolved 3D Capture of Non-stationary Gas Flows, Atcheson et al. SIGGRAPH Asia 2008
Optical Performance

Conventional Lens Image

Origami Lens Image

Scene

Conventional Scene

Origami Scene

Slides by Shree Nayar
Non-Linear Optics

- Liquid lens
  - Varioptics
• **Lens Vector**
**GRIN Lenses**

- Gradient Refractive Index Lenses
Foveon Sensor

First came film.

COLOR FILM contains three layers of emulsion which directly record red, green, and blue light.

Then came digital.

TYPICAL DIGITAL SENSORS have just one layer of pixels and capture only part of the color.

Now there’s Foveon X3.

FOVEON X3 direct image sensors have three layers of pixels which directly capture all of the color.
Line Scan Camera: PhotoFinish 2000 Hz
Multi-Perspective Camera?

M. C. Escher

Rademacher et al, Siggraph 1998

Steve Seitz

Jingyi Yu
Multi-Flash Camera, Raskar et al. SIGGRAPH 2004

Canny Edges

Depth Edges
Live Demo on Thursday at CVPR 2010
Pico Projectors

- TI’s DLP Technology with LED
- Laser Scan (MEMS mirror)

Microvision Laser Pico

TI’s DLP, $349
Light Stage, Paul Debevec, ICT
**Fig. 1.** This photograph of the *American Idol* host and judges is a digital composite of multiple photographs. The inconsistencies in the shape and position of the specular highlight on the eyes suggest that these people were originally photographed under different lighting conditions. Photo courtesy of Fox News and the Associated Press.
Truth in Images

LA Times March’03

From Hany Farid
Preventing Camera Recording by Designing a Capture-Resistant Environment, Khai N. Truong, Shwetak N. Patel, Jay W. Summet, and Gregory D. Abowd. Ubicomp 2005
Aydogan Ozcan, UCLA

New York Times Nov 2009
Blind Camera

Sascha Pohflepp, U of the Art, Berlin, 2006