Research at IVRL

The Image and Visual Representation Lab (IVRL) performs research that is primarily focused on the capture, analysis, and reproduction of color images. Aiming to improve everyone’s photographic experience, we develop algorithms and systems that help us understand, process, and evaluate images.

Our research areas include: computational photography, image processing, computer vision, image quality, computational aesthetics, digital humanities.

### Aesthetics [1]

<table>
<thead>
<tr>
<th></th>
<th>Brightness AVG</th>
<th>Contrast</th>
<th>Richness</th>
<th>Ridges</th>
<th>Ridges Top</th>
<th>Near Contrast</th>
<th>Saturation AVG</th>
<th>Sharpness</th>
<th>Salient</th>
<th>Salient Sharpness</th>
<th>Salient Hue</th>
</tr>
</thead>
<tbody>
<tr>
<td>Generic</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Animal</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Nature</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Portrait</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>City</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
</tbody>
</table>

### Depth of Field Extension [2]

![Diagram of Depth of Field Extension](image)

### Near Infrared

NIR image acquisition [3]:

- **Scene**
  - Channel separation
  - Mosaiced color image
  - Demosaiced color image
- **NIR image**
  - Full-resolution NIR image
- **Saliency detection**
  - Object stands out w.r.t. neighborhood

### Skin smoothing [4]:

![Skin smoothing diagram](image)

### Shadow detection [5]:

![Shadow detection diagram](image)

### VIZIR project

**Infrared image perception on transparent displays**

Thermal images are processed in order to maximize detail perception and temperature estimation, specifically on AR displays. The result is a hands-free thermal imaging system.

**Practical application: firefighting**

- Bad visibility environment
- See-through Augmented Reality display
- Infrared (LWIR) camera

### Saliency [6,7]

- **Input Image**
- **Spatial Center & Variances of Colors**
- **Probability of Saliency**
- **Global Contrast**
- **Saliency Map**