Cost Volume Refinement For Depth Prediction

Joao Cardoso, Nuno Goncalves, Michael Wimmer
Light Field Images
Light Field Images
Cost Volumes

\[ D(u) \simeq D_C(u) = \arg\min_z C(u, z) \]
Typical Pipelines

TAO
- Any Source
- Lenslet Variance
- Image Sharpness
- Minimum Cost
- Peak Ratio
- Markov Propagation

JEON
- Any Source
- Absolute Differences
- Gradient Differences
- Aggregation
- Label Propagation
- Median Transfer
- Super Resolution

WILLIEM
- Any Source
- Constrained Entropy
- Constrained Defocus
- Aggregation
- Label Propagation

OURS
- Any Source
- Any Heuristic
- Artifact Removal
- External Sources
- Local Smoothness
- Parabolic Cost
Independent Predictor Combination

\[ C_{k+1}(\mathbf{u}, z) = C_k(\mathbf{u}, z) + \lambda_k G(P_u - z) \]
Classification Artifact Removal

Ground Truth
Classification Artifact Removal

Floating Prediction

Ground Truth
Classification Artifact Removal

Floating Prediction

Label Propagation

Ground Truth
Classification Artifact Removal

- Floating Prediction
- Label Propagation
- Refined Floating Prediction
- Ground Truth
Iterative Local Smoothness

\[
\begin{align*}
S_0 &= C_k \\
S_{j+1}(u, z) &= C_k(u, z) + \\
& \quad \lambda_k \sum_{v \in I_u} G(D_{S_j}(v) - z) \cdot W_{S_j}(v)
\end{align*}
\]
## Statistics

<table>
<thead>
<tr>
<th>Pipeline</th>
<th>MSE</th>
<th>SSI</th>
</tr>
</thead>
<tbody>
<tr>
<td>LV (Tao <em>et al.</em> [11])</td>
<td>2.1672%</td>
<td>9.6871%</td>
</tr>
<tr>
<td>Refined Lenslet Variance</td>
<td>1.5297%</td>
<td>10.8989%</td>
</tr>
<tr>
<td>SAD (Jeon <em>et al.</em> [1])</td>
<td>1.2829%</td>
<td>11.3914%</td>
</tr>
<tr>
<td>Refined Sum of Absolute Differences</td>
<td>0.7165%</td>
<td>11.6619%</td>
</tr>
<tr>
<td>CAE (William <em>et al.</em> [13])</td>
<td>3.2723%</td>
<td>8.6063%</td>
</tr>
<tr>
<td>Refined Constrained Angular Entropy</td>
<td>2.1083%</td>
<td>9.9078%</td>
</tr>
</tbody>
</table>
Example Results
Example Results
Example Results
Thank you