Cost-Volume Filtering-Based Stereo Matching with Improved Matching Cost and Secondary Refinement

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Motivation

Although local method has achieved accuracy comparable to global method, outliers still exist in the final disparity map.

Focus of this work

Local Stereo matching
- Cost computation
- Cost aggregation
- Disparity computation
- Optimization
- Disparity refinement

Method

Combined cost

\[ C = \alpha \cdot C_{\text{left}} + \beta \cdot C_{\text{right}} + (1 - \alpha - \beta) \cdot C_{\text{interp}} \]

Modified Color Census Transform

Exploiting the small hole graph cut belief propagation

Optimization

High complexity

Experimental results

Middlebury dataset

Real-world sequences

Quantitative evaluation compared with other local methods

Algorithms

<table>
<thead>
<tr>
<th>Algorithm</th>
<th>Middlebury</th>
<th>Real-world</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Visionary</td>
<td>6.4</td>
<td>7.4</td>
<td>2.4</td>
</tr>
<tr>
<td>LRM</td>
<td>6.3</td>
<td>7.0</td>
<td>2.9</td>
</tr>
<tr>
<td>Costs1</td>
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<td>7.2</td>
<td>3.0</td>
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<tr>
<td>Costs2</td>
<td>6.4</td>
<td>7.2</td>
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<tr>
<td>Costs3</td>
<td>6.4</td>
<td>7.2</td>
<td>3.0</td>
</tr>
</tbody>
</table>

Conclusion

- Combined matching cost
- Secondary refinement scheme RADAR
- Perform well on both Middlebury and Real-world dataset

The most time-consuming parts are the cost aggregation (symmetric guided filter) and the refinement pipeline. However, both of them can be paralleled for acceleration.

Complexity

- Acceleration on CPU
- Time allocation
- Cost aggregation
- Refinement pipeline
- Cost computation etc.