Real-Time Local Stereo Using CUDA

David Gallup, Jan-Michael Frahm
University of North Carolina

Joe Stam
Nvidia

Stereo Problem

![Stereo Problem Diagram]

Fast SAD/SSD

\[ \sum ( \left( \begin{array}{c} \text{left image} \\ \text{right image} \end{array} \right) - \left( \begin{array}{c} \text{disparity map} \end{array} \right) )^2 \]

Separable box filter

Running sum (sequential)

Running sum + vertical box (parallel)

Parallel enough to utilize GPU
Sequential enough to reduce work

Timings

GeForce 8800 GTX, 50 disparities, 7x7 box

<table>
<thead>
<tr>
<th>W</th>
<th>H</th>
<th>time (ms)</th>
<th>Hz</th>
</tr>
</thead>
<tbody>
<tr>
<td>640</td>
<td>480</td>
<td>21</td>
<td>47.619</td>
</tr>
<tr>
<td>800</td>
<td>600</td>
<td>27</td>
<td>37.037</td>
</tr>
<tr>
<td>1024</td>
<td>768</td>
<td>39</td>
<td>25.641</td>
</tr>
</tbody>
</table>

Results

Open source code available at www.cs.unc.edu/~gallup/stereo-demo