Cartographer
Open House VIII
October 26, 2017
What landed on master? • cartographer

- Refactoring for life-long mapping, i.e. introduction of MapByld (#581, #583, #584, #585, #586, #587, #592, #593, #597, #603)
- Support multiple trajectories in LoadMap. (#567)
- Add TimedPointCloud and TimedRangeData. (#601)
- Bug fixes, refactorings, performance.
What landed on master? • cartographer_ros

- Adds a rosbag_validate binary. (#536, #541)
- Visualize gaps in trajectories due to trimming. (#500)
- Adds a PointsProcessor that can write ROS maps. (#548)
- Bug fixes, refactorings, performance.
### “Demo” • Unifying 2D and 3D Optimization

<table>
<thead>
<tr>
<th></th>
<th>2D</th>
<th>% rel to 2D</th>
<th>3D</th>
<th>% rel to 2D</th>
<th>3D.1</th>
<th>% rel to 2D</th>
<th>3D.2</th>
<th>% rel to 2D</th>
</tr>
</thead>
<tbody>
<tr>
<td>user time (s)</td>
<td>4730.08</td>
<td>100.00%</td>
<td>6937.91</td>
<td>146.68%</td>
<td>6199.24</td>
<td>131.06%</td>
<td>5882.86</td>
<td>124.37%</td>
</tr>
<tr>
<td>system time (s)</td>
<td>248.51</td>
<td>100.00%</td>
<td>418.68</td>
<td>168.48%</td>
<td>309.3</td>
<td>124.46%</td>
<td>308.02</td>
<td>123.95%</td>
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<tr>
<td>wall time (s)</td>
<td>1055</td>
<td>100.00%</td>
<td>1861</td>
<td>176.40%</td>
<td>1402</td>
<td>132.89%</td>
<td>1375</td>
<td>130.33%</td>
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<tr>
<td>mem (kB)</td>
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<td>100.00%</td>
<td>2840088</td>
<td>111.82%</td>
<td>2696612</td>
<td>106.17%</td>
<td>2692880</td>
<td>106.02%</td>
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<tr>
<td>optimization</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<td></td>
</tr>
<tr>
<td>avg iterations</td>
<td>6.16667</td>
<td>100.00%</td>
<td>6.54639</td>
<td>106.16%</td>
<td>6.39394</td>
<td>103.69%</td>
<td>6.31959</td>
<td>102.48%</td>
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<tr>
<td>preprocessor</td>
<td>0.128515</td>
<td>100.00%</td>
<td>0.249896</td>
<td>194.45%</td>
<td>0.237507</td>
<td>184.81%</td>
<td>0.238067</td>
<td>185.24%</td>
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<tr>
<td>res eval</td>
<td>0.0331941</td>
<td>100.00%</td>
<td>0.100476</td>
<td>302.69%</td>
<td>0.136416</td>
<td>410.96%</td>
<td>0.122881</td>
<td>370.19%</td>
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<tr>
<td>Jacobian eval</td>
<td>0.147858</td>
<td>100.00%</td>
<td>0.787842</td>
<td>532.84%</td>
<td>0.742038</td>
<td>501.86%</td>
<td>0.629186</td>
<td>425.53%</td>
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<tr>
<td>Linear solver</td>
<td>0.817438</td>
<td>100.00%</td>
<td>3.25522</td>
<td>398.22%</td>
<td>1.33157</td>
<td>162.90%</td>
<td>1.30219</td>
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<tr>
<td>Minimizer</td>
<td>1.11033</td>
<td>100.00%</td>
<td>4.50901</td>
<td>406.10%</td>
<td>2.46548</td>
<td>222.05%</td>
<td>2.30469</td>
<td>207.57%</td>
</tr>
</tbody>
</table>

3D: naive use of mapping_3d/optimization_problem.cc for 2D mapping (only translation reparametrization)
3D.1: naive use of mapping_3d/optimization_problem.cc for 2D mapping (both angular and translation reparametrization)
3D.2: optimized 3D cost function (\(\sin \theta \rightarrow \theta\), for efficient quaternion inversion)
$ rosrun cartographer_ros cartographer_rosbag_validate -bag_filename ~/Downloads/2017-10-17-08-59-28.bag

Count: 4178  Min: 0.004978  Max: 0.010394  Mean: 0.005880
[0.004978, 0.005880)  Count: 5 (0.119674%)  Total: 5 (0.119674%)
[0.005880, 0.006783)  Count: 0 (0.000000%)  Total: 5 (0.119674%)
[0.006783, 0.007686)  Count: 0 (0.000000%)  Total: 5 (0.119674%)
[0.007686, 0.008589)  Count: 0 (0.000000%)  Total: 5 (0.119674%)
[0.008589, 0.009492)  Count: 1 (0.023935%)  Total: 6 (0.143609%)
[0.009492, 0.010394)  Count: 4166 (99.712784%)  Total: 4172 (99.856392%)
[0.010394, 0.011297)  Count: 1 (0.023935%)  Total: 4173 (99.880325%)
[0.011297, 0.012200)  Count: 0 (0.000000%)  Total: 4173 (99.880325%)
[0.012200, 0.013103)  Count: 0 (0.000000%)  Total: 4173 (99.880325%)
[0.013103, 0.014006)  Count: 5 (0.119674%)  Total: 4178 (100.000000%)

I1019 11:23:49.507936 117476 rosbag_validate_main.cc:154] Time delta histogram for consecutive messages on topic "/fullscan" (frame_id: "rslidar"):
Count: 418  Min: 0.000000  Max: 0.014006  Mean: 0.010000
Demo • cartographer_rosbag_validate #540
Discussion - RFCs

- Cartographer community growing with more and more PRs to review.
- Introduction of RFCs to make code contributions less time consuming for contributors and reviewers.
- Lightweight design review process through RFCs.
- Implementation tracking of agreed upon features through Github projects.
Current work

- Life-long mapping.
- Reuse more 3D components in 2D mapping pipeline.
- Initial pose implementation.
- Point cloud unwarping.
- Bug fixes, refactorings, performance.
Placeholder for other status reports
Thanks!

Next Open House:
November 9, 5pm CET (9am PST)

If you would like to present anything next meeting, please reach out to
cschuet@google.com