



Exploiting 2D Floorplan for Building-Scale Panorama RGBD Alignment

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Overview

Problem : Align high quality 3D point clouds

Challenge : Robust alignment requires prohibitively many scans

Idea : Utilize a 2D floorplan to align 3D points



Unknown Variables per Scan

x_i, y_i : 2D position

r_i : 2D rotation (0°, 90°, 180°, 270°)

z_i : Vertical position

Step 1: Find 5 best placements per scan

For each scan, create a 2D projection and hierarchically search for the best alignments



E_{SF} : Scan-to-floorplan potential

- Ensures consistency between projected scan and floorplan

Project Site and Data

<http://cvpr17.wijmans.xyz>



Step 2: Global Inference

Solve an MRF inference problem with 3 potentials.

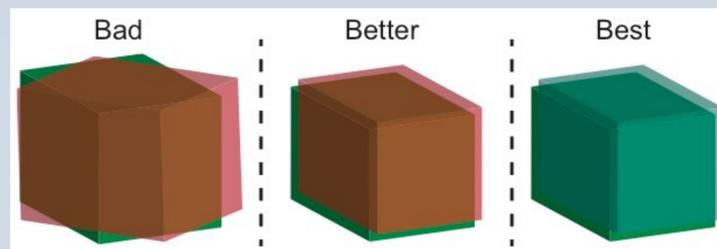
- 1) Scan-to-floorplan (E_{SF})
- 2) Scan-to-scan (E_{SS})
- 3) Floorplan Coverage (E_F)

$$\min_{\{c_1, c_2, \dots\}} E_{SF} + E_{SS} + E_F$$

$c_i \in \{1, 2, 3, 4, 5\}$
 c_i specifies one of the five candidate placements for scan i .

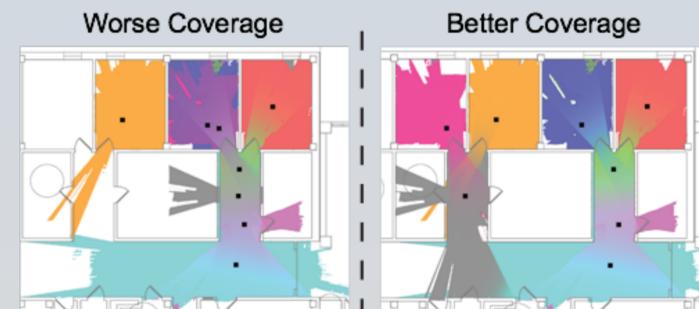
E_{SS} : Scan-to-scan potential

- Ensures geometric and photometric consistency between neighboring scans in 3D



E_F : Floorplan coverage potential

- Maximizes the area covered by the final placement

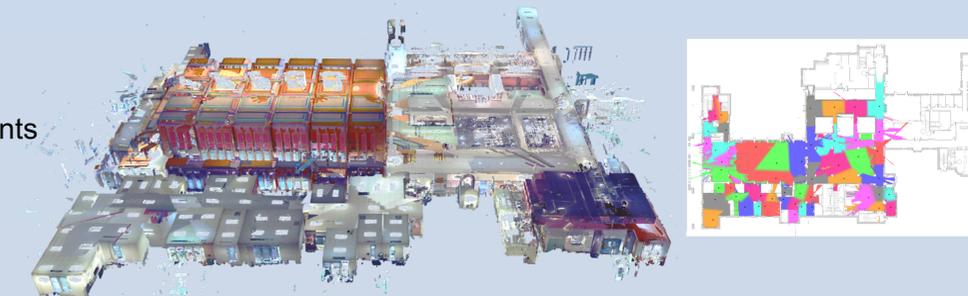


Data	SF	SF+SS	All (SF+SS+F)
Center 1	12%	0%	2%
Center 2	3%	2%	0%
Hall 1	29%	15%	15%
Hall 2	12%	15%	7%
Hall 3	44%	47%	34%

Percent of scans misaligned. Demonstrates the effect of the 3 cues on the MRF inference problem

Alignment Results

Center 1:
50 scans
2.2 billion points



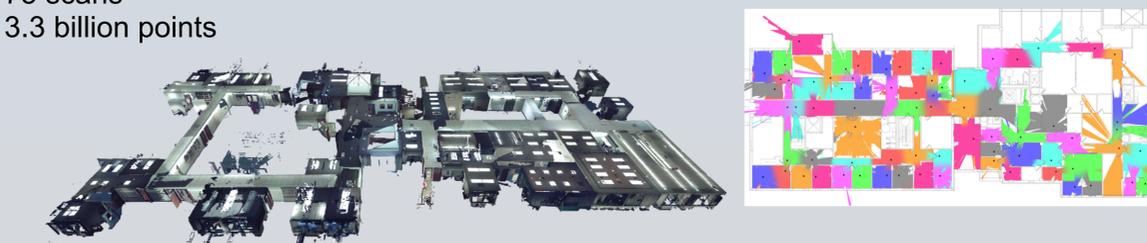
Center 2:
80 scans
3.5 billion points



Hall 1:
7 scans
0.3 billion points



Hall 2:
75 scans
3.3 billion points



Hall 3:
65 scans
2.8 billion points

