Proceduralization of 3D Building Point Clouds

İlke Demir
Purdue University
West Lafayette, IN, USA
idemir@purdue.edu

Daniel G. Aliaga
Purdue University
West Lafayette, IN, USA
aliaga@purdue.edu

Bedrich Benes
Purdue University
West Lafayette, IN, USA
bbenes@purdue.edu

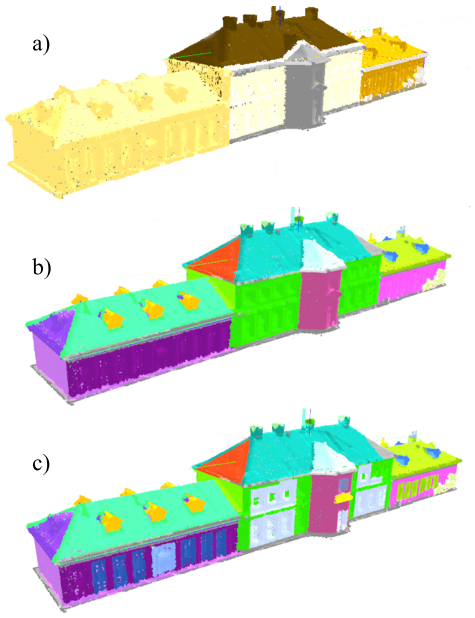

Figure 1: ***Granularity.*** A model shows largest granularity after 3 user assisted strokes (top), medium granularity after 6 strokes (1-2 minutes) (middle), and small granularity after 13 strokes (5-6 minutes) (bottom).

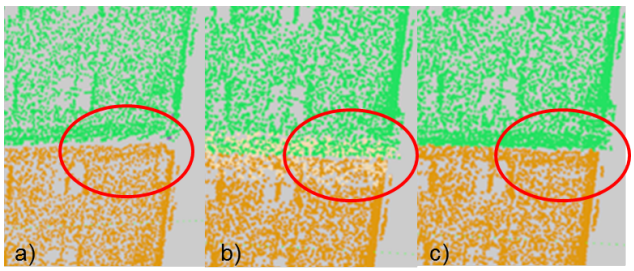

Figure 2: ***Inter-Node Seams.*** Two segments (a) are glued for seamlessness with additional points via resampling (b) and the result is (c). About 2000 points are added here.

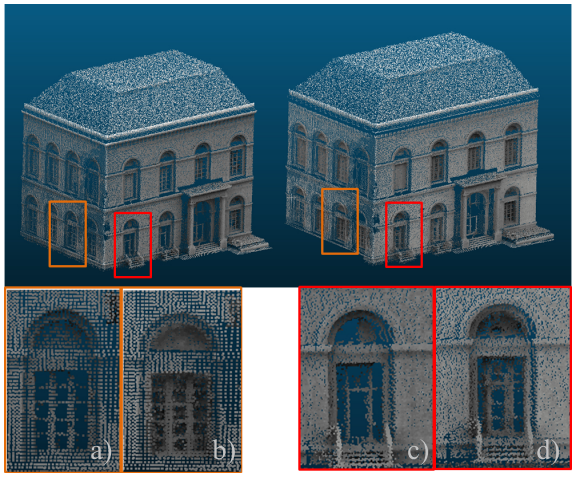

Figure 3: ***Consensus Model.*** Before (left, (a), (c)) and after (right, (b), (d)) point cloud pairing. The missing window frames are completed with the consensus model.

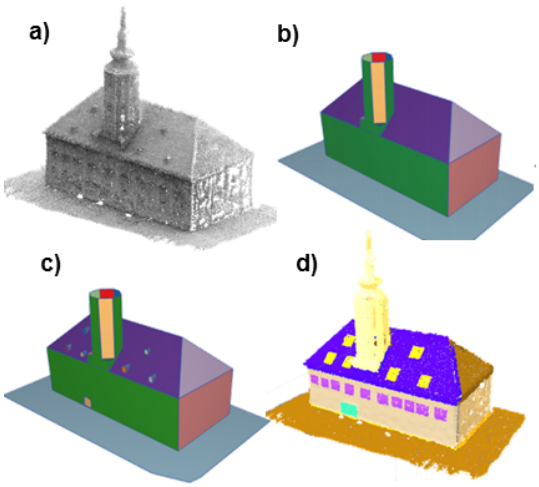

Figure 4: ***Comparison.*** Original model (a), O-Snap best cases after automatic extraction (b) and manual modeling (c). Our consensus model without editing (d). (images b, c courtesy of [2])

	Their Limitation	Our Improvement	Related Figure(s)
[2, 19]	Model is polygonized before modeling	Direct point cloud editing is provided	1d, 5b, 5f, 6, 7, 8, 9, S7
[3, 9, 13, 14, 15, 16, 28, 29, 30, 32]	No modeling support	Both modeling and completion support	1c, 1d, 3, 5d, 6, 7, 8, 9, S2, S3, S7
[13, 15]	Special case for specific type of buildings	No assumption on building types	5, 6, 7, 9, S3, S5
[2, 4, 6, 13, 14, 15, 28, 30]	No pattern search	Repetitions and patterns enhance the completion and the grammar	1b, 1d, 3, 4, 6, 8b, 8g, S3, S7
[1, 3, 9, 15, 16, 18, 23, 24, 28]	Building components are limited (facades, roofs, columns)	No restriction on supported building components	3, 4, 5, 6, 7, S1, S3, S5
[1, 2, 4, 5, 6, 9, 13, 14, 15, 16, 19, 28, 30, 31, 32]	Output grammar/patterns is limited, or no grammar is provided.	Denser and more expressive grammar, with hierarchical rules	4, 7
[3, 16, 16, 28]	The grammar is known apriori	No assumption is made before grammar extraction	4
[4, 5, 16, 18, 29]	Supports only meshes	Supports point clouds	-
[5, 15, 16, 18]	Needs labeled input	Provides semi-automatic segmentation	2, 9, S1, S4, S5

Figure 6: ***Previous Work Comparison.*** Each row summarizes a common limitation of a group of previous work, our improvement versus that limitation, and the corresponding Figure(s) that reflect the improvement.

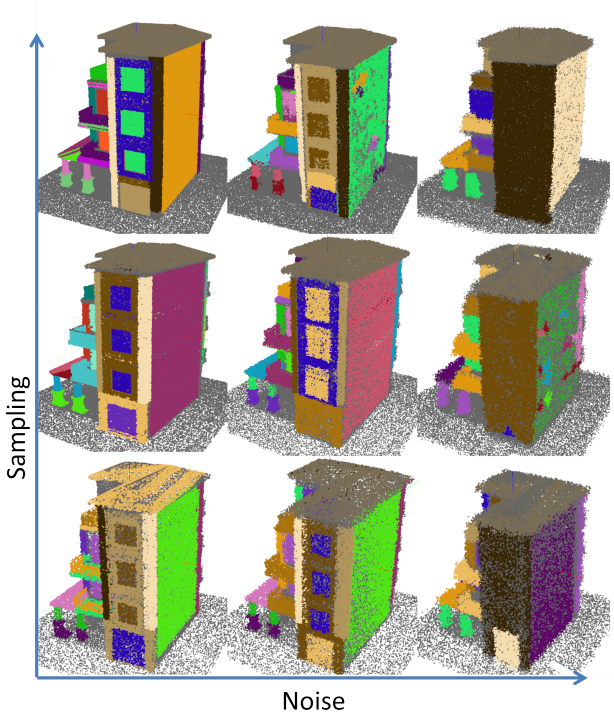

Figure 5: ***Robustness.*** Noise levels: 0, 0.5%, and 1%. Sampling amount: 500k, 250k, and 100k points. Our segmentation is robust up to about 0.5% noise of random point displacement at various densities.

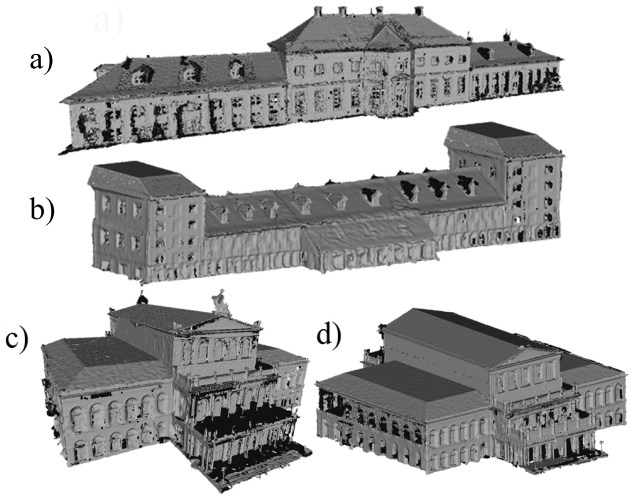

Figure 7: ***Comparisons.*** Original model reconstructed with RIMLS (a, c), and an edited version of the model reconstructed with RIMLS (b, d). Note that the roofs in (b) are a product of style transfer from the building in (c).