Out-of-Core Surface Reconstruction via Global TGV Minimization

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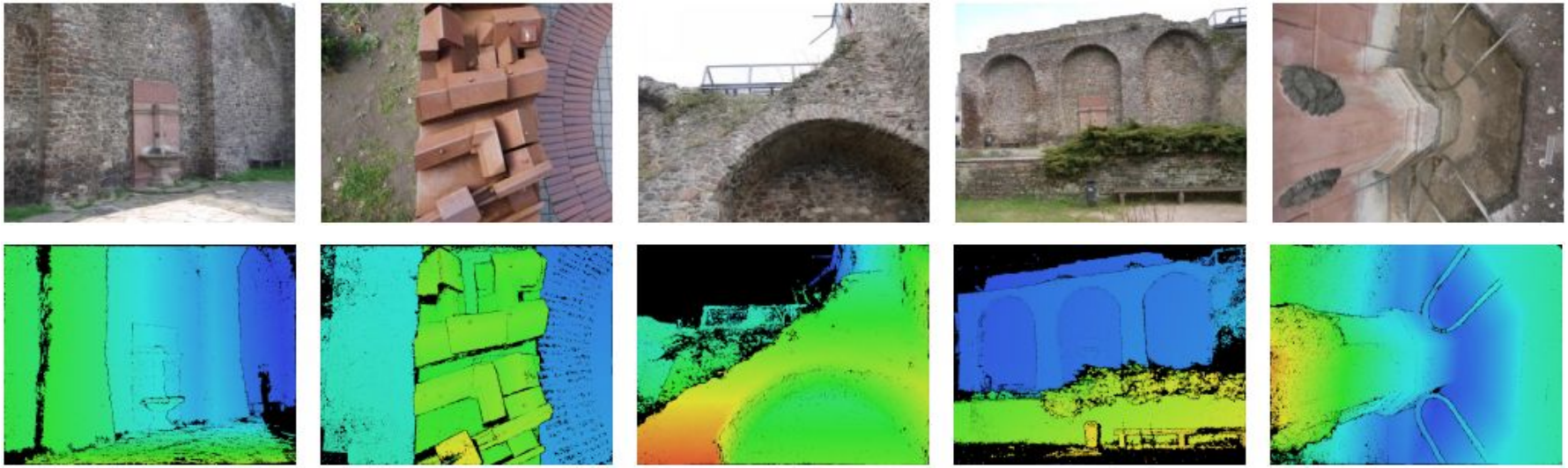
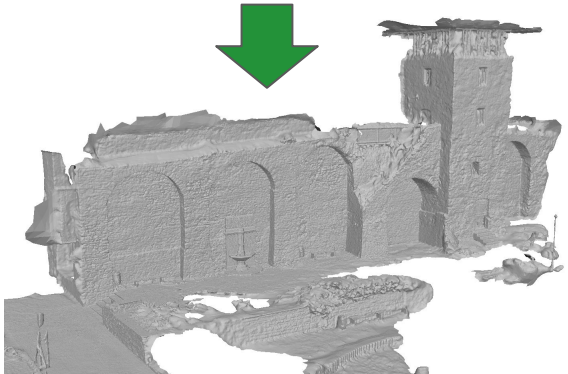
Agisoft

2021 ICCV OCTOBER 11-17 VIRTUAL

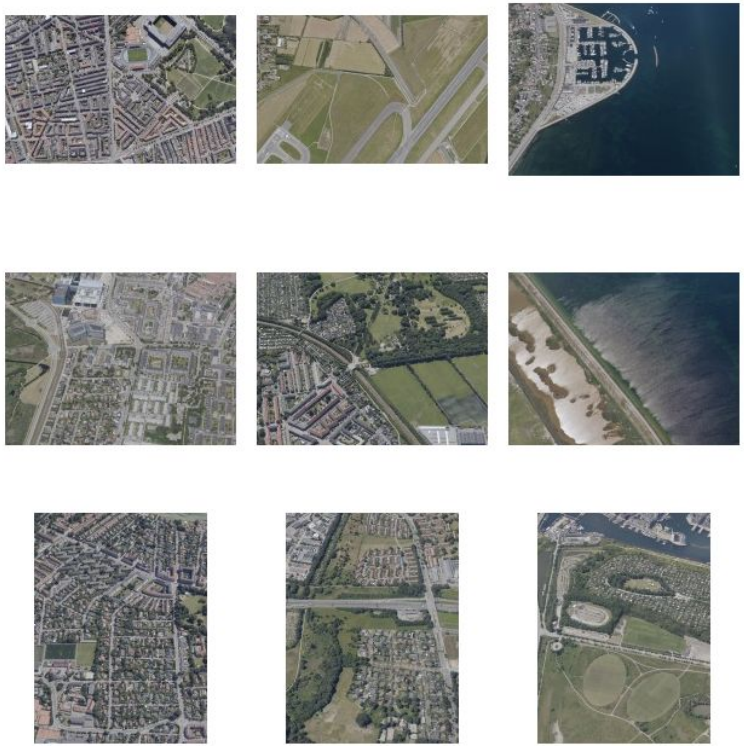
Surface Reconstruction from Depth Maps





Out-of-Core property

27,472 high resolution photos

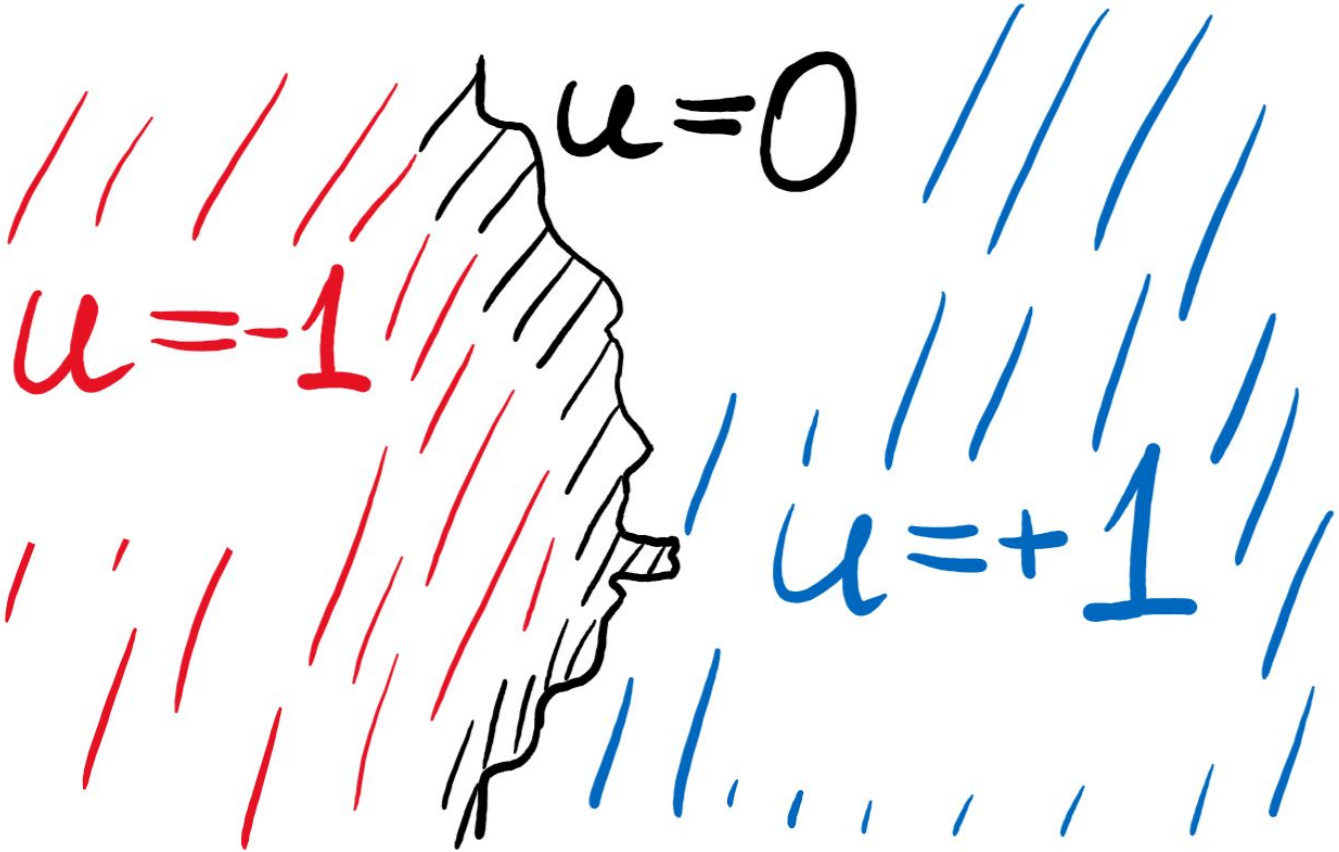


Peak RAM usage:
14 GB

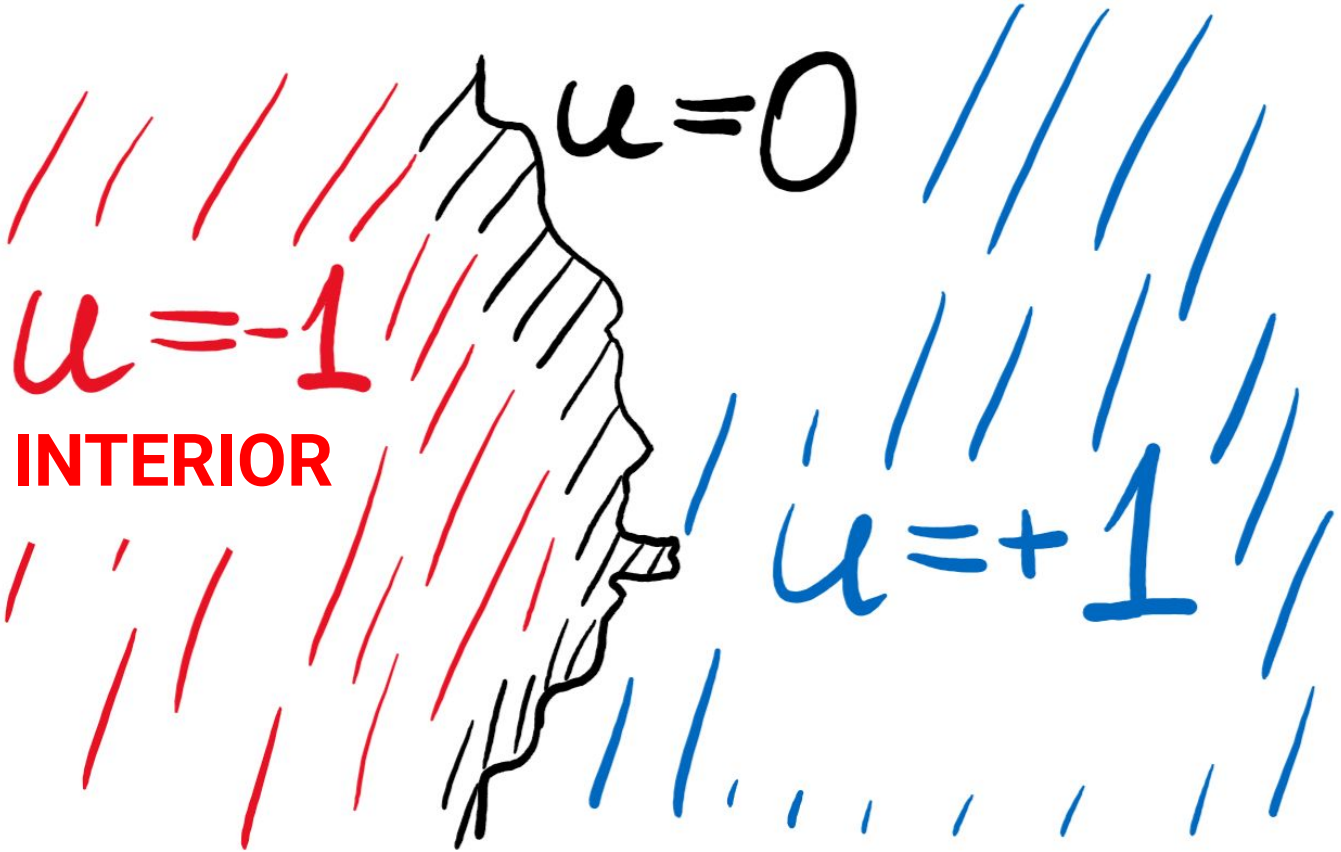
City of Copenhagen, 425 km²

3D Model (**7,490 millions** triangles)

Indicator field space representation



Indicator field space representation



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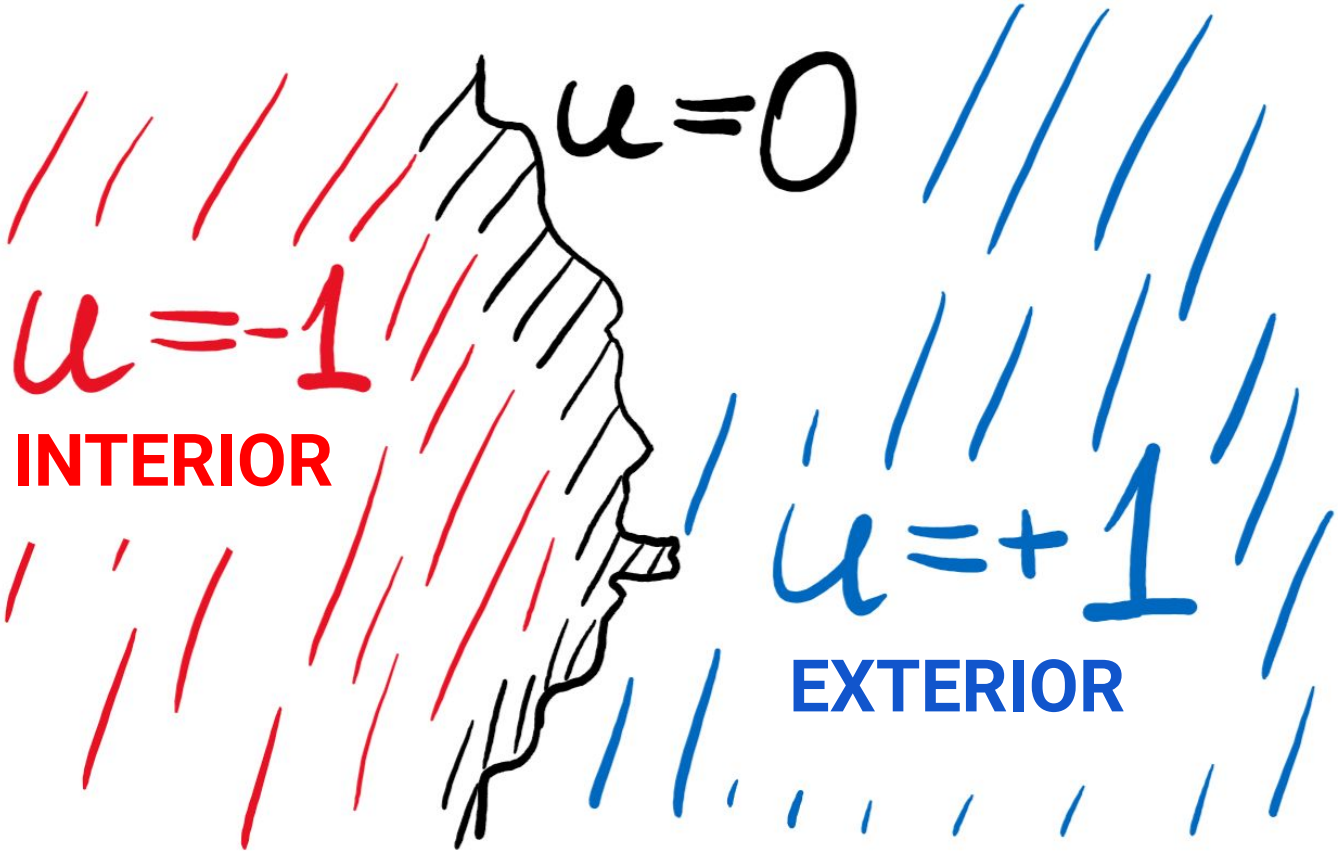

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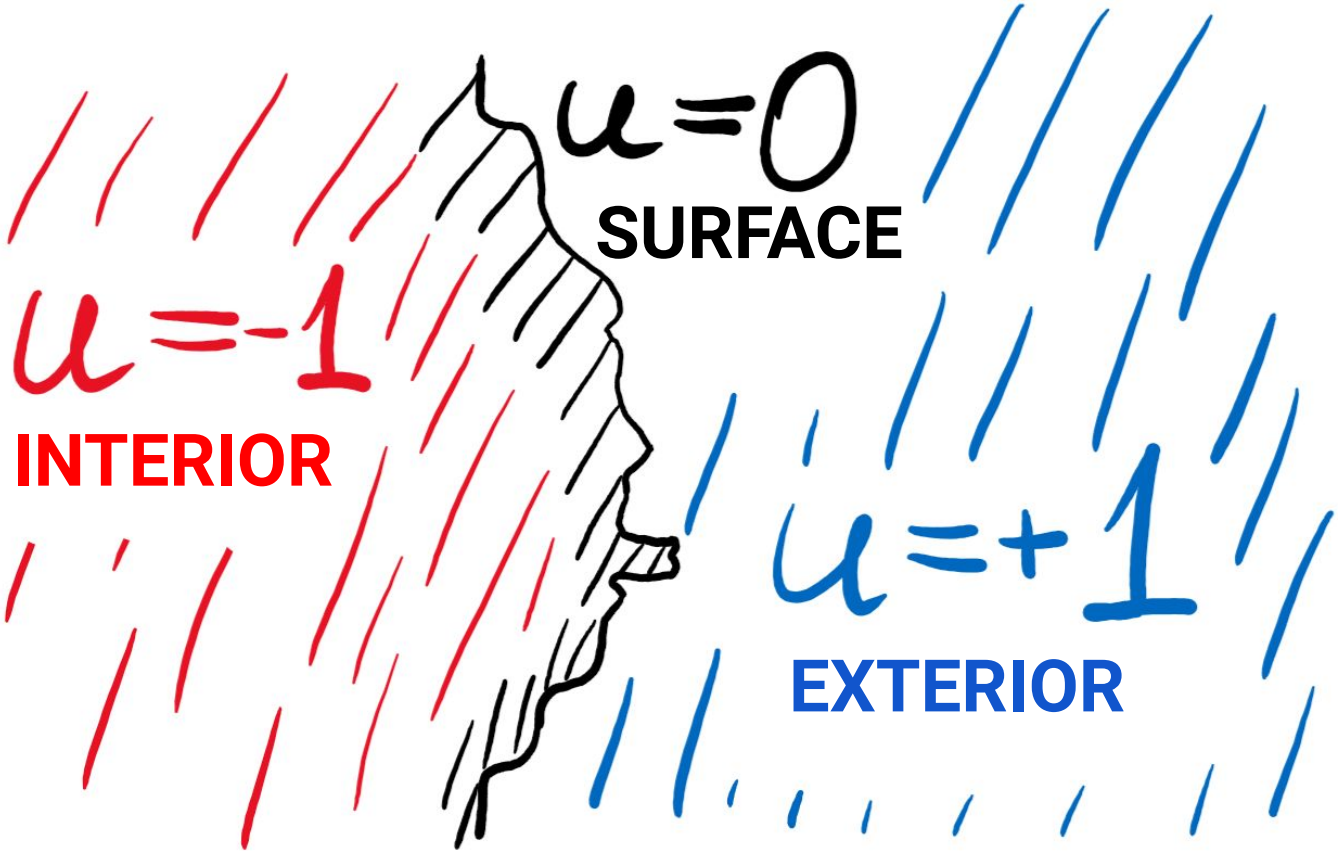
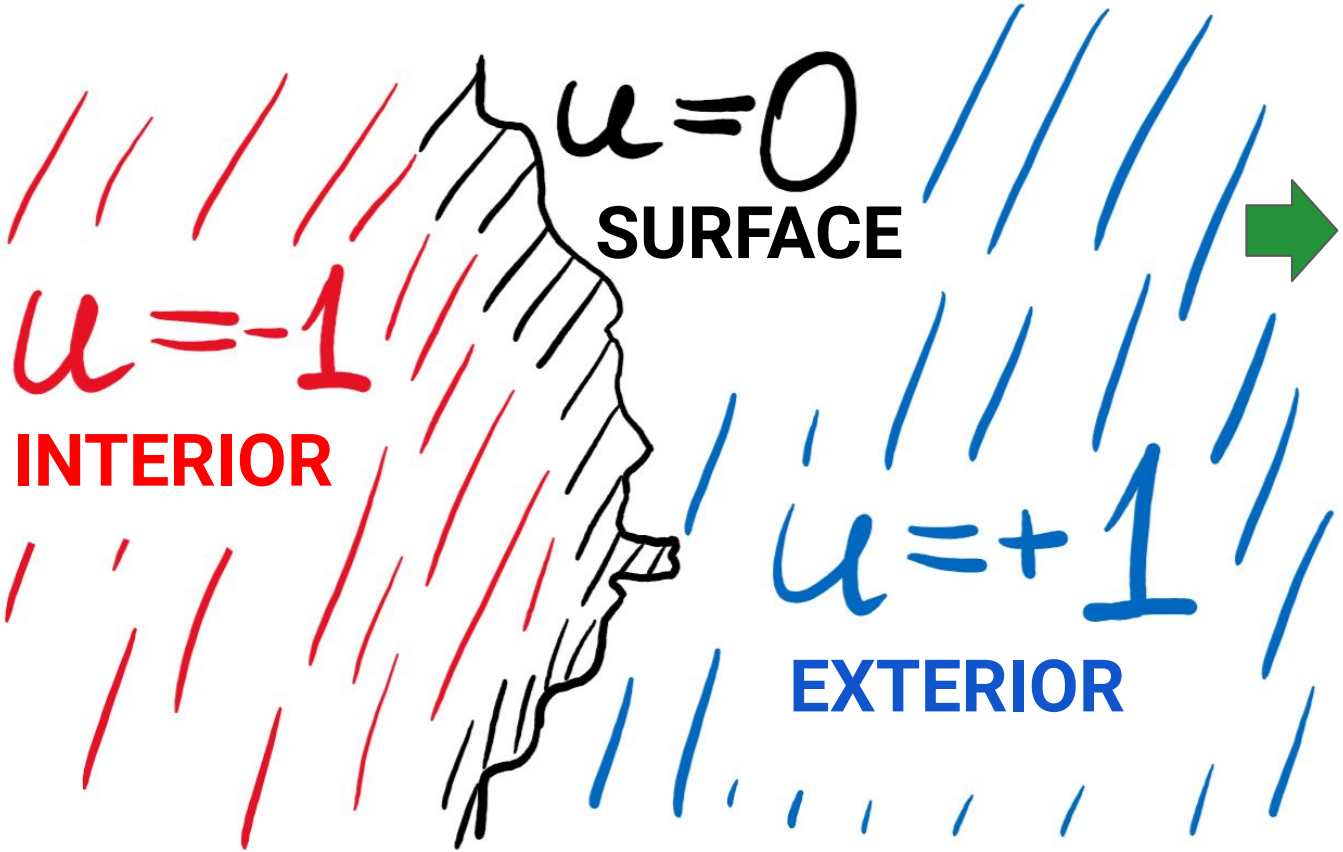
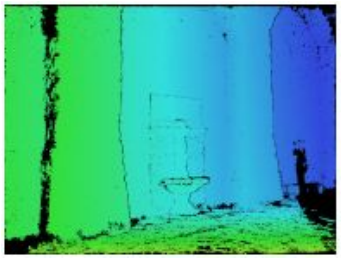


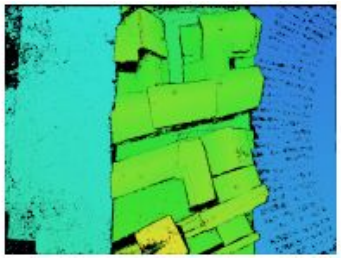
Indicator field space representation

Polygonal Model

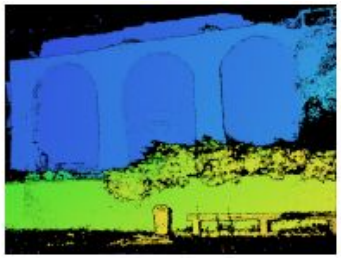


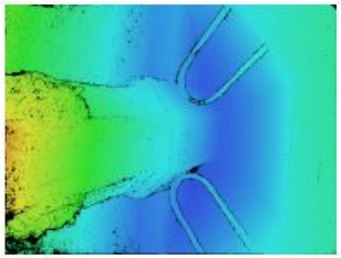
1) Out-of-Core octree: building





...





Octree #1

Octree #2

...

Octree #N-1

Octree #N

96-bit
Morton Codes

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Morton Codes

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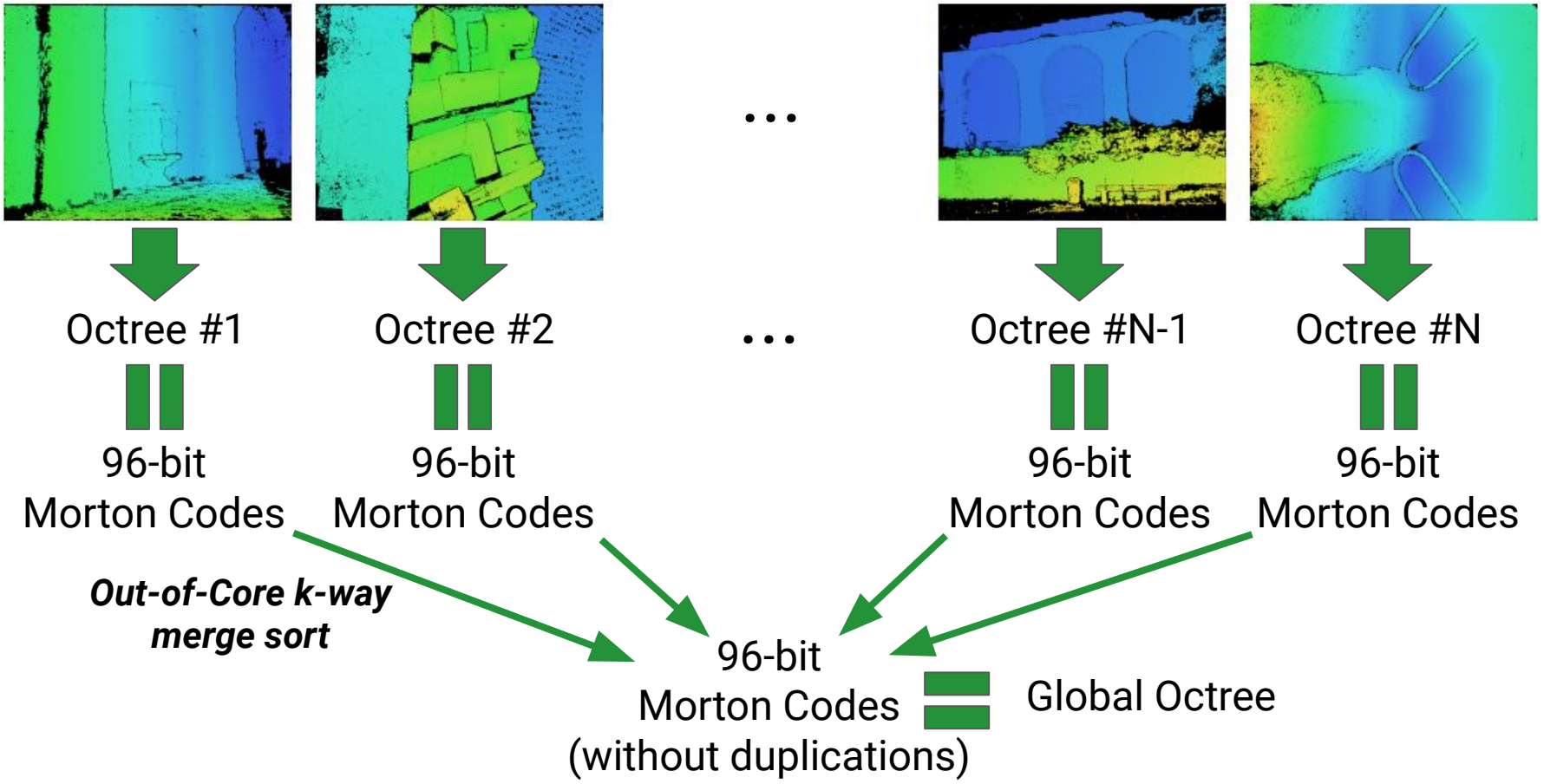
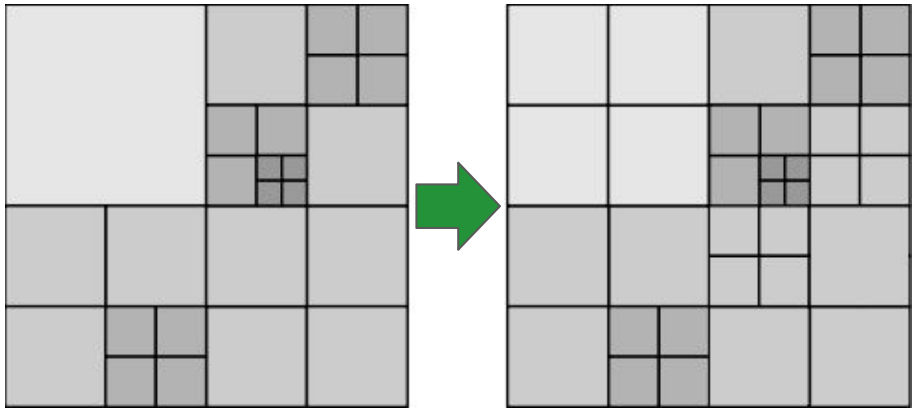


2) Out-of-Core octree: 2:1 balancing



Global Octree:
single large file
with sorted
Morton Codes

Balanced
Global Octree

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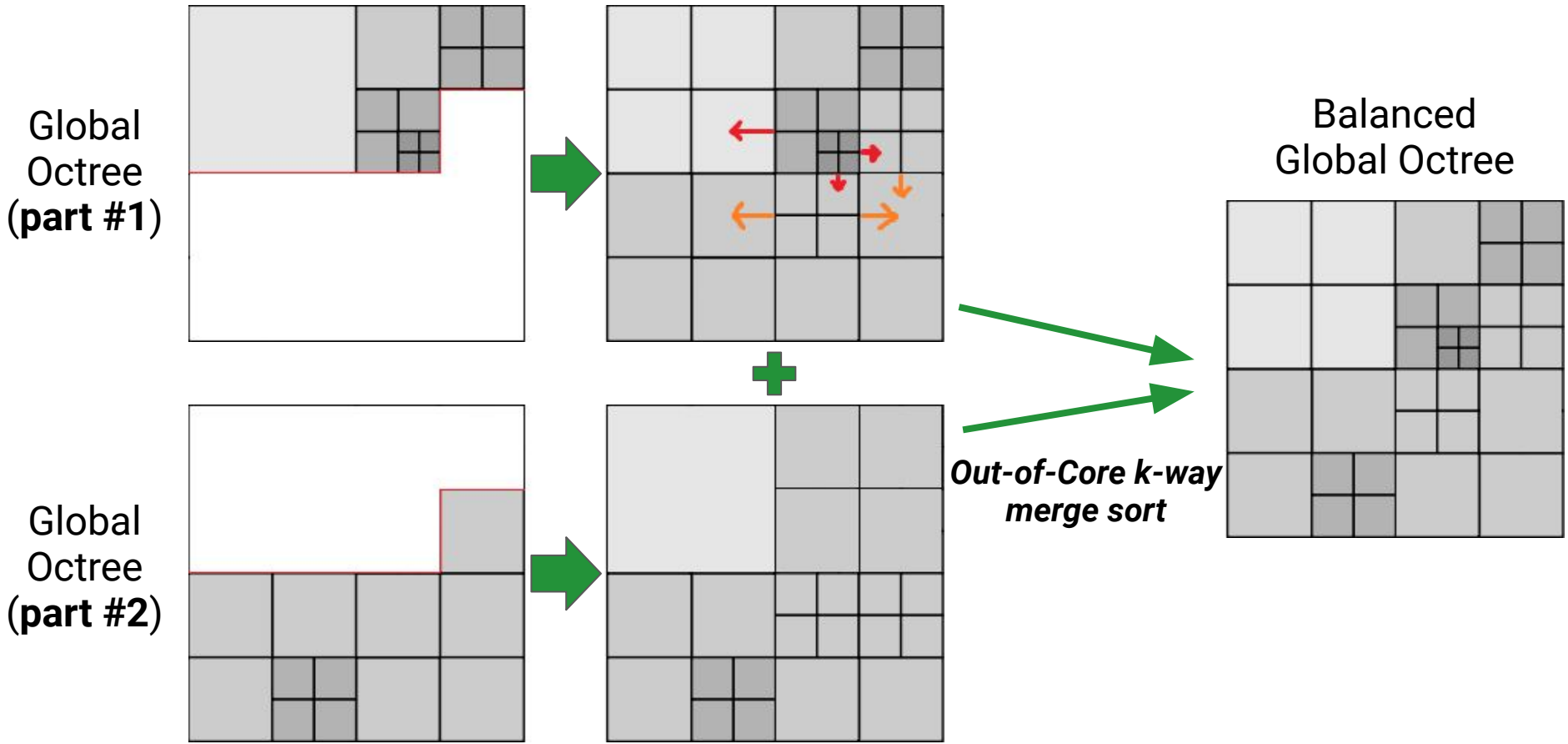
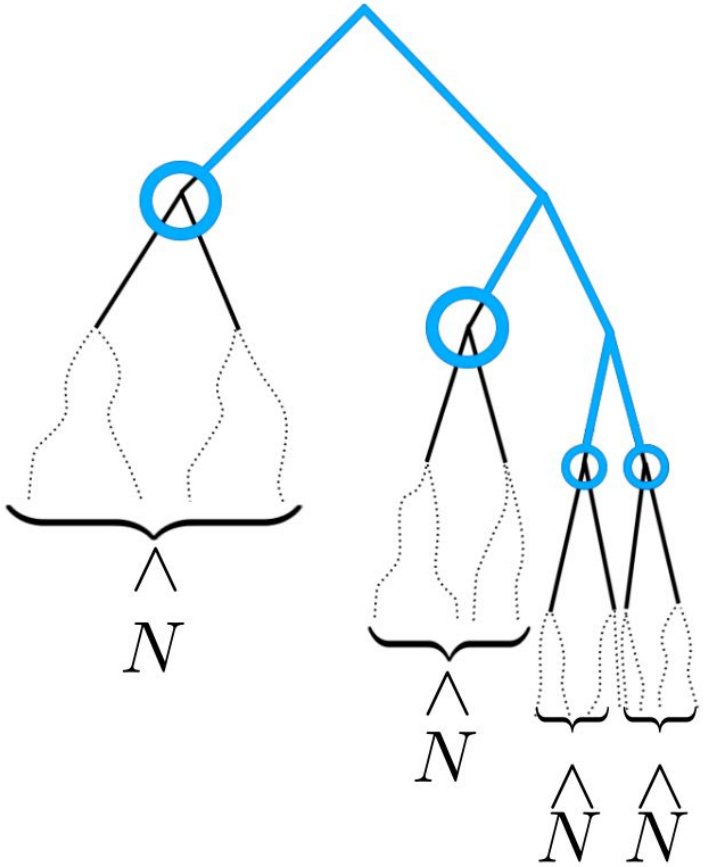


3) Out-of-Core octree: treetop



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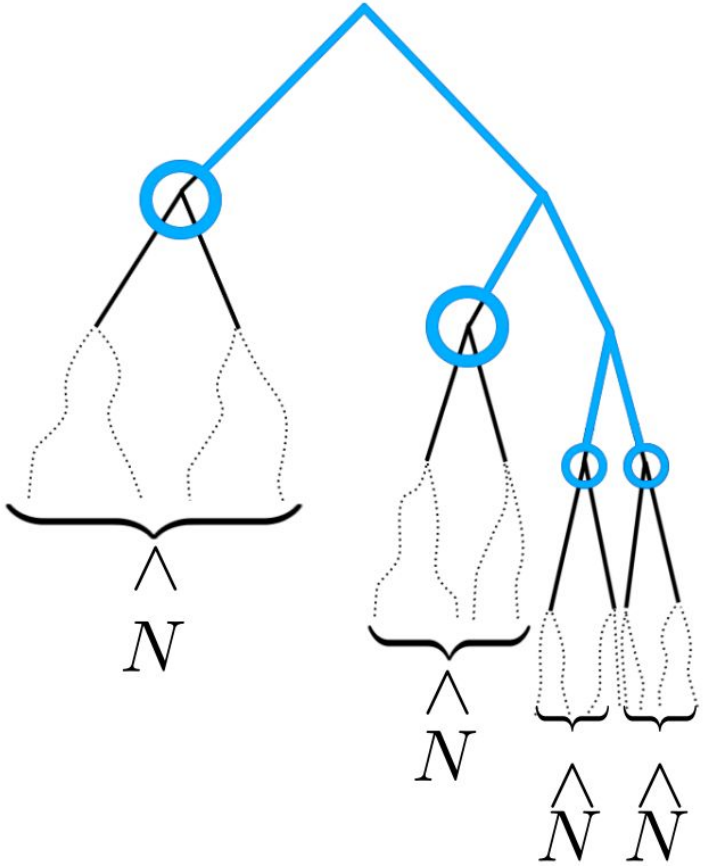
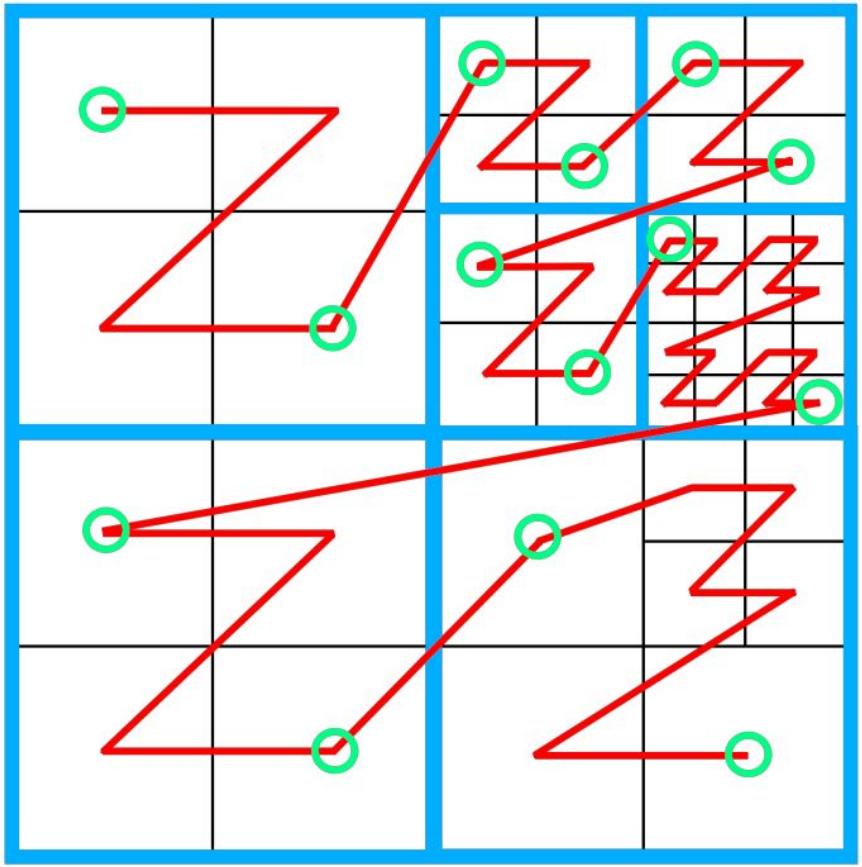
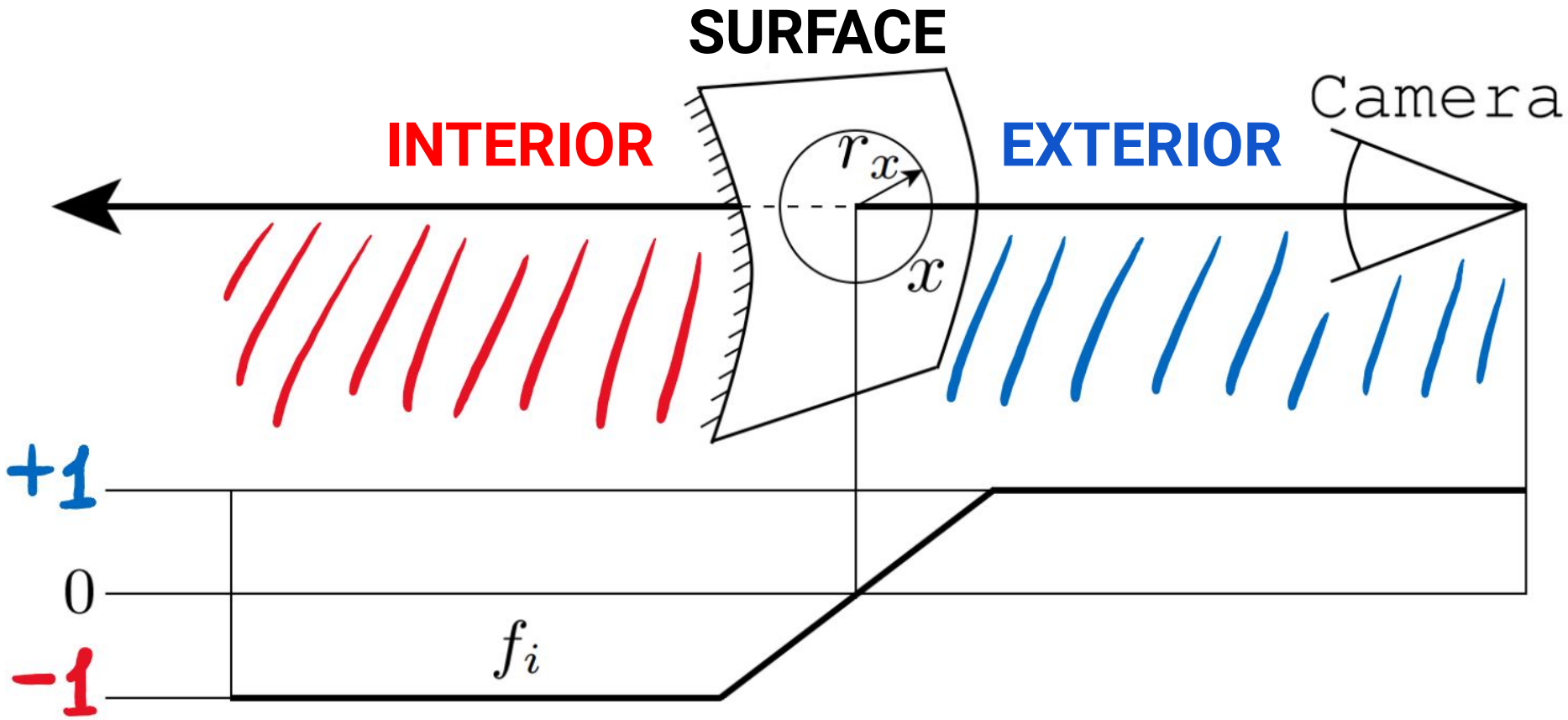




4) Octree histograms from Depth Maps



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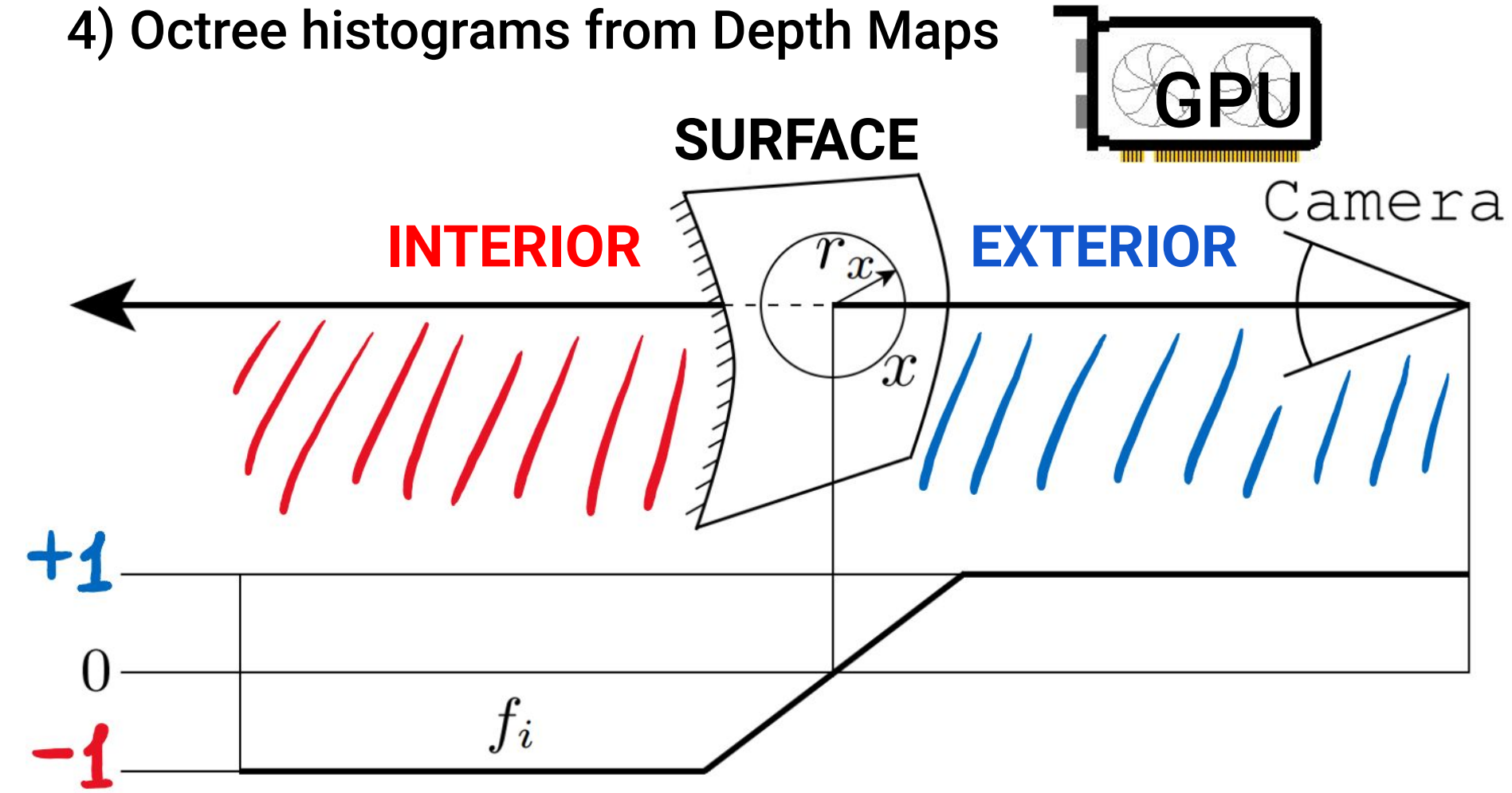
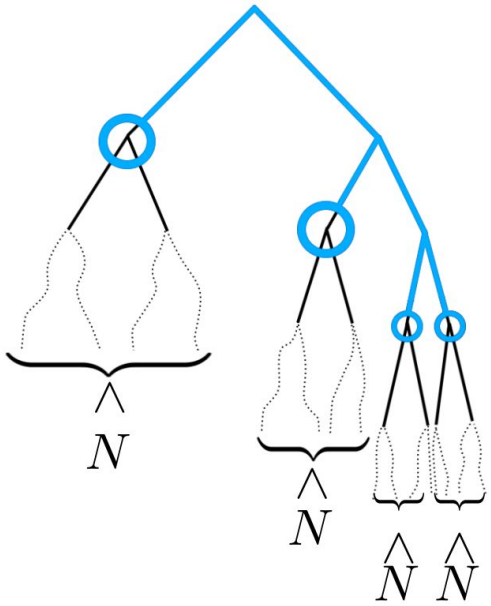
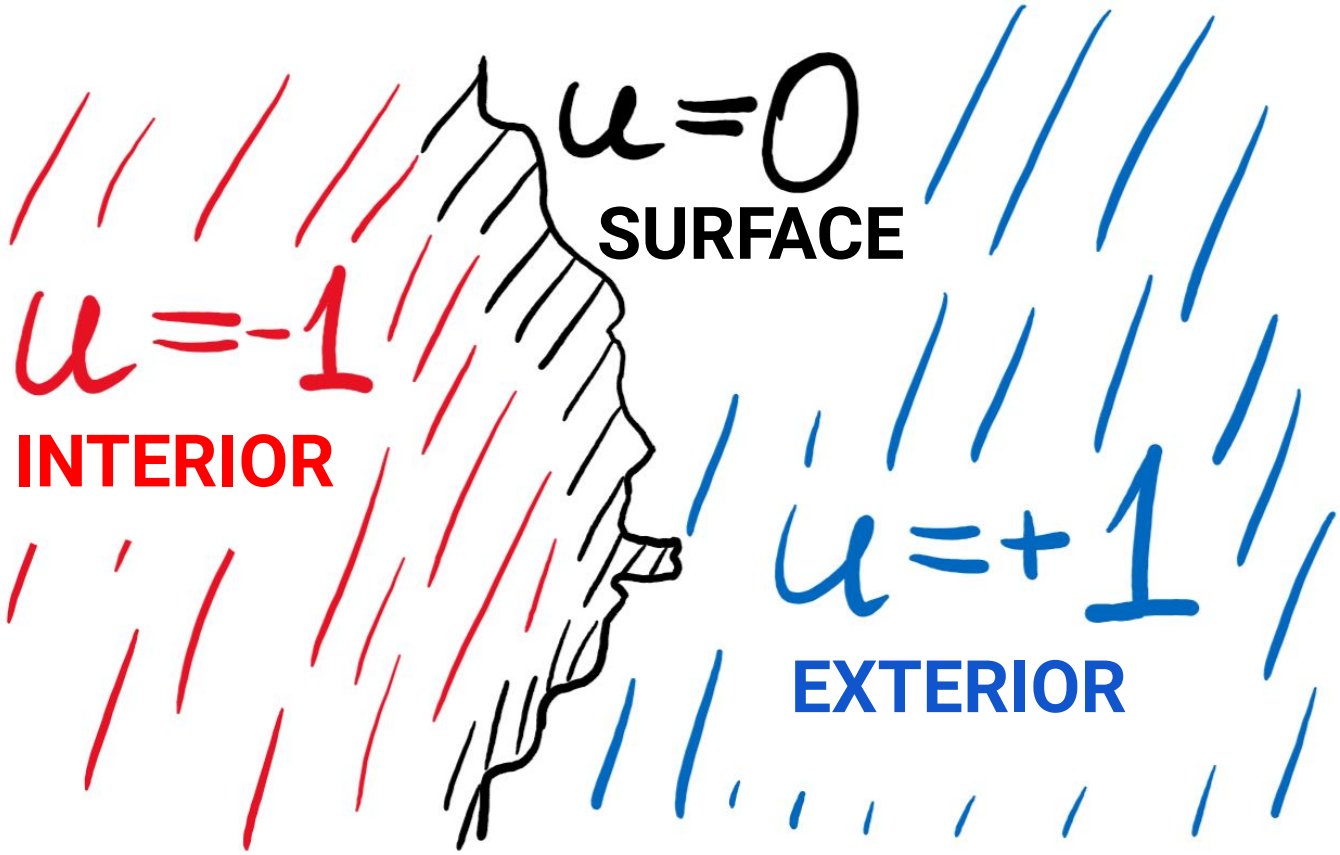
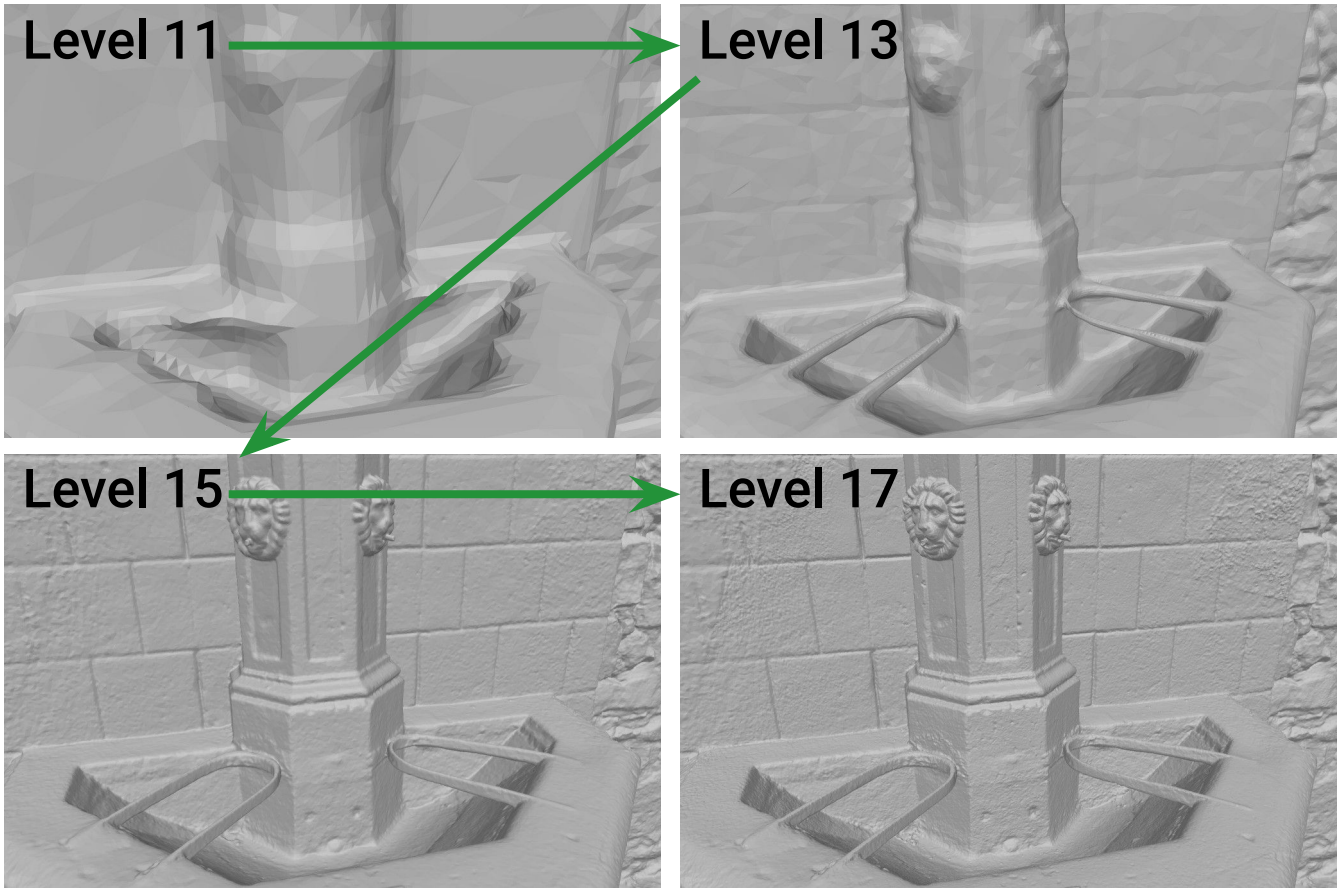


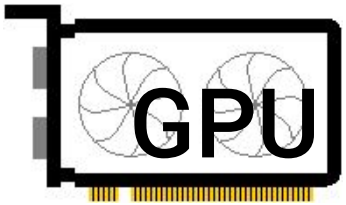
5) TGV minimization iterations



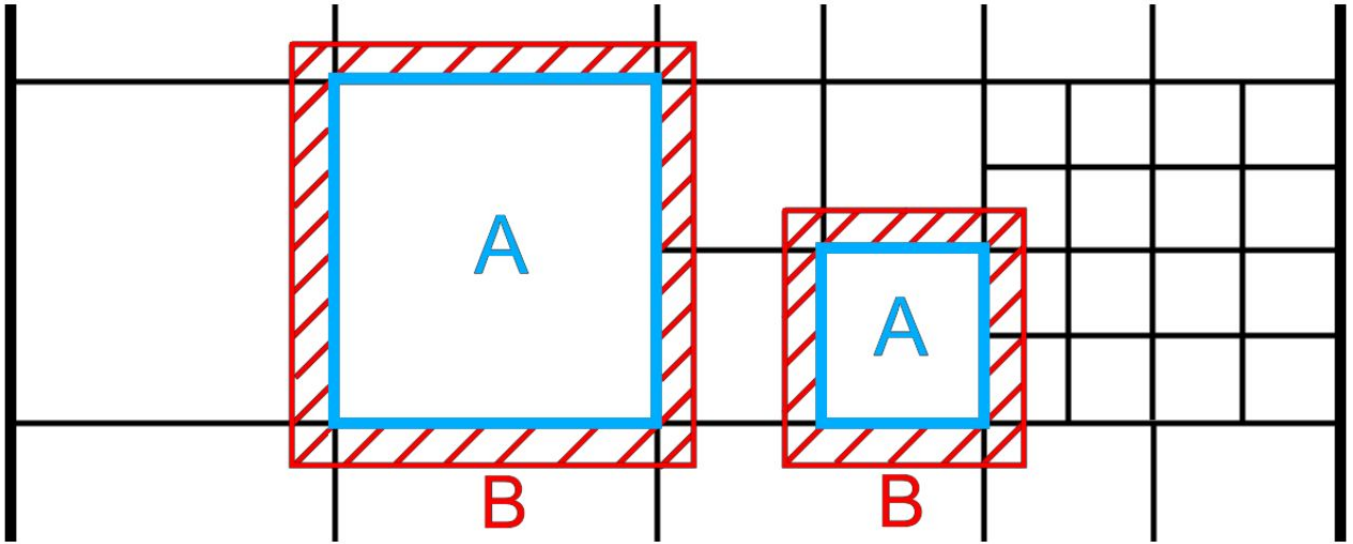


5) TGV minimization iterations: Coarse-to-Fine





5) TGV minimization iterations: fixed border



6) Marching cubes

Indicator field

Marching cubes

Polygonal Model

Quality & Practical properties

Practical properties:

- Out-of-Core (limited memory requirements)
- Fast (GPU-accelerated & IO-friendly)
- Cluster-friendly
- Support terrestrial LIDAR as input

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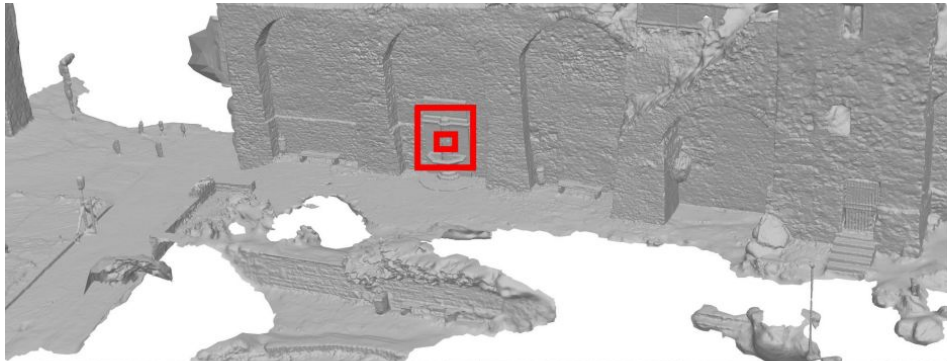
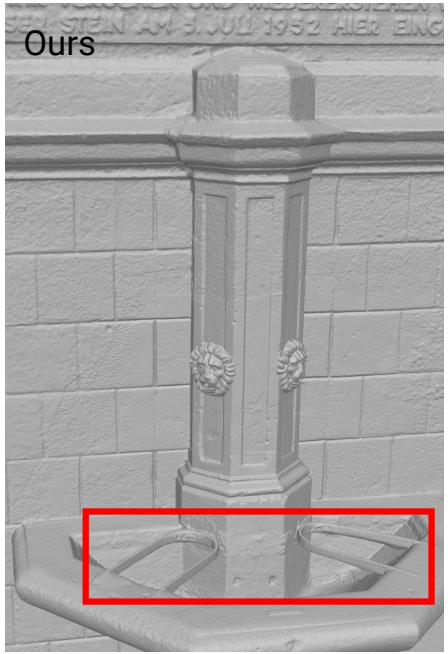
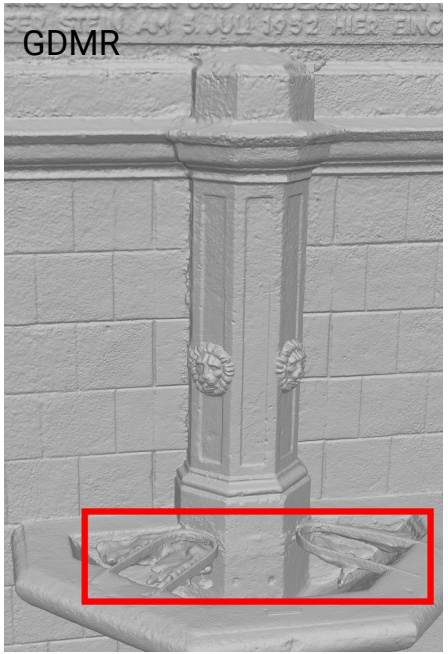
Quality properties:

- Scale-diverse (adaptive resolution)
- Strong visibility-based noise filtering
- Seamless surface







Dataset name	Input data	GDMR Peak RAM	GDMR time	**Our** Peak RAM	**Our** time	SSR Peak RAM	SSR time
Citywall	564 depth maps	75 GB	19 h	13.17 GB	63 min	32*8.9 GB	58 h

x19 faster

Thanks for listening!

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