Facetwise Mesh Refinement for Multi-View Stereo

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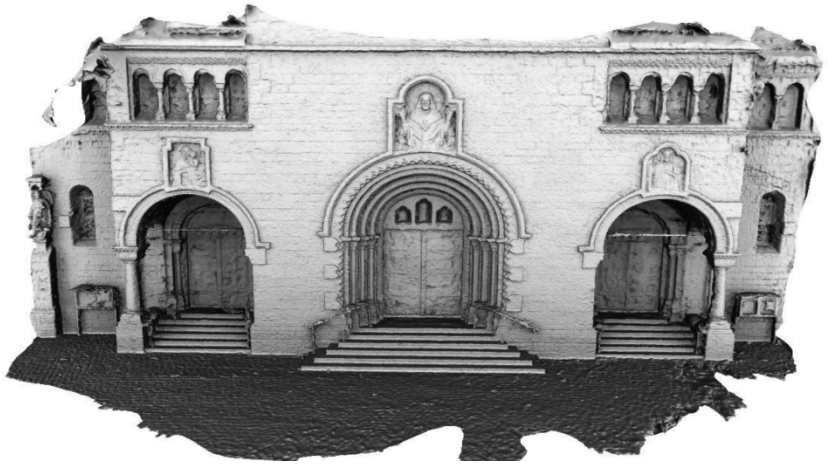
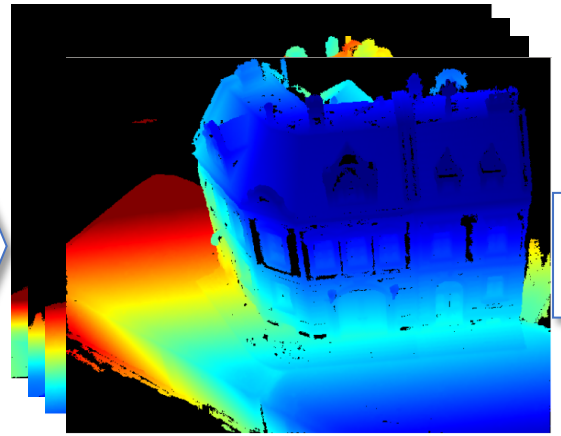
3D Reconstruction



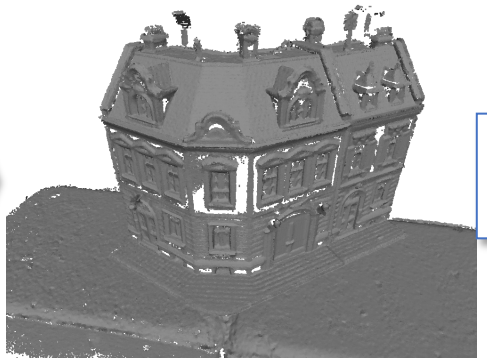
Accurate Multi-View Stereo

Input images

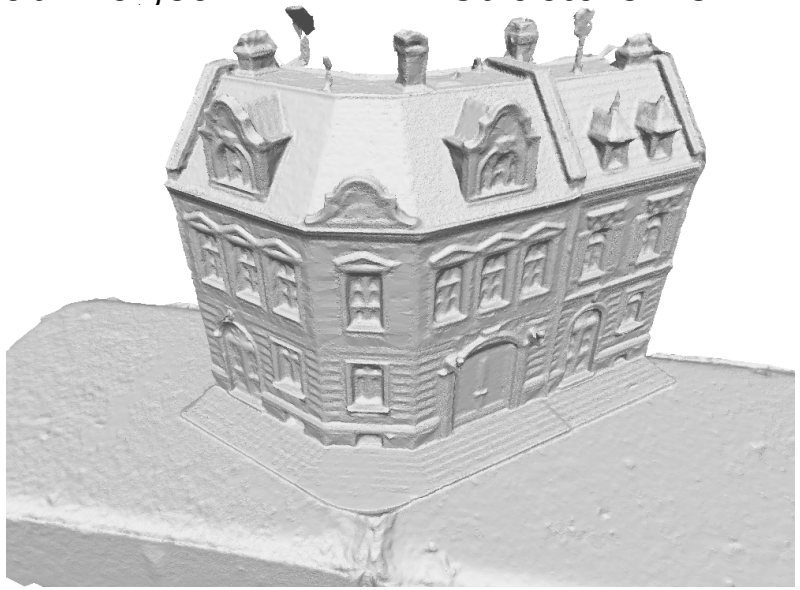
Structure from Motion



Depth Map Estimation



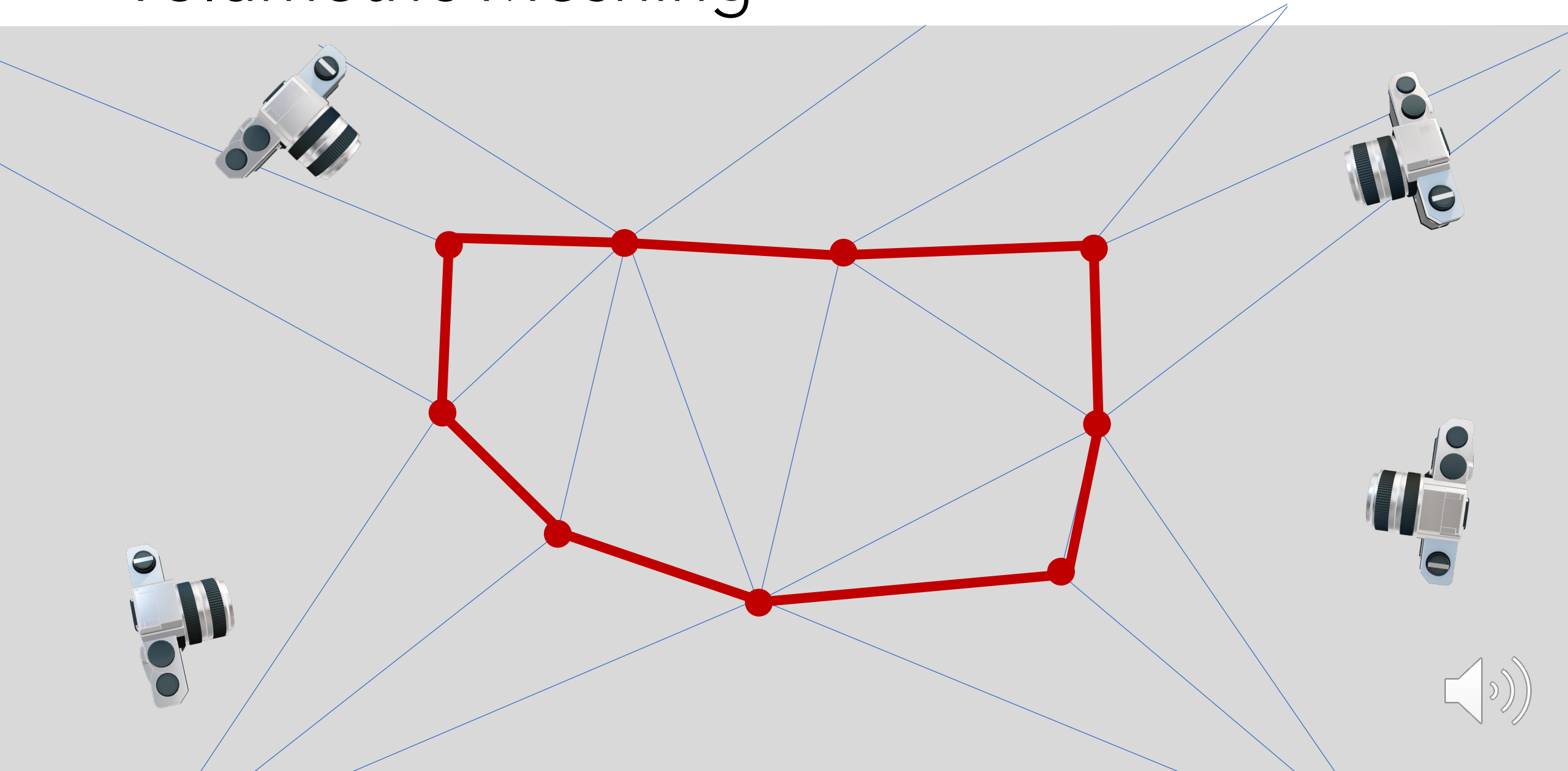
Depth Map Fusion



Meshing

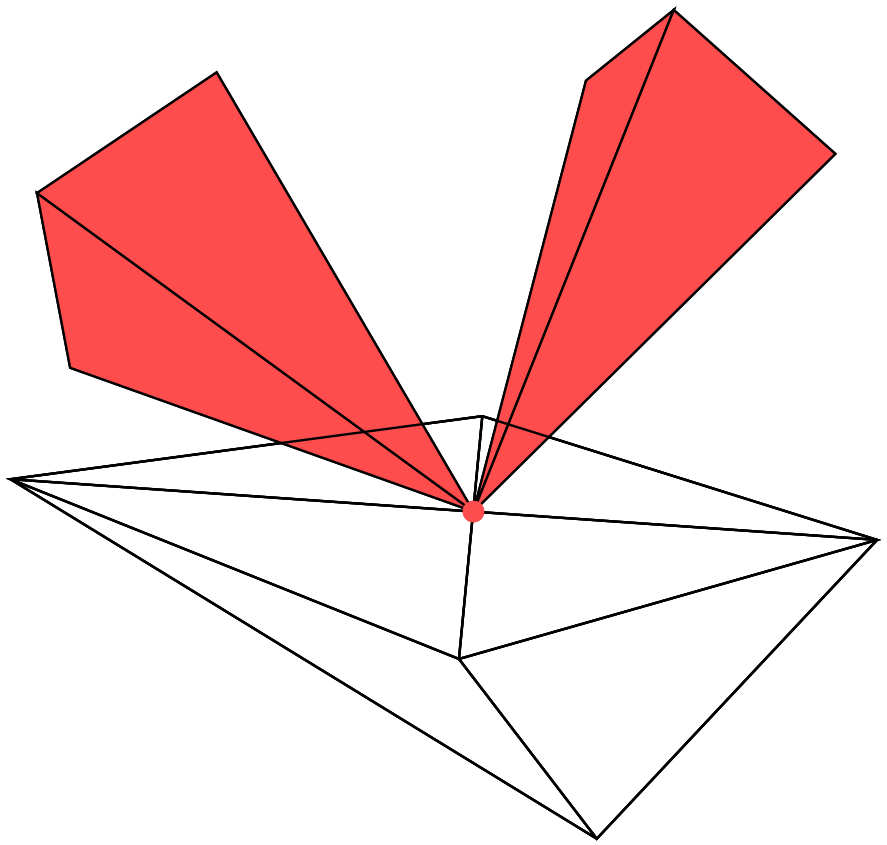
Mesh Refinement

Volumetric Meshing



Preemptive Fix Non-Manifold Vertices

The vertex is manifold if and only if the number of connected components are less or equal two [Lhuiller18]

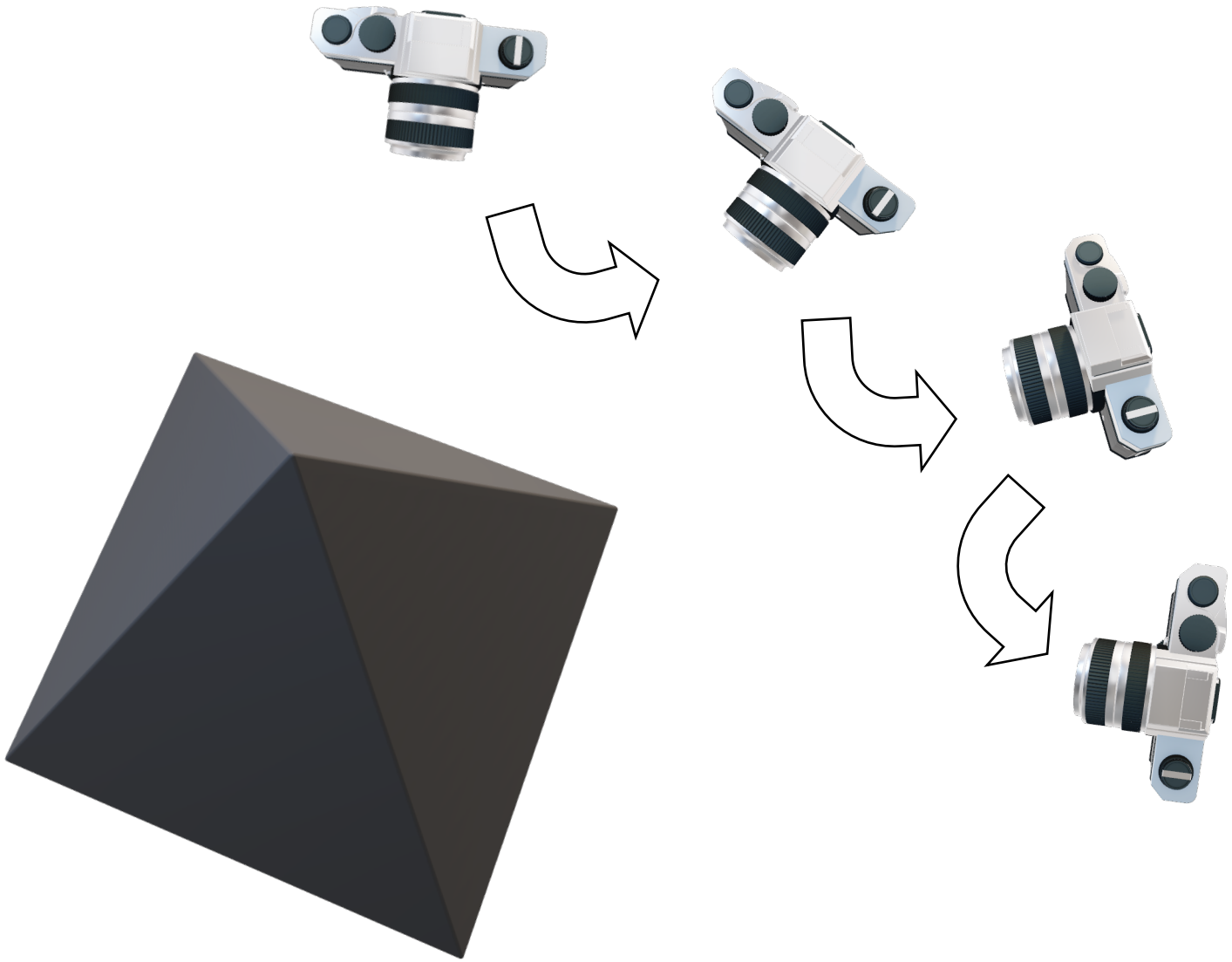


[Lhuillier 18] M. Lhuillier, “Surface reconstruction from a sparse point cloud by enforcing visibility consistency and topology constraints,”ComputerVision and Image Understanding, vol. 175, pp. 52–71, 2018

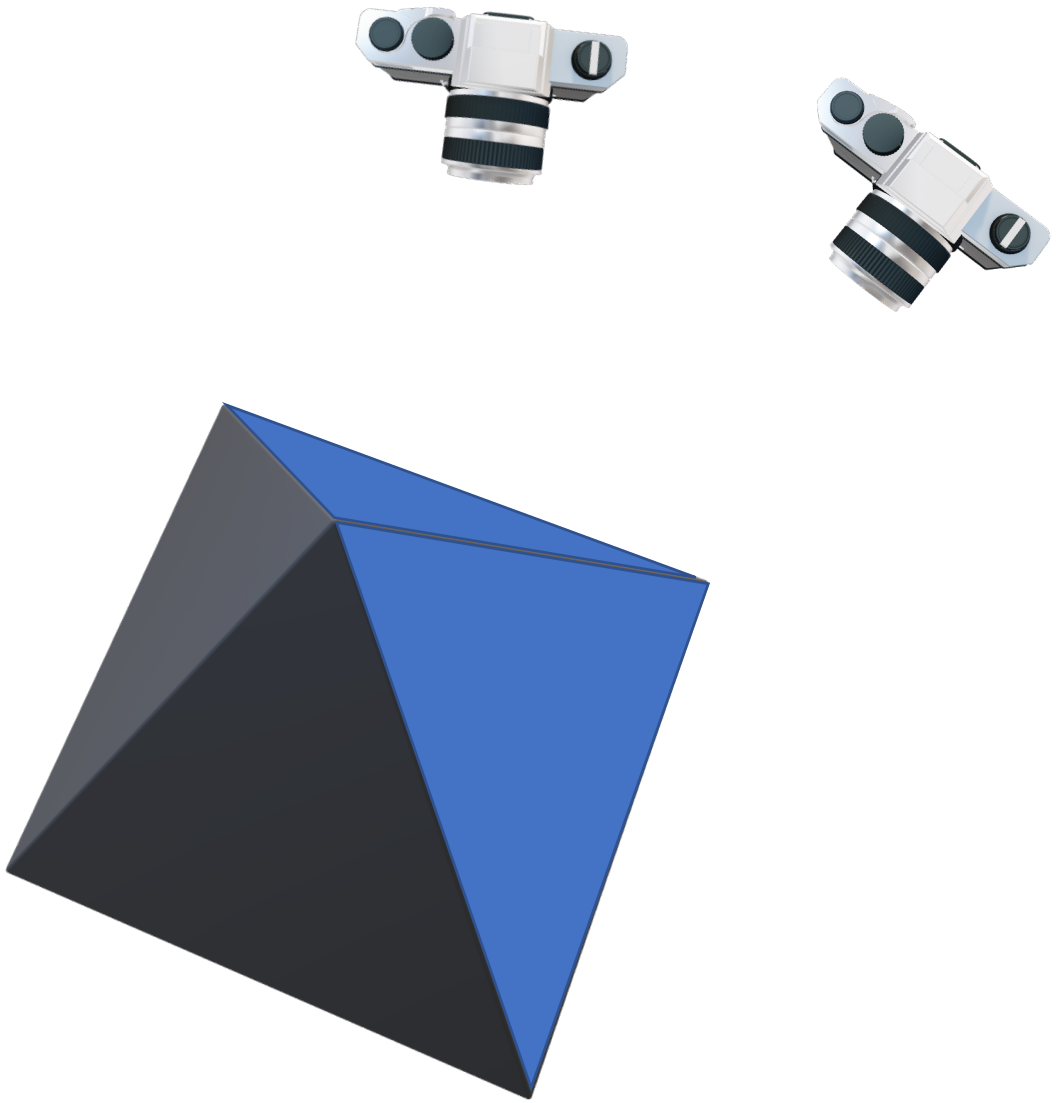
Result on DTU Dataset

DTU sequence	4	6	15	18	24	36	63	106	110	114	118	122
without preemptive fixing	52	84	69	585	122	219	41	99	74	24	54	47
with preemptive fixing	10	10	8	65	14	14	0	10	9	1	2	5
% removed	80.8	88.1	88.4	88.9	88.5	93.6	100	89.9	87.8	95.8	96.3	89.4

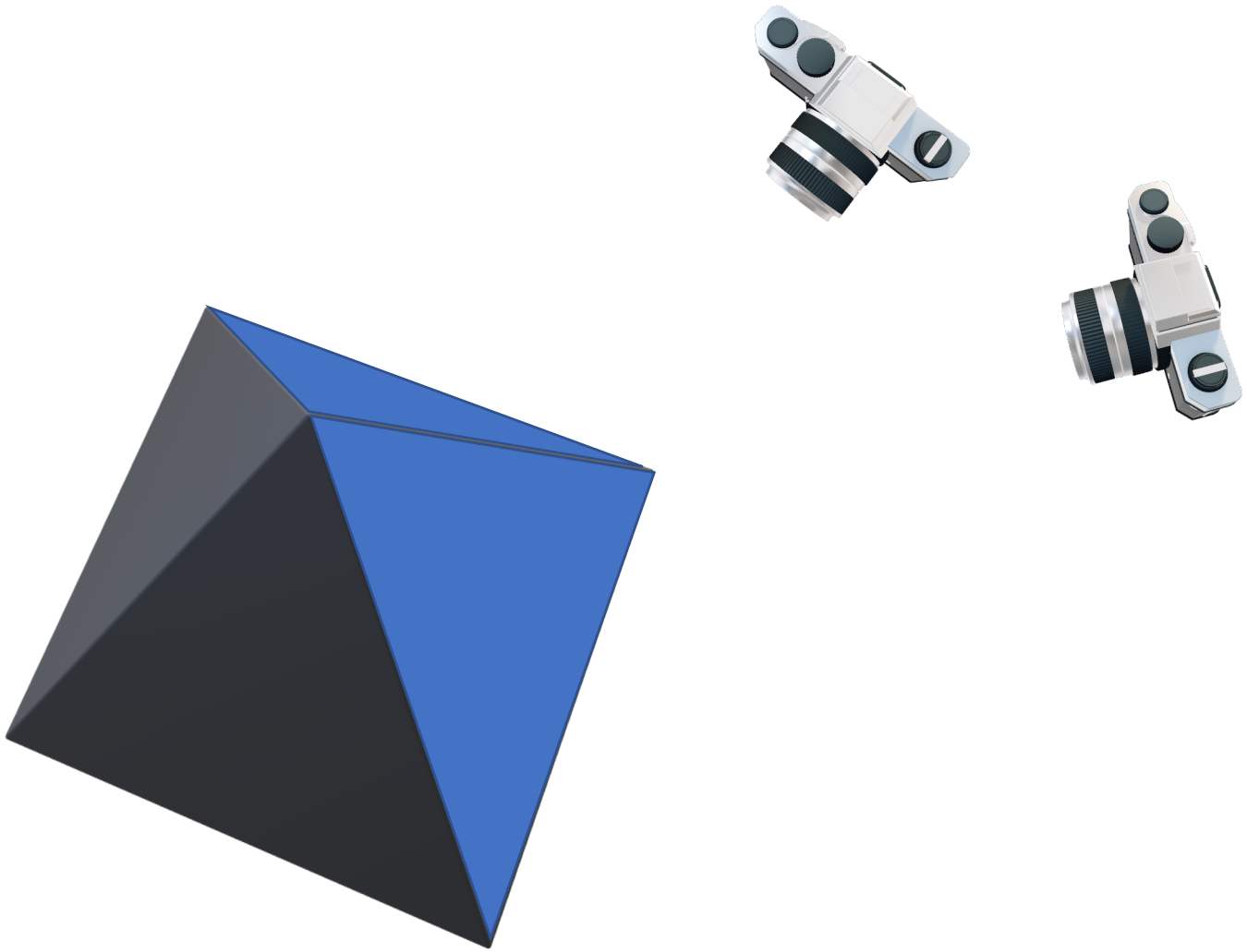
Mesh Refinement: SOA approach



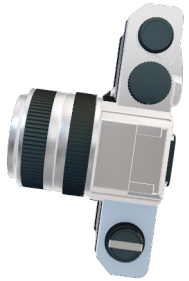
Mesh Refinement: SOA approach



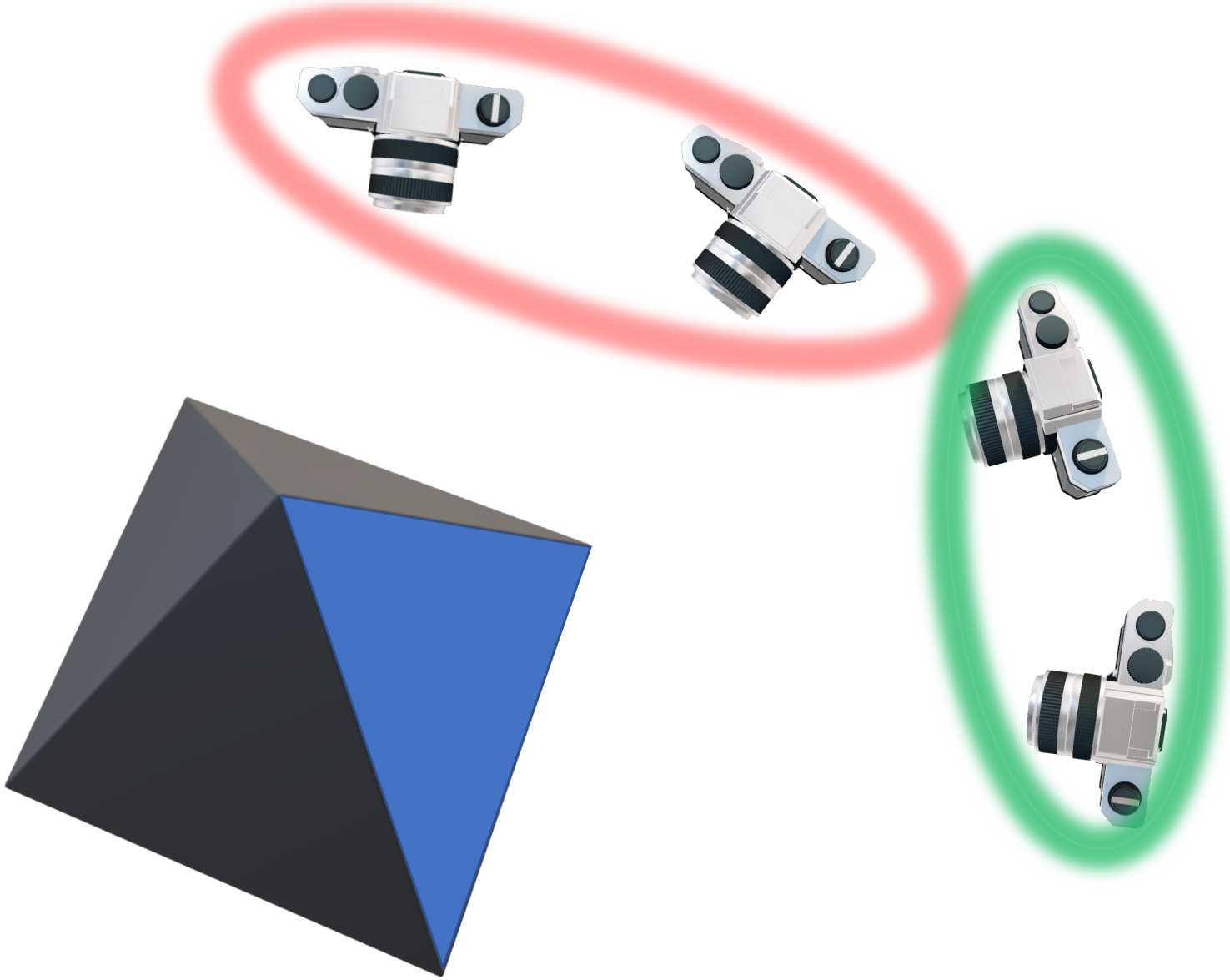
Mesh Refinement: SOA approach



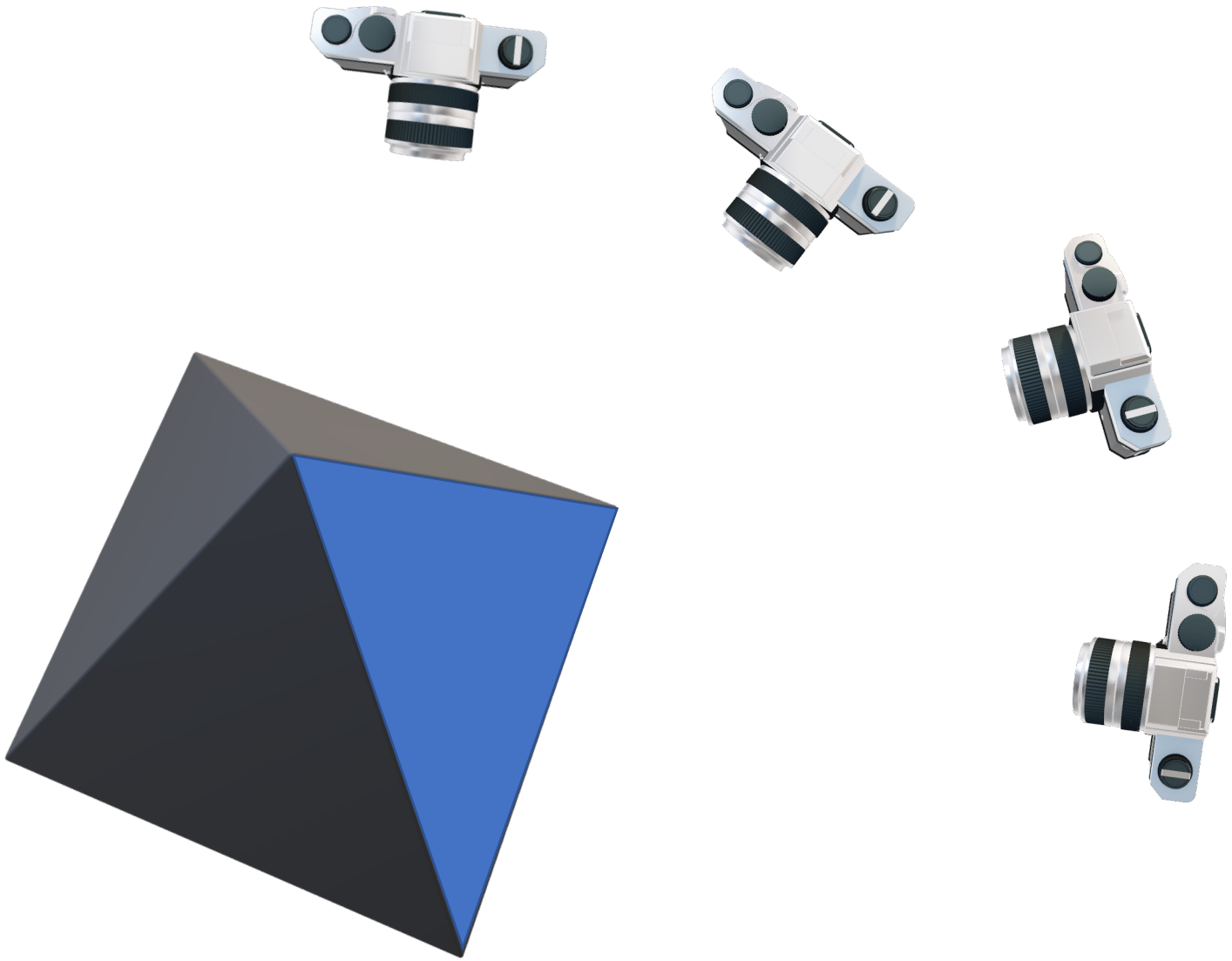
Mesh Refinement: SOA approach



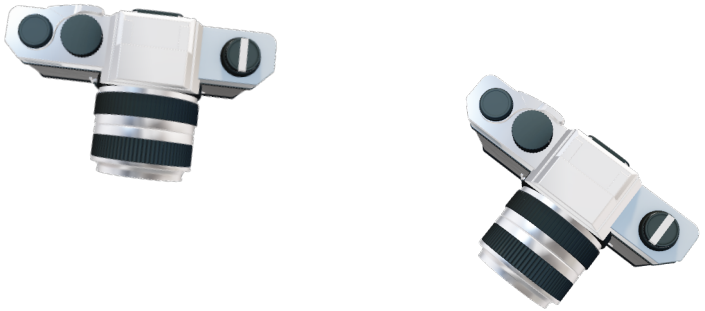
Mesh Refinement: SOA approach

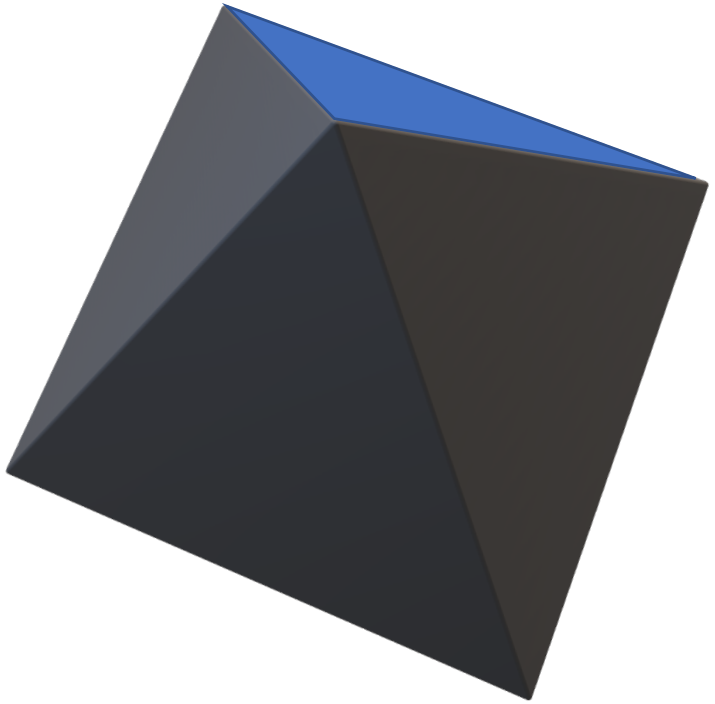


Facetwise Mesh Refinement



Facetwise Mesh Refinement





+
Smooth the
result with
Markov Random
Field (MRF)

from
$\mathcal{O}$(num. camera * num. facet)
to
$\mathcal{O}$(num. facet)

Results on DTU dataset

	Campbell08	Furukawa09	Tola2012	Li16	Romanoni19	ABLATION			Facetwise
						Initial mesh	No manif. fix	No facetwise	
mean accuracy	1.8857	0.9126	0.4455	0.4245	**0.4087**	0.4669	0.4116	0.4298	**0.4092**
median accuracy	0.749	0.3973	0.2256	0.2193	0.215	0.2195	0.2121	0.2113	**0.2067**
mean completeness	**0.4213**	0.533	0.7317	0.7252	0.7237	0.5200	0.5044	0.5005	0.4958
median completeness	**0.2856**	0.3517	0.3511	0.3426	0.3413	0.3292	0.3039	0.301	0.298
average score	0.8354	0.5486	0.4385	0.4279	0.4221	0.3839	0.358	0.3607	**0.3524**