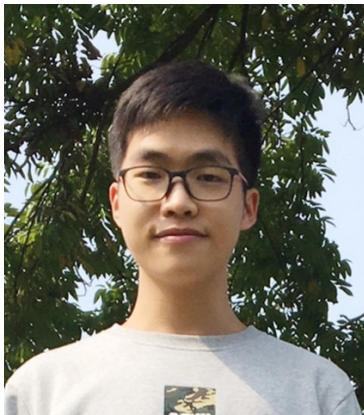




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VolRecon: Volume Rendering of Signed Ray Distance Functions for Generalizable Multi-View Reconstruction



Yufan Ren*



Fangjinhua Wang*



Tong Zhang



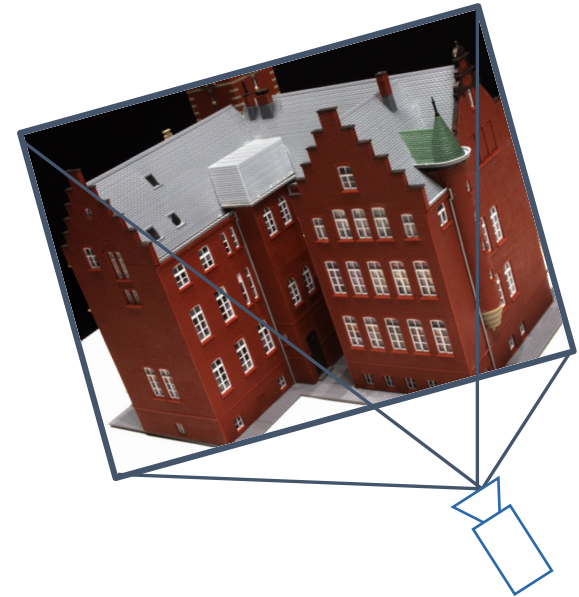
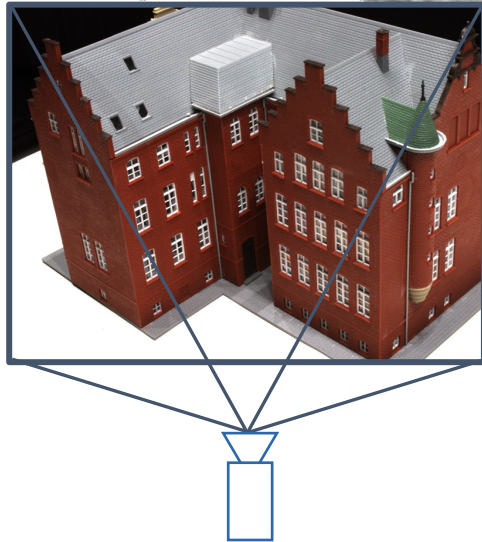
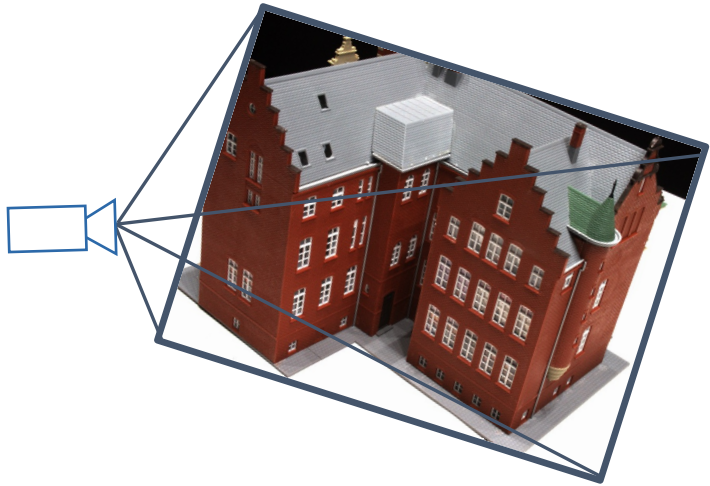
Marc Pollefeys



Sabine Süsstrunk

<https://github.com/IVRL/VolRecon>

Multi-View Reconstruction



VolRecon



...

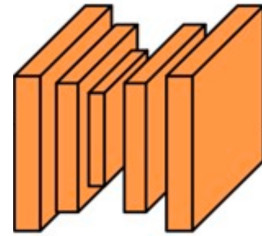
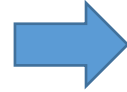
N source views

VolRecon

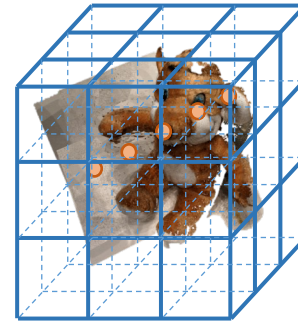
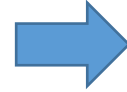


N source views

...



3D Conv Network



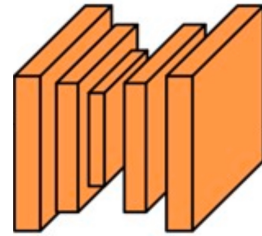
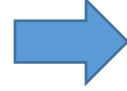
Global feature volume

VolRecon

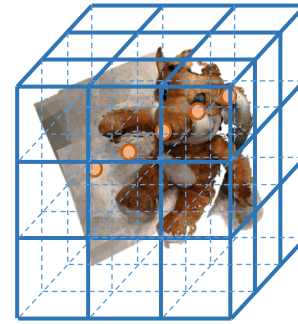
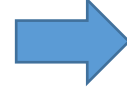


N source views

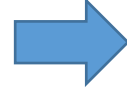
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3D Conv Network

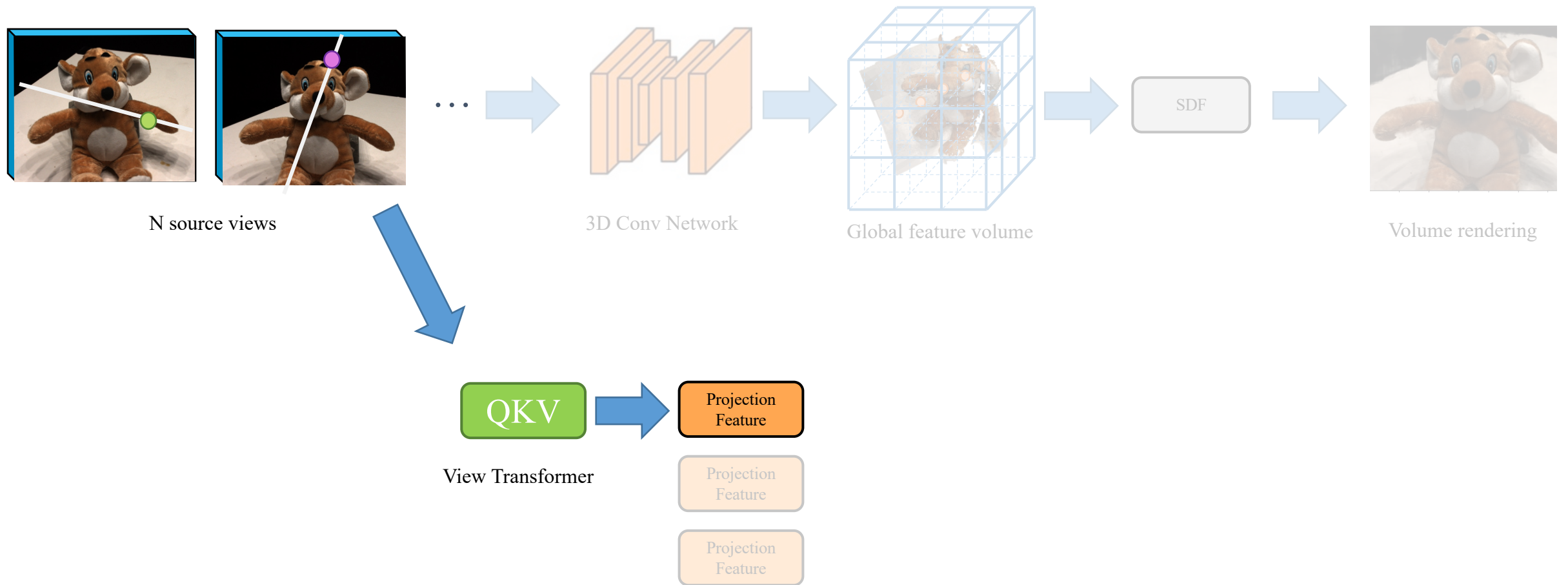


Global feature volume

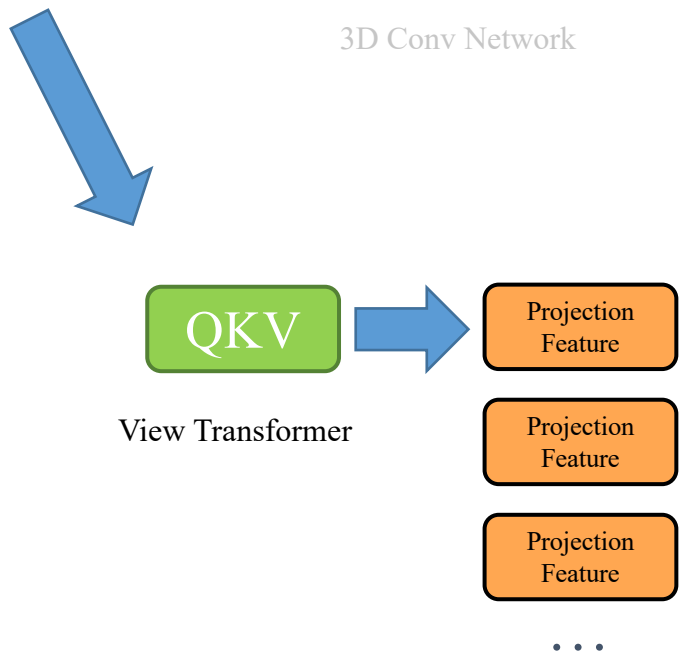
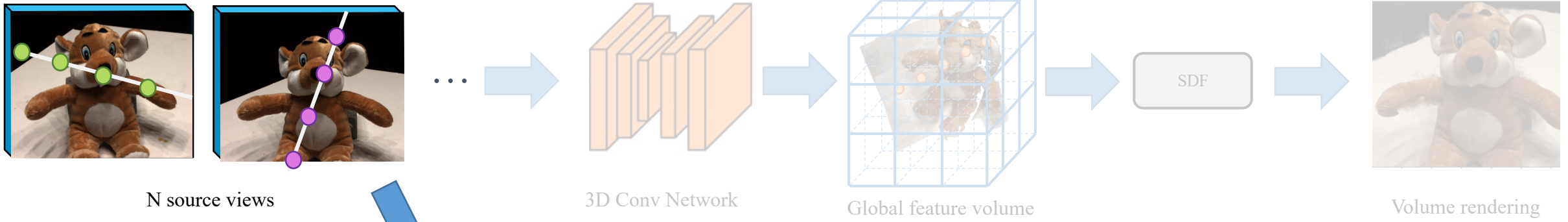


Volume rendering

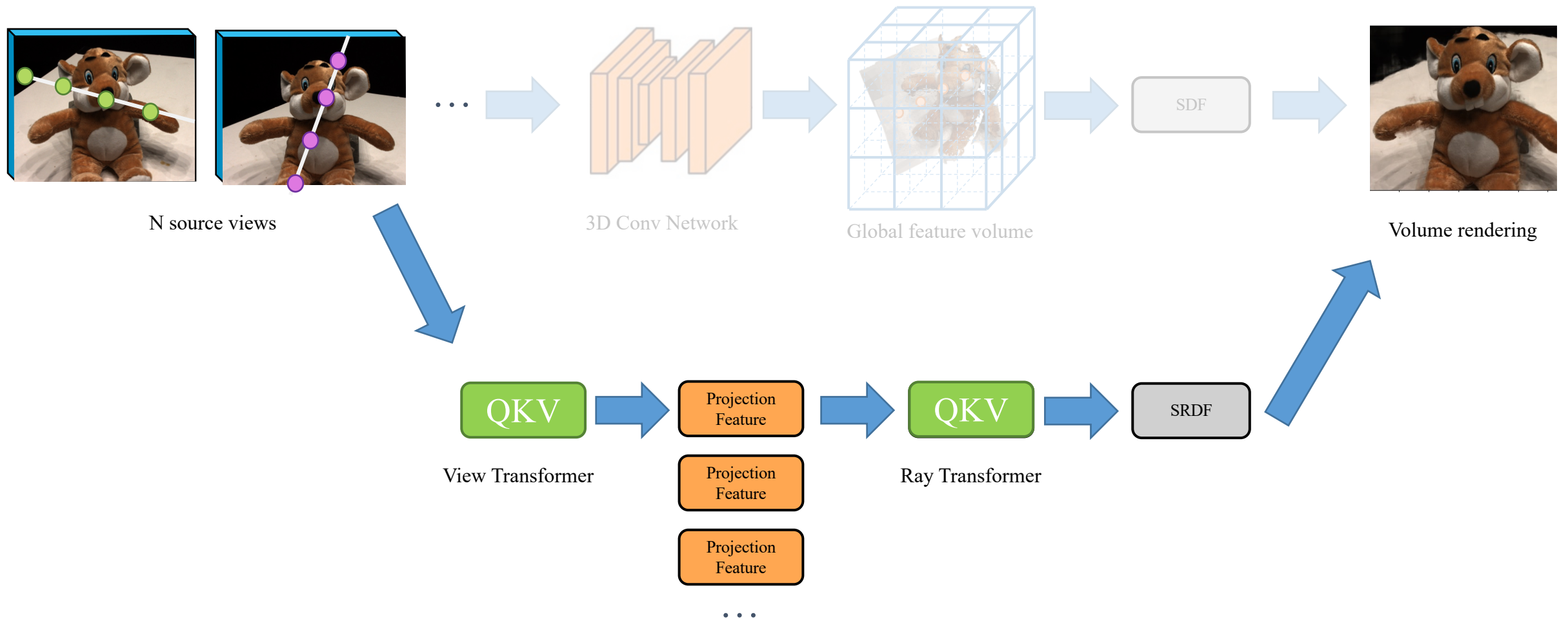
VolRecon



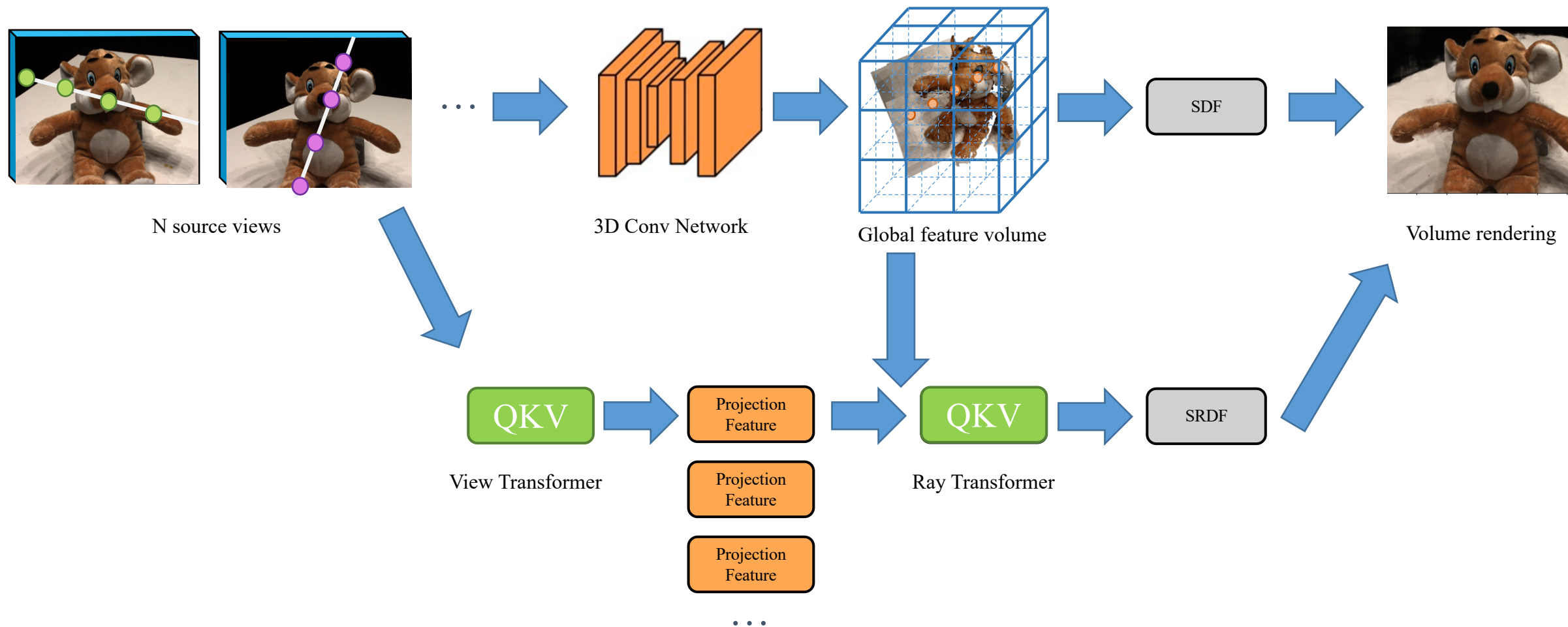
VolRecon



VolRecon



VolRecon

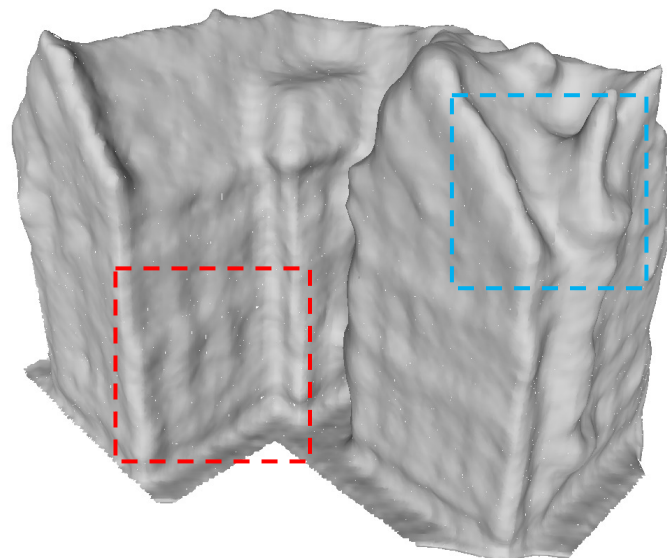


VolRecon

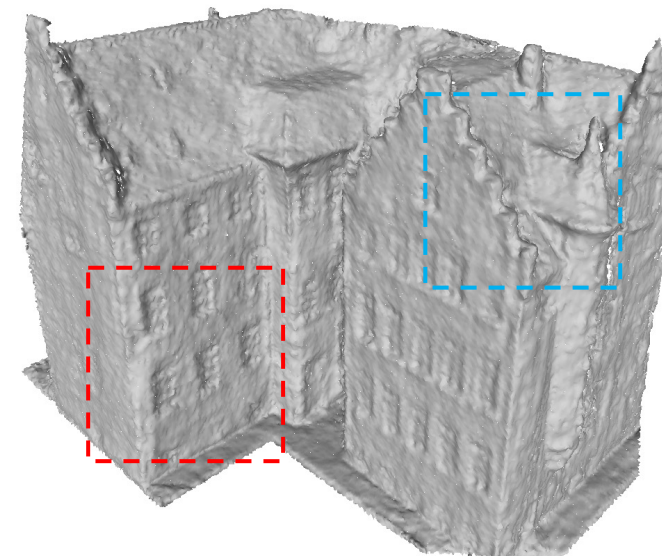
	Chamfer distance ↓
SparseNeuS	1.96
Our (VolRecon)	1.38



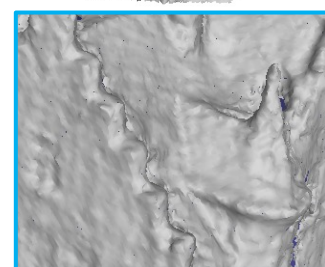
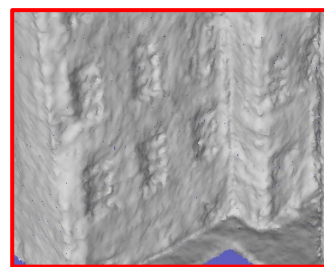
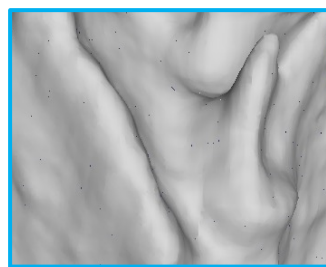
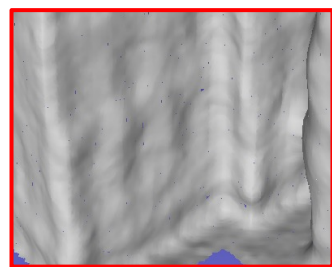
Input



SparseNeuS

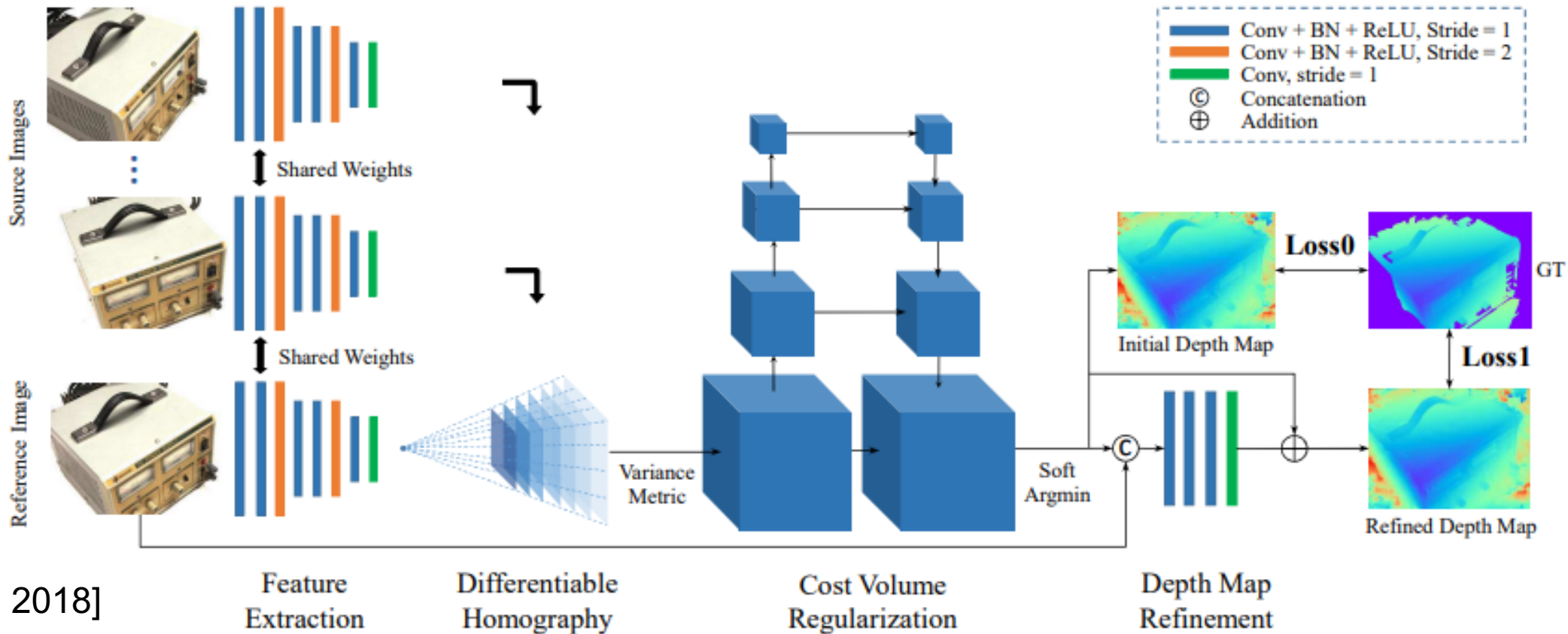


Ours (VolRecon)



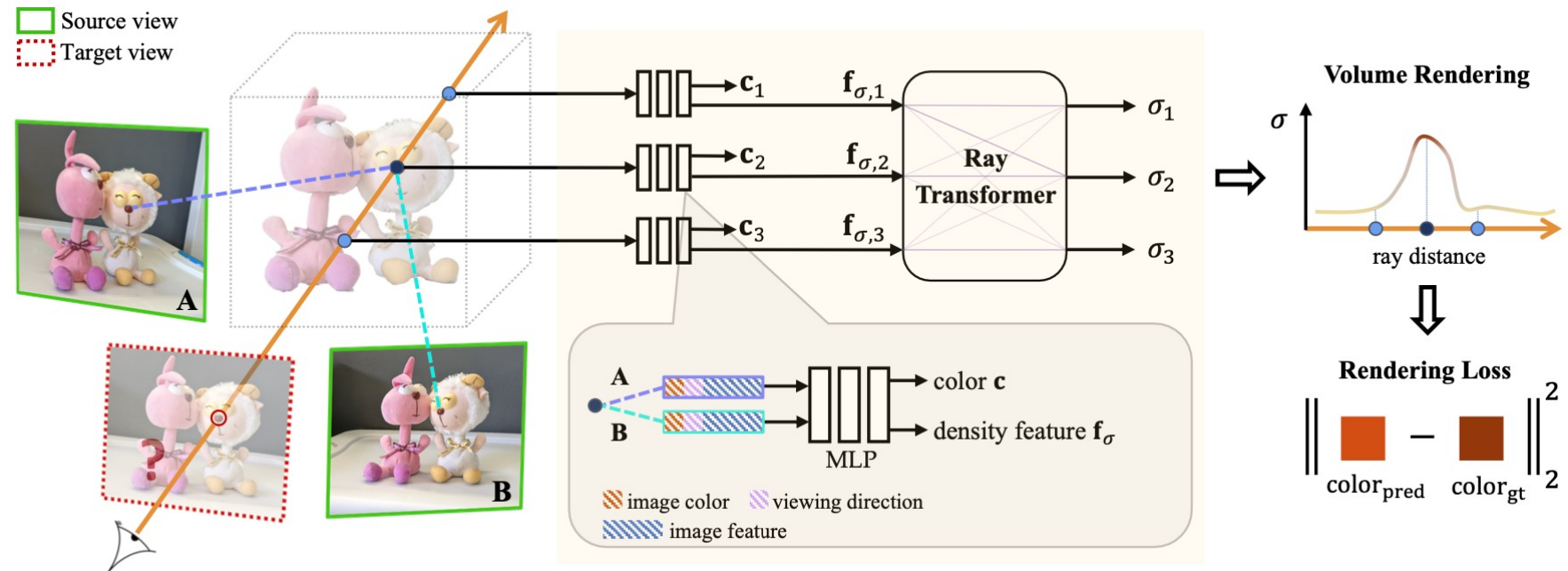
Existing Approaches

- Learning-based MVS



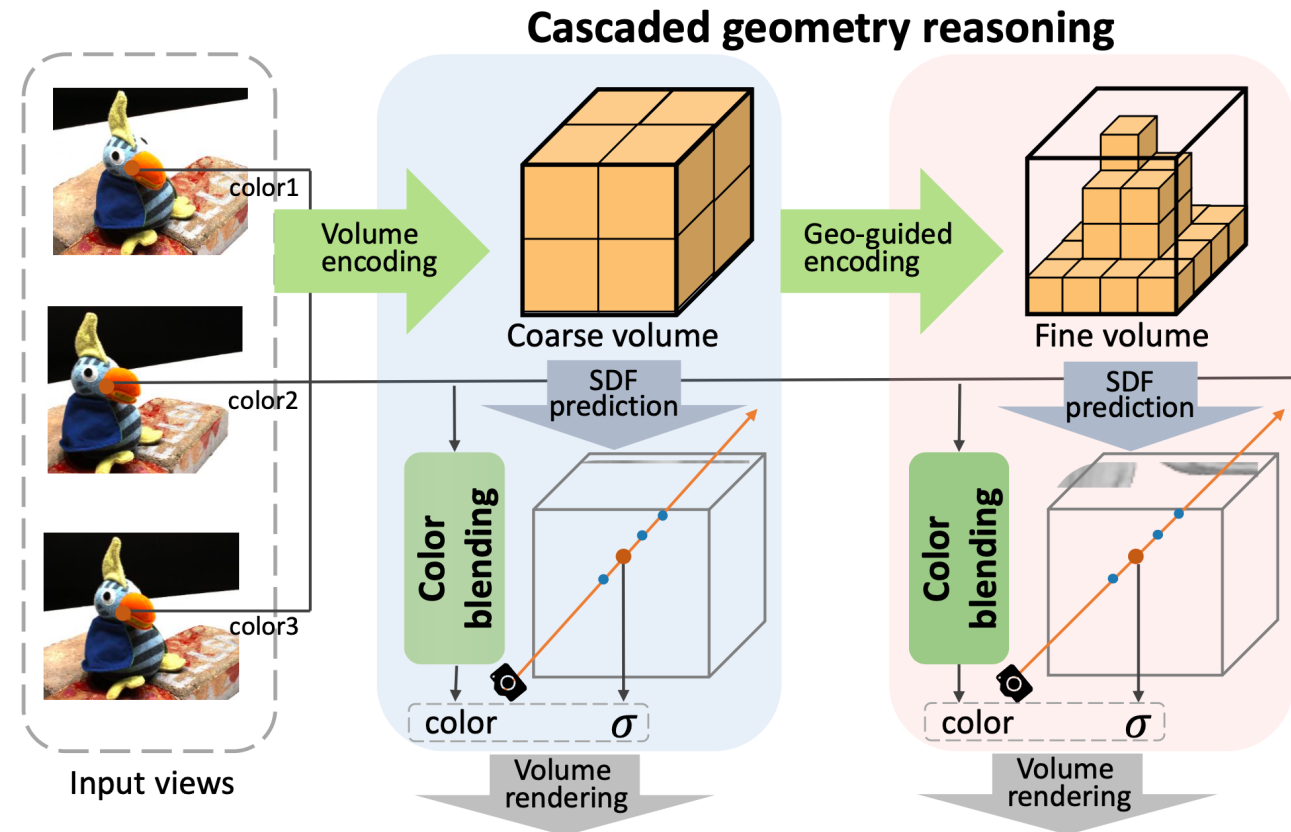
Existing Approaches

- Learning-based MVS
- Generalizable NeRF

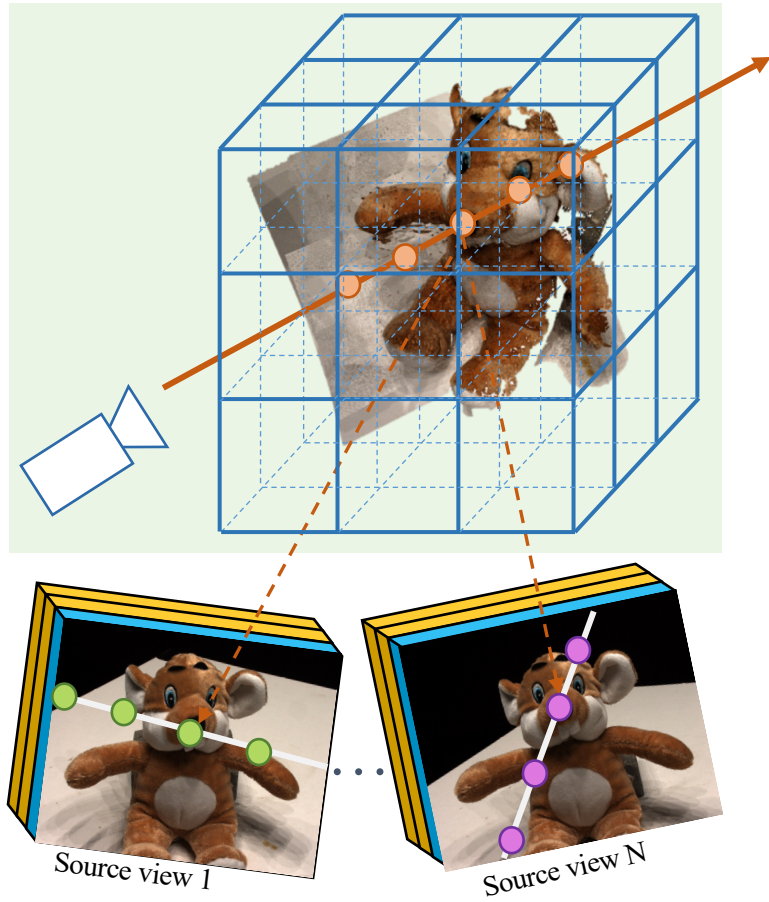



Existing Approaches

- Learning-based MVS
- Generalizable NeRF
- Generalizable Neural Surface Reconstruction

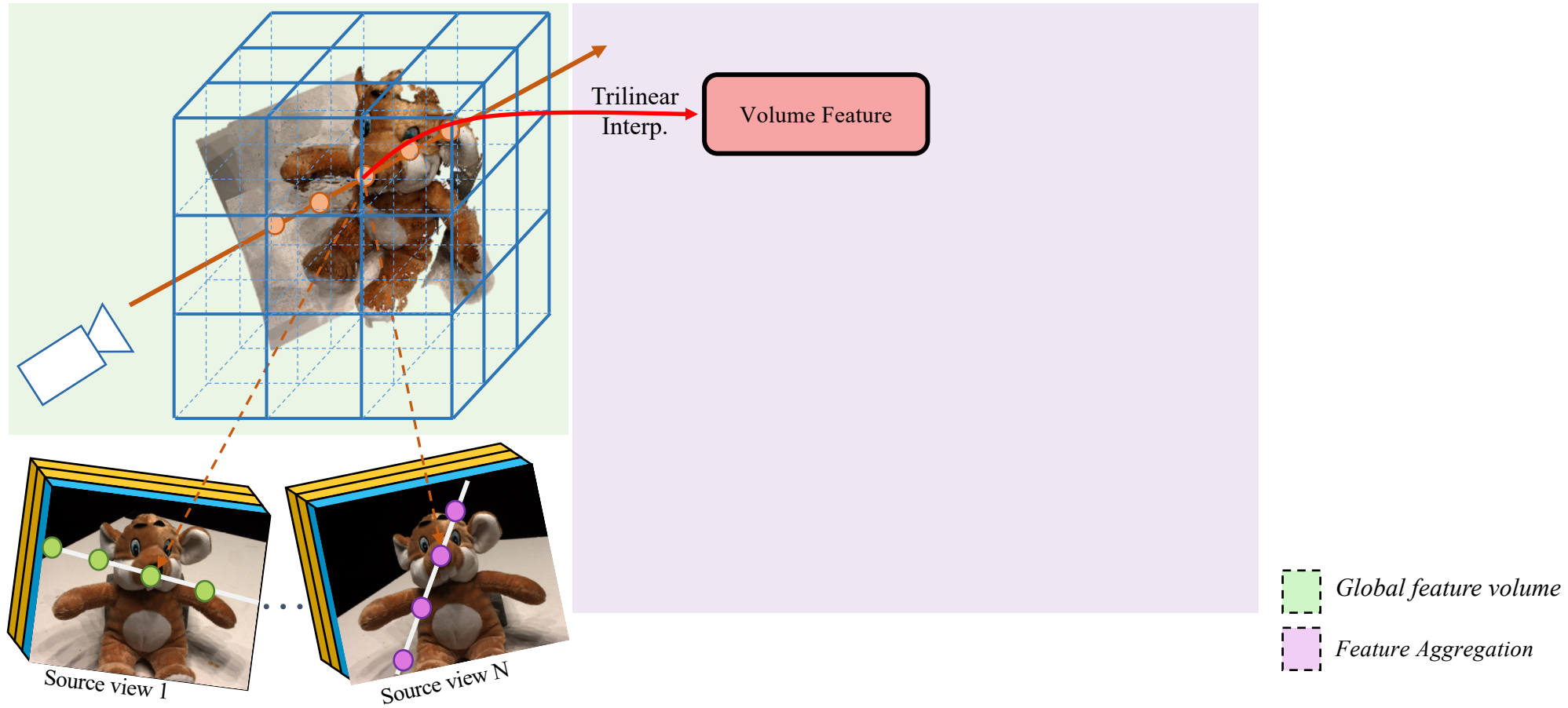


VolRecon

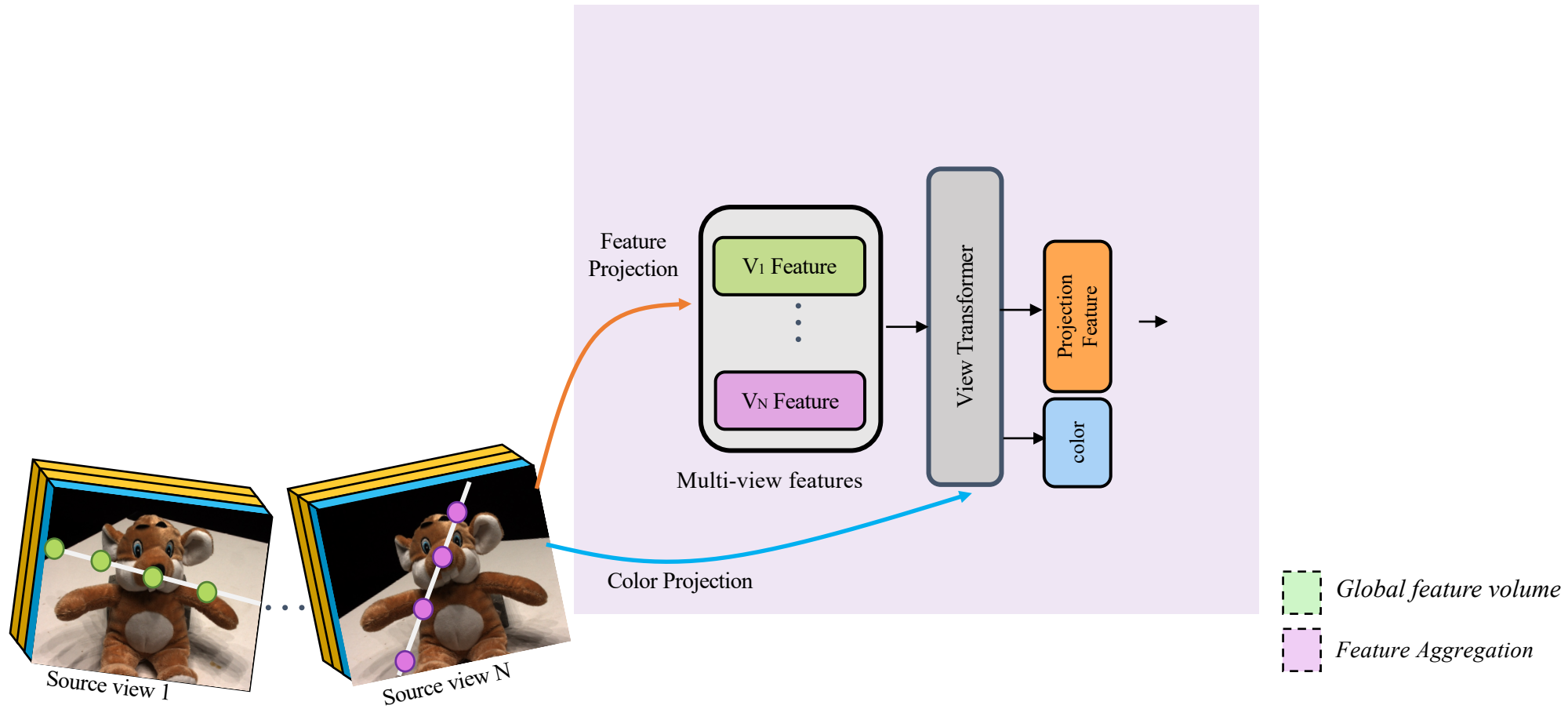


 *Global feature volume*

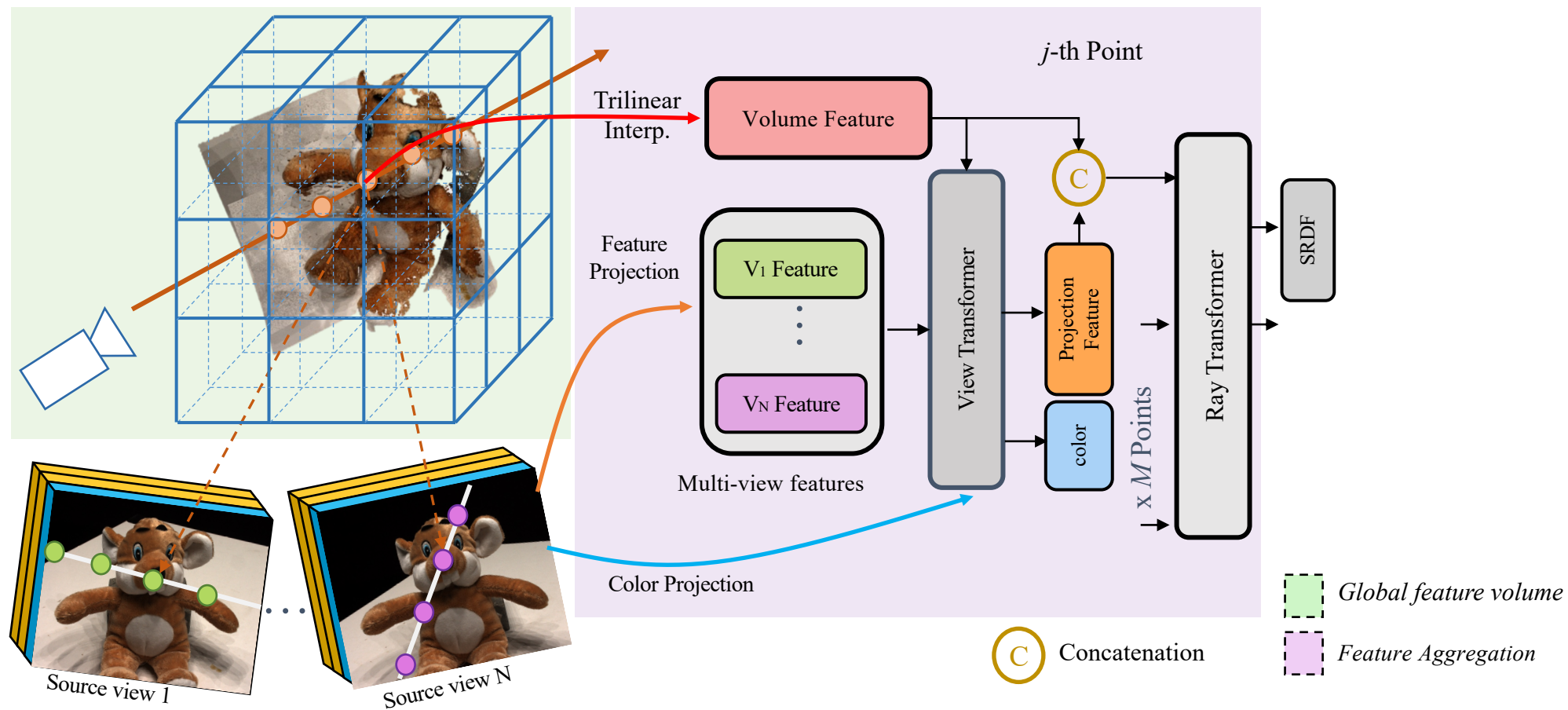
VolRecon



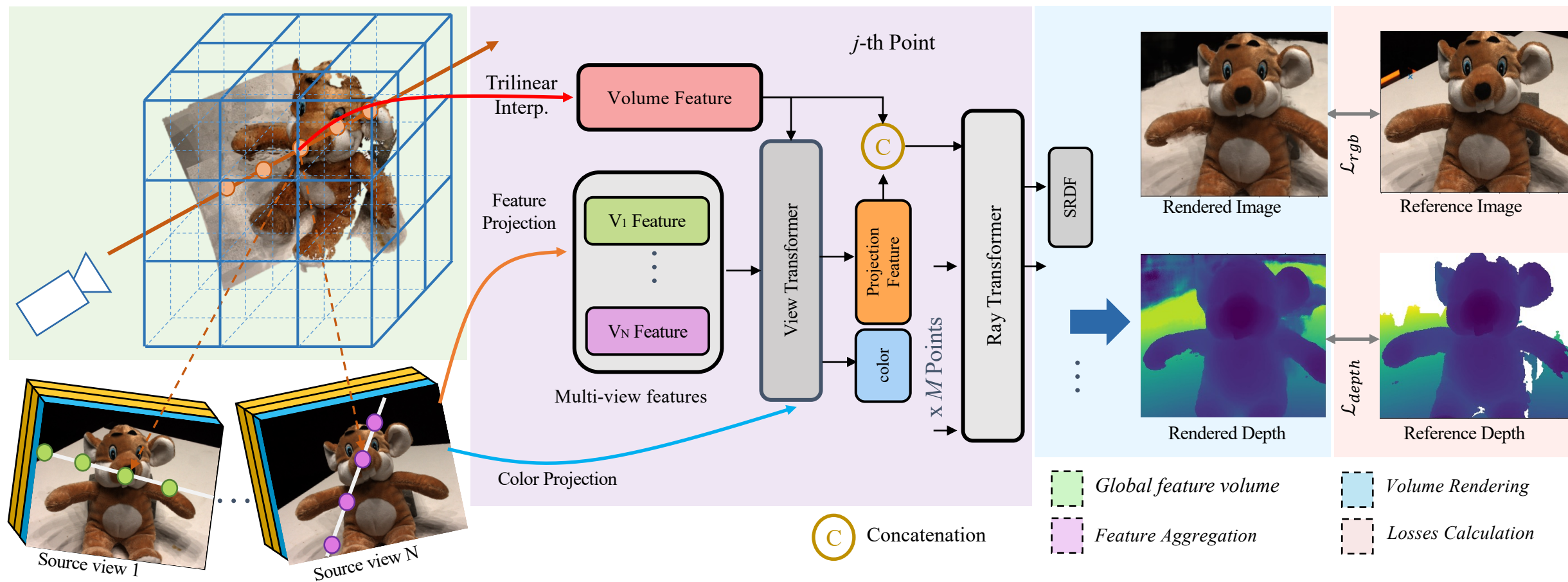
VolRecon



VolRecon



VolRecon



DTU

Scan	Mean↓	24	37	40	55	63	65	69	83	97	105	106	110	114	118	122
● COLMAP [39]	1.52	0.90	2.89	<u>1.63</u>	<u>1.08</u>	2.18	1.94	1.61	<u>1.30</u>	2.34	1.28	<u>1.10</u>	1.42	0.76	<u>1.17</u>	1.14
MVSNet [54]	1.22	<u>1.05</u>	2.52	1.71	1.04	<u>1.45</u>	1.52	0.88	1.29	1.38	1.05	0.91	0.66	0.61	1.08	<u>1.16</u>
IDR [57]	3.39	4.01	6.40	3.52	1.91	3.96	2.36	4.85	1.62	6.37	5.97	1.23	4.73	0.91	1.72	1.26
● VolSDF [56]	3.41	4.03	4.21	6.12	0.91	8.24	1.73	2.74	1.82	5.14	3.09	2.08	4.81	0.60	3.51	2.18
UNISURF [34]	4.39	5.08	7.18	3.96	5.30	4.61	2.24	3.94	3.14	5.63	3.40	5.09	6.38	2.98	4.05	2.81
NeuS [49]	4.00	4.57	4.49	3.97	4.32	4.63	1.95	4.68	3.83	4.15	2.50	1.52	6.47	1.26	5.57	6.11
PixelNeRF [58]	6.18	5.13	8.07	5.85	4.40	7.11	4.64	5.68	6.76	9.05	6.11	3.95	5.92	6.26	6.89	6.93
● IBRNet [50]	2.32	2.29	3.70	2.66	1.83	3.02	2.83	1.77	2.28	2.73	1.96	1.87	2.13	1.58	2.05	2.09
MVSNeRF [4]	2.09	1.96	3.27	2.54	1.93	2.57	2.71	1.82	1.72	2.29	1.75	1.72	1.47	1.29	2.09	2.26
● SparseNeuS [26]	1.96	2.17	3.29	2.74	1.67	2.69	2.42	1.58	1.86	1.94	1.35	1.50	1.45	0.98	1.86	1.87
● Ours (VolRecon)	1.38	1.20	2.59	1.56	1.08	1.43	1.92	1.11	1.48	1.42	1.05	1.19	1.38	0.74	1.23	1.27

● MVS

● Neural Surface Reconstruction

● Generalizable NeRF

● Generalizable Neural Surface Reconstruction

DTU

Scan	Mean↓	24	37	40	55	63	65	69	83	97	105	106	110	114	118	122
COLMAP [39]	1.52	0.90	2.89	<u>1.63</u>	<u>1.08</u>	2.18	1.94	1.61	<u>1.30</u>	2.34	1.28	<u>1.10</u>	1.42	0.76	<u>1.17</u>	1.14
MVSNet [54]	1.22	1.05	2.52	1.71	1.04	1.45	1.52	0.88	1.29	1.38	1.05	0.91	0.66	0.61	1.08	1.16
IDR [57]	3.39	4.01	6.40	3.52	1.91	3.96	2.36	4.85	1.62	6.37	5.97	1.23	4.73	0.91	1.72	1.26
VolSDF [56]	3.41	4.03	4.21	6.12	0.91	8.24	1.73	2.74	1.82	5.14	3.09	2.08	4.81	0.60	3.51	2.18
UNISURF [34]	4.39	5.08	7.18	3.96	5.30	4.61	2.24	3.94	3.14	5.63	3.40	5.09	6.38	2.98	4.05	2.81
NeuS [49]	4.00	4.57	4.49	3.97	4.32	4.63	1.95	4.68	3.83	4.15	2.50	1.52	6.47	1.26	5.57	6.11
PixelNeRF [58]	6.18	5.13	8.07	5.85	4.40	7.11	4.64	5.68	6.76	9.05	6.11	3.95	5.92	6.26	6.89	6.93
IBRNet [50]	2.32	2.29	3.70	2.66	1.83	3.02	2.83	1.77	2.28	2.73	1.96	1.87	2.13	1.58	2.05	2.09
MVSNeRF [4]	2.09	1.96	3.27	2.54	1.93	2.57	2.71	1.82	1.72	2.29	1.75	1.72	1.47	1.29	2.09	2.26
SparseNeuS [26]	1.96	2.17	3.29	2.74	1.67	2.69	2.42	1.58	1.86	1.94	1.35	1.50	1.45	0.98	1.86	1.87
Ours (VolRecon)	1.38	1.20	2.59	1.56	1.08	1.43	1.92	1.11	1.48	1.42	1.05	1.19	1.38	0.74	1.23	1.27

● MVS

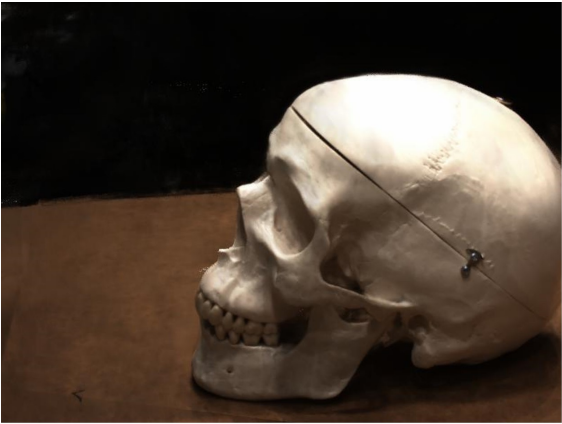
● Neural Surface Reconstruction

● Generalizable NeRF

● Generalizable Neural Surface Reconstruction

PSNR	MSE	SSIM
15.37	0.04	0.56

Novel View Synthesis



Sparse View Reconstruction on DTU

Thanks for listening!

<https://github.com/IVRL/VolRecon>



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