valeo.ai

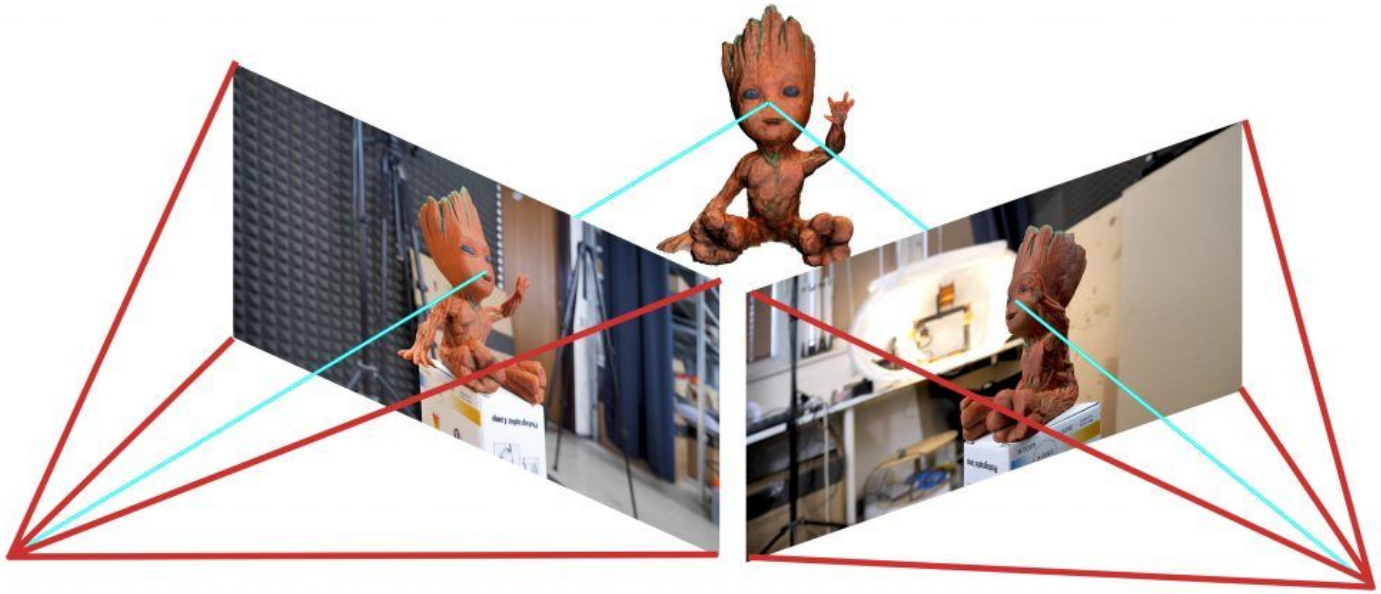
Nuages de Points et Modélisation 3D

8 - Geometric vision

I - Structure from motion

Epipolar geometry

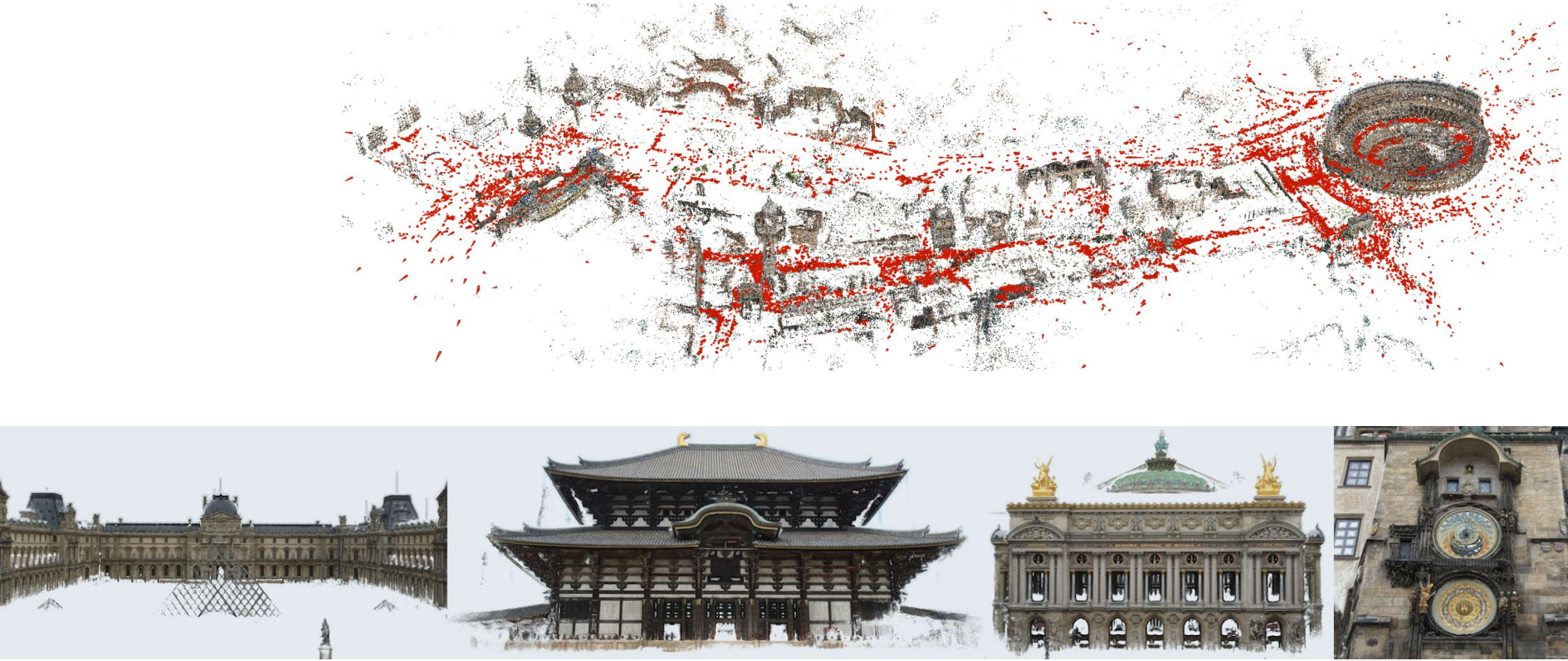
valeo.ai



https://blog.prusa3d.com/wp-content/uploads/2018/03/epipolar_geometry-1024x479.jpg

Multiview reconstruction

valeo.ai



Deep blending

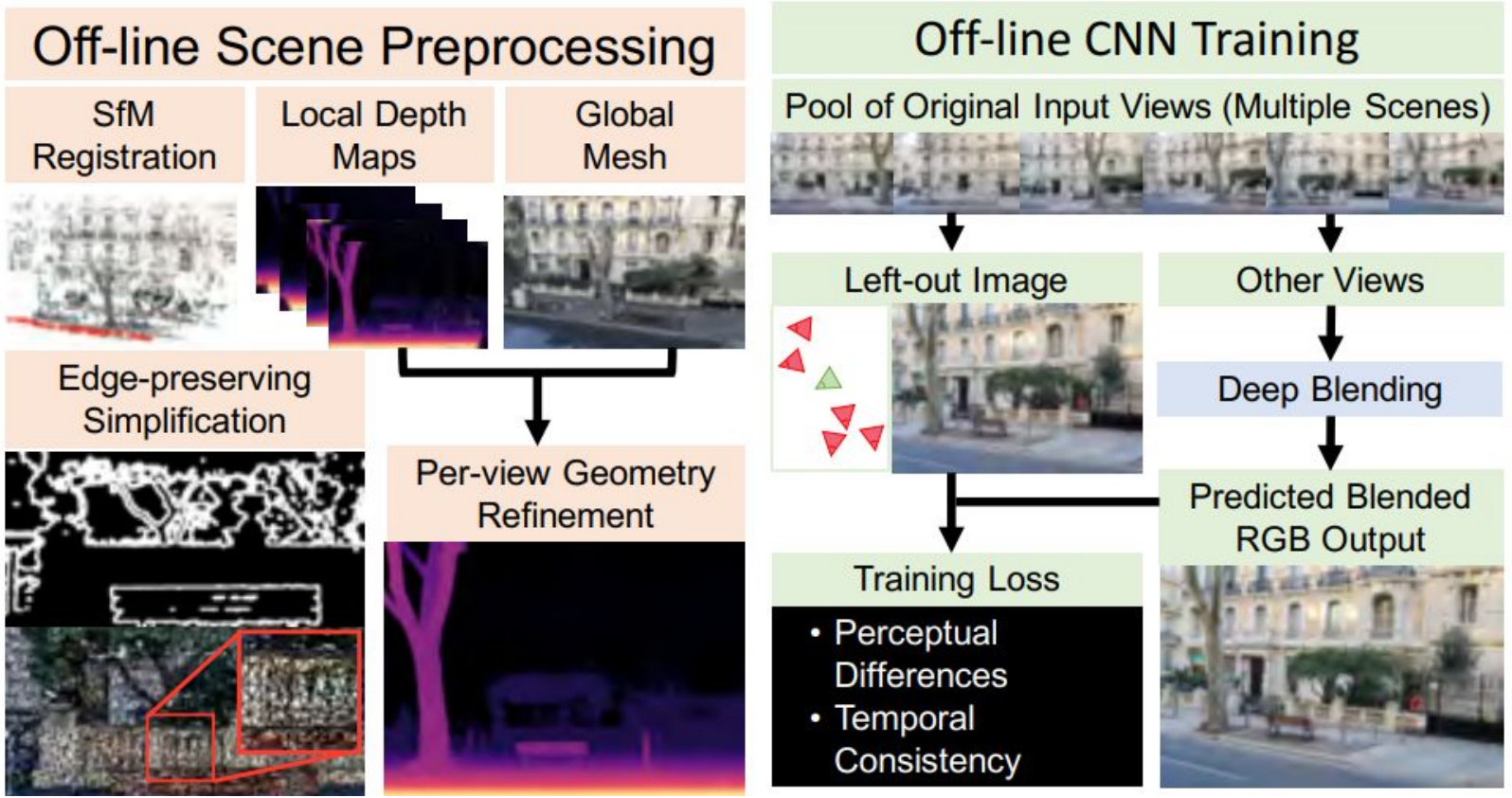
valeo.ai

Top:
Mesh-based rendering
(RealityCapture)

Bottom:
Point-based approach
(COLMAP)

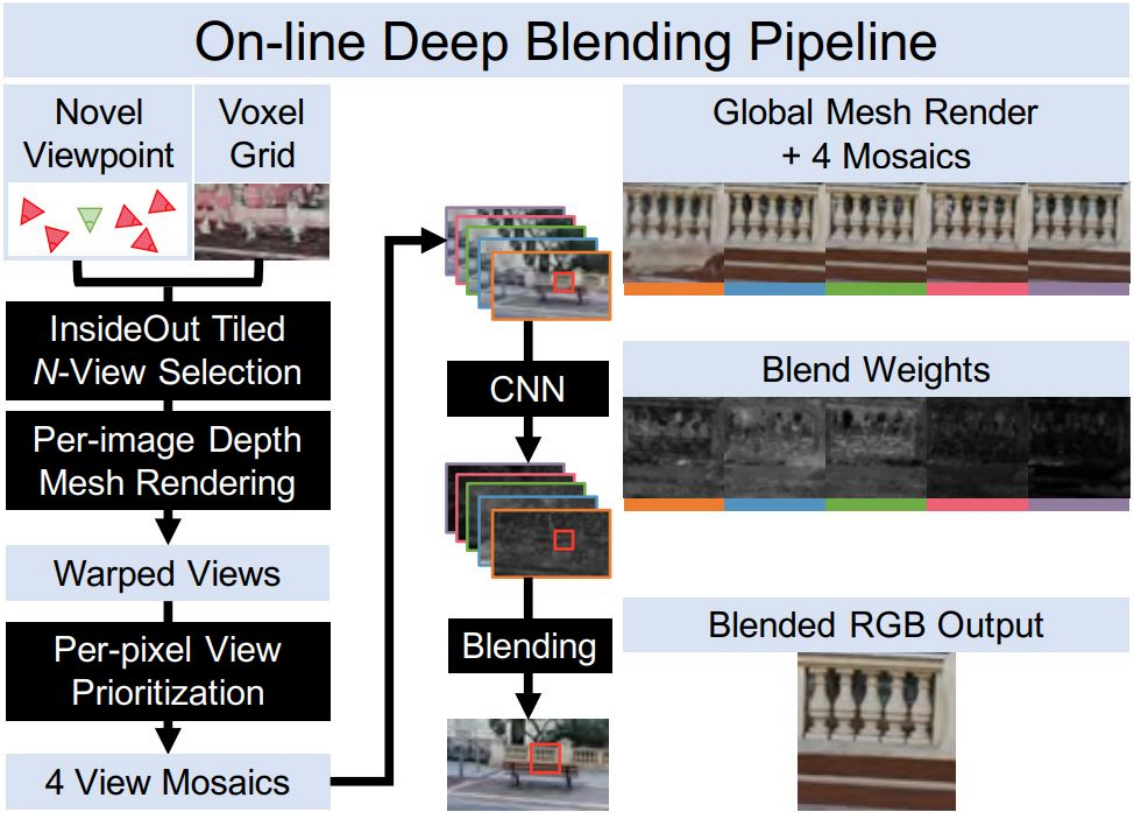
Hedman, Peter, et al. "Deep blending for free-viewpoint image-based rendering." *ACM Transactions on Graphics (ToG)* 37.6 (2018): 1-15.

Deep blending



Hedman, Peter, et al. "Deep blending for free-viewpoint image-based rendering." *ACM Transactions on Graphics (ToG)* 37.6 (2018): 1-15.

Deep blending



Hedman, Peter, et al. "Deep blending for free-viewpoint image-based rendering." *ACM Transactions on Graphics (ToG)* 37.6 (2018): 1-15.

Deep blending

Hedman, Peter, et al. "Deep blending for free-viewpoint image-based rendering." *ACM Transactions on Graphics (ToG)* 37.6 (2018): 1-15.

Deep blending

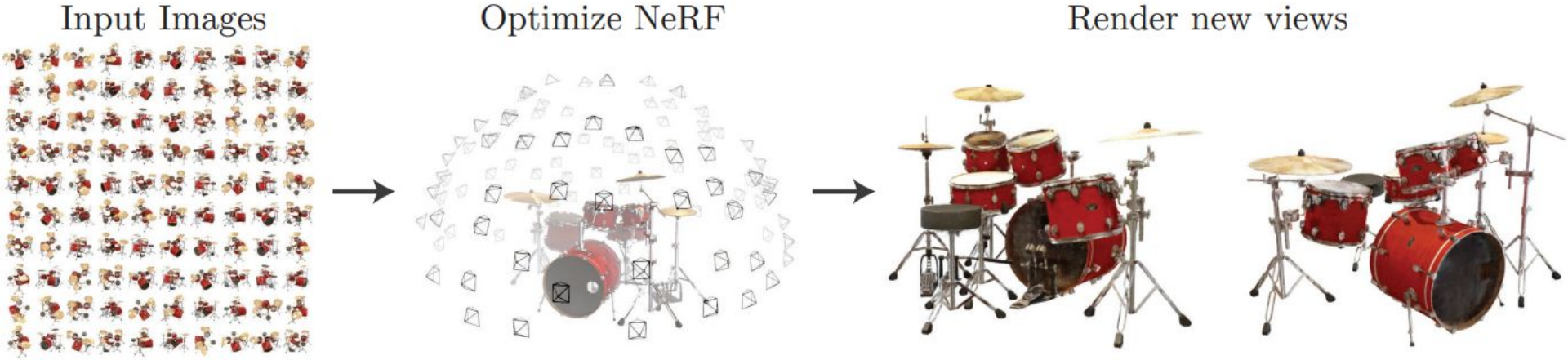
valeo.ai

Video at https://repo-sam.inria.fr/fungraph/deep-blending/

Hedman, Peter, et al. "Deep blending for free-viewpoint image-based rendering." *ACM Transactions on Graphics (ToG)* 37.6 (2018): 1-15.

II - Neural Radiance Fields

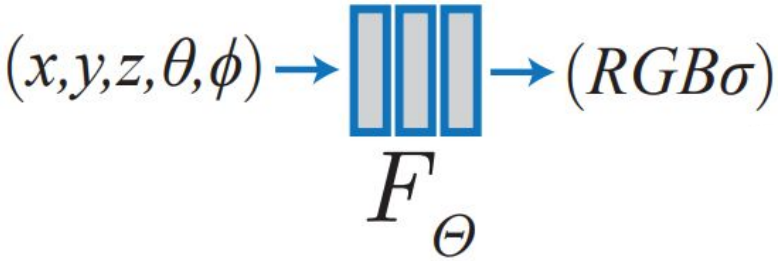
NeRF



Mildenhall, Ben, et al. "Nerf: Representing scenes as neural radiance fields for view synthesis." *Communications of the ACM* 65.1 (2021): 99-106.

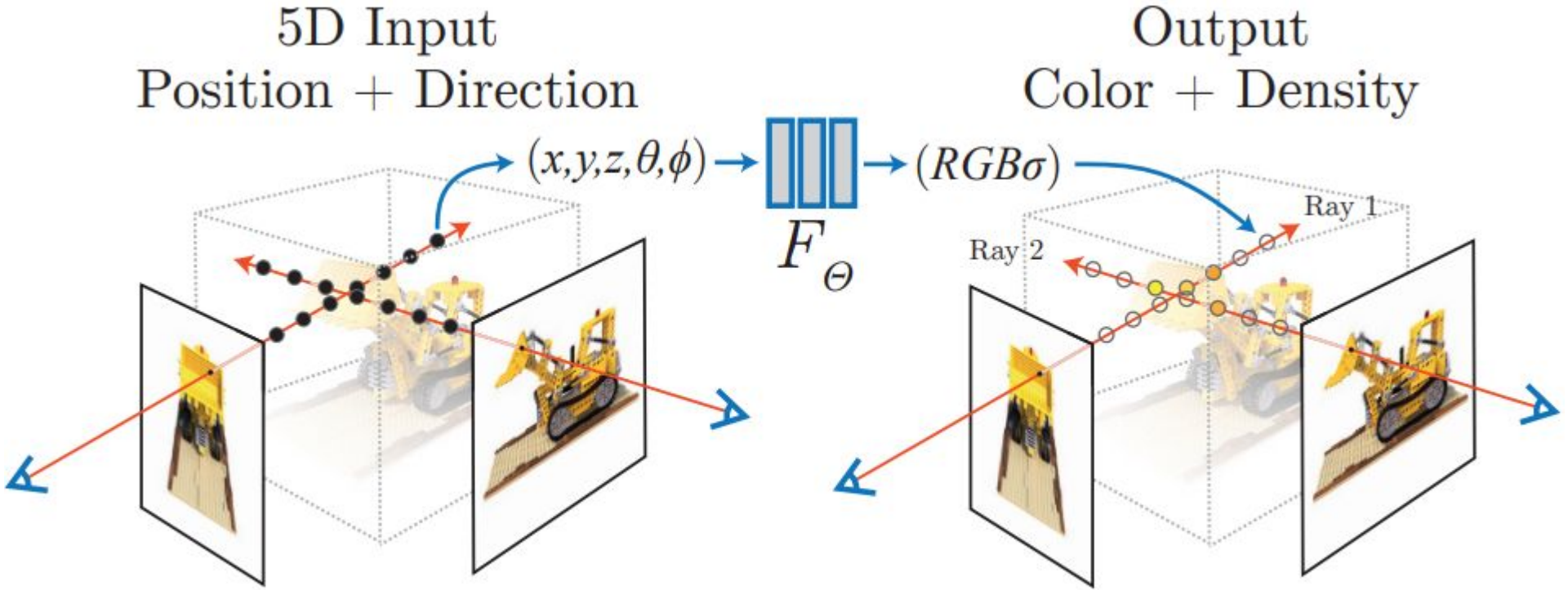
NeRF

valeo.ai



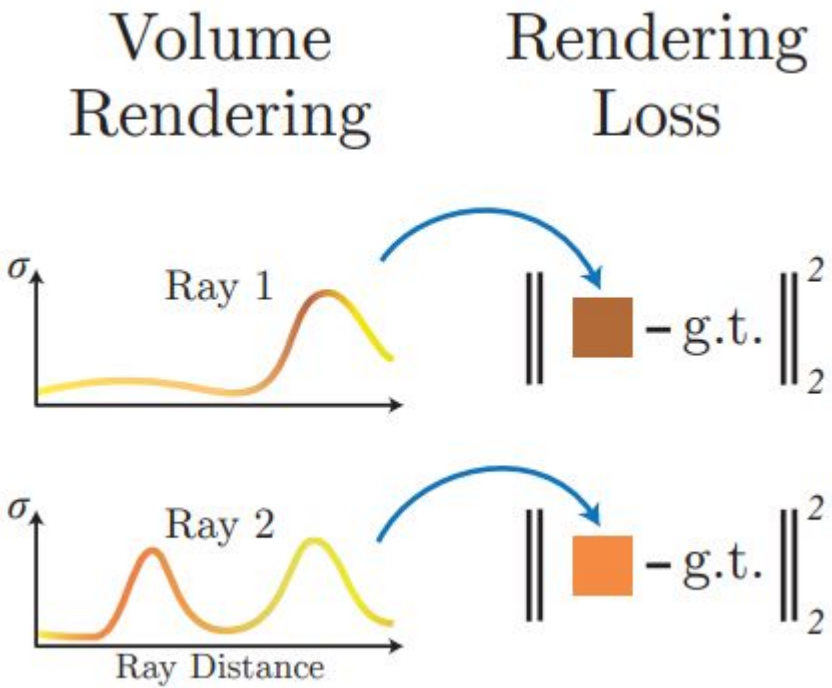
Mildenhall, Ben, et al. "Nerf: Representing scenes as neural radiance fields for view synthesis." *Communications of the ACM* 65.1 (2021): 99-106.

NeRF



Mildenhall, Ben, et al. "Nerf: Representing scenes as neural radiance fields for view synthesis." *Communications of the ACM* 65.1 (2021): 99-106.

NeRF



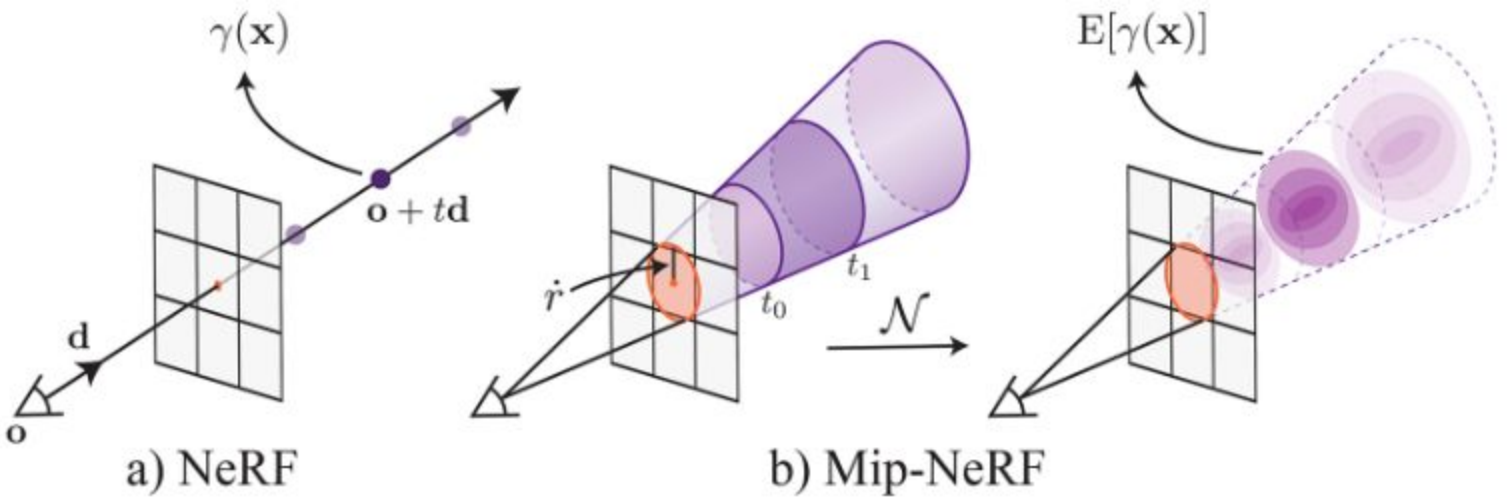
Mildenhall, Ben, et al. "Nerf: Representing scenes as neural radiance fields for view synthesis." *Communications of the ACM* 65.1 (2021): 99-106.

NeRF

valeo.ai

Videos at https://www.matthewtancik.com/nerf

Mip-NeRF



Barron, Jonathan T., et al. "Mip-nerf: A multiscale representation for anti-aliasing neural radiance fields." CVPR 2021.

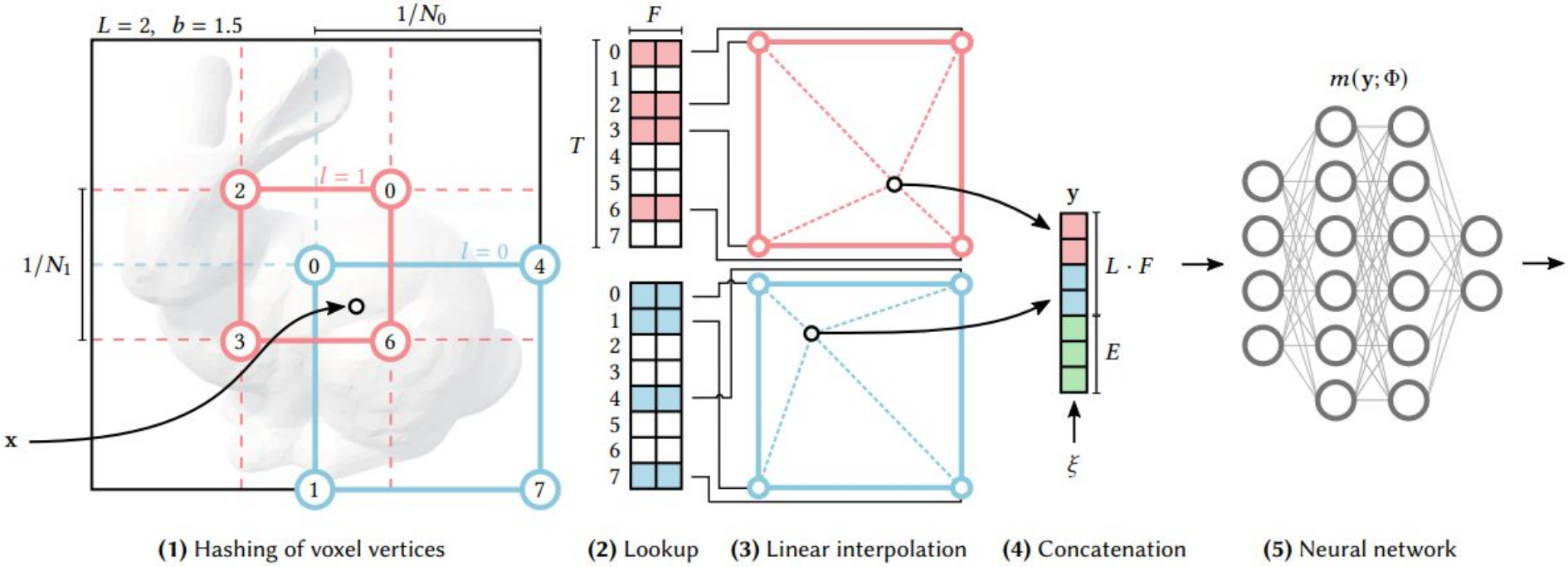
Mip-NeRF

valeo.ai

Videos for Mip-NeRF: https://jonbarron.info/mipnerf/

Videos for Mip-NeRF 360: https://jonbarron.info/mipnerf360/

InstantNGP



Müller, Thomas, et al. "Instant neural graphics primitives with a multiresolution hash encoding." ACM transactions on graphics (TOG) 41.4 (2022): 1-15.

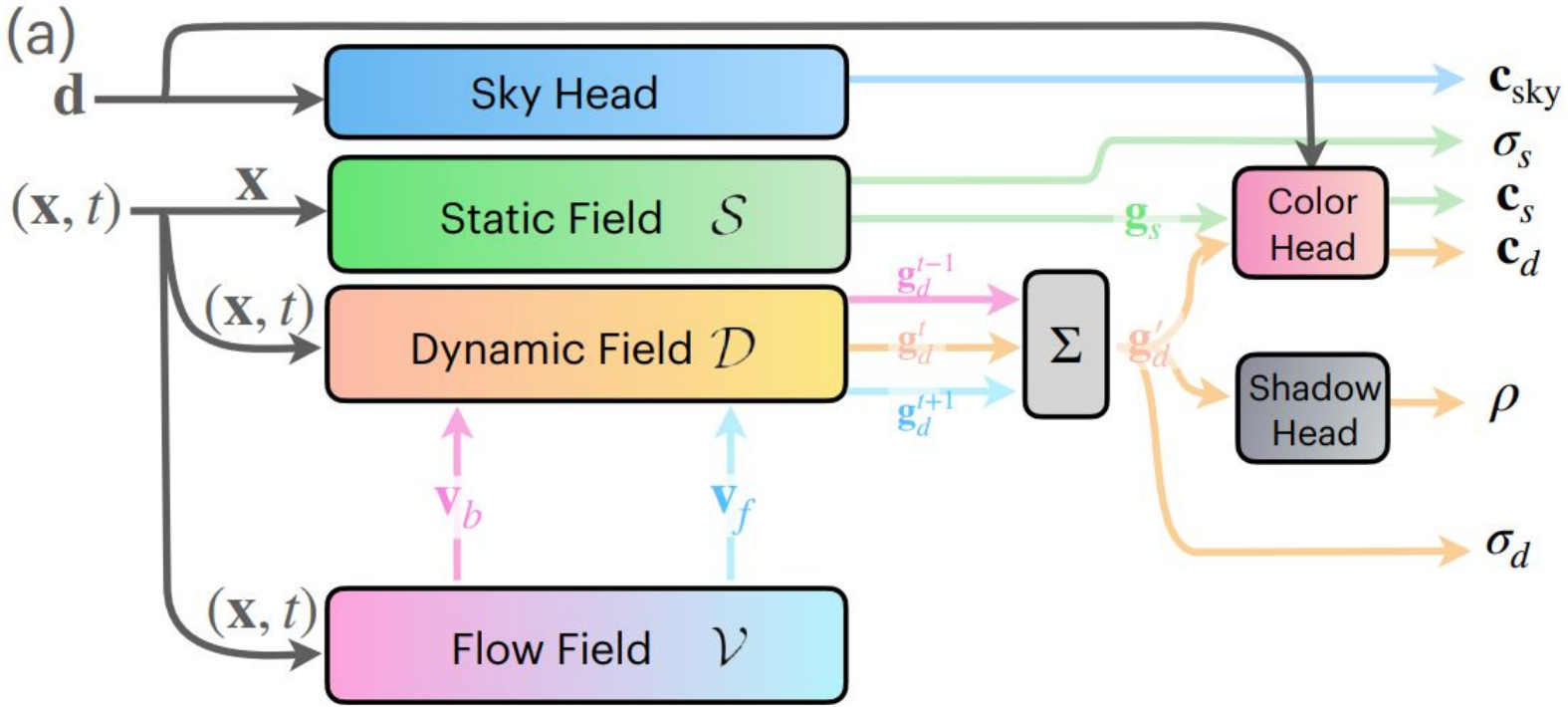
InstantNGP

valeo.ai

Videos at: https://nvlabs.github.io/instant-ngp/

Müller, Thomas, et al. "Instant neural graphics primitives with a multiresolution hash encoding." ACM transactions on graphics (TOG) 41.4 (2022): 1-15.

EmerNeRF



Yang, Jiawei, et al. "Emernerf: Emergent spatial-temporal scene decomposition via self-supervision." arXiv preprint arXiv:2311.02077 (2023).

EmerNeRF

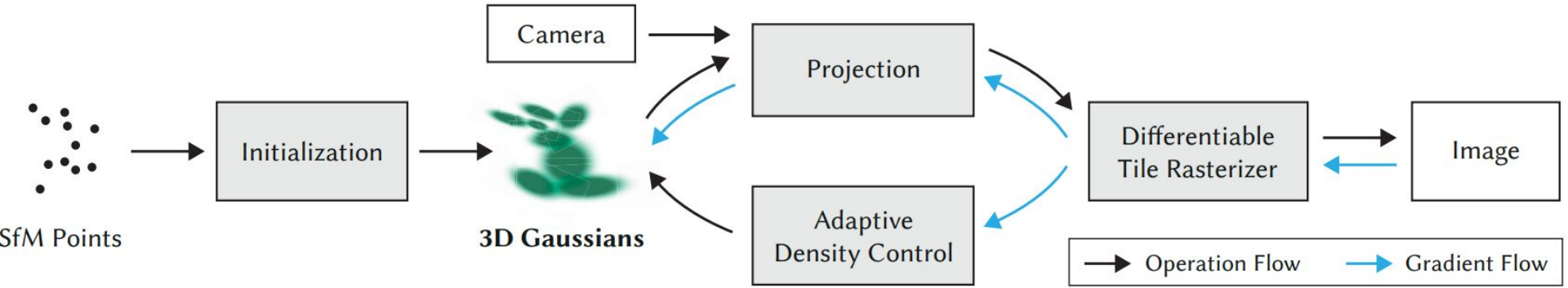
valeo.ai

Videos at: https://emernerf.github.io/

Yang, Jiawei, et al. "Emernerf: Emergent spatial-temporal scene decomposition via self-supervision." arXiv preprint arXiv:2311.02077 (2023).

II - Gaussian Splatting

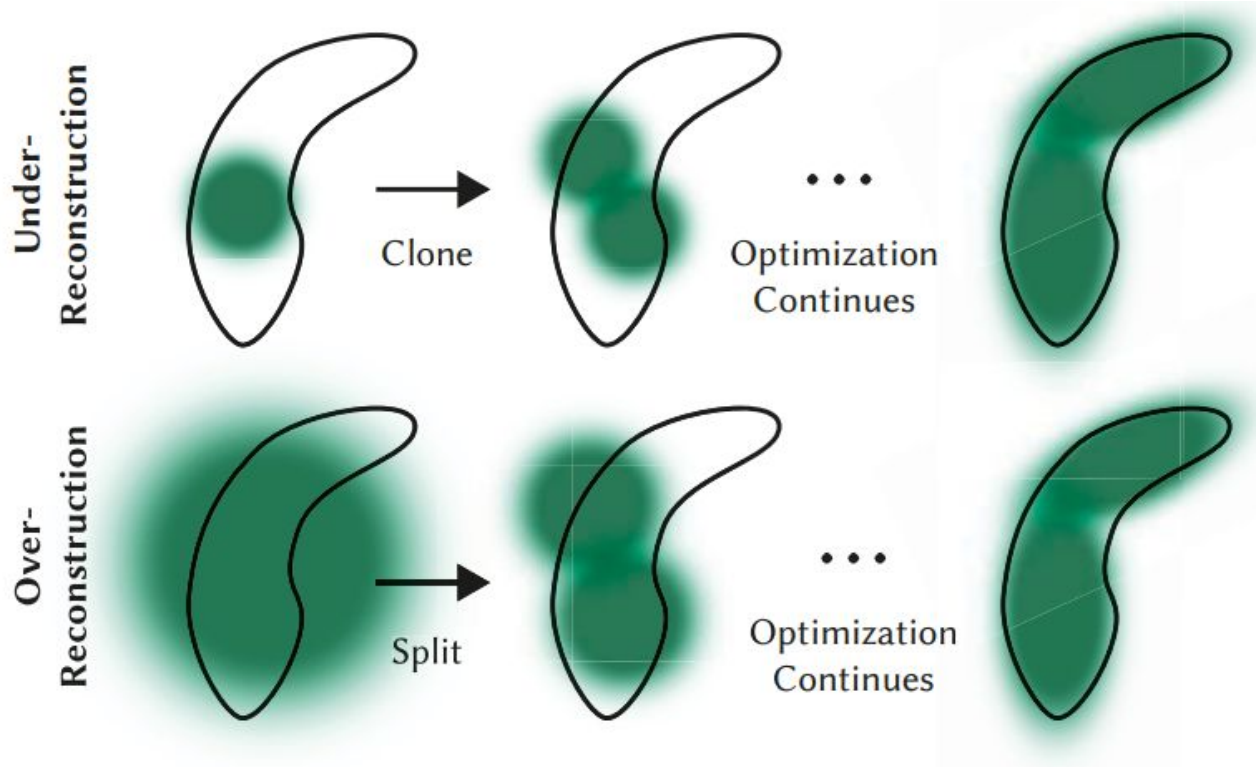
3D Gaussian Splatting



Kerbl, Bernhard, et al. "3d gaussian splatting for real-time radiance field rendering." ACM Trans. Graph. 42.4 (2023): 139-1.

3D Gaussian Splatting

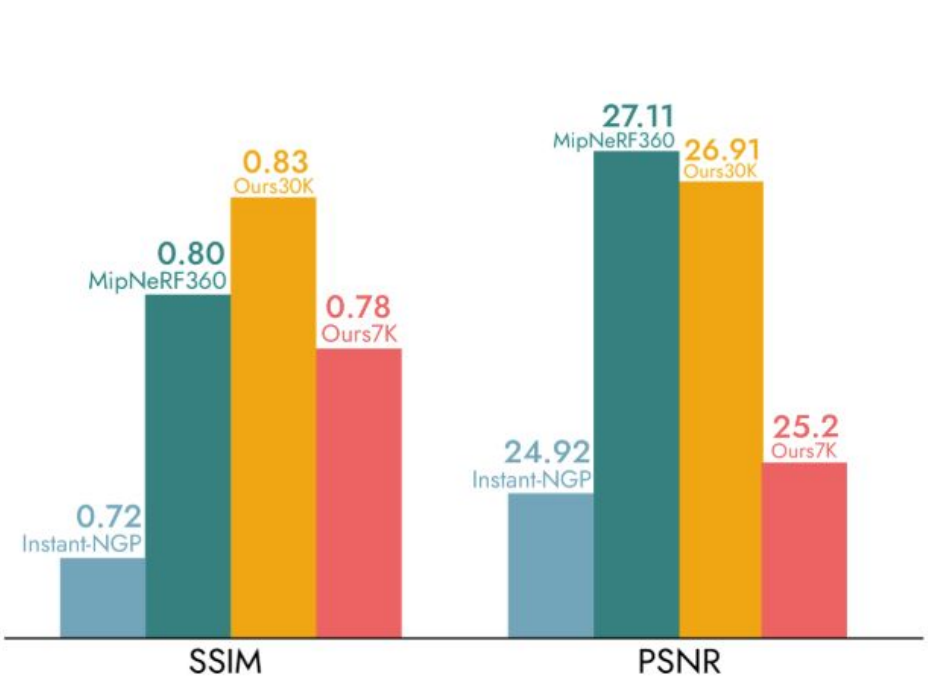
valeo.ai

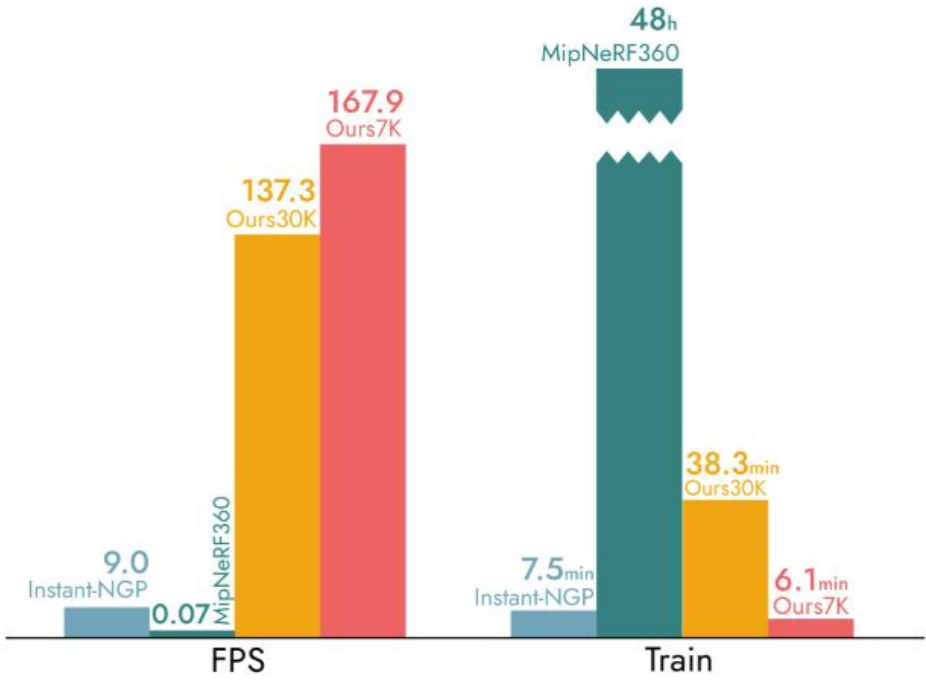


Kerbl, Bernhard, et al. "3d gaussian splatting for real-time radiance field rendering." ACM Trans. Graph. 42.4 (2023): 139-1.

3D Gaussian Splatting

valeo.ai





Kerbl, Bernhard, et al. "3d gaussian splatting for real-time radiance field rendering." ACM Trans. Graph. 42.4 (2023): 139-1.

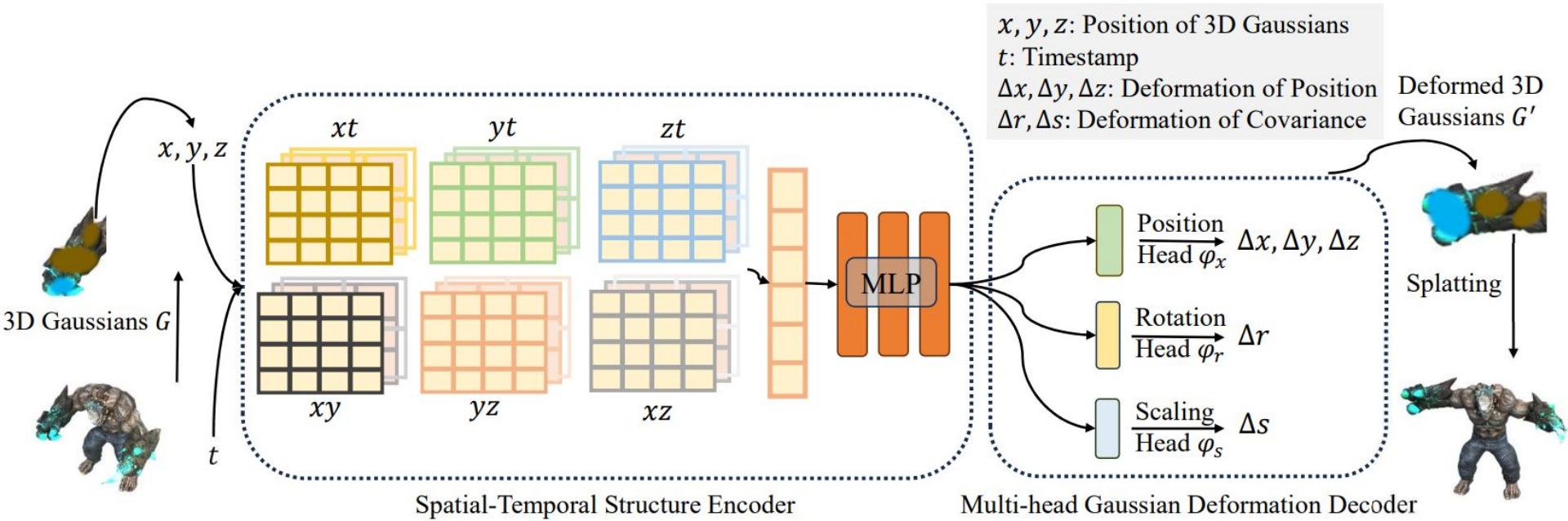
3D Gaussian Splatting

valeo.ai

Videos at: https://repo-sam.inria.fr/fungraph/3d-gaussian-splatting/

Kerbl, Bernhard, et al. "3d gaussian splatting for real-time radiance field rendering." ACM Trans. Graph. 42.4 (2023): 139-1.

4D Gaussians



Wu, Guanjun, et al. "4d gaussian splatting for real-time dynamic scene rendering." Proceedings of the IEEE/CVF conference on computer vision and pattern recognition. 2024.

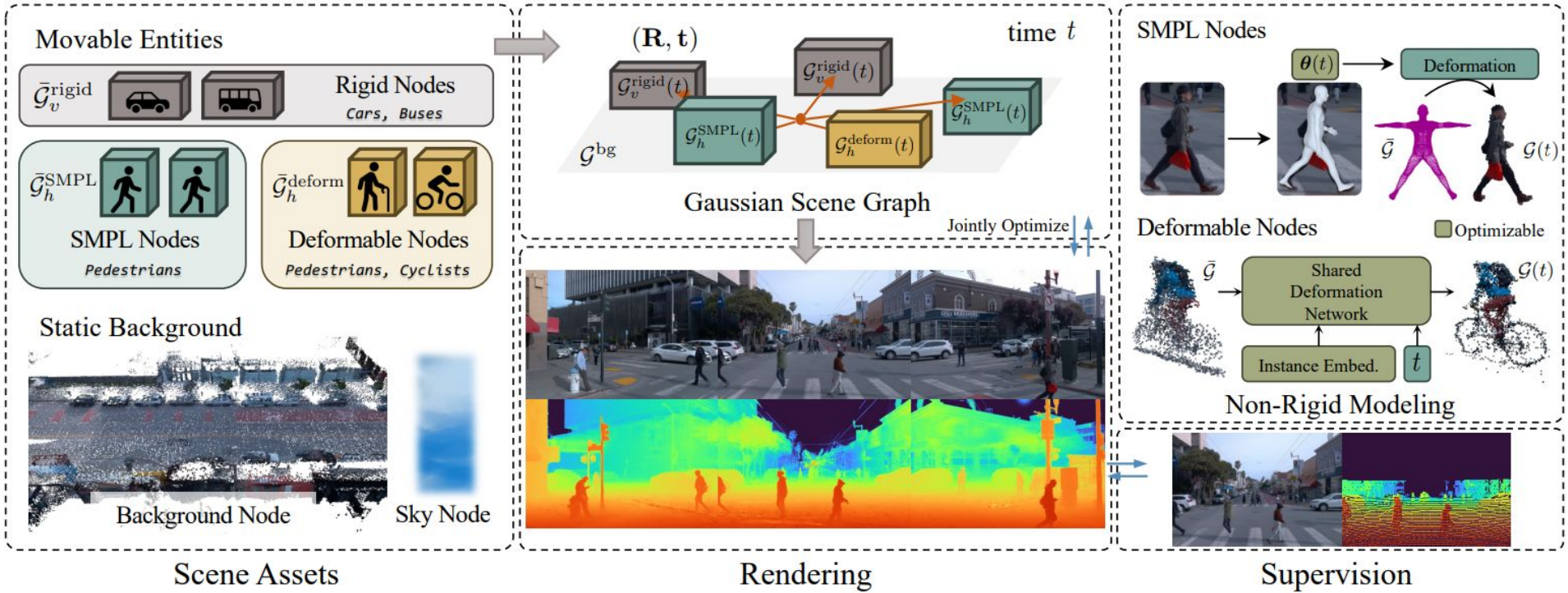
4D Gaussians

valeo.ai

Videos at: https://guanjunwu.github.io/4dgs/

Wu, Guanjun, et al. "4d gaussian splatting for real-time dynamic scene rendering." Proceedings of the IEEE/CVF conference on computer vision and pattern recognition. 2024.

OmniRe

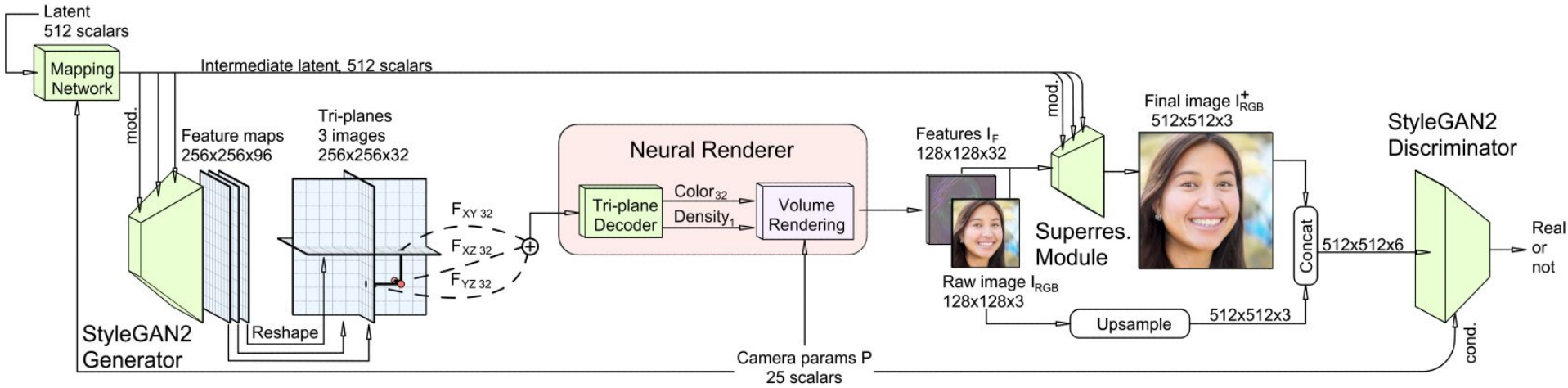


Chen, Ziyu, et al. "Omnire: Omni urban scene reconstruction." arXiv preprint arXiv:2408.16760 (2024).

https://ziyc.github.io/omnire/

III - Usage of NeRFs and Gaussian Splatting

EG3D



Chan, Eric R., et al. "Efficient geometry-aware 3d generative adversarial networks." Proceedings of the IEEE/CVF conference on computer vision and pattern recognition. 2022.

EG3D

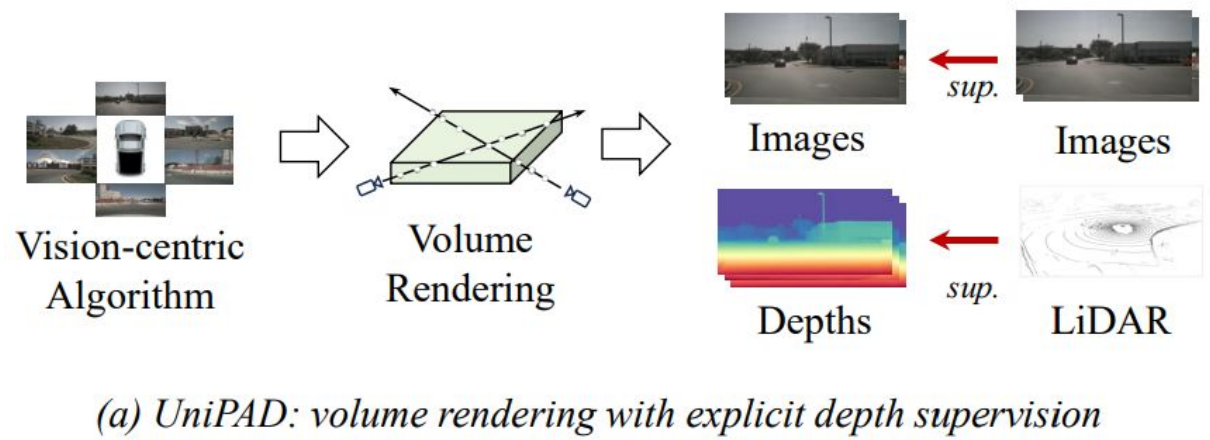
valeo.ai

Videos at: https://nvlabs.github.io/eg3d/

Chan, Eric R., et al. "Efficient geometry-aware 3d generative adversarial networks." Proceedings of the IEEE/CVF conference on computer vision and pattern recognition. 2022.

Pretraining

Pretrain for semantic occupancy prediction from images.



(a) UniPAD: volume rendering with explicit depth supervision

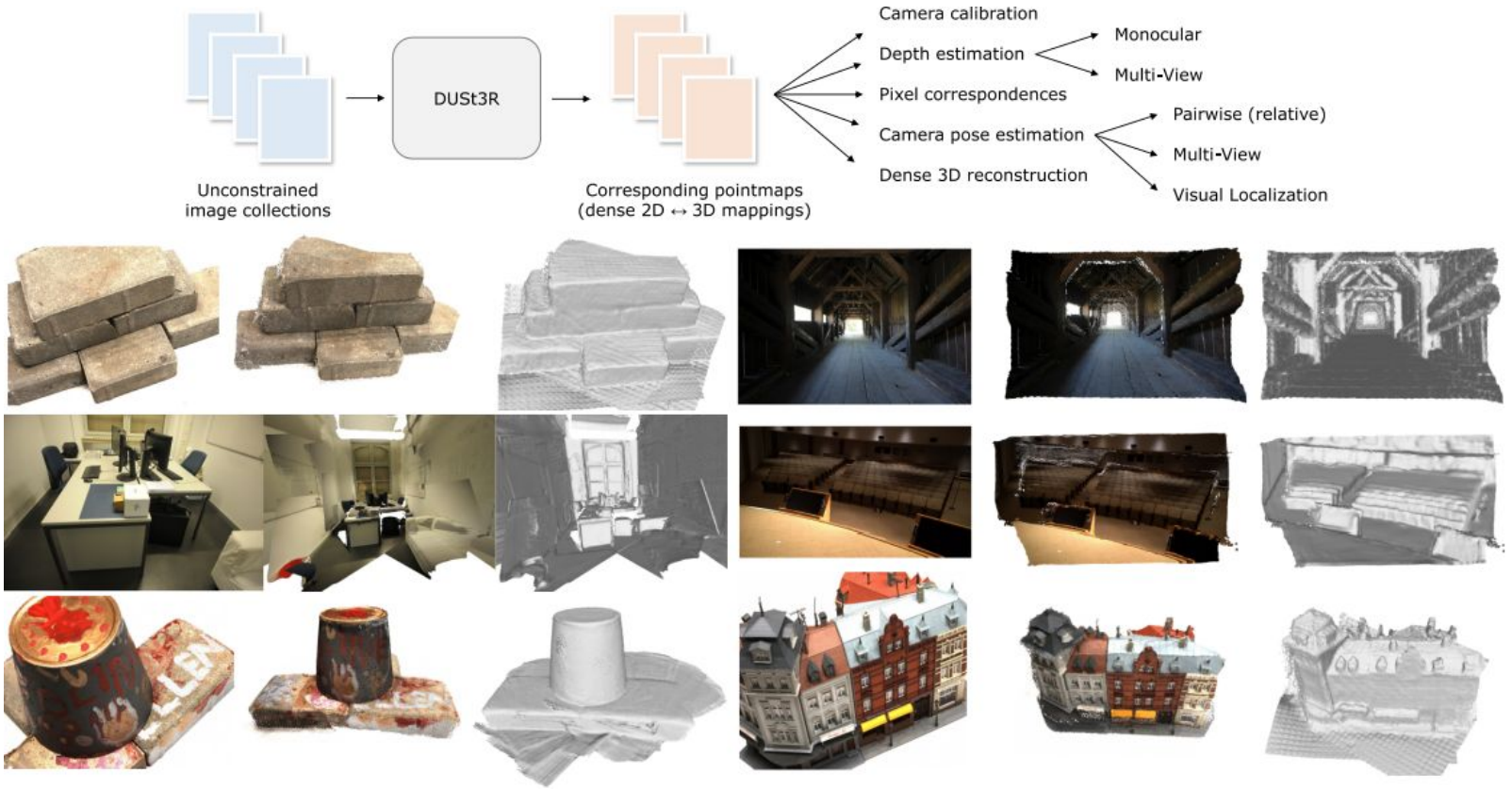
(b) VisionPAD: 3D-GS with sorely vision-centric supervision

Zhang, Haiming, et al. "VisionPAD: A Vision-Centric Pre-training Paradigm for Autonomous Driving." arXiv preprint arXiv:2411.14716 (2024).

valeo.ai

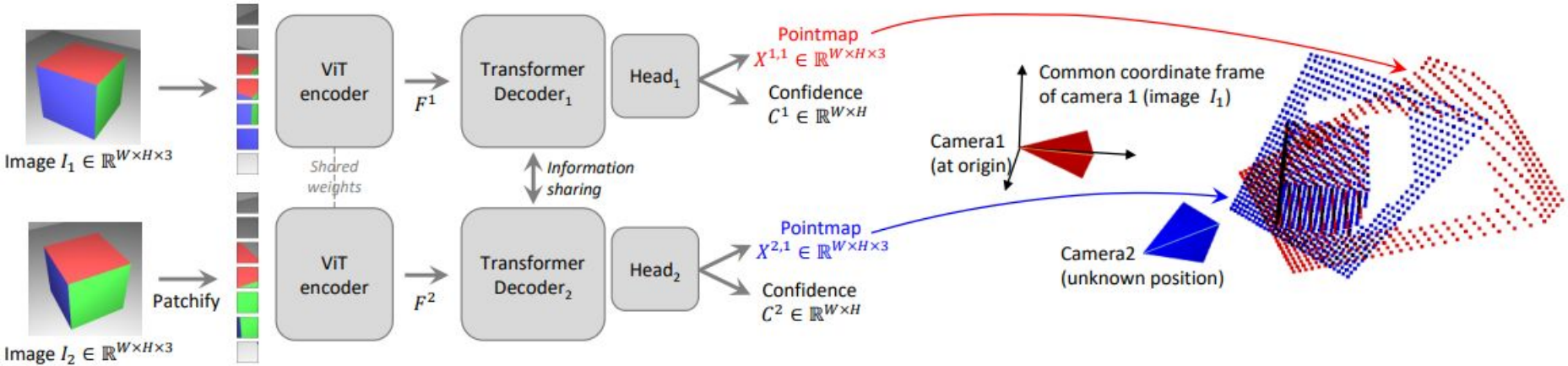
III - Geometric Vision

Dust3r



Wang, Shuzhe, et al. "Dust3r: Geometric 3d vision made easy." *Proceedings of the IEEE/CVF Conference on Computer Vision and Pattern Recognition*. 2024.

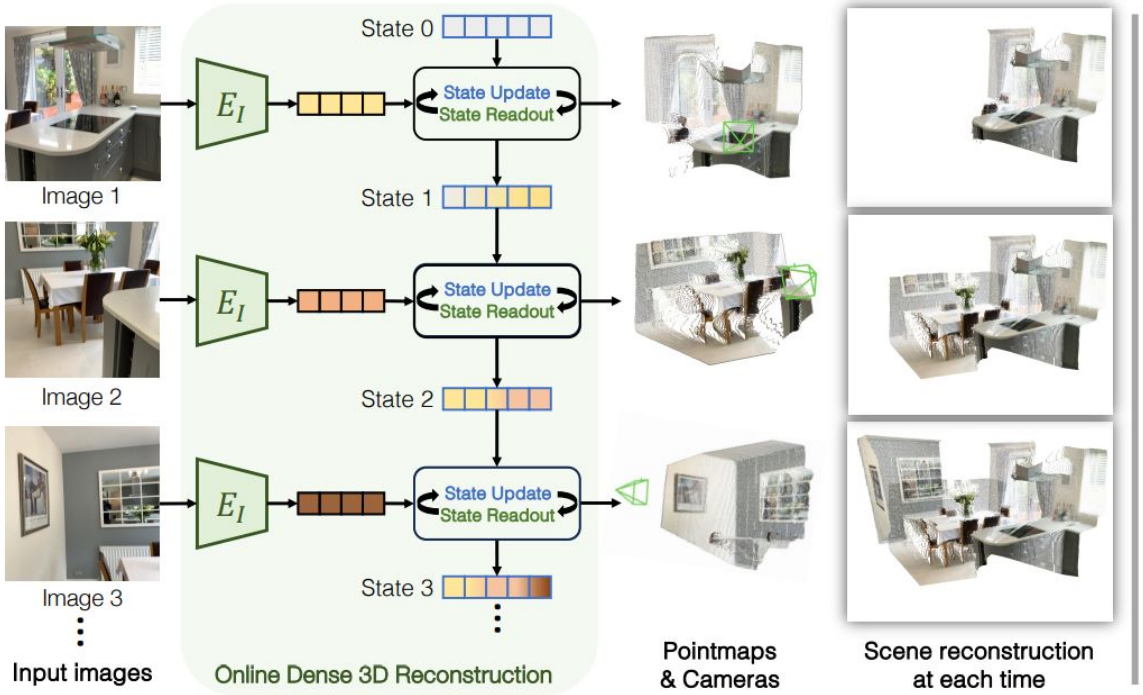
Dust3r

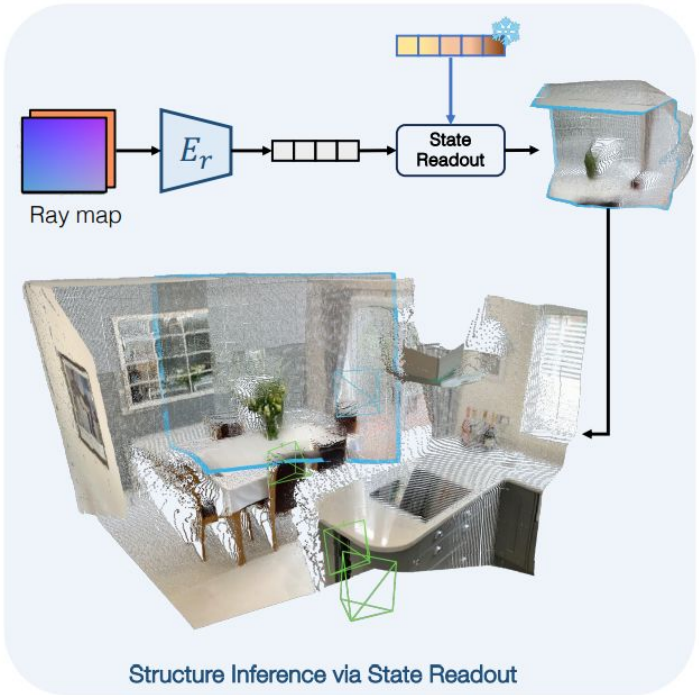


https://europe.naverlabs.com/research/publications/dust3r-geometric-3d-vision-made-easy/

Wang, Shuzhe, et al. "Dust3r: Geometric 3d vision made easy." *Proceedings of the IEEE/CVF Conference on Computer Vision and Pattern Recognition*. 2024.

Cut3r



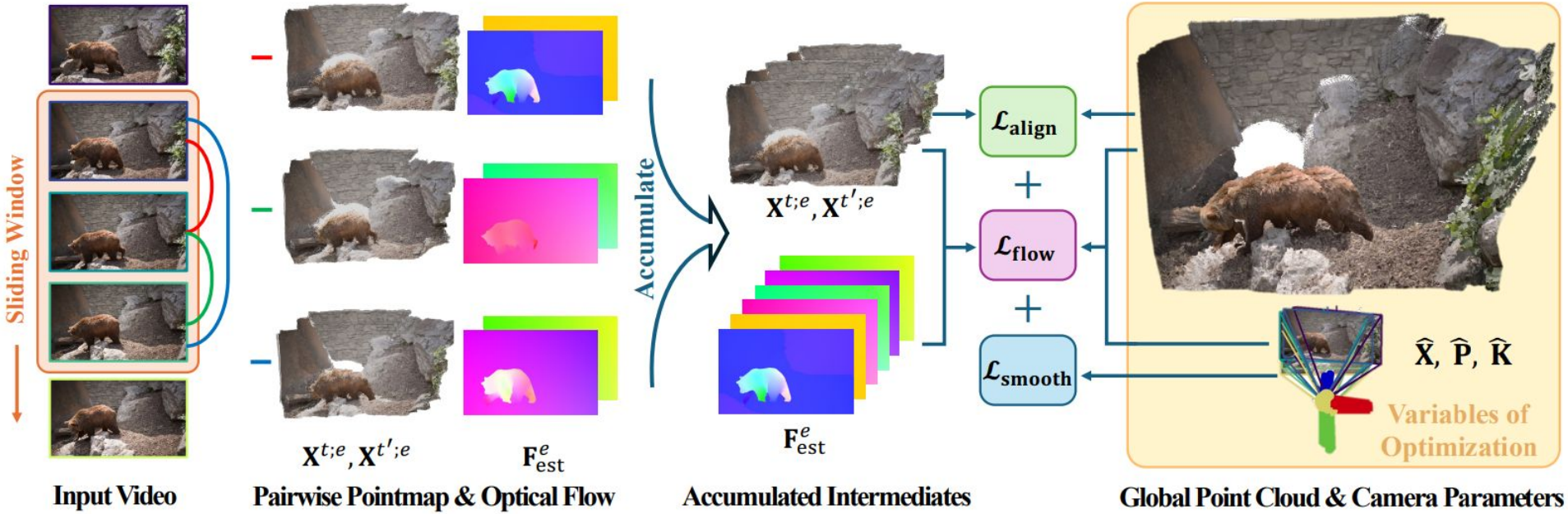


https://cut3r.github.io/

Wang, Qianqian, et al. "Continuous 3D Perception Model with Persistent State." arXiv preprint arXiv:2501.12387 (2025).

Monst3r

valeo.ai



https://monst3r-project.github.io/

Zhang, Junyi, et al. "Monst3r: A simple approach for estimating geometry in the presence of motion." arXiv preprint arXiv:2410.03825 (2024).

Conclusion

Conclusion

valeo.ai

Thank you for your attention !