Spatial Interrogations Or the Color of the Sky

38C3
27.12.2024
Artur Neufeld

The Backrooms
26.09. — 05.10.2024

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3D Gaussian Splatting for Real-Time Radiance Field Rendering

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Fig. 1. Our method achieves real-time rendering of radiance fields with quality that equals the previous method with the best quality [Barron et al. 2022], while only requiring optimization times competitive with the fastest previous methods [Fridovich-Keil and Yu et al. 2022; Müller et al. 2022]. Key to this performance is a novel 3D Gaussian scene representation coupled with a real-time differentiable renderer, which offers significant speedup to both scene optimization and novel view synthesis. Note that for comparable training times to InstantNGP [Müller et al. 2022], we achieve similar quality to theirs; while this is the maximum quality they reach, by training for 51min we achieve state-of-the-art quality, even slightly better than Mip-NeRF360 [Barron et al. 2022].

Radiance Field methods have recently revolutionized novel-view synthesis of scenes captured with multiple photos or videos. However, achieving high visual quality still requires neural networks that are costly to train and render, while recent faster methods inevitably trade off speed for quality. For unbounded and complete scenes (rather than isolated objects) and 1080p resolution rendering, no current method can achieve real-time display rates. We introduce three key elements that allow us to achieve state-of-the-art visual quality while maintaining competitive training times and importantly allow high-quality real-time (≥ 30 fps) novel-view synthesis at 1080p resolution. First, starting from sparse points produced during camera calibration, we represent the scene with 3D Gaussians that preserve desirable properties of continuous volumetric radiance fields for scene optimization while avoiding unnecessary computation in empty space; Second, we perform interleaved optimization/density control of the 3D Gaussians, notably optimizing anisotropic covariance to achieve an accurate representation of the scene; Third, we develop a fast visibility-aware rendering algorithm that supports anisotropic splatting and both accelerates training and allows real-

Additional Key Words and Phrases: novel view synthesis, radiance fields, 3D gaussians, real-time rendering

ACM Reference Format:
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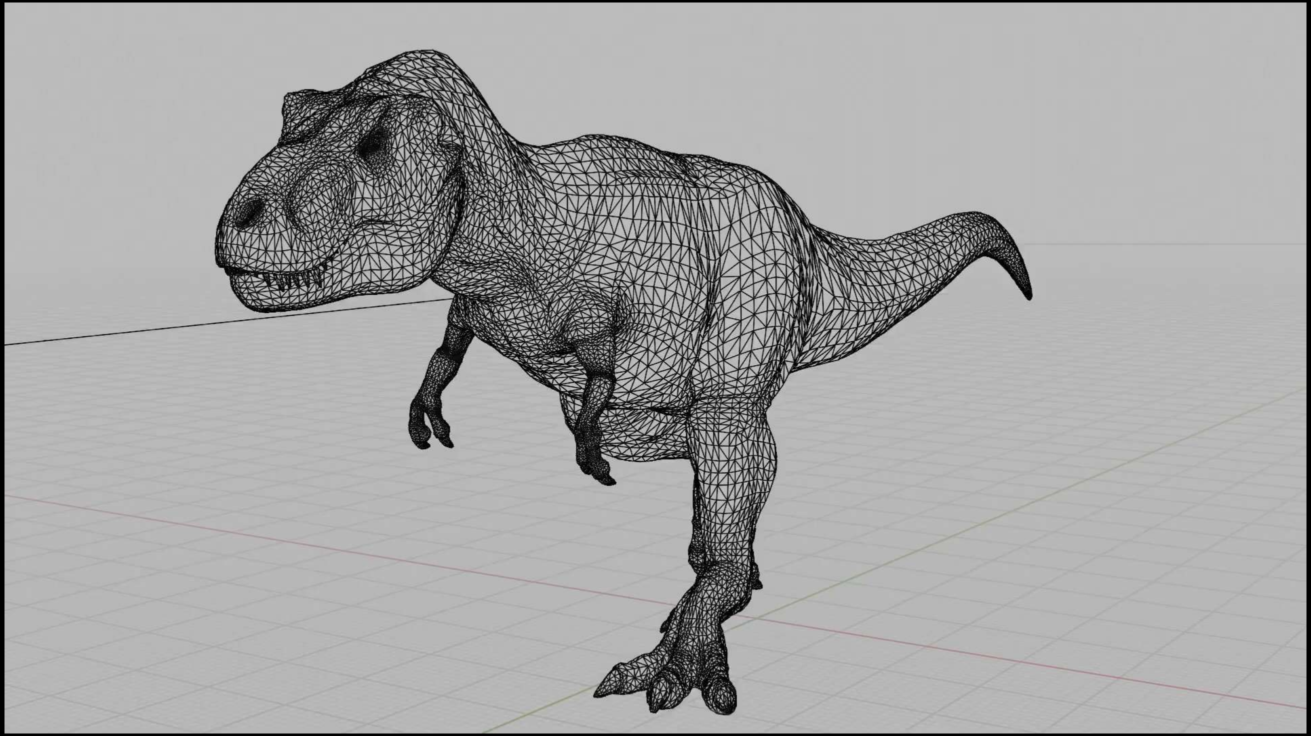
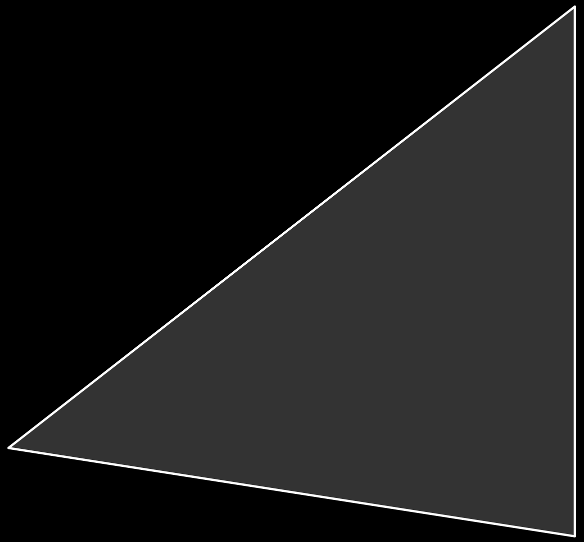
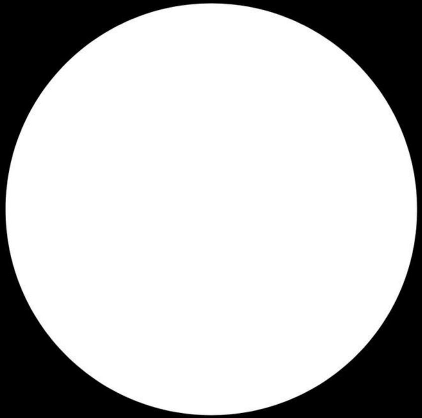
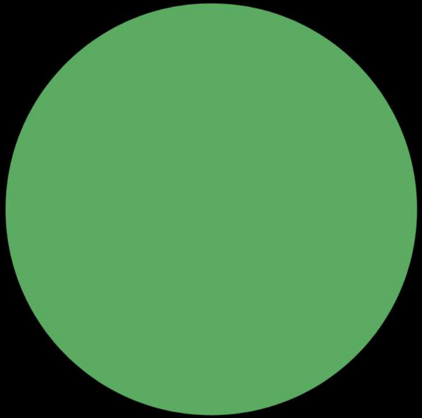
1 INTRODUCTION

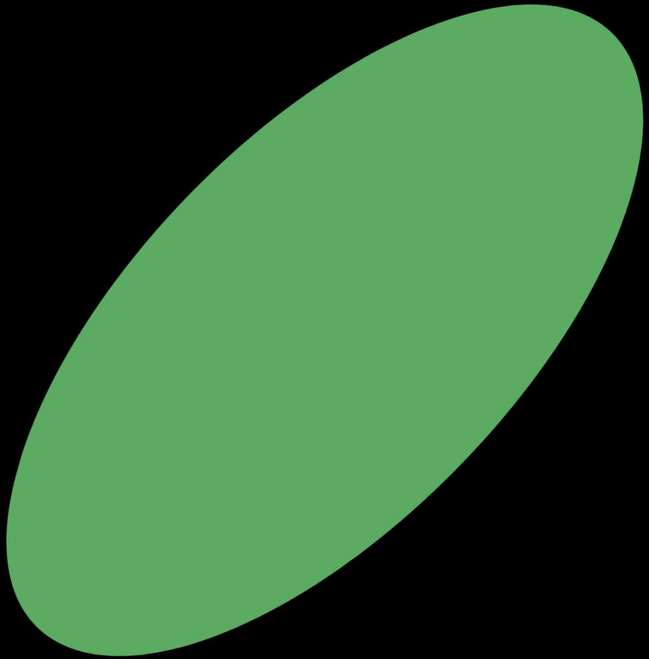
Meshes and points are the most common 3D scene representations because they are explicit and are a good fit for fast GPU/CUDA-based rasterization. In contrast, recent Neural Radiance Field (NeRF) methods build on continuous scene representations, typically optimizing a Multi-Layer Perceptron (MLP) using volumetric ray-marching for novel-view synthesis of captured scenes. Similarly, the most efficient

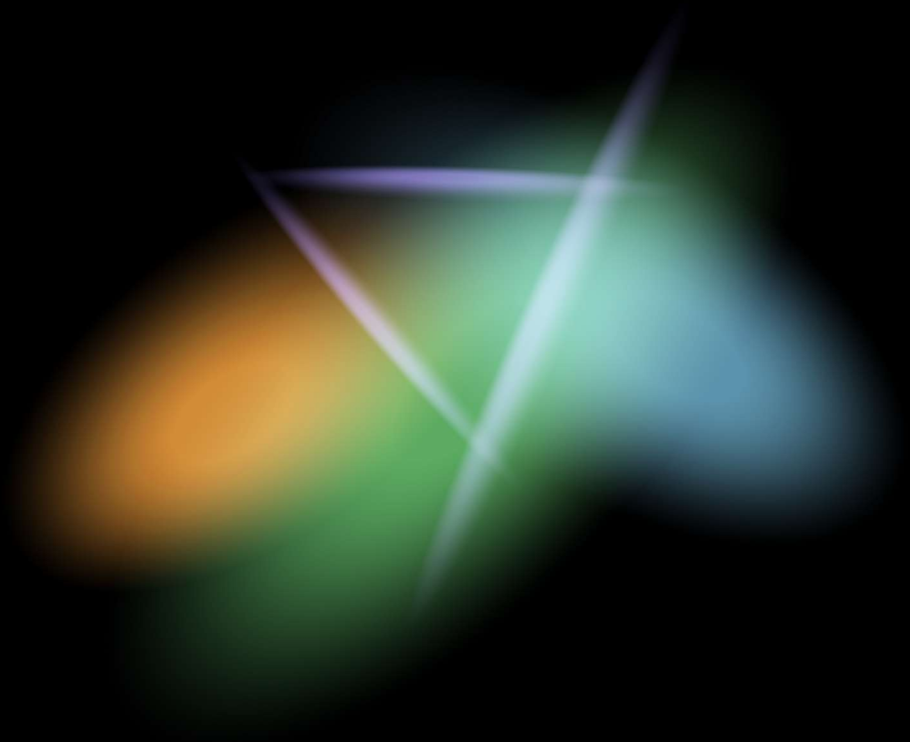

Credit: T-Rex Walk Animation, Wireframe Mode, @MoreAnimationStudios











Credit: Kerbl et al. (2023), "3D Gaussian Splatting for Real-Time Radiance Field Rendering", ACM Transactions on Graphics

Credit: Kerbl et al. (2023), "3D Gaussian Splatting for Real-Time Radiance Field Rendering", ACM Transactions on Graphics

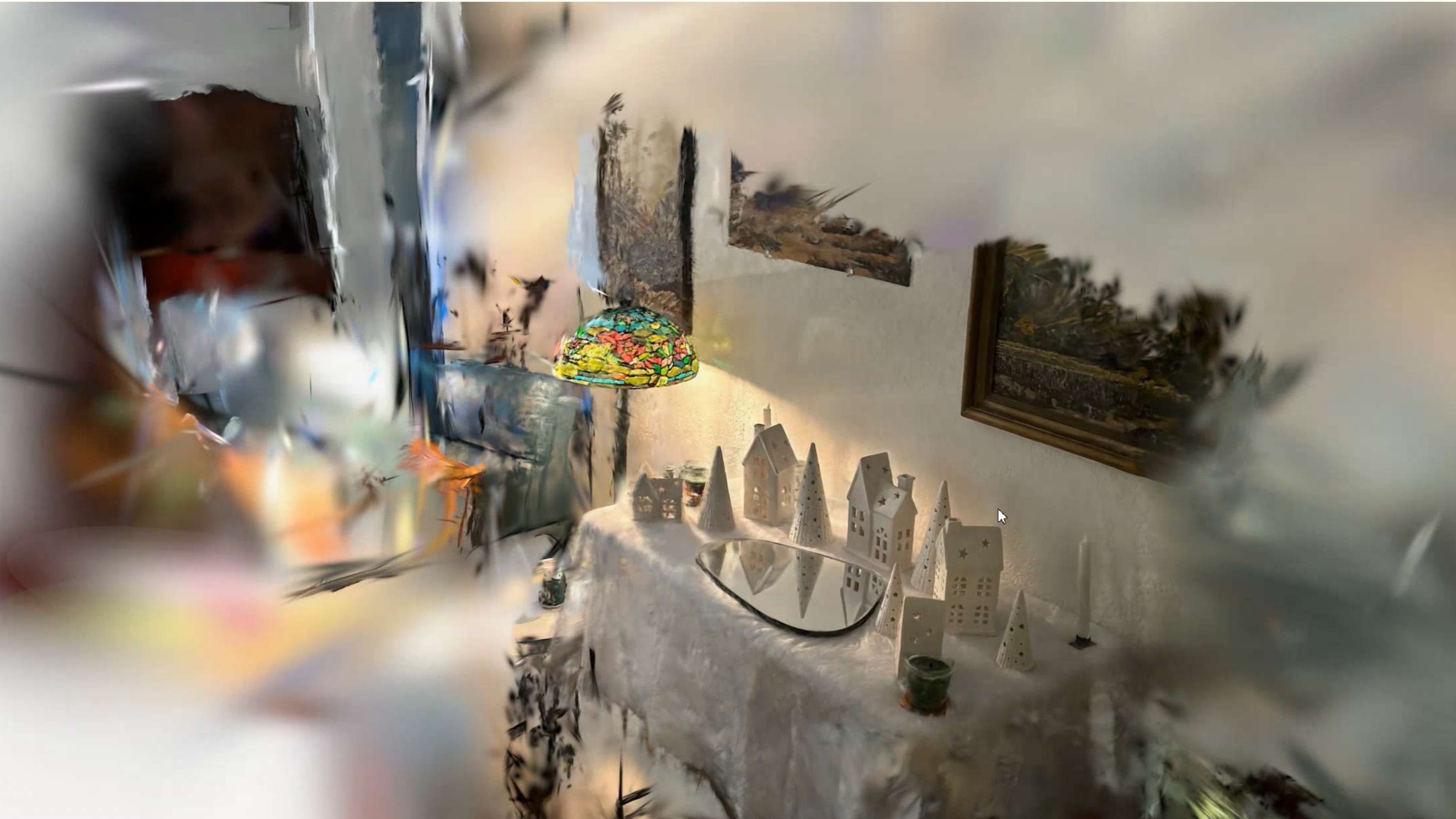
About splatting.

Ablation Study - 30k vs 7k Iterations

30k Iterations

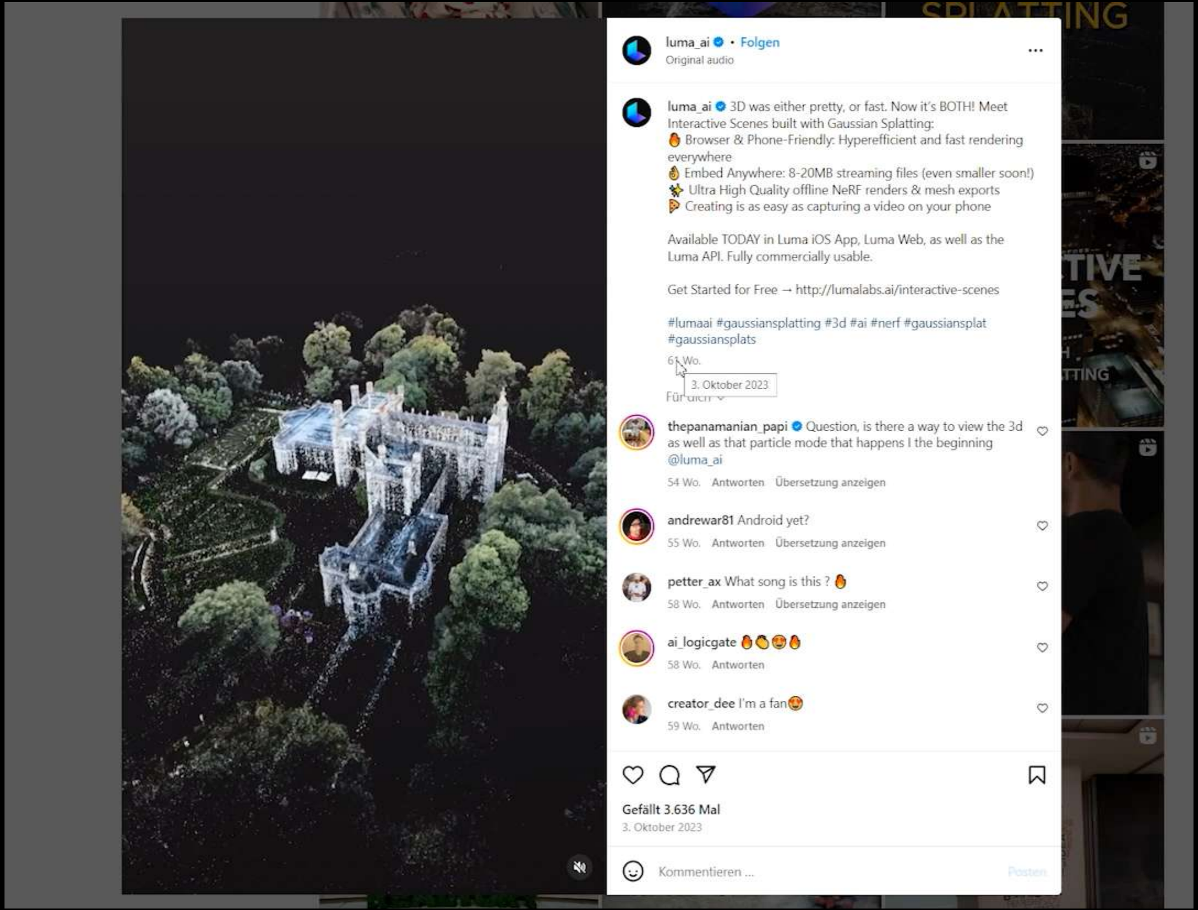
7k Iterations

Credit: Kerbl et al. (2023), "3D Gaussian Splatting for Real-Time Radiance Field Rendering", ACM Transactions on Graphics

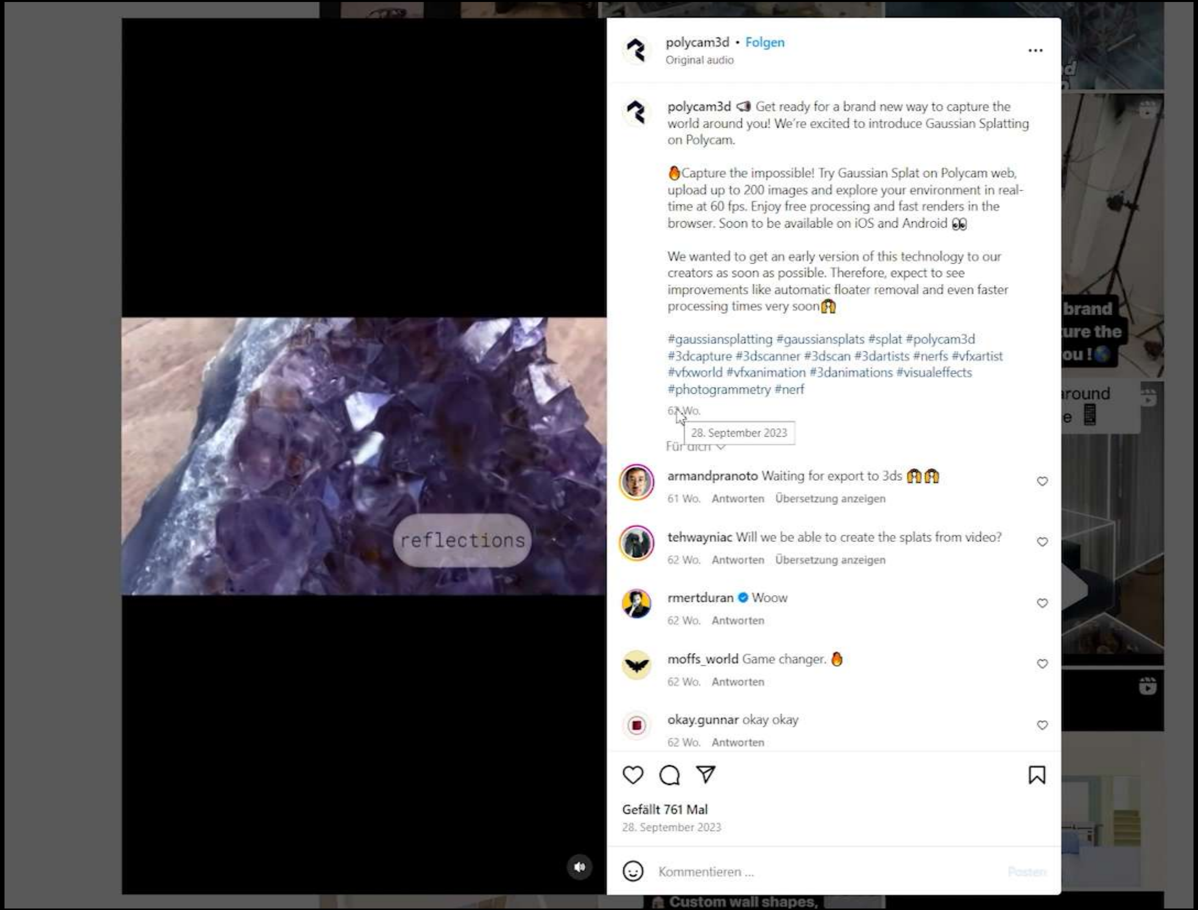


Shows only the first 1.5 seconds of the process. 0.5x Playback Speed.

Credit: Kheradmand et al. (2024), "3D Gaussian Splatting as Markov Chain Monte Carlo", arXiv:2404.09591



Luma.ai, first anouncement: 3.10.2023



Poly.cam, first anouncement: 28.9.2023

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Dec 21 at 8…
LoyalMoon… • 1h
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uforce 1000
Perspicac… • 1h
0 0

180 Curved …
DavoPhoto • 3h
0 0

CT4
mrwright… • 13h
0 1

3DMark Spee…
DudeWhoD… • 15h
0 1

The Good Lo…
Junkrog • 20h
0 2

Mission inn…
Junkrog • 21h
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Starbucks P…
Bjar • 22h
0 1

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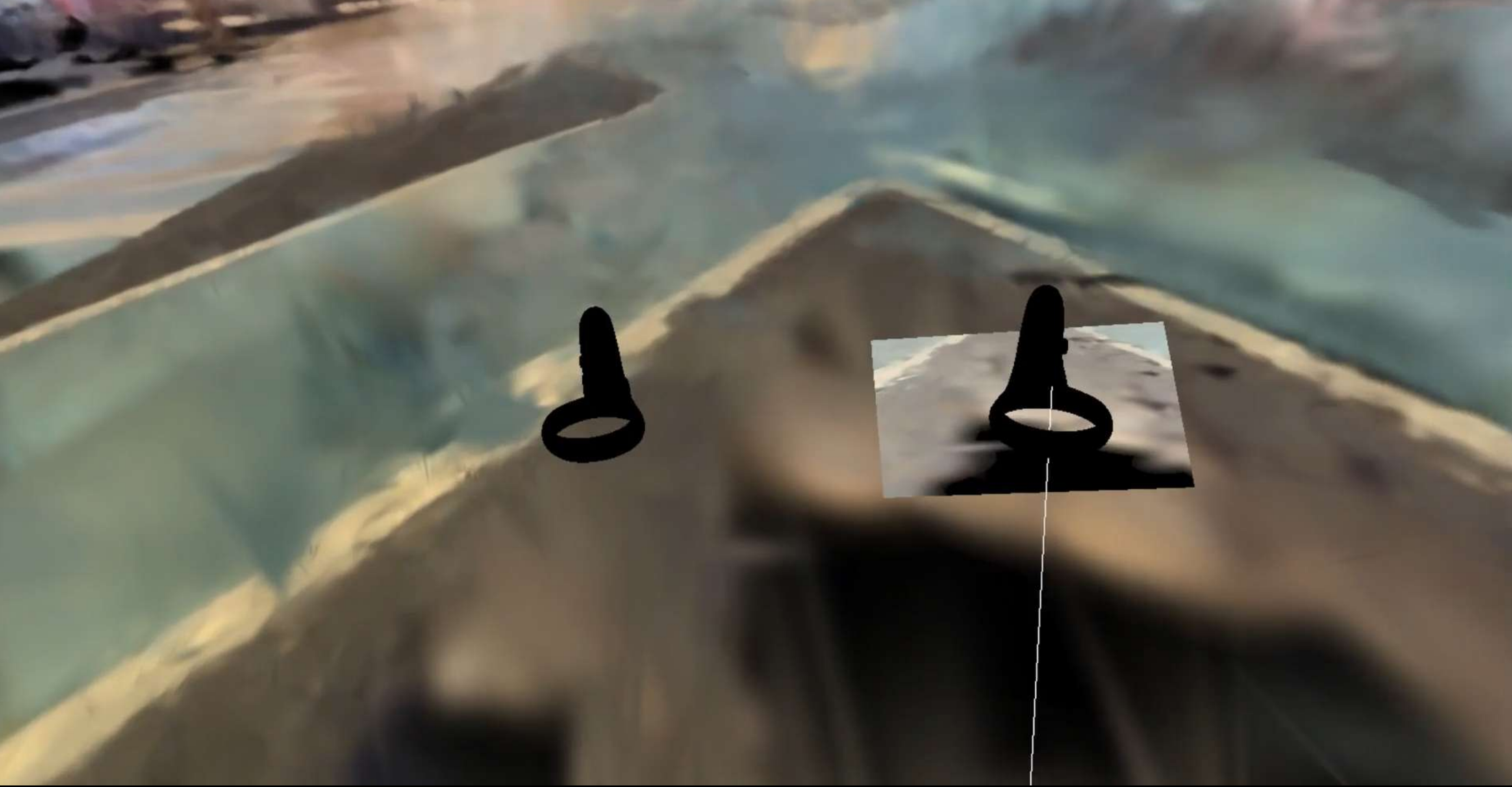

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Escaneo 3D Demo / marcovirtualmx / August 5th, 2024. 09:30 PM

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Anki's boyfriend / anki / Oct 30 2023, 07:01 PM

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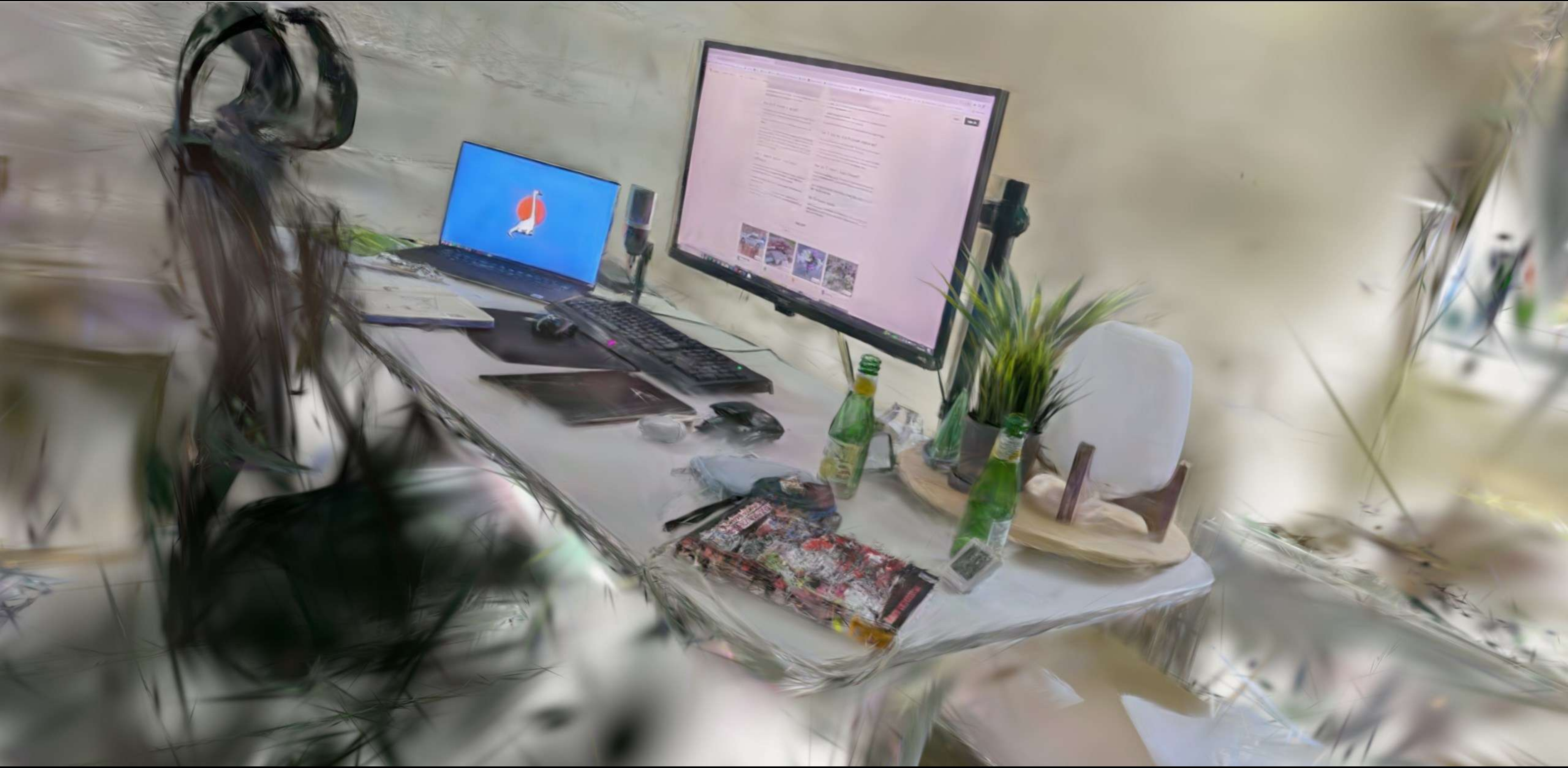

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Old friends / wackything69 / Oct 8 2023, 02:12 PM

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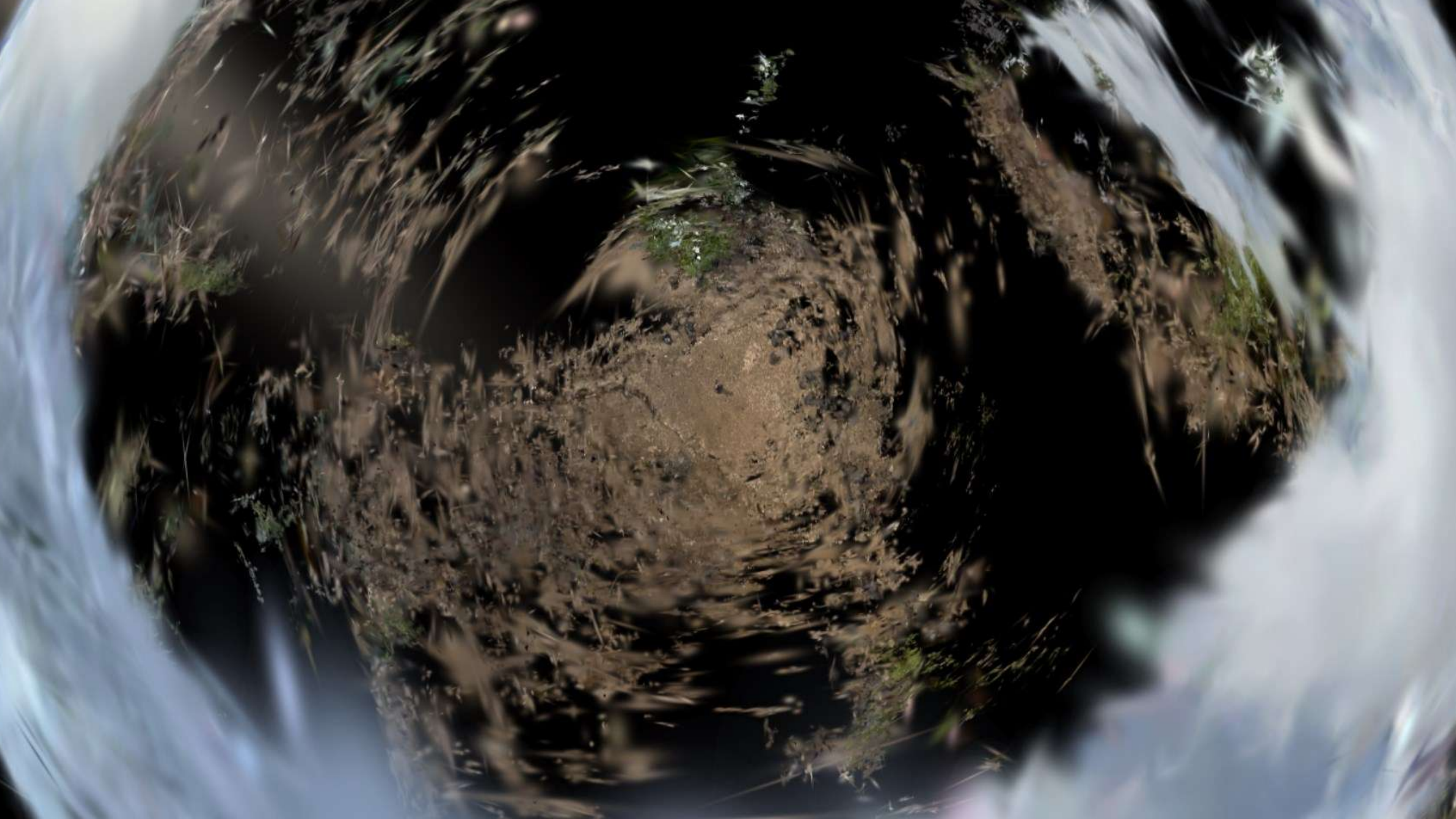
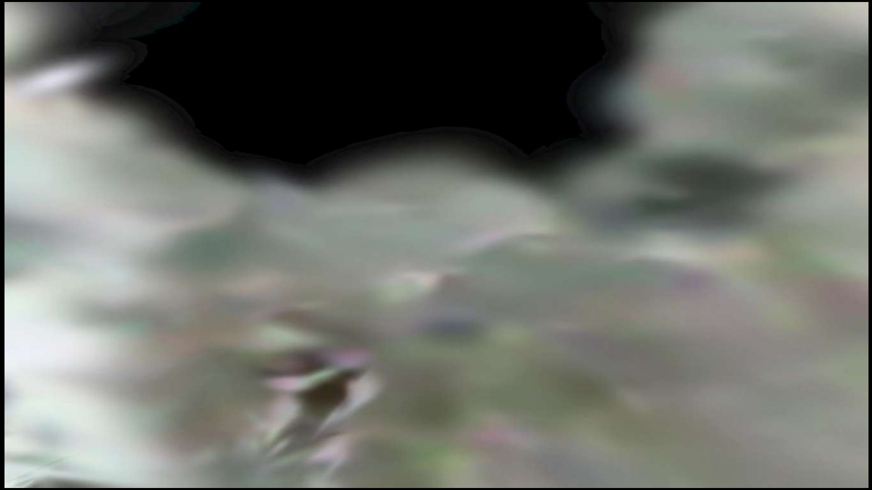
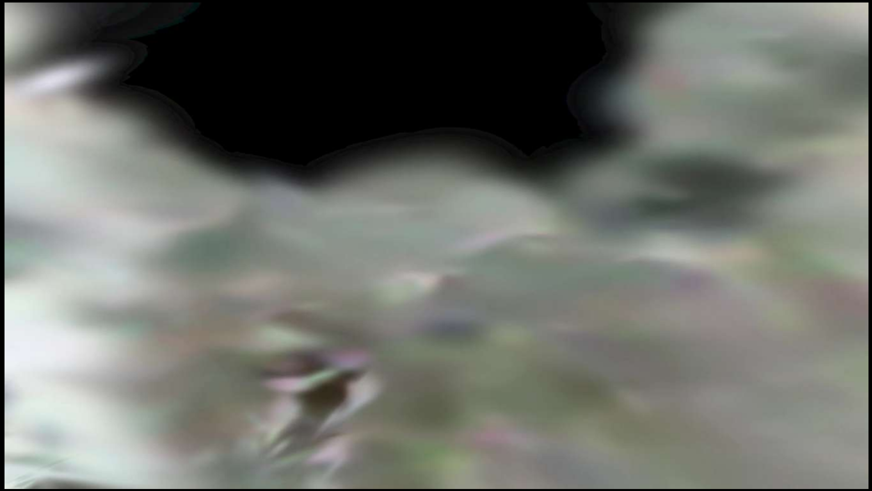



SHISEIDO
TUDOR
First, pixel data from video motion is statistically compared


SHISEIDO
TUDOR

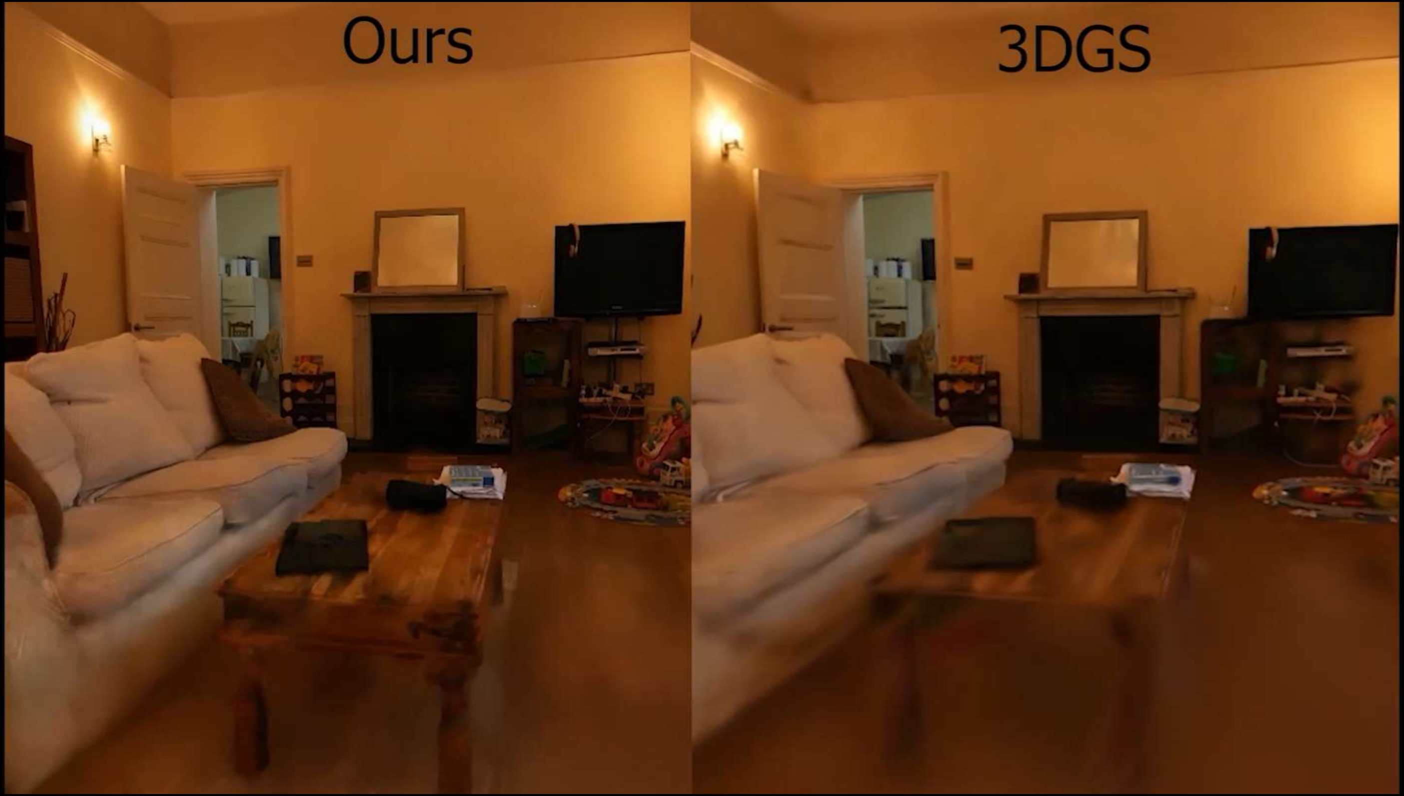

a mother’s woes carved in shadow.



CREDITS

In order of appearance



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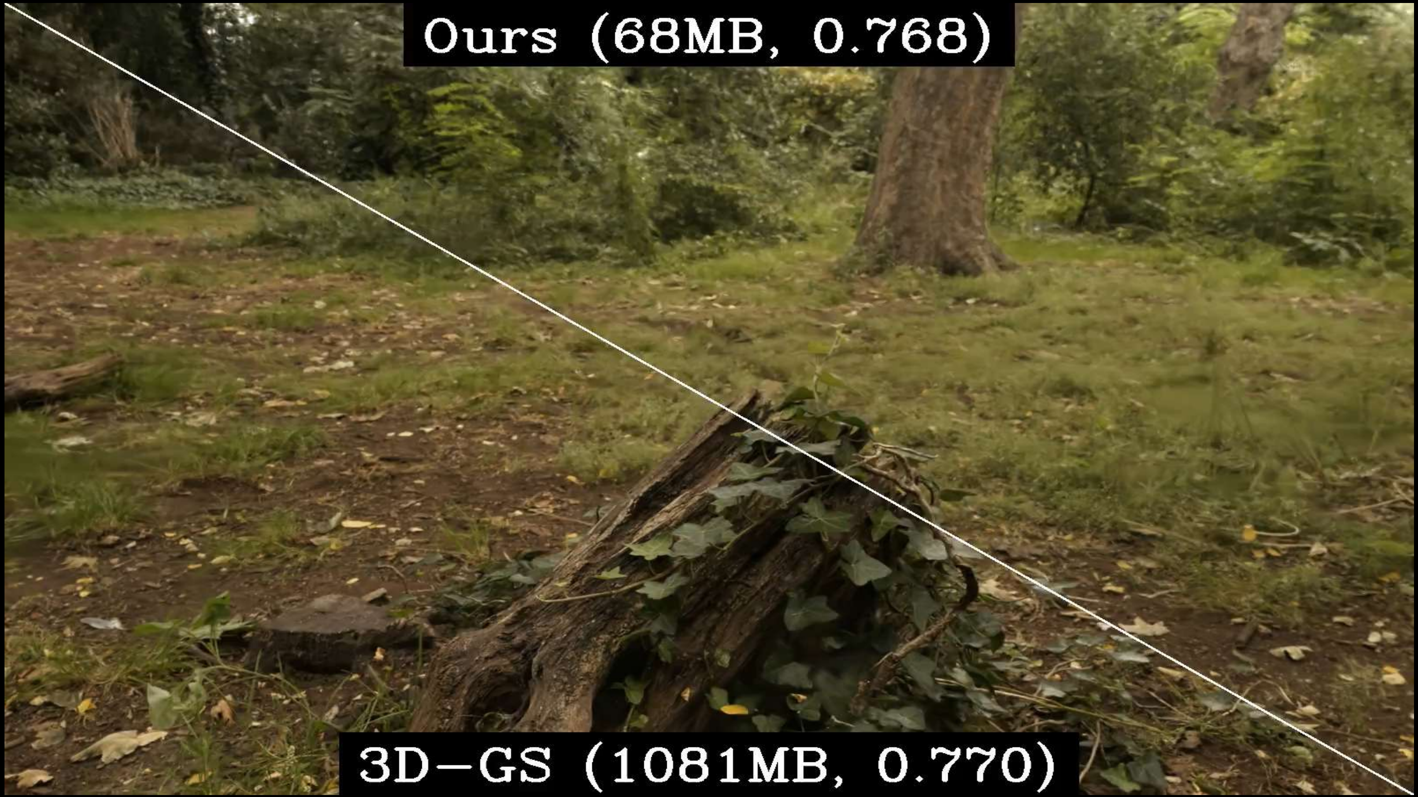

Fan et al. (2023), "LightGaussian: Unbounded 3D Gaussian Compression", arXiv:2311.17245

"A high quality photo of the
Resolute Desk in the Oval Office"

Fan et al. (2023), "LightGaussian: Unbounded 3D Gaussian Compression", arXiv:2311.17245

Luiten et al. (2024), "Dynamic 3D Gaussians: Tracking by Persistent Dynamic View Synthesis", 3DV Conference

https://youtu.be/G2kzLXqNPFc

Thank you.