Procedural Relightable Gaussian Tiles

(Masters-level internship)

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Context and goal

Large virtual worlds need detailed surfaces that can be rendered under changing light. This internship builds on 3D Gaussian textures for mesoscale appearance [1] and NeRF-Texture [2] to synthesize large, relightable textures from small material exemplars. We aim to preserve local geometry and appearance at scale without visible seams or repetition.



(a) Sunflower Wang tile (b) Synthesized sunflower field

Figure 1: *Example from [3] where a small patch of sunflowers is used to generate an entire field.*

Approach

The project starts by fitting a 3D Gaussian volume to exemplar images and estimating albedo, surface normals, roughness, and metallicity for physically based rendering. We will investigate combinations of optimization and learning-based methods, including the use of diffusion priors, possibly involving fine-tuning steps with specifically generated data. Efficient differentiable rendering approaches will be studied for this part of the task. The next step is to explore whether Wang tiling [3] or histogram-preserving blending [4] can be adapted to synthesize larger textures while preserving geometric continuity and material appearance across patch boundaries. For dynamic relighting, we will consider ray tracing, shell mapping [5], or hybrid mesh–Gaussian representations. Results will be reported on real and synthetic data across materials. Tests will assess seams, repetition, relighting quality, and rendering cost. Quantitative validation will use synthetic scenes with known geometry, material properties, and lighting.

Work environment and requirements

The internship will take place at the Inria Centre at Université Côte d'Azur in Sophia Antipolis, near Nice and Antibes.

We are looking for a Master's or final-year engineering student with a strong interest in computer graphics and machine learning. Experience with Python/PyTorch, physically based rendering and optimization are desirable; familiarity with differentiable rendering and Gaussian Splatting is a plus, as is proficiency in agentic coding.

References

[1] X. Chen, J. Li, L. Wang, and B. Wang. *3D Gaussian Texture for Real-Time Mesoscale Appearance Synthesis and Rendering*. ECCV, 2026. Paper.

[2] Y.-H. Huang, Y.-P. Cao, Y.-K. Lai, Y. Shan, and L. Gao. *NeRF-Texture: Texture Synthesis with Neural Radiance*

Fields. SIGGRAPH, 2023. Project page.
[3] Y. Zeng, L. Ma, and P. V. Sander. *GSWT: Gaussian Splatting Wang Tiles*. SIGGRAPH Asia, 2025. Project page.
[4] E. Heitz and F. Neyret. *High-Performance By-Example Noise using a Histogram-Preserving Blending Operator*. High-Performance Graphics, 2018. Paper.
[5] S. D. Porumbescu, B. Budge, L. Feng, and K. I. Joy. *Shell Maps*. ACM Transactions on Graphics, 2005. Paper.