Feature Field Rendering of 3D SMoE Splatting

Background

3D Gaussian Splatting (3DGS) [1] has shown strong performance in real-time radiance field rendering. This technique enables high-quality scene reconstruction and efficient rendering, which are useful for applications such as scene editing, visualization, and virtual reality.

In addition to representing color and geometry, recent research [2-4] has started to include *feature fields* for scene understanding. These fields store semantic or learned features that describe higher-level information about the scene. With feature fields, it becomes possible to perform segmentation, object editing, and content generation directly in 3D space. They provide a way to link low-level rendering with higher-level scene interpretation.

Problem Specification

The feature field in current 3DGS systems is usually guided by the same function as the radiance field. Since the radiance field is not edge-aware, it produces blurred boundaries, and this problem also appears in the feature field. As a result, the semantic features near object boundaries may become mixed or inconsistent, leading to arbitrary segmentation labels.

Recent studies in edge-aware radiance rendering [5] have shown that sharper boundaries can be preserved in real-time rendering. It is worth investigating whether similar ideas can also improve the sharpness and stability of the feature field. The main question is:

How can edge-aware radiance modeling be applied to improve boundary sharpness and feature consistency in 3D SMoE Splatting [5]?

Suggested Method

This work will apply edge-aware radiance modeling to reconstruct feature fields in the 3D SMoE Splatting framework. Based on Feature 3DGS: Supercharging 3D Gaussian Splatting to Enable Distilled Feature Fields [2], this project aims to extend 3D SMoE Splatting [5] with edge-aware and feature-aware optimization. The goal is to achieve a rendering framework that keeps both visual and feature accuracy while staying efficient for real-time rendering.

Relevant Articles

[1] B. Kerbl, G. Kopanas, T. Leimkuehler, and G. Drettakis, “3D Gaussian Splatting for real-time radiance field rendering,” ACM Transactions on Graphics, vol. 42, no. 4, pp. 139:1–139:14, Jul. 2023.

[2] S. Zhou, H. Chang, S. Jiang, Z. Fan, Z. Zhu, D. Xu, P. Chari, S. You, Z. Wang, and A. Kadambi, “Feature 3dgs: Supercharging 3d gaussian splatting to enable distilled feature fields,” in Proceedings of the IEEE/CVF Conference on Computer Vision and Pattern Recognition, 2024, pp. 21 676–21 685.

[3] Y. Li, Q. Ma, R. Yang, H. Li, M. Ma, B. Ren, N. Popovic, N. Sebe, E. Konukoglu, T. Gevers et al., “Scenesplat: Gaussian splatting-based scene understanding with vision-language pretraining,” in Proceedings of the IEEE/CVF International Conference on Computer Vision (ICCV), 2025.

[4] S. He, P. Ji, Y. Yang, C. Wang, J. Ji, Y. Wang, and H. Ding, “A survey on 3d gaussian splatting in segmentation, editing and generation,” arXiv preprint arXiv:2508.09977, 2025.

[5] Y.-H. Li, T. Sikora, S. Knorr, and M. Sjöström, “3d smoe splatting for edge-aware realtime radiance field rendering,” in Siggraph Asia, 2025.