Novelty Assessment Report

Paper: 3DGEER: 3D Gaussian Rendering Made Exact and Efficient for Generic Cameras
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Abstract

3D Gaussian Splatting (3DGS) achieves an appealing balance between rendering quality and efficiency, but relies on approximating 3D Gaussians as 2D projections—an assumption that degrades accuracy, especially under generic large field-of-view (FoV) cameras. Despite recent extensions, no prior work has simultaneously achieved both projective exactness and real-time efficiency for general cameras. We introduce 3DGEER, a geometrically exact and efficient Gaussian rendering framework. From first principles, we derive a closed-form expression for integrating Gaussian density along a ray, enabling precise forward rendering and differentiable optimization under arbitrary camera models. To retain efficiency, we propose the Particle Bounding Frustum (PBF), which provides tight ray–Gaussian association without BVH traversal, and the Bipolar Equiangular Projection (BEAP), which unifies FoV representations, accelerates association, and improves reconstruction quality. Experiments on both pinhole and fisheye datasets show that 3DGEER outperforms prior methods across all metrics, runs 5x faster than existing projective exact ray-based baselines, and generalizes to wider FoVs unseen during training—establishing a new state of the art in real-time radiance field rendering.

Core Task Landscape

This paper addresses: **Exact and Efficient 3D Gaussian Rendering for Wide Field-of-View Cameras**

A total of **41 papers** were analyzed and organized into a taxonomy with **35 categories**.

Taxonomy Overview

The research landscape has been organized into the following main categories:

- **Camera Model Adaptation and Projection Methods**
- **Exact Volumetric Rendering and Ray-Based Integration**
- **Generalizable and Feed-Forward 3D Gaussian Splatting**
- **Rendering Efficiency and Optimization**
- **Scene-Specific Optimization and Reconstruction**
- **Multi-Sensor Fusion and Cross-Domain Methods**
- **Quality Assessment and Evaluation**
- **Specialized Applications and Extensions**
- **Related Wide-Angle Vision Methods**

Complete Taxonomy Tree

- Exact and Efficient 3D Gaussian Rendering for Wide Field-of-View Cameras Survey Taxonomy
- Camera Model Adaptation and Projection Methods
  - Omnidirectional and 360-Degree Camera Rendering
  - Spherical Projection and Ray Casting (3 papers)
    - [14] OmniGS: Fast radiance field reconstruction using omnidirectional gaussian splatting (Longwei Li, 2025) View paper
    - [18] Odgs: 3d scene reconstruction from omnidirectional images with 3d gaussian splattings (Lee, 2024) View paper
    - [23] SPaGS: Fast and Accurate 3D Gaussian Splatting for Spherical Panoramas (J. Li, 2025) View paper
  - Self-Calibrating Omnidirectional Systems (1 papers)
    - [17] SC-OmniGS: Self-Calibrating Omnidirectional Gaussian Splatting (Huang Hua-jian, 2025) View paper
  - Dual-Fisheye and Seamless Panorama Synthesis (1 papers)
    - [9] Seam360GS: Seamless 360deg Gaussian Splatting from Real-World Omnidirectional Images (Changha Shin, 2025) View paper
  - Cubemap and Transition Plane Approaches (1 papers)
    - [12] You Need a Transition Plane: Bridging Continuous Panoramic 3D Reconstruction with Perspective Gaussian Splatting (Shen, 2025) View paper
  - Web-Based and Real-Time Panoramic Visualization (1 papers)
    - [30] WebGS360: Towards web-based visualization of Gaussian Splatting from panoramic images (Chongli Zhang, 2025) View paper
  - Fisheye Camera Methods
  - Fisheye-Specific Projection and Gradient Computation (2 papers)
    - [7] Fisheye-GS: Lightweight and Extensible Gaussian Splatting Module for Fisheye Cameras (Chen Siyan, 2024) View paper
    - [22] Evaluating Fisheye-Compatible 3D Gaussian Splatting Methods on Real Images Beyond 180 Degree Field of View (Ulas Gunes, 2025) View paper
  - Self-Calibrating Fisheye Aberration Correction (1 papers)
    - [27] Selfâ□□Calibrating Fisheye Lens Aberrations for Novel View Synthesis (Jinhui Xiang, 2025) View paper

- Fisheye BEV Feature Lifting (1 papers)
  - [33] FisheyeGaussianLift: BEV Feature Lifting for Surround-View Fisheye Camera Perception (Shubham Sonarghare, 2025) View paper
- Unified Multi-Camera and Heterogeneous Systems
- Pinhole-Fisheye Joint Optimization (1 papers)
  - [15] PFDepth: Heterogeneous Pinhole-Fisheye Joint Depth Estimation via Distortion-aware Gaussian-Splatted Volumetric Fusion (Zhiwei Zhang, 2025) View paper
- Unified Gaussian Representations Across Camera Models (1 papers)
  - [21] Unigaussian: Driving scene reconstruction from multiple camera models via unified gaussian representations (Ren Yuan, 2024) View paper
- Self-Calibrating Large Field-of-View Systems (1 papers)
- [3] Self-calibrating gaussian splatting for large field of view reconstruction (Deng Youming, 2025) View paper

- Exact Volumetric Rendering and Ray-Based Integration
  - Closed-Form Ray-Gaussian Integration ★ (2 papers)
  - [0] 3DGEER: 3D Gaussian Rendering Made Exact and Efficient for Generic Cameras (Anon et al., 2026) View paper
  - [20] 3DGEER: Exact and Efficient Volumetric Rendering with 3D Gaussians (Huang Zixun, 2025) View paper
- Generalizable and Feed-Forward 3D Gaussian Splatting
  - Feed-Forward Omnidirectional Reconstruction (1 papers)
  - [2] OmniSplat: Taming Feed-Forward 3D Gaussian Splatting for Omnidirectional Images with Editable Capabilities (Suyoung Lee, 2025) View paper
  - Wide-Baseline Panoramic Generalization (1 papers)
  - [4] Splatter-360: Generalizable 360 Gaussian Splatting for Wide-baseline Panoramic Images (Zheng Chen, 2025) View paper
  - Free-View Synthesis from Long Sequences (1 papers)
  - [8] Freesplat: Generalizable 3d gaussian splatting towards free view synthesis of indoor scenes (Wang Yun-song, 2024) View paper
  - Feed-Forward 3D-Aware Generation (1 papers)
  - [32] F3D-Gaus: Feed-forward 3D-aware Generation on ImageNet with Cycle-Aggregative Gaussian Splatting (Wang Yu-xin, 2025) Vi ew paper
- Rendering Efficiency and Optimization
  - Hardware Acceleration and Architectural Support (1 papers)
  - [11] GSCore: Efficient Radiance Field Rendering via Architectural Support for 3D Gaussian Splatting (Junseo Lee, 2024) View paper
  - Foveated and Perceptual Rendering (1 papers)
  - [1] Fov-GS: Foveated 3D Gaussian Splatting for Dynamic Scenes (Runze Fan, 2025) View paper
  - Hierarchical and Scalable Gaussian Organization (1 papers)
  - [6] Scale-GS: Efficient Scalable Gaussian Splatting via Redundancy-filtering Training on Streaming Content (Yang Jia-yu, 2025) Vie w paper
- Scene-Specific Optimization and Reconstruction
  - Sparse-View and Depth-Regularized Reconstruction (1 papers)
  - [24] Sparse-view reconstruction and rendering of power transmission infrastructure using depth-regularized Gaussian splatting (R Chen, 2025) View paper
  - Single RGB-LiDAR View Reconstruction (1 papers)
  - [5] Structured 3D gaussian splatting for novel view synthesis based on single RGB-LiDAR View (Libin Liu, 2025) View paper
  - Multi-Camera SLAM and Mapping (1 papers)
  - [10] Mcgs-slam: A multi-camera slam framework using gaussian splatting for high-fidelity mapping (Cao Zhihao, 2025) View paper
  - Construction Site and Domain-Specific Reconstruction (1 papers)
  - [16] 3D gaussian splatting for construction sites (Sina RÃ¼ter, 2024) View paper
  - Acquisition-Aware Frame Selection (1 papers)
  - [28] Robust 3D Content Generation with Acquisition Aware Frame Selection for Gaussian Splatting (Sijan, 2025) View paper
- Multi-Sensor Fusion and Cross-Domain Methods
  - LiDAR-Inertial-Visual Fusion (1 papers)
  - [29] LiDAR-Inertial-Visual Multi-Sensor Fusion for Localization and Mapping With Gaussian Splatting (Sheng Hong, 2025) View paper
  - Event and RGB Camera Fusion (1 papers)
  - [25] From Motion to Localization: Cross-View Optimization with Stationary Event and RGB Cameras for Enhanced Pose Estimation (Y Zhao, 2025) View paper
  - Cross-Domain Image Generation for Localization (1 papers)
  - [38] Enhancing Visual Localization with Cross-Domain Image Generation (Y Wang, n.d.) View paper
- Quality Assessment and Evaluation (1 papers)
  - [19] GS-QA: Comprehensive Quality Assessment Benchmark for Gaussian Splatting View Synthesis (Pedro MartÃn, 2025) View paper
- Specialized Applications and Extensions
  - Light Field and Synthetic Aperture Imaging (2 papers)
  - [31] Single-View Encoding of 3D Light Field Based on Editable Field of View Gaussian Splatting (Shizhou Shi, 2025) View paper
  - [36] Light field-guided optical synthetic aperture imaging system on masterâ□□slave UAVs (Yijie Zhang, 2025) View paper
  - Immersive Teleoperation and Reality Fusion (1 papers)
  - [37] Reality Fusion: Robust Real-time Immersive Mobile Robot Teleoperation with Volumetric Visual Data Fusion (Ke Li, 2024) View paper
  - Dynamic Avatar Reconstruction (1 papers)
  - [40] TGA: True-to-Geometry Avatar Dynamic Reconstruction (B Guo, n.d.) View paper
  - Visuomotor Policy Learning (1 papers)
  - [13] One Demo is Worth a Thousand Trajectories: Action-View Augmentation for Visuomotor Policies (C Pan, 2025) View paper
  - Sky-Aware Outdoor Scene Reconstruction (1 papers)
  - [41] Look at the Sky: Sky-Aware Efficient 3D Gaussian Splatting in the Wild. (Yuze Wang, n.d.) View paper
  - Automatic Video-Based Reconstruction Systems (2 papers)

    - [35] Automatic 3D Space Reconstruction System from Video Using 3D Gaussian Splatting (Anh Khoi Ngo Ho, 2025) View paper
    - [39] 3D GAUSSIAN SPLATTING FOR REAL TIME RADIANCE FIELD RENDERING USING INSTA360 CAMERA (Gunes, 2023) View paper
- Related Wide-Angle Vision Methods
    - Wide-Angle SLAM and Autocalibration (2 papers)
    - [26] Real-time 3D SLAM with wide-angle vision (A. Davison, 2004) View paper
    - [34] Integrating geometric and learning-based methods for camera autocalibration and multi-body structure-from-motion (CIN, 2024) View paper

Narrative

Core task: Exact and efficient 3D Gaussian rendering for wide field-of-view cameras. The field addresses the challenge of adapting 3D Gaussian splatting to cameras with significant lens distortion and wide viewing angles, where standard pinhole projection assumptions break down. The taxonomy reveals several complementary research directions: Camera Model Adaptation focuses on handling fisheye and omnidirectional projections through modified splatting formulations (e.g., Fisheye-GS[7], OmniSplat[2]); Exact Volumetric Rendering develops rigorous ray-based integration methods that account for curved ray paths; Generalizable approaches like Freesplat[8] aim for feed-forward reconstruction without per-scene optimization; while Rendering Efficiency tackles the computational costs of these more complex projection models. Scene-Specific Optimization methods refine reconstruction quality through careful parameter tuning, and Multi-Sensor Fusion explores combining wide-angle cameras with LiDAR or other modalities. Specialized Applications demonstrate the practical value in domains like construction site monitoring and SLAM systems.

A central tension emerges between computational efficiency and geometric accuracy when rendering non-pinhole cameras. Many works adopt approximate projection strategies that preserve real-time performance but sacrifice exactness, while others pursue mathematically rigorous formulations at higher computational cost. 3DGEER[0] sits within the Exact Volumetric Rendering branch alongside 3DGEER Volumetric[20], emphasizing closed-form ray-Gaussian integration that maintains both accuracy and efficiency for wide FOV scenarios. This contrasts with approaches like Fov-GS[1] or Self-calibrating Gaussian[3], which may prioritize different trade-offs between generalization, calibration flexibility, and rendering speed. The distinction between exact integration methods and approximate splatting adaptations represents a key design choice, with 3DGEER[0] advocating for analytical solutions that avoid Monte Carlo sampling overhead while handling the geometric complexities of fisheye and omnidirectional lenses.

Related Works in Same Category

The following **1 sibling papers** share the same taxonomy leaf node with the original paper:

1. 3DGEER: Exact and Efficient Volumetric Rendering with 3D Gaussians

Authors: Huang Zixun, Wu Cho Ying, Zixun Huang, Guo Yuliang, Cho-Ying Wu, et al. (10 authors total) | **Year/Venue**: 2025 | **URL**: View paper

Abstract

3D Gaussian Splatting (3DGS) marks a significant milestone in balancing the quality and efficiency of differentiable rendering. However, its high efficiency stems from an approximation of projecting 3D Gaussians onto the image plane as 2D Gaussians, which inherently limits rendering quality--particularly under large Field-of-View (FoV) camera inputs. While several recent works have extended 3DGS to mitigate these approximation errors, none have successfully achieved both exactness and high effic...

⚠ Similarity Notice

These papers appear to be the same work or closely related variants. Both titles are nearly identical ('3DGEER: 3D Gaussian Rendering Made Exact and Efficient for Generic Cameras' vs '3DGEER: Exact and Efficient Volumetric Rendering with 3D Gaussians'), both propose the same method name (3DGEER), and both describe identical technical contributions: deriving closed-form expressions for integrating Gaussian density along rays, introducing Particle Bounding Frustum (PBF) for efficient ray-particle association, and proposing Bipolar Equiangular Projection (BEAP). The core technical content, methodology, and experimental setup are essentially the same.

Contributions Analysis

Overall novelty summary. The paper proposes a closed-form ray-Gaussian integration framework for exact rendering under arbitrary camera models, particularly wide field-of-view configurations. It resides in the 'Closed-Form Ray-Gaussian Integration' leaf, which contains only two papers total (including this work and one sibling). This represents a sparse research direction within the broader taxonomy of 41 papers across 36 topics, suggesting the exact volumetric rendering approach is less explored compared to approximate projection adaptations that dominate the Camera Model Adaptation branch.

The taxonomy reveals that most wide-FOV work concentrates in Camera Model Adaptation subtopics—Omnidirectional Camera Rendering (7 papers), Fisheye Camera Methods (4 papers), and Unified Multi-Camera Systems (2 papers)—which primarily modify splatting formulations rather than deriving exact ray integration. The paper's parent branch, Exact Volumetric Rendering and Ray-Based Integration, stands apart from these projection-focused methods and from the Generalizable/Feed-Forward branch (4 papers) that prioritizes learning-based reconstruction. The scope_note for the leaf explicitly excludes 'approximate splatting methods or approaches using BVH traversal,' positioning this work against efficiency-oriented approximations prevalent elsewhere in the field.

Among 14 candidates examined across three contributions, the closed-form rendering framework itself shows no clear refutation (4 candidates examined, 0 refutable). However, the Particle Bounding Frustum contribution faces one refutable candidate from a single paper examined, and the Bipolar Equiangular Projection encounters one refutable case among 9 candidates. The limited search scope (14 total candidates, not hundreds) means these statistics reflect top-K semantic matches rather than exhaustive coverage. The core integration formulation appears more novel within this constrained search, while the auxiliary techniques (PBF, BEAP) show some overlap with existing spatial indexing and projection methods.

Given the sparse population of the exact integration leaf and the limited literature search scope, the work appears to occupy a relatively underexplored niche. The analysis covers top-14 semantic matches and does not claim exhaustive field coverage. The contribution-level statistics suggest the mathematical framework for ray-Gaussian integration may be the most distinctive element, while the efficiency mechanisms show partial overlap with prior spatial acceleration techniques within the examined candidate set.

This paper presents **3 main contributions**, each analyzed against relevant prior work:

Contribution 1: Closed-form projective-exact Gaussian rendering framework

Description: The authors derive a mathematically exact closed-form solution for integrating 3D Gaussian density along rays through canonical coordinate transformation. This eliminates projective approximation errors inherent in splatting-based methods while supporting arbitrary camera models including wide field-of-view fisheye cameras.

This contribution was assessed against **4 related papers** from the literature. Papers with potential prior art are analyzed in detail with textual evidence; others receive brief assessments.

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1. 3DGUT: Enabling Distorted Cameras and Secondary Rays in Gaussian Splatting

URL: View paper

Brief Assessment

3DGUT[51] focuses on enabling distorted cameras and secondary rays through unscented transform approximation, not on deriving closed-form exact ray integration. The candidate explicitly states it 'replaces the ewa splatting formulation with the unscented transform that approximates the particles through sigma points,' which is fundamentally different from the original paper's canonical coordinate transformation approach for exact integration.

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2. Radiative Gaussian Splatting for Efficient X-ray Novel View Synthesis

URL: View paper

Brief Assessment

Radiative Gaussian Splatting[53] focuses on X-ray imaging with radiative rasterization for transmission imaging, not general camera models with ray-based integration for arbitrary FOV cameras.

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3. Don't Splat your Gaussians: Volumetric Ray-Traced Primitives for Modeling and Rendering Scattering and Emissive Media

URL: View paper

Brief Assessment

Volumetric Ray-Traced Primitives[50] focuses on physically-based volumetric path tracing for scattering and emissive media with closed-form transmittance solutions, but does not address projective exactness for arbitrary camera models or the elimination of splatting approximation errors that are central to the original paper's contribution.

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4. Ray techniques in electromagnetics

URL: View paper

Brief Assessment

Ray Electromagnetics[52] focuses on ray optics techniques for electromagnetic field computations and Gaussian beam propagation in optics/electromagnetics, not computer graphics rendering or 3D scene reconstruction with arbitrary camera models.

Contribution 2: Particle Bounding Frustum (PBF) for efficient ray-particle association

Description: The authors introduce PBF, a novel frustum-based method that efficiently associates rays with 3D Gaussians by computing tight bounding frustums directly from true 3D covariance. This approach avoids costly BVH traversal and intermediate conic approximations while maintaining geometric exactness.

This contribution was assessed against **1 related papers** from the literature. Papers with potential prior art are analyzed in detail with textual evidence; others receive brief assessments.

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1. 3DGEER: Exact and Efficient Volumetric Rendering with 3D Gaussians

URL: View paper

Prior Art Analysis

3DGEER Volumetric[20] demonstrates that a frustum-based method for efficient ray-Gaussian association without BVH traversal was already proposed. Both papers introduce frustum-based approaches that compute tight bounding structures directly from 3D covariance to avoid costly BVH traversal. The candidate paper explicitly describes computing particle bounding frustums (PBF) from true 3D covariance and using camera sub-frustums (CSF) for association, matching the core novelty claim of the original contribution.

Evidence

Evidence 1 - **Rationale**: Both papers introduce PBF as a method for tight ray-Gaussian association without BVH traversal, demonstrating prior work on this exact concept. - **Original**: we propose theparticle bounding frustum (pbf), which provides tight ray-gaussian association without bvh traversal - **Candidate**: we propose an efficient method for computing a tight particle bounding frustum (pbf) for each 3d gaussian, enabling accurate and efficient ray-gaussian association

Evidence 2 - **Rationale**: The text is nearly identical, showing that the candidate paper contains the same technical approach of CSF-PBF association with closed-form solutions, refuting novelty. - **Original**: To perform efficient ray-particle association without compromising geometric exactness, we reformulate the problem as associating camera sub-frustums (csf) with particle bounding frustums (pbf)-analogous to the tile-aabb mapping used in 3dgs. For each 3d gaussian, we derive a closed-form solution to... - **Candidate**: To perform efficient ray-particle association without compromising rendering exactness, we reformulate the problem as associating camera sub-frustums (csf) with particle bounding frustums (pbf)-analogous to the tile-aabb mapping used in 3dgs. for each 3d gaussian, we derive a closed-form solution to...

Evidence 3 - **Rationale**: Both papers describe solving ray-particle association at the frustum level in 3D space with identical technical claims, demonstrating prior work exists. - **Original**: our approach solves the ray-particle association problem directly at the frustum level in 3d space (see fig. 1right), preserving the geometric exactness of ray-based rendering across arbitrary camera models while maintaining rendering speeds comparable to 3dgs - **Candidate**: in contrast to these methods, our approach solves the ray-particle association problem directly at the frustum level in 3d space, preserving the exactness of ray-based rendering across arbitrary camera models while maintaining rendering speeds comparable to 3dgs

Evidence 4 - **Rationale**: The identical phrasing about deriving closed-form PBF solutions indicates the candidate paper already presented this contribution. - **Original**: we derive a closed-form solution to compute the pbf tightly bounding it, enabling highly efficient association. (iii) in addition, we propose to uniformly sample rays in a novel bipolar equiangular projection (beap) space - **Candidate**: for each 3d gaussian, we derive a closed-form solution to compute the pbf tightly bounding it, enabling highly efficient association. (iii) in addition, we propose to uniformly sample rays in a novel bipolar equiangular projection (beap) space to apply color supervision

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Contribution 3: Bipolar Equiangular Projection (BEAP) image representation

Description: The authors propose BEAP, a novel image representation that uniformly samples rays in spherical angular coordinates. This unifies field-of-view representations across camera models, aligns image-space partitioning with camera sub-frustums for efficient association, and provides more balanced spatial coverage that improves reconstruction quality.

This contribution was assessed against **9 related papers** from the literature. Papers with potential prior art are analyzed in detail with textual evidence; others receive brief assessments.

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1. A fast reconstruction method for geometric deviations in equiangular fan-beam industrial CT system

URL: View paper

Brief Assessment

Equiangular Fan-beam Reconstruction[44] focuses on geometric deviation correction in industrial CT systems with fan-beam projections, not on image representation methods for camera-based 3D reconstruction or novel view synthesis.

2. Deferred slanted-edge analysis: a unified approach to spatial frequency response measurement on distorted images and color filter array subsets

URL: View paper

Brief Assessment

Deferred Slanted-edge[43] focuses on spatial frequency response measurement for distorted images (e.g., equiangular fisheye lenses) and color filter arrays, not on novel image representations for 3D reconstruction or rendering. The candidate addresses image quality measurement, while BEAP addresses uniform ray sampling for improved reconstruction in 3D Gaussian rendering.

3. â¦ redundancy of Radon transform using a set of partial derivative equations: could we precisely reconstruct the image from a sparse-view projection without any image â¦

URL: View paper

Brief Assessment

Radon Transform Redundancy[42] focuses on partial differential equations for Radon transform in CT reconstruction, not on equiangular projection representations for 3D Gaussian rendering or camera model unification.

4. Modelling light obstruction in three conifer forests using hemispherical photography and fine tree architecture

URL: View paper

Brief Assessment

Hemispherical Photography Forests[47] focuses on modeling light obstruction in forest canopies using hemispherical photography and tree architecture, not on novel image representations for 3D reconstruction or rendering systems.

5. Extraction of 3D freeform surfaces as visual landmarks for real-time tracking

URL: View paper

Brief Assessment

Freeform Surface Extraction[48] focuses on extracting 3D surfaces as visual landmarks for tracking, not on novel image representations for 3D reconstruction. The brief mention of equiangular resampling appears in a different context (image rectification) and does not constitute a comprehensive image representation framework like BEAP.

6. Incoherent and Robust Projection Matrix Design Based on Equiangular Tight Frame

URL: View paper

Brief Assessment

Equiangular Tight Frame[49] focuses on designing projection matrices for compressed sensing and signal reconstruction from high-dimensional data, not on image representations for 3D reconstruction or camera models.

7. Equiangular Fan-beam CT Image Reconstruction Based on Field Theory

URL: View paper

Brief Assessment

Field Theory CT[46] focuses on CT image reconstruction using field theory for equiangular fan-beam geometry in medical/industrial imaging, not on 3D scene rendering or camera model unification for novel view synthesis.

8. Synchronization and self-calibration for helmet-held consumer cameras, applications to immersive 3d modeling and 360 video

URL: View paper

Brief Assessment

Helmet-held Camera Synchronization[45] focuses on synchronization and calibration of helmet-mounted cameras for 360° video and 3D modeling, using equiangular camera models. It does not propose a novel image representation for unifying field-of-view across camera models or improving reconstruction quality through uniform angular sampling as BEAP does.

9. 3DGEER: Exact and Efficient Volumetric Rendering with 3D Gaussians

URL: View paper

Prior Art Analysis

3DGEER Volumetric[20] demonstrates that a bipolar equiangular projection representation unifying field-of-view for improved reconstruction quality was already proposed. Both papers introduce BEAP as a novel image representation that uniformly samples rays in spherical angular coordinates, unifies FOV representations across camera models, aligns image-space partitioning with camera sub-frustums, and provides more balanced spatial coverage for improved reconstruction quality.

Evidence

Evidence 1 - **Rationale**: Both papers introduce BEAP as unifying FOV representations and improving reconstruction quality through uniform ray sampling. - **Original**: thebipolar equiangular projection (beap), which unifies fov representations, accelerates association, and improves reconstruction quality - **Candidate**: we introduce a novel bipolar equiangular projection (beap) representation to accelerate ray association under generic camera models. beap further provides a more uniform ray sampling strategy to apply supervision, which empirically improves reconstruction quality

Evidence 2 - **Rationale**: Nearly identical text describing BEAP's purpose of aligning image-space partitioning with CSF and improving reconstruction quality over conventional projections. - **Original**: we propose to uniformly sample rays in a novel bipolar equiangular projection (beap) space to apply color supervision. this ray sampling strategy not only aligns image-space partitioning and the underlying csf but also improves conventional pinhole or equidistant projections in reconstruction qualit... - **Candidate**: we propose to uniformly sample rays in a novel bipolar equiangular projection (beap) space to apply color supervision. this ray sampling strategy not only aligns image-space partitioning and the underlying csf but also improved conventional pinhole or equidistant projections in reconstruction qualit...

Evidence 3 - **Rationale**: The text is nearly identical, describing all three key benefits of BEAP: FOV representation, CSF parameterization alignment, and uniform ray distribution. - **Original**: we introduce a novel beap image representation for several reasons. first, it effectively represents images from large-fov cameras without introducing fov loss. second, it allows image tiles and their corresponding csfs to share an identical parameterization in terms of two θand twoϕangles, enabling... - **Candidate**: we introduce a novel beap image representation for several reasons. first, it effectively represents images from large field-of-view (fov) cameras without introducing fov loss. second, it allows image tiles and their corresponding camera sub-frustums (csfs) to share an identical parameterization in ...

Evidence 4 - **Rationale**: Identical description of BEAP's uniform sampling advantage over projective and equidistant approaches, demonstrating prior work on this contribution. - **Original**: sampling rays uniformly in(θ, ϕ)leads to more balanced spatial coverage within the view frustum. our sampling strategy contrasts with projective sampling, which disproportionately allocates samples toward peripheral regions, and equidistant projection, which oversamples near the image center - **Candidate**: sampling rays uniformly in(□,□) leads to more balanced spatial coverage within the view frustum. our sampling strategy contrasts with projective sampling, which disproportionately allocates samples toward peripheral regions, and equidistant projection, which oversamples near the image center

Appendix: Text Similarity Detection

Textual similarity detection checked 13 papers and found 2 similarity segment(s) across 1 paper(s).

The following **1 paper(s)** were detected to have high textual similarity with the original paper. These may represent different versions of the same work, duplicate submissions, or papers with substantial textual overlap. Readers are advised to verify these relationships independently.

1. 3DGEER: Exact and Efficient Volumetric Rendering with 3D Gaussians

Detected in: Core Task (sibling), Contribution: contribution_2, Contribution: contribution_3

⚠ **Note**: This paper shows substantial textual similarity with the original paper. It may be a different version, a duplicate submission, or contain significant overlapping content. Please review carefully to determine the nature of the relationship.

References

- [0] 3DGEER: 3D Gaussian Rendering Made Exact and Efficient for Generic Cameras View paper
- [1] Fov-GS: Foveated 3D Gaussian Splatting for Dynamic Scenes View paper
- [2] OmniSplat: Taming Feed-Forward 3D Gaussian Splatting for Omnidirectional Images with Editable Capabilities View paper
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