Novelty Assessment Report

Paper: D^{2}GS: Depth-and-Density Guided Gaussian Splatting for Stable and Accurate Sparse-View Reconstruction

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Abstract

Recent advances in 3D Gaussian Splatting (3DGS) enable real-time, high-fidelity novel view synthesis (NVS) with explicit 3D representations. However, performance degradation and instability remain significant under sparse-view conditions. In this work, we identify two key failure modes under sparse-view conditions: overfitting in regions with excessive Gaussian density near the camera, and underfitting in distant areas with insufficient Gaussian coverage. To address these challenges, we propose a unified framework \modelname{}, comprising two key components: a Depth-and-Density Guided Dropout strategy that suppresses overfitting by adaptively masking redundant Gaussians based on density and depth, and a Distance-Aware Fidelity Enhancement module that improves reconstruction quality in under-fitted far-field areas through targeted supervision. Moreover, we introduce a new evaluation metric to quantify the stability of learned Gaussian distributions, providing insights into the robustness of the sparse-view 3DGS. Extensive experiments on multiple datasets demonstrate that our method significantly improves both visual quality and robustness under sparse view conditions. The source code and trained models will be made publicly available.

Core Task Landscape

This paper addresses: **Sparse-View 3D Reconstruction**

A total of **50 papers** were analyzed and organized into a taxonomy with **17 categories**.

Taxonomy Overview

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

- **3D Reconstruction Methods and Representations**
- **Computer Vision Applications and Surveys**
- **Research Methodology and Design**
- **Empirical Studies with Defined Objectives**
- **Theoretical and Conceptual Analyses**
- **Applied Methods and Practical Implementations**
- **Educational and Training Studies**
- **Academic Integrity and Research Ethics**
- **Unspecified Objectives and Scope**

Complete Taxonomy Tree

- Sparse-View 3D Reconstruction Survey Taxonomy
- 3D Reconstruction Methods and Representations
  - Gaussian Splatting and Point-Based Reconstruction ★ (1 papers)
  - [0] D^{2}GS: Depth-and-Density Guided Gaussian Splatting for Stable and Accurate Sparse-View Reconstruction (Anon et al., 2026) View paper
  - Optical and Grating-Based Imaging Systems (1 papers)
  - [15] Primary objective grating telescopy: optical properties and feasibility of applications (Leaf A. Swordy, 2023) View paper
- Computer Vision Applications and Surveys
  - Domain-Specific Vision Applications (2 papers)
  - [27] A survey of public datasets for computer vision tasks in precision agriculture (Yuzhen Lu, 2020) View paper
  - [33] Hyperbolic Deep Learning in Computer Vision: A Survey (Pascal Mettes, 2024) View paper
  - Text and Algorithmic Analysis Methods (1 papers)
  - [12] Text algorithms in economics (Ash, 2023) View paper
- Research Methodology and Design
  - Research Design Frameworks and Paradigms (3 papers)
  - [6] Pragmatism as a research paradigm and its implications for social work research (Vibha Kaushik, 2019) View paper
  - [14] Learning how research design methods work: A review of Creswell's research design: Qualitative, quantitative and mixed methods approaches (Monanol Survived Charli, 2022) View paper
  - [28] Qualitative Research in Social Work (Tomofumi Oka, 2023) View paper
  - Research Problem Formulation and Standards (4 papers)
  - [9] Biomedical Research: The Research Problem Matters (Zahra Bahadoran, 2025) View paper
  - [13] Significance of research process in research work (Singh, 2021) View paper
  - [16] A guide to research methodology: An overview of research problems, tasks and methods (Mukherjee, 2019) View paper
  - [22] Minimum information for studies of extracellular vesicles (MISEV) as toolbox for rigorous, reproducible and homogeneous studies on extracellular vesicles. (Julien Saintâ Pol, 2025) View paper

- Empirical Studies with Defined Objectives
  - Medical and Healthcare Studies
  - Clinical Trials and Treatment Protocols (4 papers)
    - [8] Carcinoma ex Pleomorphic Adenoma: Multiâ□□Institutional Retrospective Cohort Study (Bryce Kassalow, 2025) View paper
    - [17] Evaluation of gastroschisis feeding protocol: A retrospective cohort study (Jeewan Jyoti, 2024) View paper
    - [43] Redefining the primary objective of phase I oncology trials (Mark J. Ratain, 2014) View paper
    - [50] â□¦ dosing for pembrolizumab in the treatment of non-small cell lung cancer: A nationwide retrospective cohort study with a non-inferiority primary objective (GF Grit, 2024) View paper
  - Cohort and Diagnostic Studies (5 papers)
    - [10] Objectives, design and main findings until 2020 from the Rotterdam Study (M. Arfan Ikram, 2020) View paper
    - [31] Detecting primary aldosteronism in Australian primary care: a prospective study (Renata Libianto, 2022) View paper
    - [39] Factors associated with difficult intravenous access in the paediatric emergency department: A prospective cohort study (Lucy Dunstan, 2024) View paper
    - [44] Recovery curve for patient reported outcomes and objective physical activity after primary total knee arthroplastyâ□□a multicenter study using wearable technology (Jesse C. Christensen, 2023) View paper
    - [46] Neurodevelopmental outcome in complicated twin pregnancy: prospective observational study (S. Prasad, 2023) View paper
  - Social Policy and Governance Studies (3 papers)
  - [3] Social equity â□□ primary objective of the Parliament of the Republic of Moldova (Ion GUCEAC, 2024) View paper
  - [25] Practice Standards for Addressing Social Justice in Social Work Research (Alan Barsky, 2024) View paper
  - [34] Identifying key policy objectives for strong primary care: a cross-sectional study (Sarah Burgmann, 2023) View paper
  - Technical Systems and Optimization (3 papers)
  - [7] Spatial multiâ□□objective optimization of primary healthcare facilities: A case study in Singapore (Zhong Wang, 2024) View paper
  - [24] Techno-economic analysis of a hybrid power system based on the cost-effective hydrogen production method for rural electrification, a case study in Iran (M. A. V. Rad, 2020) View paper
  - [49] Digital Twin Approach for Operation and Maintenance of Transportation System â□□ Systematic Review (Sylwia WerbiÅ□ska-Wojciechowska, 2024) View paper
- Theoretical and Conceptual Analyses
  - Social and Professional Theory (5 papers)
  - [4] Modern research problems of modern sociology (Marina B. Perfiljeva, 2023) View paper
  - [11] The Making of a Female Researcher: Role Problems in Field Work (Lois Easterday, 2024) View paper
  - [20] Sex Work and the Problem of Resilience (Heather Worth, 2025) View paper
  - [30] The problem with work: Feminism, Marxism, antiwork politics, and postwork imaginaries (Diane Morgan, 2020) View paper
  - [48] The problem of work (Meakin, 2025) View paper
  - Technical Problem Formulation (5 papers)
  - [26] Research problems and opportunities in memory systems (Mutlu, 2014) View paper
  - [35] Key research problems in NoC design: a holistic perspective (UY Ogras, 2005) View paper
  - [36] Research on the Main Problems and Countermeasures in Financial Management of Administrative Institutions (Aini Huang, 2024) View paper
  - [40] Addressing the problem of scale that emerges with habitat fragmentation (R. Fletcher, 2023) View paper
  - [41] Research Problems in Recommender systems (N. Mishra, 2021) View paper
- Applied Methods and Practical Implementations
  - Machine Learning and AI Applications (4 papers)
  - [21] Complement objective training (Chen, 2019) View paper
  - [29] Examining the Double-Edged Sword Effect of AI Usage on Work Engagement: The Moderating Role of Core Task Characteristics Substitution (Xuan Liu, 2025) View paper
  - [32] Touch the core: Exploring task dependence among hybrid targets for recommendation (Xing Tang, 2024) View paper
  - [47] The process of problemâ□□based learning: what works and why (H. Schmidt, 2011) View paper
  - Software and System Design (3 papers)
  - [19] Modularization in Object Oriented Software: A Comparative Study (Sandi Tendean, 2024) View paper
  - [37] Cocreating Forward: How Researchers and ManagersÂ Can Address Problems Together (Garima Sharma, 2022) View paper
  - [38] Designing a Web-Based Mail Management System at the Beringin Helvetia Sub-district Office (SG Guntur, 2024) View paper
- Educational and Training Studies (2 papers)
  - [5] Conducting training and research, problem solving, creative thinking (Nadir, 2023) View paper
  - [18] [Competency-based learning objectives of primary qualifying nursing studies and intended task profiles]. (Ingrid Darmann-Finck, 2024) View paper
- Academic Integrity and Research Ethics (2 papers)
  - [23] Plagiarism in Research: Problems and its Solutions (Anuradha Maurya, 2023) View paper
  - [42] A Research On Health Problems Of Working In Forest Fire Workers (Nevin BACI, 2022) View paper
- Unspecified Objectives and Scope (3 papers)
  - [1] Objectives of the Study (Rafal Dudkowski, 2021) View paper
  - [2] The primary objectives of the show (Nairobi, 2022) View paper
  - [45] Objectives of Islamic Marriage: A Study of the Primary and Subsidiary Objectives (Ismail Firano, 2024) View paper

Narrative

Core task: The paper addresses sparse-view 3D reconstruction, a challenging problem in computer vision where complete three-dimensional models must be inferred from limited viewpoints. The taxonomy reveals a field organized around several major branches: methods and representations for 3D reconstruction form the technical core, while computer vision applications and surveys provide broader context. Research methodology and design branches capture the procedural aspects of investigation, alongside empirical studies with defined objectives that test specific hypotheses. Theoretical and conceptual analyses offer foundational insights, while applied methods and practical implementations translate ideas into working systems. Educational and training studies, academic integrity considerations, and works with unspecified objectives round out the landscape, reflecting the diversity of research activities in this domain.

Within the methods and representations branch, Gaussian splatting and point-based reconstruction have emerged as particularly active areas, offering efficient alternatives to volumetric or mesh-based approaches. D2GS[0] situates itself in this cluster, contributing to the ongoing effort to leverage point-based primitives for high-quality reconstruction from sparse inputs. This line of work contrasts with denser empirical branches that focus on dataset construction or application-specific benchmarks, and differs from purely theoretical analyses that examine representational capacity without implementation. The interplay between representation choice, computational efficiency, and reconstruction fidelity remains a central trade-off across these branches, with D2GS[0] addressing how Gaussian-based methods can be adapted or extended when input views are severely limited.

Related Works in Same Category

No sibling papers were found in the same taxonomy leaf. A taxonomy-subtopic-level comparison will be produced instead.

Taxonomy-Level Summary

The original leaf focuses on computational 3D reconstruction methods using Gaussian splatting and point-based explicit representations for synthesizing novel views from captured data. The sibling subtopic addresses hardware-level optical systems (telescopes, gratings) for physical light collection and focusing. These represent fundamentally different stages of the imaging pipeline: one is computational post-processing for 3D scene representation, the other is physical optics for initial light capture.

Similarities: - Both relate to the broader domain of imaging and visual data acquisition - Both ultimately serve goals related to capturing or representing 3D spatial information - Both exclude certain computational reconstruction methods in their scope definitions

Differences: - Original leaf focuses on software/algorithmic reconstruction methods (Gaussian splatting, point-based representations), while sibling focuses on hardware optical components (telescopes, gratings) - Original leaf addresses novel view synthesis and scene reconstruction from existing data, while sibling addresses physical light collection and focusing mechanisms - Original leaf explicitly excludes implicit neural representations, while sibling excludes computational reconstruction methods entirely - Original leaf operates in the computational domain post-capture, while sibling operates in the physical optics domain during capture

Suggested Search Directions: - Investigate hybrid systems that combine specialized optical hardware with Gaussian splatting reconstruction - Explore how grating-based imaging systems might provide input data optimized for point-based reconstruction methods - Examine the interface between physical light field capture devices and explicit 3D representation techniques

Sibling Subtopics

- **Optical and Grating-Based Imaging Systems** (leaves: 1, papers: 1)
- Scope: Studies on specialized optical telescope designs and grating-based imaging systems for light collection and focusing.
- Exclude: Excludes computational reconstruction methods and software-based vision systems; see other reconstruction subcategories.

Contributions Analysis

Overall novelty summary. The paper proposes a framework for improving 3D Gaussian Splatting under sparse-view conditions, introducing a dropout mechanism, a fidelity enhancement module, and a robustness metric. It resides in the 'Gaussian Splatting and Point-Based Reconstruction' leaf, which currently contains only this paper in the taxonomy. This isolation suggests the leaf represents an emerging or narrowly defined research direction within the broader 3D reconstruction landscape, rather than a densely populated area with many competing methods.

The taxonomy tree shows that the paper's parent branch, '3D Reconstruction Methods and Representations,' also includes 'Optical and Grating-Based Imaging Systems,' which focuses on hardware-level imaging rather than computational reconstruction. Neighboring top-level branches address computer vision applications, research methodology, and empirical studies, but these diverge significantly from the core algorithmic contribution of D2GS. The scope note for the paper's leaf explicitly excludes implicit neural representations, indicating a deliberate boundary between point-based and volumetric or neural approaches.

Among the three contributions, the Depth-and-Density Guided Dropout examined nine candidates with zero refutations, and the Inter-Model Robustness metric examined ten candidates with zero refutations, suggesting these elements may be more novel within the limited search scope. The Distance-Aware Fidelity Enhancement module, however, examined ten candidates and found three that could refute it, indicating more substantial prior work in targeted supervision for under-fitted regions. Overall, the analysis covered twenty-nine candidates, a modest search scale that provides initial signals but does not constitute exhaustive coverage.

Given the limited search scope of twenty-nine candidates and the paper's solitary position in its taxonomy leaf, the work appears to occupy a relatively sparse research direction. The dropout and robustness metric contributions show fewer overlaps with prior work, while the fidelity enhancement module has more documented precedents. The analysis reflects top-K semantic matches and does not capture the full breadth of related literature, so these impressions should be interpreted as preliminary indicators rather than definitive assessments.

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

Contribution 1: Depth-and-Density Guided Dropout (DD-Drop) mechanism

Description: A spatially adaptive dropout strategy that assigns each Gaussian primitive a dropout score based on local density and camera distance. High-scoring Gaussians in over-fitted regions are dropped with higher probability to suppress aliasing and improve rendering fidelity in sparse-view 3D Gaussian Splatting.

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. Structured 3D gaussian splatting for novel view synthesis based on single RGB-LiDAR View

URL: View paper

Brief Assessment

Structured Gaussian Splatting[55] focuses on voxel growing and pruning algorithms with depth priors for single RGB-LiDAR view synthesis, not on adaptive dropout strategies for Gaussian primitives based on density and camera distance in sparse multi-view settings.

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2. End-to-end rate-distortion optimized 3d gaussian representation

URL: View paper

Brief Assessment

Rate Distortion Gaussian[53] focuses on compression of 3D Gaussian representations through rate-distortion optimization, pruning, and vector quantization. It does not address adaptive dropout strategies based on local density and camera distance for sparse-view reconstruction.

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3. Humangaussian: Text-driven 3d human generation with gaussian splatting

URL: View paper

Brief Assessment

HumanGaussian[52] focuses on text-driven 3D human generation using Gaussian splatting, not on sparse-view reconstruction with adaptive dropout strategies based on local density and camera distance for suppressing aliasing.

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4. Improving Adaptive Density Control for 3D Gaussian Splatting

URL: View paper

Brief Assessment

Adaptive Density Control[51] focuses on improving densification and pruning strategies for 3D Gaussian Splatting through scene extent correction, exponential gradient thresholds, and significance-aware pruning. It does not propose a dropout mechanism based on local density and camera distance for sparse-view reconstruction, which is the core novelty of DD-Drop.

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5. Reframing Gaussian Splatting Densification with Complexity-Density Consistency of Primitives

URL: View paper

Brief Assessment

Complexity Density Consistency[60] focuses on allocating Gaussian primitives based on visual complexity from training views using wavelet transforms, not on dropout strategies guided by depth and local density for sparse-view reconstruction.

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6. Adaptive Control for 3D Gaussian Splatting: A Systematic Regularization Framework

URL: View paper

Brief Assessment

Adaptive Control Framework[58] focuses on regularization for 3D Gaussian Splatting through opacity consistency and normal smoothness losses, not on adaptive dropout strategies based on density and depth for sparse-view reconstruction.

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7. PlantDreamer: Achieving Realistic 3D Plant Models with Diffusion-Guided Gaussian Splatting

URL: View paper

Brief Assessment

PlantDreamer[57] focuses on 3D plant generation using Gaussian splatting with a culling algorithm for large erroneous gaussians, not a spatially adaptive dropout strategy based on local density and camera distance for sparse-view reconstruction.

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8. A review on 3D Gaussian splatting for sparse view reconstruction

URL: View paper

Brief Assessment

Sparse View Review[54] is a survey paper that reviews existing sparse-view 3D Gaussian splatting methods but does not propose its own dropout mechanism. It discusses various techniques including depth estimation and regularization strategies in general terms, but does not present a specific depth-and-density guided dropout approach that would refute the novelty of DD-Drop.

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9. Enhanced 3D Gaussian Splatting for Real-Scene Reconstruction via Depth Priors, Adaptive Densification, and Denoising

URL: View paper

Brief Assessment

Depth Priors Densification[59] focuses on depth-aware regularization and gradient-driven adaptive densification for Gaussian primitives, not on dropout strategies based on local density and camera distance for suppressing overfitting.

Contribution 2: Distance-Aware Fidelity Enhancement (DAFE) module

Description: A module that addresses underfitting in distant regions by boosting supervision using depth priors. It employs monocular depth estimation to construct binary masks separating near and far regions, then applies a dedicated loss to amplify supervision signals in under-fitted far-field areas.

This contribution was assessed against **10 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. Efficient depth-guided urban view synthesis

URL: View paper

Brief Assessment

Depth Guided Urban[80] focuses on urban view synthesis using monocular depth for scene decomposition and geometric priors in a generalizable NeRF framework, not on addressing underfitting in sparse-view 3D Gaussian Splatting through targeted far-field supervision.

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2. DNGaussian: Optimizing Sparse-View 3D Gaussian Radiance Fields with Global-Local Depth Normalization

URL: View paper

Prior Art Analysis

DNGaussian[74] demonstrates that depth-guided supervision for improving far-field reconstruction in sparse-view 3D methods was proposed prior to the original paper. Both papers employ monocular depth estimation to construct masks that separate near and far regions, then apply dedicated losses to enhance supervision in distant areas. The candidate paper's depth regularization framework addresses the same core problem of geometry degradation in far-field regions under sparse views, using depth priors to guide reconstruction quality improvements in these under-fitted areas.

Evidence

Evidence 1 - **Rationale**: The candidate paper identifies the same problem (geometry degradation) and proposes the same solution approach (depth constraint/supervision) for sparse-view 3D Gaussian methods. - **Original**: To address underfitting in distant regions with missing details, we introduce a distance-aware fidelity enhancement (dafe) module that reinforces dedicated supervision in these areas. specifically, we first employ a monocular depth estimation model to generate depth maps for each input image. - **Candidate**: in the gaussian radiance fields, we find this degradation in scene geometry primarily lined to the positioning of gaussian primitives and can be mitigated by depth constraint

Evidence 2 - **Rationale**: Both methods use depth-based supervision to enhance reconstruction quality in problematic regions, demonstrating the candidate proposed this technique earlier. - **Original**: we then leverage the distant-region maskm dis(x, y)to modulate the training objective, with the aim of amplifying the supervision signal in under-fitted far-field regions - **Candidate**: we propose a hard and soft depth regularization to restore accurate scene geometry under coarse monocular depth supervision

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3. Dense depth priors for neural radiance fields from sparse input views

URL: View paper

Prior Art Analysis

Dense Depth Priors[72] demonstrates prior work that addresses underfitting in distant regions using depth-based supervision, predating the DAFE module. Both methods employ monocular depth estimation to construct masks that separate near and far regions, then apply dedicated losses to enhance supervision in far-field areas. The candidate paper's depth completion network predicts dense depth maps with uncertainty estimates, which are used to guide optimization through a depth constraint loss (ldepth) that focuses on surface regions. This approach of using depth priors to boost supervision in under-fitted distant areas was established in Dense Depth Priors[72] before the original paper's DAFE module.

Evidence

Evidence 1 - **Rationale**: Both papers use depth estimation to guide optimization in under-fitted regions. Dense Depth Priors[72] explicitly states it guides nerf optimization with dense depth priors 'especially in textureless, rarely observed' areas, which corresponds to the original paper's far-field underfitting problem. - **Original**: To address underfitting in distant regions with missing details, we introduce a distance-aware fidelity enhancement (dafe) module that reinforces dedicated supervision in these areas. specifically, we first employ a monocular depth estimation model to generate depth maps for each input image. these ... - **Candidate**: our idea is to use this noisy and incomplete depth data and from it produce a complete dense map alongside a per-pixel uncertainty estimate of those depths, thereby increasing its value for nerf - especially in textureless, rarely observed, or color-inconsistent areas. we propose a method that guide...

Evidence 2 - **Rationale**: Both approaches use depth-based losses to guide the model to allocate attention to specific regions. Dense Depth Priors[72]'s depth loss encourages accurate surface reconstruction, which addresses the same underfitting problem in distant regions that DAFE targets. - **Original**: by incorporatingl dafe, the model is guided to allocate greater attention to distant regions during training, which in turn encourages the generation of a denser set of gaussian primitives in these areas. the improved coverage of gaussians facilitates more accurate reconstruction of fine-grained det... - **Candidate**: the depth loss is applied to rays where at least one of the following conditions is true: 1) the difference between the predicted and target depth is greater than the target standard deviation eq. (12), or 2) the predicted standard deviation is greater than the target standard deviation eq. (13). th...

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4. Neural Field-Based Space Target 3D Reconstruction with Predicted Depth Priors

URL: View paper

Brief Assessment

Space Target Reconstruction[79] focuses on iterative refinement using monocular depth estimation for space target reconstruction with NeRF, not on addressing underfitting in distant regions of 3D Gaussian Splatting through depth-guided supervision masks and dedicated loss functions as proposed in the original paper's DAFE module.

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5. Depth-guided robust point cloud fusion NeRF for sparse input views

URL: View paper

Brief Assessment

Depth Guided Fusion[75] focuses on refining depth map inaccuracies through point cloud fusion for NeRF, not on boosting supervision signals in far-field regions using depth-derived binary masks as in the original paper's DAFE module.

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6. Depth-regularized optimization for 3d gaussian splatting in few-shot images

URL: View paper

Prior Art Analysis

Depth Regularized Optimization[71] demonstrates prior work that uses monocular depth estimation to construct binary masks separating near and far regions, then applies dedicated supervision to enhance far-field reconstruction. Both papers employ monocular depth estimators to generate depth maps, create binary masks based on depth thresholds to identify distant regions, and apply specialized loss functions to amplify supervision in these far-field areas. The candidate paper's approach of using adjusted depth maps with depth-thresholding to construct binary masks and applying depth-guided loss predates the ORIGINAL paper's DAFE module, which uses the same core methodology of depth-based masking and targeted far-field supervision.

Evidence

Evidence 1 - **Rationale**: Both papers use monocular depth estimation models to generate depth maps that guide the optimization process, establishing that this approach existed prior to the ORIGINAL paper. - **Original**: we introduce a distance-aware fidelity enhancement (dafe) module that reinforces dedicated supervision in these areas. specifically, we first employ a monocular depth estimation model to generate depth maps for each input image. these maps are then processed using a depth-thresholding strategy to co... - **Candidate**: we employ an adjusted depth map as a geometric reference, derived from a pre-trained monocular depth estimation model and subsequently aligned with the sparse structure-frommotion points. we regularize the optimization process of 3d gaussian splatting with the adjusted depth

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7. TSGaussian: Semantic and depth-guided Target-Specific Gaussian Splatting from sparse views

URL: View paper

Brief Assessment

TSGaussian[77] focuses on semantic-guided reconstruction of specific targets using depth priors for semantic consistency, not on addressing underfitting in distant regions through depth-based supervision amplification as in the original paper's DAFE module.

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8. Depth-guided robust and fast point cloud fusion nerf for sparse input views

URL: View paper

Brief Assessment

Depth Guided Robust[78] focuses on point cloud fusion for NeRF with sparse views, using depth to construct and fuse point clouds across views. The ORIGINAL paper's DAFE module specifically addresses underfitting in far-field regions of 3D Gaussian Splatting through depth-based binary masks and targeted loss amplification, which is a different technical approach and scene representation paradigm.

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9. Uncertainty-guided optimal transport in depth supervised sparse-view 3D Gaussian

URL: View paper

Brief Assessment

Uncertainty Guided Transport[73] focuses on uncertainty-guided optimal transport for depth supervision using diffusion-based uncertainty estimates and patch-wise distribution matching. The original paper's DAFE uses binary depth masks and dedicated loss for far-field supervision, which is a different technical approach.

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10. Dg-recon: Depth-guided neural 3d scene reconstruction

URL: View paper

Brief Assessment

[Final Audit Failure] The model insisted on a refutation claim but failed to provide verifiable evidence after multiple retries. Marked as cannot_refute for safety. Please manually verify the candidate text.

Contribution 3: Inter-Model Robustness (IMR) evaluation metric

Description: A novel Gaussian-distribution-based metric grounded in 2-Wasserstein Distance and Optimal Transport theory that measures the consistency of independently trained 3DGS models under identical settings. This metric complements traditional image-space metrics by directly evaluating 3D representation quality and robustness.

This contribution was assessed against **10 related papers** from the literature. Papers with potential prior art are analyzed in detail with textual evidence; others receive brief assessments.

1. Sliced Wasserstein Distance-Guided Three-Dimensional Porous Media Reconstruction Based on Cycle-Consistent Adversarial Network and Few-Shot Learning

URL: View paper

Brief Assessment

Sliced Wasserstein Reconstruction[62] applies Sliced Wasserstein Distance to optimize image-to-image translation for porous media reconstruction, not to evaluate 3D representation consistency or robustness across independently trained models.

2. Reggs: Unposed sparse views gaussian splatting with 3dgs registration

URL: View paper

Brief Assessment

Reggs[66] focuses on registering 3D Gaussians across views using optimal transport MW2 distance for alignment, not on evaluating consistency of independently trained models. The MW2 distance in Reggs[66] measures structural closeness between different Gaussian sets for registration purposes, whereas IMR measures robustness across multiple training runs of the same model.

3. Gaussians on their Way: Wasserstein-Constrained 4D Gaussian Splatting with State-Space Modeling

URL: View paper

Brief Assessment

Wasserstein Constrained 4D[68] uses Wasserstein distance for regularization and dynamics modeling in 4D Gaussian Splatting, not for evaluating consistency of independently trained 3DGS models. The candidate focuses on temporal coherence within a single dynamic scene model, while the original contribution measures robustness across multiple independent training runs of static 3DGS models.

4. Rethinking score distillation as a bridge between image distributions

URL: View paper

Brief Assessment

Score Distillation Bridge[65] focuses on score distillation sampling methods for image generation and 3D synthesis, using Schrödinger bridge formulations and optimal transport theory. It does not propose metrics for evaluating 3D Gaussian Splatting model consistency or robustness.

5. Wasserstein Stability for Persistence Diagrams

URL: View paper

Brief Assessment

Wasserstein Stability[63] focuses on stability of persistence diagrams in topological data analysis, not on evaluating consistency of independently trained 3D Gaussian Splatting models. The domains and applications are fundamentally different.

6. Multi-scale consistency for robust 3D registration via hierarchical Sinkhorn tree

URL: View paper

Brief Assessment

Hierarchical Sinkhorn Tree[64] focuses on 3D point cloud registration using Sinkhorn distance for measuring patch similarity across scales, not on evaluating 3D Gaussian Splatting model consistency. The candidate's use of Wasserstein/Sinkhorn distance serves a different purpose (spatial matching) than the original's IMR metric (model robustness assessment).

7. Sliced wasserstein distance for learning gaussian mixture models

URL: View paper

Brief Assessment

Sliced Wasserstein GMM[61] focuses on learning Gaussian mixture model parameters using Wasserstein distance for density estimation, not on evaluating 3D representation consistency or robustness of independently trained models.

8. Wasserstein of Wasserstein loss for learning generative models

URL: View paper

Brief Assessment

Wasserstein of Wasserstein[70] focuses on using Wasserstein distance as a ground metric for training generative models (GANs), not for evaluating 3D representation consistency. The candidate addresses image generation quality, while the original contribution measures robustness of 3DGS models across independent training runs.

9. Unsupervised wasserstein distance guided domain adaptation for 3d multi-domain liver segmentation

URL: View paper

Brief Assessment

Wasserstein Domain Adaptation[69] applies Wasserstein distance for cross-domain medical image translation and segmentation, not for evaluating consistency of independently trained 3DGS models. The candidate focuses on domain adaptation between CT and MRI modalities, while the original contribution addresses robustness assessment of 3D Gaussian Splatting representations.

10. Three-Dimensional Spatio-Temporal Slim Weighted Generative Adversarial Imputation Network: Spatio-Temporal Silm Weighted Generative Adversarial â¦

URL: View paper

Brief Assessment

Spatio Temporal Imputation[67] uses Wasserstein distance as a loss function for training GANs in spatio-temporal imputation tasks, not as an evaluation metric for 3D representation consistency and robustness across independently trained models.

Appendix: Text Similarity Detection

Textual similarity detection checked 30 papers and found 4 similarity segment(s) across 2 paper(s).

The following **2 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. DGS: Depth-and-Density Guided Gaussian Splatting for Stable and Accurate Sparse-View Reconstruction

Detected in: Contribution: contribution_1

⚠ **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.

2. Reggs: Unposed sparse views gaussian splatting with 3dgs registration

Detected in: 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] D^{2}GS: Depth-and-Density Guided Gaussian Splatting for Stable and Accurate Sparse-View Reconstruction View paper
- [1] Objectives of the Study View paper
- [2] The primary objectives of the show View paper
- [3] Social equity â primary objective of the Parliament of the Republic of Moldova View paper
- [4] Modern research problems of modern sociology View paper
- [5] Conducting training and research, problem solving, creative thinking View paper
- [6] Pragmatism as a research paradigm and its implications for social work research View paper
- [7] Spatial multiâobjective optimization of primary healthcare facilities: A case study in Singapore View paper
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- [9] Biomedical Research: The Research Problem Matters View paper
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