Novelty Assessment Report

Paper: Uncertainty-Aware 3D Reconstruction for Dynamic Underwater Scenes
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Abstract

Underwater 3D reconstruction remains challenging due to the intricate interplay between light scattering and environment dynamics. While existing methods yield plausible reconstruction with rigid scene assumptions, they struggle to capture temporal dynamics and remain sensitive to observation noise. In this work, we propose an Uncertainty-aware Dynamic Field (UDF) that jointly represents underwater structure and view-dependent medium over time. A canonical underwater representation is initialized using a set of 3D Gaussians embedded in a volumetric medium field. Then we map this representation into a 4D neural voxel space and encode spatial-temporal features by querying the voxels. Based on these features, a deformation network and a medium offset network are proposed to model transformations of Gaussians and time-conditioned updates to medium properties, respectively. To address input-dependent noise, we model per-pixel uncertainty guided by surface-view radiance ambiguity and inter-frame scene flow inconsistency. This uncertainty is incorporated into the rendering loss to suppress the noise from low-confidence observations during training. Experiments on both controlled and in-the-wild underwater datasets demonstrate our method achieves both high-quality reconstruction and novel view synthesis. Our code will be released.

Core Task Landscape

This paper addresses: **Uncertainty-Aware 3D Reconstruction for Dynamic Underwater Scenes**

A total of **29 papers** were analyzed and organized into a taxonomy with **15 categories**.

Taxonomy Overview

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

- **Neural Scene Representation Methods**
- **Uncertainty-Aware Mapping and Localization**
- **Classical and Hybrid Reconstruction Methods**
- **Path Planning and Inspection**
- **Tracking and Prediction Systems**
- **Specialized Estimation and Reconstruction Tasks**
- **Probabilistic and Stochastic Modeling Foundations**

Complete Taxonomy Tree

- Uncertainty-Aware 3D Reconstruction for Dynamic Underwater Scenes Survey Taxonomy
- Neural Scene Representation Methods
  - Neural Radiance Field Extensions ★ (4 papers)
  - [0] Uncertainty-Aware 3D Reconstruction for Dynamic Underwater Scenes (Anon et al., 2026) View paper
  - [1] Uncertainty quantification of neural reflectance fields for underwater scenes (H. Lian, 2024) View paper
  - [15] Bayesian uncertainty analysis for underwater 3D reconstruction with neural radiance fields (Li Xinhao, 2024) View paper
  - [24] Towards End-to-End Underwater vSLAM Using Neural Radiance Fields (Rytis Mikutavicius, 2025) View paper
  - Gaussian Splatting for Underwater Scenes (3 papers)
  - [8] From Restoration to Reconstruction: Rethinking 3D Gaussian Splatting for Underwater Scenes (Huang Guo-xi, 2025) View paper
  - [14] UW-3DGS: Underwater 3D Reconstruction with Physics-Aware Gaussian Splatting (Xing, 2025) View paper
  - [16] Aqua3DGS: Enhanced 3D Gaussian Splatting for Robust Underwater Scene Reconstruction (Zhe Wang, 2025) View paper
- Uncertainty-Aware Mapping and Localization
  - Vision-Based Uncertainty Mapping (3 papers)
  - [7] Uncertainty Aware Mapping for Vision-Based Underwater Robots (Singh, 2025) View paper
  - [9] Underwater visual slam with depth uncertainty and medium modeling (R Liu, 2025) View paper
  - [29] Ai-Driven Robotic Semantic Slam: Real-Time Depth and Adaptive Mapping for Autonomous Navigation in Complex Environments (Lyes Saad Saoud, n.d.) View paper
  - Sonar-Based Uncertainty Estimation (3 papers)
  - [19] Uncertainty estimation for a 6-dof spectral registration method as basis for sonar-based underwater 3d slam (M. Pfingsthorn, 2012) View paper
  - [27] Three-dimensional stochastic modeling using sonar sensing for undersea robotics (W.K. Stewart, 1996) View paper
  - [28] Multibeam 3D Underwater SLAM with Probabilistic Registration. (Albert Palomer, 2016) View paper
  - General Robotic Uncertainty Frameworks (3 papers)
  - [13] SAFESUB: Safe and Autonomous Subsea Intervention (Aksel A. Transeth, 2024) View paper
  - [17] Towards Uncertainty-aware Robotic Perception via Mixed-signal BNN Engine Leveraging Probabilistic Quantum Tunneling (Likai Pei, 2025) View paper
  - [18] Online mapping and motion planning under uncertainty for safe navigation in unknown environments (Pairet, 2021) View paper

- Classical and Hybrid Reconstruction Methods
  - Large-Scale Optical Reconstruction (1 papers)
  - [6] Large area 3D reconstructions from underwater surveys (Oscar Pizarro, 2004) View paper
  - Reconstruction with Quality Assessment (1 papers)
  - [25] Underwater image-based 3D reconstruction with quality estimation (Istenic, 2021) View paper
- Path Planning and Inspection
  - Uncertainty-Driven View Planning (1 papers)
  - [10] Uncertainty-driven view planning for underwater inspection (Geoffrey A. Hollinger, 2012) View paper
  - Cooperative Multi-Vehicle Planning (1 papers)
  - [2] â¦ Cooperative Path Planning with Hybrid Particle Swarm and Dynamic Window Algorithm in Three-Dimensional Terrain and Ocean Current Environment (B Sun, 2025) View paper
- Tracking and Prediction Systems
  - Underwater Target Tracking (1 papers)
  - [11] 3D underwater uncooperative target tracking for a time-varying non-Gaussian environment by distributed passive underwater buoys (Xianghao Hou, 2021) View paper
  - Environmental Prediction and Modeling (3 papers)
  - [5] Simulation of non-stationary mobile underwater acoustic communication channels based on a multi-scale time-varying multipath model (Honglu Yan, 2025) View paper
  - [12] Toward the probabilistic forecasting of cyclone-induced marine flooding by overtopping at Reunion Island aided by a time-varying random-forest classification â¦ (S Lecacheux, 2021) View paper
  - [26] POAC'25 (A Ghasemi, 2025) View paper
- Specialized Estimation and Reconstruction Tasks
  - Marine Parameter Estimation (1 papers)
  - [3] Deep learning-driven 3D marine nitrate estimation: uncertainty mitigation through underwater signal exploitation and label augmentation (Xiang Yu, 2025) View paper
  - Seafloor Topography Reconstruction (1 papers)
  - [22] A Hybrid Dropout Method for High-Precision Seafloor Topography Reconstruction and Uncertainty Quantification (Xinye Cui, 2025) View paper
  - Semantic Scene Understanding (2 papers)
  - [4] Probabilistic Particle Filter Anchoring (PPFA): A Novel Perspective in Semantic World Modeling for Autonomous Underwater Vehicles With Acoustic and Optical â¦ (A Topini, 2025) View paper
  - [23] Underwater Tri-Dimensional Scene Understanding for an Eye-in-Hand Perception System (Leite, 2025) View paper
- Probabilistic and Stochastic Modeling Foundations (2 papers)
  - [20] Towards stochastic time-varying geological modeling (Guillaume Caumon, 2010) View paper
  - [21] Probabilistic FrÃ©chet Means for Time Varying Persistence Diagrams (Elizabeth Munch, 2022) View paper

Narrative

Core task: uncertainty-aware 3D reconstruction for dynamic underwater scenes. The field spans a diverse set of approaches organized into several major branches. Neural Scene Representation Methods leverage modern differentiable rendering techniques—such as neural radiance fields and Gaussian splatting—to capture complex underwater appearance and geometry, often incorporating medium-specific effects like scattering and attenuation. Uncertainty-Aware Mapping and Localization focuses on probabilistic frameworks for SLAM and sensor fusion, quantifying confidence in pose estimates and map features under challenging visibility and acoustic conditions. Classical and Hybrid Reconstruction Methods combine traditional photogrammetry or structure-from-motion pipelines with learning-based components, balancing interpretability and robustness. Path Planning and Inspection, Tracking and Prediction Systems, and Specialized Estimation and Reconstruction Tasks address downstream robotic applications—view planning, target tracking, and task-specific inference—while Probabilistic and Stochastic Modeling Foundations provide the mathematical underpinnings for reasoning about noise and variability across sensors and environments.

Within the neural representation branch, a small cluster of works has emerged that explicitly models uncertainty in learned scene models. Uncertainty Aware Underwater Reconstruction[0] sits squarely in this line, extending neural radiance field methods to quantify reconstruction confidence in dynamic underwater settings. It shares close ties with Uncertainty Neural Reflectance Underwater[1] and Bayesian Underwater Neural Radiance[15], both of which also embed probabilistic reasoning into differentiable rendering pipelines, though each emphasizes different aspects of the forward model or inference strategy. Nearby efforts like Underwater vSLAM Neural Radiance[24] integrate these representations with simultaneous localization, illustrating how neural methods increasingly bridge classical mapping concerns with modern volumetric scene encoding. The main open questions revolve around scaling these probabilistic neural approaches to larger scenes, handling real-time dynamics, and fusing heterogeneous sensor modalities while maintaining tractable uncertainty estimates.

Related Works in Same Category

The following **3 sibling papers** share the same taxonomy leaf node with the original paper:

1. Uncertainty quantification of neural reflectance fields for underwater scenes

Authors: H. Lian, Xinhao Li, Leilei Chen, Xin Wen, Mengxi Zhang, et al. (9 authors total) | **Year/Venue**: 2024 | **URL**: View paper

Abstract

Neural radiance fields and neural reflectance fields are novel deep learning methods for generating novel views of 3D scenes from 2D images. To extend the neural scene representation techniques to complex underwater environments, beyond neural reflectance fields underwater (BNU) was proposed, which considers the relighting conditions of on-aboard light sources by using neural reflectance fields, and approximates the attenuation and backscatter effects of water with an additional constant. Becaus...

Relationship Analysis

Both papers belong to the Neural Radiance Field Extensions category, extending NeRF-based methods with physics-based underwater models and uncertainty quantification for underwater scene representation. The candidate paper focuses on uncertainty quantification for static underwater scenes using an ensemble strategy applied to Beyond Neural Reflectance Fields Underwater (BNU), quantifying cognitive uncertainty through RGB variance and termination probabilities. In contrast, the original paper addresses dynamic underwater scenes by jointly modeling temporal evolution of geometry and medium properties through 4D neural voxel spaces, deformation networks, and heteroscedastic uncertainty based on surface-view ambiguity and inter-frame flow inconsistency.

2. Bayesian uncertainty analysis for underwater 3D reconstruction with neural radiance fields

Authors: Li Xinhao, Haojie Lian, Qu, Yilin, Xinhao Li, et al. (13 authors total) | **Year/Venue**: 2024 | **URL**: View paper

Abstract

Neural radiance fields (NeRFs) are a deep learning technique that can generate novel views of 3D scenes using sparse 2D images from different viewing directions and camera poses. As an extension of conventional NeRFs in underwater environment, where light can get absorbed and scattered by water, SeaThru-NeRF was proposed to separate the clean appearance and geometric structure of underwater scene from the effects of the scattering medium. Since the quality of the appearance and structure of unde...

Relationship Analysis

Both papers belong to the Neural Radiance Field Extensions category, extending NeRF with physics-based underwater models and uncertainty quantification for underwater 3D reconstruction. They overlap in addressing uncertainty-aware underwater scene representation using NeRF-based approaches with physics-informed medium modeling. However, the original paper focuses on dynamic underwater scenes with temporal evolution of geometry and medium properties using 4D Gaussian Splatting and deformation networks, while the candidate paper applies Bayesian uncertainty analysis via Laplace approximation to static SeaThru-NeRF models using spatial perturbation fields without modeling temporal dynamics.

3. Towards End-to-End Underwater vSLAM Using Neural Radiance Fields

Authors: Rytis Mikutavicius, Olaya Ãlvarez-TuÃ±Ã³n, Yury Brodskiy, Andriy Sarabakha | **Year/Venue**: 2025 | **URL**: View paper

Abstract

â¦ Here, an uncertainty field managed noise and variability â¦ on view synthesis and 3D scene reconstruction, designed to â¦ methods with intricate textures from marine flora and biofouling, a â¦

Relationship Analysis

Both papers belong to the Neural Radiance Field Extensions category, extending NeRF-based methods for underwater 3D reconstruction with uncertainty modeling and physics-based approaches. They overlap in addressing uncertainty quantification for underwater scene representation and incorporating neural radiance fields for dynamic underwater environments. However, the original paper (UDF) focuses on joint modeling of dynamic geometry and time-varying medium properties using 3D Gaussian Splatting with heteroscedastic uncertainty, while the candidate paper appears to focus on end-to-end underwater visual SLAM integration with neural radiance fields, emphasizing localization and mapping rather than explicit medium dynamics modeling.

Contributions Analysis

Overall novelty summary. The paper proposes an Uncertainty-aware Dynamic Field (UDF) that jointly models underwater structure, view-dependent medium properties, and temporal dynamics using 3D Gaussians embedded in a volumetric medium field. It resides in the 'Neural Radiance Field Extensions' leaf of the taxonomy, which contains four papers total—including the original work and three siblings. This represents a relatively sparse research direction within the broader neural scene representation branch, suggesting the combination of uncertainty quantification, dynamic modeling, and medium-aware rendering for underwater scenes remains an emerging area rather than a crowded subfield.

The taxonomy tree reveals that the paper's immediate neighbors focus on probabilistic extensions of neural radiance fields for underwater reconstruction, while a sibling category ('Gaussian Splatting for Underwater Scenes') explores explicit representations with physics-aware models. Adjacent branches address uncertainty-aware mapping and localization through SLAM frameworks, classical reconstruction with quality assessment, and specialized estimation tasks like seafloor topography. The paper bridges neural representation methods with uncertainty quantification, connecting to both the neural rendering community and the broader robotic perception literature that emphasizes confidence estimation under challenging visibility conditions.

Among the 23 candidates examined through top-K semantic search and citation expansion, none were found to clearly refute any of the three core contributions. The first contribution (UDF framework) was assessed against 10 candidates with no refutable overlap; the second (motion-aware medium dynamics) similarly examined 10 candidates without finding prior work that anticipates the specific combination of deformation networks and time-conditioned medium offsets; the third (heteroscedastic uncertainty modeling) reviewed 3 candidates, again without identifying clear precedent. This suggests that within the limited search scope, the integration of dynamic scene modeling, medium-aware rendering, and input-dependent uncertainty appears relatively novel.

The analysis is constrained by the scale of the literature search—23 candidates from semantic retrieval rather than an exhaustive survey. While no refutable prior work emerged in this sample, the sparse population of the taxonomy leaf and the absence of overlapping contributions among examined papers indicate the work occupies a distinct position. However, the limited scope means potentially relevant work outside the top-K matches or in adjacent communities may not have been captured, and a broader search could reveal closer antecedents or parallel efforts.

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

Contribution 1: Uncertainty-aware Dynamic Field (UDF) for underwater reconstruction

Description: The authors introduce a unified framework that simultaneously models time-varying 3D geometry using Gaussian primitives and dynamic participating medium properties. This representation captures both structural evolution and motion-aware medium changes in underwater environments.

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. 3d sketching using multi-view deep volumetric prediction

URL: View paper

Brief Assessment

3D Sketching Volumetric Prediction[34] focuses on sketch-based 3D modeling from line drawings using CNNs to predict voxel occupancy. It does not address underwater reconstruction, dynamic scenes, participating medium modeling, or uncertainty quantification in time-varying environments.

2. Spacetime stereo: Shape recovery for dynamic scenes

URL: View paper

Brief Assessment

Spacetime Stereo[37] focuses on dynamic scene reconstruction through temporal appearance variation in stereo matching, not on underwater environments with participating medium modeling. The candidate addresses general dynamic scenes under varying illumination, while the original paper specifically tackles underwater light scattering and medium properties.

3. Volumedeform: Real-time volumetric non-rigid reconstruction

URL: View paper

Brief Assessment

VolumeDeform[35] focuses on real-time non-rigid reconstruction in clear-air environments using RGB-D sensors, not underwater scenes with participating medium modeling. The candidate does not address wavelength-dependent attenuation, backscattering, or medium-aware rendering that are central to the original paper's underwater-specific contribution.

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4. Function4d: Real-time human volumetric capture from very sparse consumer rgbd sensors

URL: View paper

Brief Assessment

Function4d[30] focuses on real-time human volumetric capture from sparse RGBD sensors using dynamic sliding fusion and deep implicit functions. It does not address underwater reconstruction, participating medium modeling, or uncertainty-aware rendering for scattering environments.

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5. Spatio-Temporal 3D Reconstruction from Frame Sequences and Feature Points

URL: View paper

Brief Assessment

Spatio-Temporal Frame Reconstruction[31] focuses on fast 3D mesh reconstruction from frame sequences using diffusion models for general environments, not underwater-specific dynamic field modeling with uncertainty-aware medium properties.

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6. Neural volumes: Learning dynamic renderable volumes from images

URL: View paper

Brief Assessment

Neural Volumes[33] focuses on learning dynamic renderable volumes from multi-view images in clear-air environments for general objects (hair, smoke, faces), not underwater reconstruction with participating medium modeling specific to water scattering and attenuation.

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7. Constraints on deformable models: Recovering 3D shape and nonrigid motion

URL: View paper

Brief Assessment

Deformable Models Shape Recovery[38] focuses on geometric mappings for deformable objects (spine and tube structures) without addressing underwater-specific challenges like participating medium, light scattering, or uncertainty modeling in degraded visibility conditions.

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8. General automatic human shape and motion capture using volumetric contour cues

URL: View paper

Brief Assessment

Automatic Human Shape Capture[36] focuses on human body reconstruction using Gaussian primitives for volumetric shape representation in general scenes, not underwater environments with participating medium modeling or dynamic scattering effects.

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9. 3D location and trajectory reconstruction of a moving object behind scattering media

URL: View paper

Brief Assessment

3D Trajectory Scattering Media[32] focuses on reconstructing object trajectories behind scattering media using time-varying light transport models and back-projection methods, not on underwater scene reconstruction with Gaussian primitives and participating medium modeling.

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10. Numerical simulations of scattering from time-varying, randomly rough surfaces

URL: View paper

Brief Assessment

Scattering Time-Varying Surfaces[39] focuses on electromagnetic scattering from time-evolving ocean surfaces using numerical methods like MOMI and FMM. It does not address 3D reconstruction, Gaussian primitives, neural fields, or uncertainty modeling for reconstruction tasks.

Contribution 2: Motion-aware medium dynamics modeling

Description: The method employs two specialized networks: a deformation network that predicts geometric transformations of 3D Gaussians over time, and a medium offset network that updates volumetric medium attributes conditioned on scene motion. This enables consistent representation of dynamic geometry and motion-aware medium effects.

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. Time-Varying Coronary Artery Deformation: A Dynamic Skinning Framework for Surgical Training

URL: View paper

Brief Assessment

Coronary Deformation Surgical Training[49] focuses on skeletal skinning-based deformation for coronary arteries in surgical simulation, not on neural networks for volumetric medium updates conditioned on scene motion in underwater environments.

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2. A novel personalized time-varying biomechanical model for estimating lung tumor motion and deformation.

URL: View paper

Brief Assessment

Time-Varying Lung Tumor Model[47] focuses on biomechanical modeling of lung tumor motion and deformation in medical imaging. This is a completely different domain from underwater scene reconstruction and does not address motion-aware medium dynamics in the context of 3D Gaussians or volumetric rendering.

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3. Time-Varying Coronary Artery Deformation: A Dynamic Skinning Framework for Coronary Intervention Planning and Training

URL: View paper

Brief Assessment

Time-Varying Coronary Deformation[41] focuses on coronary artery vessel deformation using skinning weights for medical simulation, not on volumetric medium properties or scattering effects in dynamic scenes.

4. Data-driven 3D neck modeling and animation

URL: View paper

Brief Assessment

Data-Driven Neck Modeling[46] focuses on anatomical neck deformation driven by larynx motion and speech audio, not on volumetric medium dynamics or 3D Gaussian transformations in underwater scenes.

5. Real-time geometry, albedo, and motion reconstruction using a single rgb-d camera

URL: View paper

Brief Assessment

Real-time Geometry Albedo Motion[45] focuses on RGB-D reconstruction of geometry, albedo, and motion in general scenes without modeling underwater medium effects or volumetric scattering properties.

6. Temporal residual jacobians for rig-free motion transfer

URL: View paper

Brief Assessment

Temporal Residual Jacobians[43] focuses on rig-free motion transfer for character animation using temporal residual jacobians and neural ODEs, not on underwater scene reconstruction with medium dynamics modeling. The candidate addresses geometric deformation transfer across time for animated characters, while the original contribution models volumetric medium properties conditioned on scene motion in underwater environments.

7. DeformStream: Deformation-based Adaptive Volumetric Video Streaming

URL: View paper

Brief Assessment

DeformStream[42] focuses on mesh deformation for volumetric video streaming in clear-air environments, not underwater medium dynamics. The candidate uses deformation networks for geometric transformations of mesh vertices, while the original models motion-conditioned volumetric medium properties (attenuation, backscattering) in underwater scenes.

8. ODE-GS: Latent ODEs for Dynamic Scene Extrapolation with 3D Gaussian Splatting

URL: View paper

Brief Assessment

ODE-GS[48] focuses on extrapolating dynamic 3D scenes using latent ODEs for Gaussian trajectories in clear-air environments, not underwater medium modeling. The deformation network in ODE-GS[48] predicts geometric transformations without conditioning on volumetric medium properties or motion-aware medium updates.

9. Personalized 3D Myocardial Infarct Geometry Reconstruction from Cine MRI with Explicit Cardiac Motion Modeling

URL: View paper

Brief Assessment

Personalized Myocardial Infarct Reconstruction[44] focuses on cardiac motion modeling for medical imaging (myocardial infarct reconstruction from MRI), not underwater scene reconstruction with medium dynamics. The deformation networks serve entirely different purposes in distinct application domains.

10. Sc-gs: Sparse-controlled gaussian splatting for editable dynamic scenes

URL: View paper

Brief Assessment

Sparse-Controlled Gaussian Splatting[40] focuses on deformation networks for general dynamic scene reconstruction without participating medium modeling. The original paper's contribution specifically addresses underwater medium effects conditioned on scene motion, which is not present in the candidate.

Contribution 3: Heteroscedastic uncertainty modeling for underwater observations

Description: The authors formulate input-dependent uncertainty by combining two physically grounded cues: surface-view radiance ambiguity (when ray direction aligns with surface normal) and inter-frame flow inconsistency (temporal instability from motion). This per-pixel variance is integrated into a probabilistic rendering loss to adaptively down-weight unreliable observations during training.

This contribution was assessed against **3 related papers** from the literature. Papers with potential prior art are analyzed in detail with textual evidence; others receive brief assessments.

1. Uncertainty-Aware Hyperspectral Image Reconstruction from RGB Measurements Using Unrolled Sparse Coding

URL: View paper

Brief Assessment

Uncertainty Aware Hyperspectral Reconstruction[52] addresses hyperspectral image reconstruction from RGB measurements, focusing on spectral ambiguity in imaging systems. This is fundamentally different from the original paper's underwater-specific uncertainty modeling based on surface-view radiance ambiguity and inter-frame flow inconsistency for dynamic 3D reconstruction.

2. Camera-Lidar Consistent Neural Radiance Fields

URL: View paper

Brief Assessment

Camera-Lidar Neural Radiance Fields[51] focuses on camera-lidar sensor fusion for outdoor autonomous driving scenarios, not underwater reconstruction or uncertainty modeling based on radiance ambiguity and flow inconsistency.

3. Physics informed neural fields for smoke reconstruction with sparse data

URL: View paper

Brief Assessment

Physics Informed Smoke Reconstruction[50] focuses on physics-informed neural fields for smoke reconstruction using Navier-Stokes equations, not on uncertainty modeling for underwater observations using radiance ambiguity and flow inconsistency.

Appendix: Text Similarity Detection

Textual similarity detection checked 26 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. Bayesian uncertainty analysis for underwater 3D reconstruction with neural radiance fields

Detected in: Core Task (sibling)

⚠ **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] Uncertainty-Aware 3D Reconstruction for Dynamic Underwater Scenes View paper
- [1] Uncertainty quantification of neural reflectance fields for underwater scenes View paper
- [2] â¦ Cooperative Path Planning with Hybrid Particle Swarm and Dynamic Window Algorithm in Three-Dimensional Terrain and Ocean Current Environment View paper
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