2.5D-GS: Sparse-View Geometry-Aware Gaussian Splatting via Depth and Normal Clues

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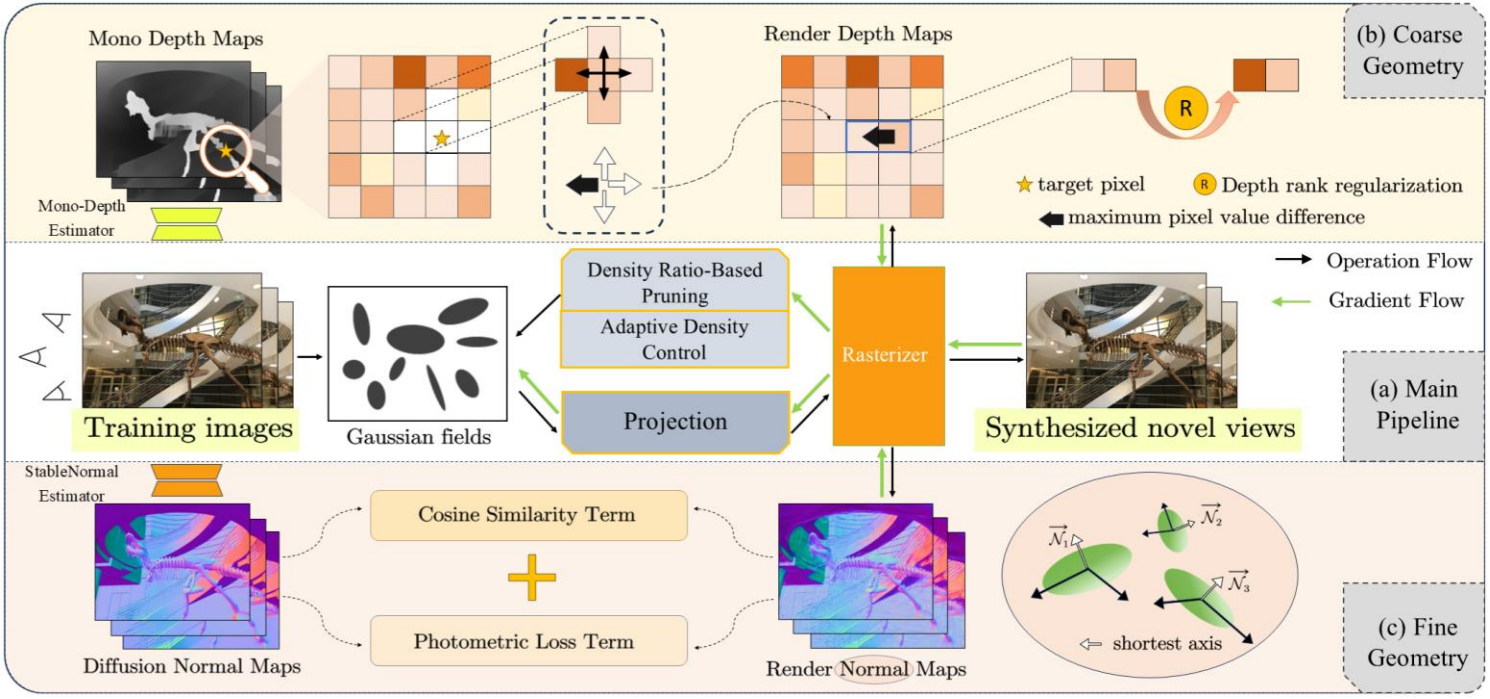
Problems & Ideas

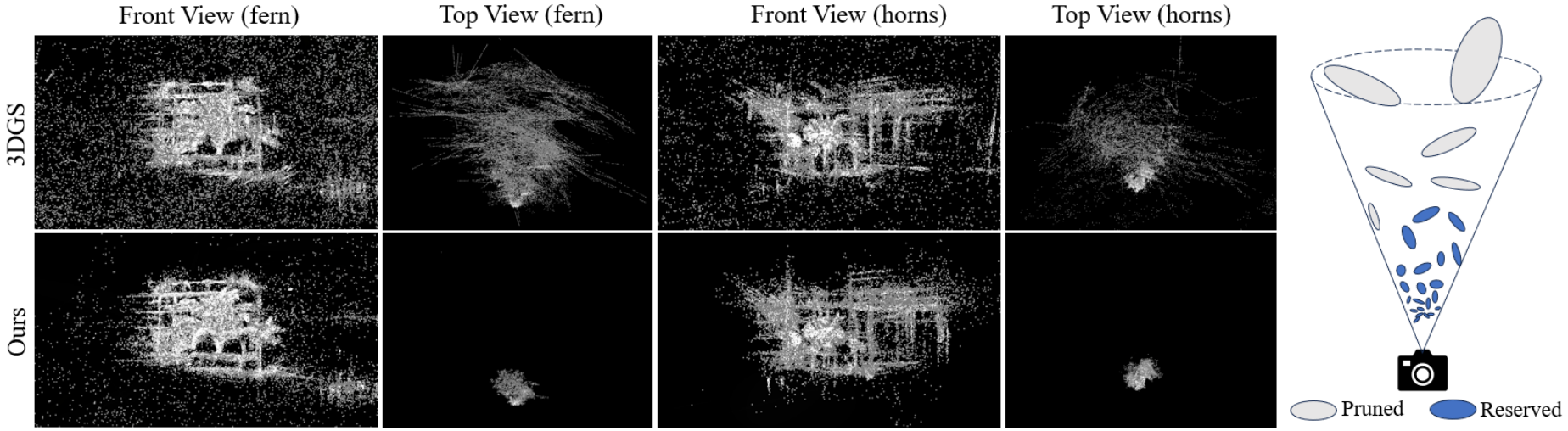
- Problems of conventional few-shot novel view synthesis approaches:
  - Accurate Gaussian geometry reconstruction is challenging with sparse RGB-only inputs.
  - Existing methods improve speed, rendering quality, or memory efficiency, but struggle to balance all three.
- Ideas: A model leverages 2.5D clues from sparse input views to guide geometry learning and reduces redundancy through density-aware pruning.



Overview of the 2.5D-GS. Our method leverages depth and normal clues to guide Gaussian placement and achieves high-quality rendering results from sparse inputs.

Main Contributions

- Contributions:
  - A 2.5D geometry-aware regularization scheme that jointly enforces depth plane constraints and normal plane constraints to ensure accurate scene structure and fine-grained surface details;
  - A density ratio-based pruning strategy to effectively remove detached and redundant Gaussians, yielding compact and efficient radiance fields;
  - An end-to-end framework that integrates geometric regularization and pruning for high-quality novel view synthesis from few-shot inputs, achieving performance comparable to state-of-the-art methods.



Visual Comparison of Gaussian Distributions. By applying Density Ratio-Based Pruning, we achieve a compact representation of Gaussian radiance fields, effectively eliminating a substantial number of redundant Gaussians while preserving essential scene details.