HDR-Plenoxels: Self-Calibrating High Dynamic Range Radiance Fields

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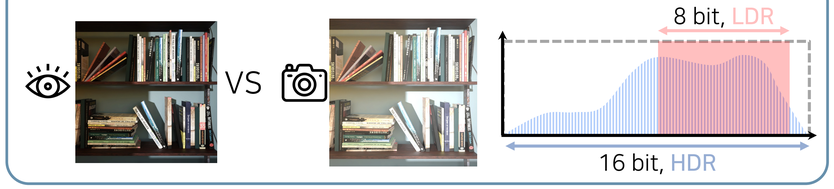
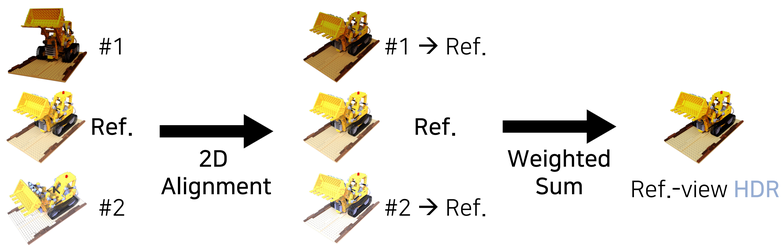
AMI Algorithmic Machine Intelligence Lab.

HDR vs. LDR

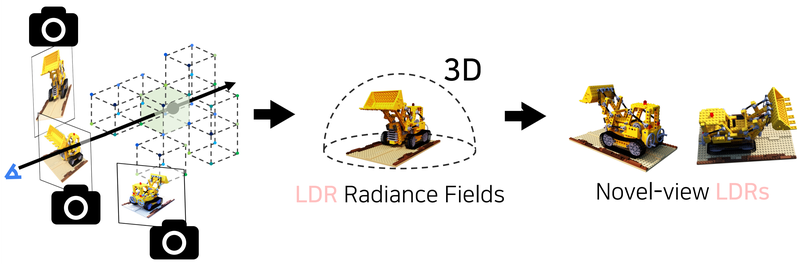


Motivation

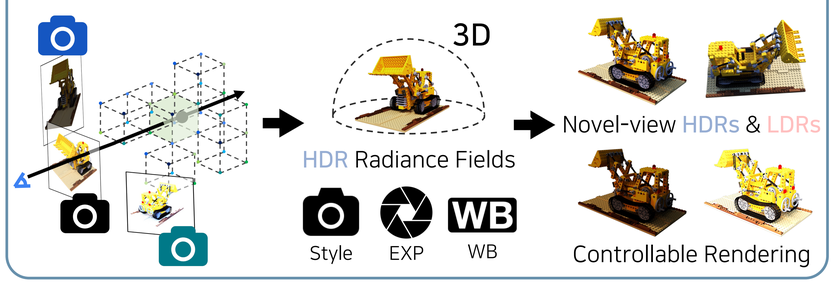
HDR Reconstruction at 2D



Plenoxels (Yu et al., CVPR 2022)



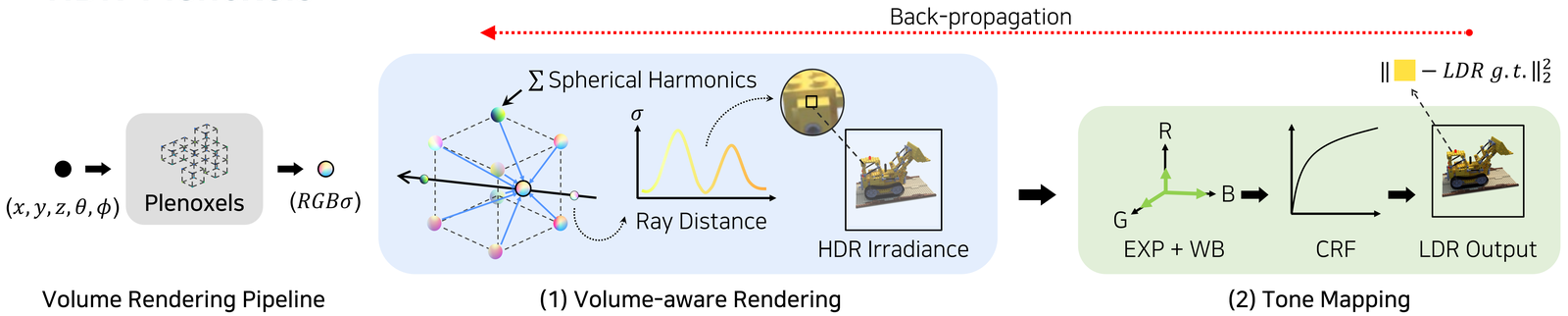
HDR-Plenoxels



Contribution

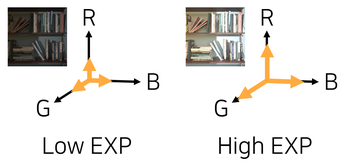
- End-to-end HDR radiance fields learning method
  - w/ only LDR images of the varying camera
  - w/o additional camera information (e.g., exposure value)
- Modeling the tone-mapping module based on a physical camera pipeline
- Deploying a multi-view dataset containing varying camera conditions

HDR-Plenoxels



Volume Rendering Pipeline (1) Volume-aware Rendering (2) Tone Mapping

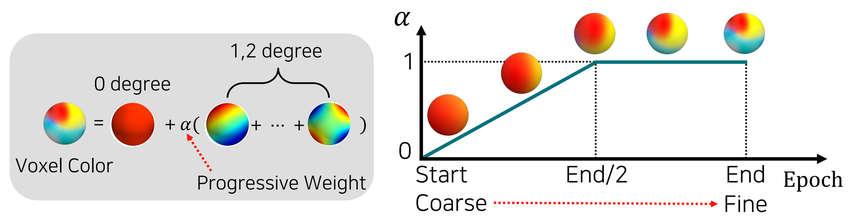
Tone Mapping Design



EXP + WB	CRF	PSNR ↑
		14.42
✓		23.03
✓	✓	29.34

- The tone mapping module converts an HDR into an LDR.
- White balance (WB) scale parameters are merged with the exposure value and learned at once.

Spherical Harmonics Regularization



- The optimization speed of tone mapping does not match SH coefficients.
- SH regularization allows scheduling to optimize low frequency first.

Experiments

Comparison with Baseline (Plenoxels)

1) Static 2) Varying 3) Varying w/ Ours

HDR Rendering at Saturation Points

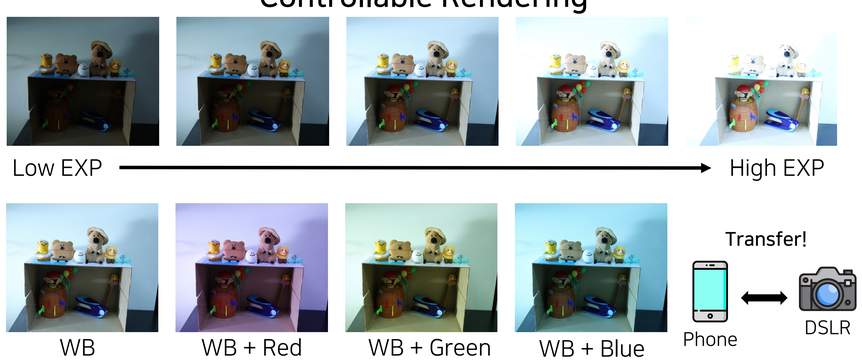
LDR Input HDR Novel View HDR GT

Comparison with Counterparts

LDR GT Ours NeRF-A ADOP

- Our results show fine-grained details compared to NeRF-A and proper color rendering compared to ADOP counterparts.

Controllable Rendering



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