GLOW: Global Illumination-Aware Inverse Rendering of Indoor Scenes Captured with Dynamic Co-Located Light & Camera

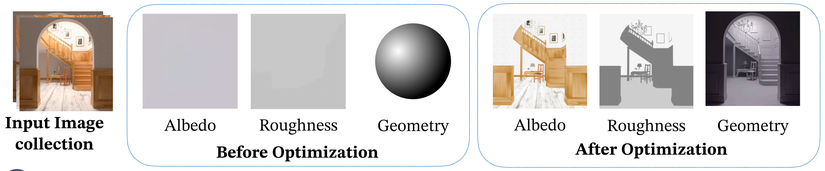
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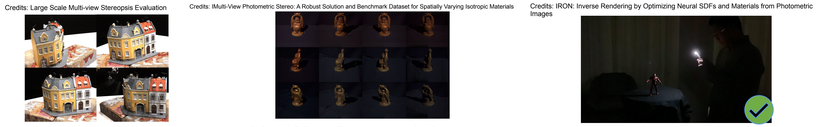
Find our project website, pre-print, and code using this QR code:
Website: glow-inverse-rendering.github.io

Background

Inverse Rendering: We focus on recovering all scene graphical attributes from image collections with optimization.



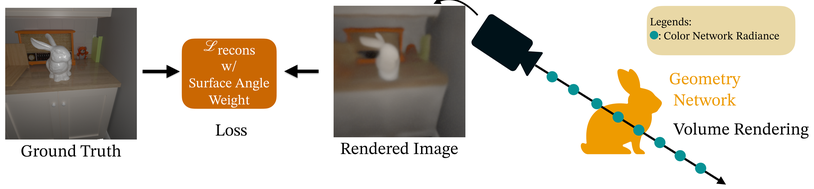
Capture Setup



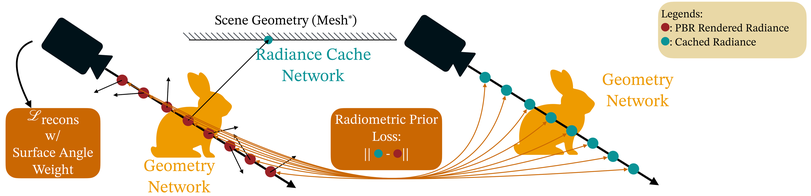
Method

Inverse rendering under global illumination.
Long range inter-dependencies & Difficult optimization problem.

Stage 1: Geometry Initialization

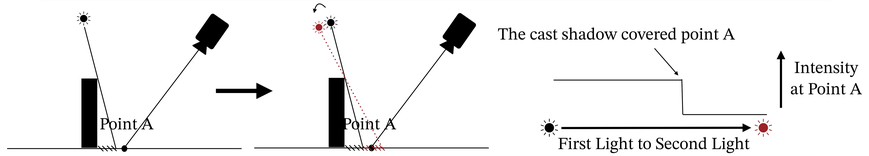


Stage 2: Joint Optimization Through PBR



Discontinuous Radiance With Moving Point Light

Radiance of a scene is discontinuous with respect to flashlight position.
Neural networks are unable to cache such discontinuous signal.



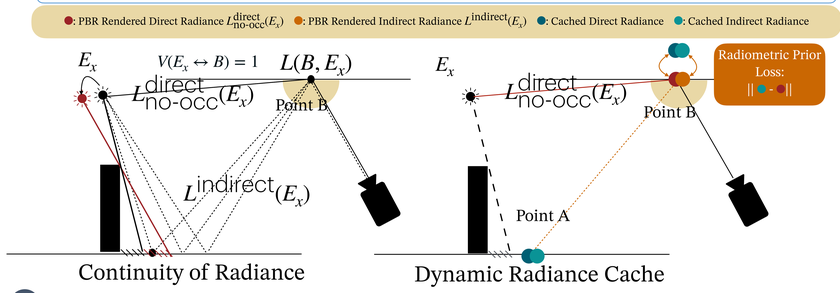
Dynamic Radiance Cache

$$L(B, E_x) = V(E_x \leftrightarrow B) \cdot L^{\text{direct}}_{\text{no-occ}}(B, E_x) + L^{\text{indirect}}(B, E_x).$$

$V(E_x \leftrightarrow B)$ visibility between E_x and B.

$L^{\text{direct}}_{\text{no-occ}}/L^{\text{indirect}}(B, E_x)$ direct/indirect radiance.

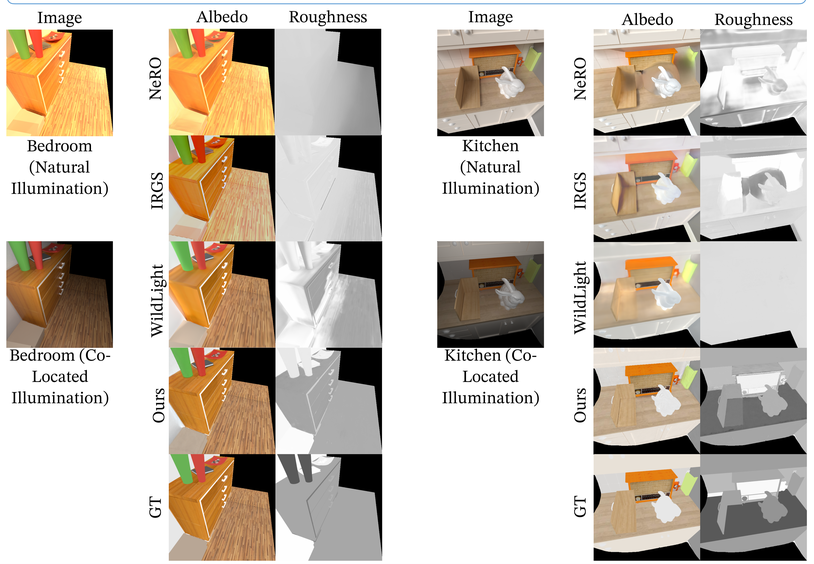
$L^{\text{direct}}_{\text{no-occ}}(B, E_x)$ and $L^{\text{indirect}}(B, E_x)$ are continuous!



Results



Qualitative Comparison of Material Properties



Quantitative Comparison of Material Properties

	Albedo				Roughness			
	Bedroom	Shelf	Counter	*Mean*	Bedroom	Shelf	Counter	*Mean*
NeRO	0.19	0.35	0.20	0.25	0.97	3.03	1.81	1.94
IRGS	0.16	0.54	0.14	0.28	0.77	1.28	1.72	1.25
IRON	0.47	0.27	0.29	0.34	1.00	2.53	2.64	2.06
WildLight	0.04	0.33	0.14	0.17	0.64	1.34	1.93	1.30
Ours	**0.03**	**0.04**	**0.02**	**0.03**	**0.23**	**0.16**	**0.06**	**0.15**

Ablation on Radiance Caches

	Path	Ours	Direct	Naive Cache
Albedo	0.38	**0.35**	7.21	4.97
Roughness	7.46	**6.11**	304.8	235.6
Runtime	3097	821	**453**	794