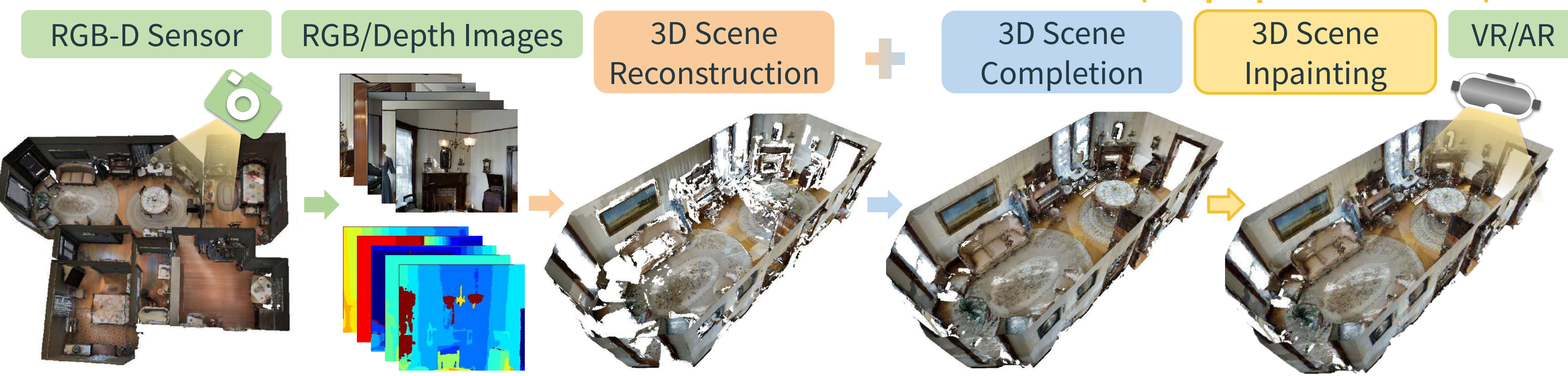


3D Scenes in VR/AR Applications



3D Scene Inpainting: given a 3D scene with some manually specified 3D masks, fill these regions with proper contents, including both geometry and color. (e.g. user editing, unwanted objects removal)

Why NOT 3D Scene Completion

Insufficient Evaluation:

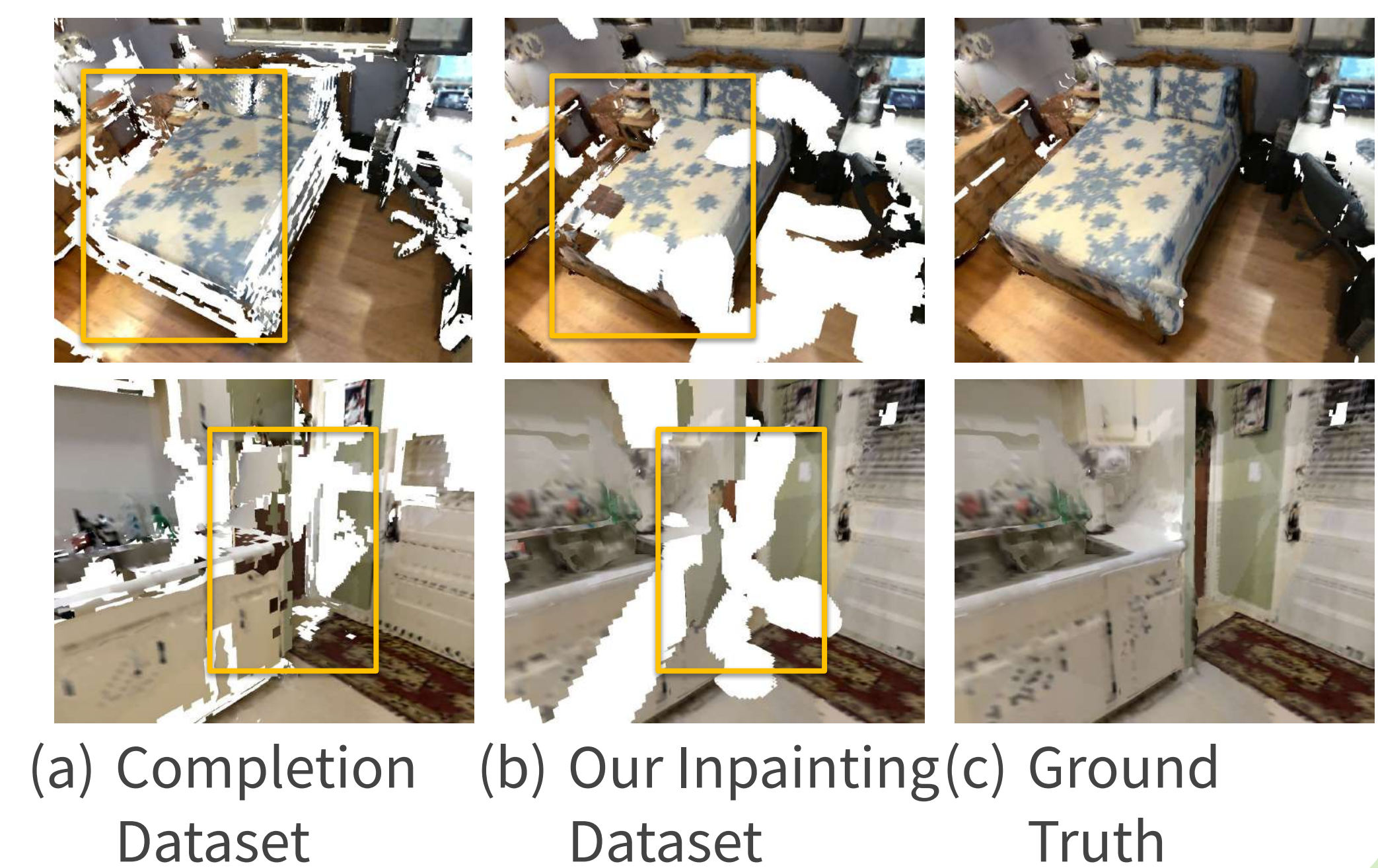
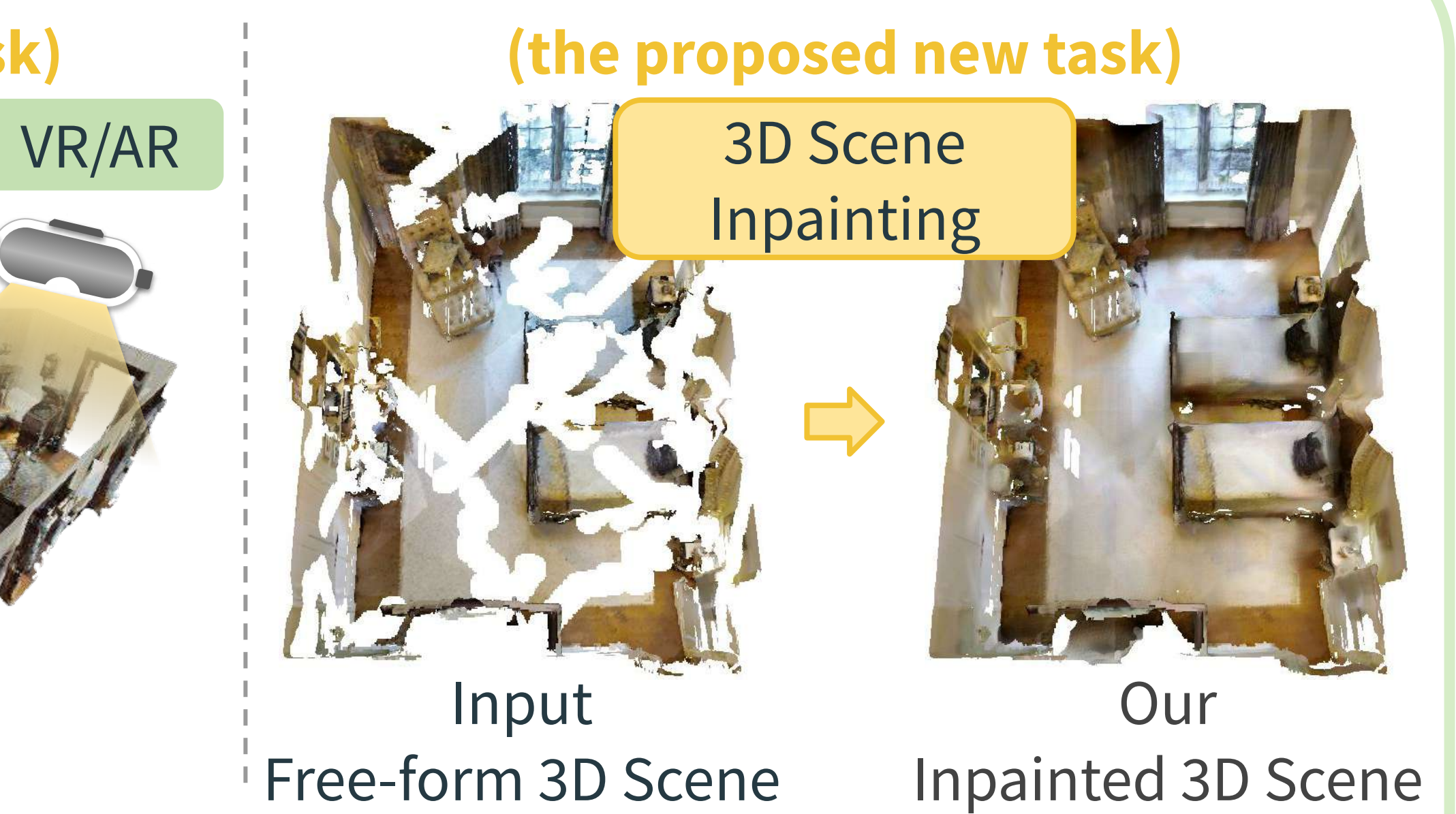
- datasets lack the masks that specify the missing regions
- the missing regions are strongly correlated to object occlusion or specific camera view

Poor Geometry and Color Reconstruction:

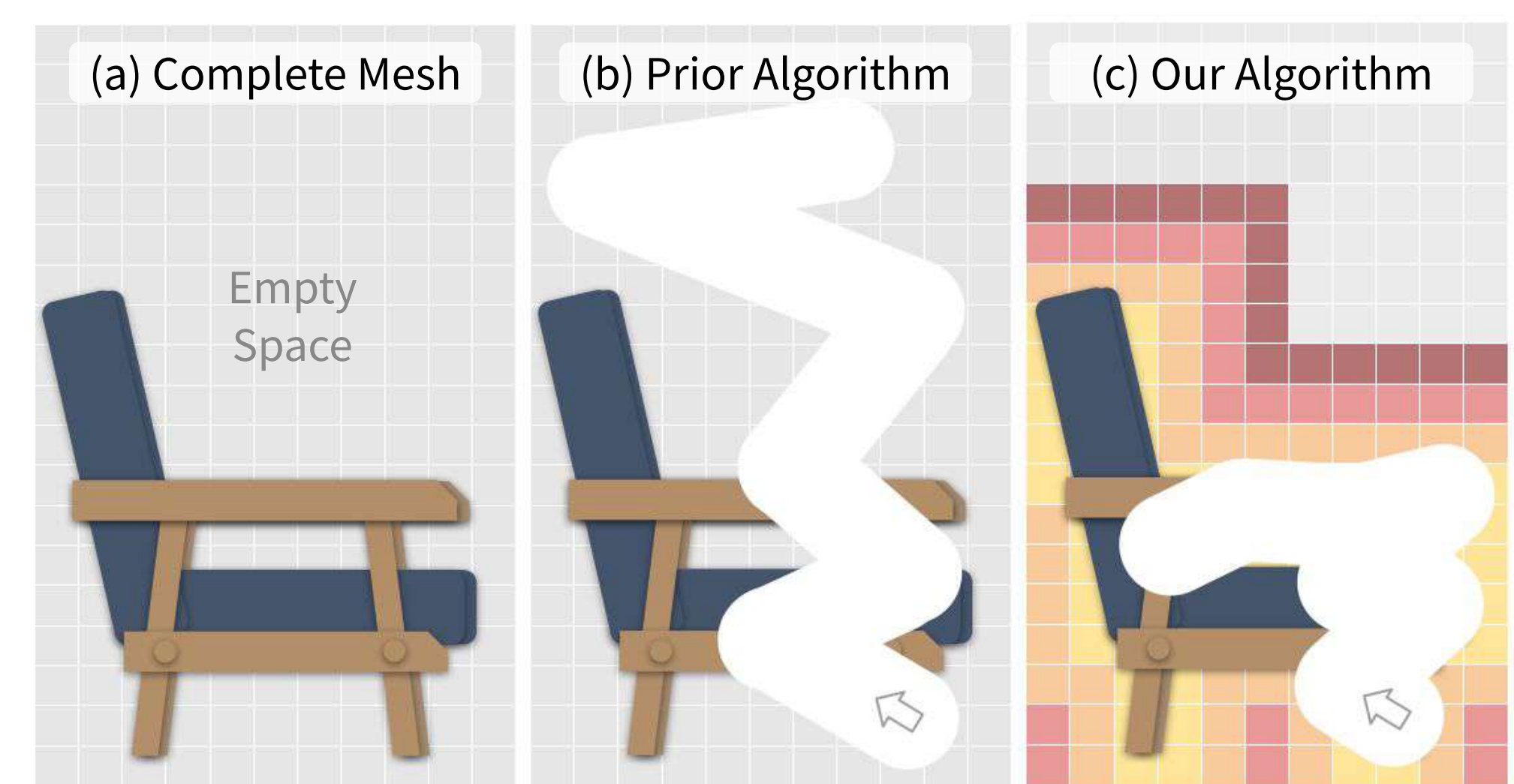
- models lack the mask information
- the error propagation problem of the previous two-stage generator results in poor inpainting results

Crude Details:

- producing blurred and distorted boundaries when recovering large damaging regions



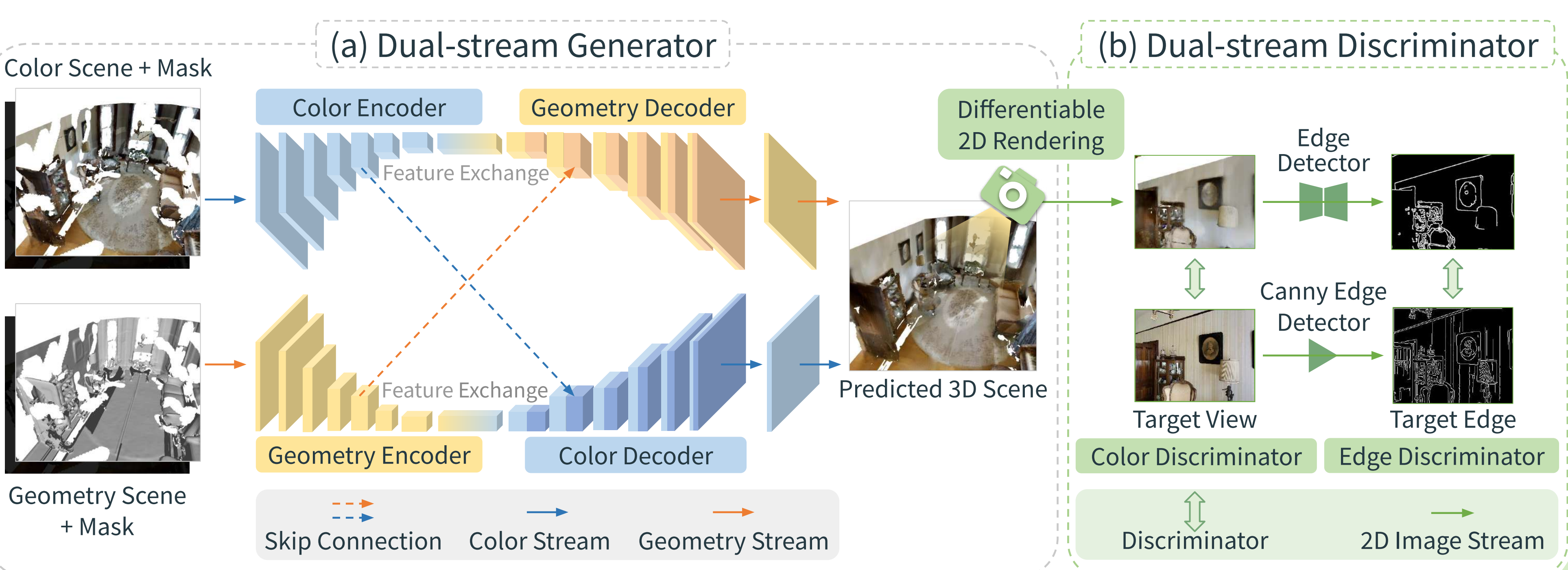
Free-form 3D Dataset Generation



Free-Form Matterport3D (FF-Matterport):

- Convert to Truncated Signed Distance Field (TSDF)
- Dynamically move considering the TSDF value

Dual-stream Generator and Discriminator

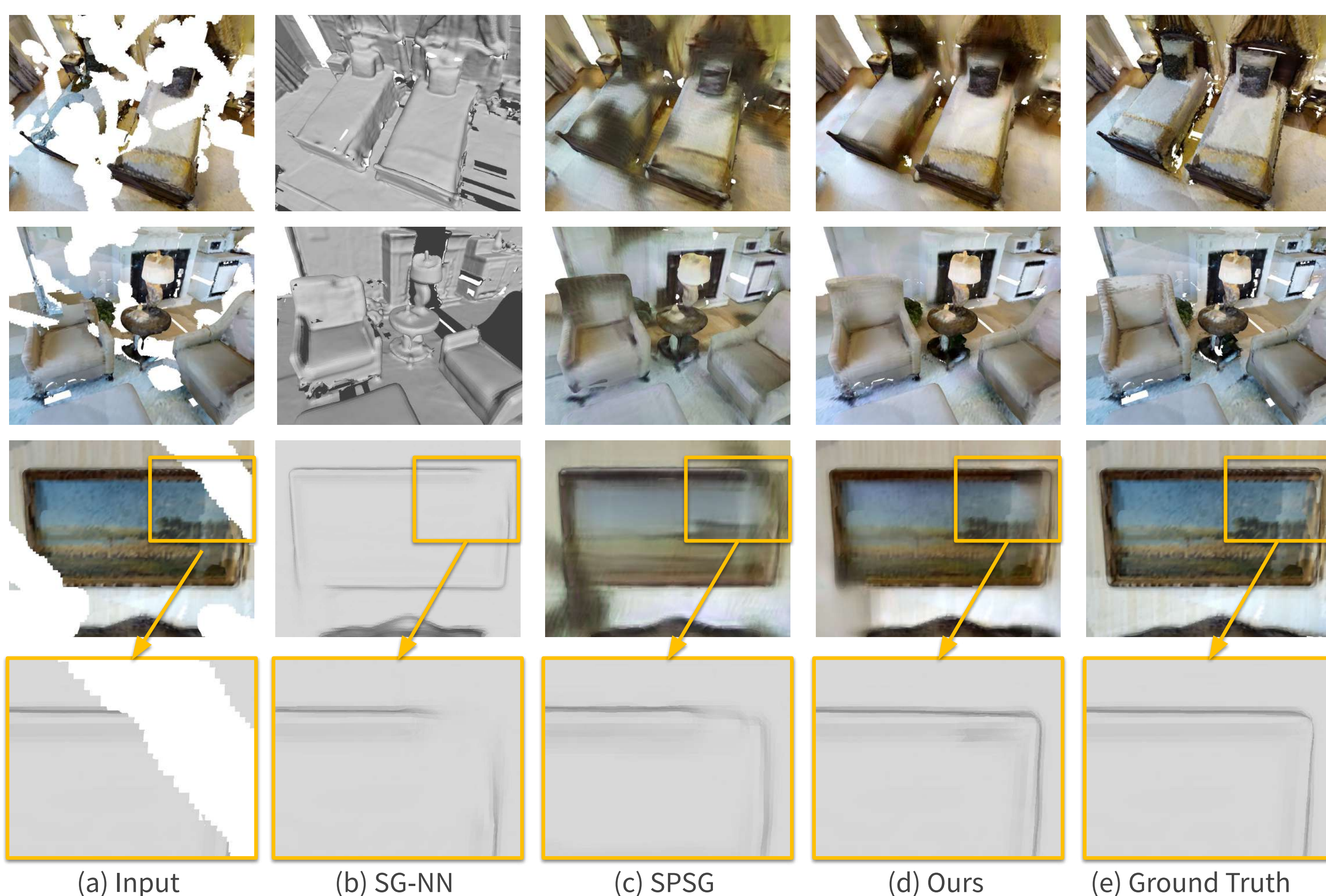


Experimental Results

A. Quantitative Comparison of Geometric and Color Inpainting

Methods	IoU(↑)	Geometry Recall(↑)	CD(↓)	SSIM(↑)	Color Feature- ℓ_1 (↓)	FID(↓)
PIFu ⁺ [42]	0.241	0.525	19.537	0.744	0.253	108.87
SG-NN [9]	0.636	0.857	20.988	-	-	-
SPSG [10]	0.466	0.683	17.457	0.829	0.220	75.10
SPSG (+mask) [10]	0.491	0.659	3.336	0.843	0.214	69.60
Ours	0.781	0.896	2.110	0.853	0.209	65.28

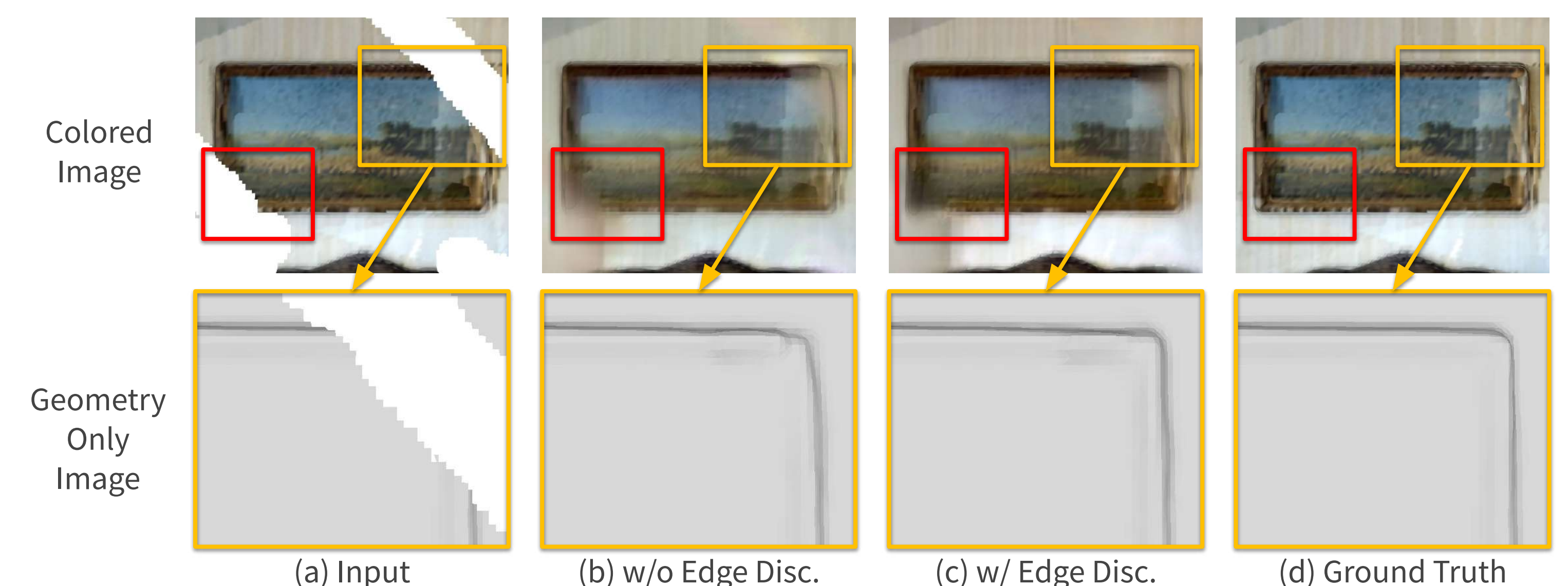
B. Qualitative Comparison of Inpainting Performance



C. Ablation Studies

Methods	IoU(↑)	Geometry Recall(↑)	CD(↓)	SSIM(↑)	Color Feature- ℓ_1 (↓)	FID(↓)
Dual-stream GAN (Full)	0.781	0.896	2.110	0.8536	0.209	65.28
- Edge Discriminator	0.774	0.892	2.137	0.8534	0.209	65.62
- 3D GatedConv	0.747	0.875	2.250	0.8491	0.211	68.28
- Mask Info.	0.592	0.827	24.356	0.8471	0.213	69.75
Single-stream GAN	0.744	0.878	2.523	0.8511	0.210	66.68

D. Edge Discriminator Qualitative Result



E. Practical Application: Object Removal

