### **ZeroComp: Zero-shot Object Compositing from Image Intrinsics via Diffusion** ΤΤ UNIVERSITÉ dępix I C Zitian Zhang<sup>1</sup>, Frédéric Fortier-Chouinard<sup>1</sup>, Mathieu Garon<sup>2</sup>, Anand Bhattad<sup>3</sup> & Jean-François Lalonde<sup>1</sup>

### The **shading** and **shadows** are important when inserting 3D objects into images











Realistic composite

### Existing methods require **specialized datasets**, and they fail to preserve **object identity**



Anydoor 23



ControlCom 23



Simulated GT

## In this work, we train a **diffusion neural renderer** on intrinsic maps, that achieves zero-shot compositing



Intrinsic maps and RGB images from OpenRooms, 2021

Background

Shading

Prediction

# Zero-shot compositing pipeline

The input background image (top-left) is first converted to intrinsic maps using specialized networks (top, in yellow) • The corresponding intrinsics of the 3D object, except for the shading, are rendered with simple shaders (middle, in **blue**). The intrinsic maps are then composited together to obtain the combined instrinsics (bottom, in green). From this, our trained ZeroComp model renders a realistic final composite (top-right).

#### Background image



# Shading mask size

masking radius



### Missing/incomplete shadows





Too small

#### Just right



#### **Realistic shadow**



# **Test dataset for object compositing**

**Real background images** Crops extracted from Gardner et al., 2017



213 publicly available high-quality composites Rendered with the ground truth HDR lighting





Final composite









High quality virtual objects 3D models from Collins et al., 2022







**EMLight** 

**User study** 

- The ground truth composite and method output are randomly shown side by side.
- Observers are asked to select the most realistic image.
- Our method outperformed all baselines in terms of achieving the highest confusion with the ground truth

# Material editing







Original

Metallic

Lighting control can be achieved with no retraining by injecting custom shadows during the denoising process of ZeroComp

No shadow conditioning









Object





SpotLight (shadow maps)

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ZeroComp





AnyDoor







ControlCom ZeroComp (Ours) Simulated G1





### **2D** compositing



Background

Compositing

## Follow-up paper: SpotLight







SpotLight (scribbles)