

# Problem of Uncalibrated Stereo

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Topic: Uncalibrated Stereo, Module: Reconstruction II  
First Principles of Computer Vision

# Uncalibrated Stereo

Compute 3D structure of static scene from two arbitrary views



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**Intrinsics**  $(f_x, f_y, o_x, o_y)$  are **known** for both views/cameras.





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# Uncalibrated Stereo

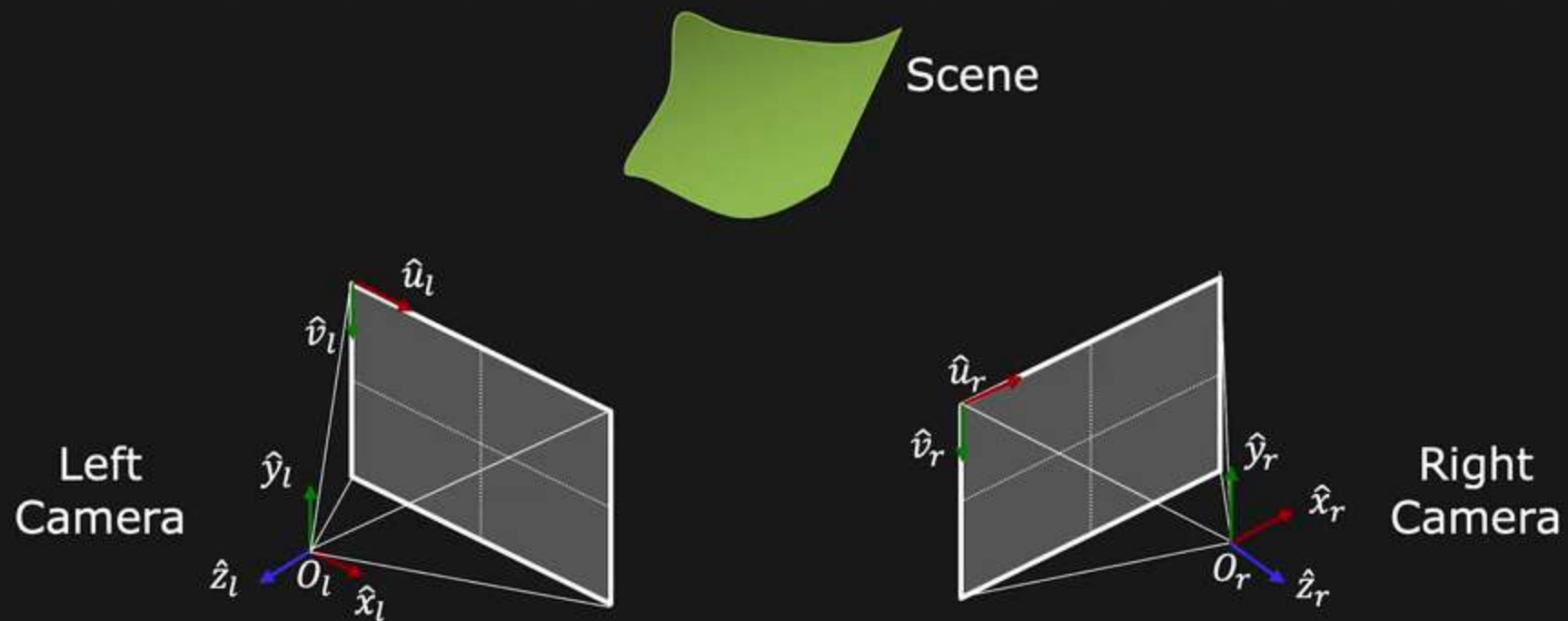
Compute 3D structure of static scene from two arbitrary views



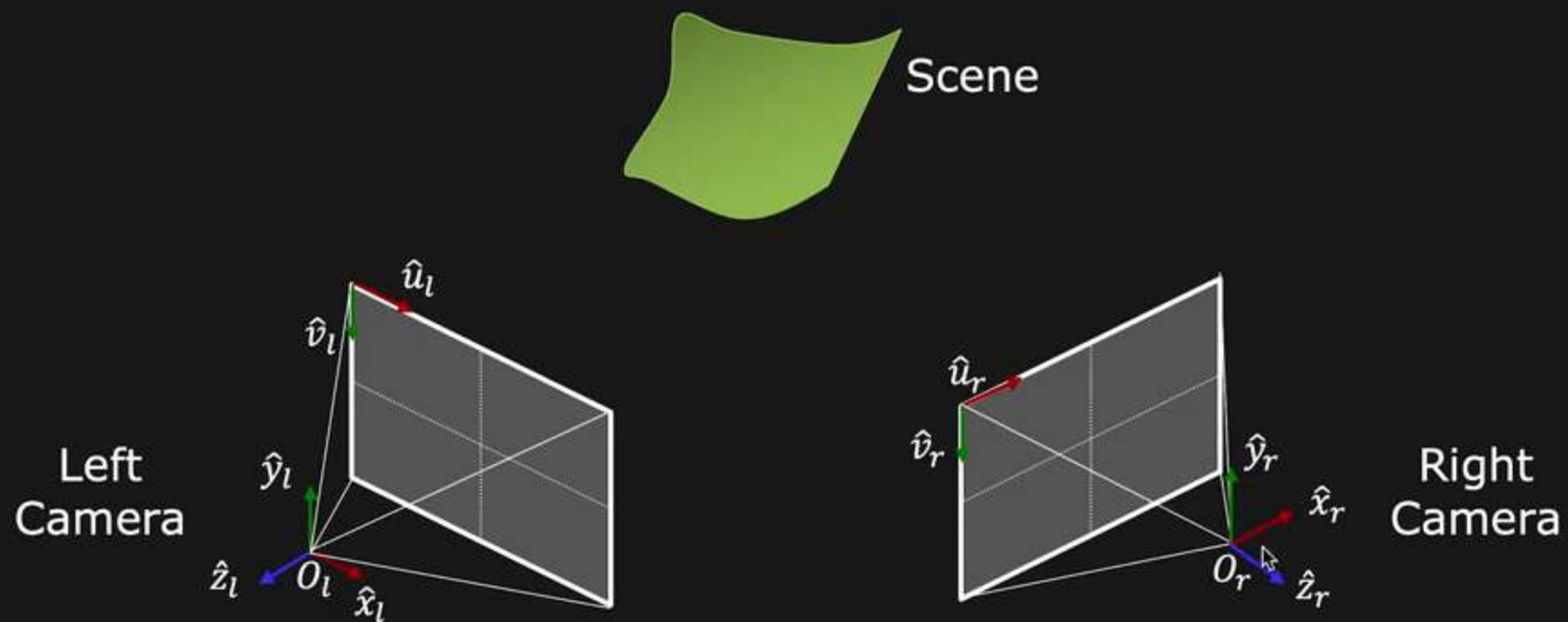
**Intrinsics** ( $f_x, f_y, o_x, o_y$ ) are **known** for both views/cameras.

**Extrinsics** (relative position/orientation of cameras) are **unknown**.

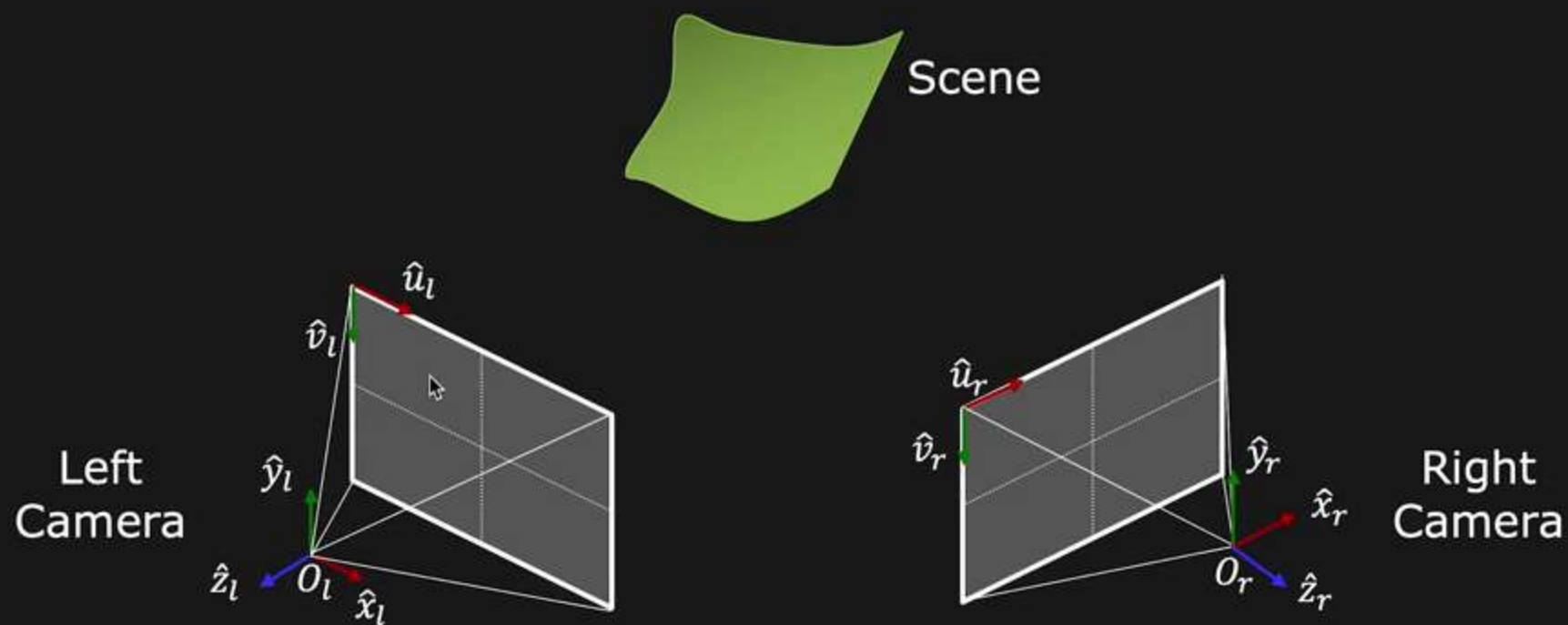
# Uncalibrated Stereo



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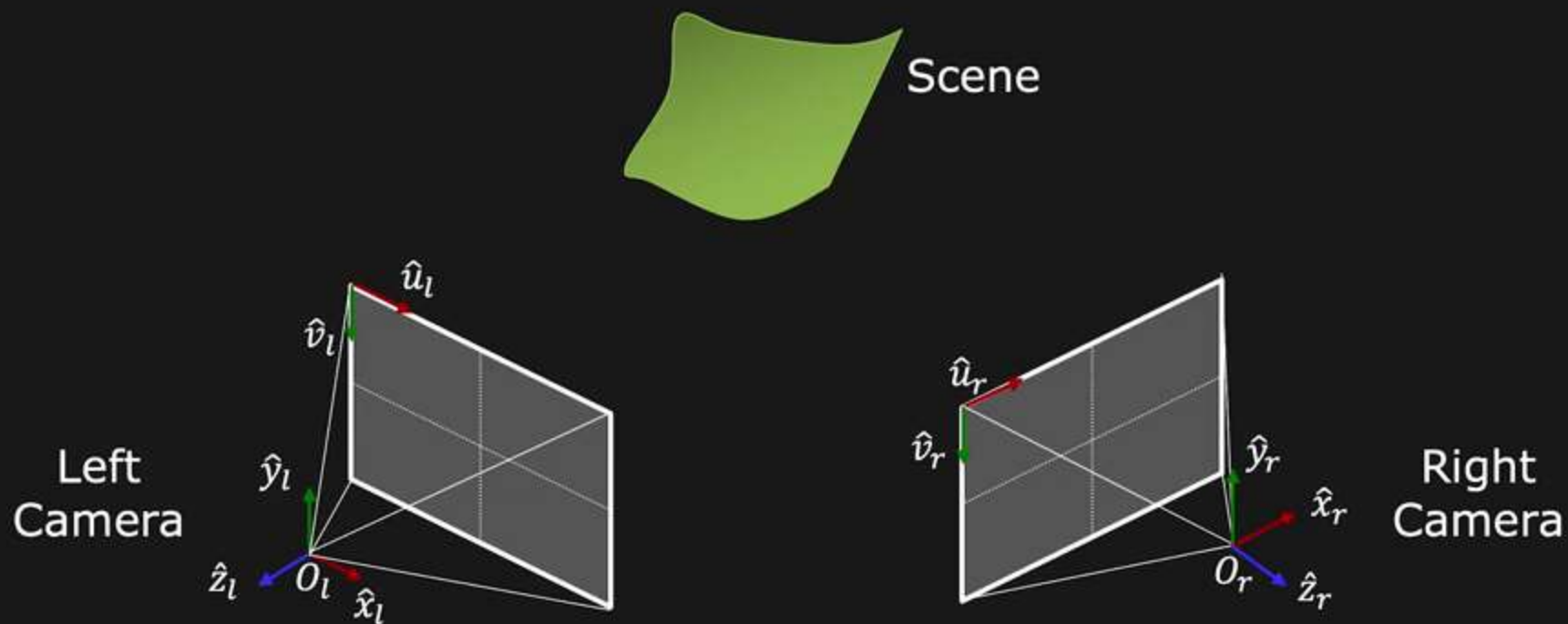


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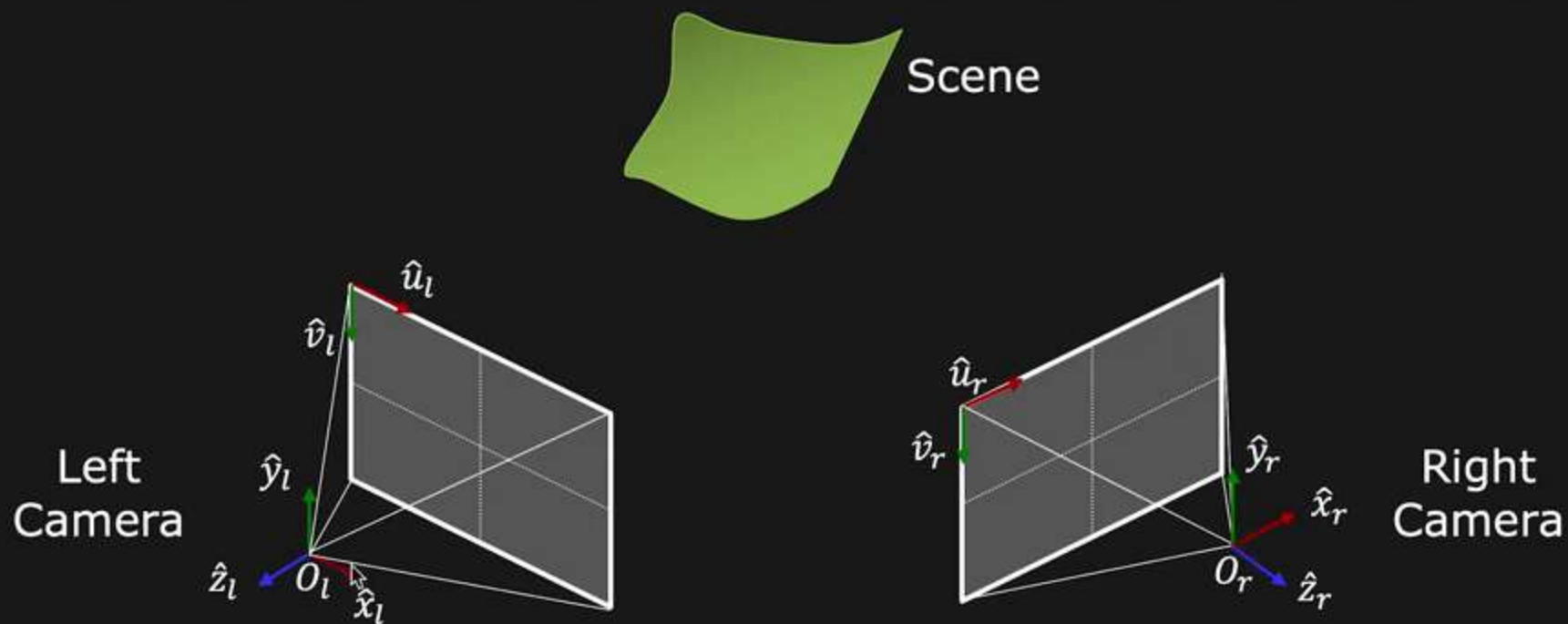
# Uncalibrated Stereo



- ✓ 1. Assume Camera Matrix  $K$  is known for each camera



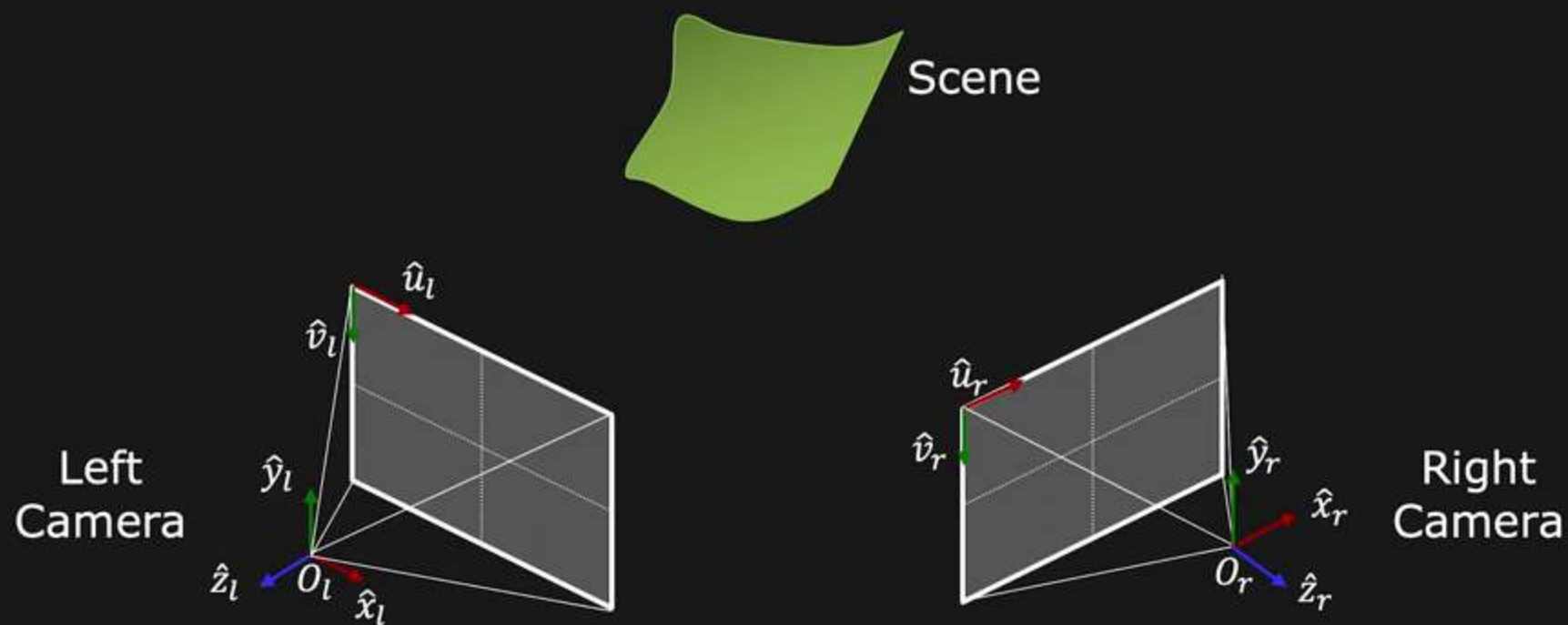
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# Uncalibrated Stereo



- ✓ 1. Assume Camera Matrix  $K$  is known for each camera
- 2. Find a few Reliable Corresponding Points



# Initial Correspondence

Find a set of **corresponding features** (at least 8) in left and right images (e.g. using SIFT or hand-picked).

Left image

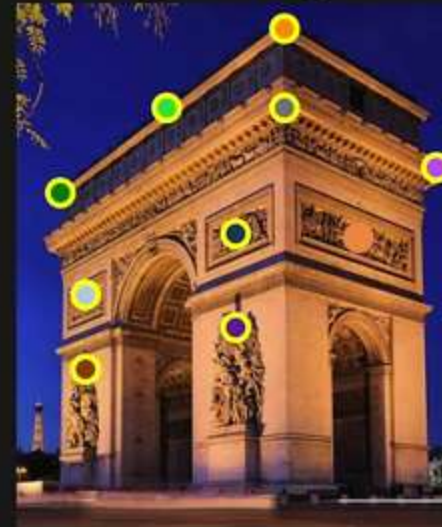


$$\bullet (u_l^{(1)}, v_l^{(1)})$$

$\vdots$

$$\bullet (u_l^{(m)}, v_l^{(m)})$$

Right image



$$\bullet (u_r^{(1)}, v_r^{(1)})$$

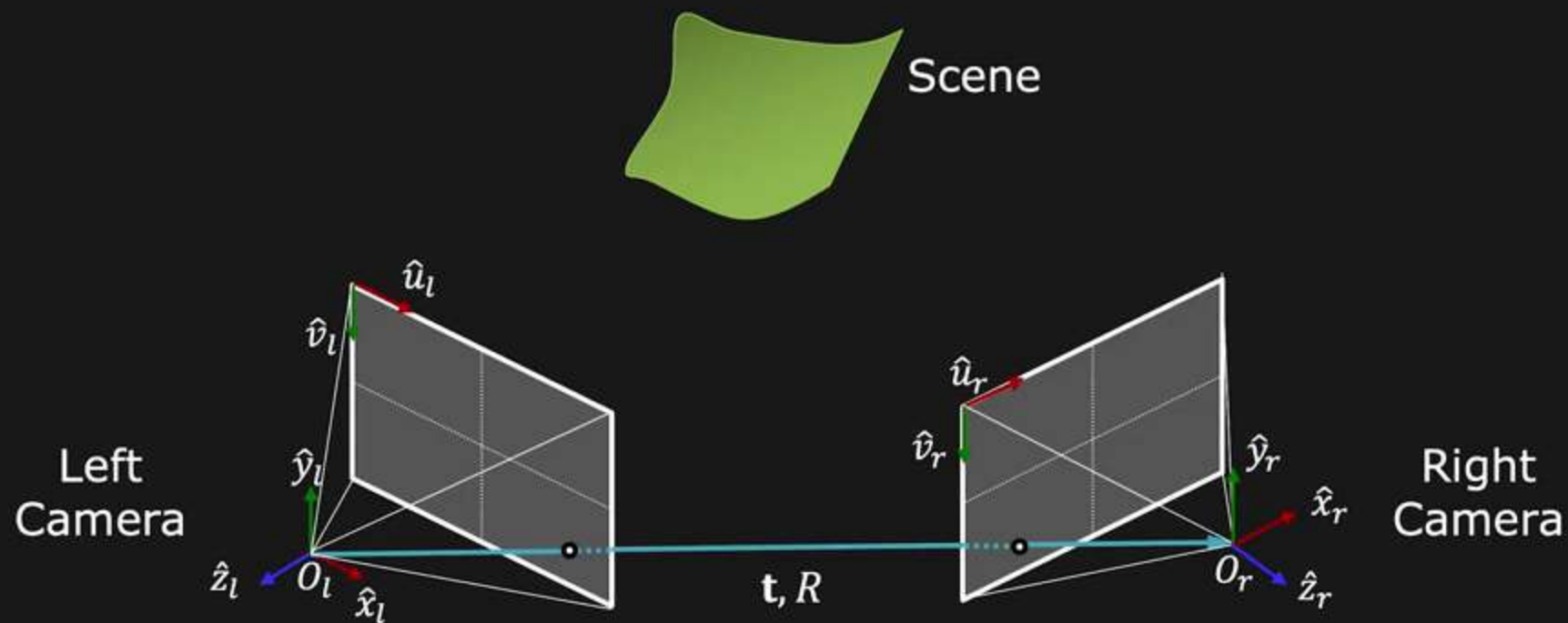
$\vdots$

$$\bullet (u_r^{(m)}, v_r^{(m)})$$





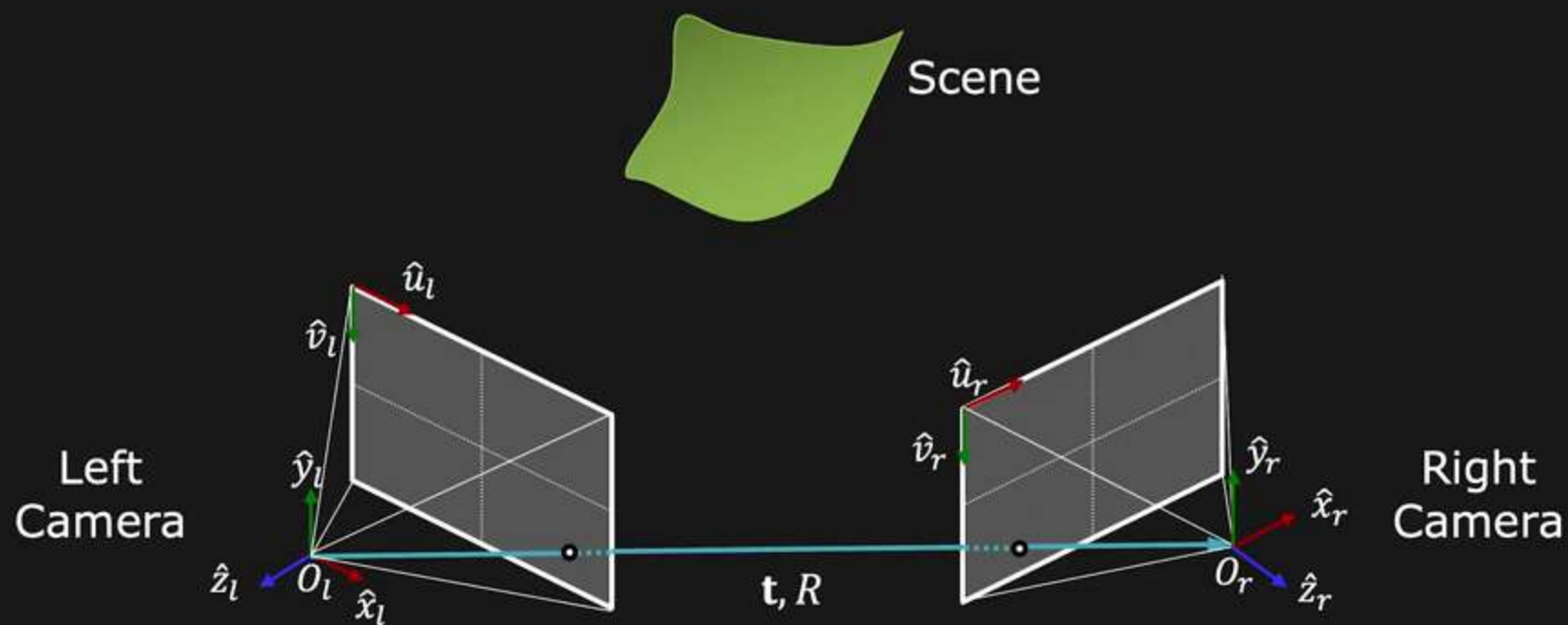
# Uncalibrated Stereo



- ✓ 1. Assume Camera Matrix  $K$  is known for each camera
- ✓ 2. Find a few Reliable Corresponding Points
- 3. Find Relative Camera Position  $\mathbf{t}$  and Orientation  $\mathbf{R}$



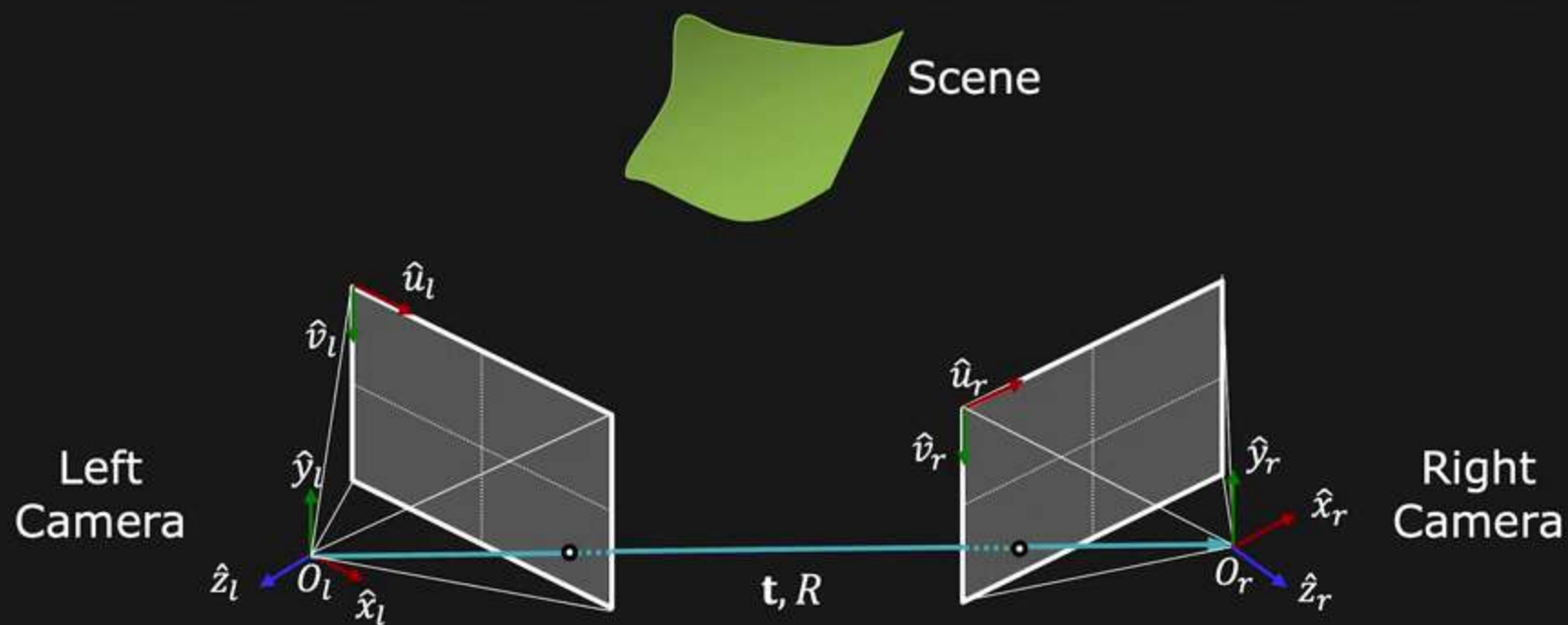
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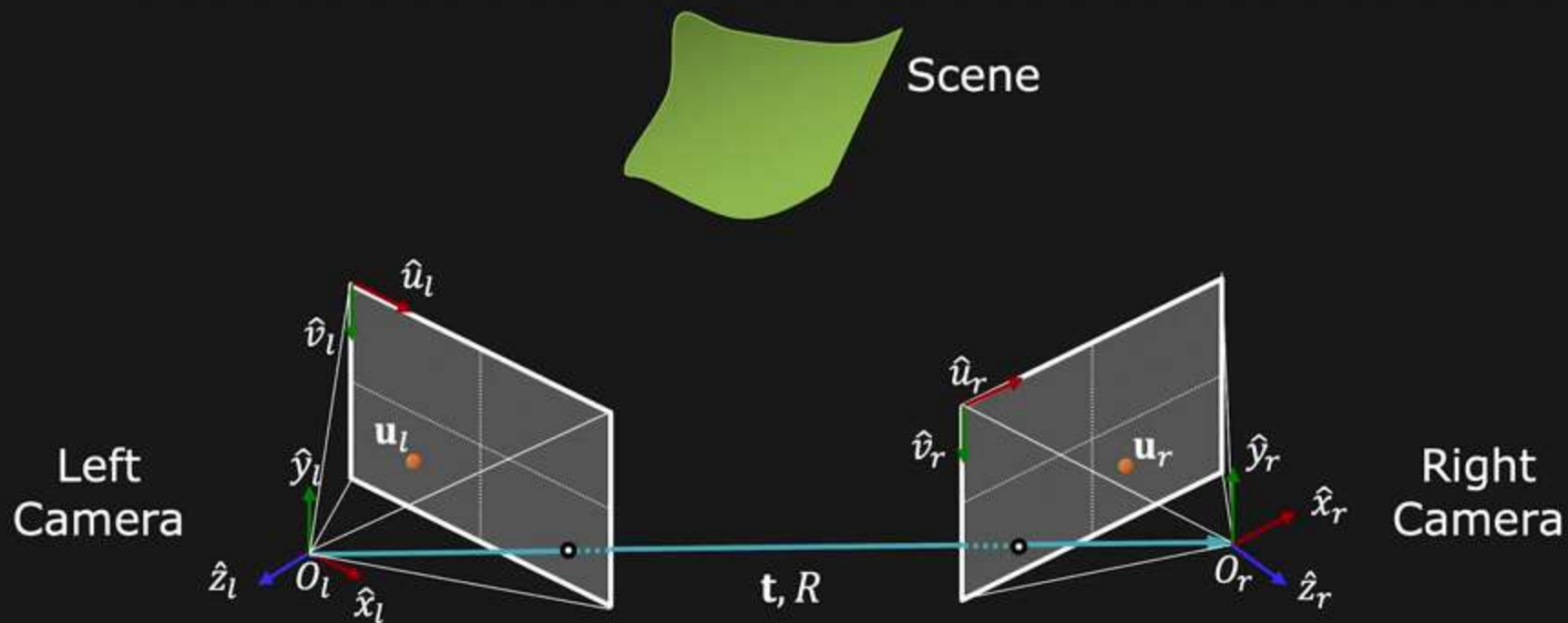
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# Uncalibrated Stereo

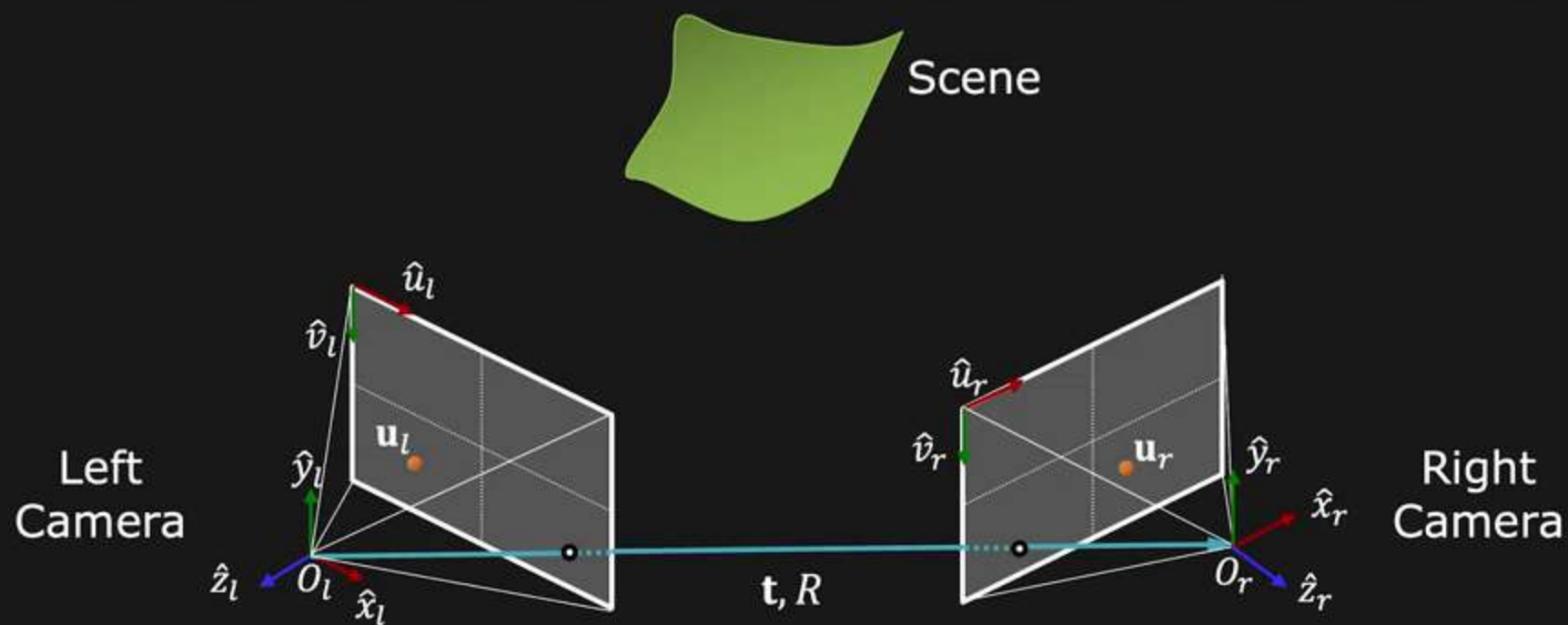


- ✓ 1. Assume Camera Matrix  $K$  is known for each camera
- ✓ 2. Find a few Reliable Corresponding Points
- 3. Find Relative Camera Position  $t$  and Orientation  $R$
- 4. Find Dense Correspondence





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- ✓ 1. Assume Camera Matrix  $K$  is known for each camera
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- 3. Find Relative Camera Position  $t$  and Orientation  $R$
- 4. Find Dense Correspondence