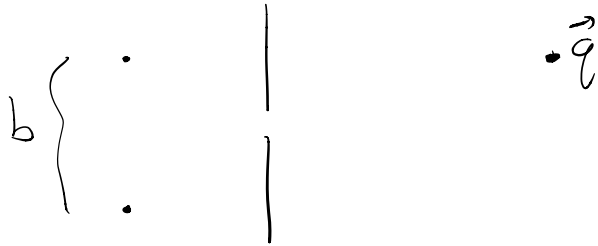


# Plane Sweep Stereo

Previously, assumed very restricted case:



Standard Stereo:

for each pixel in left image:

for each possible disparity,

find and compare patch in right image

Planesweep:

for each disparity  $d$ :

for each pixel:

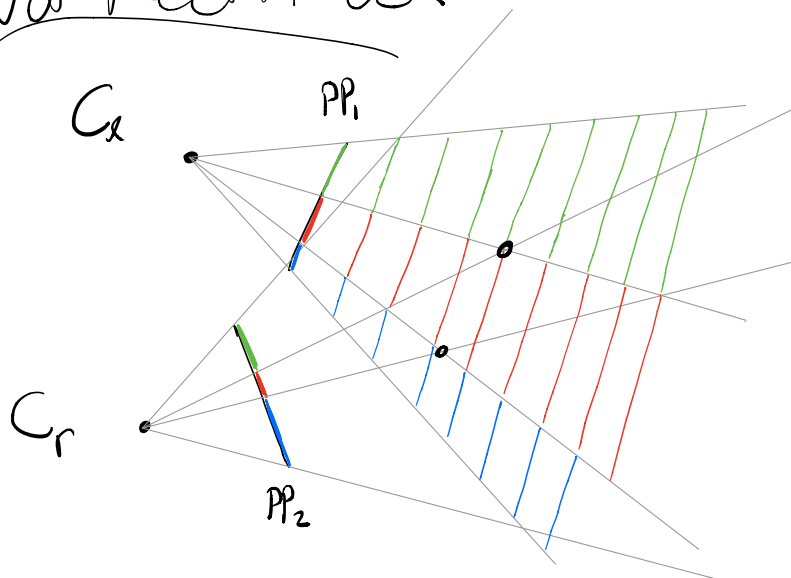
find and compare patch in right image

Rectified

$C_l \cdot$

$C_r \cdot$

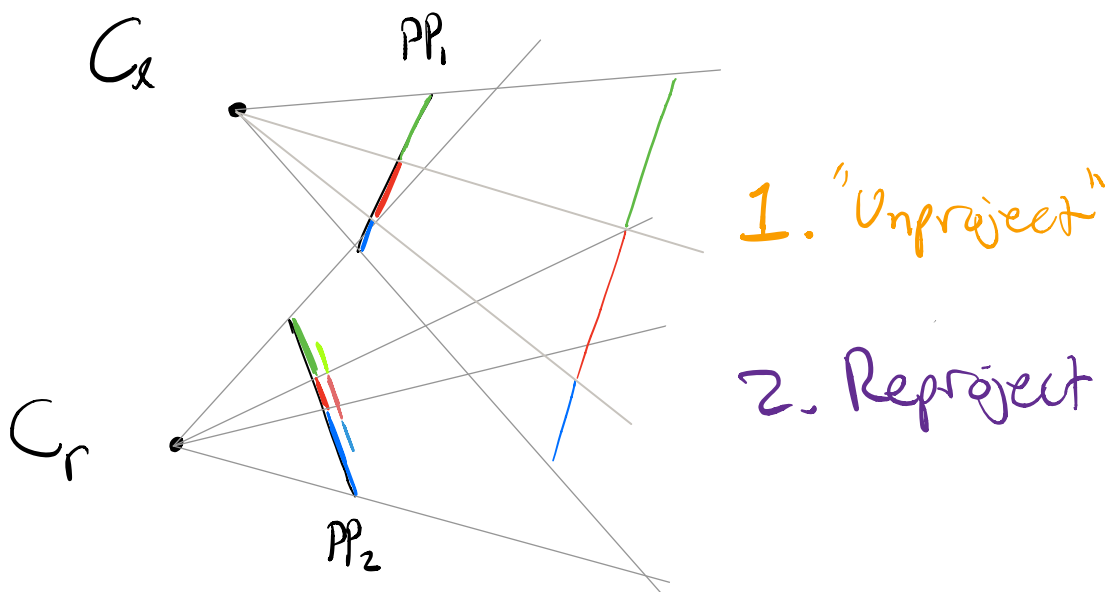
Not Rectified:



1. "Unproject" pixels from  $C_l$  at depth  $d$

$$\begin{bmatrix} x_w \\ y_w \\ z_w \\ 1 \end{bmatrix} = \underbrace{t_l}_{\text{extrinsics}} \cdot \underbrace{R_l^T}_{\text{target depth}} \cdot d \cdot \underbrace{K_l^{-1}}_{\text{intrinsics}} \begin{bmatrix} x_l \\ y_l \\ 1 \end{bmatrix}$$

in world coords at depth  $d$  on image plane left pixel coords



2. "Reproject" them into  $C_r$  and compute NCC score.

$$\begin{bmatrix} x_r \\ y_r \\ 1 \end{bmatrix} \approx K_r \begin{bmatrix} 1 & 0 & 0 & 0 \\ 0 & 1 & 0 & 0 \\ 0 & 0 & 1 & 0 \end{bmatrix} \begin{bmatrix} R_r & | & t_r \end{bmatrix} \begin{bmatrix} x_w \\ y_w \\ z_w \\ 1 \end{bmatrix}$$

right pixel coords right camera coords world coords

In Practice: don't need to do this at every pixel - just planes mapping to planes.

Unproject - reproject 4 corners of  $C_e$ , then fit a homography!

Warp  $I_e$  to align with  $I_r$ , then compute NCC