

Question:

Given a pair of images, transform both images so that epipolar lines are scan lines.

Answer:

Consider a point in world coordinate system $[X, Y, Z]$. This point is mapped to point $[x_l, y_l, w_l]$ in image taken from camera 1.

Consider a point in world coordinate system $[X, Y, Z]$. This point is mapped to point $[x_r, y_r, w_r]$ in image taken from camera 2.

$$\begin{bmatrix} x_l \\ y_l \\ w_l \end{bmatrix} = P \begin{bmatrix} X \\ Y \\ Z \\ 1 \end{bmatrix}$$

$$\begin{bmatrix} x_r \\ y_r \\ w_r \end{bmatrix} = P' \begin{bmatrix} X \\ Y \\ Z \\ 1 \end{bmatrix}$$

We need to simply stereo matching by warping the images.

We need to apply projective transformation so that epipolar lines correspond to horizontal scanlines.

We should transform the images such that epipoles of images are mapped to $[1, 0, 0]$.

Let the epipole of image 1 be e^l and epipole of image 2 be e^r .

Therefore,

$$\begin{bmatrix} 1 \\ 0 \\ 0 \end{bmatrix} = H^l e^l$$

$$\begin{bmatrix} 1 \\ 0 \\ 0 \end{bmatrix} = H^r e^r$$

.

Find H^l and H^r and then apply transformation to image 1 and image 2 respectively. After this, we would get epipolar lines as scan lines for both images.