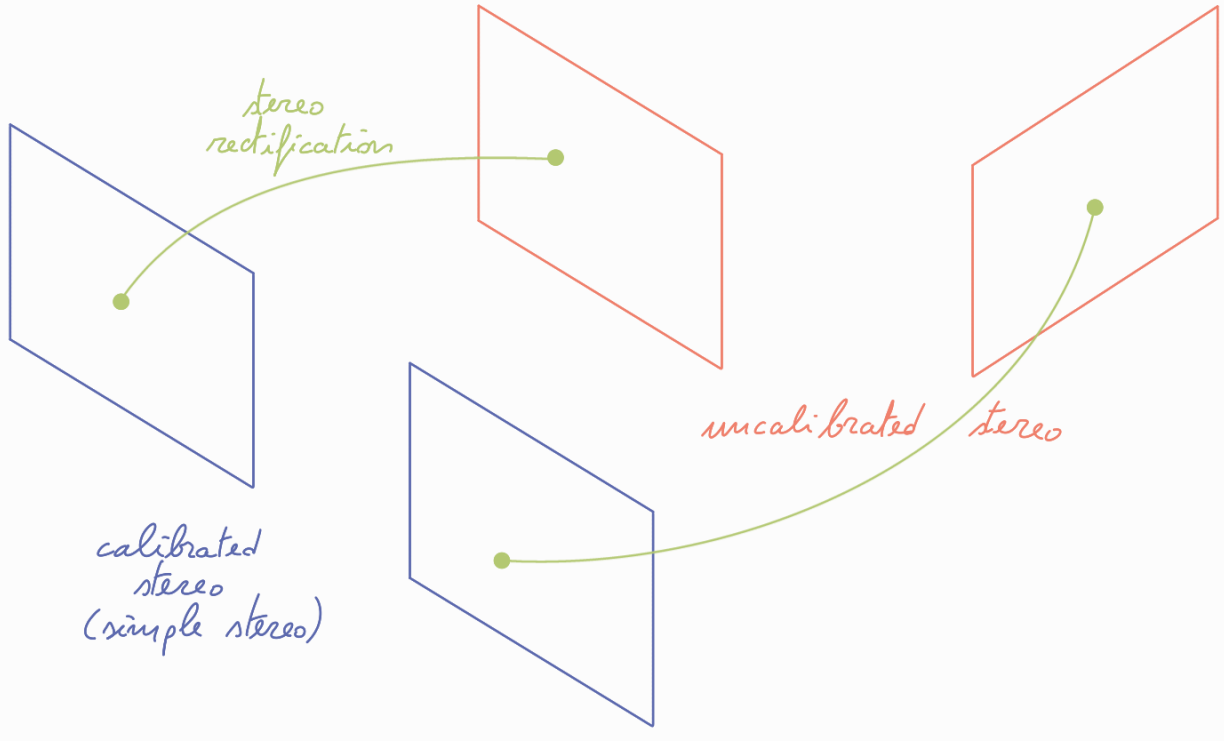
Finding correspondances between features

Goal : find correspondances between points in the left and right image.

Uncalibrated stereo : After you have found rotation and translation the stereo matching problem still remains a 1-dimensional search. The question is along which line ?

Another way is to use stereo rectification : first you need to estimate the parameters of the cameras. You can now reproject the camera planes such that they lie on the same plane. You end up in the simple stereo case.

Simple stereo : left and right camera are on the same line ; no rotation between the two, only translation of B (baseline). In this case, for any point in the left image the corresponding point on the right image must lie on the same horizontal scanline.



Finding Epipolar Lines

The epipolar lines are the intersection between the image planes and the epipolar plane. In case of an uncalibrated stereo pair, given a point in one image, the corresponding point in the other image must lie on the epipolar line.

Given : fundamental matrix F and point on left image (u_l, v_l)

Find : equation of epipolar line in the right image

Epipolar constraint equation

$$\begin{vmatrix} u_l & v_l & 1 \end{vmatrix} \begin{vmatrix} f_{11} & f_{12} & f_{13} \\ f_{21} & f_{22} & f_{23} \\ f_{31} & f_{32} & f_{33} \end{vmatrix} \begin{vmatrix} u_r \\ v_r \\ 1 \end{vmatrix} = 0$$

expanding the matrix equation gives:

$$(f_{11} u_l + f_{21} v_l + f_{31}) u_r + (f_{22} u_l + f_{22} v_l + f_{32}) v_r + (f_{13} u_l + f_{23} v_l + f_{33}) = 0$$

equation of the right epipolar line:

$$a_l u_r + b_l v_r + c_l = 0$$

similarly we can compute the epipolar line in the left image for a point in the right image.