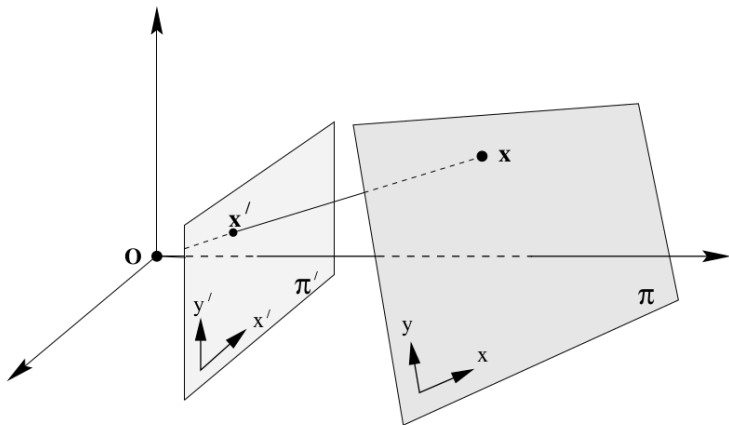


ECE 417/598: Direct Linear Transform

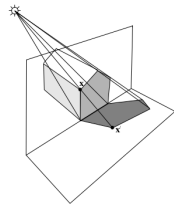
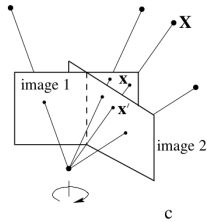
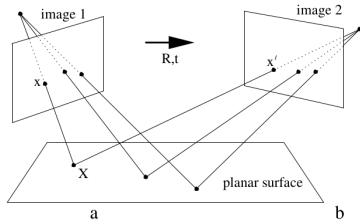
Vikas Dhiman

March 23, 2022

Homography

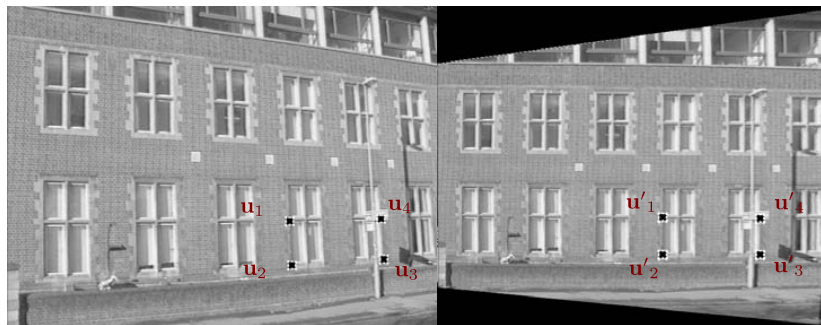


Examples of Homography





Computing Homography



$$\underline{u}_1 = [100, 98, 1]^\top$$

$$\underline{u}_3 = [107, 90, 1]^\top$$

$$\underline{u}'_1 = [100, 98, 1]^\top$$

$$\underline{u}'_3 = [107, 98, 1]^\top$$

$$\underline{u}_2 = [102, 95, 1]^\top$$

$$\underline{u}_4 = [110, 85, 1]^\top$$

$$\underline{u}'_2 = [102, 95, 1]^\top$$

$$\underline{u}'_4 = [110, 95, 1]^\top$$

Find H such that $\underline{u}' = H\underline{u}$ for any point on one image to another image, where $\underline{u}', \underline{u} \in \mathbb{P}^2$

2D homography

Given a set of points $\underline{\mathbf{u}}_i \in \mathbb{P}^2$ and a corresponding set of points $\underline{\mathbf{u}}'_i \in \mathbb{P}^2$, compute the projective transformation that takes each $\underline{\mathbf{u}}_i$ to $\underline{\mathbf{u}}'_i$. In a practical situation, the points $\underline{\mathbf{u}}_i$ and $\underline{\mathbf{u}}'_i$ are points in two images (or the same image), each image being considered as a projective plane \mathbb{P}^2 .

Solving for Homography

Solving for Homography

Solving for Homography

3D to 2D camera projection matrix estimation

Given a set of points \mathbf{X}_i in 3D space, and a set of corresponding points \mathbf{x}_i in an image, find the 3D to 2D projective \mathbf{P} mapping that maps \mathbf{X}_i to $\mathbf{x}_i = \mathbf{P}\mathbf{X}_i$.