

Auto-estimation of homography over a planar patch, from a single view

Computer Vision (CS6350)

TPA - 13

1. Problem statement:

Homography estimation is an important step in many computer vision problems. A homography models the global geometric transformation between two images. Typically, given two views of a scene consisting of a planar patch, one may use DLT or its variant to compute homography matrix, \mathbf{H} where $\mathbf{I}' = \mathbf{H} \cdot \mathbf{I}$

In this assignment, we look at the inverse situation to solve an ill-posed problem, where given an inclined texture \mathbf{I}' we try to estimate both the homography matrix, \mathbf{H} and the orthogonal image, \mathbf{I} .

The task is to estimate \mathbf{H} of a planar patch but only from a single view image (\mathbf{I}') consisting of an inclined planar texture surface. Additionally, we need to reconstruct and display the input image \mathbf{I} as that would have been visible before and after transformation.

A few assumptions can be made - e.g. \mathbf{I} is the orthogonal view of the planar patch.

For example: One can assume to transform the upright planar patch by \mathbf{H} , by a perspective transformation of a camera placed exactly in front of the input image (as shown below).

2. Input Image:



3.Outputs:

A. Orthogonal Image (**I**)



B. Homography matrix (**H**)

Note: You may create as many samples of **I'** (inputs) as you like, using $H = KRK'$ and other texture samples.

5.References:

- [1]. Andrejs Rudzitis, Margarita A. Zaeva, Alternative Inverse Perspective Mapping Homography Matrix Computation for ADAS Systems Using Camera Intrinsic and Extrinsic Calibration Parameters, *Procedia Computer Science*, Volume 190, 2021
- [2]. Le, Hoang, et al. "Deep homography estimation for dynamic scenes." *Proceedings of the IEEE/CVF Conference on Computer Vision and Pattern Recognition*. 2020.
- [3]. Zhang, Jirong, et al. "Content-aware unsupervised deep homography estimation." *European Conference on Computer Vision*. Springer, Cham, 2020..
- [4]. DeTone, Daniel, Tomasz Malisiewicz, and Andrew Rabinovich. "Deep image homography estimation." *arXiv preprint arXiv:1606.03798* (2016).

[5]. Nie, Lang, et al. "Depth-Aware Multi-Grid Deep Homography Estimation with Contextual Correlation." *arXiv preprint arXiv:2107.02524* (2021).

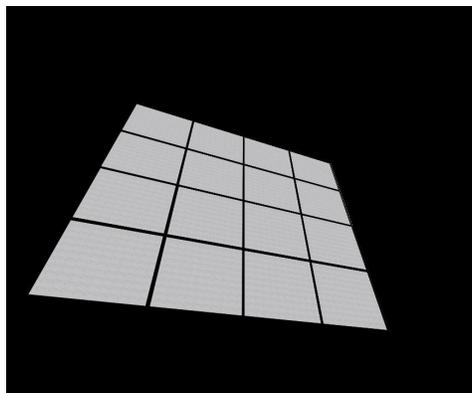
[6]. Baker, Simon, Ankur Datta, and Takeo Kanade. "Parameterizing homographies." *Technical Report CMU-RI-TR-06-11*. 2006.

[7]. <https://forum.opencv.org/t/warpperspective-but-inverse-homography/5547>

[8]. <https://stackoverflow.com/questions/42396860/inverse-homography>

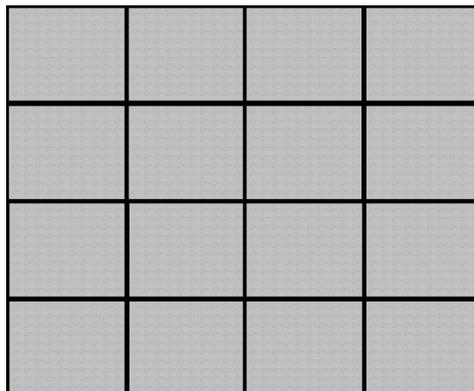
Example:

Input:



Outputs:

A. Orthogonal Image (**I**)



B. Homography matrix (**H**)

Aug. 2022.