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

Computer Vision (CS6350)
TPA - 18

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 **H**,
where **I' = H.I ;**

In this assignment, we look at the inverse situation, to solve an ill-posed problem, where given **I',** estimate both **H** and **I**.
The task is to estimate **H** of a planar patch but only from a single view image (**I'**), consisting of an inclined planar texture surface.
Additionally, we need to reconstruct and display the input image **I** as that would have been visible before transformation.

A few assumptions can be made - e.g. **I** is the orthogonal view of the planar patch.

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

2.Input:

3.Outputs:

A..

B. Homography matrix **(H**)

Note: You may create as many samples of **I'** (inputs) as you like, using H (= KRK'), and other texture samples. Ask TA for a few realistic and virtual samples.

4.Dataset:

1. MS-COCO Dataset [3] - https://github.com/nightrome/cocostuff#downloads
2. UDIS-D Dataset [5] - https://github.com/nie-lang/UnsupervisedDeepImageStitchingh

5.References:

[1]. Le, Hoang, et al. "Deep homography estimation for dynamic scenes." *Proceedings of the IEEE/CVF Conference on Computer Vision and Pattern Recognition*. 2020.

[2].Zhang, Jirong, et al. "Content-aware unsupervised deep homography estimation." *European Conference on Computer Vision*. Springer, Cham, 2020..

[3]. DeTone, Daniel, Tomasz Malisiewicz, and Andrew Rabinovich. "Deep image homography estimation." arXiv preprint arXiv:1606.03798 (2016).

[4]. Kähler, Olaf, and Joachim Denzler. "Detection of planar patches in handheld image sequences." *Proc. Photogrammetric Computer Vision* 36 (2006): 37-42

[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.

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