Computer Vision, IIIT Sri City (Spring 2018)

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Programming Assignment – 3

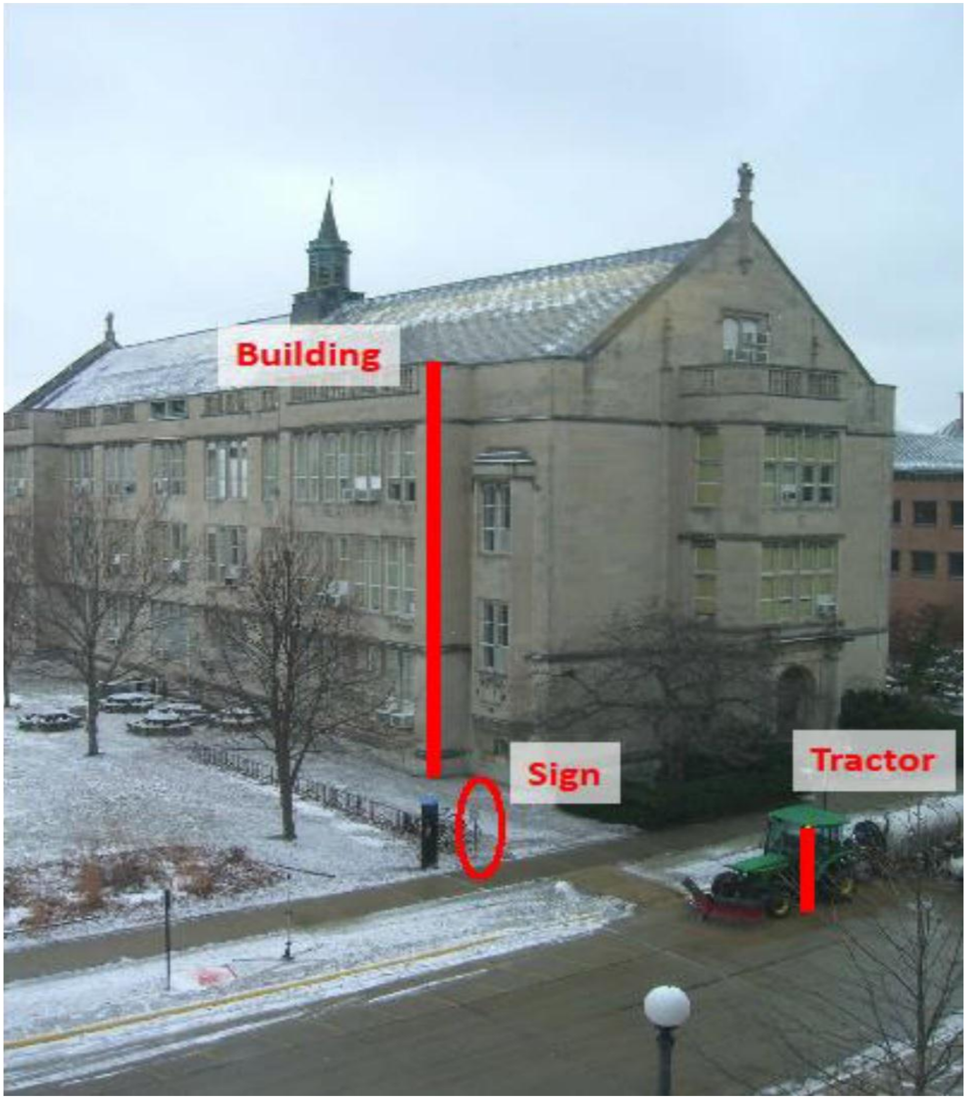
Release Date: 05-April-2018, Deadline: 19-April-2018 (5.00 pm)

1. Vanishing point detection

For the img1.jpg, shown above and also uploaded, estimate the positions (in the image plane) of the three major orthogonal vanishing points (VPs), corresponding to the building orientations. Use at least three manually selected lines to solve for each vanishing point.

- Plot the VPs and the lines used to estimate them on the image plane.
- Specify the VPs coordinate (u,v).
- Plot the ground horizon line (i.e. vanishing line) and specify its parameters in the form au + bv + c = 0. Normalize the parameters so that: a^2 + b^2 = 1.

2. Single-view metrology



For the img2.jpg, shown above and also uploaded, estimate the horizon (i.e. vanishing line) and draw/plot it on the image. Assume that the sign is 1.65 meter. Estimate the heights of the tractor, the building, and the camera (in meters).

- Turn in an illustration that shows the horizon line, and the lines and measurements used to estimate the heights of the building, tractor, and camera.
- Report the estimated heights of the building, tractor, and camera in meters.

3. Stitching Pairs of Images

The first step is to write code to stitch together a single pair of images. For this part, you will be working with the following ‘uttower_left.JPG’ and ‘uttower_right.JPG’ pair (also uploaded):


Steps:

a). Compute Sift key-points and descriptors for both images.

b). Compute distances between every descriptor in one image and every descriptor in the other image.

c). Select putative matches based on the matrix of pairwise descriptor distances obtained above. You can select all pairs whose descriptor distances are below a specified threshold, or select the top few hundred descriptor pairs with the smallest pairwise distances.

d). Run RANSAC to estimate a homography mapping one image onto the other. Report the number of inliers and the average residual for the inliers (squared distance between the point coordinates in one image and the transformed coordinates of the matching point in the other image). Also, display the locations of inlier matches in both images.

For RANSAC, a very simple implementation is sufficient. Use four matches to initialize the homography in each iteration. You should output a single transformation that gets the most inliers in the course of all the iterations. For the various RANSAC parameters (number of iterations, inlier threshold), play around with a few "reasonable" values and pick the ones that work best.

e). Warp one image onto the other using the estimated transformation.

f). Create a new image big enough to hold the panorama and composite the two images into it. You can composite by simply averaging the pixel values where the two images overlap.

Extra Credit

Extend your homography estimation to work on multiple images. Feel free to acquire your own images and stitch them.

- Implement bundle adjustment or global nonlinear optimization to simultaneously refine transformation parameters between all pairs of images.

- Learn about and experiment with image blending techniques and panorama mapping techniques (cylindrical or spherical).

Acknowledgments: This assignment is inspired from the Computer Vision courses by Derek Hoem and Svetlana Lazebnik, University of Illinois Urbana-Champaign.