Intro to Image Understanding (CSC420)

Assignment 3

Posted: Feb 22, 2018 **Submission Deadline : March 3, 11.59pm, 2018**

Instructions for submission: Please write a document (either pdf, doc, etc) with your solutions (include pictures where needed). Include your code inside the document.

Max points: 15, max extra credit points: 3

1. [**2 points**] Take an item for which you know the height (in cm). This could be yourself. Place the item next to or in front of the door. Take a picture of the door such that all four corners of the door are visible on the photo. Take this picture in an oblique view, ie, the door is not a perfect rectangle but rather a quadrilateral in the photo. Estimate the width and height of the door (in cm) from the picture.
2. [**4.5 points**] You are given a few photos of landscape. The goal is to take two photos, LANDSCAPE_1 and LANDSCAPE_2 and stitch them into one photo. You can do this by extracting SIFT features from both photos, match them, and estimate a homography of one photo to the other. Use RANSAC to find the best homography. Once you compute the homography, "stitch" the two photos together, forming a small panorama. You may use all code you have written for Assignment 2.
3. [**2 points**] You are given an image and disparity captured from a camera on top of a car (in a simulated environment). The file RGB.PNG is the RGB image captured by the camera and DISPARITY.PNG contains disparity values for each pixel. When you read the disparity file, please do:
   DISP=DOUBLE(IMREAD(DISPARITY.PNG))/256
   in order to get the disparity. The file BASELINE_AND_K has information about the baseline (in meters) and the internal camera matrix K.

   Compute the depth of every pixel, and visualize the 3D scene.
4. Attached is an image UM_000038.PNG recorded with a camera mounted on a car. The focal length of the camera is 721.5, and the principal point is $(609.6, 172.9)$. We know that the camera was attached to the car at a distance of 1.7 meters above ground.
   (a) [**0.5 points**] Write the internal camera parameter matrix K.
   (b) [**1 point**] Write the equation of the ground plane in camera's coordinate system. You can assume that the camera's image plane is orthogonal to the ground.

(c) **[2 points]** How would you compute the 3D location of a 2D point (x, y) in the image by assuming that the point lies on the ground? You can assume that the camera's image plane is orthogonal to the ground. No need to write code, math is fine.

5. **[Extra credit: 3 points]** Use all provided landscape images to create the panorama. Read about Poisson blending (http://eric-yuan.me/poisson-blending/) and use it to make your panorama look better.