MVG Assignment-1

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1 Instructions

- The goal of the assignment is to familiarize you to the process of camera calibration and transforms.
- You can use C/C++, Python or Matlab for this. However, you are expected to implement it yourselves and not use an existing implementation.
- Download the assignment related files from here: `https://iiitaphyd-my.sharepoint.com/:f:/g/personal/rahul_sajnani_research_iiit_ac_in/EnMWPgFtVuJJlUwBDJxUICkB6RH5vje2jEd_iPvI9QLStg?e=5Wzxs4`

2 Transforms

You are working on a self-driving car and the team has decided to fuse image data from a camera with distance measurements from a LiDAR (a laser scanner with a 360 field-of-view that records distance measurements) in order to associate every point in the image with accurate distance measurements. A LiDAR frame and its corresponding camera image have been provided to you as lidar-points.bin and image.png respectively. The camera calibration matrix, K, is provided inside K.txt.
The LiDAR's frame is defined such that its X-axis points forward, Y-axis points to the left, and its Z-axis points upwards. And the camera's frame is defined such that its Z-axis points forward, X-axis points to the right, and Y-axis points downwards. The camera's center is found to be (via extrinsic calibration) 8 cm below, 6 cm to the left, and 27 cm in front of the LiDAR's center (as measured from the LiDAR).

This is illustrated in the following image:

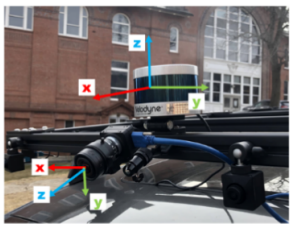

Figure 1: Frame illustration

Then, using this computed transformation and the provided camera calibration matrix, project the LiDAR's points onto the image plane and visualize it as shown below. The color code (colormap) corresponds to the depth of the points in the image (color is optional, but it helps in debugging). Use matplotlib or any equivalent library for plotting the points on the image. Code for loading the LiDAR points in Python is provided.

Figure 2: LIDAR points projected onto image and colored according to depth.

3 Direct Linear Transform

This assignment requires you to implement camera calibration technique. You are expected to do the following:

- Take an image from your device camera and perform Direct Linear Transform algorithm. **Note:** You will have to manually find 3D - 2D point correspondence.
- Implement the RANSAC based variant of the above calibration method and report your observations.
- Does the scale of the world points play any role in camera calibration (as in measuring the points in metres vs cms vs kms)? If so, why or why not?