ENG301 - Computer Vision

Assignment 2

Demonstration deadline: 26 April 2023
Report submission deadline: 11:59 pm, 28 April 2023

Note: This is an individual assignment. Each student needs to submit their own report.

Plagiarism note: *Students are free to discuss among the groups as well as learn from existing online codes. However, their programs should be written by themselves. If similarity is detected in their report or programs, heavy penalties will be applied.*

Theory

When setting up a simple stereo system, we observe that a point on one image plane can be found on the other image by searching along a horizontal line of the same vertical coordinate. This observation is then used to simplify the process of finding correspondences. In fact, this observation can be mathematically proved by using the essential matrix. Derive equations to prove the above statement. Specifically, you are given:

- A simple stereo system with two cameras put in parallel and at the same height. They have the same focal length f and baseline B.
- A point P in the real world and its projection $p_l = (u, v)$ on the left image.

You need to prove that the projection of point P on the right image lies on a horizontal line having the same vertical coordinate as p_l.

Programming

1. **Simple stereo**
- Using the cameras provided in class to make a simple stereo system.
- Write a program to compute the depth information from the stereo system. Export the depth map together with the color images to a point cloud file (.ply) that can be visualized using 3D software such as MeshLab.
- Write a program to use that depth information to detect the distance from the camera to the object. Generate a warning if the object is close to the camera, for example, < 50 cm.

2. **Uncalibrated stereo**

Write a program to generate the depth map from two images captured from a single camera at two different positions.