Photogrammetrics & Robot Vision
Exercises

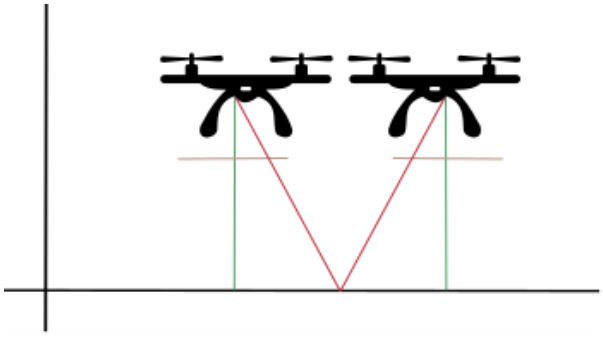
Contents

1 Context

Drones and aerial photography use for civil engineering purposes are increasing because of their low-cost compared to other documentation technologies.

In order to obtain a 3D model of the environment, the proposed system consists of the following elements:

- GPS and INS that provides the position and the orientation (POSE) of the drone in a NED coordinate system and angles *roll*, *pitch*, *heading*.
- A 3-axis gimbal that is fixed after the first setting of the payload orientation .
- A Camera with known calibration parameters that provides undistorted images.



2 Objectives

The objective of this practice is to obtain the relative orientation of two images that were corrected and undistorted as a base for target geolocation.

3 Methodology

3.1 Obtain correspondence points from undistorted images

We have to obtain points in the first and second images to solve the orientation. For this specific task you can use your preferred CV library to obtain the correspondent points from undistorted images

The alternatives are

1. Mark at least 8 point correspondences in both images
2. Compute interest points and use the descriptors to do a previous matching of the correspondence and select the best 8-10 matchings

3.2 Relative orientation

We assume that the camera calibration has been previously applied using a frame camera model and the correspondent points are correct.

Using ONLY numerical libraries, write a function that obtains the parameters for relative orientation, R'' and b and obtain the model coordinates of the points.

```
for each point in correspondent_points
    #define coplanarity constraints
     obtain the 3D coordinates of the points in the Camera
CS
     create ai with the coordinates of the observables to
obtain the equation matrix
Solve the system of equations obtaining the SVD of the
matrix A
#Apply restrictions of the essential matrix: non-zero
singular values are equal and the third is zero
Normalize U,V
Obtain 2 solutions for both R and b
check that the solution is in front of both cameras
return solution
```

3.3 Computing the coordinates of the 3D correspondent points

After obtaining the solution for Relative Orientation, the calculationof model 3D coordinates of the points is possible as the intersection of the perspective rays.

Define and implement a function to solve this triangulation.

4 Deliverables

The deliverables of the exercise are the python functions and scripts developed. The preferred format for the deliverable is a Jupyter Notebook.