COMP 4102A: Assignment 2 - Part 2

Posted: March 4,2020 Due by 23:59 Sunday, March 15

Instructions for submission: Please write a document (pdf or doc) with your solutions on theory questions. The helper codes are in C++. You should change them to a new version of the OpenCV (3+). Submit your results Part2a and Part2b with your solutions from Part1 of the assignment2. Include comments to code to make it easier to read by TAs. Please submit through cuLearn. You are expected to work on the assignment **individually**.

1 Panoramic image (25 points)

The goal of this question is to create a program that take as input three images that are related by a homography; a left (keble-a-half), middle (keble-b-long) and right image (keble-c-right), and creates a single panoramic image (same size as keble-b-long) as output. This is done by warping the left and right image "into" the middle image. The middle image has been made big enough to hold both the warped left and right image. Your program needs to find some features between the left and middle images, match these features to compute a homography, and use this homography to warp the left image into the middle image. Then this process is repeated for the right image relative to the middle image. The final output image will look like as three-images.jpg. You also need to combine the two warped images and the original center image in a way that makes sense so that the final image is visually correct, which means that it looks similar to my output image. I also have included a version of the Visual Studio OpenCVExample which has the proper library included for compiling and running the program find-obj.cpp (which has been copied into OpenCVExample.cpp). The reason for this is that the easiest way to answer the question is to modify this example program but still use the same basic idea; find surf features in all images, find matches between images and then compute the appropriate homographies.

Note: The provided codes are written in older version of the OpenCV. You should adapt it to the new version. Use codes as your guide. You can find the Surf library in xfeatures2d module. If you want to compile the provided code, it should be link with the library opencv-nonfree248.lib (or opencv-nonfree248d.lib).

Submit your code and result in a folder name assign2-Part2a.

2 Calibration (25 points)

The goal of the first questions is to implement some code that performs calibration using the method described in the book; by first computing a projection matrix, and then decomposing that matrix

to find the extrinsic and intrinsic camera parameters. I provided you a program that uses OpenCV, called assign2-projection-shell.cpp. This program takes ten given 3d points and projects them into a 2d image using the given camera calibration matrix, rotation matrix and translation vector. Your goal is to write the two routines that are missing, which are computeprojectionmatrix and decomposeprojectionmatrix. The first routine computes the projection matrix using the method described in Section 6.3.1 of the Trucco and Verri Book, and the second uses the method in Section 6.3.2 to decompose the projection matrix into a camera calibration matrix, rotation matrix and translation vector. It should be the case that the computed camera matrix, rotation matrix and translation vector are the same (or very similar) to the original versions that were used to create the projected points. This shows that your two routines are working properly.
Submit your program source and the resulting output in a file assign2-Part2b created by running this modified program.