CS 6384 Computer Vision Homework 1

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Download the homework1_programming.zip file from eLearning, Assignments, Homework 1. Finish the following programming problems and submit your scripts to eLearning. You can zip all the data and files for submission. TA will run your scripts to verify them.

Install the Python packages needed by

- pip install -r requirement.txt

Here are some useful resources:

- Python basics `https://pythonbasics.org/`
- Numpy `https://numpy.org/doc/stable/user/basics.html`
- OpenCV `https://docs.opencv.org/4.x/d6/d00/tutorial_py_root.html`

Problem 1

(4 points) 2D Transformations.

Implement the transform() function in image_transformations.py. The function takes an image and a 2D transformation T, a 3×3 matrix, as input, and outputs a transformed image according to the transformation T.

After your implementation, run the image_transformations.py in Python to verify it. Figure 1 shows an example of running the script.

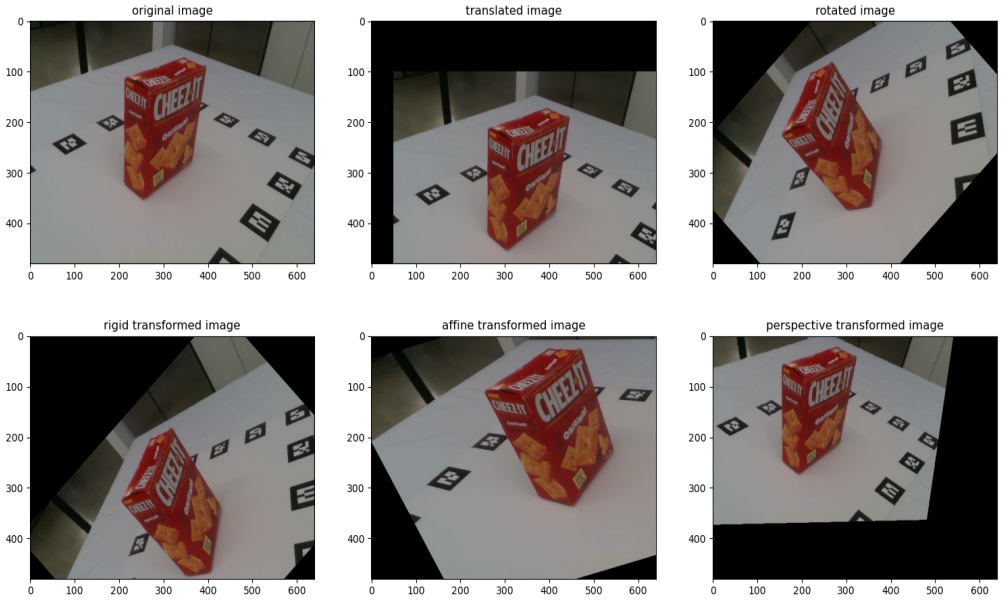

Figure 1: Image transformations.

Problem 2

(3 points) Backprojection.

Implement the backproject() function in backproject.py. The function takes a depth image with height H and width W, and a camera intrinsics matrix as input, and outputs a point cloud with shape $H \times W \times 3$ generated from the depth image.

After your implementation, run the backproject.py in Python to verify it. Figure 2 shows an example of running the script. It shows the 3D points on the cracker box.

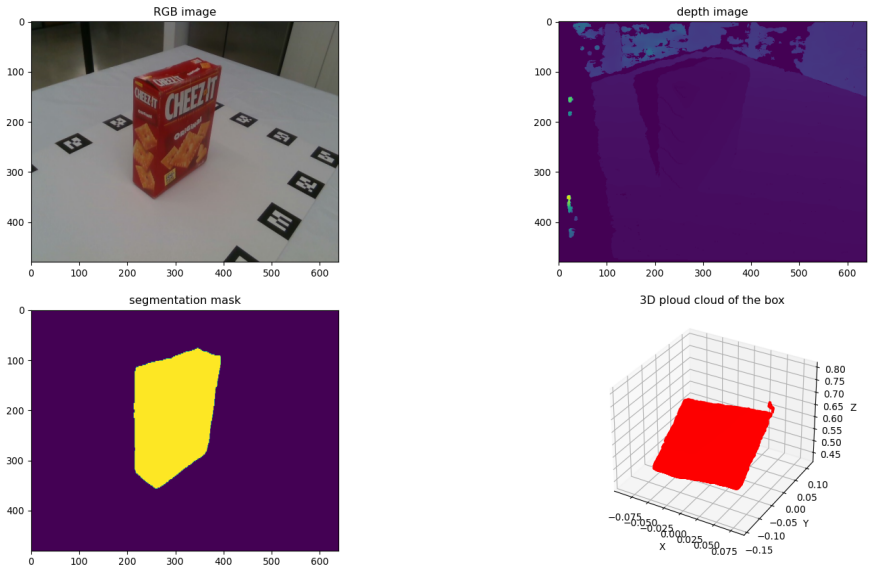

Figure 2: Backprojection.

Problem 3

(3 points) Correspondences.

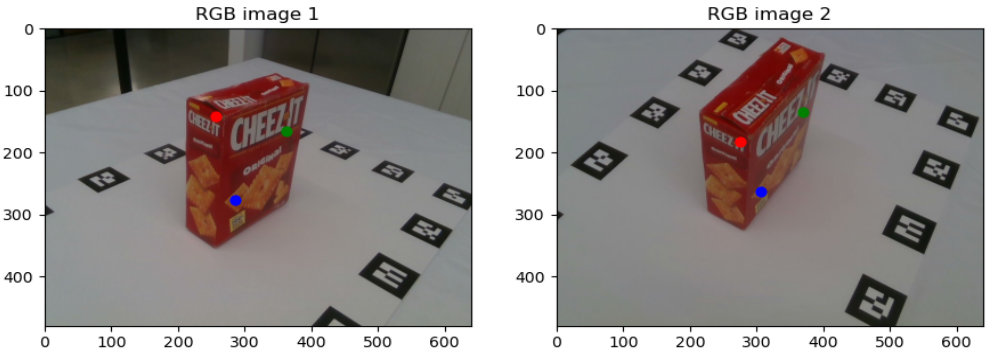

Figure 3: Correspondences

Implement the missing code in correspondences.py. This script finds the correspondences of pixels between two images using their camera parameters. You need to use the backproject() function in Problem 2.

After your implementation, run the correspondences.py in Python to verify it. Figure 3 shows an example of running the script. The 2D points with the same color correspond to each other.