Homework 4 - SfM

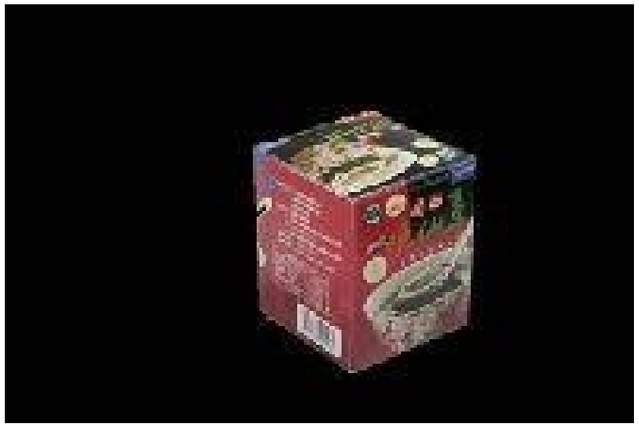
1. In this homework, you have to work on not only the given data but your own photos.

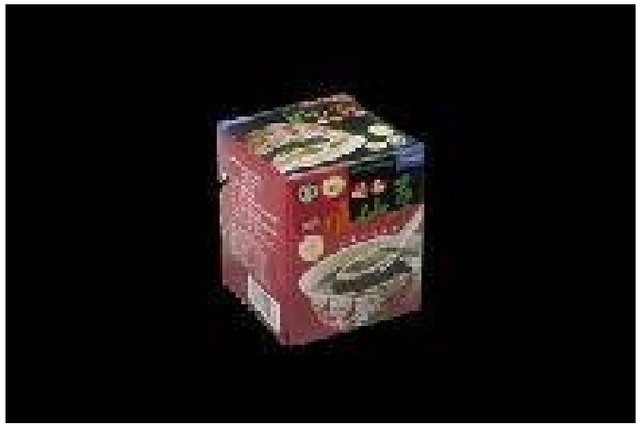
2. You are allowed to use any camera calibration related functions.

3. Deadline: **2024/12/07 23:59**

Homework 4 - SfM

Just to let you get initial experience on SfM



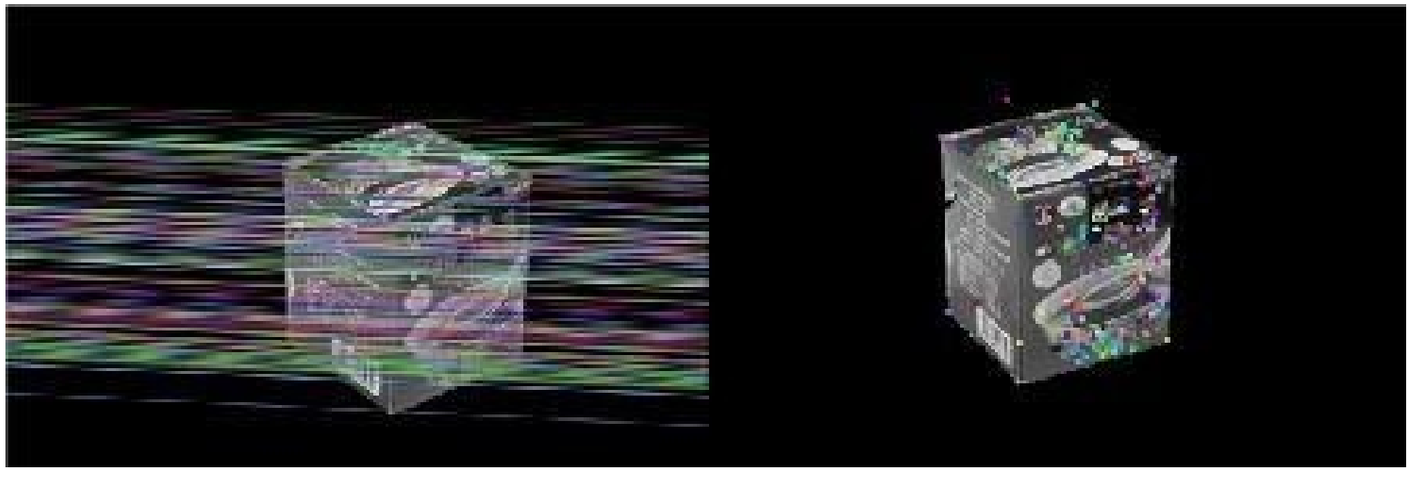


two images
know intrinsic matrix

$$K = \begin{bmatrix} 1.4219 & 0.0005 & 0.5092 \\ 0 & 1.4219 & 0.3802 \\ 0 & 0 & 0.0010 \end{bmatrix}$$

Steps

1. find out correspondence across images
2. estimate the fundamental matrix across images (normalized 8 points)
3. draw the interest points on you found in step.1 in one image and the corresponding epipolar lines in another



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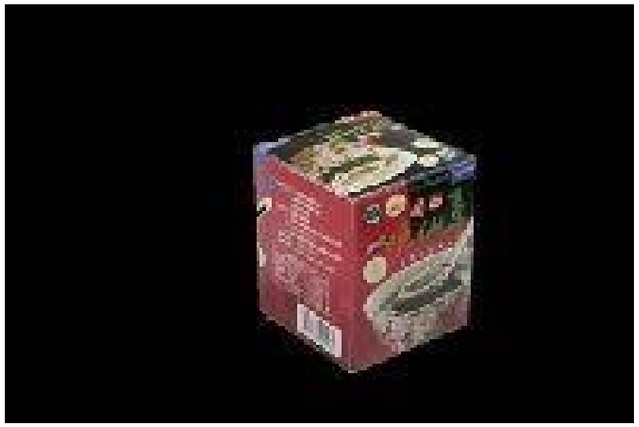

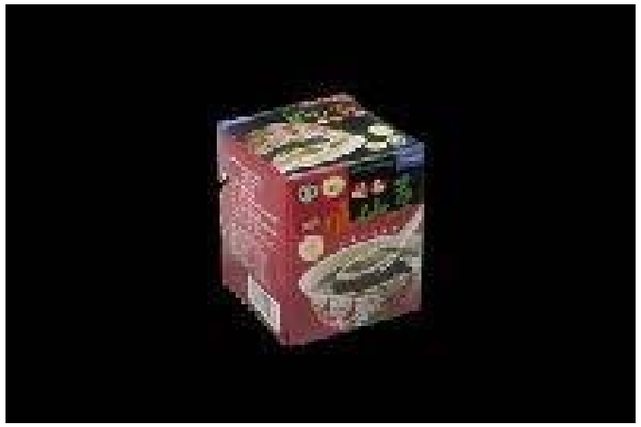

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4. get 4 possible solutions of essential matrix from fundamental matrix, hint:

```
[U,S,V] = svd(E);
m = (S(1,1)+S(2,2))/2;
E = U*[m,0,0;0,m,0;0,0,0]*V';
[U,S,V] = svd(E);
W = [0,-1,0;1,0,0;0,0,1];
```

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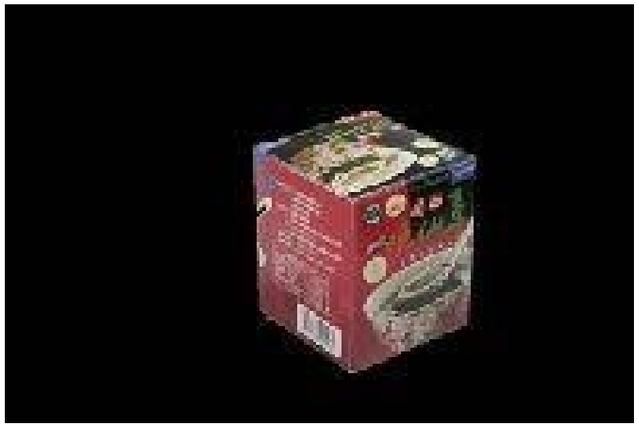

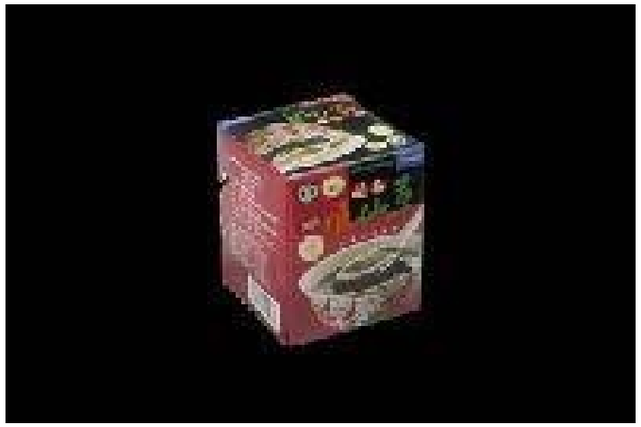

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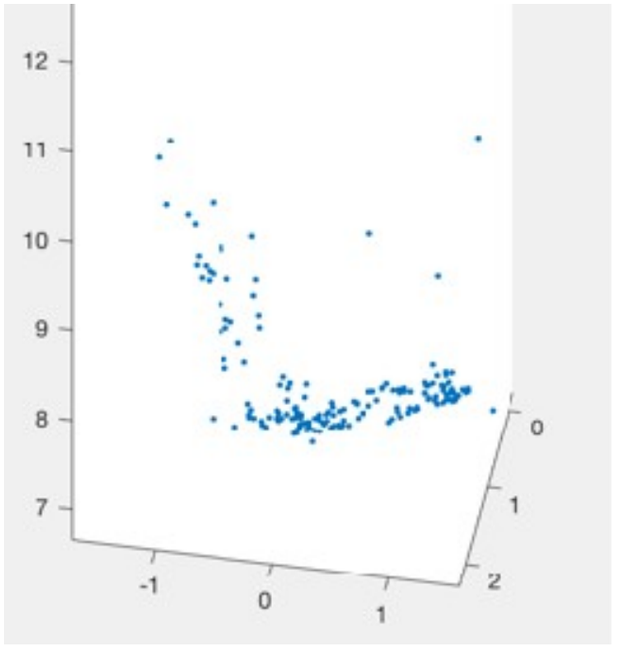
5. find out the most appropriate solution of essential matrix
6. apply triangulation to get 3D points



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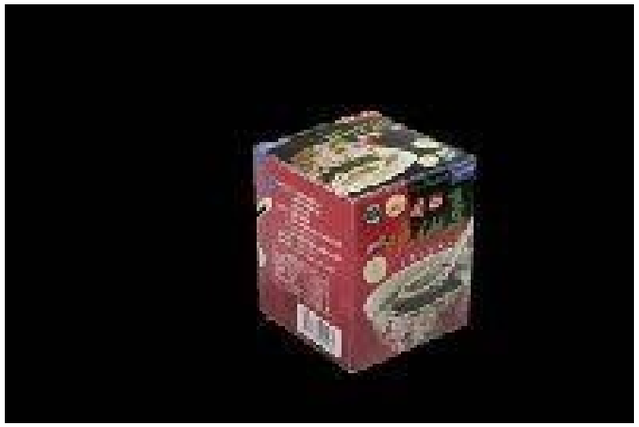

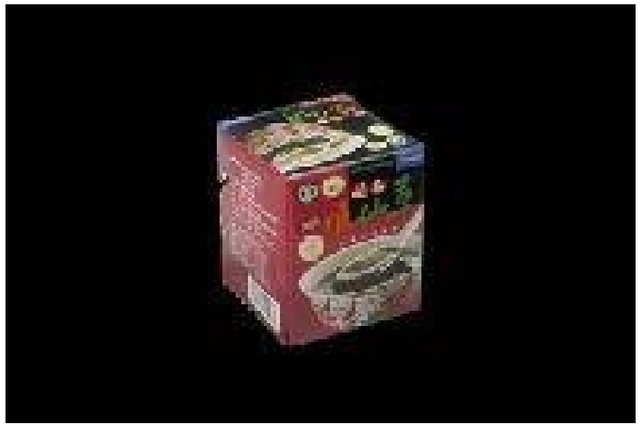

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6.apply triangulation to get 3D points

7.use texture mapping to get a 3D model(matlab code will be provided as reference. You can use your own code if you hate matlab. But we need to see the mesh plot)

Matlab function: obj_main(3dPoints, 2dPoints, CameraMatrix, 'Mesona1.JPG', 1);

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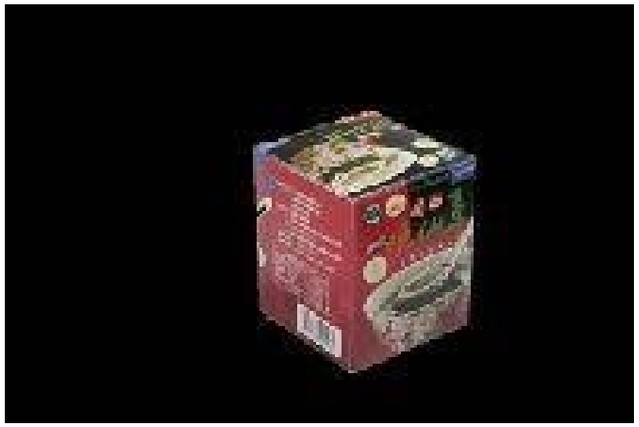

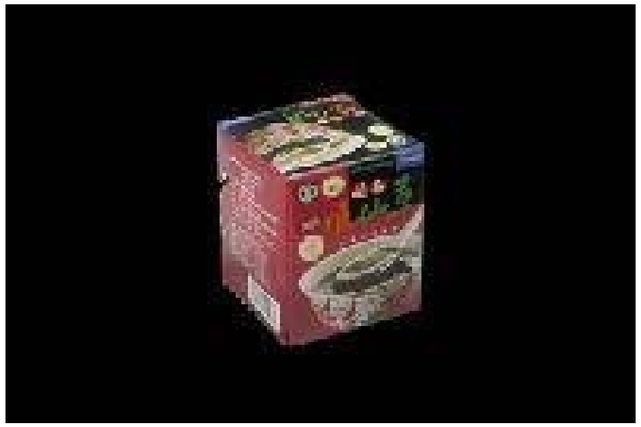

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7.use texture mapping to get a 3D model

8.Use 3d software like Blender to visualize the resulting 3D model(import .obj and .mtl files)

Homework 4 - SfM

two images
know intrinsic matrix
know extrinsic matrix

(extrinsic for your reference)

$$P = K [R, -RT]$$

Homework 4 - SfM

- For your own photos:
  - Take your own photos
  - Do calibration on your photos
  - Reconstruct 3D model

- For the given data:
  - Follow instructions in slide 2 to 6 to reconstruct 3D model.
  - Camera parameters are provided in *Statue_calib.txt, Mesona_calib.txt*

Submission:

- Hand in your Group[1]_HW[1]_report.pdf and Group[1]_HW[1]_code.zip on E3. (Please replace the numbers in [ ])

- Your report should be as detailed as possible, including:

➔ your introduction
➔ implementation procedure
➔ experimental results (of course you should also try your own images)
➔ discussion (what difficulties you have met? how you resolve them?)
➔ conclusion
➔ work assignment plan between team members.

- The report should be written in English.

Submission:

- The zip file should include:
  1. All the content of the original zip file
  2. Any additional code you may have
  3. The images used in the experiments (put under my_data/)
  4. Any output file you may have (put under output/)

  Note: please give a short description about the filenames in the report.

- Only one member in your team needs to upload the zip and report file. If there are multiple submissions, the last submission will be considered your final submission.

- Please submit your homework before the deadline!!!