

Computer Vision & Imaging/ Robot Vision - Formative task

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March 24, 2021

Part 1

This task is formative. Please submit your code as `username_formativetask2.m` and all graphs and figures produced as `username_formativetask2.pdf` see below the expected results of each question. To complete these tasks first load the data used by executing the following command which will create an image directory, the images loaded are shown below:

```
imageDir = fullfile(toolboxdir('vision'), 'visiondata', 'structureFromMotion');
```

The aim of this task is the calculate the relative positions of a camera to an object as it moves around said object given the images taken. You can assume that there is no in-plane rotation of the camera. Please remember to add comments to your code to explain your steps, this is good practice for coding beyond this course where it is standard practice.

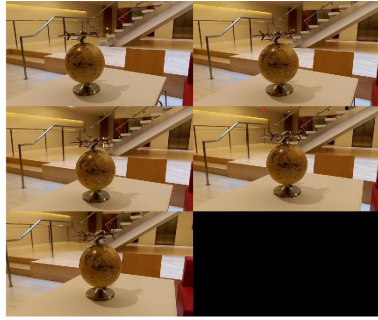
Question 1.1 *Read the `imageDir` and create an appropriate datastore of all the images in the directory, justify your choice of datastore type. Convert all the images to grayscale and display the resulting images.*

Question 1.2 *Load the camera parameters (`cameraParams.mat`) from `imagedir`. Open `cameraParams.mat`, you should now be able to see a number of parameters which you will need for the rest of the task*

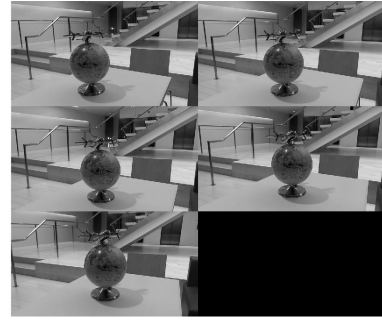
Question 1.3 *Extract key common features from the images and estimate the camera position relative to the previous image. These changes in position should then be related in a global coordinate system, use bundle adjustment to refine all points. If you get stuck the script `helperEstimateRelativePose` can be used to relate the relative positions.*

Question 1.4 *Plot the relative camera positions and 3-D features you have calculated, ensuring your graph is fully labelled and titled.*

Data courtesy of The Mathworks inc



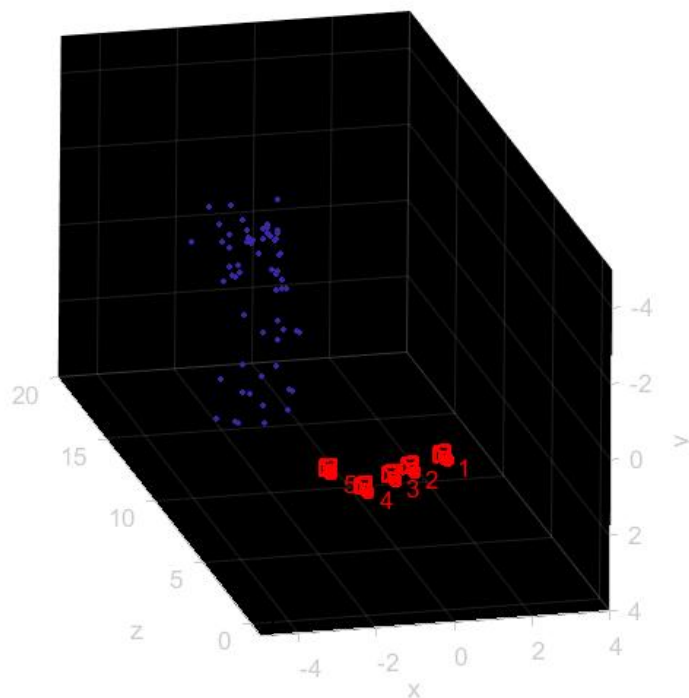
(a) Original image of part 1.



(b) Grayscale images from 1.1

Variables - data.cameraParams	
data.cameraParams	
data.cameraParams	
Property	Value
ImageSize	[720,1280]
RadialDistorti...	[0.1469,-0.2144]
TangentialDis...	[0,0]
WorldPoints	54x2 double
WorldUnits	'mm'
EstimateSkew	0
NumRadialDi...	2
EstimateTang...	0
TranslationVe...	140x3 double
ReprojectionE...	54x2x140 double
RotationVect...	140x3 double
NumPatterns	140
Intrinsics	1x1 cameraIntrin...
IntrinsicMatrix	[1.0376e+03,0,0;...
FocalLength	[1.0376e+03,1.04...
PrincipalPoint	[642.2316,387.83...
Skew	0
MeanReproje...	0.2972
ReprojectedP...	54x2x140 double
RotationMatri...	3x3x140 double

(c) Camera parameters loaded in 1.2



(d) Final plot of camera positions from 1.4