Lab 2: Camera Calibration

Due date: March 8, 2021

Prelab work:

- If you use webcam, make sure you have MATLAB support package for USB webcam installed.
- Read Lectures 8-9.

Part 1: Camera Calibration

In this part of the lab assignment, we use a MATLAB Application called Camera Calibrator to calculate the intrinsic and extrinsic matrices of your laptop camera.
1. Print the checkboard pattern in the zip file of this assignment.
2. Follow the instructions at: https://www.mathworks.com/help/vision/ug/single-camera-calibrator-app.html.

3. From the workspace open the variable cameraParams then open intrinsicMatrix parameter

Write down the values from your camera calibration session

$f =$

$C_x =$

$C_y =$

$S =$

4. Open translationVectors and record the readings for the first image

${}^{c}t_{x_{morg}} =$

${}^{c}t_{y_{morg}} =$

${}^{c}t_{z_{morg}} =$

5. Open rotationVectors and record the readings for the first image

${}^{c}_{m}\theta_x \ =$

${}^{c}_{m}\theta_y \ =$

${}^{c}_{m}\theta_z \ =$

Note: see the link below for more details on cameraParams
https://www.mathworks.com/help/vision/ref/cameraparameters.html

Part 2: Calculating Camera Pose Using Newton's Method

In this part, we will use the code provided in class in Lecture 9 to estimate the pose of the model with respect to the camera (${}_{m}^{c}H$) – We will do this for two poses: camera1 and camera2

1. You can use either the two pictures provided in the zip file or your own camera to take two pictures from a similar cube.
2. Copy the files pose3D.m and fproject.m from the assignment zip file to your MATLAB working folder and fill in the missing parts – do this for the first picture.

- To obtain the 2D image coordinates in the first picture, you can open the image using imtool and then find the points x,y coordinates manually. Then use the 3D coordinates only from the file 3D-2D.pdf
- If you use the pictures provided in the zip file then use the coordinates provided in the file called 3D-2D.pdf

3. Run the script in pose3D.m and make sure that the points converge correctly – This will validate your solution.
4. Record the final values of the model pose with respect to camera1:

${}_{m}^{c1}\theta_x$ =

${}_{m}^{c1}\theta_y$ =

${}_{m}^{c1}\theta_z$ =

${}^{c1}t_{x_{morg}}$ =

${}^{c1}t_{y_{morg}}$ =

${}^{c1}t_{z_{morg}}$ =

5. Repeat the same steps for picture 2 and record the model pose with respect to camera 2.

${}_{m}^{c2}\theta_x$ =

${}_{m}^{c2}\theta_y$ =

${}_{m}^{c2}\theta_z$ =

${}^{c2}t_{x_{morg}}$ =

${}^{c2}t_{y_{morg}}$ =

${}^{c2}t_{z_{morg}}$ =