Open your mind. LUT.
Lappeenranta University of Technology

LUT Engineering Science
Computational Engineering and Technical Physics
Arto Kaarna
Spring term 2017

BM40A0901 Computer Vision
Exercise 1, January 12, 2017.
Introduction, Matlab, frames.

Practical arrangements of the exercises were discussed during the first lecture. This first exercise session is just an introduction to Matlab. The same (or similar) tutorial tasks have been used in other courses (e.g. Machine Vision and Digital Image Analysis). Check the attached *matlabintro*, and if you feel comfortable you can handle such Matlab-tasks on your own, you can freely exercise Matlab on your own. However, this session is very important, if you do not know Matlab (and of course, you are welcome into a repetition even if you do).

1. Image processing with Matlab. (no points awarded)

   (a) Familiarize yourself with Matlab by going through the Matlab tutorial provided along with the exercise tasks. In addition, you can go through other tutorials (links to some can be found on the Moodle).

   (b) After the basics, make sure that you know at least the following image and graphics related commands (see Matlab help if necessary):

   `imread, imshow, imwrite, plot, plot3`

   and complete the following tasks:

   a) download a PNG image `lenastd.png` provided with the exercises.
   b) read it in Matlab.
   c) show the original image (using Image processing toolbox).
   d) store the image in DCT/JPEG format.

   (c) Some historic information can be found from Wikipedia -> Robot Hall of Fame at
   `http://en.wikipedia.org/wiki/Robot_Hall_of_Fame`. Go through the inductees, i.e., the robots in the hall of fame.

   You may also visit NASA collection of robot competitions at
   `http://robotics.nasa.gov/events/competitions.php`

   What uses there are for robots? What are the differences between real and fictional robots? In which applications could visual sensing be useful or even necessary?

2. Drawing in 3-D using Matlab (1 point)

   Write a Matlab function `drawtransf(T)` that plots the coordinate system (a frame) given as a homogeneous matrix. Unit length axes should be plotted, starting from the origin of the coordinate system. X-axis should be colored in red, Y-axis in green, and Z-axis in blue. Drawing of each axis can be done with `plot3`.

Then use your function to plot the world frame W, and a camera frame C, both given as two homogeneous matrices

$$ {}^{W}T_{W} = \begin{pmatrix} 1 & 0 & 0 & 0 \\ 0 & 1 & 0 & 0 \\ 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & 1 \end{pmatrix} \qquad {}^{W}T_{C} = \begin{pmatrix} -0.866 & -0.500 & 0.000 & 2.0 \\ -0.500 & 0.866 & 0.000 & -1.0 \\ 0.000 & 0.000 & -1.000 & 3.0 \\ 0 & 0 & 0 & 1 \end{pmatrix} $$

Use `hold on` to plot both frames in the same figure without erasing the previous. Use `axis equal` to have the same scaling along all axes.

Define a new frame ${}^{W}R_{C}$, the robot frame, as a homogeneous matrix and also plot that in the same figure.