CS268: MACHINE PERCEPTION

Lab 1

Due according to schedule on website

This assignment is meant for you to familiarize with the programming environment. We will assume by default that you have Matlab available. This is the case if you are using a CS department account or the computers on the SEASnet. Student licenses for Matlab are available at the student store if you want to have the software for home use. If you prefer to use other software, or to write your code in C/C++, that is acceptable as long as your code performs equivalent functions.

- Familiarize yourself with Matlab. If you do not have access to Matlab or wish to use other software, you are free to do so, as long as you produce software that performs equivalent functions.
- Download the primitives `rodrigues.m` and `skew3.m`.
- Test the conversion between rotation matrices R and rotation vectors ω, and between real vectors ω and their corresponding skew-symmetric matrices $\widehat{\omega}$.
- What happens when $\omega = 0$? Can you perform a sensitivity analysis of the algorithm described in `rodrigues.m` around the point $\omega = 0$?
- Familiarize yourself with the primitives that your sofware has available to upload images. In Matlab, check out the function `imread.m` (help imread). Visualize an image as an array of numbers, as a mesh, and as a contour plot.
- Write a routine that will convert a pixel location (i, j), which is the position of the pixel in an orthonormal reference frame with origin on the top-left corner of the image, with units equal to the length of the pixel along the coordinate axes, to the position (x, y) in a reference frame centered in the center of the image, with x along the horizontal axis, and y along a vertical axis. Use your knowledge of rigid motions as changes of coordinates to write this software. Measure the size of your images in millimeters as it is displayed on the screen of your computer to determine the units (x and y are expressed in millimeters). How does everything we have talked about in class transfer to rigid motions in $\Re^2$? (what are the twists? what are the exponential coordinates?).

- Turn in via email to the instructor your routine, with the following syntax `[x,y] = pxl_to_cart(i,j,I);`, where I is a raster or JPG image. Make sure your code works with images of different dimension. This is the only thing you have to turn in. Do not turn in discussions or reports on the previous items.

While this assignment can be easily completed by elementary trigonometry, please make an effort to use the notation and the knowledge acquired in class. Feel free to discuss the assignment with your fellow students, and to develop solution in collaboration. Collaborative assignments must indicate clearly the name of each contributor.