

Sensors and Control for Mechatronics Systems

Tutorial 3

Convolution and RGB-D Cameras

Convolution

1. Write a Matlab function that takes a Greyscale image and a kernel as input and output the convolution between the image and the kernel.
2. Using the appropriate kernels introduced in the lecture,
 - i. Sharpen the *Sydney_Harbour_Bridge_from_Circular_Quay.jpg* image
 - ii. Detect edges on *SydneyOperaHouse.jpg* image
- iii. Apply a Gaussian blur to *Ultrasound.png* image

ROS USB_CAM Node

Setup ROS `usb_cam` node.

1 : Your laptops should have ROS installed in the Ubuntu environment. Create a ROS workspace by following the 3rd step of the ROS tutorial “Installing and Configuring Your ROS Environment”.

Link : <http://wiki.ros.org/ROS/Tutorials/InstallingandConfiguringROSEnvironment>

2 : Checkout ROS `usb_cam` package to your Catkin Workspace from the source.

Link : https://github.com/ros-drivers/usb_cam

3 Build the `usb_cam` package using `catkin_make`

4 Launch the `usb_cam` package using `roslaunch usb_cam usb_cam-test`. You should be able to see the laptop's web camera image stream from the

5 List down the ROS topics available using `rostopic list`

6 Save images from the camera using `roslaunch image_view image_saver image:=<The raw image topic>`

7 Explore the parameters listed down in the ROS wiki page of `usb_cam`. Change the brightness, contrast, saturation and sharpness parameters in the launch file and observe the effects. You can save images with different settings for comparison. Link : http://wiki.ros.org/usb_cam

RGB-D Cameras with ROS

Step 1 :

Download the rosbag provided. Play it using `roslaunch play -l <bag name>` (You need to have a roscore running).

Step 2 :

Use *rostopic list* command to see available topics. Use *rostopic info <topic name>* to obtain more information about each interesting topic. Identify and list down the ROS topics for depth and RGB images.

Use *rosbag info <bag name>* to observe the data stored in the bag file.

Use *rostopic echo -n1 <topic name>* to view a message published to that topic.

Step 3 :

Use *roslaunch image_view image_view image:=<topic name>* to view the depth and RGB images.

Step 4 :

The depth image and the RGB image are published separately to two topics. Discuss how an RGB-D image can be obtained from those two images.

Step 5 :

Launch Rviz, a visualization tool, using *roslaunch rviz rviz*.

Set *Global Options* → *Fixed Frame* to *camera_depth_frame*. Add a camera view using the GUI. Set the topic to RGB and Depth image topics and visualize the images.

Step 6 :

Set *Global Options* → *Fixed Frame* to *camera_depth_optical_frame*. Add a PointCloud2 display with topic */camera/depth/points* and observe the unregistered point cloud from IR cameras.