ARO

Deep Learning Lab #2

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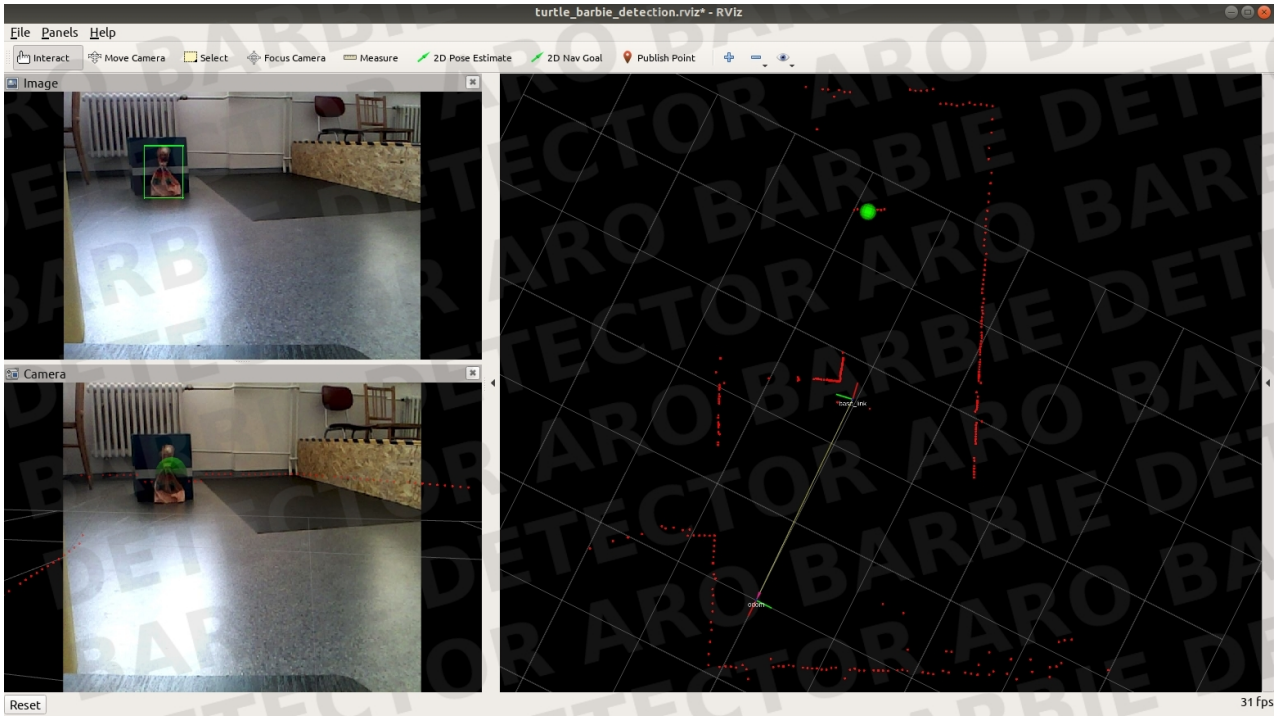
Goal

- We will prepare the barbie detection pipeline



Before start

You already should have the detector weights from previous homework

Download detector package from lab website and paste it in your workspace

- Ideally on remote computers (the semestral work will be evaluated on them as well)
- How to work on them: https://cw.fel.cvut.cz/b202/courses/aro/tutorials/remote_access

Detection package

- Download the package form lab website
- Add the network.py from your last homework to the package in folder scripts
- Add the package in you workspace
  - We suggest you to do that on remote lab computers
- Set the path to your weights in launch/detector_bagfile.launch
- Set the detector threshold in launch/detector_bagfile.launch

Usage – 4 basic steps

singularity shell --bind /opt/barbie /opt/singularity/robolab/melodic

- Bind gives you access to bagfile saved on lab computers in folder */opt/barbie*

source */opt/torchenv/bin/activate*

- *Allows you to use pytorch*

source your_ws/devel/setup.bash

- *Your workspace should extend* /opt/aro/ros

export ROS_MASTER_URI="http://localhost:12345"

- *Where 12345 is your chosen port*
- *You can list all occupied ports by “netstat -ntl”*

Please try to run it now

- Run detector node using command
  roslaunch barbie_detection detector_bagfile.launch

- Play bagfile
  rosbag play /opt/barbie/2019-03-30-12-42-27.bag --clock

TO DO LIST

- Find the best detection trade of between false positive and and false negative
  - Retrain the network if your weights is not good enough

- Get position of the barbie from laser
  - We know the vector where the barbie is but we do not know the depth

How to get position

- Transform laser poincloud from laser frame to camera frame
- Filter points that are behind camera
- Transform points from camera frame to image frame
- Filter points that are not in the field of view of camera
- Look what depths are inside the detected bbox and estimate the depth of detected barbie
- Project the center of detection bbox into the the camera frame using the estimated depth
- Transform the projected point from camera frame to map frame

How to transform points from one frame to second frame

- Use the function lookup transform which will give you the transformation between two frames
- This example will give you transformation FROM CAMERA TO LASER:

  transform = self.tf_buffer.lookup_transform(laser_data.header.frame_id, image_data.header.frame_id, image_data.header.stamp, timeout=rospy.Duration(2.0))

- Use try-except statement for lookup_transform

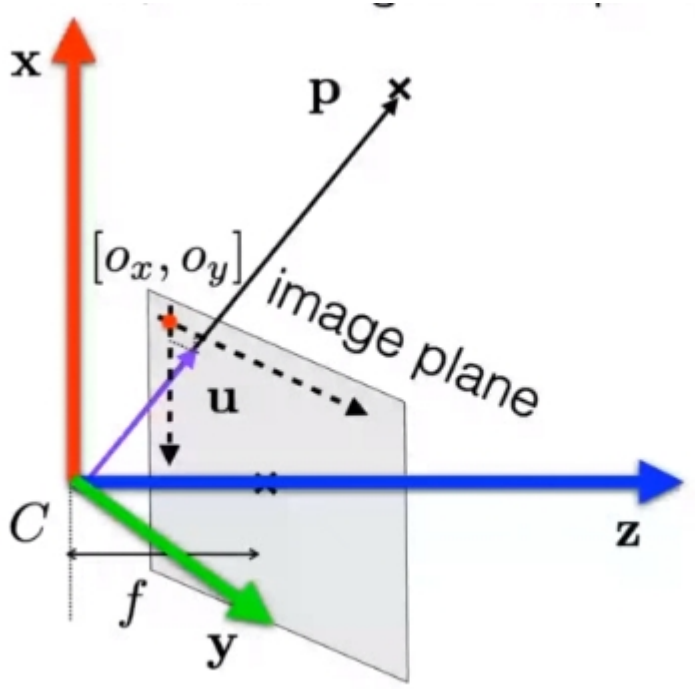
- You can easily get the transformation matrix using the ros_numpy function

  T = ros_numpy.numpify(transform.transform)

- Then you can transform the points using the homogenous coordinates

Transformation between camera frame and image plane

- Look in the second lecture if you need more details



$$\lambda \bar{\mathbf{u}} = \mathbf{K}\mathbf{p}$$

HOMEWORK

- Implement the missing part of the detector.py that will estimate 3d position of the detected barbie using laser

- Record video of rviz window showing how detector perform while replaying rosbag 2019-03-30-12-42-27.bag

  To get all the points there should be barbie detected from different distances, correctly projected in 3d and no false positives

- Upload all the codes and video in brute.

  In case the video will be too big to upload, attach the video.txt file with the link