

# RoboCup@Home Education

## ONLINE CHALLENGE 2020

### Online Classroom Open Platform

## 04 Robot Visual Perception (2/2) : Image Processing

Jeffrey Tan, Jupiter Robot | 2020.05.07

# Online Challenge 2020: Online Classroom OP

## 04 Robot Visual Perception (1/2) : RGB-D Sensing

Speakers: Jeffrey Tan, Jupiter Robot

Time: **May 07, 2020 (Thu) 10:00 - 11:00 am (GMT+8)**

## 04 Robot Visual Perception (2/2) : Image Processing

Speakers: Jeffrey Tan, Jupiter Robot

Time: **May 07, 2020 (Thu) 11:00 - 12:00 noon (GMT+8)**

Zoom: <https://cernet.zoom.com.cn/j/64488547874> | PW: robocup

Facebook Live: <https://www.facebook.com/robocupathomeedu/live/>

Web:  
<https://www.robocupathomeedu.org/challenges/robocuphome-education-online-challenge-2020>

Online Classroom:  
<https://www.robocupathomeedu.org/learn/online-classroom/online-challenge-2020>

\*\* Privacy reminder: Video will be recorded and published online.

# Take Photo

## Take Photo

- Bring up
  - [Astra] \$ roslaunch astra\_launch astra.launch
  - [Kinect] \$ roslaunch freenect\_launch freenect-registered-xyzrgb.launch
  - [USB Camera] \$ roslaunch usb\_cam usb\_cam-test.launch
  - [Multiple Astra] \$ roslaunch rchomeedu\_vision multi\_astra.launch
- \$ rosrn rchomeedu\_vision take\_photo.py
- \$ rosrn rchomeedu\_vision take\_photo\_sub.py
  - \$ rostopic pub -1 /take\_photo std\_msgs/String "take photo"

\* Image topic = "/camera\_top/rgb/image\_raw" [Multiple Astra] (edit code according to the camera used)

\* Photo taken is saved in the current folder

# CamShift Object Tracking

## OpenCV CamShift filter

- Bring up
  - [Astra] \$ roslaunch astra\_launch astra.launch
  - [Kinect] \$ roslaunch freenect\_launch freenect-registered-xyzrgb.launch
  - [USB Camera] \$ roslaunch usb\_cam usb\_cam-test.launch
  - [Multiple Astra] \$ roslaunch rchomeedu\_vision multi\_astra.launch
- Image topic
  - [USB Camera] image:=/usb\_cam/image\_raw
- Launch node:
  - \$ roslaunch opencv\_apps camshift.launch image:=/usb\_cam/image\_raw

# People/Face Detection and Recognition

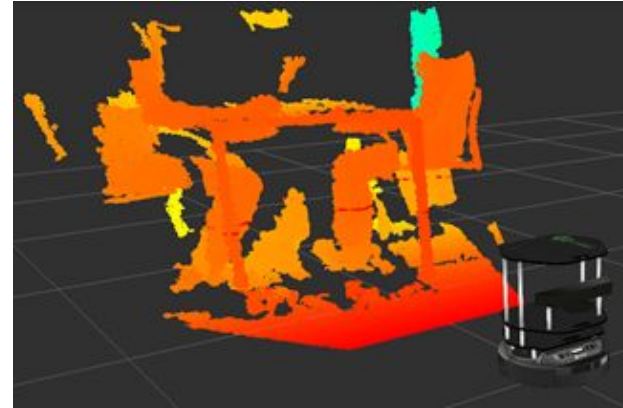
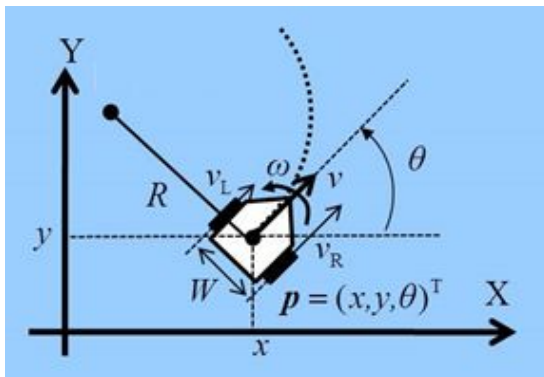
- Bring up
  - [Astra] \$ roslaunch astra\_launch astra.launch
  - [Kinect] \$ roslaunch freenect\_launch freenect-registered-xyzrgb.launch
  - [USB Camera] \$ roslaunch usb\_cam usb\_cam-test.launch
  - [Multiple Astra] \$ roslaunch rchomeedu\_vision multi\_astra.launch
- Image topic
  - [USB Camera] image:=/usb\_cam/image\_raw
- Face Detection using Cascade Classifier
  - \$ roslaunch opencv\_apps face\_detection.launch image:=/usb\_cam/image\_raw
- Face Recognition
  - \$ roslaunch opencv\_apps face\_recognition.launch image:=/usb\_cam/image\_raw
- People Detection using Histogram of Oriented Gradients (HOG)
  - \$ roslaunch opencv\_apps people\_detect.launch image:=/usb\_cam/image\_raw

# People Tracking (Follow Me)



# People Tracking (Follow Me)

- Parallel Two-Wheel Vehicle (Mobile Robot)



Data Point Cloud

- Vehicle Following Control

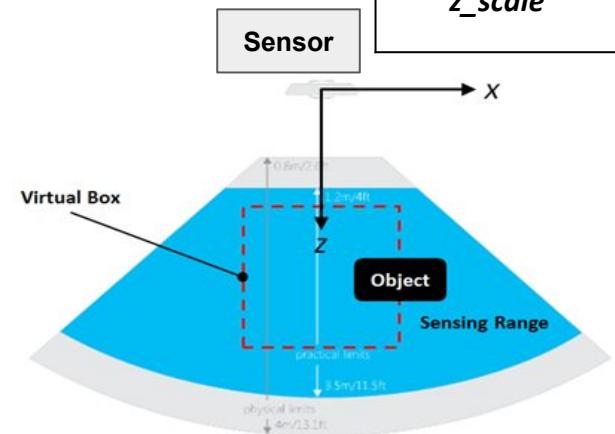
$$\text{-- Lateral, } X_{centroid} = \frac{\sum_{i=1}^n x_i}{n}$$

$$\text{-- Longitudinal, } Z_{centroid} = \frac{\sum_{i=1}^n z_i}{n}$$

$$\text{-- Rotation, } \omega_{PMV} = -X_{centroid} \times x\_scale$$

$$\text{-- Speed, } v_{PMV} = (Z_{centroid} - goal\_z) \times z\_scale$$

Parameter
<i>min_y</i>
<i>max_y</i>
<i>min_x</i>
<i>max_x</i>
<i>max_z</i>
<i>goal_z</i>
<i>x_scale</i>
<i>z_scale</i>



# People Tracking (Follow Me)

- TurtleBot Follower Demo
  - [http://wiki.ros.org/turtlebot\\_follower/Tutorials/Demo](http://wiki.ros.org/turtlebot_follower/Tutorials/Demo)
- Bring up
  - `$ roslaunch turtlebot_bringup minimal.launch`
- Launch node
  - `$ roslaunch turtlebot_follower follower.launch`
- Changing Follower Parameters
  - `$ rosrn rqt_reconfigure rqt_reconfigure`
- Follower start/stop service control
  - `$ rosrn rchomeedu_follower follower_control.py`

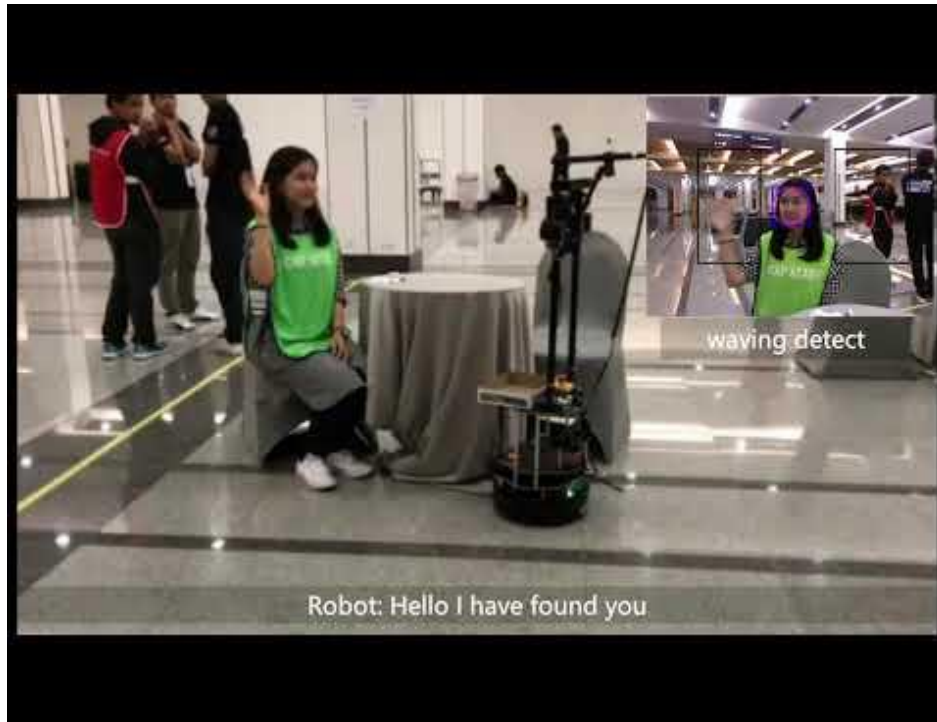


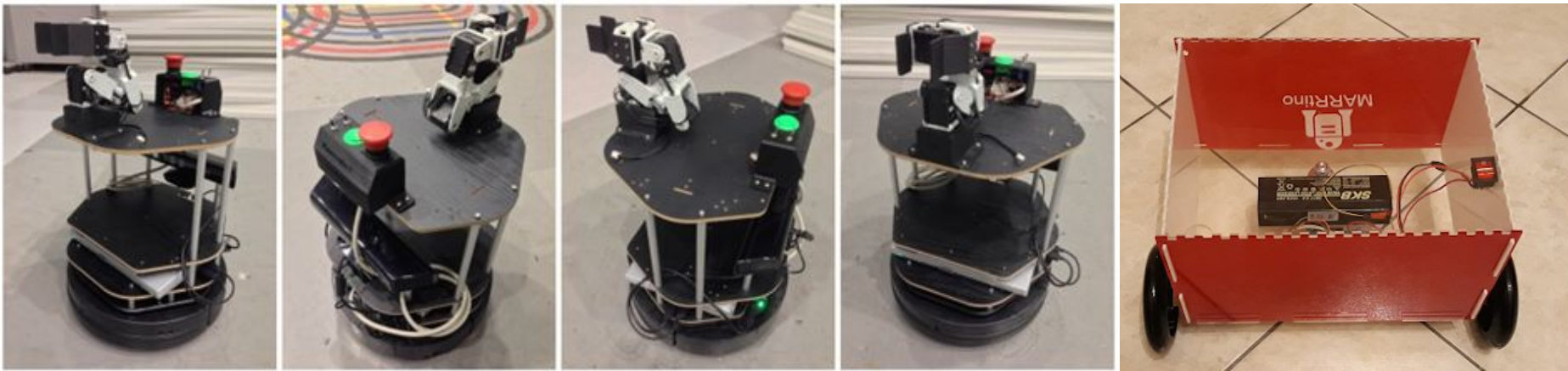
# Assignment

1. Combine **speech interaction** and **visual perception** to develop an interactive robot vision application
  - a. Design and develop robot vision application using human/object detection/tracking with speech interface.
2. Upload to GitHub
  - a. Create own repository and upload the source code, system design, and visual+speech interaction video (with terminal results) to GitHub.

# More Robot Visual Perception Classes

- Image processing applications by OpenCV
- Human pose and gesture recognition
- Deep learning based object detection
- Vision based manipulation





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Web: <https://www.robocupathomeedu.org/challenges/robocuphome-education-online-challenge-2020>

Online Classroom: <https://www.robocupathomeedu.org/learn/online-classroom/online-challenge-2020>

Online Entry Form: <https://forms.gle/UBREeC1xTCVQ9wr78>

Online Entry Form (backup): <https://www.wjx.cn/jq/72082120.aspx>

Contact: [oc@robocupathomeedu.org](mailto:oc@robocupathomeedu.org)

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**EDUCATION**

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