Cognitive Systems
Practical Exercises – Computer Vision

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Outline

- Co-ordinate Frames
- Camera Calibration
  - Intrinsics, Extrinsics
  - MATLAB Demo
- Object Detection
  - Color based
Demonstrator Overview

Gripper Bot

- Robot Motion
- Grasping

=> Pick and Place Task

Resources

- 3DOF Robot
- Gripper
- Table with work pieces
Demonstrator Overview

Cam Bot
- Object Detection
- Robot Motion

Resources
- 3DOF Robot
- Calibrated Monocular Camera
Preparation

Requirements

• Group work

• Min 1 C++/Java GURU per group :-)

• Virtual box installation - [https://www.virtualbox.org](https://www.virtualbox.org) or (native Ubuntu 12.04)

• ROS Hydro installation

• Packages camera and object_detector working
**ROS Package**

**camera**

- **Function:** Grabbing images from camera and publishing them
- **Interface**
  - ROS Topic: /camera/image
  - ROS Service: /camers_srvs/CameraInfo
- **Message:**
  - sensor_msgs/Image
  - device_msgs/CameraCalibData
ROS Package

object_detector

- Function: Detects 3D position of workpieces on the table wrt reference frame
- Interface: ROS Topic /object_detector/objects_data
- Msg: /actor_msgs/ActorVec
  - ActorVec: array of message actor_msg/Actor
Object Detection

- Color-based segmentation
  - RGB to HSV conversion
  - Thresholding
- Noise suppression
  - Morphological operations: erosion, dilation
- Contour Detection
  - Suppression of small, non-circle contours
Object Detection

- Color-based segmentation
  - RGB to HSV conversion
  - Thresholding
Object Detection

- Noise suppression
  - Morphological operations

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Object Detection

- Contour Detection
  - Suppression of small contours
  - Removing non-circle contours
Co-ordinate Frames

- camerobot_base_frame
- camerobot_ef_frame
- camera_frame

- gripperbot_base_frame
- gripperbot_wrist_frame
- gripperbot_gripper_frame
Exercise 1 – World Model

• Maintains the state of the system and the actors/objects
• Publishes poses of objects/actors as tf
  • e.g. obtain the pose of the green_ball in the gripperbot_base_frame
    – Pose of camerobot_ef
    – Extrinsic calibration of camera w.r.t camerobot_ef
    – Pose of green_ball w.r.t camera_frame

• See http://wiki.ros.org/tf/Tutorials

• See http://wiki.ros.org/ROS/Tutorials/WritingServiceClient(c%2B%2B)

• See http://wiki.ros.org/ROS/Tutorials/CreatingPackage
LIVE DEMO?