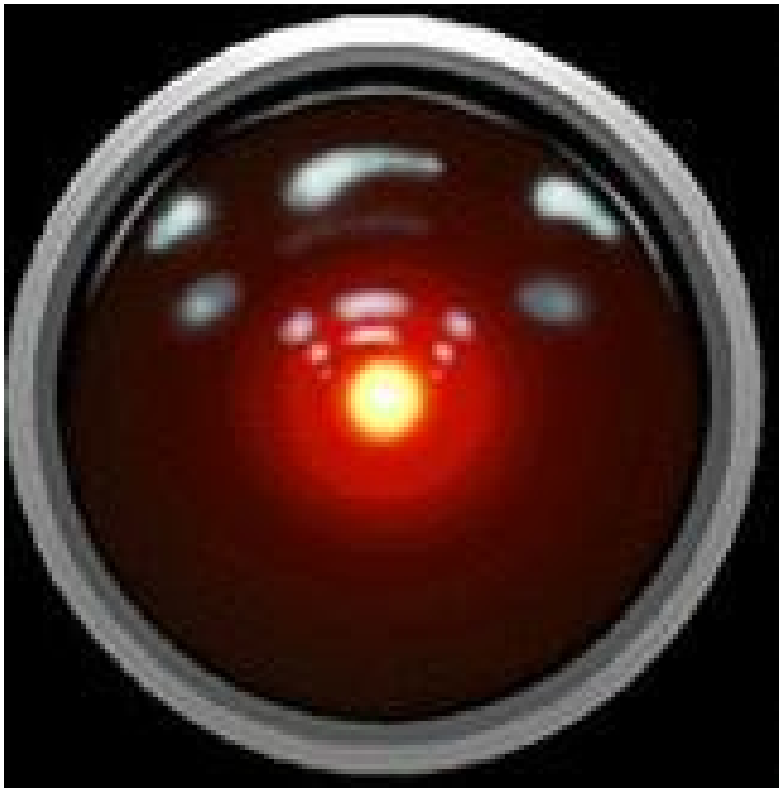


CS 378: Autonomous Intelligent Robotics

Instructor: Jivko Sinapov

http://www.cs.utexas.edu/~jsinapov/teaching/cs378/

Announcements

FRI Summer Research Fellowships:

https://cns.utexas.edu/fri/beyond-the-freshman-lab/fellowships

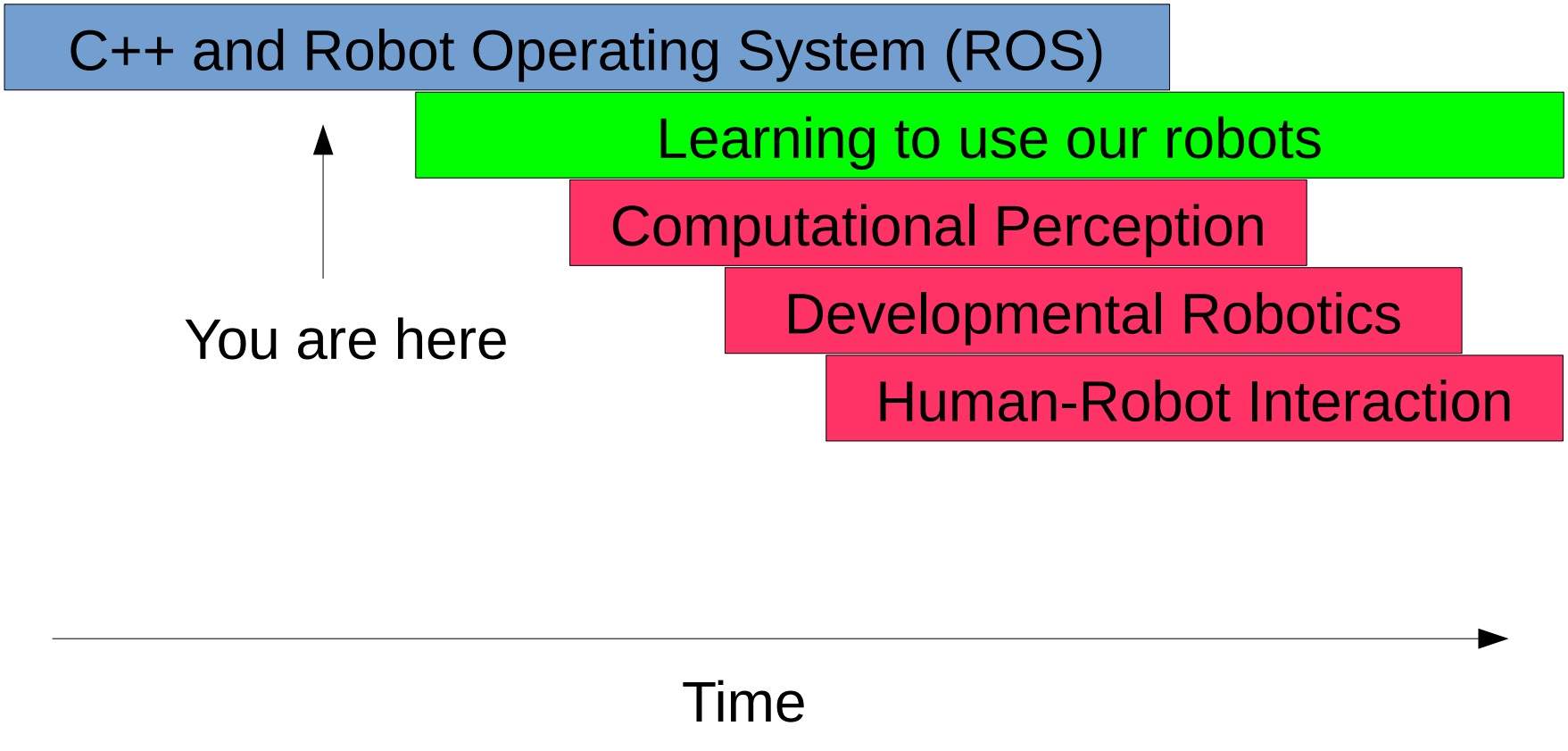
Applications are due March 1st but apply now!

Funding is available for 4-5 students per FRI stream

Announcements

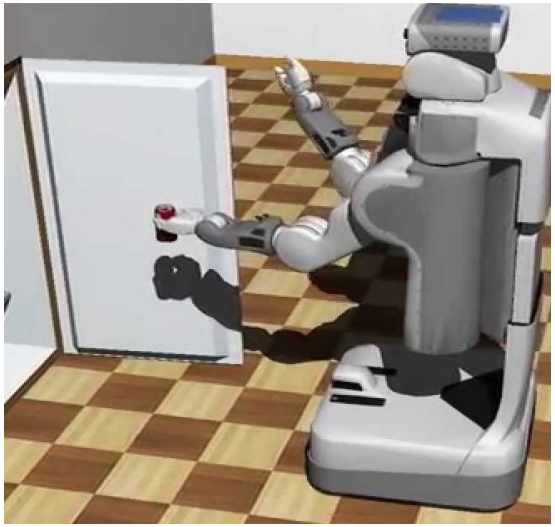
Homework 3 is due Thursday night

Semester Schedule



Progression

2D simulation



3D simulation

Real World

The Gazebo 3D simulator

- Install gazebo_ros package:

  sudo apt-get install ros-indigo-gazebo-ros
- Run the simulator:

  roslaunch gazebo_ros rubble_world.launch

Today

1) Reading Discussion

2) Introduction to services in ROS

3) Homework 3 Q&A

Reading Discussion

“Learning to Look”

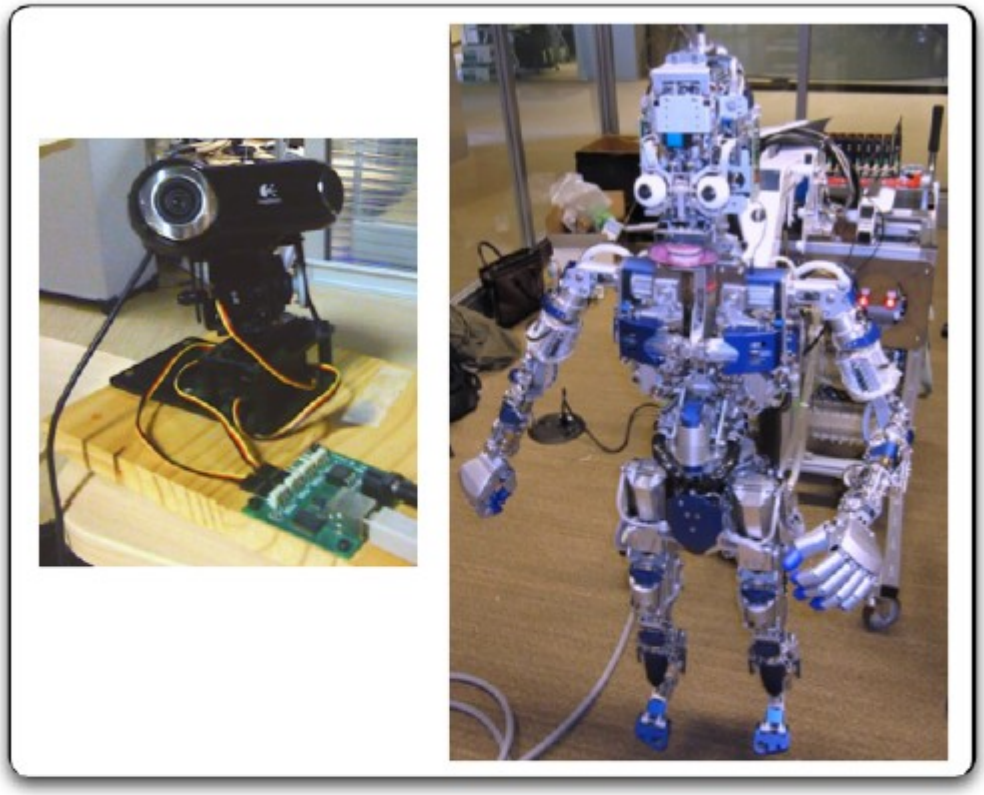


Fig. 1: Different robots like Nobody (left) and Diego-san (right) have sensory and motor capabilities. It is tedious and impractical to measure the sensory-motor properties of many different robots. It would be better if each robot could learn to use and make sense of its sensory-motor capabilities in terms of its developmental experience.

“Learning to Look”

Fig. 2: This robot is currently looking at the car, but he would like to look at the beach (starred). What command should he send to his servo motors? Can the robot learn what command to send from developmental experience?

“Learning to Look”

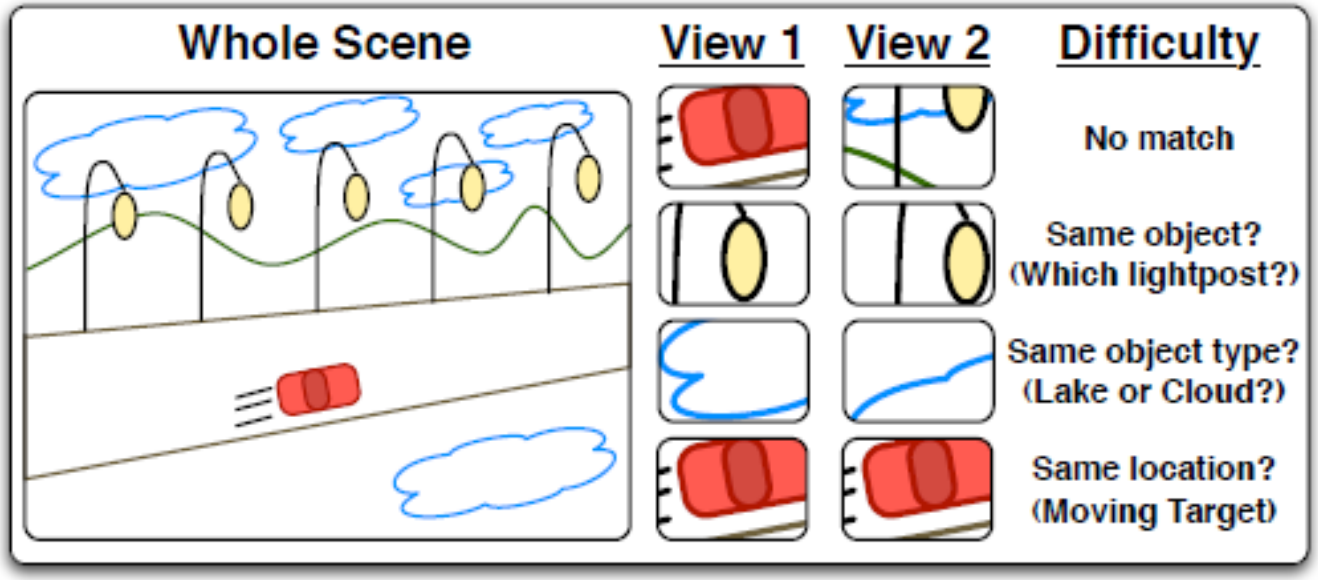


Fig. 3: Matching objects in two consecutive images may fail for many reasons. 1) After moving its camera, there may be no objects in common. 2) Common objects may be present at regular intervals in the environment, and give systematic false matches. 3) Objects may have a similar appearance to different objects. 4) Objects may move; assuming a matched object is in the same location may give a corrupt training signal.

“Learning to Look”

“... the model is only for robots that can move their cameras up and down and left and right. They said that the model does not yet consider camera motions that could rotate, translate, and scale. I wonder if the general idea of this model could be applied to more complex sensory motors, or would the entire model have to be scrapped and started from scratch?”

- Victoria

“Learning to Look”

“I'm curious into how this calibration system fits into developmental learning processes as a whole - for example, could the robot learn to understand the concept of moving objects and objects which react to it's own motor processes, and be able to separate this from normal sensory input? Furthermore, to what level does the robot actually develop an understanding of it's environment? Does it simply learn how to move around it's sensors, or does it learn something about the world in the process? “

- Tres

“Learning to Look”

“At times the difficulty of math diluted my interest in the article, but it definitely acted as a strong stimulus to learn linear algebra, probability and statistics to a further degree. The doors to lot of these AI papers will make much more sense when I am able to advance myself in the mathematical world. “

- Brahma

“Developmental robotics architecture for active vision and reaching”

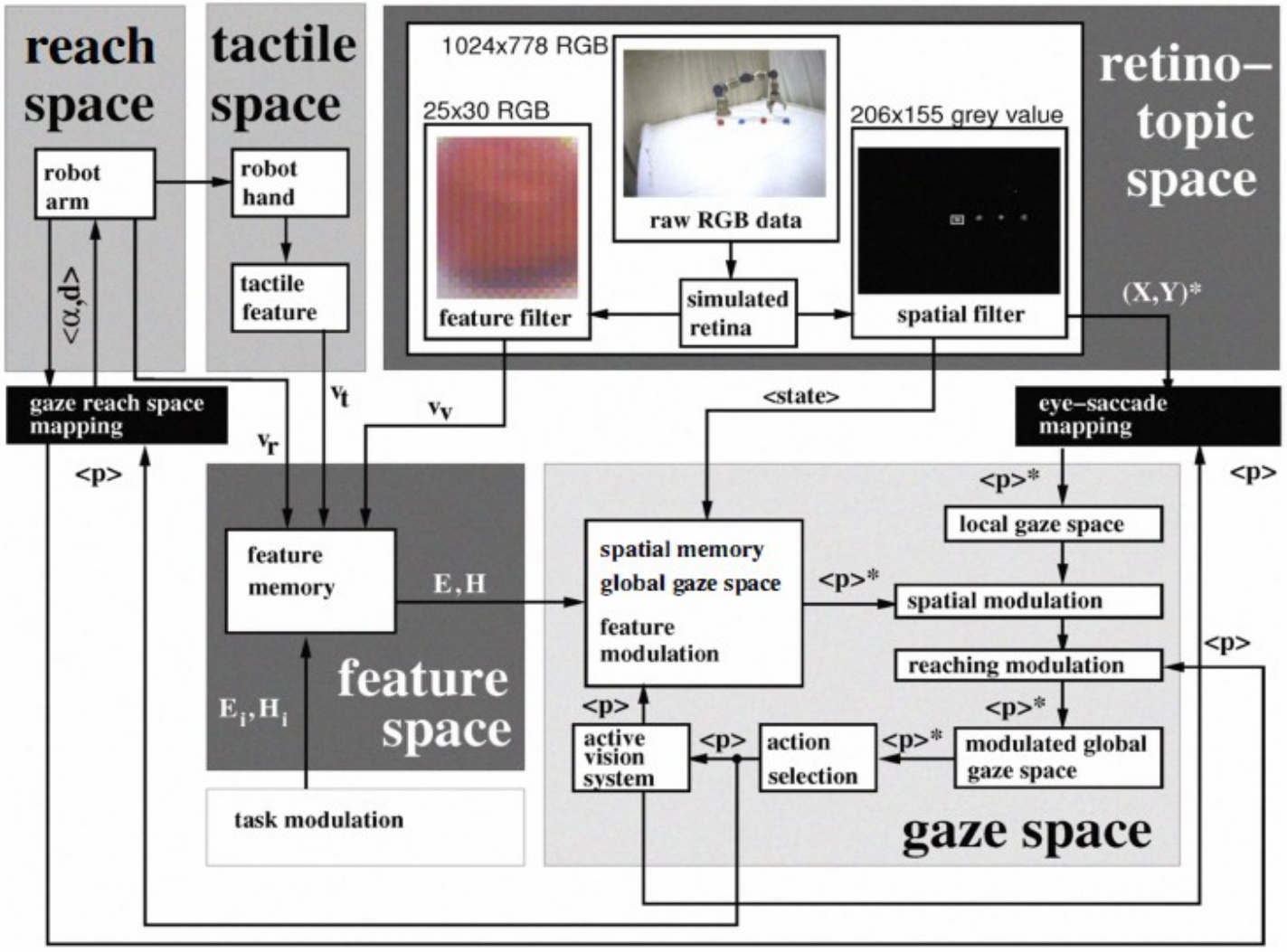
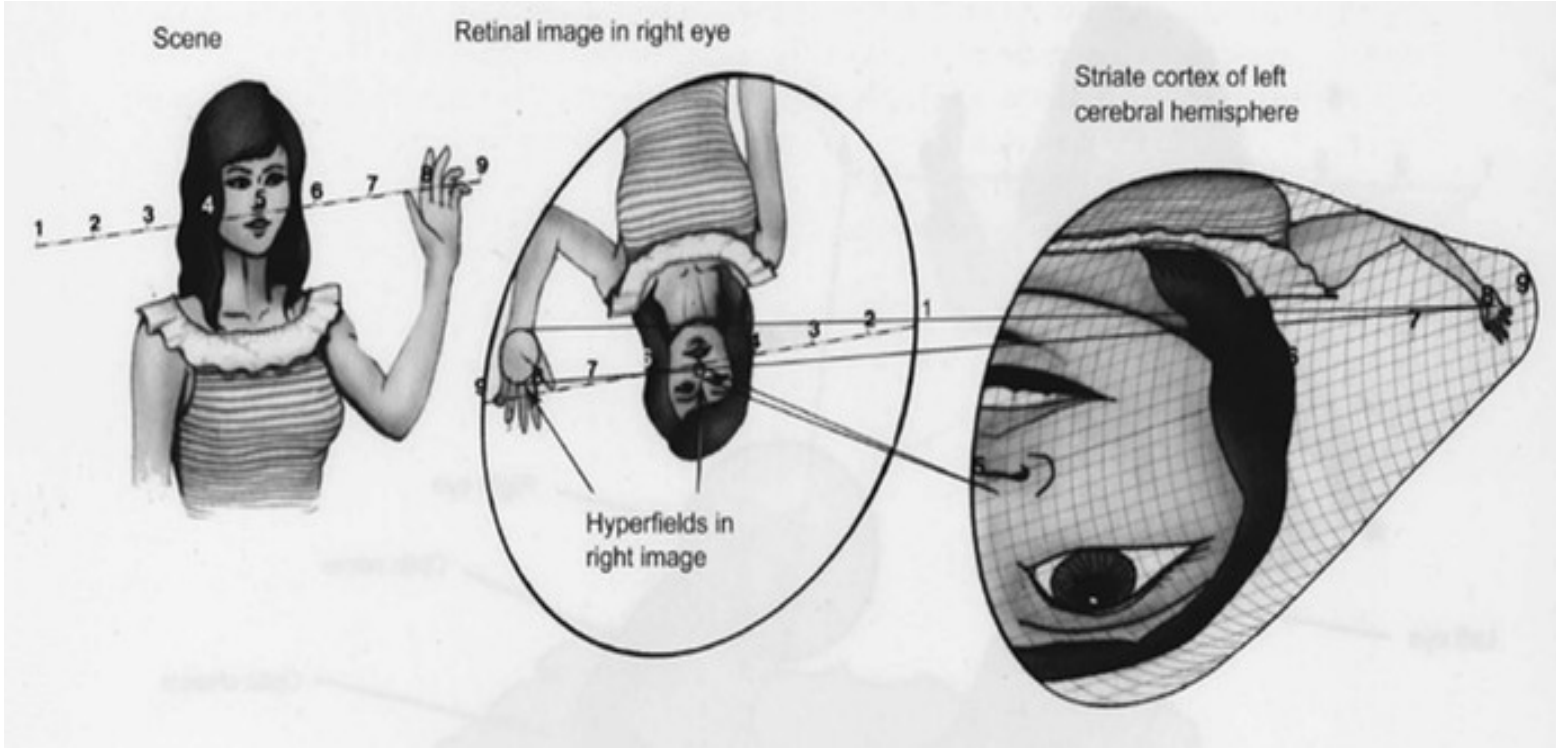


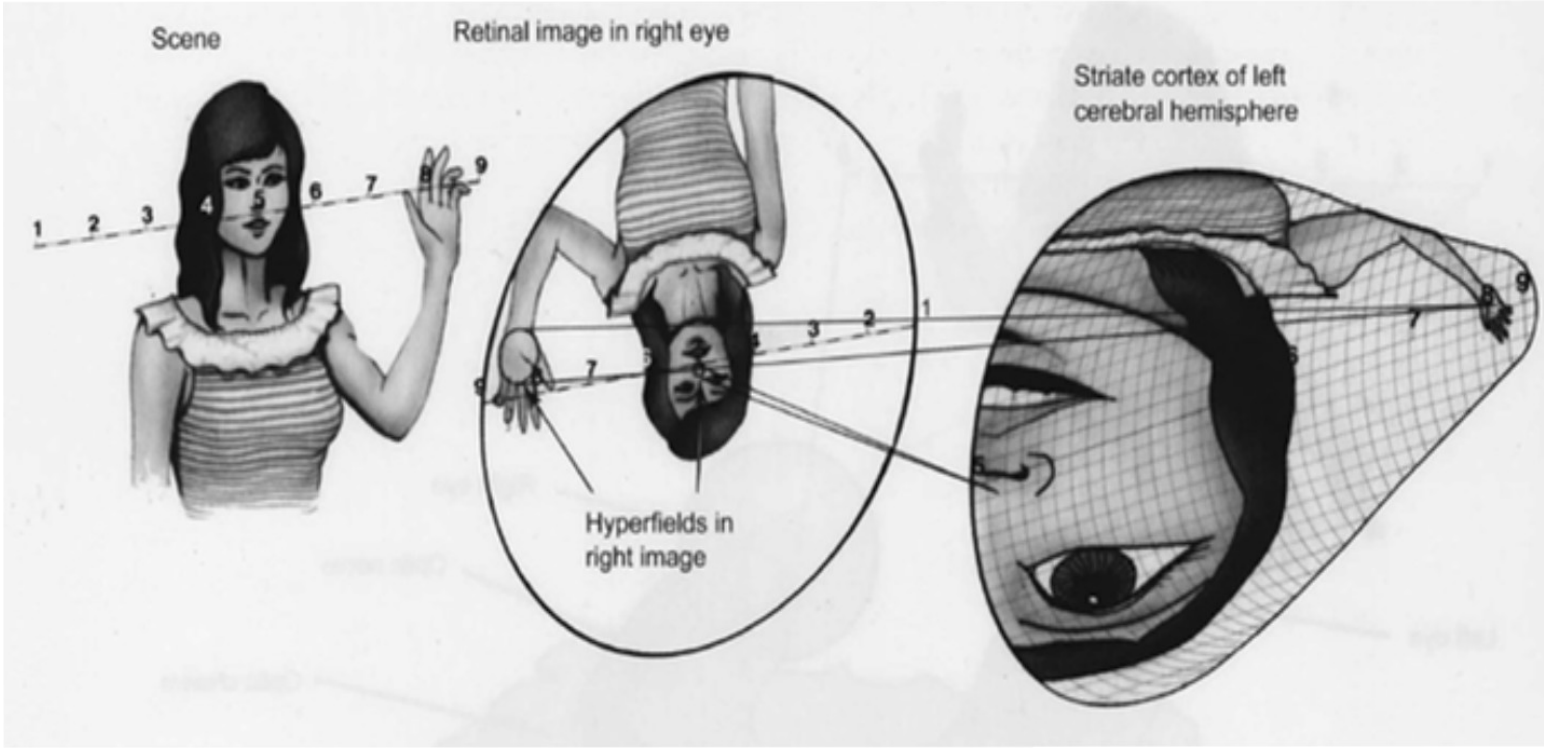
Fig. 1. Computational architecture for active vision and object manipulation.

“Developmental robotics architecture for active vision and reaching”

“The one part I found most interesting was their method for eye control. Instead of just having a camera take a general image and process that, they simulated a human eye by one high resolution filtered only to the center of the robot's vision while having the rest of the periphery a lower resolution that was not the focus.”

- Michael


Scene
Retinal image in right eye
Striate cortex of left
cerebral hemisphere
1 2 3 4 5 6 7 8 9
Hyperfields in
right image


Scene
Retinal image in right eye
Striate cortex of left
cerebral hemisphere
1 2 3 4 6 7 8 9
Hyperfields in
right image

“Developmental robotics architecture for active vision and reaching”

“The one part I found most interesting was their method for eye control. Instead of just having a camera take a general image and process that, they simulated a human eye by one high resolution filtered only to the center of the robot's vision while having the rest of the periphery a lower resolution that was not the focus.”

- Michael

“Developmental robotics architecture for active vision and reaching”

“(1)In the future, how will the robot be able to differentiate between soft and hard objects if they do not correlate to the color differentiating system the robot has now? (2)Additionally, although color differentiating system is a good idea to use for the robotic architecture but when objects of the same exact color come into the robot’s range of vision, how will it differentiate that?”

- Annie

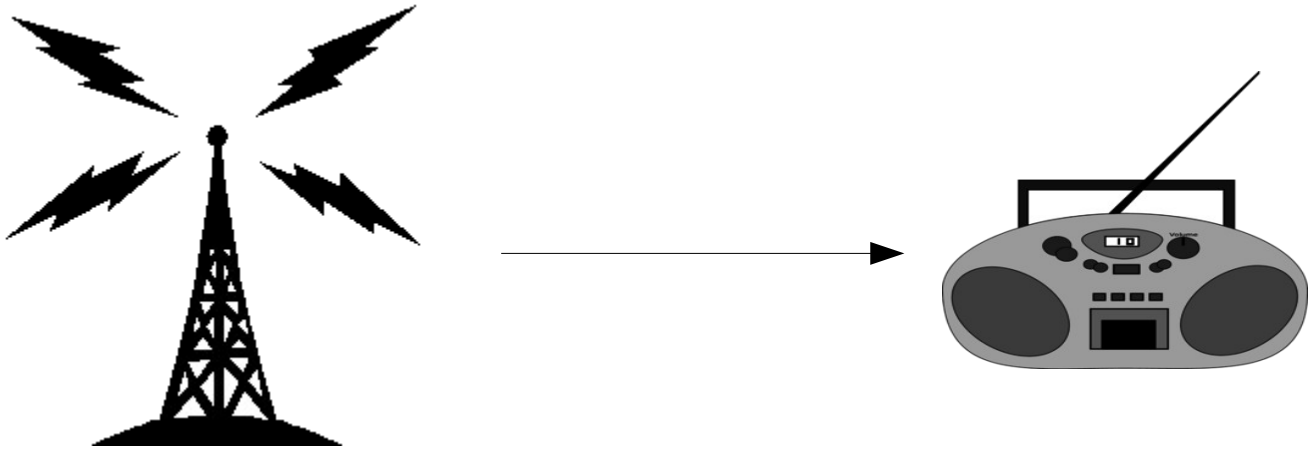
Readings for this week: Behavior-based robotics

R. Brooks (1986). ``A Robust Layered Control System for a Mobile Robot", MIT AI Memo 864, Vol RA-2, No. 1. p. 14-23

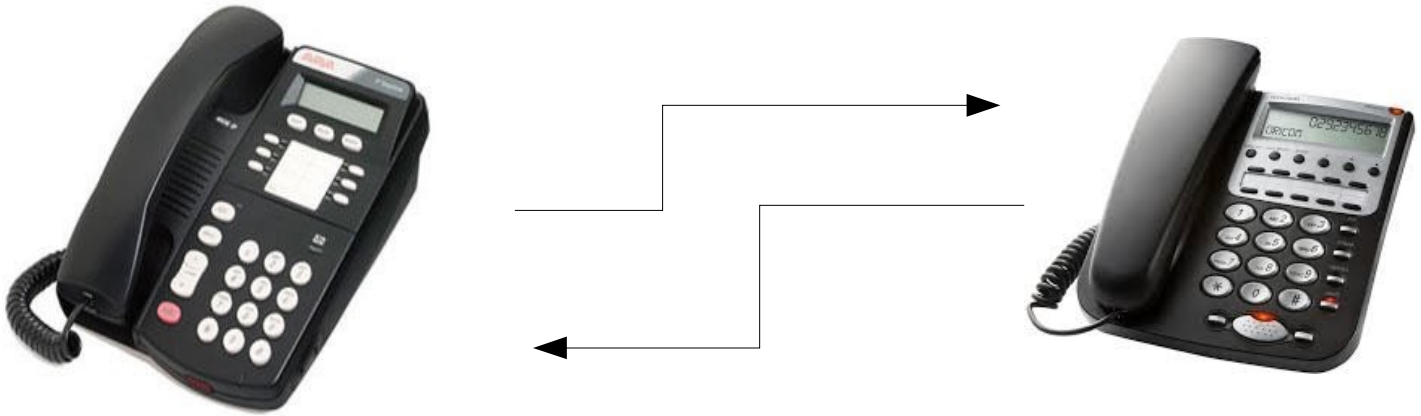
R. Brooks (1991). "Intelligence Without Representation", Artificial Intelligence, Volume 47 , Issue 1-3

ROS Services

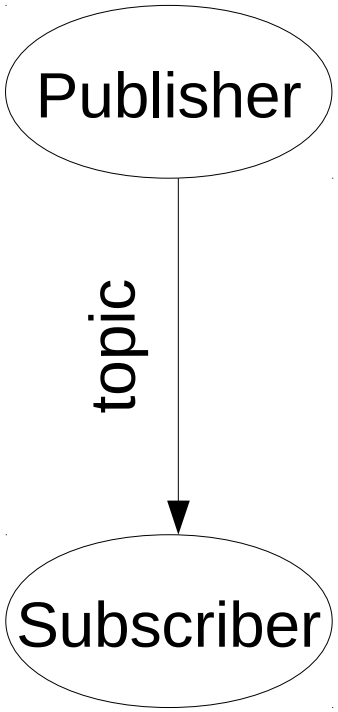
Messages vs. Services

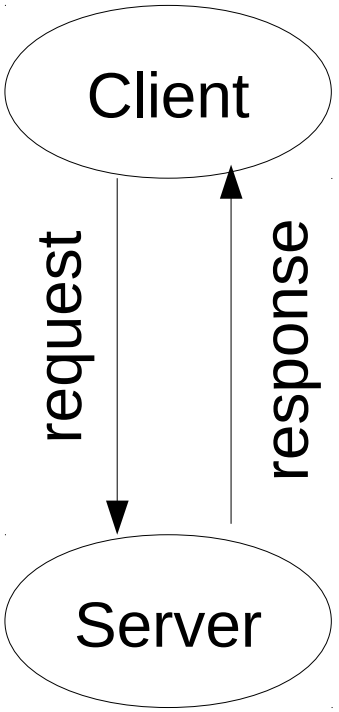


Messages vs. Services



Messages vs. Services





Services in ROS

Services in ROS

Steps to writing a .srv

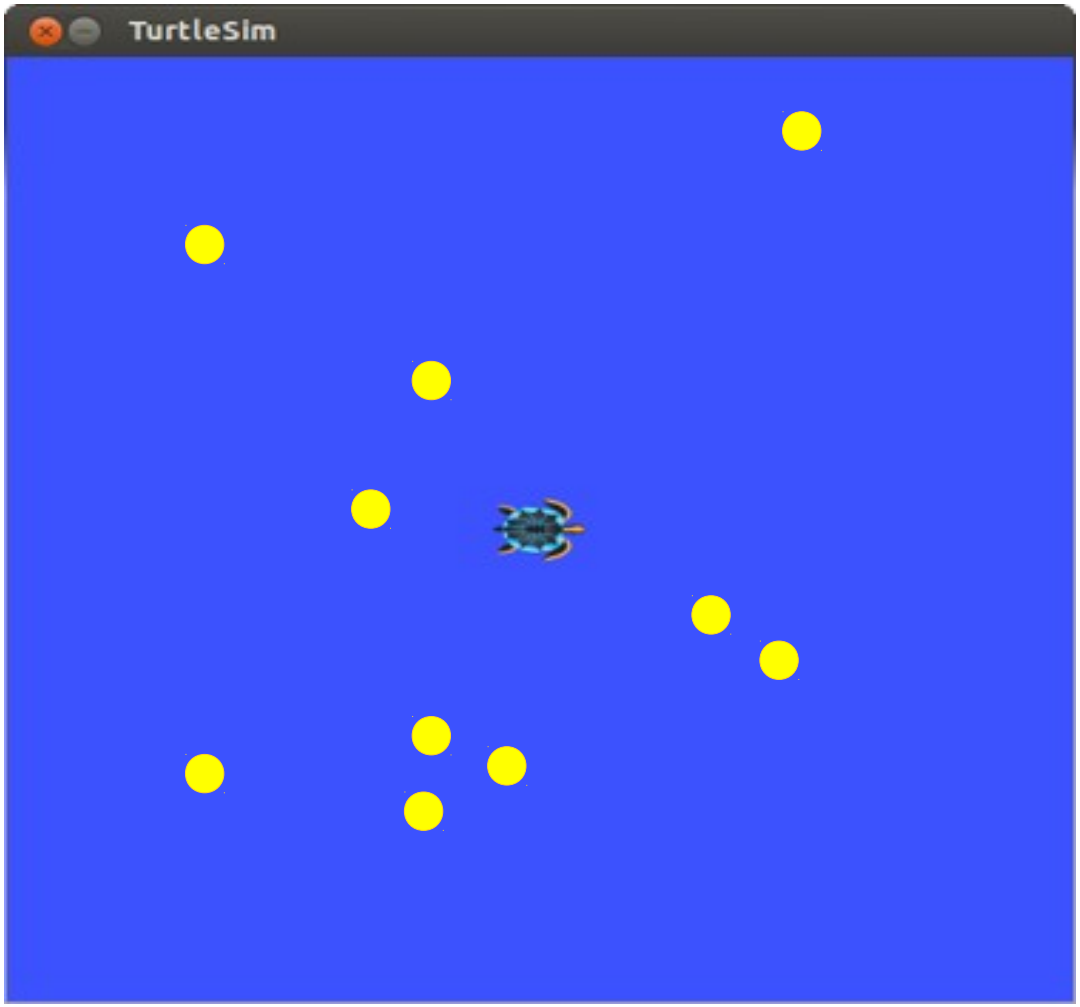
1) Write the .srv file in the srv/ folder

2) Modify package.xml and CMakeLists.txt as described in the ROS tutorial

Homework 3

- The main task consists of making the turtle visit a set of points in the environment
- The behavior needs to be semi-intelligent, i.e., the turtle needs to actively decide which point to visit next
- Your program will need to log the total distance traveled by the turtle and the time it took the turtle to visit every point

Example



Homework Q & A

Homework Brainstorm

- How should the problem be broken down?
- How can the turtle detect that it has reached a desired position?
- How should the turtle keep track of which positions have already been visited?

THE END