Robot Programming with Lisp

1. Introduction, Setup

Arthur Niedzwiecki

Institute for Artificial Intelligence
University of Bremen

20th October, 2020

General Info

- Lecturer: Arthur (PhD student at IAI)
- Correspondence: `aniedz@cs.uni-bremen.de`
- Dates: Thursdays, 14:15 - 15:45, 16:15 - 17:45
- Language: English and German
- Credits: 6 ECTS (4 SWS)
- Course type: practical course
- Course number: 03-IBVP-RPWL (03-BE-710.98b)
- Location: TAB Building, Room 0.30 EG

Plan

Introduction

Course Content

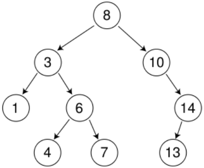
Organizational

Assignment

Course content

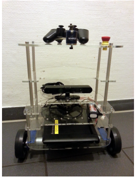
Common Lisp

Artificial Intelligence



Robot Operating System (ROS)

Robot platform



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Applications using / written in dialects of Lisp:
Emacs, AutoCAD, Grammarly, Mirai (Gollum animation), Google ITA (airplane ticket price planner AI), DART (DARPA logistics AI), Maxima (computer algebra system), AI frameworks, NASA satellites ...

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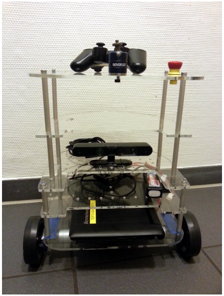
- *De facto* standard in modern robotics

TortugaBot

- 2 controllable wheels
- 2D laser scanner
- Thinkpad E485 PC with bluetooth
- PlayStation joystick



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- ROS supports a number of languages
- Lisp is good for rapid prototyping
- It is more suitable for symbolic reasoning and AI
- There are existing robot programming languages in Lisp that automate decision making

Rough schedule

Assignments (single, this year)

- Introduction & Setup
- Lisp basics
- OOP & Failure Handling
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- 2D world of *turtlesim*
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Project (groups, Jan-Feb '22)

- Controlling TortugaBot
- Reading sensor data
- Collision avoidance
- Heuristic decision-making
- The big day: competition

Course Goals

You will learn / improve your skills in the following:

- Common Lisp, of course
- Git
- Functional programming
- Cognitive robotics
- Jupyter Notebook
- Docker
- Linux
- ROS (for future roboticists)
- Emacs (the IDE for Lisp devs)

...and get to play with a real little robot!

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- Solutions are discussed in the tutorial.
- Can get 60 of 50 points in homework (can skip one homework).
- Bonus points for very good homework solutions.

Scheinbedingungen Summary

- Graded homework every week until January, then group project
- Live presentation of the group project, individual grading
- 50 homework + 50 group project = 100 points for final grade
- homeworks have 60 points total, so there's a buffer if you miss one
- at least 25 points from the homeworks
- Final grade: 50 of 100 points - 4.0, 100 of 100 points - 1.0.
- $Grade = \frac{(100 - P_{your})}{(100 - 50)} * 3 + 1$

Links

- This lectures website:
  https://ai.uni-bremen.de/teaching/cs-lisp-ws22
- Git reference book:
  https://git-scm.com/docs/gittutorial
- Lisp books:
  http://landoflisp.com/, http://www.paulgraham.com/onlisp.html, http://www.gigamonkeys.com/book/
- Emacs cheat sheet:
  https://www.gnu.org/software/emacs/refcards/pdf/refcard.pdf

Info summary

Next class:

- Date: 27.10.
- Time: 14:15 (14:00 - 14:15 for questions)
- Place: same room (TAB 0.30)

Assignment:

- Due: 26.10, Wednesday, 23:59
- Points: 3 points
- For questions: write me a mail
  or ask your colleagues in the StudIP forum

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Assignment goals

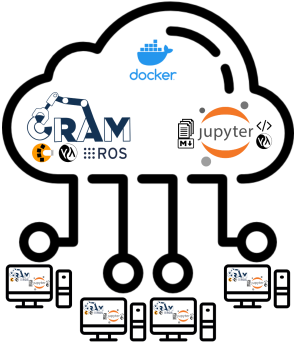
Set up your working environment

Set up your Git repository

Get comfortable with Jupyter

Cognitive Robotics for everyone

Docker is a manager vor virtual machines.
DockerHub hosts the virtual machine, ready to be downloaded



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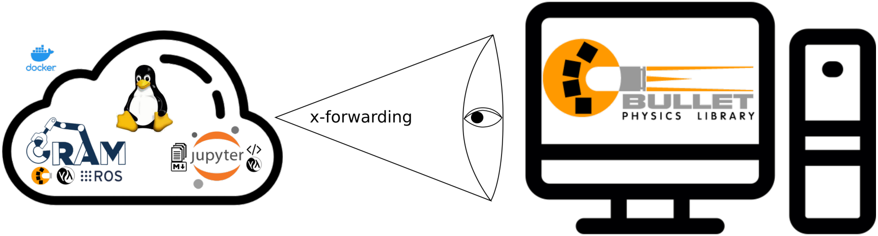
- MacOS
  If you have an ARM M1 CPU check out these notes here:
  `https://docs.docker.com/desktop/mac/apple-silicon/`

Task 1 Check: Test if Docker works

- On Linux and older installations:
  `docker-compose version`
- On newer and other (e.g. Windows, Rosetta):
  `docker compose version`
- Check rights
  `docker run hello-world`

Task 2: Configure X-Forwarding

Visual applications run in the virtual machine (Docker container) using X, which is a visualization technique for Linux systems. Docker can't visualize itself, so we forward the Bullet Physics Simulation to your PC.



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- MacOS
  ?

Task 3: Git

Git provides version-control of changing code. A Git repository is a storage place for code. With Git it is easy to manage group projects and keep track of changes.

`https://git-scm.com/book/en/v2/Getting-Started-Installing-Git`

Using Git via CLI provides the best experience to understand how it works. There are also Git clients with a GUI. This lecture will only cover the CLI commands for Git.

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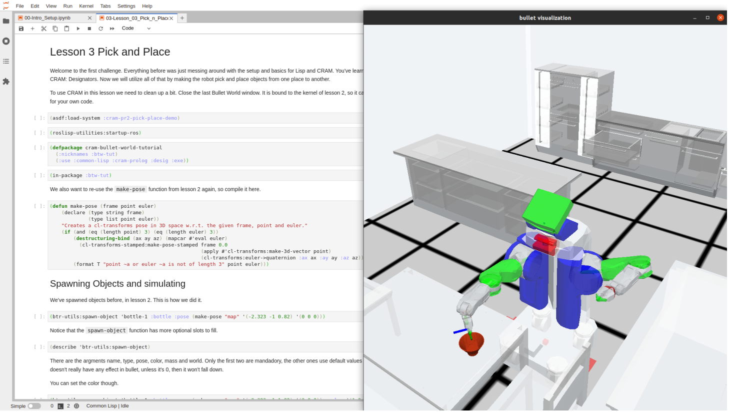
- Upload the files to your new GitHub repo:
  `git push -u my main`

Task 5: Get into Jupyter & Test your setup

Jupyter combines code with documentation. Each lesson is a mix of Markdown plain text, and executable Lisp code.



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- In Jupyter, navigate to "lectures/tutorials/00-Intro_Setup.ipynb"
  Go through the setup guide. If the demo at the end runs, your good!

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- Finally, to **upload** your local commits to the Github server, push the changes upstream:
  `git push`

Troubleshoot

For troubleshooting, consider the setup documention here:

`https://github.com/cram2/cram_teaching#readme`

or use the forum to work with your colleagues or write me a mail.

Q & A

Thanks for your attention!