Robot Programming with Lisp

1. Introduction, Setup

Gayane Kazhoyan

Institute for Artificial Intelligence
University of Bremen

18th October, 2018

General Info

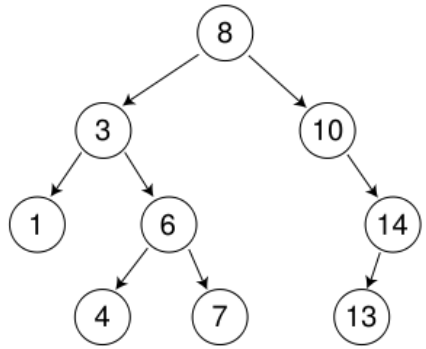
- Lecturer: Gaya (PhD student at IAI)
- Tutor: Arthur (HiWi at IAI)
- Correspondence: gaya@cs.uni-bremen.de, artnie91@cs.uni-bremen.de
- Dates: Thursdays, 14:15 - 15:45, 16:15 - 17:45
- Language: English and German
- Credits: 6 ECTS (4 SWS)
- Course type: practical course
- Course number: 03-BE-710.98d
- Location: TAB Building, Room 0.36 EG

Plan

Course content

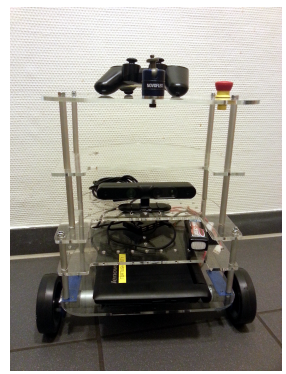
Common Lisp

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 and robotics frameworks, ...

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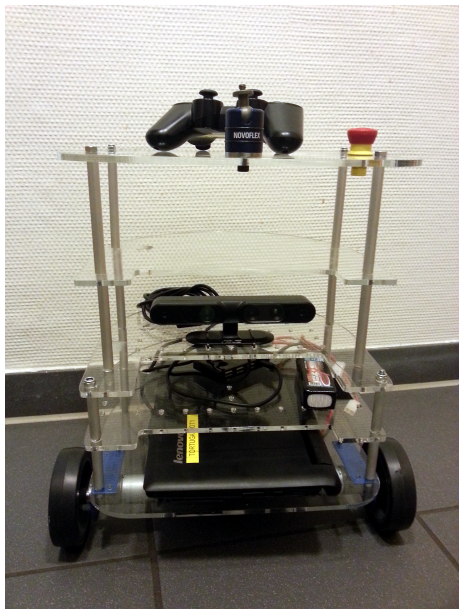
- *De facto* standard in modern robotics

TortugaBot

- 2 controllable wheels
- 2D laser scanner
- Optional 2.5D vision sensor
- Asus Eee PC with bluetooth
- Optional basket in the top part
- PlayStation joystick



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- 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

- Introduction, Setup

- Lisp basics
- Functional programming
- OOP

- ROS, ROS Lisp API (*roslisp*)
- *roslisp*, 2D world of *turtlesim*
- coordinate frames, *tf*

- TortugaBot, navigation
- Collision avoidance
- Project scenario
- Project implementation
- The big day: competition

Software requirements

Bringing a *personal laptop* is encouraged.

OS:	Ubuntu 16.04 (18.04 or 14.04 with manual setting up)
IDE:	Emacs 24+
Version control:	Git
Packaging system:	ROS
Lisp software:	SBCL compiler, ASDF build system, Emacs plugin for Common Lisp

Bottom line

You will learn / improve your skills in the following:

- Linux
- Git
- Emacs
- Functional programming
- Common Lisp, of course
- ROS (for future roboticists)

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

Plan

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- Final grade: 50 of 100 points - 4.0, 100 of 100 points - 1.0.

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- Bonus points for very good homework solutions.

Links

- Emacs cheat sheet:

  `https://www.gnu.org/software/emacs/refcards/pdf/refcard.pdf`

- Git reference book:

  `http://git-scm.com/book/de`

- Lisp books:

  `http://landoflisp.com/`, `http://www.paulgraham.com/onlisp.html`, `http://www.gigamonkeys.com/book/`

Info summary

Next class:

- Date: 25.10
- Time: 14:15 (14:00 - 14:15 for questions)
- Place: same room (TAB 0.36)

Assignment:

- Due: 24.10, Wednesday, 23:59
- Points: 3 points
- For questions: write an email to Arthur or Gaya

Plan

Assignment goals

Set up your working environment

Set up your Git repositories

Get comfortable with Emacs

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- Create a boot USB with the `.iso` (or burn a DVD).
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  and in Linux you could, e.g., use the Startup Disk Creator or `unetbootin`.
- Install Ubuntu 16.04 (aka Xenial).
  Dual boot installation with default settings is a one click thing.

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  It should work but if you can't get it to run turn off the UEFI mode:
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- Update your bash startup script and make sure it worked:
  ```
  echo -e "\n# ROS\nsource $HOME/ros_ws/devel/setup.bash\n" >> ~/.bashrc && tail ~/.bashrc && source ~/.bashrc
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- In project "Settings" → "Collaborators" add "Arthur Niedzwiecki" and "Gayane Kazhoyan" as collaborators.
- Install Git:

  ```
  sudo apt-get install git
  ```
- Download the course material into your ROS workspace:

  ```
  roscd && cd ../src
  git clone https://github.com/lisp-course/lisp_course_exercises.git && ll
  ```
- Define a remote target with the address of your new GitHub repo:

  ```
  cd lisp_course_exercises
  git remote add my-repo https://github.com/YOUR_GITHUB_USERNAME/lisp_course_exercises.git
  ```

Task 4 (alternative): Git and GitHub

- Create an account on GitHub and get a student discount:

  ```
  https://education.github.com/
  ```

- Click on "Start a project", call the project `lisp_course_exercises`. Once you get student discount, make the project private.
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  ```

- Upload the files to your new GitHub repo:

  ```
  git push -u my-repo master
  ```

Task 5: Install the IDE

- Install the editor itself (Emacs), the Common Lisp compiler (SBCL), the linker (ASDF) and the Emacs Common Lisp plugin (Slime):

```
sudo apt-get install ros-kinetic-roslisp-repl
```

Task 5: Install the IDE

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```
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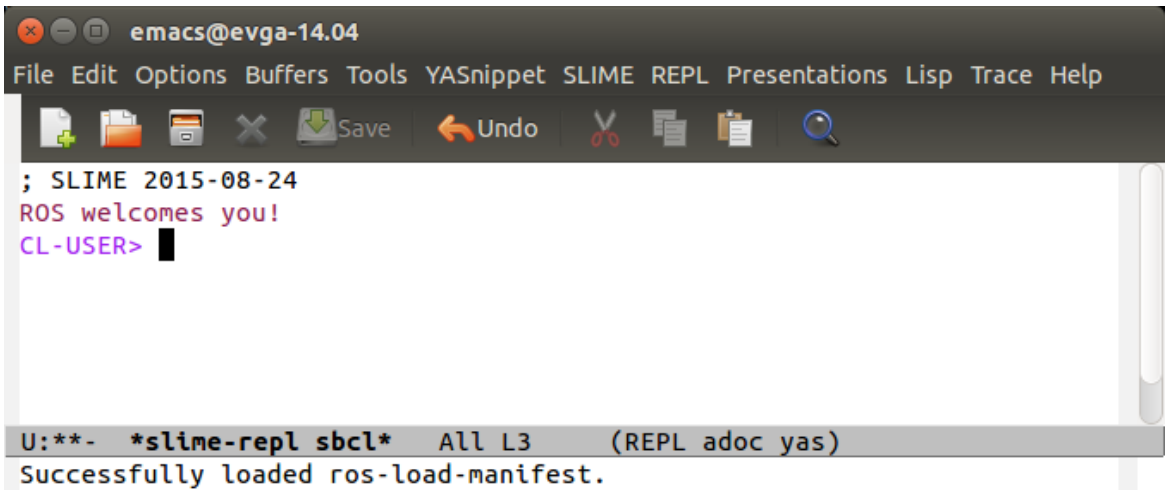
```

- Start the editor (after compilation is finished you'll see the Lisp shell):

```
roslisp_repl &
```



Task 6: Get familiar with Emacs

The following notation is used in Emacs for keyboard shortcuts:

- `C` for `<Ctrl>`
- `M` for `<Alt>`
- `SPC` for `<Space>`
- `RET` for `<Enter>`
- `-` for when two keys are pressed together (e.g. `C-x` for `<Ctrl>+x`)

The basic shortcuts you will need are listed below:

- `C-x C-f` opens a file
- `C-x 3` or `C-x 2` opens a new tab, `C-x 0` closes it, `C-x 1` maximizes
- `C-x o` switches between tabs
- `C-x b` switches buffers, `C-x C-b` lists all open buffers, `C-x k` kills
- `C-g` cancels a command half-way, `C-x C-c yes` exits Emacs

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Open the file with your first assignment and follow the instructions:

```
ROS_WORKSPACE/src/lisp_course_exercises/assignment_1/src/orc-battle.lisp
```

Task 7: Get familiar with Git

- Once done editing `orc-battle.lisp`, check what's new in your local repo (the one on your hard drive):

```
cd ROS_WORKSPACE/src/lisp_course_exercises && git status
```

Task 7: Get familiar with Git

- Once done editing `orc-battle.lisp`, check what's new in your local repo (the one on your hard drive):

```
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```

- To see which exactly lines changed ask for the `diff` (*q* to exit):

```
git diff
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- Once you're sure the changes are final, commit locally:

```
git commit -m "A meaningful commit message."
```

- Finally, to upload your local commits to the GitLab server, push the changes upstream:

```
git push # or git push my-repo master
```

If you decided to go for Ubuntu 14.04

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  `https://sourceforge.net/projects/sbcl/files/sbcl/1.3.1/`

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  `cd /Downloads/sbcl-1.3.1-x86-64-linux`
- Install the compiler:
  `sh install.sh`

If you decided to go for Ubuntu 18.04

- The name of the ROS distribution will be not “kinetic” but “melodic”. Follow the official instructions on ROS webpage for installing ROS melodic.

If you decided to go for Ubuntu 18.04

- The name of the ROS distribution will be not “kinetic” but “melodic”. Follow the official instructions on ROS webpage for installing ROS melodic.
- The current version of “roslisp-repl” might not work for you. So you will either have to wait a week or two for the update that fixes the problems, or install the REPL from source. Write an email to Gaya if you decide to do that.

Q & A

Thanks for your attention!