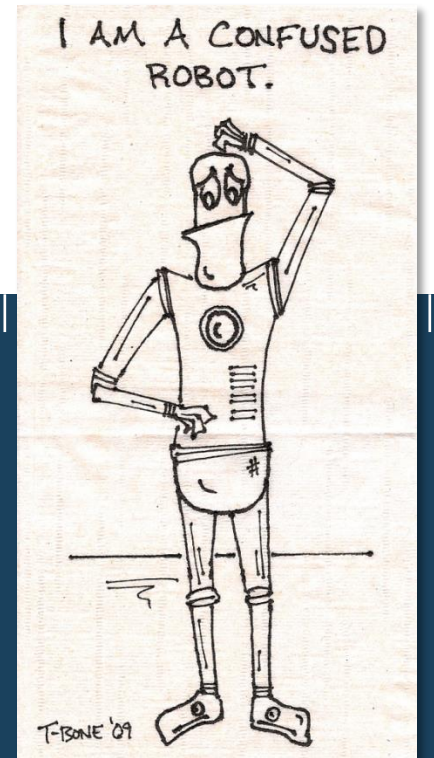# Robotics

Course Introduction

Matteo Matteucci
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Artificial Intelligence and Robotics Lab - Politecnico di Milano

About me and my lectures …

Lectures given by Matteo Matteucci

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- matteo.matteucci@polimi.it

Research Topics

- Robotics and Autonomous Systems
- Computer Vision and Perception
- Pattern Recognition & Machine Learning
- Benchmarking in Robotics

<u>Aims of these lectures</u>: *learning how to design and implement the software which makes autonomous an autonomous mobile robot (e.g., symbolic planning, trajectory planning, localization, perception, mapping, etc.)*

... what about the course?
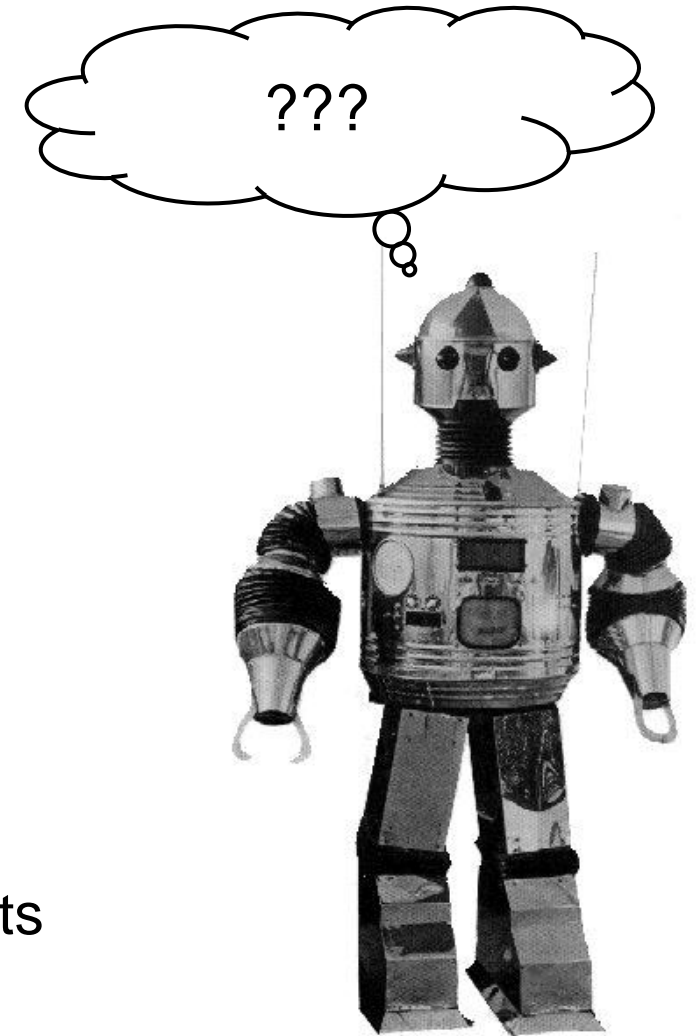
All the infos on the course website

- https://chrome.deib.polimi.it/index.php?title=Robotics

Lectures given by:

- Matteo Matteucci (Lecturer ~30h)
  matteo.matteucci@polimi.it

- Simone Mentasti (Teaching Assistant ~20h)
  simone.mentasti@polimi.it

Course in code sharing!!

- Robotics
- Perception, localization, and mapping for mobile robots

???

Lectures outline / approach

Introduction to (mobile) robotics

The mind of a mobile robot

Anatomy of a mobile robot

- Sensors and actuators
- Common Kinematics

Localization and Mapping

- Localization vs Mapping
- Simultaneous Localization & Mapping

Robot autonomous navigation

- Motion control and obstacle avoidance
- Trajectory following
- Trajectory planning
  (graph and sample based)

«Theory»

Middleware in robotics

- Motivations and state of the art
- ROS Installation party

ROS Basics

- Publisher/subscriber
- Messages, services, parameters
- Bags, tb, actionlib, rqt_tools
- Message filters, rospy

ROS Advanced

- ROS on multiple machines
- Time synchronization
- Stage

Navigation in ROS

ROS2 & …

Linux Ubuntu + ROS 1.0

«Practice»

Course organization / rules

Classes (no distinction between lecture and exercise day):
- Wednesday, 12:15 – 14:15, in T2.1
- Thursday, 14:15 – 16:15, in 8.0.1

> Cum tempore!

> May change …

Detailed calendar online (updated weekly)
- https://chrome.deib.polimi.it/index.php?title=Robotics

Grading policy:
- <u>Written examination</u> covering the whole program up to   26/32 ✚
- <u>ROS Home projects</u> graded up to   06/32 ═
- Final score will be the sum of the two grades …   32/32

> Deadlines to deliver it, valid the whole academic year.

Alternative projects (instead of exam)

This year we plan to set up 2 teams of students participating to competitions

- Field Robot Event (https://fieldrobot.nl/event/) June 2024
- Leonardo Drone Contest (https://www.leonardo.com/en/innovation-technology/open-innovation/drone-contest) October/November 2024

> Real Robots + ROS2 + physical event + ...

Organization of the teams (4-5 people per team)

- Supervised by a PhD Student / Researcher
- Led by Master Students doing his/her thesis on the topic
- Composed by 3-4 Students from the course

Grading policy:

> I suggest to do the homeworks anyway!

- The project replace the homeworks
- Written exam replaced by an oral exam with the teacher

Course material

Material available on the course website
- Check *https://chrome.deib.polimi.it/index.php?title=Robotics*
- Slides from the teachers (not necessarily in advance, but you have last year ones)
- Link to online sources, books and papers
- Link to other websites for tools and digital resources

Past exams and sample questions
- Expect 3 theoretical questions + 2 practical exercises (on average)
- No coding exercise since you have it in the home project
- Few past exam examples are available on the course website

Do you need any further info?