Welcome to

Introduction to Mobile Robotics

Instructor:
Wolfram Burgard

Teaching Assistants:
Christian Plagemann and Patrick Pfaff

Organization

- We 14:00 – 16:00
  Fr 11:00 – 12:00
  - lectures, discussions
  - homework, practical exercises

- Web page:
  - www.informatik.uni-freiburg.de/~ais

Goal of this course

- Provide an overview of problems / approaches in mobile robotics

- Probabilistic reasoning: Dealing with noisy data

- Hands-on experience

AI View on Mobile Robotics

Sensor data

Control system

World model

Actions
Robots are moving away from factory floors to
- Entertainment, toys
- Personal services
- Medical, surgery
- Industrial automation (mining, harvesting, ...)
- Hazardous environments (space, underwater)

RoboCup-99, Stockholm, Sweden
Emotional Robots: Cog & Kismet

[Brooks et al., MIT AI Lab, 1993-today]

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General Background

• Autonomous, automaton
  • self-willed (Greek, auto+matos)

• Robot
  • Karel Capek in 1923 play R.U.R.
    (Rossum’s Universal Robots)
    • labor (Czech or Polish, robo/ta)
    • workman (Czech or Polish, robotnik)

Asimov’s Three Laws of Robotics

1. A robot may not injure a human being, or, through inaction, allow a human being to come to harm.

2. A robot must obey the orders given it by human beings except when such orders would conflict with the first law.

3. A robot must protect its own existence as long as such protection does not conflict with the first or second law.

[Runaround, 1942]

Wiener, Cybernetics

• Studied regulatory systems and their application to control (antiaircraft gun)

• “it has long been clear to me that the modern ultra-rapid computing machine was in principle an ideal central nervous system to an apparatus for automatic control; and its input and output need not be in the form of numbers or diagrams, but might very well be, respectively, the readings of artificial sensors such as photoelectric cells or thermometers, and the performance of motors or solenoids”.

[Electronics, 1949]

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Trends in Robotics Research

Classical Robotics (mid-70’s)
- exact models
- no sensing necessary

Reactive Paradigm (mid-80’s)
- no models
- relies heavily on good sensing

Hybrids (since 90’s)
- model-based at higher levels
- reactive at lower levels

Probabilistic Robotics (since mid-90’s)
- seamless integration of models and sensing
- inaccurate models, inaccurate sensors

Brief Case Study:
Museum Tour-Guide Robots

Rhino, 1997

Minerva, 1998

Rhino
(Univ. Bonn + CMU, 1997)

Minerva
(CMU + Univ. Bonn, 1998)