MOBILE ROBOTS AND AUTONOMOUS VEHICLES

INTRODUCTION

- How to program the new generation of mobile robots ?
- Primarily intended to students with engineering or master degree… *but any person with a basic familiarity with Robotics & Probabilities can benefit from it*

Christian Laugier

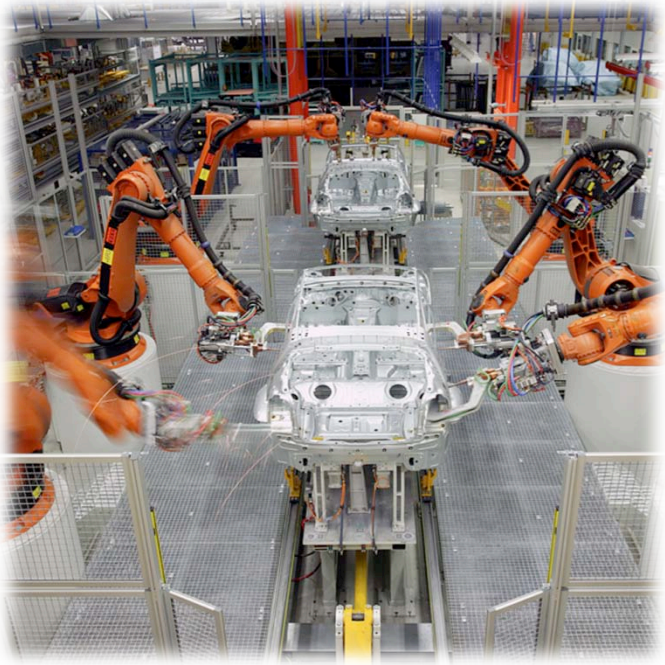
informatiques mathématiques Inria

Context

- “**Cobots**”: new generation of robots working in close interaction with human being

Context

- “**Cobots**”: new generation of robots working in close interaction with human being
- **Various environments:** *Industrial sites with lines of cooperating robots*



Context

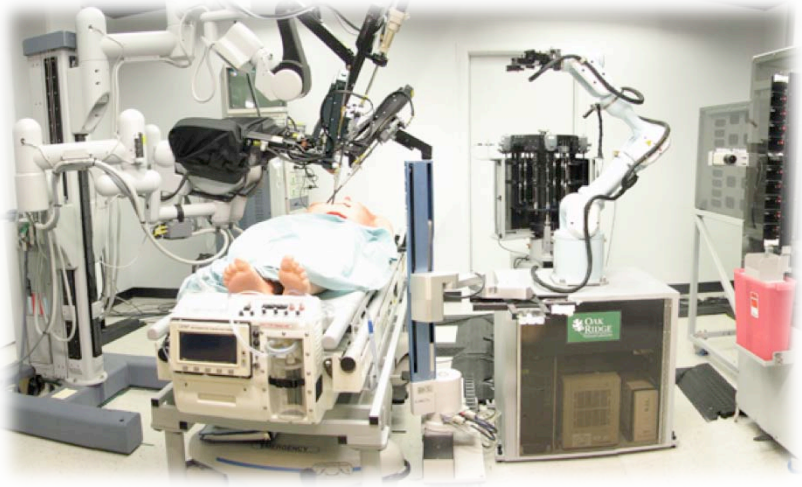
- “**Cobots**”: new generation of robots working in close interaction with human being
- **Various environments:** *Public space (e.g. for mobility assistance)*

Context

- “**Cobots**”: new generation of robots working in close interaction with human being
- **Various environments:** *Sustainable transportation Systems*

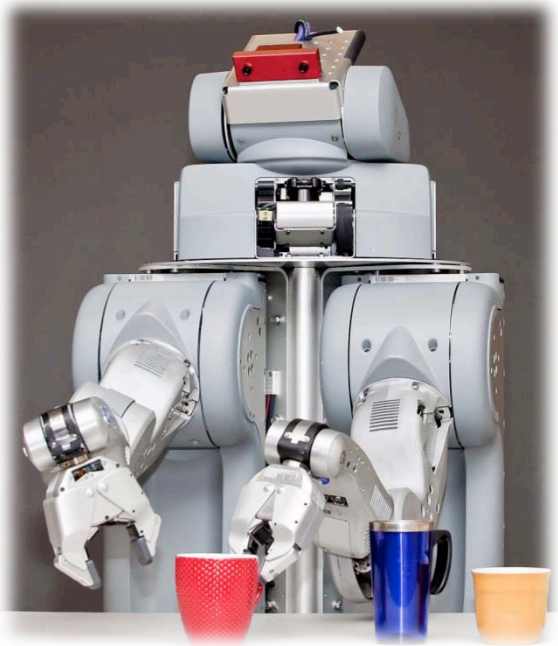
Context

- “**Cobots**”: new generation of robots working in close interaction with human being
- **Various environments:** *Hospital (e.g. for surgery)*



Context

- “**Cobots**”: new generation of robots working in close interaction with human being
- **Various environments:** *Home (e.g. companion robot)*



Context

- “**Cobots**”: new generation of robots working in close interaction with human being
- **Various environments:** *Disaster areas for rescue ….*

Context

- “**Cobots**”: new generation of robots working in close interaction with human being
- **Various environments**
- **Major challenge** for both Industry and Human Society

Context

- “**Cobots**”: new generation of robots working in close interaction with human being
- **Various environments**
- **Major challenge** for both Industry and Human Society
- **New robots characteristics for**:
  - ✓ *Balancing **Safety**, **Efficiency**, **Autonomy** constraints*
  - ✓ *Addressing the novel problem of **Social Acceptability** & **Intuitive Human-Robot Interaction***

Objective of the course

- Present **Key Concepts & Tools** for Programming Autonomous Mobile Robots & Vehicles

- Describe **Formal & Algorithmic tools,** illustrated using **Realistic examples.** Programming **exercises in Python** will also been provided.

- Particular attention to underlying **Bayesian approaches**

Objective of the course

- The course is presented by 3 researchers from Inria :
  Christian Laugier, Agostino Martinelli, Dizan Vasquez

- It also includes contributions from *Stephanie Lefevre, Mathias Perrollaz, Lukas Rummelhard and Amaury Negre*

Course plan

1. Objectives, Challenges, State of the Art, Technologies - *C. Laugier*
2. Bayes & Kalman Filters - *A. Martinelli*
3. Extended Kalman Filter, Observability properties - *A. Martinelli*
4. Perception & Situation Awareness & Decision Making - *C. Laugier*
5. Behavior Modeling & Learning - *D. Vasquez*

Pictures & Movies

- p. 1:
  - Dragon Runner robot with QinetiQ operator by QinetiQ – Droits réservés
  - Cybus Véhicule intelligent – © Inria 2015
- p. 3: « Application field automotive » by KUKA Systems GmbH — KUKA Systems GmbH. CC BY SA 3.0 via Wikimedia Commons
- p. 4: Autonomous navigation in Human Environment – © Inria – E-Motion Team
- p. 5: Cybus Véhicule intelligent – © Inria 2015
- p. 6: « SRI Trauma Pod » by SRI International. CC BY SA 3.0 via Wikimedia
- p. 7: « PR2 Tabletop » by Willow Garage CC BY SA 3.0 via Wikimedia Commons
- p. 8: Dragon Runner robot with QinetiQ operator by QuinetiQ – Rights Reserved