Robotics and AI laws (AI section 2)

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Why

MAS address complex problems:

- computationally heavy
- articulated (require specific competencies)
- physicallydistributed

with the aim of
- improving performances
- solving conflicts

Motivation (one viewpoint)

The idea

Agents as computational paradigm

- interaction → fundamental component of software engineering
- Agents as an evolution of Object Oriented Programming:

Agent Oriented Programming

MAS and OOP

OOP	MAS
Objects are passive, i.e. an object has no control over method invocation	Agents are autonomous, i.e. pro-active
Objects are designed for a common goal	Agents can have diverging goals, e.g. coming from different organizations
Typically integrated into a single thread	Agents have own thread of control

Objects do it for free; agents do it for money. (Jennings et al. 1998)

MAS are Distributed Systems

But:

• Dynamic (and not Static) synchronization among entities

• Entities with own goals: PDA that books an air flight

Example domains:

- **1. Semantic web**
  2. IoT
  3. Computational Systems (grids)
- **4. Distributed problem solving**

Motivation (another viewpoint)

The idea

Agents for social interaction

- Computational tool for understanding the evolution of a social system
- Analysis of organizations
- Models of(human and animal societies)

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Motivation (another viewpoint)

The idea

Agents in economic theories

- Game Theory analyzes what happens when two (or more) agents interact, but not how the interaction takes place
- Very strong assumptions (reasoning capabilities, knowledge and synchronization)

Motivation (one more viewpoint)

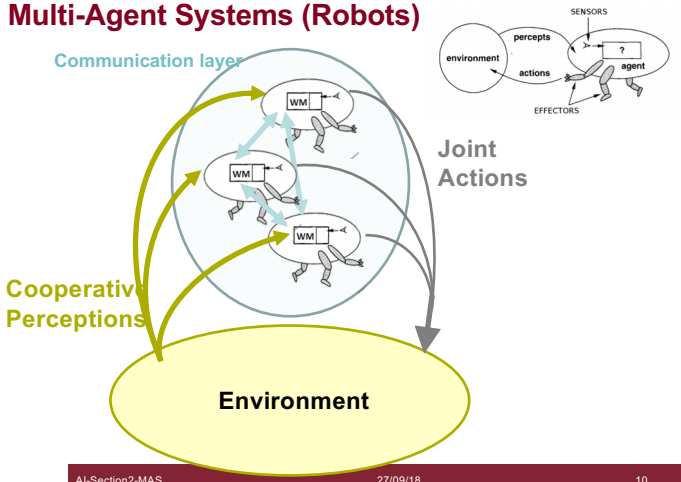
The idea

Agents as Robots

Multi robots are not just a special case of multi agent systems.

Uncertainty in:
- the knowledge about the environment
- the knowledge about teammates
- the execution of actions

Multi-Agent Systems (Robots)

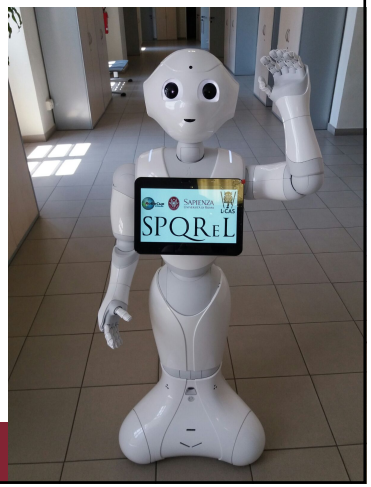


Human Robot Interaction

Social Robots

Spoken Language

Multi Modal



The field according to AAMAS

Agent theories and models
Communication and argumentation
Agent cooperation
Knowledge Representation
Agent societies and societal issues
Learning and Adaptation
Agents and computing
Verification and Validation of ABS
Agent-based Simulation

- Robotics
- Socially Interactive Agents
- MAS Engineering
- Industrial Applications

Summarizing

Key Insight

Interaction is akey element of intelligence

Our Goal:

MAS as Intelligent Agents and Robots

Plan of the lectures

Working Together

- 2 player games
- Contract Net
- Constraint Optimization
- Swarms

Robot soccer

- Agent Programming Language
- Coordination and Cooperation

Interaction

- Communication
- Spoken Language Interaction
- Natural Language Processing