BASICS OF MULTIAGENT INTERACTIONS

Agent communication

- Agent interaction is the fundamental characteristic of multiagent systems
- Interaction is (usually) based on communication
- Interaction is present both in "cooperative" and in "selfish" multiagent systems

Chopra and Singh, "Agent Communication"

- Languages for agent communication are inspired to the *speech acts* theory (Austin, 1962; Searle, 1969), which has been developed in the philosophy of language
  - A communication is an action
- Communicative act (message): *performative* and content
- Agent communication languages
  - Syntax (fields-values)
  - Semantics (preconditions and effects on the mental states of the agents involved in the communication, commitments)
  - Protocols (sequences of communicative acts)
  - Ontologies (sharing the meaning of the terms in a domain)

Video segment: cooperation among robots

- From the Marco Dorigo's group (Marco is a PhD alumnus of DEIB), now at IRIDIA Université Libre de Bruxelles

- https://www.youtube.com/watch?v=teRFP3FshDE

- So, how can cooperative multiagent systems be built?

Evolution of cooperative behaviors

- Cooperative behaviors can be imposed at design time or can be evolved at run time

- Agents can be cooperative, or *benevolent*, even if each agent is *selfish*, namely has the goal of maximizing its own utility

- Evolution of cooperation can be described by game theory models on the basis of costs and benefits of cooperating and defecting

[presented by Edoardo Giacomello]

Video segment: human negotiation

- From "Miracolo a Milano", a 1951 movie by Vittorio De Sica
- https://www.youtube.com/watch?v=xX-QCeqISZk

- So, how can autonomous agents negotiate to reach agreements?

Rosenschein and Zlotkin, "Designing Conventions for ..."

- Negotiation = interaction between agents with the goal to reach an agreement
  - Coordination between selfish agents
  - Distributed search in the space of possible agreements
- Designing suitable negotiation domains influences (forces) the private strategies of the interacting agents
  - Mechanisms vs. strategies

[presented by Marco Tangi]

Video segment: formation control with obstacles

- Julie Shah's Interactive Robotics Group at MIT
- https://www.youtube.com/watch?v=zCD4pMG-Zdc

- How can robots agree on their positions?

The consensus problem

- Reaching distributed agreement over some values, despite faulty or unreliable agents
    - Database transactions
    - Clock synchronization
    - Opinion formation
    - Load balancing
    - …
- Different variants of the consensus problem have been formulated, together with corresponding solving algorithms

[presented by Paolo Gazzotti]