Artificial Intelligence

Actuation — Communication and Robotics

Outline

- Communication

- Robotics

Communication

- "Classical" view (pre-1953):
  language consists of sentences that are true/false
  (compare with logic)

- "Modern" view (post-1953):
  language is a form of action

- Why?
  it can be used to change the actions of the agents.

Speech Acts

- Speech acts achieve the speaker's goals:

  - Inform

  - Query

  - Command

  - Promise

  - Acknowledge

- Speech act planning requires knowledge of

  - situation

  - semantic and syntactic conventions

  - hearer's goals, knowledge base, and rationality

Stages in Communication (Informing)

- Stages on the speaker's end:
  - Intention — Speaker wants to inform Hearer that P
  - Generation — Speaker selects words W to express P in context C
  - Synthesis — Speaker utters words W
- Stages on the hearer's end:
  - Perception — Hearer perceives W'
  - Analysis — Hearer infers possible meanings P_1, …, Pn
  - Disambiguation — Hearer infers intended meaning Pi
  - Incorporation — Hearer incorporates Pi into knowledge base
- How could this go wrong? Lots!
  - Insincerity (S doesn't believe P)
  - Speech wreck ignition failure (Speech recognition failure)
  - Ambiguous utterance
  - Differing understanding of current context (C <> C')

Robotics

- Design, construction, operation, and use of robots that can substitute for humans and replicate some human actions

- Involves mechanical engineering, electrical engineering, control engineering, computer engineering, electronics, software engineering, bioengineering, mathematics, and many more fields

- Used in more and more application fields

Robots

- Manipulators

  - different effectors

- Mobile Robots

  - wheeled, tracked, walking, flying, etc

- Humanoid Robots

Robot Control

- Degree of freedom vs degree of control

  - holonomic vs non-holonomic

- Calibration

  - to improve the accuracy of robots

- Kinematics

  - calculation of end effector's position and orientation

- Dynamics

  - add velocity and acceleration for each degree of freedom

  - calculation of the actuator forces necessary to create the prescribed effector acceleration

Sensors

- Range finders

- Imaging sensors

- Proprioceptive sensors

Localization, Mapping and Planning

- Localization is the process of determining where a robot is located with respect to its environment.

    - location and orientation (pose)

- Mapping is the process of updating robot's map based on its location and observation

- Motion/path planning is the process of finding a sequence of valid configuration that moves robot from one location/pose to another

    - Cell decomposition and Skeletonization

Summary

- Actuators give the AI agent the ability to actively affect the environment.

- Many technology issues.

- Even more social/ethical issues.