Relations of AI, Robotics and Machine Learning

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Artificial Intelligence

Studies of intelligence in general:

- ✔ How do we perceive the world?
- ✔ How do we understand the world?
- ✔ How do we reason about the world?
- ✔ How do we predict the consequences of our actions?
- ✔ How do we act to influence the world?

Artificial Intelligence (AI) not only wants to understand the "intelligence", but also wants to

- ✔ create an intelligent entity (agent, robot)
- ✔ imitating or improving
- ✔ the human behavior and effects in the outer world, and/or
- ✔ the inner human mind processes and reasoning.

Robot vs. agent:

- ✔ very often interchangeable terms describing systems with varying degrees of autonomy able to predict the state of the world and effects of their own actions. Sometimes, however:
- ✔ **agent:** the software responsible for the "intelligence"
- ✔ **robot:** the hardware, often used as substitute for humans in dangerous situations, in poorly accessible places, or for routine repeating actions

Requirements for an Ideal Agent

Knowledge representation:

- ✔ how to store the model of the world, the relations between the entities in the world, the rules that are valid in the world, ...

Automated reasoning:

- ✔ how to infer some conclusions from what is known or answer some questions

Planning:

- ✔ how to find an action sequence that puts the world in the desired state

Pattern recognition:

- ✔ how to decide about the state of the world based on observations

Machine learning:

- ✔ how to adapt the model of the world using new observations

Multiagent systems:

- ✔ how to coordinate and cooperate in a group of agents to reach the desired goal

Natural language processing:

- ✔ how to understand what people say and how to say something to them

Computer vision:

- ✔ how to understand the observed scene, what is going on in a sequence of pictures

Robotics:

- ✔ how to move, how to manipulate with objects, how to localize and navigate

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Course outline

1. AI, machine learning, robotics. Pattern recognition. Bayesian and non-Bayesian tasks. Learning. Learning without teacher.

2. Classification (decision) trees.

3. Linear discriminant function. Perceptron algorithm (revision). Optimal separating hyperplane. Support vector machine. AdaBoost.

4. Classification (decision) rules. Association rules.

5. Feature selection and extraction. Sequential decision making. Wald's algorithm.

6. Computational learning theory. Consistence, capacity. Probably approximately correct learning.

7. Graphical probabilistic and Markov models.

8.-13. Planning and multiagent systems.