Introduction to Artificial Intelligence

Informatics Engineering Study Program
School of Electrical Engineering and Informatics
Institute of Technology Bandung

Overview

- Course Organization
- Introduction to Artificial Intelligence (AI)

Lecturers & Assistant

Lecturers:

- Nur Ulfa Maulidevi (K1)
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- Masayu Leylia Khodra (K2)
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Assistants:

- Magdalena (Manda)
- Gressia
- Garibaldy (Gery)
- Stevie

Objectives

For Students:

- Understand basic knowledge of AI
  - definition, concepts, techniques
- Recognize (able to identify) AI applications
  - Simple Problem Solving, Knowledge Based Systems, Learning Agent, Planning Agent, Multiagent System, Robotics
- Develop simple AI applications
  - Simple problem solving, simple knowledge based system

Courses

- Credits: 3 credit points
- Prerequisites:
  - Algorithmic Strategy
  - Informatics Logic
  - Automaton and Formal Language Theory
- Courses:
  - Attending classes 3 hours/week (14 weeks):
    - Monday 10.00-11.40; Wednesday 9.00-9.50
    - attendance is obligatory (20 mnts late)
  - 2 or 3 programming assignments (in group)
  - Homeworks/exercises and quizes (individually)
  - Midterm Exam (week 8); Final Exam (week 16)

Courses contents

1. *Introduction*
2. *Problem Solving*
3. *Knowledge and Reasoning (Knowledge Representation, Knowledge Based Systems)*
4. *Natural Language Processing*
5. *Learning*
6. *Planning*
7. *Communicating → Multiagent*
8. *Introduction to Robotics*

Grading

- Homeworks and exercises
- Assignments
- Quizes
- Midterm Exam
- Final Exam

References

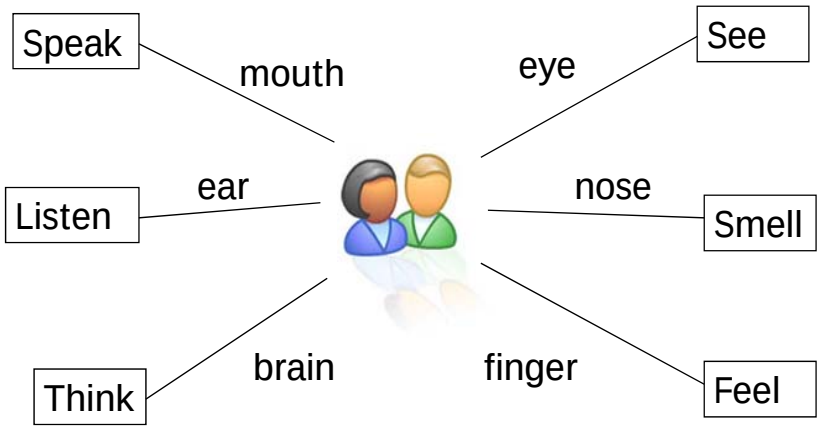
- Stuart J Russell & Peter Norvig, Artificial Intelligence: A Modern Approach, 2nd Edition, Prentice-Hall International, Inc, 2003, Textbook Site: http://aima.cs.berkeley.edu/
- John F. Sowa, Knowledge Representation and: Logical, Philosophical, and Computational Foundations ,Course Technology, 1999, Textbook
- George F. Luger & William A. Stubblefield, Artificial Intelligence Structure and Strategies for Complex Problem Solving 2nd Edition, The Benjamin/ Cummings Publishing Company Inc., 1993, Textbook
- Gerhard Weiss, Multiagent Systems: A Modern Approach to Distributed Artificial Intelligence, The MIT Press, 1999, Textbook
- Roland Siegwart & Illah R. Nourbakhsh, Introduction to Autonomous Mobile Robots, The MIT Press, 2004, Textbook
- Course Website: http://kuliah.itb.ac.id → STEI → Teknik Informatika → IF3054

Introduction to AI

Overview

- Humans vs Robots (agents)
- What is AI (Artificial Intelligence)?
- AI vs not AI Applications
- Intro to Intelligent Agent

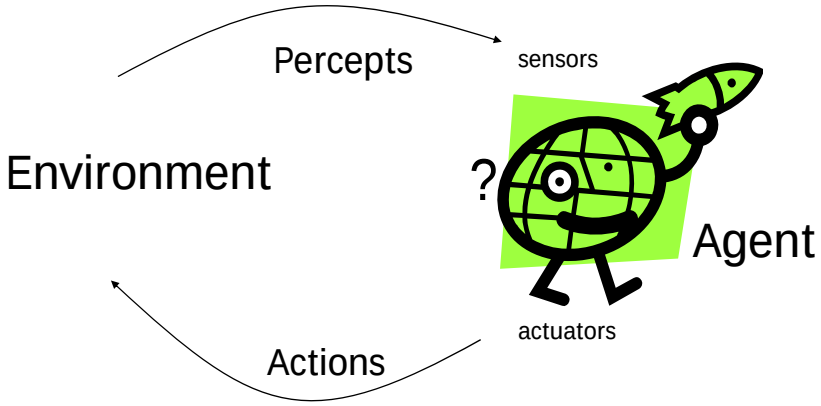
Human Capabilities



Intelligent Human

- Solve problems:
  - Needs knowledge
  - Can use the knowledge (reasoning)
  - Can plan to use what knowledge and when
  - Can add new knowledge (learn)
  - Can understand natural language (NLP)
  - Can communicate with others
  - …

Intelligent Agent



What is AI: Thinking humanly

- Computational models of human "thought" processes? (Thinking humanly)
  - Programs that operate (internally) the way humans do
    - How humans think ? → actual working of human minds
  - Cognitive modeling approach
  - Machines with minds
    - Searle (1980), The Chinese room
      - Running the right program does not necessarily generate understanding
  - Focus: vision and natural language.

Loebner Prize

PC Therapist III, 1991

PC Professor - discusses Men versus Women, 1992

PC Politican - discusses Liberals versus Conservatives, 1993

…

Ultra Hal Assistant, 2007

Artificial Solution, 2008

http://www.artificial-solutions.com/

What is AI: Acting humanly

- Computational models of human behaviour? (Acting humanly)
  - Programs that behave (externally) like humans: playing chess
  - Turing Test approach
    - Turing's suggestion was that, if the responses from the computer were indistinguishable from those of a human, the computer could be said to be thinking.
  - Loebner Prize Competition: Chatterbot
    - World Championship for conversational software

What is AI: Thinking/Acting rationally

- Computational systems that behave intelligently? (Thinking rationally)
  - What does it mean to behave intelligently?
  - Laws of thought approach
  - Right thinking: reasoning
- Computational systems that behave rationally! (Acting rationally)
  - Goal, knowledge → act rationally
  - Later: rational agent

AI Applications

- Autonomous control: ALVINN
- Autonomous planning & scheduling: NASA Remote Agent (controlling operations of spacecraft)
- Game playing: IBM's Deep Blue
- Diagnosis: medical expert system
- Robotics: ASIMO, HipNav (3D model of patient's internal anatomy)
- Language understanding and problem solving

Humanoid Robot

Communication ability: recognition technology

Recognition of registered faces

Recognition of moving objects

Recognition of gestures

Recognition:
- environment
- sound
- …

http://world.honda.com/ASIMO/technology/intelligence.html

DARPA Grand Challenge: $2 millions

- Stanley, Stanford Racing Team, 2005
- Urban Challenge 2007:
  - Qualification: 35 → 11 team
  - Tartan Racing Team, CMU

Tartan Team

Software	**Static Localization and Mapping:** Dirk Haehnel, Jesse Levinson, Hendrik Dahlkamp, David Stavens
	Dynamic Objects: Anna Petrovskaya, Dirk Haehnel
	Control: Gabe Hoffmann, Ganymed Stanek
	Simulation: Doug Johnston
	Planning and Optimization: Dmitri Dolgov and Michael Montemerlo
Testing	Jan Becker and Scott Ettinger

Stanley Team

Text Analysis Competition

- Document Understanding Conference
  - http://duc.nist.gov/
- Text Analysis Conference
  - http://www.nist.gov/tac/

Bidang penelitian:

- Natural Language Processing
- Machine learning, Text Mining
- Automatic Text Classification
- Automatic Text Summarization
- Information Retrieval
- QA

AI vs not AI Applications

- AI Applications: problems in computer science that don't feel well specified enough for the rest of the computer science community to want to work on.
- Those problems could evolve out of AI.
- By definition, no AI ever works; if it works, it's not AI.
  - Information retrieval, data mining, game technology, etc ?
- But there are all kinds of applications of AI.
- AI applications are very viable (berkembang).

Agents

- [1]: Software that gathers information about an environment and takes actions based on that information.
  - A robot
  - A factory
  - A web shopping program
  - …
- [2]: computer system that is *situated* in some *environment*, and that is capable of *autonomous action* in this environment in order to meet its design objectives

⇒ Computational agents that behave autonomously

The Agent & the Environment

- How do we begin to formalize the problem of building an agent?
  - Make a dichotomy between the agent and the environment
  - Not everyone believes that making this dichotomy is a good idea, but we need the leverage it gives us

How intelligent agents should act?

- A rational agent is an agent that does the right thing.
- A rational agent takes actions it believes will achieve its goals.
- Rationality at any given time depends on:
  1. The performance measurement that defines degree of success
  2. Everything that the agent has perceived so far (percept sequence)
  3. What the agent knows about the environment
  4. The actions that the agent can perform

Review

- AI: think/act humanly/rationally
- no AI ever works
- Is X AI application ?
- Agent
- Intelligent/rational agent

References

[1] A lecturer from MIT, "Techniques in Artificial Intelligence" based on Russell's book

[2] Gerhard Weiss, Multiagent Systems, MIT Press

THANK YOU