Artificial intelligence (AI)

Course description

Artificial intelligence (AI) is a research field that studies how to realize the intelligent human behaviors on a computer. The ultimate goal of AI is to make a computer that can learn, plan, and solve problems autonomously. Although AI has been studied for more than half a century, we still cannot make a computer that is as intelligent as a human in all aspects. However, we do have many successful applications. In some cases, the computer equipped with AI technology can be even more intelligent than us. The Deep Blue system which defeated the world chess champion is a well-know example.

The main research topics in AI include: problem solving, reasoning, planning, natural language understanding, computer vision, automatic programming, machine learning, and so on. Of course, these topics are closely related with each other. For example, the knowledge acquired through learning can be used both for problem solving and for reasoning. In fact, the skill for problem solving itself should be acquired through learning. Also, methods for problem solving are useful both for reasoning and planning. Further, both natural language understanding and computer vision can be solved using methods developed in the field of pattern recognition.

In this course, we will study the most fundamental knowledge for understanding AI. We will introduce some basic search algorithms for problem solving; knowledge representation and reasoning; pattern recognition; fuzzy logic; and neural networks.

Course objective

The main purpose of this course is to provide the most fundamental knowledge to the students so that they can understand what the AI is. Due to limited time, we will try to eliminate theoretic proofs and formal notations as far as possible, so that the students can get the full picture of AI easily. Students who become interested in AI may go on to the graduate school for further study.

Course schedule

Training Schedule	
Number	Contents
1	Introduction to AI
2	Problem formulation
3	Search-I
4	Search - II
5	Production system
6	Ontology
7	Propositional logic
8	First order predicate logic
9	Fuzzy logic
10	Pattern Recognition
11	Distance-Based Neural Networks
12	Multilayer Neural Networks
13	Decision trees
14	Population-based search

Textbook

- Qiangfu ZHAO and Tatsuo Higuchi, Artificial Intelligence: from fundamentals to intelligent searches, Kyoritsu, 2017, ISBN:978-4-320-12419-6 (in Japanese).

Prerequisites

- Probability and statistics
- Automata and languages

Student Evaluation

- Exercises (40), and final examination (60)

Referential sources

- Introduction to Artificial Intelligence, Shinji Araya, KYORITSU SHUPPAN, ISBN4-320-12116-3 (in Japanese)

- New Artificial Intelligence (Fundamental), Takashi Maeda and Fumio Aoki, Ohmsha, ISBN4-274-13179 (in Japanese)

- New Artificial Intelligence (Advanced), Takashi Maeda and Fumio Aoki, Ohmsha, ISBN4-274-13198-X (in Japanese)
- Artificial Intelligence: a modern approach, S. Russell and P. Norvig, Prentice Hall, ISBN0-13-
080302-2