Artificial Intelligence

Introduction

Logistics

- Course home page: http://csci.viu.ca/~liuh/485/

- General Information:
  http://csci.viu.ca/~liuh/485/OutlineCSCI485.html

- No-show Policy

- Late Policy: negotiate with me BEFORE the due date

- Exam Policy:

  - Closed book exam

  - One piece of letter-sized and double-sided notes

Outline

- What is AI?

- A brief history

- The state of the art

- Course overview

What is Intelligence?

- the ability to understand and learn things;

- the ability to think and understand instead of doing things by instinct or automatically.

AI Definition

A good general definition of AI could be:

AI is the part of computer science concerned with designing intelligent computer systems, that is, computer systems that exhibit the characteristics we associate with intelligence in human behaviour - understanding language, learning, reasoning and solving problems.

What is AI?

Views of AI fall into four categories:

Thinking Humanly	Thinking Rationally
Acting Humanly	Acting Rationally

The textbook advocates "Acting Rationally".

Acting Humanly (Turing Test)

- Turing (1950) "Computing machinery and intelligence":
- "Can machines think?" ==> "Can machines behave intelligently?"
- Operational test for intelligent behaviour: the Imitation Game
- Using humans as a standard for determining intelligence avoids the inevitable debates over the "true" nature of intelligence
- Whether or not the entity uses the appropriate internal processes or whether or not the entity is actually conscious of its actions are irrelevant.
- It touched the major components of AI:
  - natural language understanding,
  - knowledge representation,
  - automatic reasoning,
  - machine learning, etc.
  - computer vision
  - robotics
- Problem: it is not constructive.

Thinking Humanly

- need to really understand how humans think first.

- two approaches:

  - Cognitive Science

  - Cognitive Neuroscience;

- both are distinct from AI now.

- only common thing with AI: the available theories do not explain (or engender) anything resembling human-level general intelligence.

Thinking Rationally (Ideal Thinking Process)

- "Right thinking" means irrefutable reasoning processes. That is, it is a system that always yields correct conclusions when given correct premises.

- The laws of thought initiated the field called Logic.

- Problems:

  - Not all intelligent behaviour is mediated by logical deliberation (not easy to express informal knowledge as formal logical terms)

  - difference in solving problems "in principle" and "in practice"

  - What is the purpose of thinking? What thoughts should I have?

Acting Rationally (Rational Agent)

- Rational behaviour: doing the right thing

- The right thing: that which is expected to maximize goal achievement, given the available information

- Doesn't necessarily involve thinking – e.g., blinking reflex – but thinking should be in the service of rational action

- An agent is an entity that perceives and acts

- Advantages:

  - it is easier to set a standard;

  - think rationally is just part of the game for achieving rationality;

  - it is better than just acting humanly.

Fields that helped AI

- Philosophy — Logic, methods of reasoning, rationality, etc

- Mathematics — Formal representation, computation, (un)decidability, probability

- Economics — utility, decision theory

- Neuroscience — physical substrate for mental activity

- Psychology — perception and motor control,

- Computer science/engineering — building fast computers and more efficient algorithms

- Control theory — design systems that maximize an objective function over time

- Linguistics — knowledge representation, grammar

- etc

Application Fields

- Game playing

- Automated reasoning and theorem proving

- Expert systems (diagnosis)

- Natural language understanding

- Modelling human performance

- Planning and robotics

- Machine learning

Course overview

- Intelligent agents

- Problem solving and search

- Game Playing

- Knowledge representation and reasoning

- Planning

- Learning

- Communication, Perception and Action

State of the art

- Alpha Go/Zero

- Deep Mind's AI predicting protein folding structure (AlphaFold?)

- Voice Recognition products

- Image to Characters

- chatGPT (How can it not be mentioned!)

- What do you know?