COMP219: Artificial Intelligence

Dr. Frans Oliehoek
Department of Computer Science
University of Liverpool
COMP219: Artificial Intelligence

Lecture 1: Introduction
Today

• Admin and module info
• Introduction to AI
Module Outline

• The module consists of
  – 28 lectures
  – 4 labs (exercises not assessed)
  – Enough self study to understand the material

• Assessment
  – 2 class tests
  – A two hour exam

• Module information page:
  http://www.fransoliehoek.net/comp219/
# Module Delivery

**Lecturer:**

Dr. Frans Oliehoek  
Room 222, Ashton Building  
Email: frans.oliehoek@liverpool.ac.uk

I am available to answer short queries after lectures and will be happy to schedule an appointment to discuss any more detailed queries.

**Demonstrators:**

Joe Collenette –  
sgjcolle@student.liverpool.ac.uk

Gregory Palmer –  
G.J.Palmer@liverpool.ac.uk

Pavithra Rajendran –  
Pavithra.Rajendran@liverpool.ac.uk
Timetable

Lectures

Monday, 16:00-17:00, CTH-LTB.
Tuesday, 10:00-11:00, REN-LT6.
Friday, 11:00-12:00, CHAD-CHAD.

There will be no lectures on:

2-10-2017
9-10-2017

(Due to changes in lab times...) there will be a lecture on 6-10-2017
Module Assessment

• Non-assessed lab exercises
  – You should have been assigned to one of the lab classes; check time and allocation on your online timetable.
  – Labs start in week 3

• 2 class tests each worth 10% of the final mark for the module

• Exam in January, which will last 2 hours and is worth 80% of the final mark for the module
  – Multiple choice exam
Feedback

• Both continual assessment components will take the form of class tests.

• Results of the class tests will be returned within two working weeks (the departmental guideline).

• Feedback will be in the form of comments and suggestions noting where you went wrong (if applicable) and what you could have done differently.

• You can also receive feedback on the non-assessed lab exercises by submitting your answer sheets to the demonstrators.

• I will run through the solutions to the first class test during a lecture.
Notes

• Lecture note will be available for download from the COMP219 website.

• You should supplement with your own notes.

• IMPORTANT:
In some lectures I will set exercises that DO NOT appear in the notes – **if you miss the lecture it is up to you to catch up on missed exercises.**
Reading

• Good AI books include:

• The following is a (cheap) text (not as comprehensive as the above) which covers standard material
Prolog Books

• Comprehensive books:

• Straightforward book
Module Content

• Introduction to artificial intelligence
• Prolog - an AI programming language
• Search
• Knowledge representation
• Logic
• Planning
• Learning
• AI applications
Module Aims

• To provide an introduction to the topic of artificial intelligence through studying problem solving, knowledge representation, planning and learning in intelligent systems.

• To provide a grounding in the AI programming language Prolog.
Learning Outcomes

At the end of this module, students should be able to:

• identify or describe the characteristics of intelligent agents and the environments that they can inhabit;
• identify, contrast and apply to simple examples the major search techniques that have been developed for problem-solving in AI;
• distinguish the characteristics, and advantages and disadvantages, of the major knowledge representation paradigms that have been used in AI, such as production rules, semantic networks, propositional logic and first-order logic;
• solve simple knowledge-based problems using the AI representations studied;
• identify or describe approaches used to solve planning problems in AI and apply these to simple examples;
• identify or describe the major approaches to learning in AI and apply these to simple examples;
• identify or describe some of the major applications of AI;
• understand and write Prolog code to solve simple knowledge-based problems.
Please ensure that you...

• Switch off all mobile phones during lectures and practical classes.
• Do not scan/sign the register on behalf of other people.
• Attend lectures but do not talk during them or distract others.
  – A major distraction for me and others is laptops: please do not use these during lectures unless you have a valid reason that you have first discussed with me.
• Attempt the laboratory exercises.
• Do whatever reading and self study that is required to understand the material.
• Ask questions if there is anything that you do not understand.
• Sit the class tests!
Credits

• This set of slides contains material provided by people who have previously taught this module in the University of Liverpool
  – John Fearnley,
  – Katie Atkinson
  – Annabel Latham
  – Adam Wyner
  – Boris Konev
  – Clare Dixon
  – Simon Parsons
  – Trevor Bench-Capon

• Russell & Norvig “AlaMA” supplement slides
Introduction to Artificial Intelligence
What is AI?

- AI attempts to build **intelligent** entities
  - What is intelligence...?
  - Not a clear cut answer!
  - E.g.,:
    - must relate to tasks involving “higher mental processes”: so **not** simple response to some stimulus (e.g. a thermostat)
    - **not** mechanical performance of some algorithm
What is AI?

- “Hard” AI view
  - “The ultimate goal of AI research ... is to build a person, or more humbly an animal” – Charniak and McDermott

- “Soft” AI view
  - “AI is the study of how to make computers do things, at which, at the moment, people are better” - Elaine Rich
AI is both science and engineering

• the *science* of understanding intelligent entities – of developing theories which attempt to explain and predict the nature of such entities

• the *engineering* of intelligent entities
Four views of AI

• Systems that **think like humans**
  – cognitive science, expert systems

• Systems that **act like humans**
  – The Turing Test, chess programs

• Systems that **think rationally**
  – Approaches based on logic and mathematics

• Systems that **act rationally**
  – Contemporary agent-based approaches
Acting Humanly

• Emphasis on how to *tell* if a machine is intelligent, not on how to *make* it intelligent
• When can we count a machine as being intelligent?
• “Can machines think?” → “Can machines behave intelligently?”
• Most famous response due to Alan Turing, British mathematician and computing pioneer
The Turing Test

- System passes if the questioner cannot tell the difference
- *No* program has yet passed the test: most successful ones rely on *tricks* rather than intelligence
- But can obtain human level performance (or better) in some *specific* areas like chess
Thinking Humanly

• Try to understand how the mind works - how do we think?

• Two possible routes to find answers:
  – by *introspection* - we figure it out ourselves!
  – by *experiment* - draw upon techniques of *psychology* (or *neuroscience*) to conduct controlled experiments

• The discipline of *cognitive science*: at one time influential in vision, natural language processing, and learning.
Human vs Machine Thinking

- **Expert systems** – “AI success story in early 80s”
  - Human expert’s knowledge and experience is represented as a computer program
  - Rule-based representation of knowledge
  - Typical domains are:
    - medicine (INTERNIST, MYCIN, . . . )
    - geology (PROSPECTOR)
    - chemical analysis (DENDRAL)
    - configuration of computers (R1)
    - law (British Nationality Act)

- Thinking humanly can work (sometimes)
Human vs Machine Thinking

• Computer program playing chess
  – “Human way”
    • Tried by World champion Mikhail Botvinnik
      (who also was a programmer)
    • Poor performance
  – “Computer way”
    • Sophisticated search algorithms
    • Vast databases
    • Immense computing power
    • Human world champion beaten

• True also for vision, robotics, speech recognition etc.
Thinking Rationally

• Trying to understand how we actually think is one route to AI – but how about how we should think?
• Use logic to capture the laws of rational thought as symbols
• Reasoning involves shifting symbols according to well-defined rules (like algebra)
• Result is idealised reasoning

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Logic and AI

• Logical approach theoretically attractive

• Lots of problems:
  – **Transduction** - how to map the environment to symbolic representation
  – **Representation** - how to represent real world phenomena (time, space, . . . ) symbolically
  – **Reasoning** - how to do symbolic manipulation tractably
Acting Rationally

- Acting rationally = acting to achieve one’s **goals**, given one’s **beliefs**
- An **agent** is a system that **perceives** and **acts**; an intelligent agent is one that acts rationally w.r.t. the goals we delegate to it
- Emphasis shifts from designing *theoretically* best decision making procedure to the best decision making procedure possible in **circumstances**
- Logic may be **used** in the service of finding the best action – not as an end in itself
Acting Rationally

• Achieving *perfect rationality* – making the *best* decision theoretically possible – is not usually achievable because of
  – limited resources
  – limited time
  – limited computational power
  – limited memory
  – limited or uncertain information about environment

• The aim is to *do the best with what you’ve got*
Summary

• **Today**
  
  – General module information
  
  – Overview of what AI is
    * The science of understanding intelligent entities, and engineering them

• **Next time**
  
  – Overview of some common AI techniques we will study during the module
  
  – Typical AI applications