COMP219: Artificial Intelligence

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Lecture 1: Introduction
Today

• Admin and module info
• Introduction to AI
Module Outline

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

• Assessment
  – 2 class tests
  – A two hour exam

• Module information page:
  https://www2.csc.liv.ac.uk/~john/comp219/
Module Delivery

Lecturer: Dr. John Fearnley
Room 322, Ashton Building (third floor)
Email: john.fearnley@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: Ms. Latifa Al-Abdulkarim
Room 211, Ashton Building (second floor)
Email: latifak@liverpool.ac.uk

Mr. Joe Collenette
Room 211, Ashton Building (second floor)
Email: sgjcolle@student.liverpool.ac.uk
Timetable

Lectures

• **Tuesday, 13:00**, Life Sciences, LT2

• **Thursday, 11:00**, Duncan Building, LT2

• **Friday, 9:00**, Central Teaching Hub, LTC
Module Assessment

• Non-assessed lab exercises
  – Labs on **Mondays, Tuesdays** and **Fridays**. You should have been assigned to one of the lab classes; check time and allocation on your online timetable.
  – Labs start in week 2

• 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 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 who will be happy to mark them.

• At the end of the module I will run through the solutions to the class tests during a lecture, which will also serve as revision.
Notes

• Printouts of the lecture notes will be handed out during lectures

• The notes will also be posted on the COMP219 website.

• You should supplement the printouts 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

• Most comprehensive book

• 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
  – Katie Atkinson
  – Annabel Latham
  – Adam Wyner
  – Boris Konev
  – Clare Dixon
  – Simon Parsons
  – Trevor Bench-Capon

• AIAMA supplement slides
Introduction to Artificial Intelligence
What is AI?

• AI attempts to build intelligent entities
  – Intelligence – 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
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