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 (second 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

Module Assessment

• Non-assessed lab exercises
  – Labs on Thursdays 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

Timetable

Lectures

• Tuesday, 13:00, Life Sciences, LT2

• Thursday, 11:00, Duncan Building, LT2

• Friday, 9:00, Central Teaching Hub, LTC

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 available on a weekly basis from the computer science helpdesk (George Holt Building) as the module proceeds.

- The notes will also be posted on VITAL.

- 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
  - D. Crookes. *Introduction to Programming in Prolog*. Prentice-Hall, 1988

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?

- "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

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
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

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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

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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

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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

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