

COMP219:
Artificial Intelligence

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University of Liverpool

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Today

- Admin and module info
- Introduction to AI

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COMP219:
Artificial Intelligence

Lecture 1: Introduction

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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/>

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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 the notes – **if you miss the lecture it is up to you to catch up on missed exercises.**

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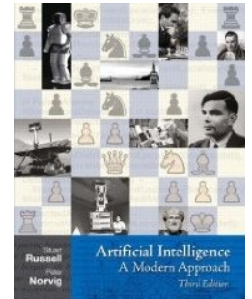
Prolog Books

- Comprehensive books:
 - [I. Bratko](#). *Prolog Programming for Artificial Intelligence*. Addison Wesley, 1990
 - [Sterling, Leon, and Ehud Y. Shapiro](#). *The art of Prolog: advanced programming techniques*. MIT press, 1994
- Straightforward book
 - [D. Crookes](#). *Introduction to Programming in Prolog*. Prentice-Hall, 1988

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Reading

- Good AI books include:
 - [S. Russell and P. Norvig](#). *Artificial Intelligence: A Modern Approach*. Prentice Hall, 2010 (3rd edition)
 - [E. Rich and K. Knight](#). *Artificial Intelligence*. McGraw-Hill, 1991 (2nd edition)
- The following is a (cheap) text (not as comprehensive as the above) which covers standard material
 - [A. Cawsey](#). *The Essence of Artificial Intelligence*. Prentice-Hall, 1998



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Module Content

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

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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**.

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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!

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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.

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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

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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

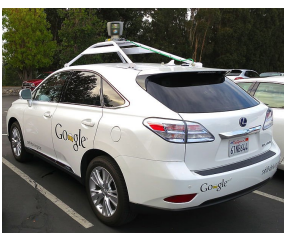
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What is AI?



- “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](#)

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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

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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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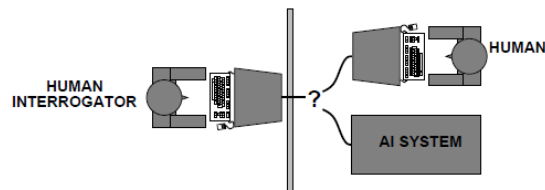
Acting Humanly

- 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

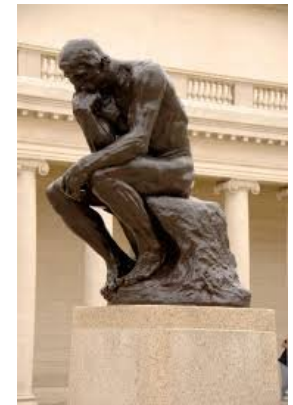


- System passes if the questioner cannot tell the difference
- **No** program has yet passed the test: most successful ones rely on **tricks** rather than intelligence
- But can obtain human level performance (or better) in some **specific** areas like chess

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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.



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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**)



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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.



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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

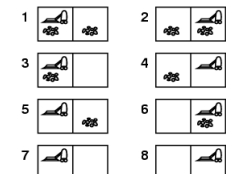
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Logic and AI

- 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



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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

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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**

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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

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