

# History of Artificial Intelligence

COMP3411 / 9814

<http://www.cse.unsw.edu.au/~cs3411>

# What is AI?

"... to investigate the fundamental laws of those operations of the mind by which reasoning is performed; to give expression to them in the symbolical language of a Calculus, and upon this foundation to establish the science of Logic and construct its method; to make that method itself the basis of a general method for the application of the mathematical doctrine of Probabilities; and, finally, to collect from the various elements of truth brought to view in the course of these inquiries some probable intimations concerning the nature and constitution of the human mind.

**George Boole (1854)**  
**An Investigation of the Laws of Thought**

# Artificial Intelligence: The First 2,400 years

• Logic (Aristotle c. 350BC, Boole 1848, Frege 1879, Tarski 1935)	Deductive reasoning, problem solving
• Formal algorithms (Euclid c. 300BC)	Theoretical foundations
• Inductive Reasoning (Bacon 16th C, Hume 18th C)	Machine Learning
• Probability (Pascal 17th C, Bayes 18th C)	Uncertain reasoning
• Utility theory (Mill 1863)	Uncertain reasoning, reinforcement learning
• Structural linguistics (Saussure 1916, Bloomfield 1933)	Natural Language Processing
• Formal systems (Gödel 1929, Turing 1936)	Theoretical foundations
• Neural networks (McCulloch & Pitts 1943)	Machine Learning
• Cybernetics/Control theory (Wiener 1948)	Autonomous systems
• Game theory (von Neumann & Morgenstern 1947)	Game play, adversarial agents
• Decision theory (Bellman 1957)	Reinforcement learning
• Formal linguistics (Chomsky 1957)	Natural Language Processing

# Thought as Calculation

The only way to rectify our reasonings is to make them as tangible as those of the Mathematicians, so that we can find our error at a glance, and when there are disputes among persons, we can simply say: “Let us calculate”, without further ado, to see who is right.

**Leibnitz (1685)**  
**The Art of Discovery**

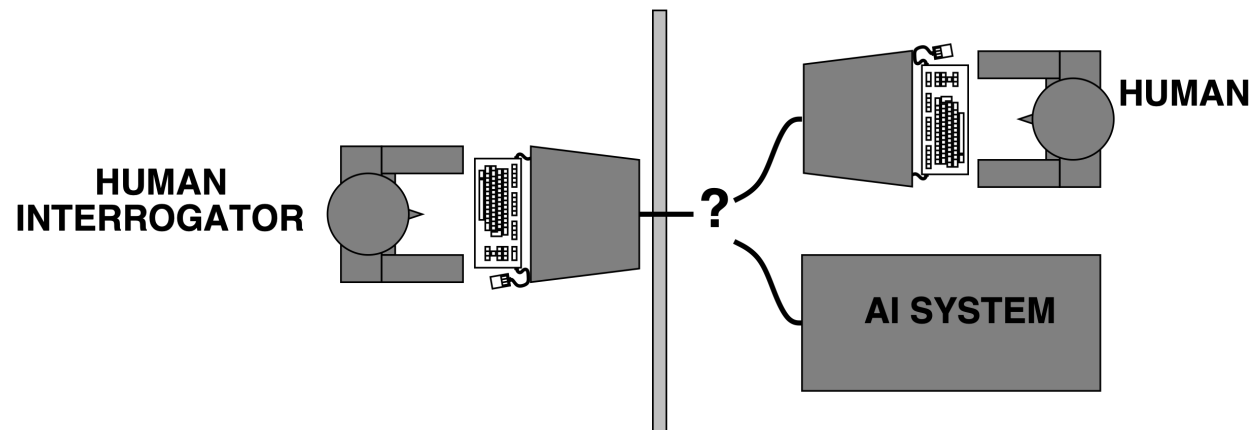
# Milestones

- 1950 – Turing's paper in the imitation game and child machine
- 1951 – Game of draughts (Christopher Strachey, Manchester)
- 1955 – Checkers learning program (Samuel, IBM)
- 1956 – Dartmouth Conference (first use of "Artificial Intelligence")
- 1959 – General Problem Solver (Newell, Simon & Shaw)
- 1960 – Adaptive Control (Widrow & Hoff)
- 1962 – Perceptrons (Rosenblatt)

# Milestones

- 1963 – Symbolic Algebra (Slagle)
- 1969 – Shakey (Nilsson, Duda, Hart, Fikes, ... SRI International)
- 1975 – Freddy and the AI Winter (Michie *et al*, Edinburgh)
- 1981 – First International Workshop on Machine Learning
- 1981 – Decision Trees (Quinlan, Stanford, USyd, NSWIT, UNSW)
- 1997 – Deep Blue beats Gary Kasparov (IBM)
- 1997 – First RoboCup competition

# Turing's Imitation Game (1950)



I believe that in about fifty years time [2000] it will be possible to programme computers with a storage capacity of about  $10^9$  to make them play the imitation game so well that an average interrogator will not have more than 70 per cent chance of making the right identification after five minutes of questioning.

# Eliza Session

Doctor: What brought you here to see me today?

Visitor: Oh, nothing much. I'm feeling a bit tired, that's all.

Doctor: Why do you think you're feeling a bit tired?

Visitor: Well, I've been traveling a lot, and away from home.

Doctor: Tell me more about your family.



# Eliza Session

Visitor: The trouble is, my mother's ill.

Doctor: How long has she been ill?

...

Visitor: The trouble is, my mother's Irish.

Doctor: How long has she been Irish?

...

Visitor: The trouble is, my mother's poodle.

Doctor: How long has she been poodle?

# Extract from Turing paper

**Interrogator:** In the first line of your sonnet which reads 'Shall I compare thee to a summer's day', would not 'a spring day' do as well or better?

**Witness:** It wouldn't scan.

**Interrogator:** How about 'A winter's day' – That would scan all right.

**Witness:** Yes, but nobody wants to be compared to a winter's day.

**Interrogator:** Would you say Mr. Pickwick reminded you of Christmas?

**Witness:** In a way.

**Interrogator:** Yet Christmas is a winter's day, and I do not think Mr. Pickwick would mind the comparison.

**Witness:** I don't think you're serious. By a winter's day one means a typical winter's day, rather than a special one like Christmas.

# ChatGPT

In the first line of Shakespeare's sonnet which reads 'Shall I compare thee to a summer's day', would not 'a spring day' do as well or better?

- The use of "summer's day" in the first line of Shakespeare's sonnet is a literary device, and the choice of "summer" specifically serves a specific purpose in the poem. The speaker is using the comparison to a summer's day to highlight the beauty and qualities of the person they are addressing, but also acknowledging that the person they are addressing may be even more beautiful and have qualities that surpass those of a summer's day. It is possible that "spring day" could have been used as well, but it may not have the same impact or meaning in the context of the poem.

A spring day wouldn't scan

- You are correct that "spring" does not scan with the meter of the first line of the sonnet. Shakespeare's sonnets follow a specific metrical pattern, known as "iambic pentameter," which consists of 10 syllables per line with the stress pattern of unstressed syllable followed by a stressed syllable. "Shall I compare thee to a spring day" would not fit this metrical pattern, as the word "spring" has one syllable more than "summer" and would disrupt the meter of the line. Therefore, Shakespeare chose to use "summer" in the first line in order to maintain the metrical structure of the poem.

# ChatGPT

How about 'A winter's day' – That would scan all right.

- You are correct that "A winter's day" would scan with the meter of the first line of the sonnet. The word "winter" has the same number of syllables as "summer", and would fit the iambic pentameter metrical pattern of the line. However, it would not provide the same imagery and meaning as "summer's day" in the context of the poem. Summer is often associated with warmth, vitality, and beauty, while winter is often associated with cold, darkness, and death. The comparison to a summer's day is a way to praise the beauty of the person addressed in the poem, while the comparison to a winter's day would bring a different imagery and meaning.

Yet Christmas is a winter's day, and I do not think Mr. Pickwick would mind the comparison.

- You are correct that Christmas is a winter's day, and it is possible that Mr. Pickwick, as a jovial and generous character, would not mind being compared to it. It is true that Dickens' novel are well known for their Christmas themes and imagery, and it's possible that "The Pickwick Papers" also has some of it, but the comparison between Mr. Pickwick and Christmas is not immediately obvious and the character is not strongly linked with the holiday in the story. It's also worth noting that Christmas is associated with warmth, family, and generosity, which are also qualities that could be associated with Mr. Pickwick, therefore the comparison can be made but it's not a common one.

# Is ChatGPT intelligent?

- Can pass Turing test
  - Plagiarises off the web
- Doesn't have any common sense
  - e.g. [ChatGPT takes astrophysics exam](#)
  - Does almost as well as average student
  - ... but asked to calculate radius of an exoplanet gives answer 0.003 Earth radii – doesn't have common sense to know the answer is ridiculous
- ChatGPT is curated

# Avoid cheating with ChatGPT

*How can a teacher prevent a student from using ChatGPT to cheat in an assignment?*

There are several strategies that a teacher can use to prevent students from using language models like ChatGPT to cheat on an assignment. Some methods include:

- Creating unique and original assignments that are difficult to find answers to online
- Using plagiarism detection software to check for similarities between student submissions and text found online
- Asking open-ended, thought-provoking questions that require critical thinking and analysis
- Encouraging students to cite their sources and include references in their work
- Providing opportunities for students to discuss and present their work in class
- Using techniques such as randomized questions, randomized order of questions, and randomized answer choices in multiple-choice questions,
- Offering a reward to students who report classmates who cheated
- Educating students about academic integrity and the dangers of plagiarism

It's important to note that no method is fool proof and preventing cheating is a continuous effort, but implementing a combination of these strategies can help reduce the likelihood of cheating.

# Conversational Agents



# The Child Machine

“Instead of trying to produce a programme to simulate the adult mind, why not rather try to produce one which simulates the child's? If this were then subjected to an appropriate course of education one would obtain the adult brain. Presumably the child-brain is something like a notebook as one buys from the stationers. Rather little mechanism, and lots of blank sheets... Our hope is that there is so little mechanism in the child-brain that something like it can be easily programmed. The amount of work in the education we can assume, as a first approximation, to be much the same as for the human child.”

**Alan Turing (1950)**  
**Computing Machinery and Intelligence**



# The World Brain

- "...a sort of mental clearing house for the mind, a depot where knowledge and ideas are received, sorted, summarized, digested, clarified and compared."
- "any student, in any part of the world, will be able to sit with his projector in his own study at his or her convenience to examine any book, any document, in an exact replica."

**H.G. Wells (1937)**

**World brain: the idea of a permanent world encyclopaedia**

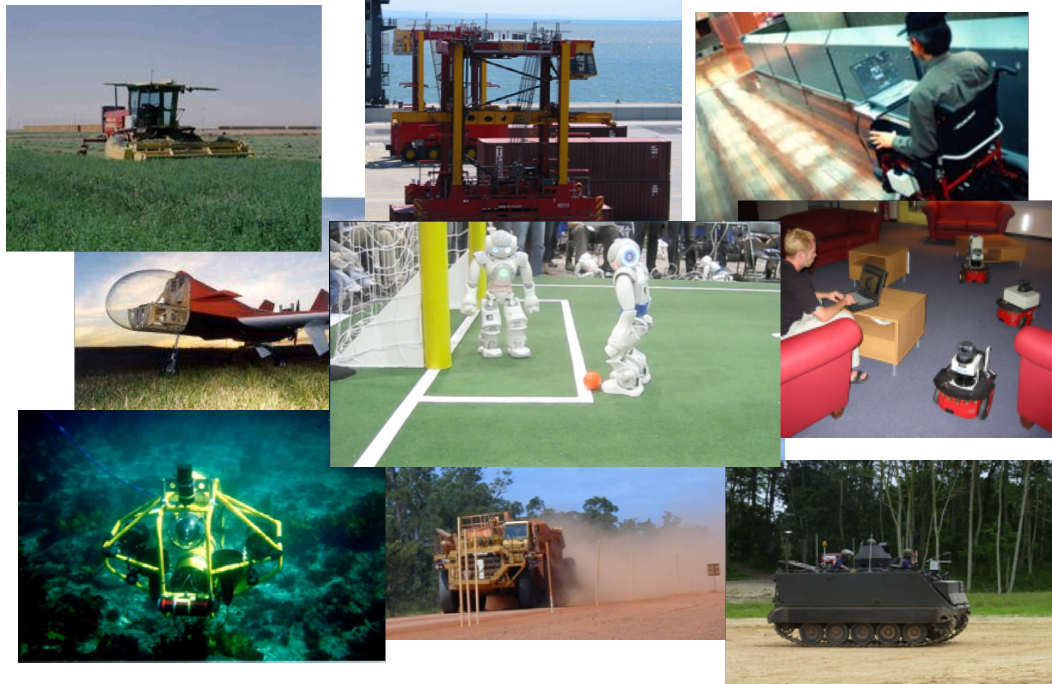
# Where has AI gone?

- A lot of focus on the world brain
  - Masses of data enable solving problems in ways we couldn't anticipate
    - E.g. Crowd-sourcing
    - Data centres have enormous computing power
- Child machine becoming more important with rise of the robots

# Agents and Autonomous Systems

- Complex behaviours in dynamic environments
- Have to integrate almost all aspects AI
- Combines computing with many other disciplines

# Autonomous Systems



# Shakey - The First Integrated AI System



# Freddy and the Lighthill Report



# Some Applications of AI in CSE

- Autonomous maritime vessels (Ocius)
- Steel manufacture (BlueScope)
- Infrastructure maintenance (ARC Research Hub)
- Museum knowledge base (Powerhouse)
- eLearning (Stronger Brains)
- Mine Automation
- Medical imaging
- Satellite image recognition (SmartSat CRC)
- Lunar analogue simulator (new ACSER LIEF grant)
- Network security and management
- IOT
- Transport planning

# Recent History

- Read Nils Nilsson's "[The Quest for Artificial Intelligence](#)"
- <https://ai.stanford.edu/~nilsson/QAI/qai.pdf>