



COMP702: Classical Artificial Intelligence
1: What Is AI?



What is “Classical” AI?



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- ✓ Performing tasks by machine (or by software) which would ordinarily require human intelligence
- ✓ Making decisions to achieve goals

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- ✓ Machine learning is an important sub-field of AI, but there are many other AI techniques

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- ✓ Maybe one day, but for now this is pure sci-fi
- ✓ Programming machines to carry out (or learn to carry out) a specific type of task

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- ▶ A.k.a. **Symbolic AI**
- ▶ Based on symbolic (“human-readable”) representations of problems, logical systems, search spaces
- ▶ As opposed to machine learning, evolutionary algorithms etc which tend to be “black boxes”

Applications of AI in games

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Why game AI?

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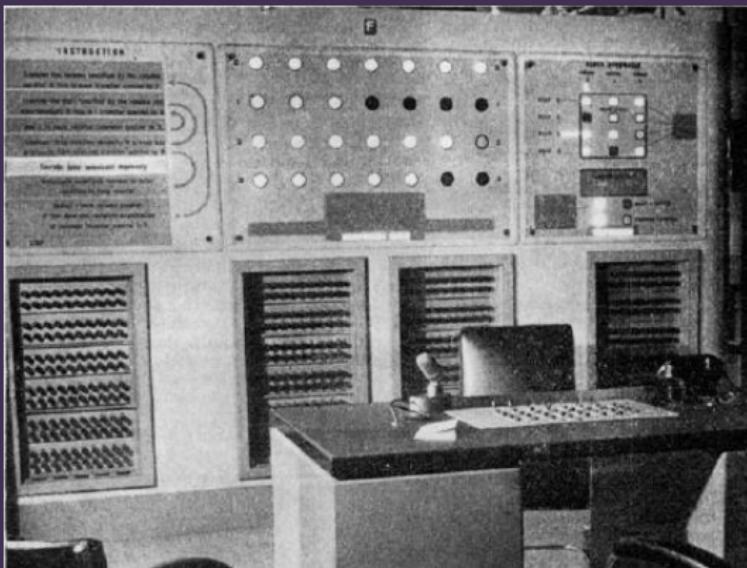
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- ▶ Games are a useful testbed for new AI technologies
- ▶ Game theory is a useful mathematical abstraction for many types of problem
- ▶ Game AI is more than pure problem solving — game AI needs to create an entertaining experience

Nimrod (Ferranti, 1951)



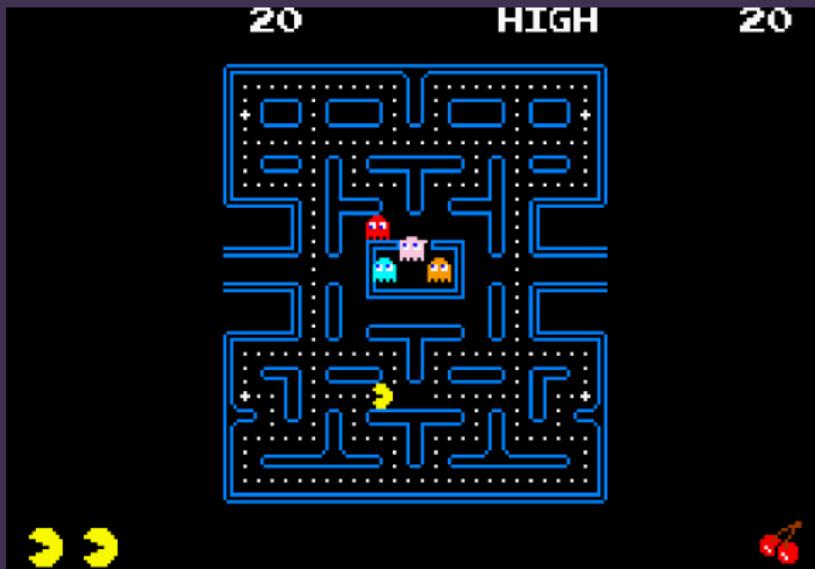
Samuel's Checkers program (IBM, 1962)



Galaxian (Namco, 1979)



Pac-Man (Namco, 1980)



Deep Blue (IBM, 1997)



Half-Life (Valve, 1998)



The Sims (Maxis, 2000)



Black & White (Lionhead, 2001)



Façade (Mateas & Stern, 2005)



Chinook (Schaeffer et al, 2007)



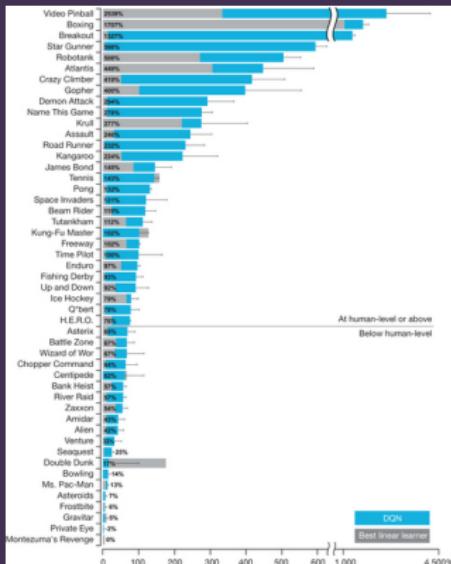
Left 4 Dead (Valve, 2008)



Watson (IBM, 2011)



Deep learning for Atari games (DeepMind, 2013)



AlphaGo (Google DeepMind, 2016)



AI architectures



Rule-based AI

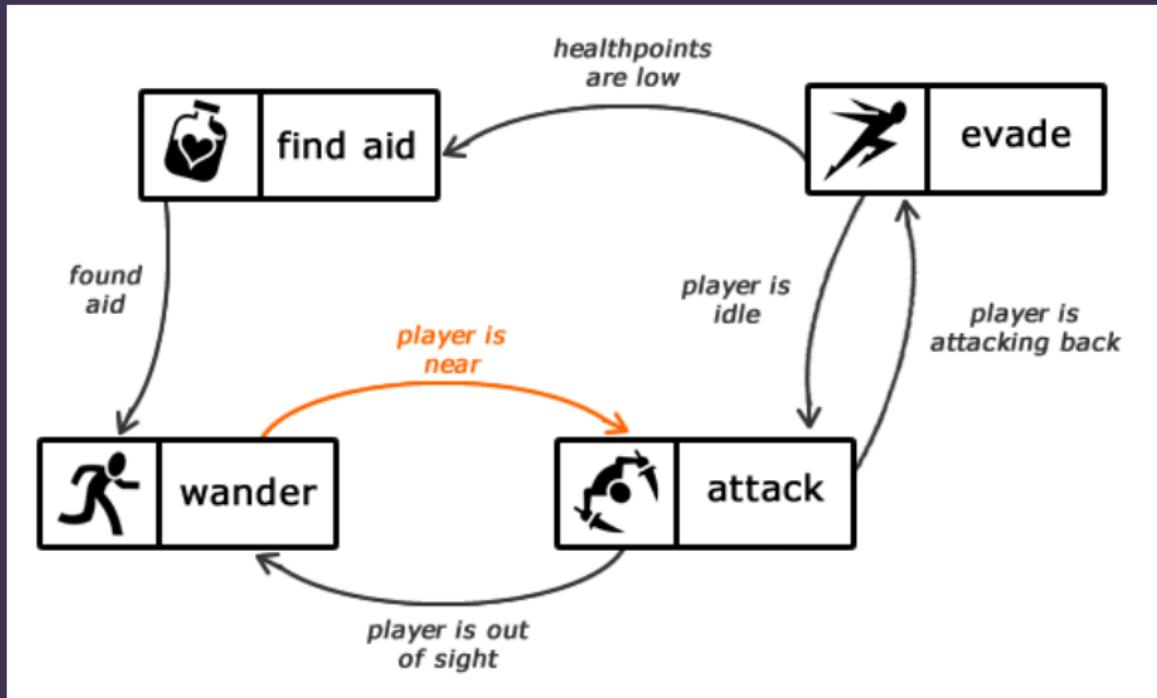
Rule-based AI

- Generally implemented as `if` statements or event-based triggers

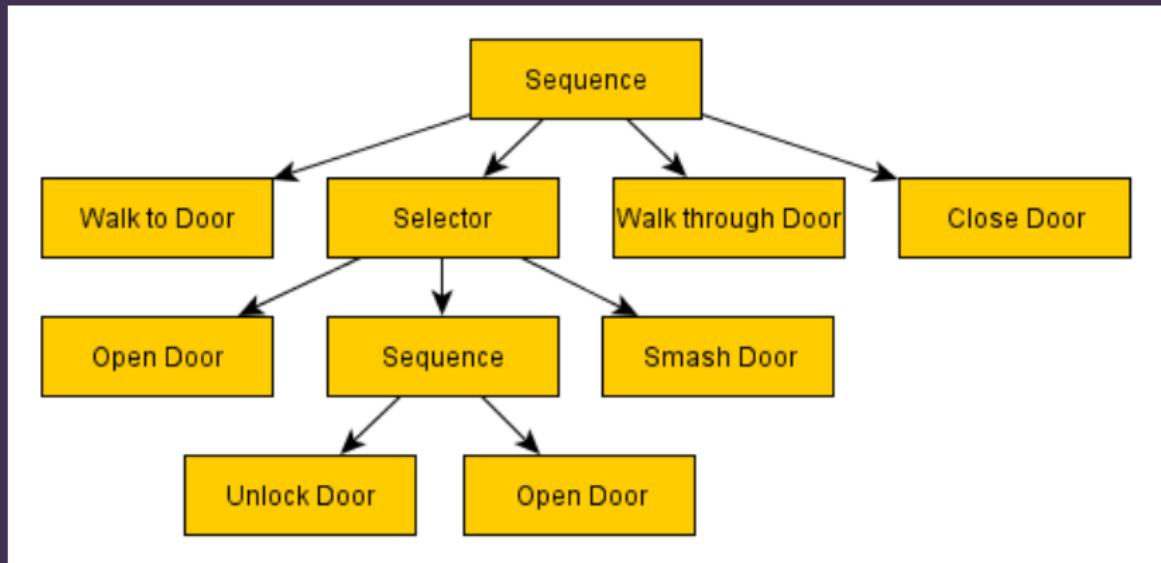
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- ▶ Triggers can be complicated e.g. based on raycasts

Finite state machines



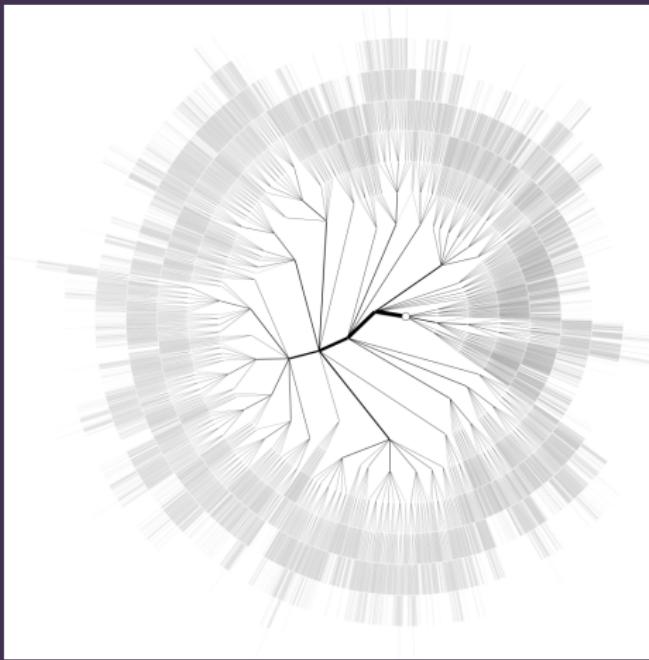
Behaviour trees



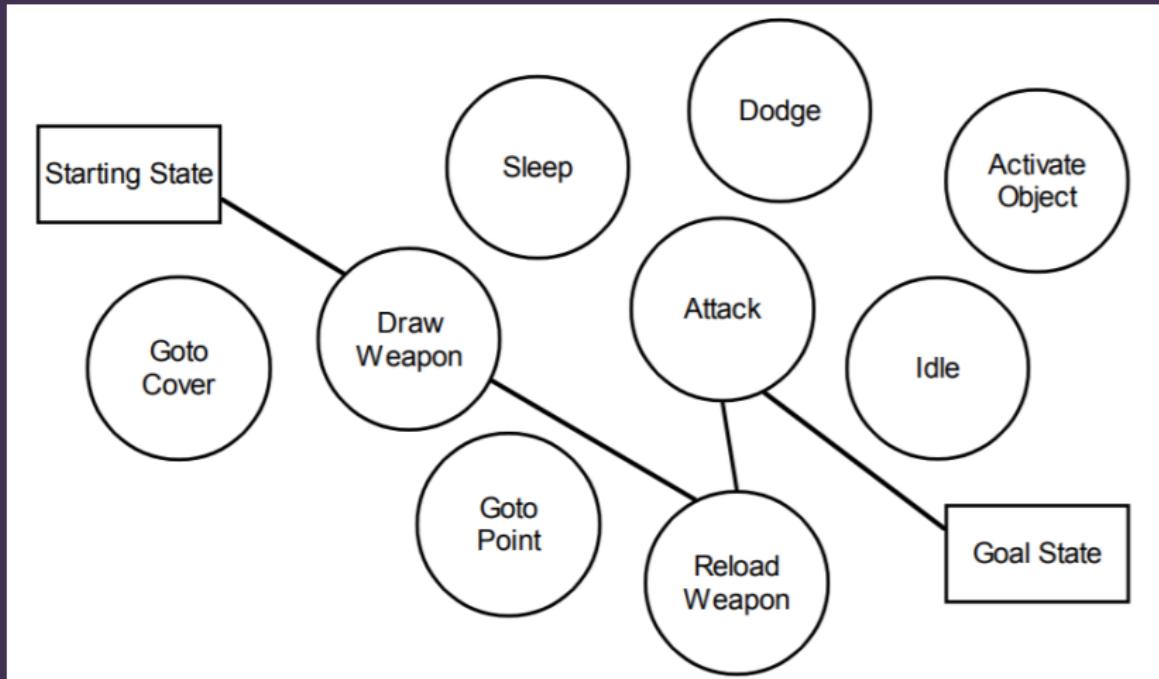
Multi-agent approaches (e.g. flocking)



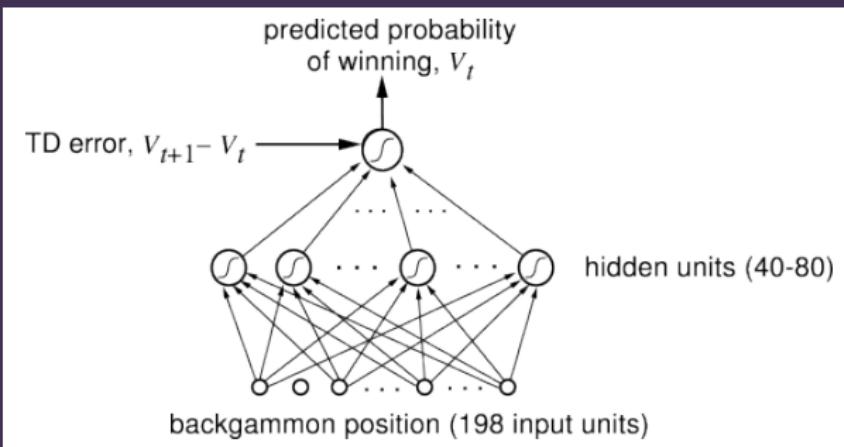
Game tree search



Planning



Machine learning



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- ▶ Do you want to **design** the AI behaviours yourself, or do you want them to **emerge** from the system?

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- ▶ Predictability and authorial control versus adaptability and novelty
- ▶ Can also combine the two, e.g. use a rule-based system to constrain a CI system