



COMP702: Classical Artificial Intelligence

1: What Is AI?

What is “Classical” AI?

What is AI?

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

What is AI?

- ✗ Programming machines to learn by themselves
- ✓ Machine learning is an important sub-field of AI, but there are many other AI techniques

What is AI?

- ✗ Programming machines to possess general intelligence, self-awareness, consciousness
- ✓ 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

What is classical AI?

- ▶ A.k.a. **Good Old Fashioned AI**
- ▶ 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

- ▶ Enemies and other NPCs
- ▶ Opponents in {board, card, strategy} games
- ▶ Automated playtesting
- ▶ Directors, hints, adaptive difficulty
- ▶ Procedural content generation
- ▶ Content production tools
- ▶ Procedural narrative
- ▶ Agent-based simulations
- ▶ ...

Why game AI?

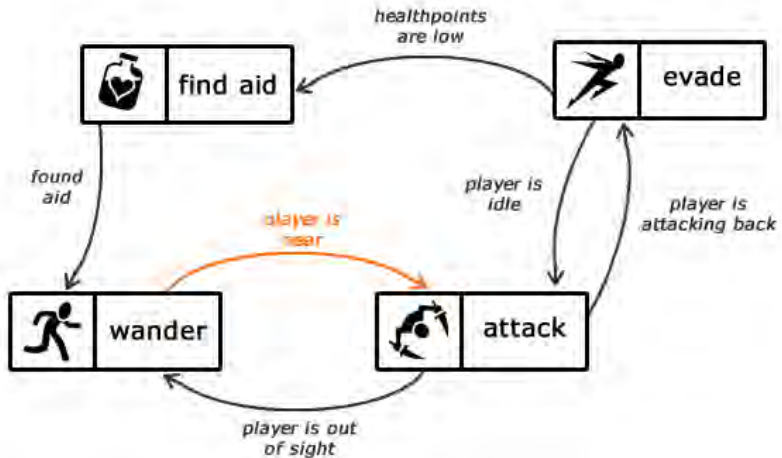
- ▶ Games are a useful testbed for new AI technologies
- ▶ Game theory is a useful mathematical abstraction for many types of problem
- ▶ Game AI is more than pure problem solving — game AI needs to create an entertaining experience

AI architectures

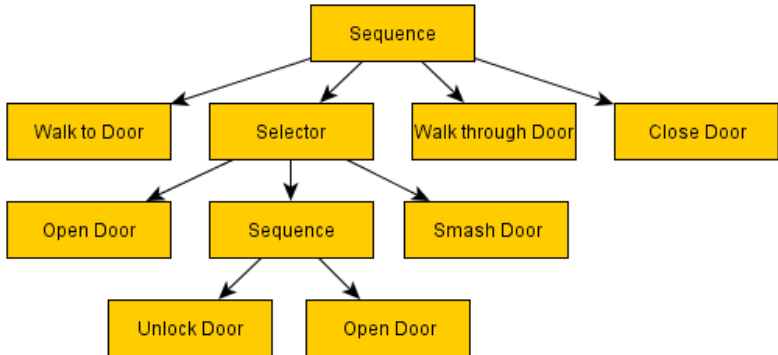
Rule-based AI

- ▶ Generally implemented as `if` statements or event-based triggers
- ▶ Triggers can be complicated e.g. based on raycasts

Finite state machines



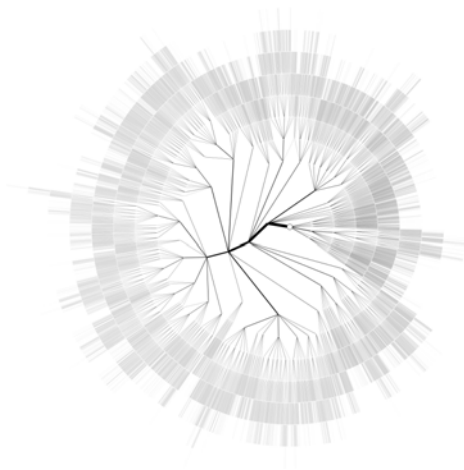
Behaviour trees



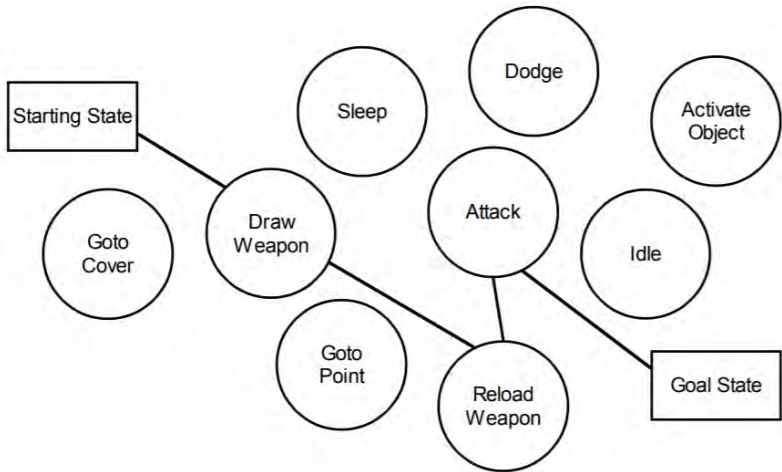
Multi-agent approaches (e.g. flocking)



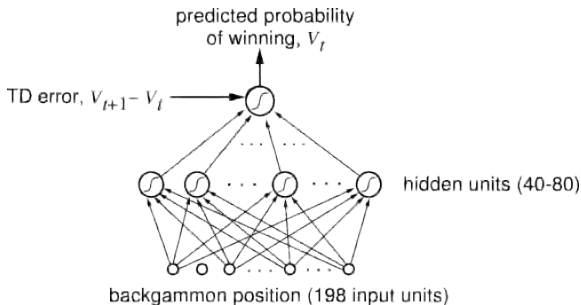
Game tree search



Planning



Machine learning

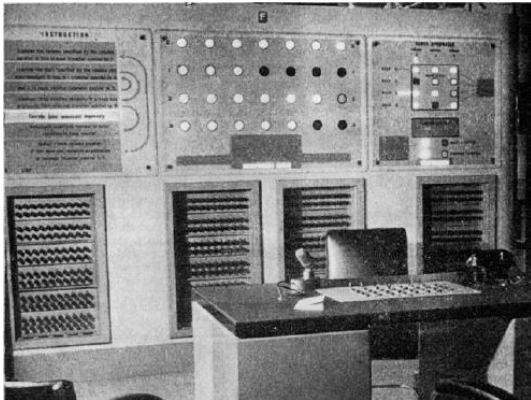


AI architectures

- ▶ Can roughly be divided into **hand-authored**...
 - ▶ Rule-based, FSM, behaviour trees
- ▶ ... and **computational intelligence**
 - ▶ Search, planning, machine learning
- ▶ Do you want to **design** the AI behaviours yourself, or do you want them to **emerge** from the system?
- ▶ 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

A brief history of game AI

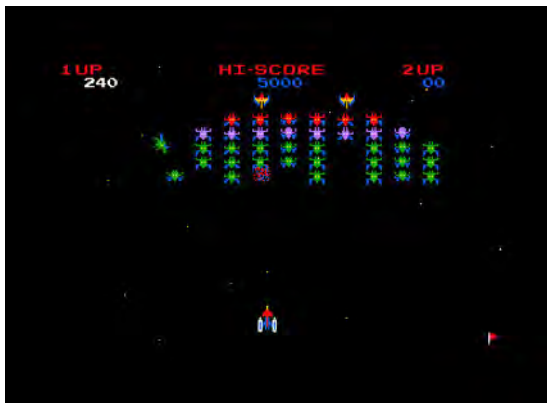
Nimrod (Ferranti, 1951)



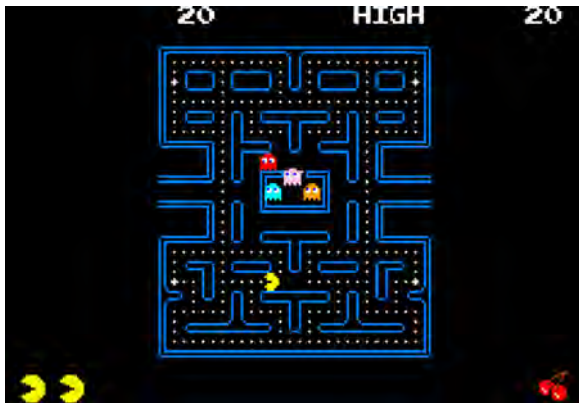
Samuel's Checkers program (IBM, 1962)



Galaxian (Namco, 1979)



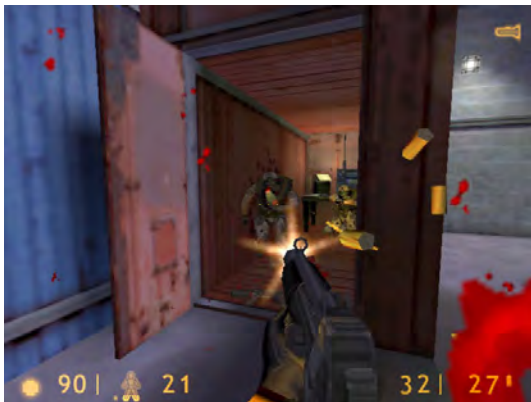
Pac-Man (Namco, 1980)



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)



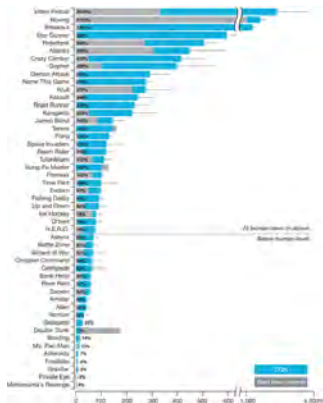
Left 4 Dead (Valve, 2008)



Watson (IBM, 2011)



Deep learning for Atari games (DeepMind, 2013)



AlphaGo (Google DeepMind, 2016)

