COMP250: Artificial Intelligence

1: Introduction to AI

Proposal

- For next week!
- Prepare a 1-2 page proposal document covering the following:
  - What is the high concept of your computing artefact?
  - What functionality will your component include?
  - How does your component fit into your chosen specialism?
  - Why is this artefact needed?
  - What are the key requirements?
  - Is the scope appropriate for the product development time-frame?
  - How will you address the architect and research requirement?

What is 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

Computers vs brains

Discuss:

- For what kinds of tasks are digital computers "better" than human brains?
- For what kinds of tasks are human brains "better" than digital computers?
- For what kinds of tasks are both "good", but approach the task in different ways?

Is it AI?

Discuss: are these examples of AI?

- Calculator
- Computer opponent in a chess program
- Enemy in a video game
- Facebook newsfeed
- Autocorrect in a text messaging app
- Autocompletion in an IDE
- Spellchecker
- Satellite navigation
- Virtual assistant (e.g. Siri, Alexa, Cortana etc.)
- Amazon product recommendations
- Search function in a text editor
- Google search
- C++ compiler
- Robot

AI in games

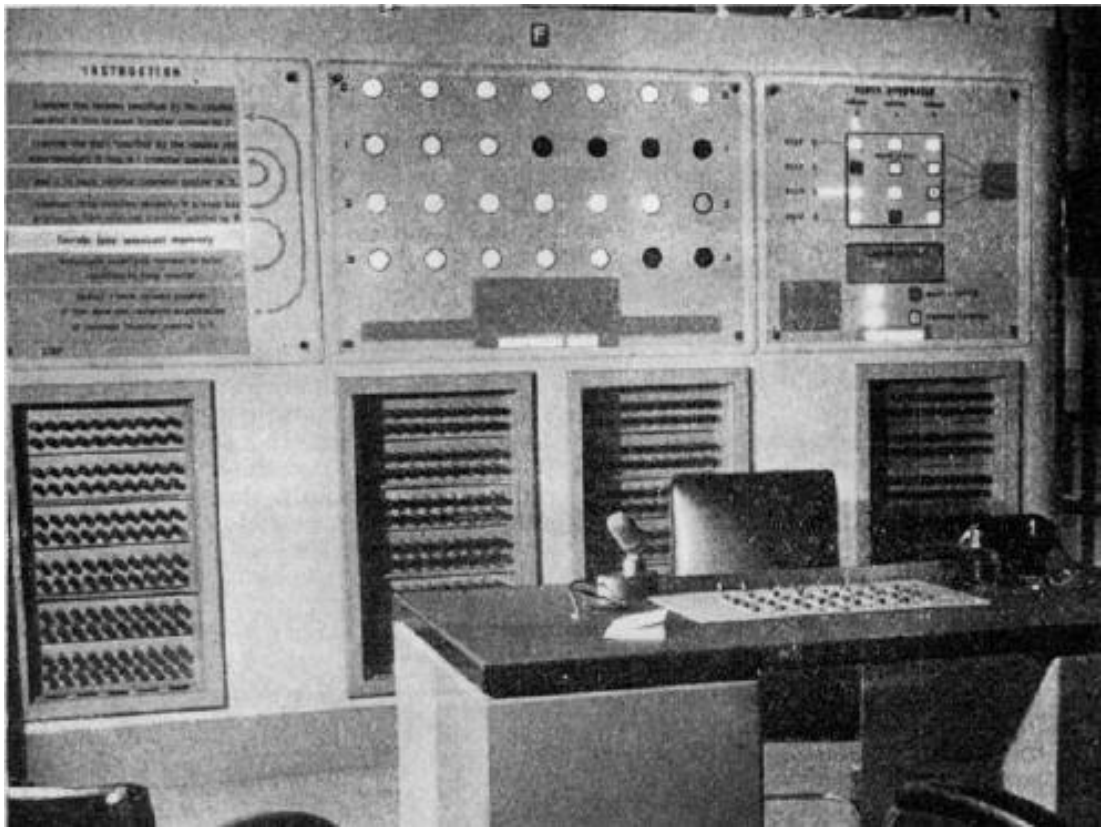
Applications of AI in games

- 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?

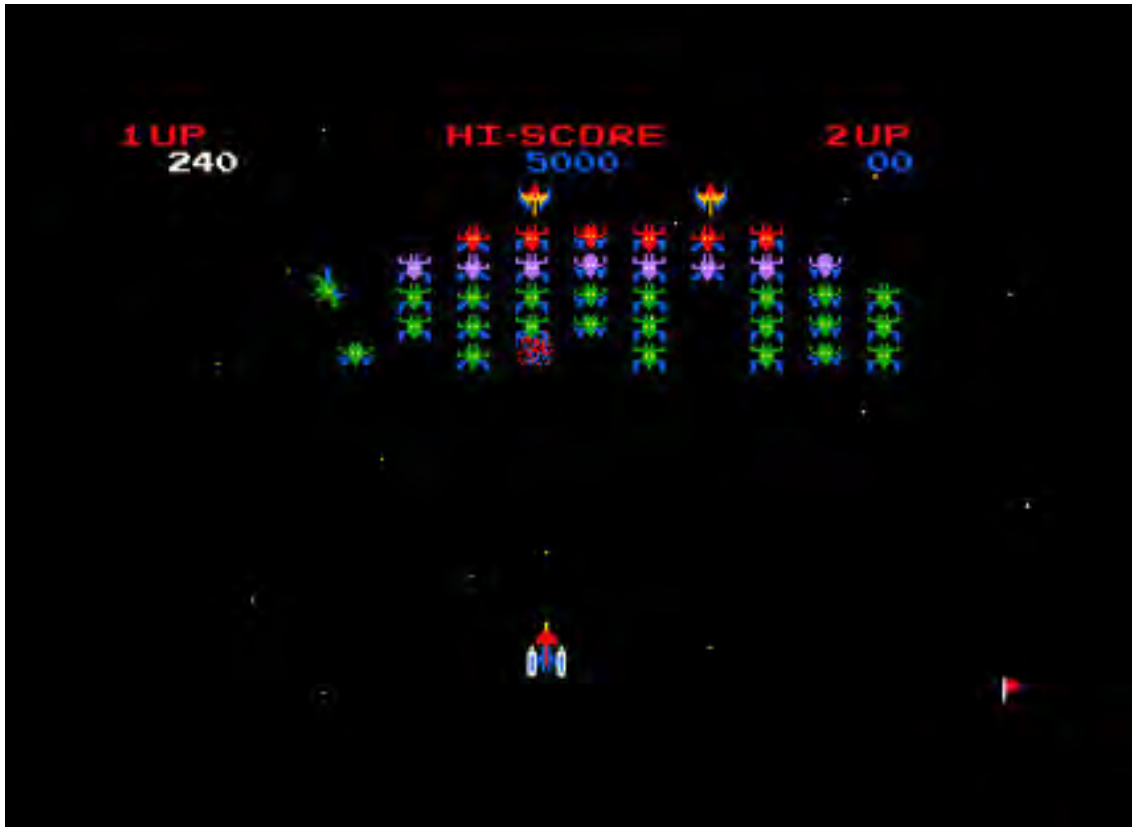
- Games are a useful testbed for new AI technologies
- Game theory is a useful mathematical abstraction for many types of problem
- Game AI is more than pure problem solving — game AI needs to create an entertaining experience

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)

Halo 2 (Bungie, 2004)

F.E.A.R. (Monolith Productions, 2005)

Façade (Mateas & Stern, 2005)

Chinook (Schaeffer et al, 2007)

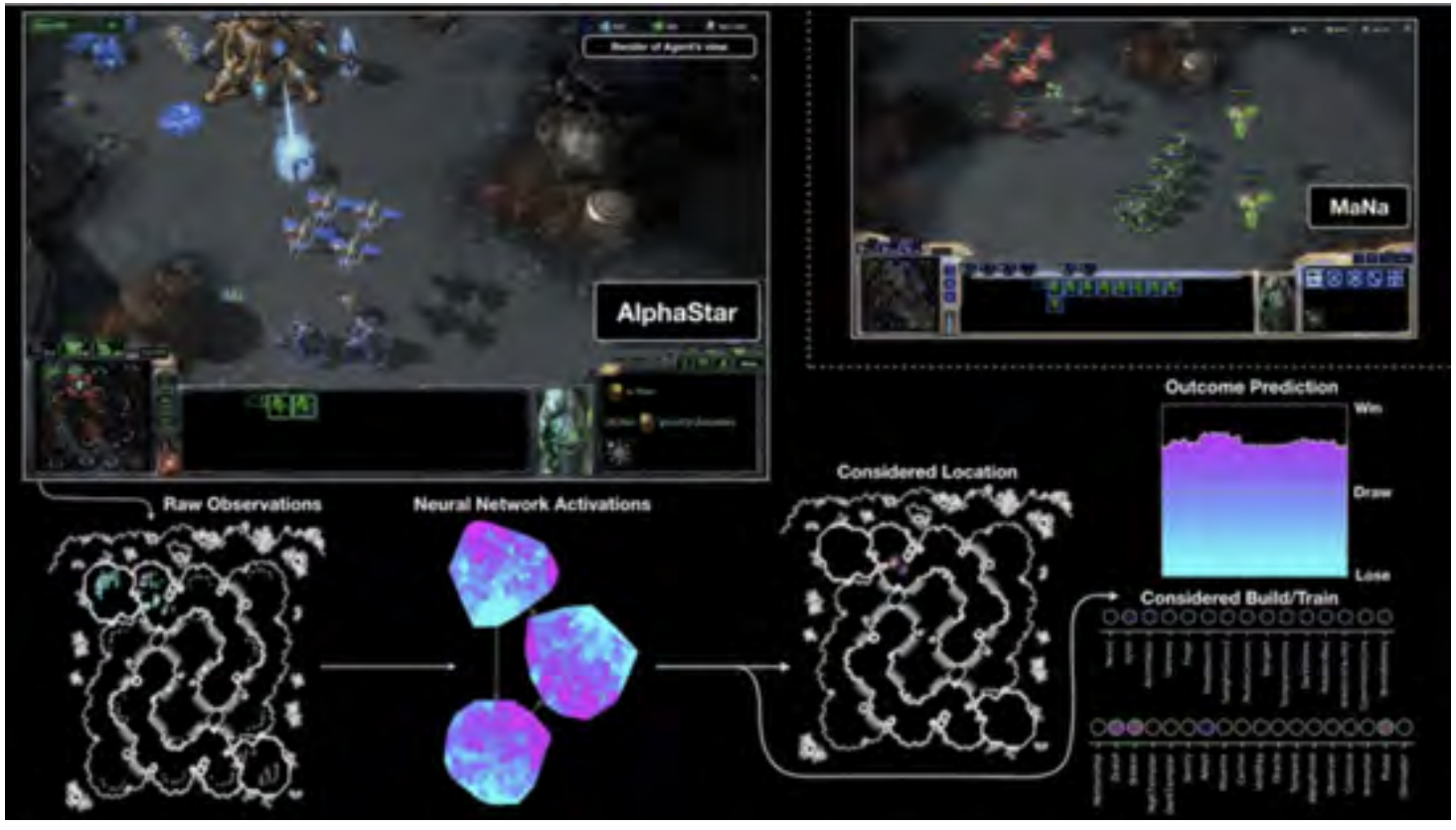
Left 4 Dead (Valve, 2008)

Watson (IBM, 2011)

Deep learning for Atari games (DeepMind, 2013)

AlphaGo (Google DeepMind, 2016)

AlphaStar (Google DeepMind, 2019)

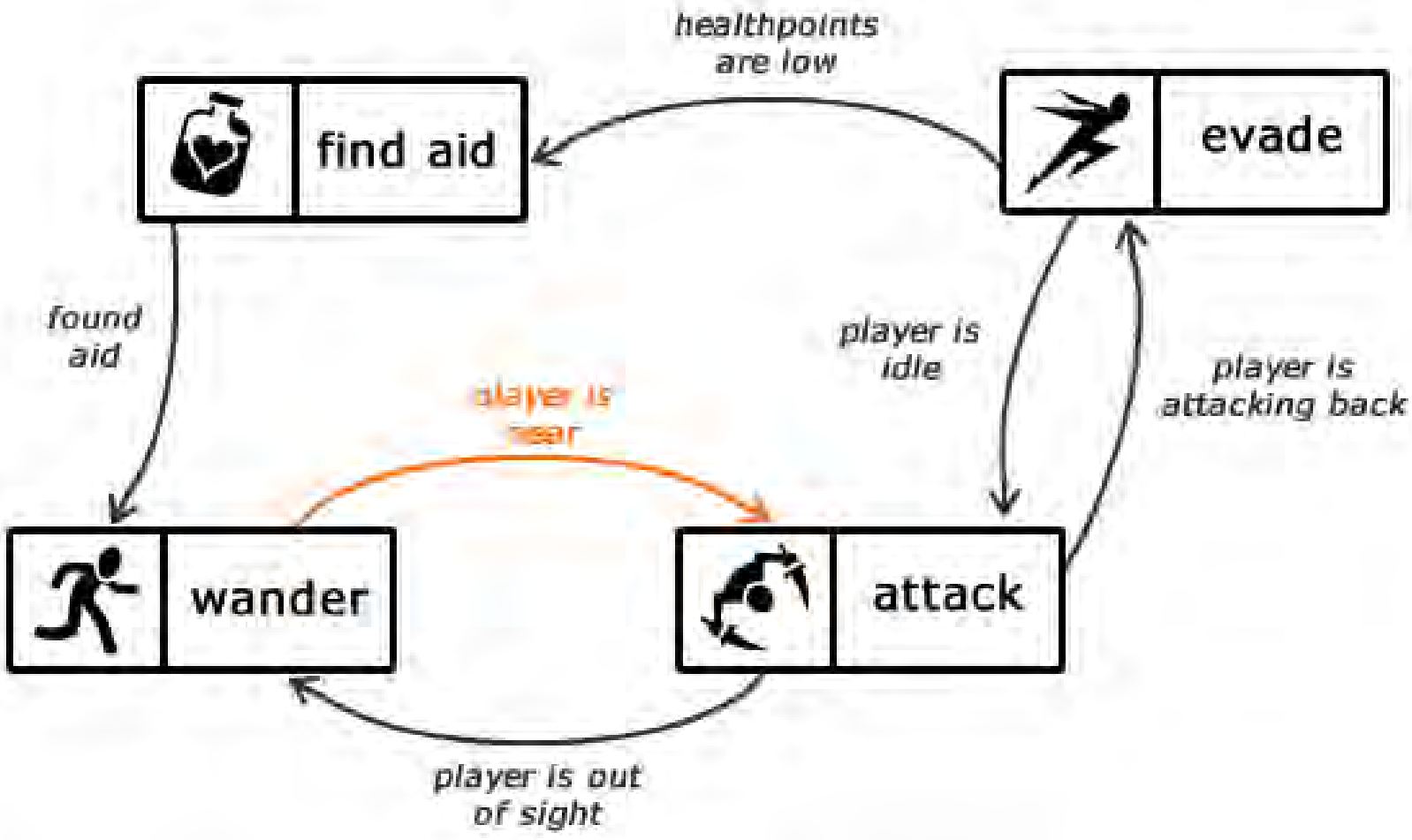


AI architectures

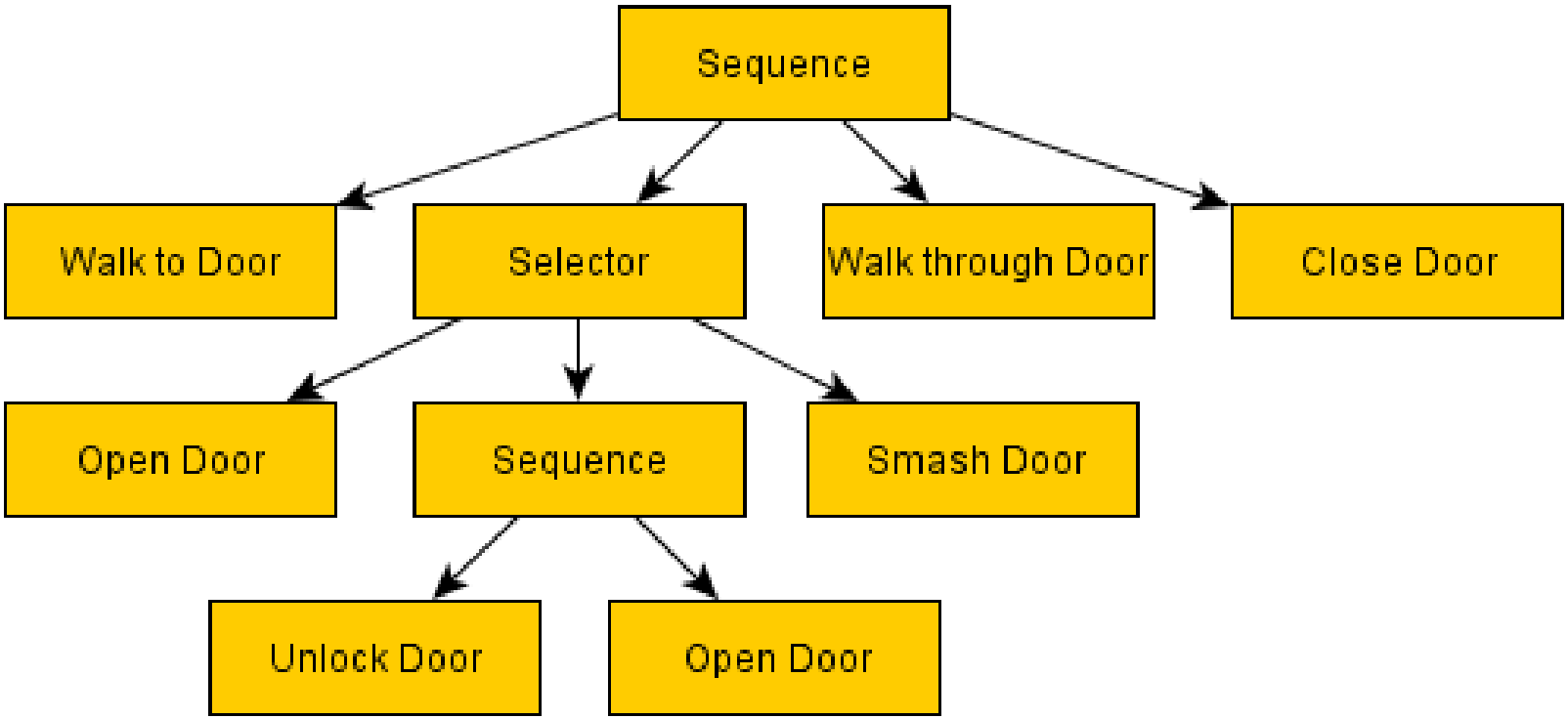
Rule-based AI

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

Finite state machines

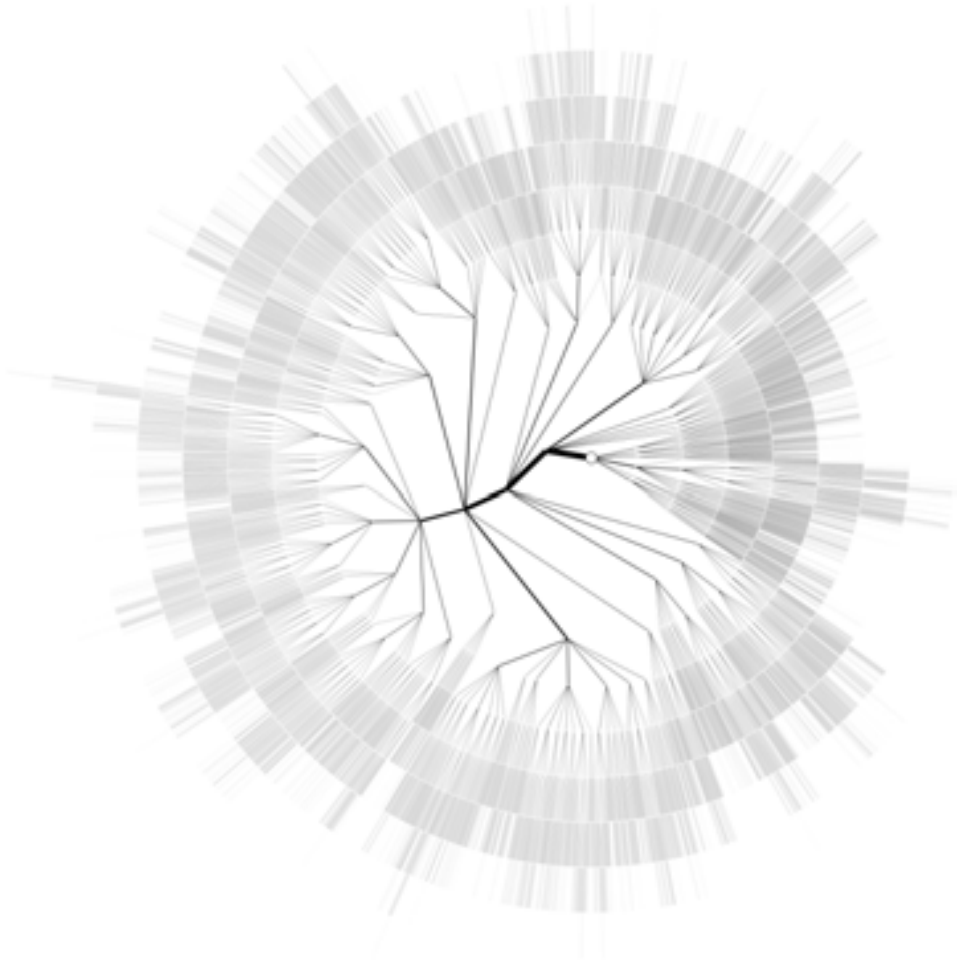


Behaviour trees

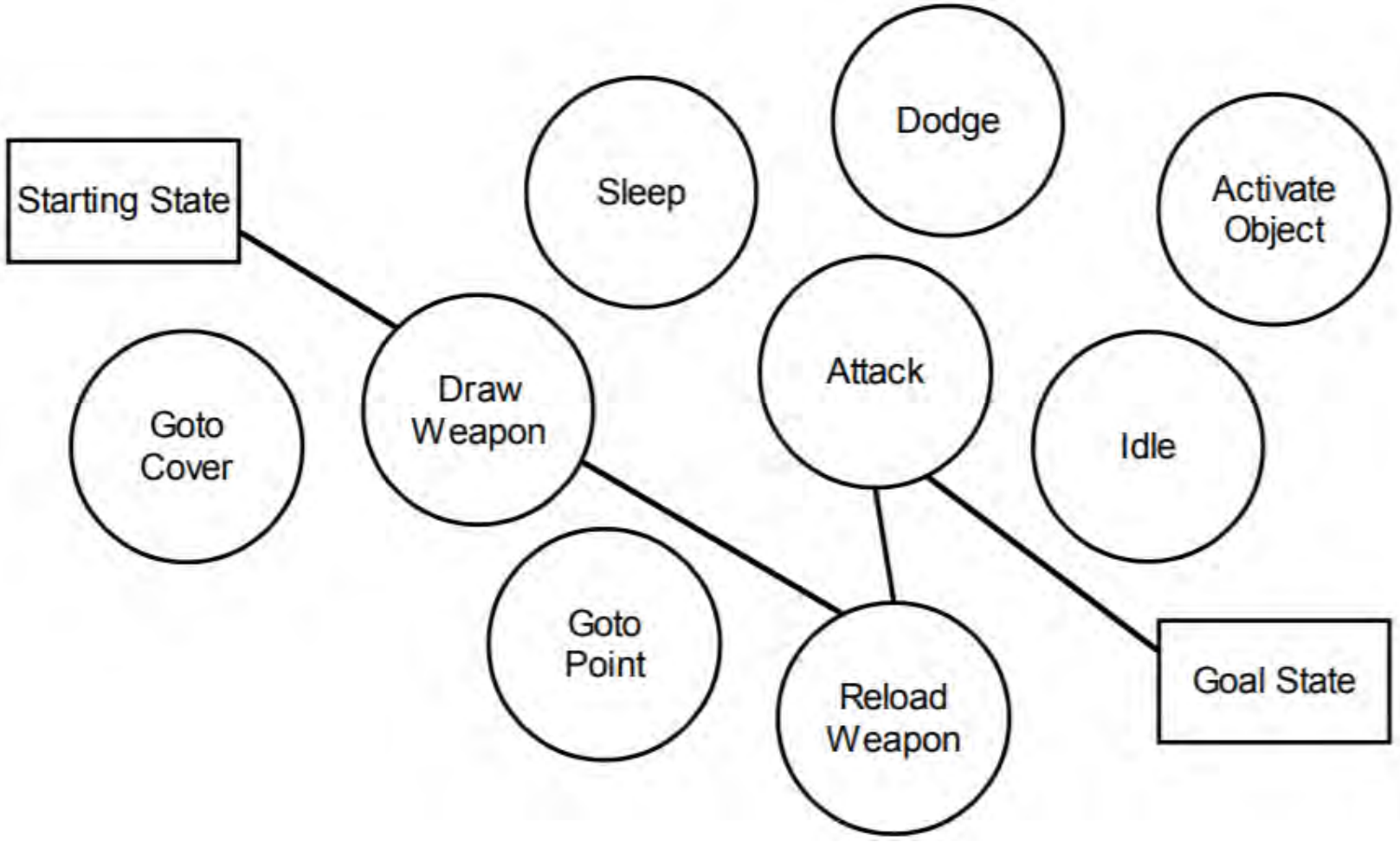


Multi-agent approaches (e.g. flocking)

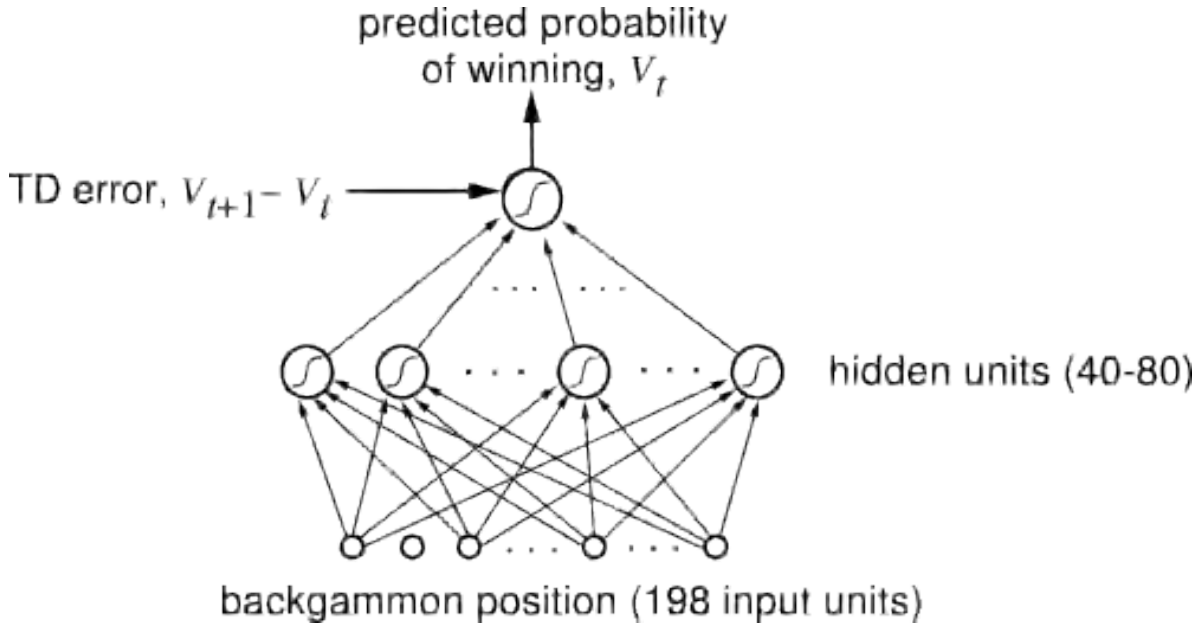
Game tree search



Planning


Starting State
Sleep
Dodge
Activate Object
Goto Cover
Draw Weapon
Attack
Idle
Goto Point
Reload Weapon
Goal State

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

Workshop

- Begin (or continue) preparing your **proposal**
- Discuss and brainstorm your ideas with your peers
- Ask me for feedback or suggestions!