Concluding Remarks

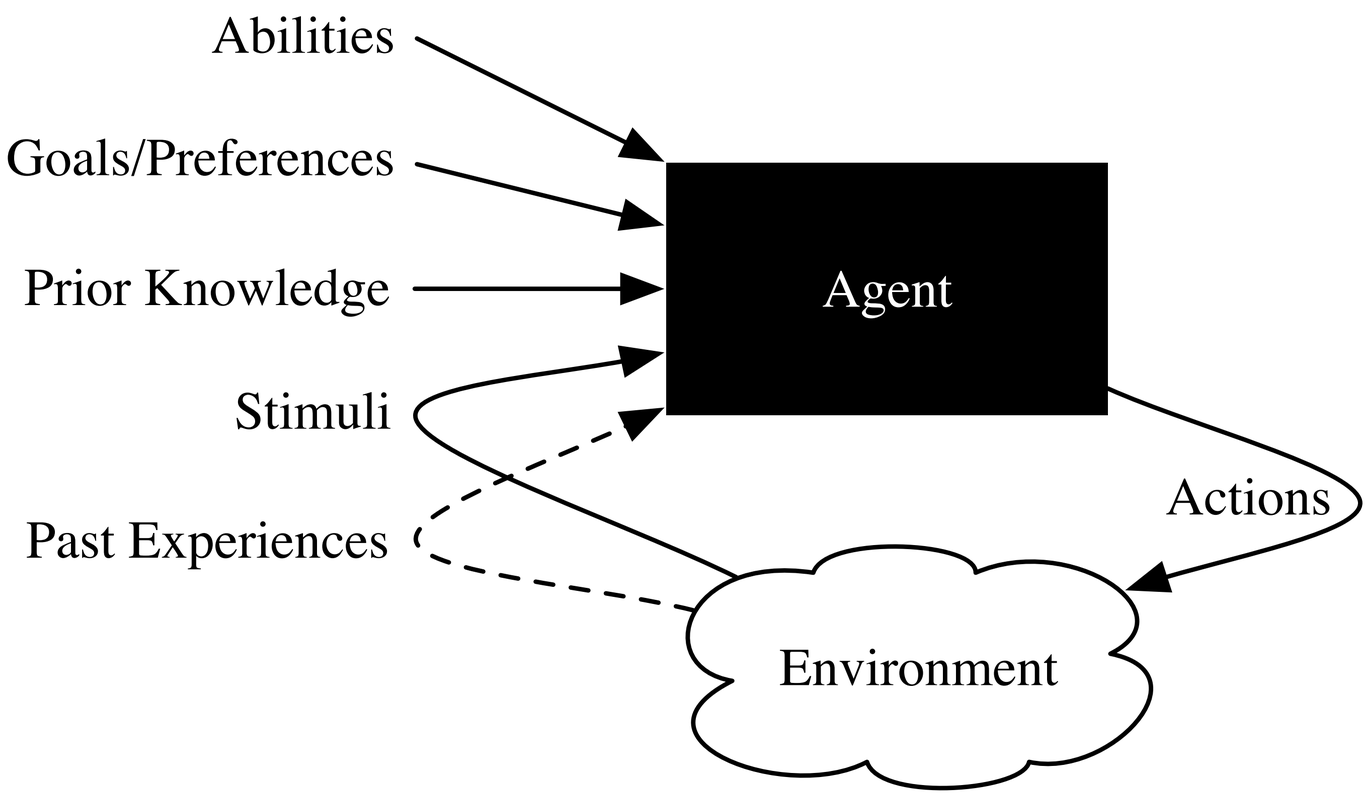
Artificial Intelligence

So what is artificial intelligence?

- No universal definition as intelligence takes many forms.
- A broad (and somewhat cyclic) definition for AI would be along the lines of *“the synthesis and analysis of computational agents that act intelligently”*.
- Aspects of interest include:
  - acting appropriately given goals and circumstances
  - being flexible/adaptive in changing environments
  - reasoning
  - learning from experience
  - dealing with perceptual and computational limitations

AI architectures

Agents acting in an environment



Example: autonomous car

abilities: steer, accelerate, brake, …

goals: safety, get to destination, timeliness, …

prior knowledge: what signs mean, what to stop for, street maps, …

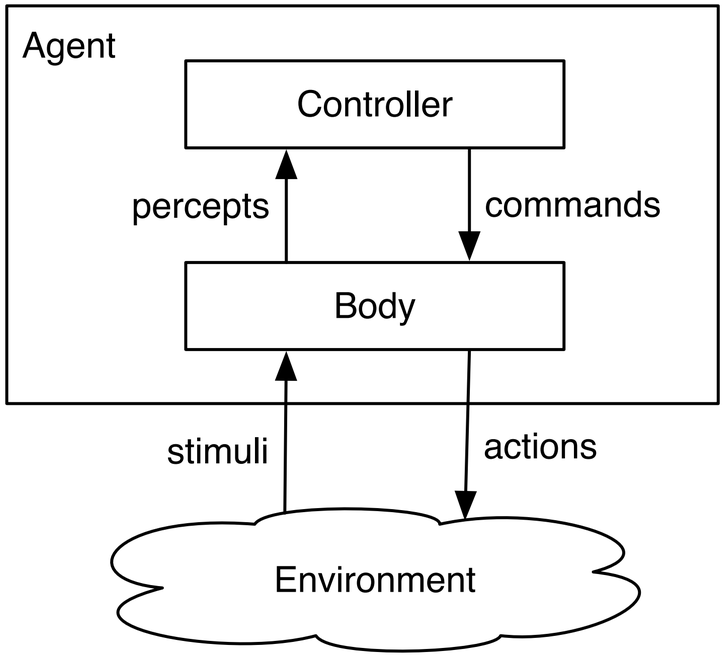
stimuli: vision, laser, GPS. . .

past experiences: how breaking and steering affect direction, street maps, …

AI architectures

Agent architecture

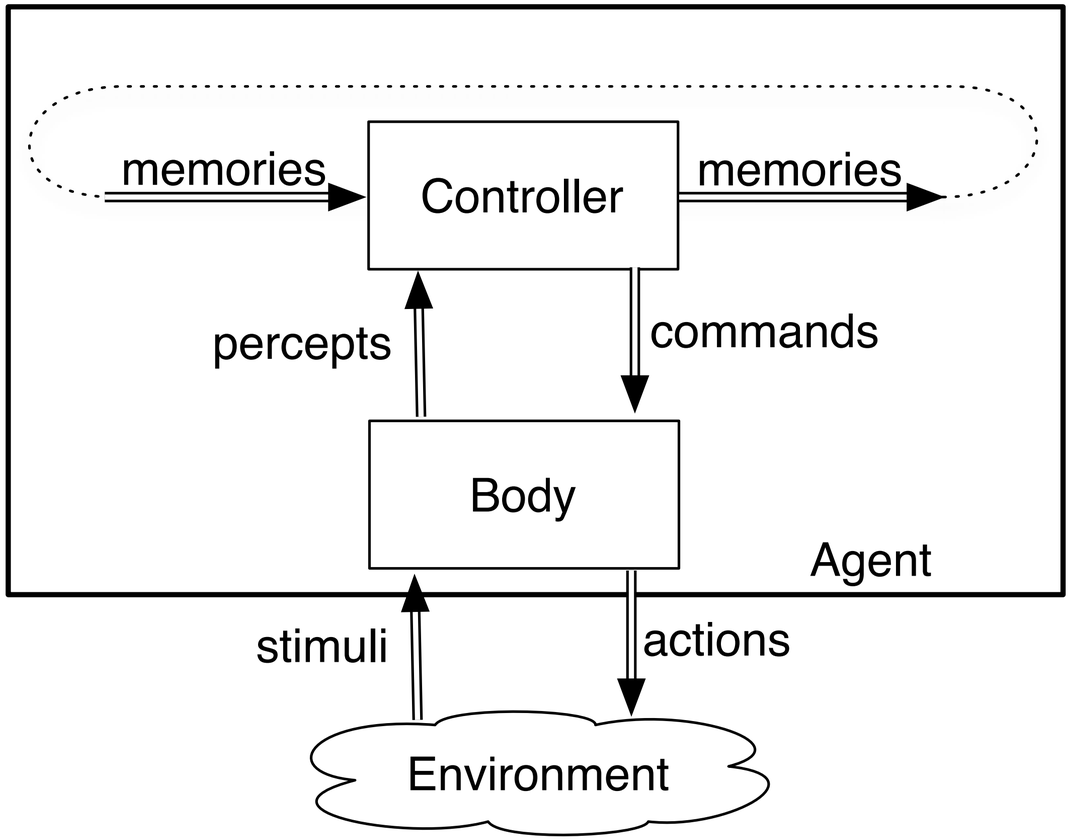
An agent is made up of a body and a controller.



- An agent interacts with the environment through its body.
- The body is made up of:
  - sensors that interpret stimuli
  - actuators that carry out actions
- The controller receives percepts from the body.
- The controller sends commands to the body.
- The body can also have reactions that are not controlled.

AI architectures

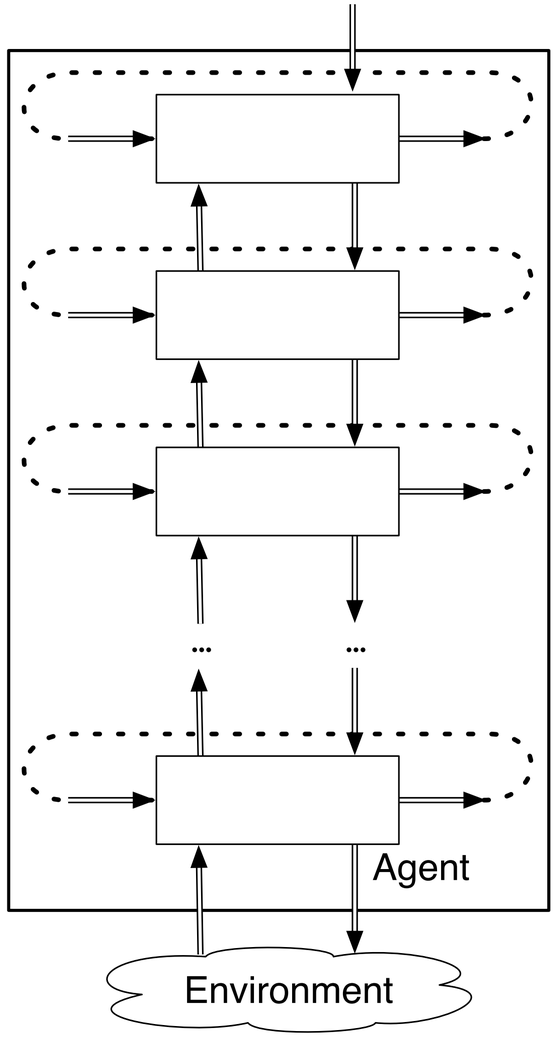
Controllers

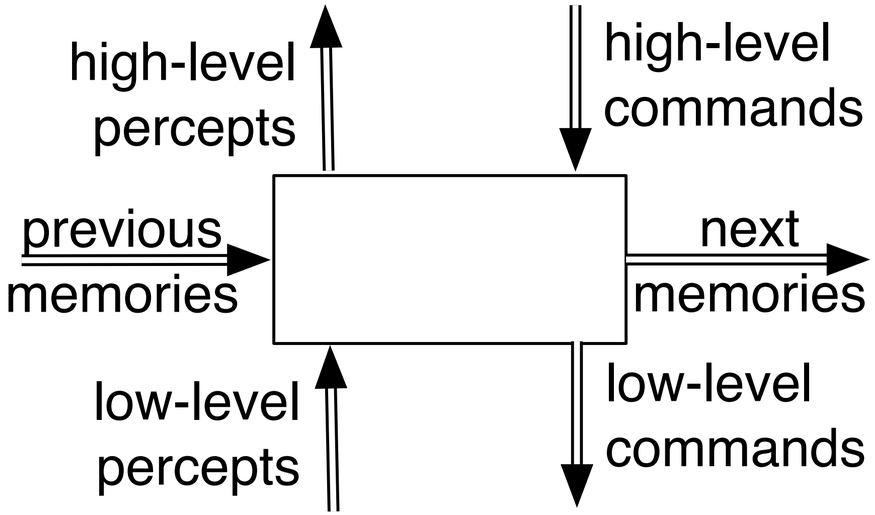


- Controllers are the “brains” of the agents.
- Agents are situated in time, they receive sensory data in time, and do actions in time.
- Controllers have (limited) memory and (limited) computational capabilities.
- The controller specifies the command at every time.
- The command at any time can depend on the current and previous percepts.
- Controllers may have states or collect past experiences.

AI architectures

Hierarchical design

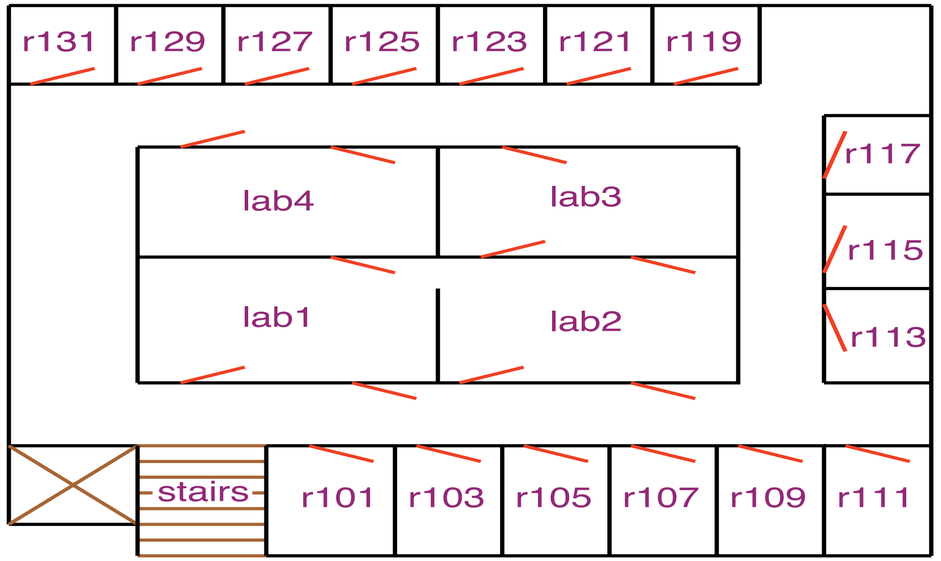




AI architectures

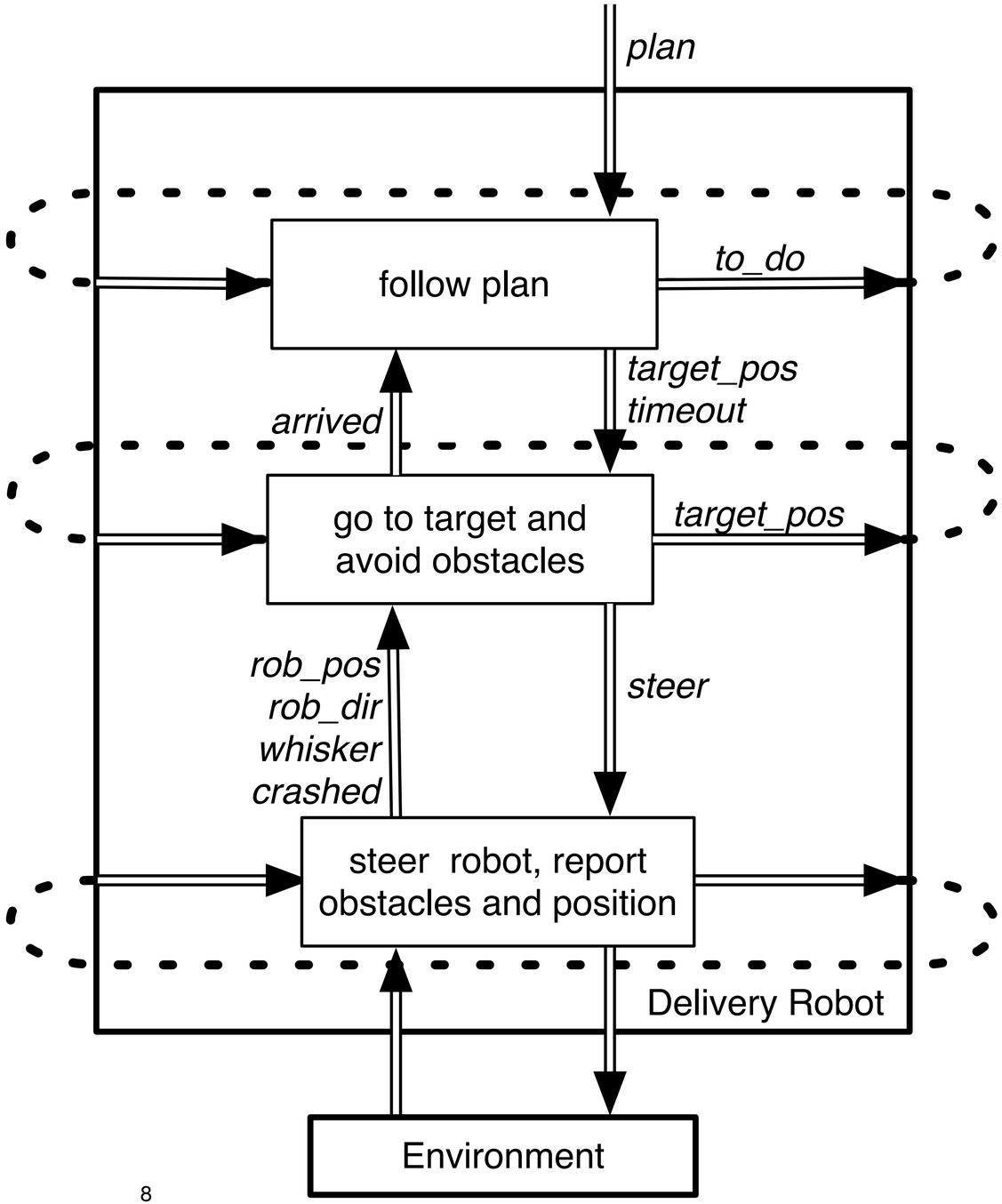
Example: delivery robot

- The robot has three **actions**: go straight, go right, go left.
- It can be given a **plan** consisting of sequence of named locations for the robot to go to in turn.
- The robot must avoid obstacles.
- It has a single whisker **sensor** pointing forward and to the right. The robot can detect if the whisker hits an object. The robot knows where it is.
- The obstacles and locations can be moved dynamically.

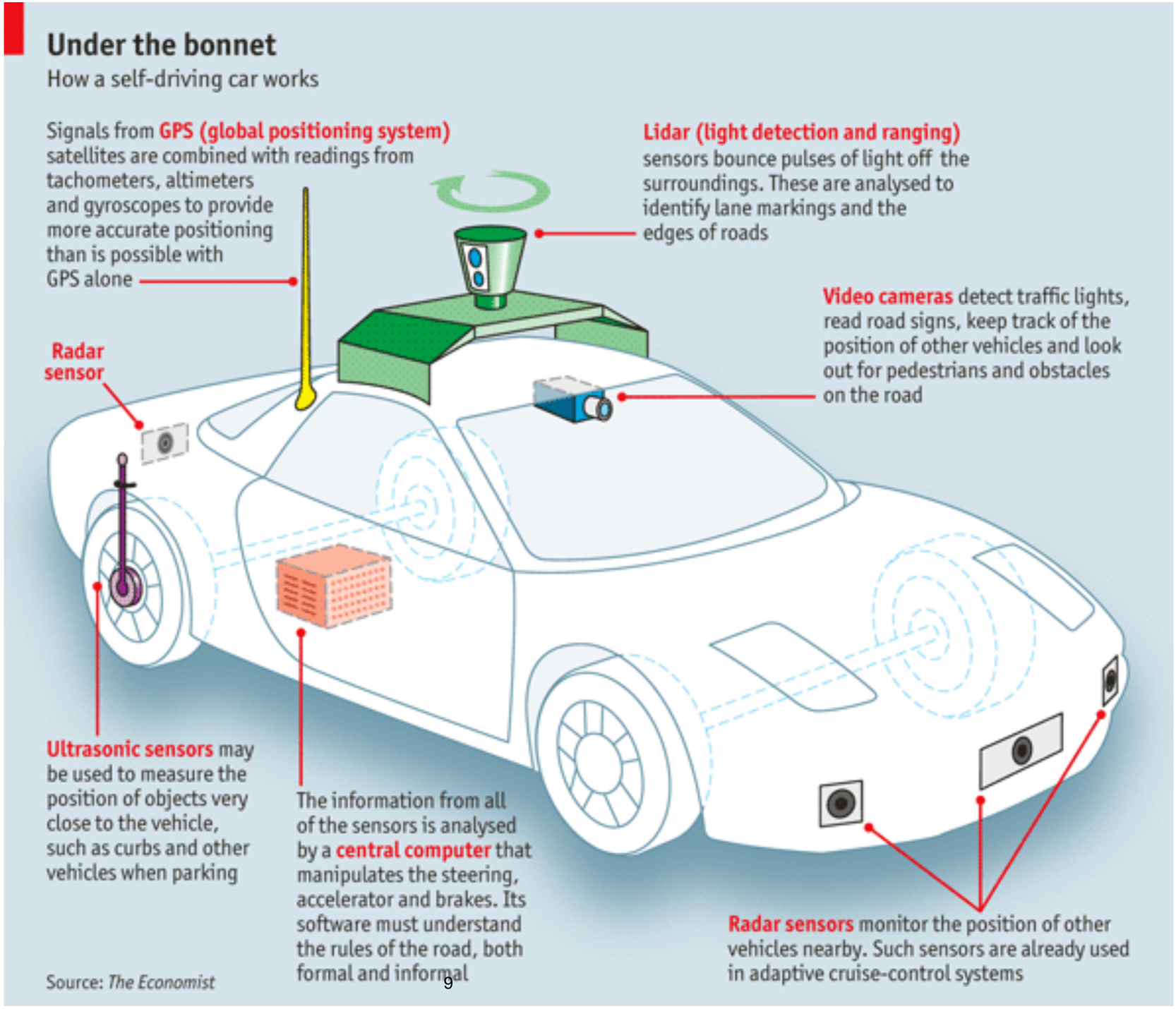


AI architectures

Example: delivery robot

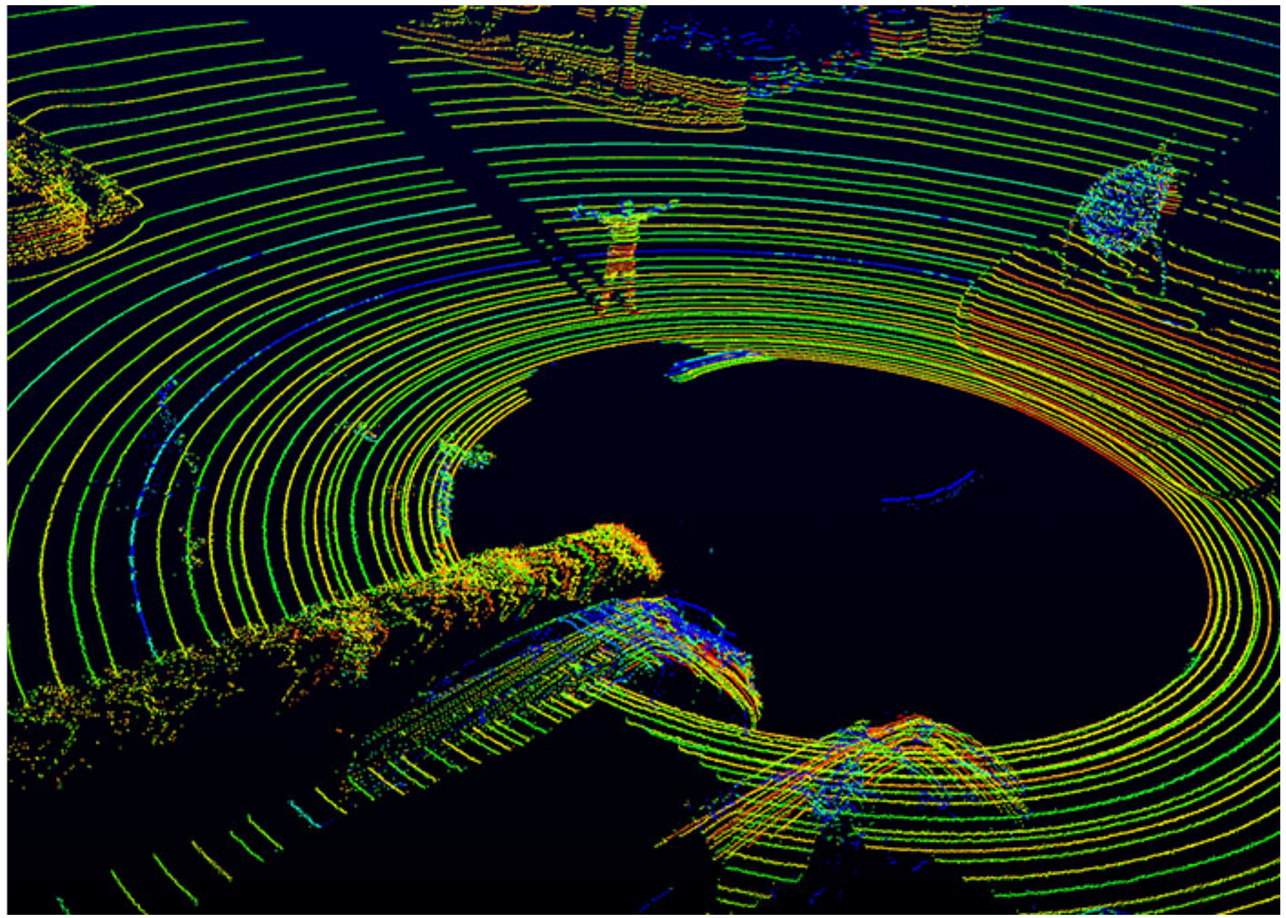


Self-driving cars: sensors



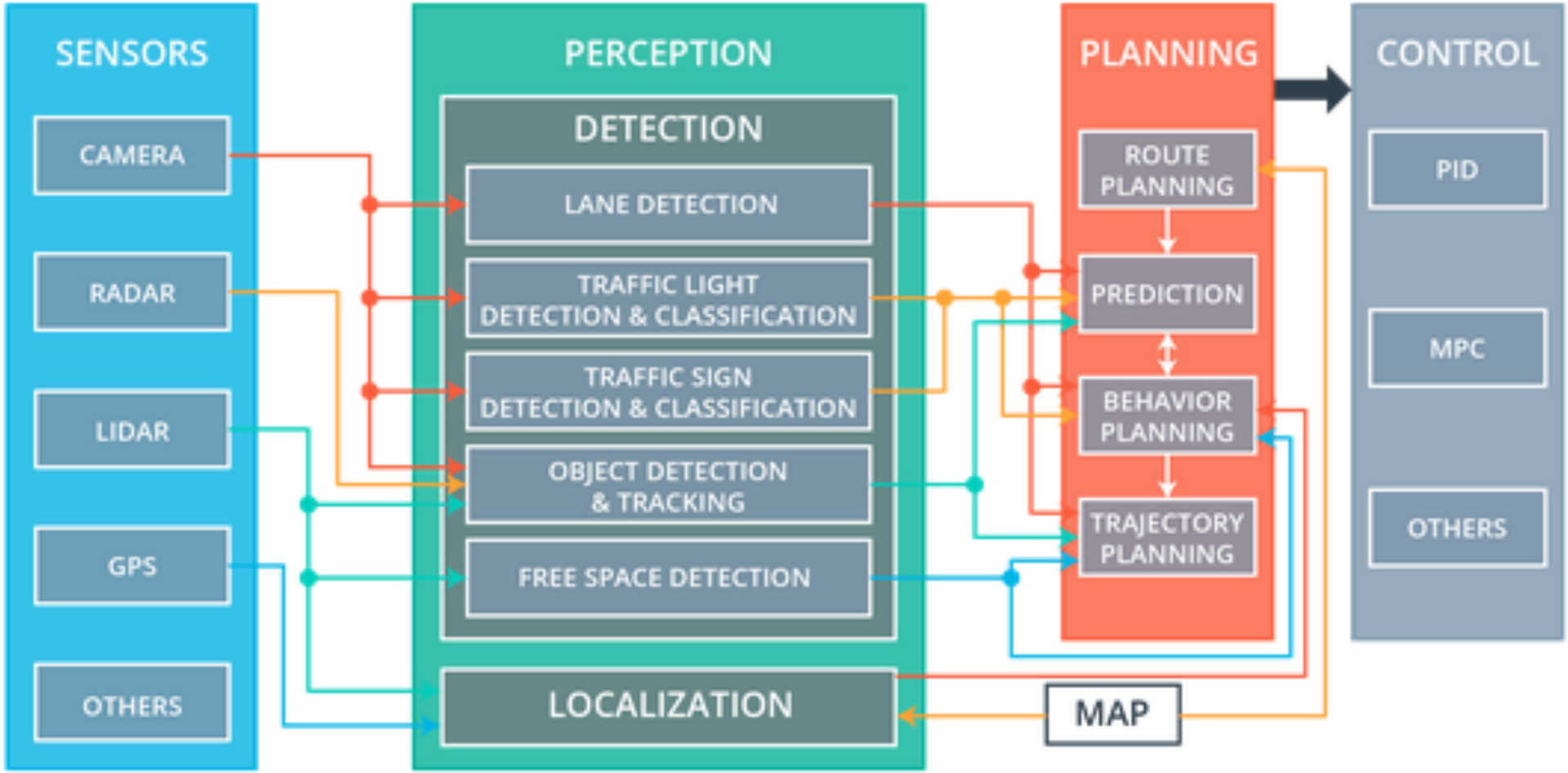
Self-driving cars

Lidar



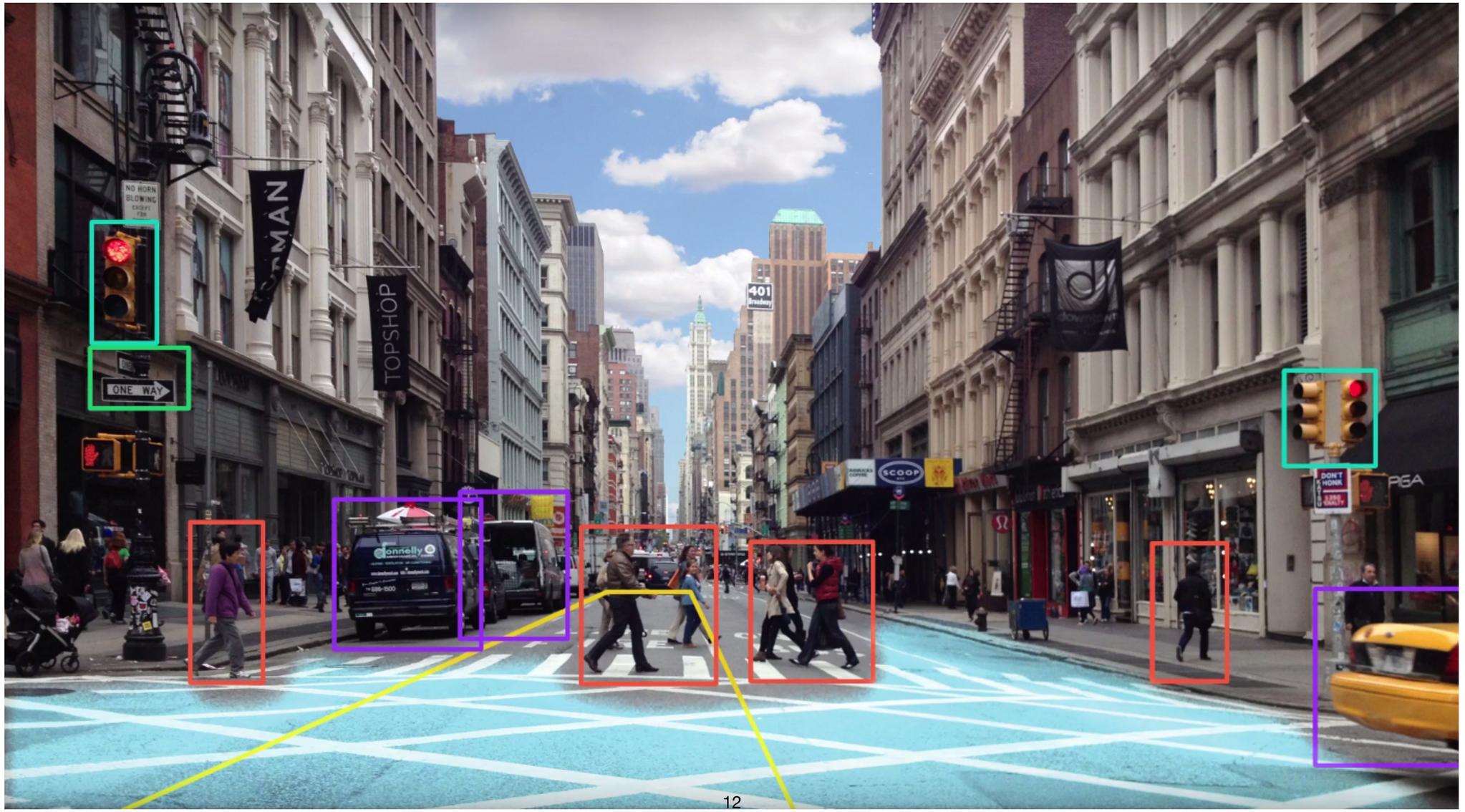
Self-driving cars

Components



Self-driving cars

Object detection and classification with neural networks



Major challenges in AI

- Knowledge representation
- Common sense

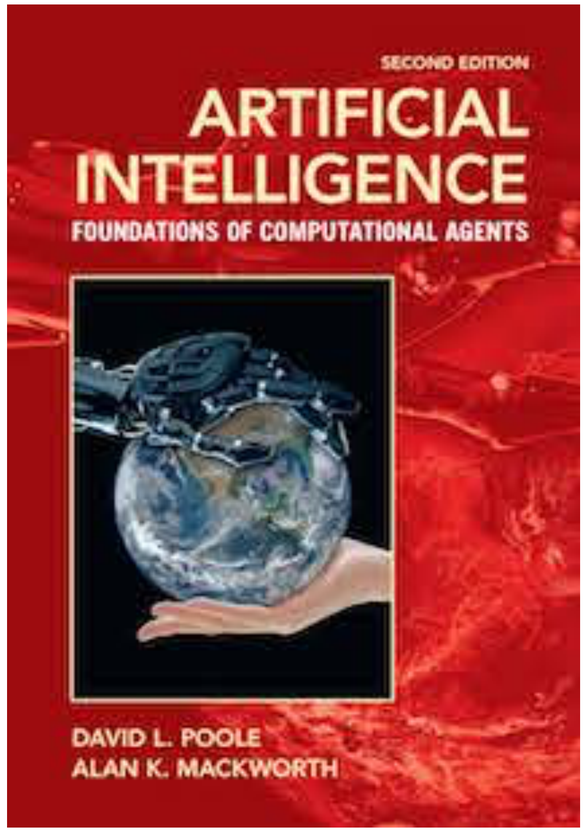
  “The trophy would not fit in the suitcase because it was too small/large.”

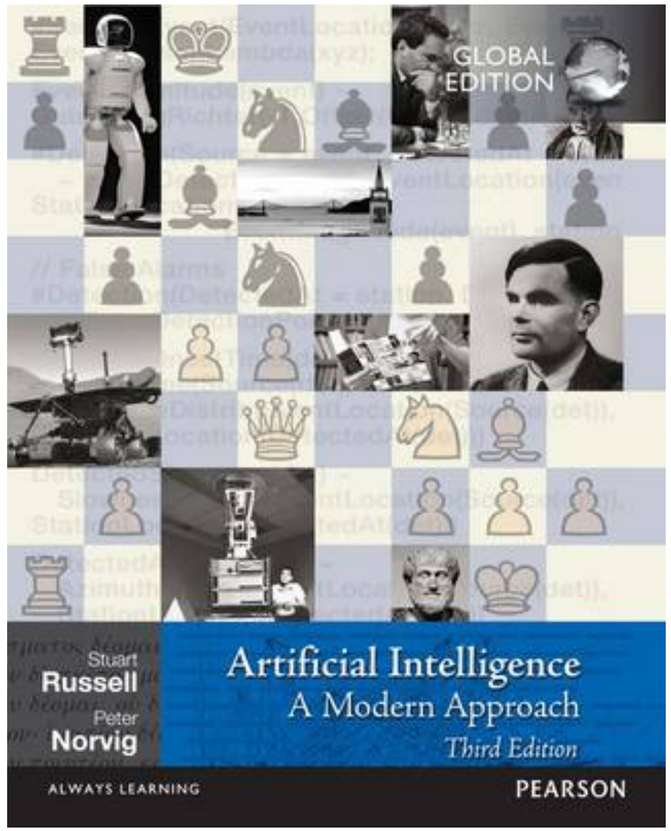
- Natural language understanding
- General artificial intelligence

Major concerns in AI

- Reliability
- Fairness
- Transparency and interpretability
- Job opportunities
- Distribution of wealth
- Singularity

How far did we go in the course?





Where to next?

Related topics:

- Advanced algorithms
- Logic
- Probability theory, Multivariate statistics, Bayesian Inference
- Linear algebra, Optimisation, Functional analysis

Courses Offered at CSSE:

- COSC401: Machine Learning (somewhat theoretical, requires some maths)
- COSC440: Deep learning
- COSC428: Computer Vision
- COSC420: Intelligent Tutoring Systems

Also see many courses offered by Maths