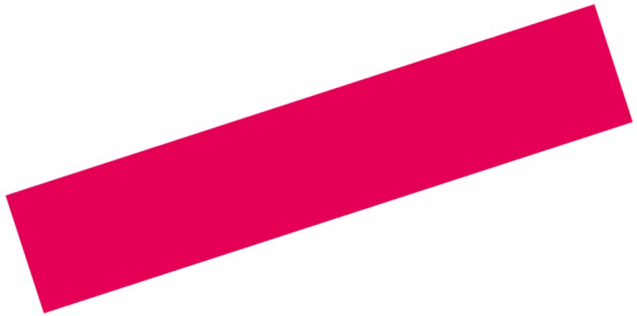
Robots les 1

World of Robots



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ESD

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HAN_UNIVERSITY
OF APPLIED SCIENCES

Wat is ons vakgebied?

Kinematics en Vision

- “Kinematica”.
- “Vision”.

De literatuur

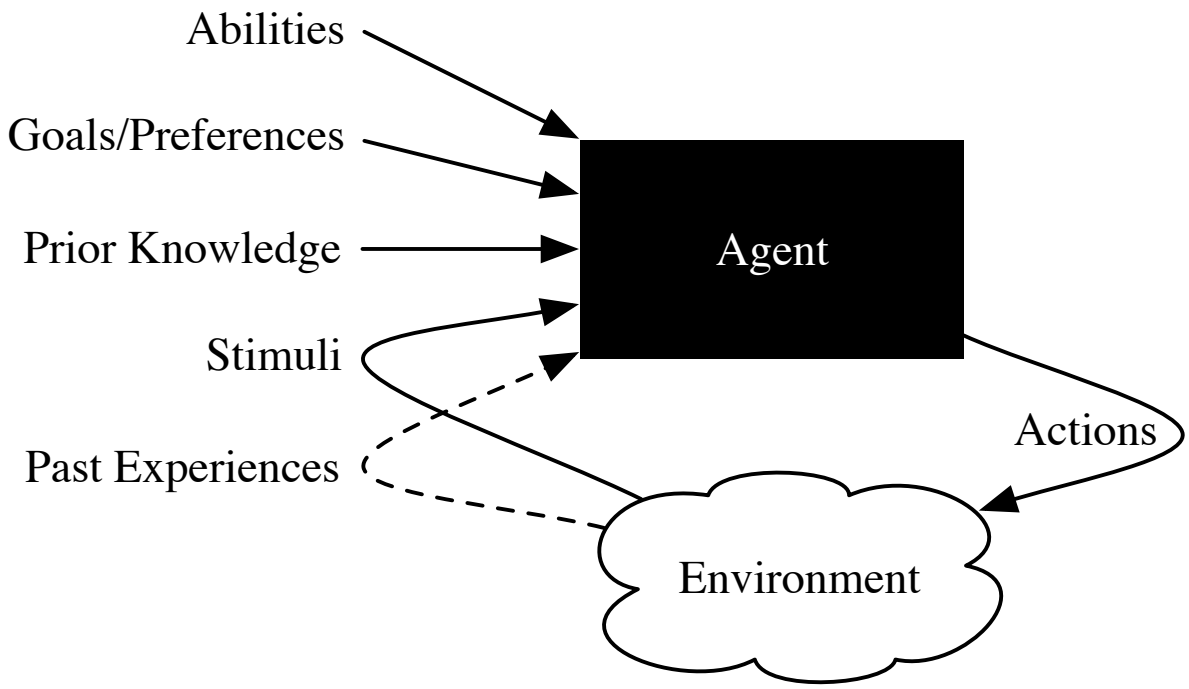
Gratis boeken:

- “Planning algoritmes”.
- “Artificial intelligence. Foundations of computational agents”.
- “Computer Vision: Algorithms and Applications”.

Bronnen

De navolgende stof is overgenomen/gebaseerd van/op “Artificial intelligence. Foundations of computational agents”.

Een agent in zijn omgeving



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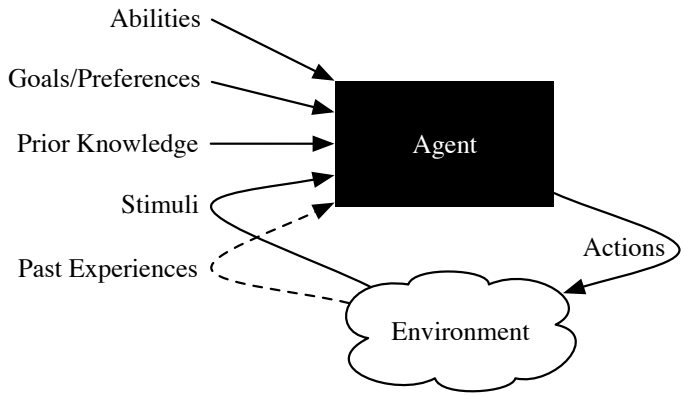

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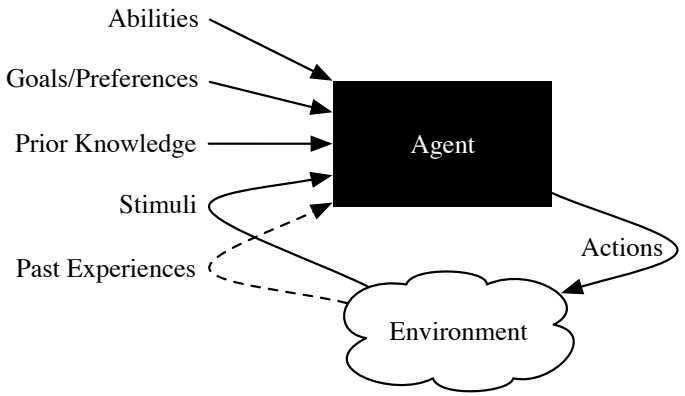

- Abilities
- Goals/Preferences
- Prior Knowledge
- History

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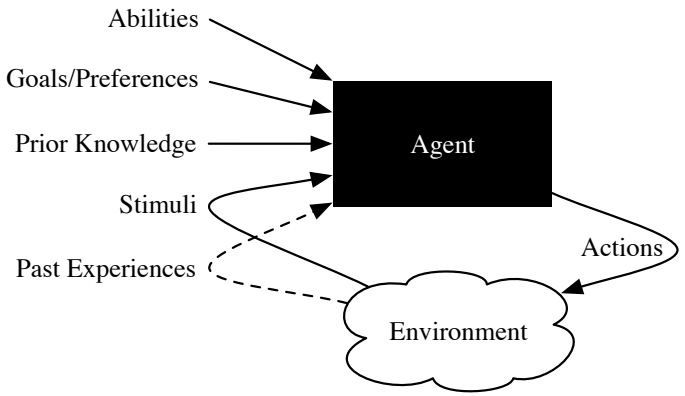

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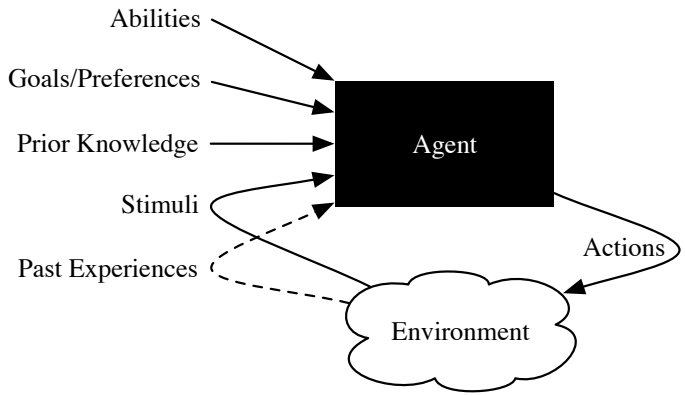

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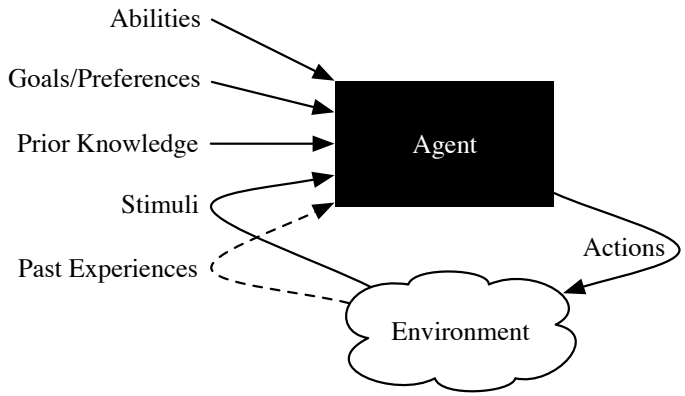

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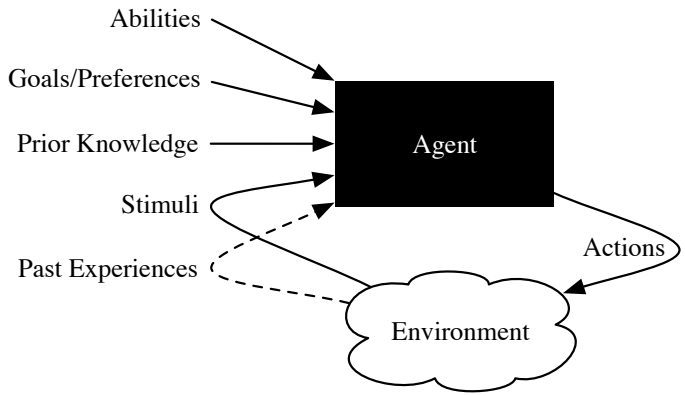

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  - Stimuli
  - Past experiences

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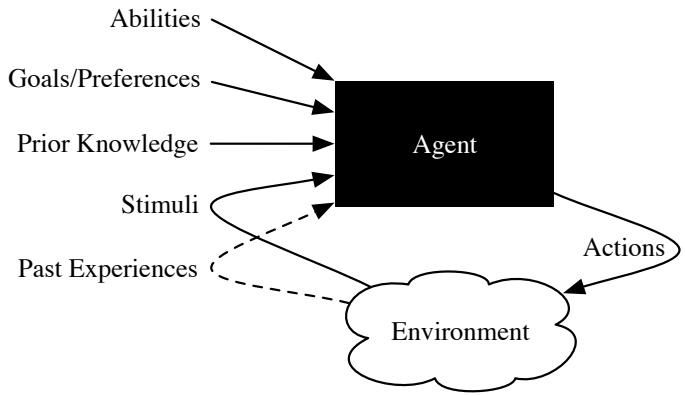

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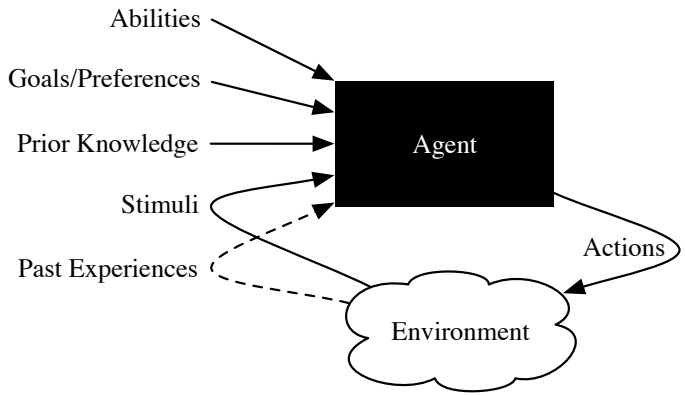

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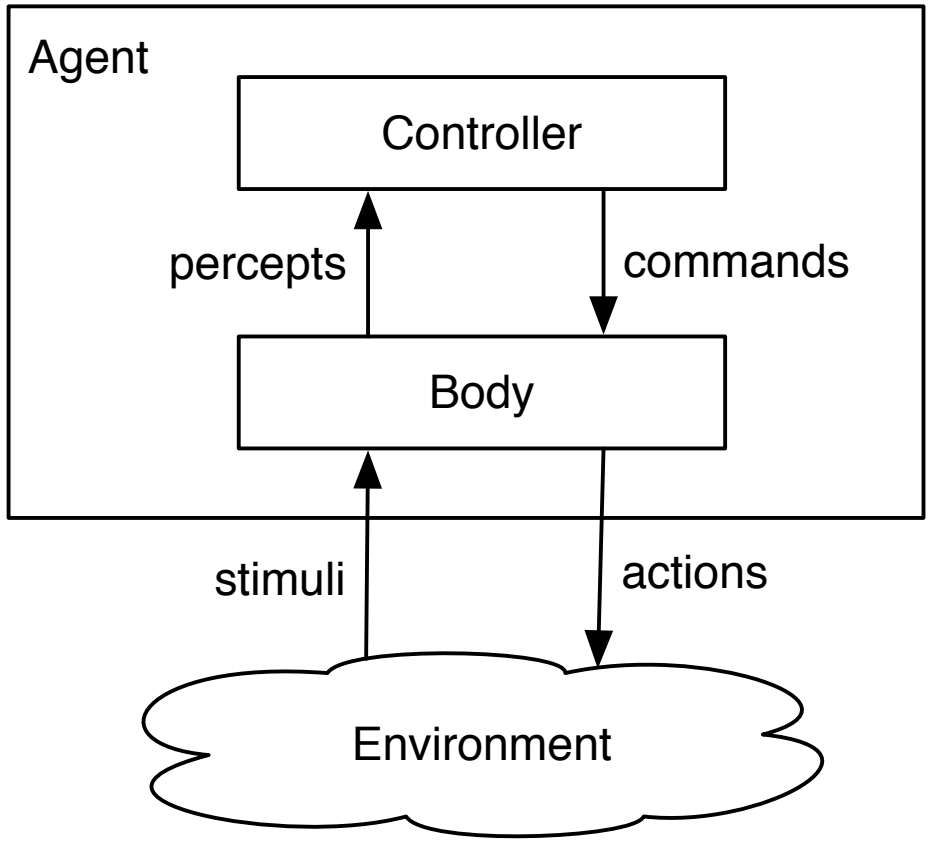
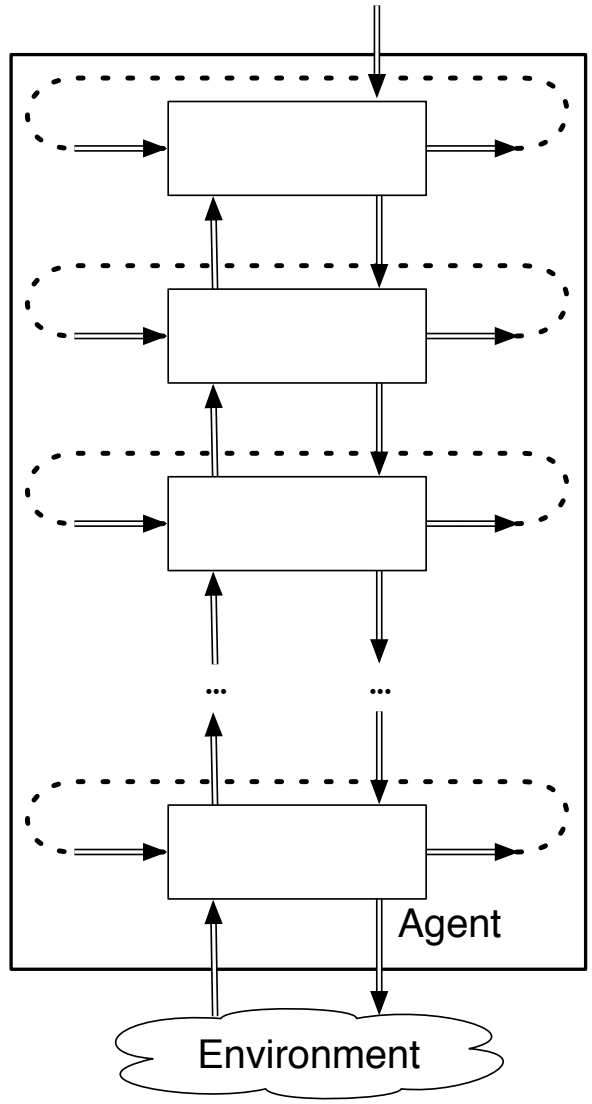
Het algemene robotmodel



De controller



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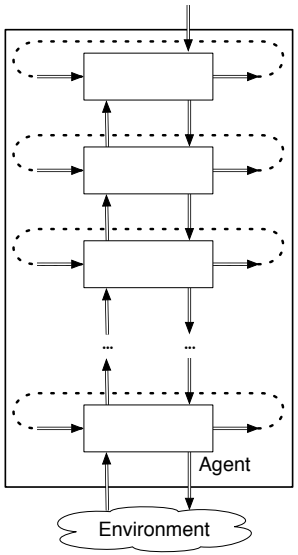

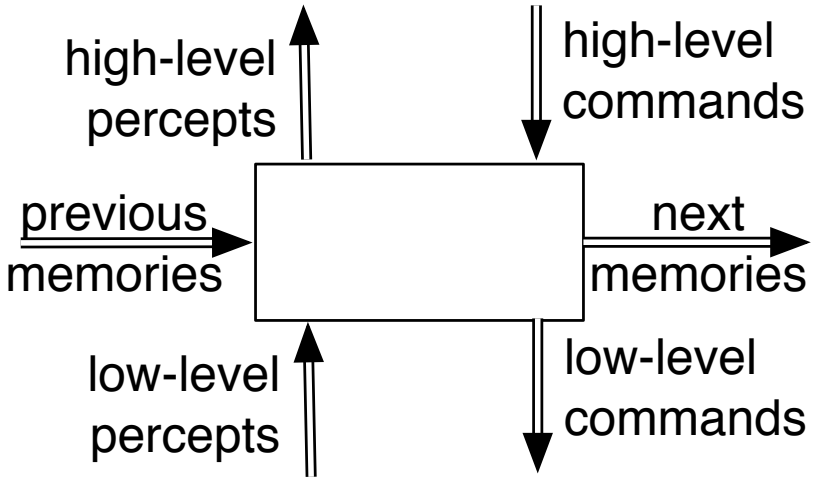

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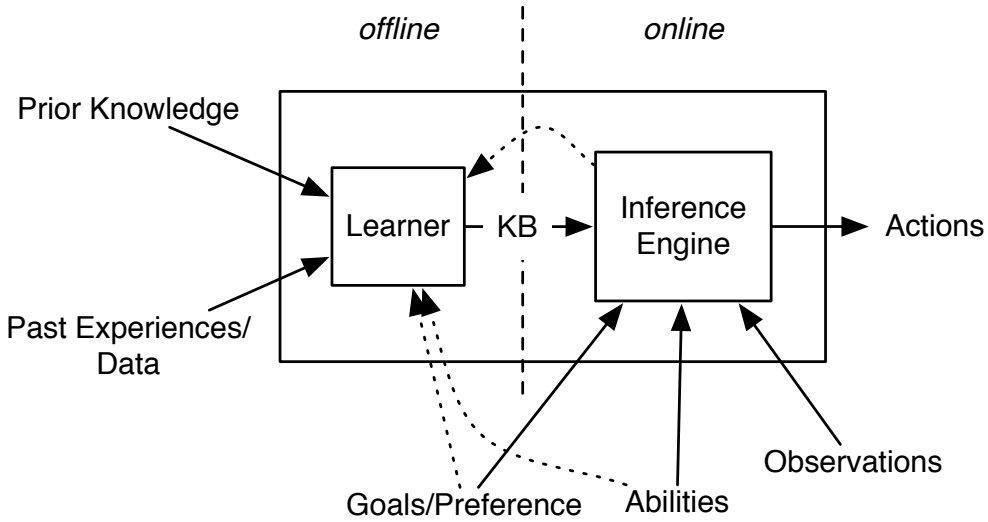

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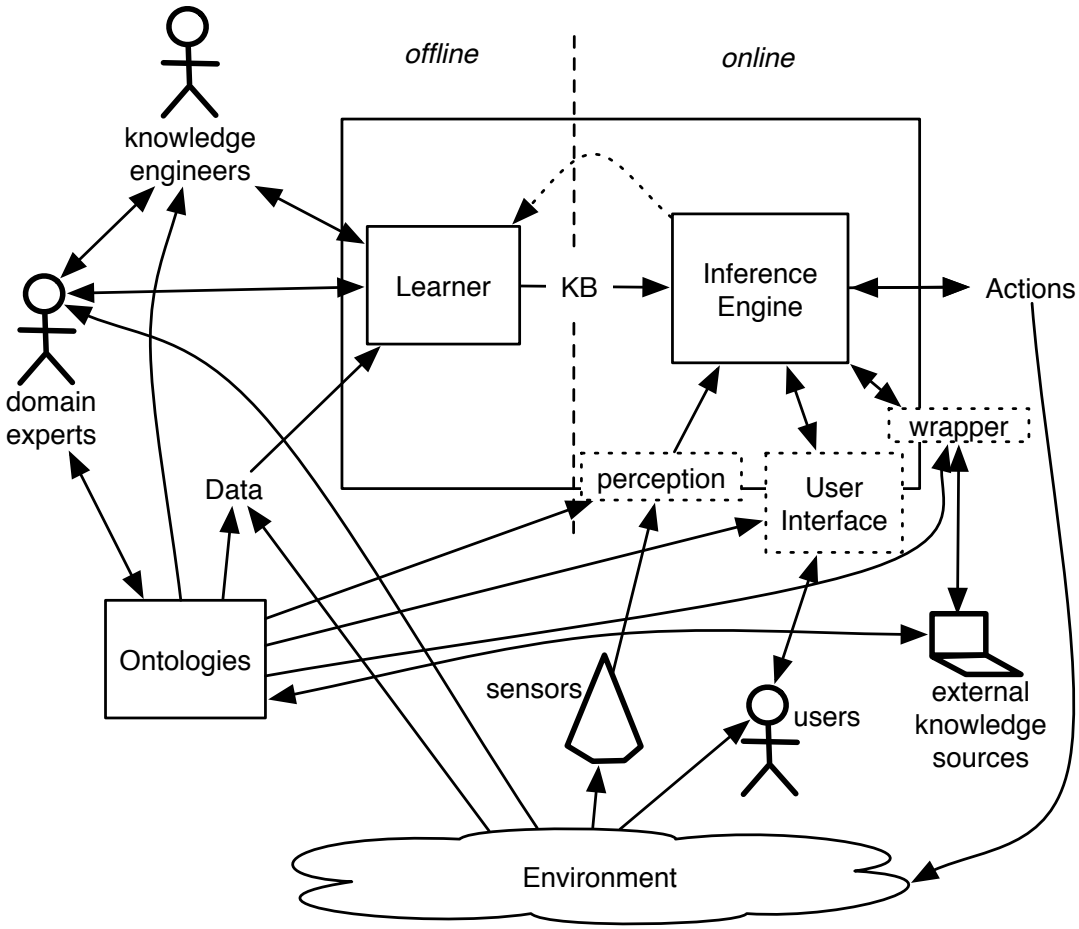

Agent ontwerp-ruimte

Complexiteit dimensies:

- Modularity: flat, modular, hierarchical
- Planning horizon: non-planning, finite horizon, indefinite horizon, infinite horizon
- Representation: states, features, relations
- Computational limits: perfect rationality, bounded rationality
- Learning: knowledge is given, knowledge is learned
- Sensing uncertainty: fully observable, partially observable
- Effect uncertainty: deterministic, stochastic
- Preference: goals, complex preferences
- Number of agents: single agent, multiple agents
- Interaction: offline, online

Complexiteit dimensies

Dimension	Values
Modularity	• flat • modular • hierarchical

- Model at one level of abstraction: flat
- Model with interacting modules that can be understood separately: modular
- Model with modules that are (recursively) decomposed into modules:hierarchical

Complexiteit dimensies

Dimension	Values
Planning horizon	• non-planning • finite stage • indefinite stage • infinite stage

- Non-planning: static world does not change
- Finite stage: agent reasons about a fixed finite number of time steps
- Indefinite stage: agent reasons about a finite, but not predetermined, number of time steps
- Infinite stage: the agent plans for going on forever (process oriented)

Complexiteit dimensies

Dimension	Values
Representation	• states • features • relations

- Explicit states: a state is one way the world could be
- Features or propositions.
  - States can be described using features.
  - 30 binary features can represent $2^{30} = 1,073,741,824$ states.
- Relations and individuals
  - There is a feature for each relationship on each tuple of individuals.
  - Often an agent can reason without knowing the individuals or when there are infinitely many individuals.

Complexiteit dimensies

Dimension	Values
Computational limits	• perfect rationality • bounded rationality

- Perfect rationality: the agent can determine the best course of action, without taking into account its limited computational resources.
- Bounded rationality: the agent must make good decisions based on its perceptual, computational and memory limitations.

Complexiteit dimensies

Dimension	Values
Learning	• knowledge is given • knowledge is learned

- Knowledge is given a priori by its creator(s)
- Knowledge is learned from data or past experience

Complexiteit dimensies

There are two dimensions for uncertainty. In each dimension an agent can have

- No uncertainty: the agent knows what is true
- Disjunctive uncertainty: there is a set of states that are possible
- Probabilistic uncertainty: a probability distribution over the worlds.

Complexiteit dimensies

- Agents need to act even if they are uncertain.
- Predictions are needed to decide what to do:
  - definitive predictions: you will be run over tomorrow
  - disjunctions: be careful or you will be run over
  - point probabilities: probability you will be run over tomorrow is 0.002 if you are careful and 0.05 if you are not careful
- Acting is gambling: agents who don't use probabilities will lose to those who do.
- Probabilities can be learned from data and prior knowledge.

Complexiteit dimensies

Dimension	Values
Sensing uncertainty	• fully observable • partially observable

- Fully-observable: the agent can observe the state of the world
- Partially-observable: there can be a number states that are possible given the agent's stimuli

Complexiteit dimensies

Dimension	Values
Effect uncertainty	• deterministic • stochastic

- Deterministic: the resulting state is determined from the action and the state
- Stochastic: there is uncertainty about the resulting state.

Complexiteit dimensies

Dimension	Values
Preference	• goals • complex preferences

- goal: is an exact goal to achieve. This can be a complex logical formula.
- complex preferences: may involve tradeoffs between various desiderata, perhaps at different times
  - ordinal: only the order matters
  - cardinal: absolute values also matter

Complexiteit dimensies

Dimension	Values
Number of agents	• single agent • multiple agents

- Single agent reasoning: any other agents are part of the environment.
- Multiple agent reasoning: an agent reasons strategically about the reasoning of other agents.

Complexiteit dimensies

Dimension	Values
Interaction	• offline reasoning • online reasoning

- reason offline: before acting
- reason online: while interacting with environment

Opdracht

Ga voor elk van de complexiteits-dimensies na wat de complexiteit van autonome project-robot is en geef met een concreet voorbeeld aan waarom dat zo is.
Mail je oplossing tenminste 1 uur voor aanvang van de volgende les naar de docent(en).