

# CS4618: Artificial Intelligence I

## Agents

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## Initialization

In [1]:

```
%reload_ext autoreload
%autoreload 2
%matplotlib inline
```

In [2]:

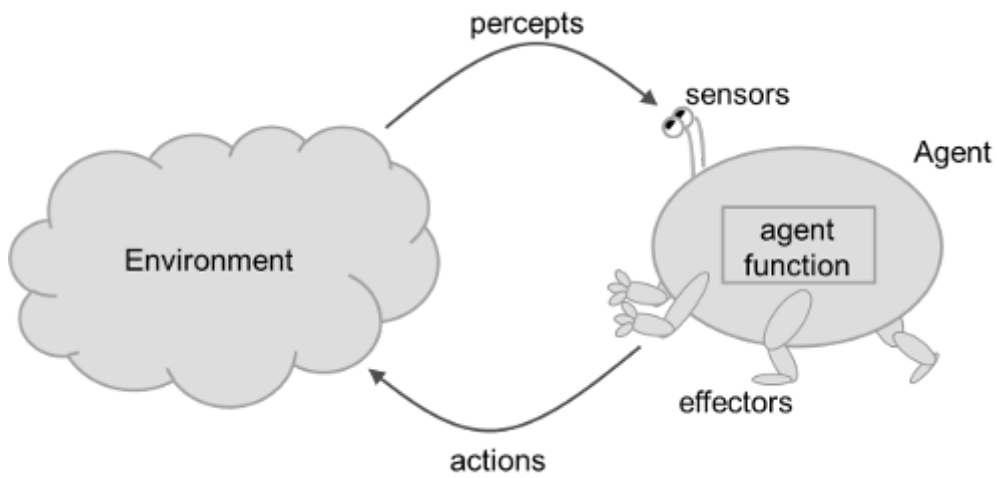
```
import pandas as pd
import numpy as np
import matplotlib.pyplot as plt
```

## Intelligence

- My far-from-perfect definition:  
*A system's degree of intelligence is defined in terms of its capacity to act autonomously and rationally when faced with disorder, uncertainty, imprecision and intractability.*
- Key points:
  - Intelligence is not a binary concept; it's a matter of **degree**
  - **Autonomous**, e.g. not under remote control; e.g. skills acquired by learning rather than instinct/pre-programming
  - **Rational**: acting so as to achieve your **goals**, given your **beliefs**
  - Certain situations are more challenging than others: **disorder**, **uncertainty**, **imprecision**, **intractability** (see also discussion of Environments, below)

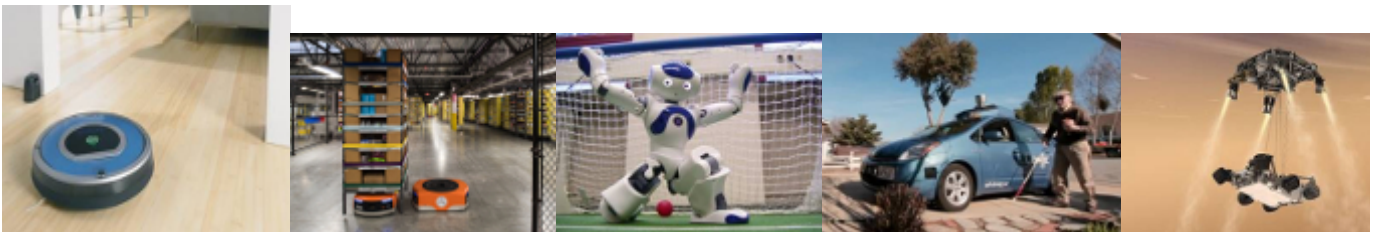
# Agents

- An **agent** is anything that can be viewed as **perceiving** its environment through **sensors** and **acting** upon that environment through **effectors**



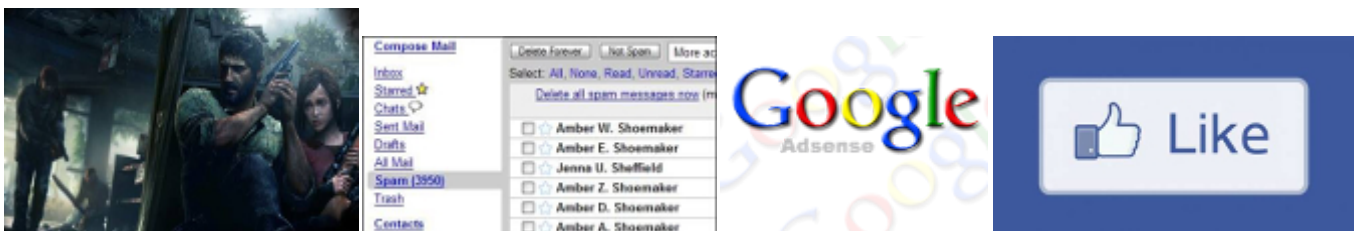
# Robots

- Robots are **embodied** agents, situated in **physical** environments



# Software agents

- Software agents (sometimes called softbots) are situated in **virtual** environments



# Sense, Plan, Act

- Sense
  - Use sensors to find things out about the environment
- Plan
  - Decide on the next action(s)
- Act
  - Use effector(s) to carry out the chosen action(s)

## Action function

- The task of the **Plan** phase is to implement an **action function** that maps
  - from **percept sequences**
  - to the **actions** the agents can perform
- In intelligent agents, this function exhibits high degrees of
  - **autonomy** and
  - **rationality**

## Environments

- Fully observable vs. partially observable
- Deterministic vs. stochastic
- Single-step vs. sequential
- Static vs. dynamic
- Discrete vs. continuous
- Single-agent vs. multi-agent
  
- Exercise: classify the environments of a chess program, a spam filter, a robot vacuum cleaner, and an autonomous car

## Agents

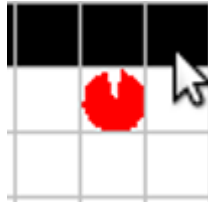
- Reactive agents
- Deliberative agents

## Table-Driven Agents

- At each point in time:
  - $s = SENSE()$ ;
  - $a = LOOKUP(s, table)$ ;
  - $EXECUTE(a)$ ;

# Class exercise: Table-Driven Wall-Following Agent

1. Suppose the agent has 8 touch sensors, each returning 0 or 1



Sensors return 11000001

How many table entries will there be?

## Class exercise

2. In fact, only three sensors are needed:



How many table entries will there be?

## Class exercise

3. The actions are:

- MOVE:
  - this moves the agent one cell forward
- TURN( $d, n$ ) where  $d = \text{LEFT}$  or  $d = \text{RIGHT}$  and  $n = 0, 1, 2, \text{etc.}$ :
  - this turns the agent to the left or right,  $n$  lots of  $45^\circ$

Fill in the table so that the agent walks the walls anticlockwise

Percept	Action
000	
001	
010	
011	
100	
101	
110	
111	

# Discussion

- Is this agent autonomous?
- When is the table-driven approach a *possible* approach?
- When is it a *practicable* approach?