#### CMSC 170

Introduction to Artificial Intelligence 2<sup>nd</sup> Semester AY 2013-2014 CNM Peralta

#### Introduction to Artificial Intelligence

## An Al program is called an intelligent agent.



Agent



Environment

Agents interact with their environments.



Agent



Environment

Agents interact with their environments.



Agent



Environment

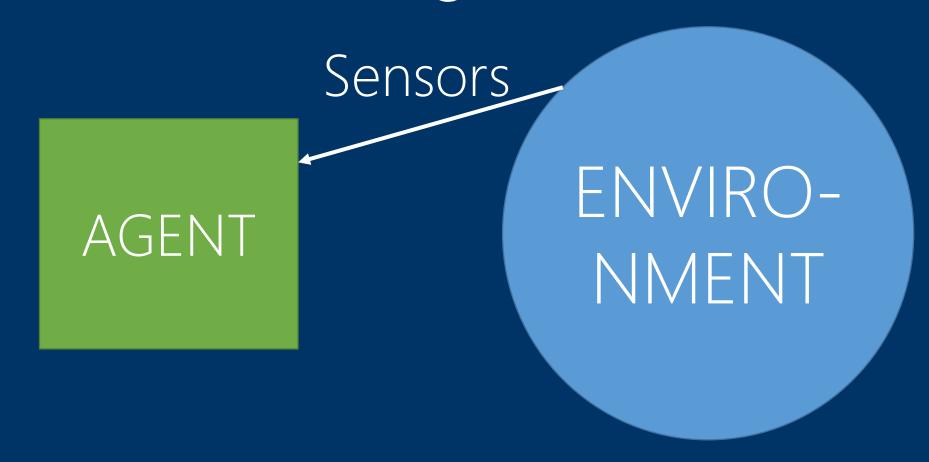
Agents interact with their environments.

#### In general...

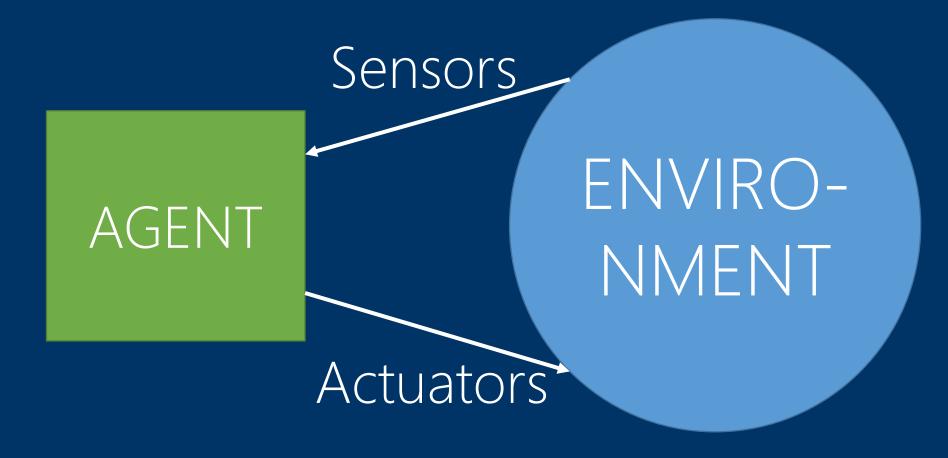
AGENT



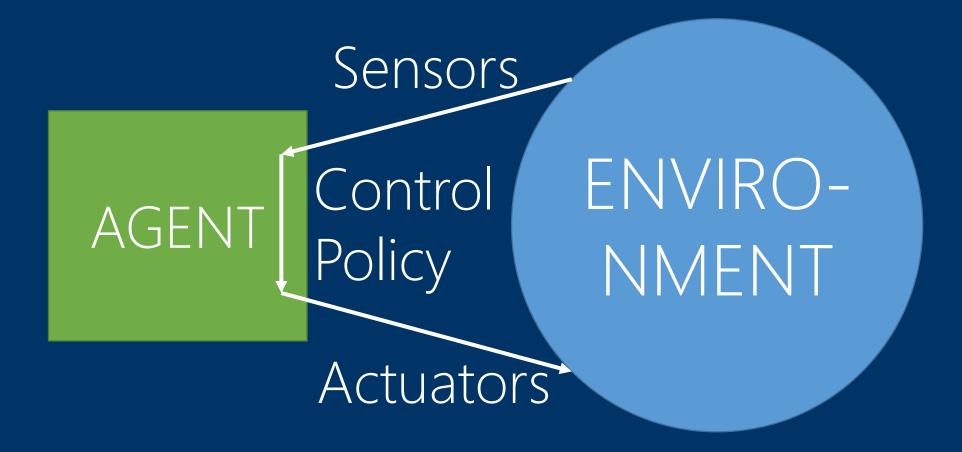
## Agents perceive the **state** of the environment through its **sensors**.



## Agents affect the **state** of the environment through its **actuators**.



The agent's *control policy* maps the input from sensors to the resulting actions by the actuators.



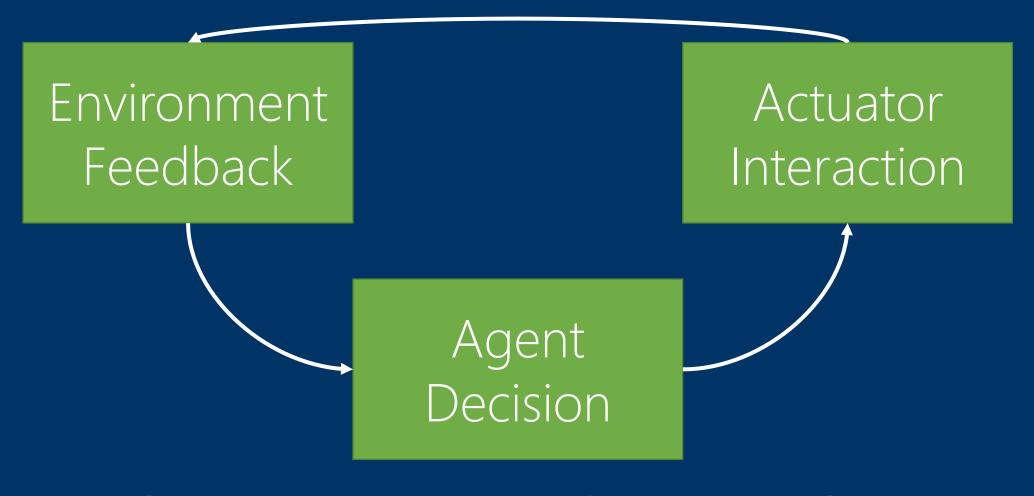
# Artificial intelligence deals with formulating/designing the control policy.

#### The Big Question

How does an agent make decisions that it can carry out using its actuators based on past sensor data?

## The process that we have described is essentially a loop called the

#### Perception-Action Cycle.



#### Perception-Action Cycle

#### Applications of Artificial Intelligence

Rates/ News



Trades

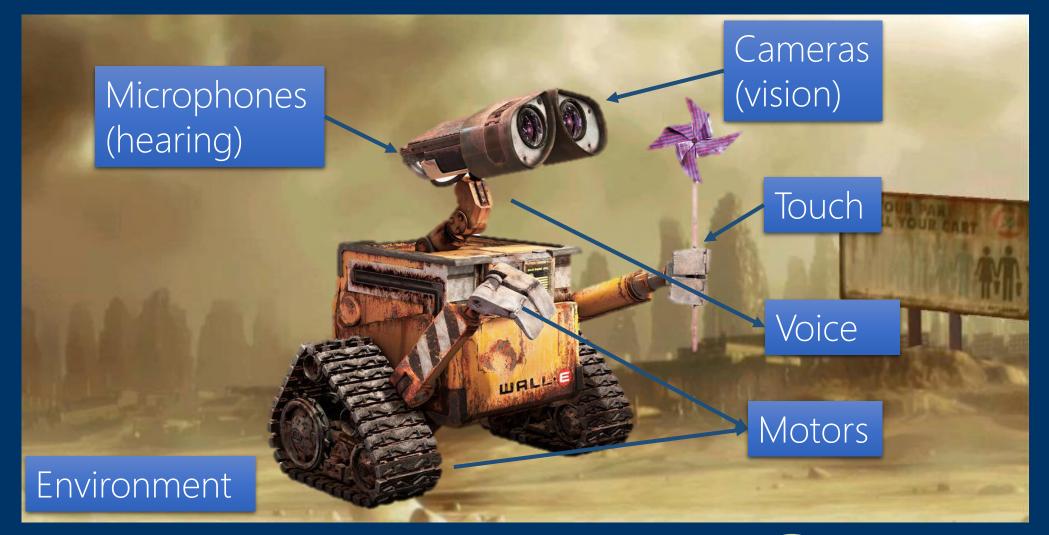
Stock Broker Agent



#### Finance



#### Robotics



#### Robotics



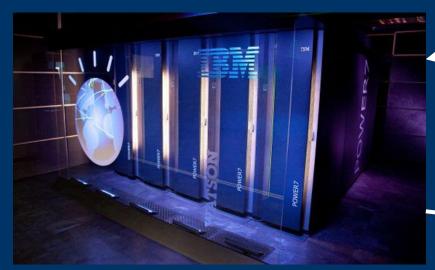
Games





Vital Signs/ Test Results





Diagnosis



Medicine



Google Search

I'm Feeling Lucky

Web <u>Pages</u>



Query

List of sites

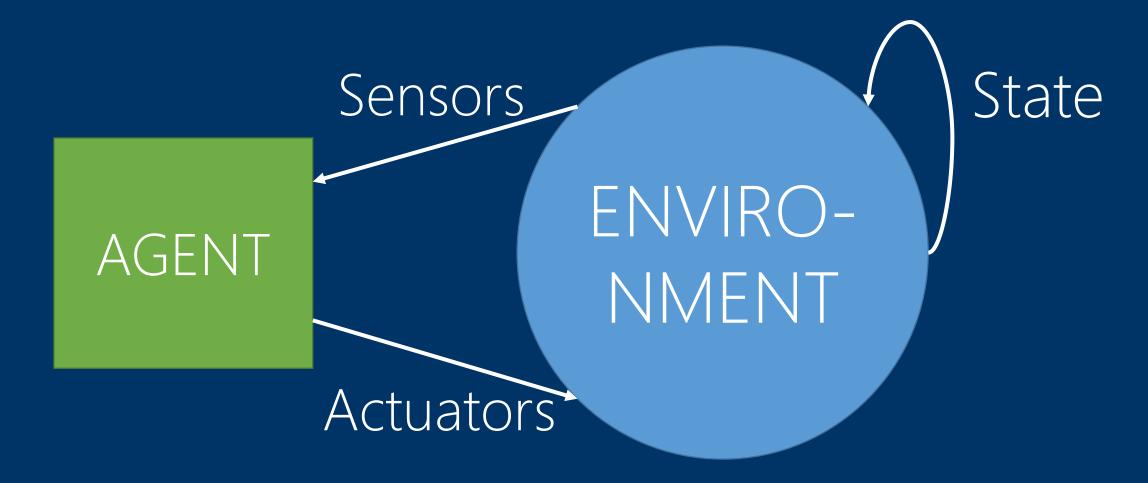
Google	"space travel" Search Advanced	Appliance Search
0.0	Search: ② public content ○ public and secure content	
Search		Results 1 - 10 of about 201 for "space trave
Next>	Sort by date / Sort by relevance	
proy SPACE TRAVEL AND THE Page 1. Student information shee OF WEIGHTLESNEESS ON THE www.corp google.com/space/edu CSA. 3TS-97. WIGStation. Spa Group Activity. Space Travel shape as the solar system. Hee www.corp google.com/space/spa Proy Controlled Environment As Page 1. Controlled Environment As Page 1. Controlled Environment As Page 1. Controlled Environment As pace Travel Michael Stassisk. www.corp google.com/space/spc The way in which television an and exploration over the years ha www.corp google.com/space/spc I. Transportation Tigs. 1 Intimal Bre. Research various Environ of spa of space Travel Ask an online or space Travel Ask an online or space travel.	EFFECTS OF WEIGHTLESSNESS ON THE HUMAN BODY  (Cloides 6-5 SPACE TRAVEL AND THE EFFECTS  HUMAN BODY THE human body is an  cation-incregnate, science, size and 12-202-12-02-12-12-12-12-12-12-12-12-12-12-12-12-12	Related Results From Public Domain  1 Human spaceflight - Wikipedia, the free encoclopedia the International Space Station (ISS) to investigate questions like, Vinhal happens to food and medicine exposed to stir-plus moreths of space travel? the provided to stir-plus moreths of space travel? the provided to stir-plus more than subjects any time than spaceflight lists plus extravel. Encyclopedia.com space science Author not available, SPACE TRAVEL. The Columbia Encyclopedia. Sorth Edition Station of the stirley plusves encyclopedia com/door/LE-X-appaceta html 3 Spaceflight - Wikipedia, the free encyclopedia The realistic proposal of space travel goes back to this most famous work. "Eccanogasiane wepoeiax reportpaints peacmentum preference."
www.corp.google.com/space/briefing_e.html - 23k - Cached  Arts Ed (Grade 3) - Grade 3 Visual Art Unit 2		More Results
Make a model. Read books, st Encourage students to tell their s	pace travel stories to other students  pace travel stories to other students  se 3 arts html - 13k - 2006-08-28 - Carched	

On the Web

#### Basic Terminology

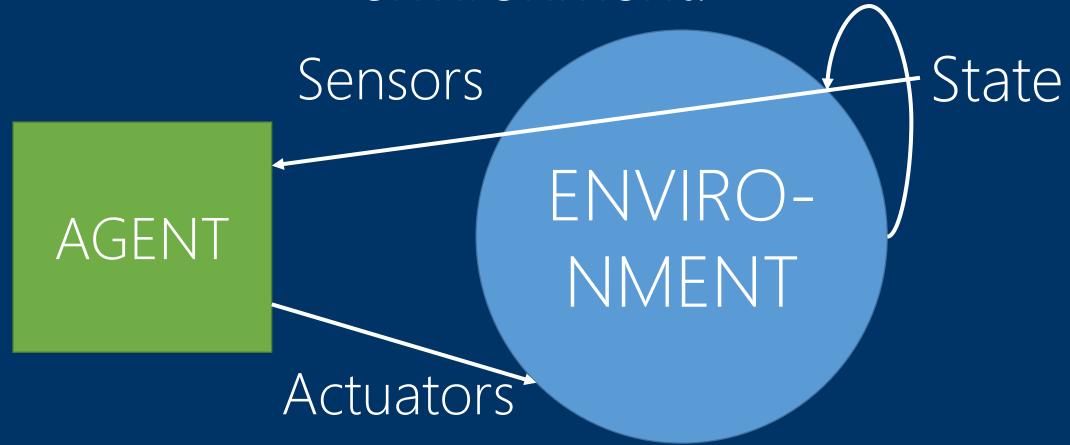
Before we continue, we will discuss some terminology that we can use to differentiate the problems that we will be encountering.

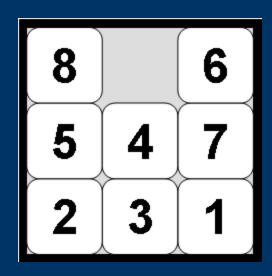
#### The environment has an internal state.



A problem has a *fully-observable* environment if the agent can sense all the information it needs to make the optimal decision.

The agent can see the **entire state** of the environment.





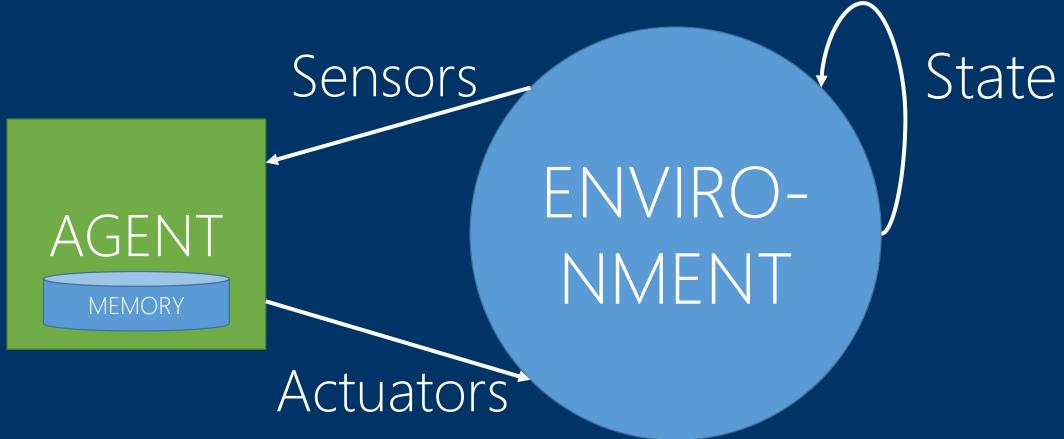




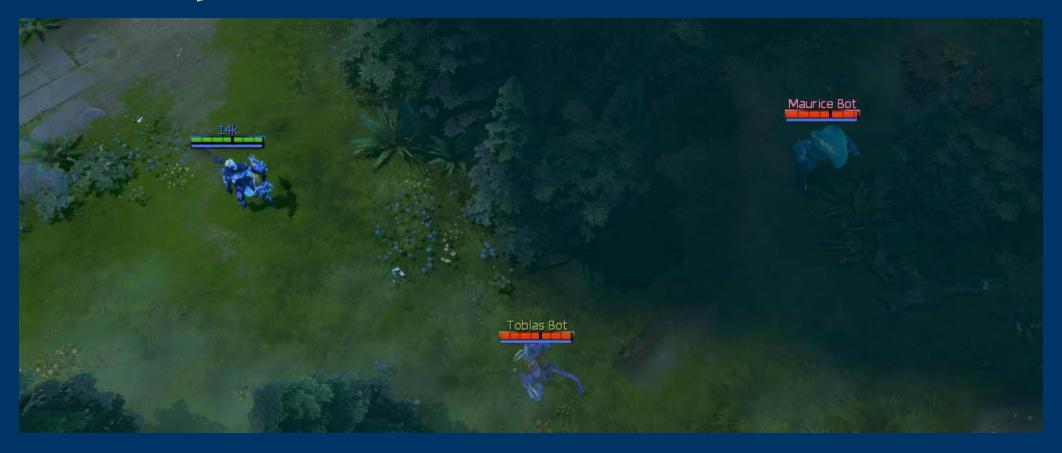
A problem has a *partially-observable* environment if the agent needs memory of previous events to make the best possible decision.

### Basically, not all information needed to make the optimal decision is available.

The agent needs memory of previously detected states.

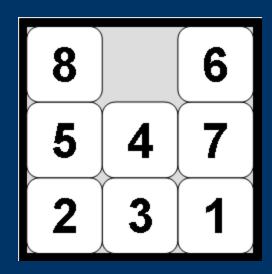








# A problem is *deterministic* if the agent's actions uniquely determine the outcome.



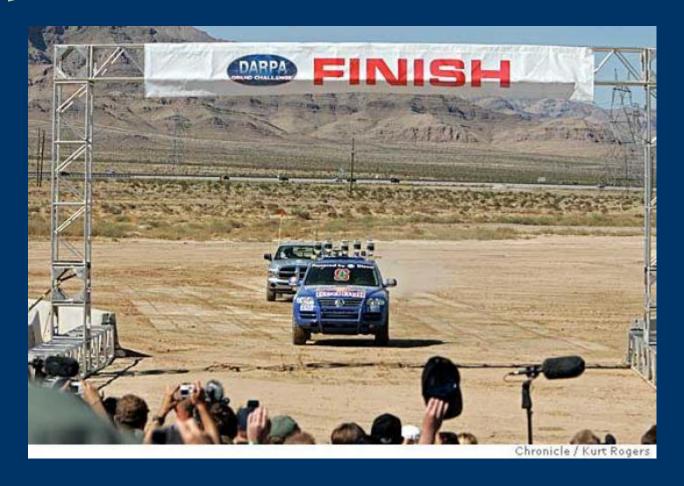




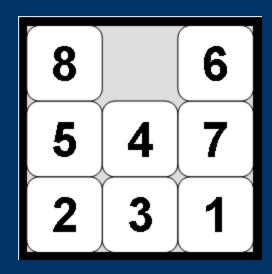
## A problem is **stochastic** if there is an element of randomness to it.







A problem has a *discrete* environment if there is a *finite* number of action choices and a *finite* number of things to be sensed.



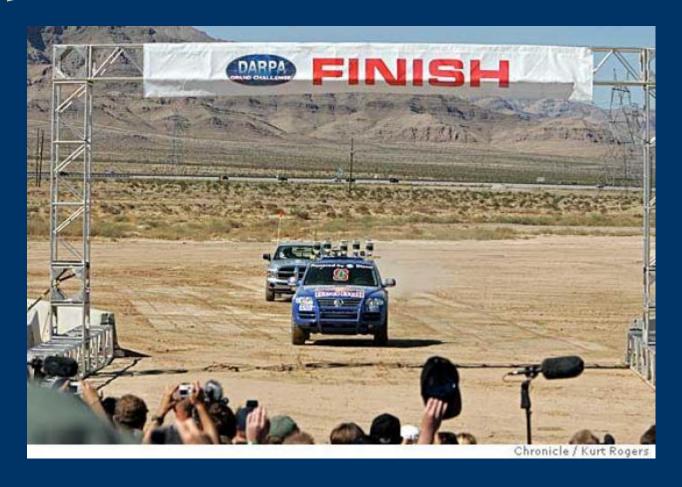


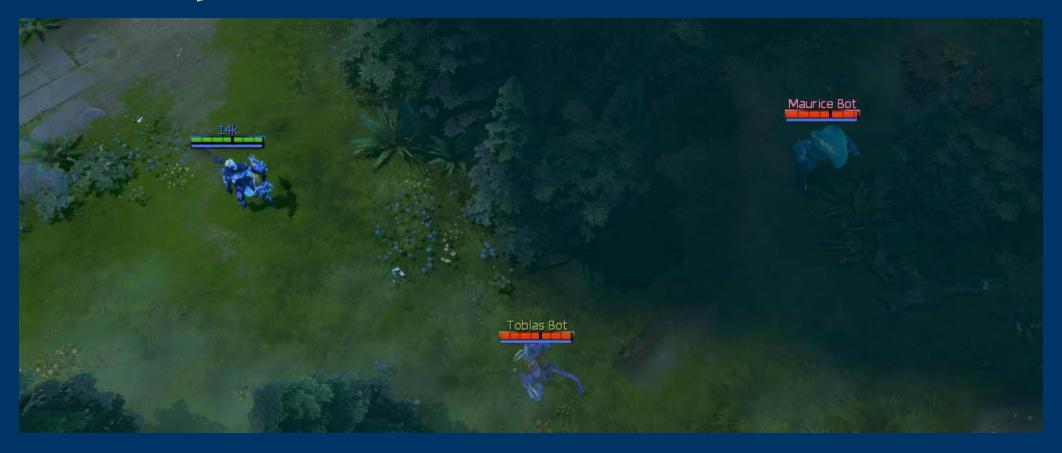






## A problem has a *continuous* environment if the space of possible actions or things to sense is infinite.





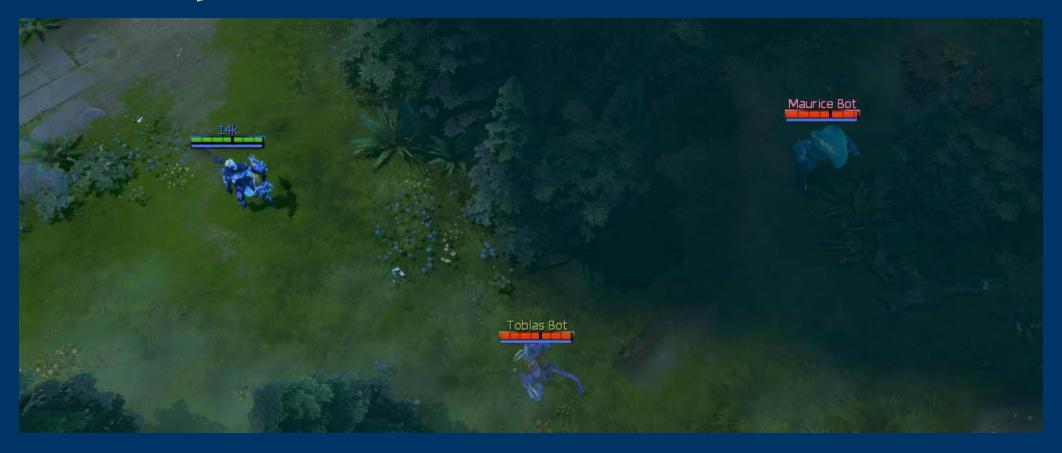


# A problem's environment is **benign** if it, or other agents, do not contradict the agent's objectives.





A problem's environment is **adversarial** if it, or any other agents oppose the agent's objectives or threaten its safety.





### Artificial Intelligence in Uncertainty Management

## Artificial intelligence is commonly used when we humans can not figure out what to do. :-D

#### Why don't we know what to do?

#### Why don't we know what to do?

#### Because of *uncertainty*.

#### How do we become uncertain?

Sensor Limits

Laziness

Adversaries

Ignorance

Stochasticity