

Artificial Intelligence

Introduction

Fernando Rodríguez Sánchez

ferjorosa@gmail.com

Universidad Politécnica de Madrid

16/10/2020



Table of contents

- ① What is Artificial Intelligence?**
- ② Types of Artificial Intelligence**
- ③ Main topics in Artificial Intelligence**
- ④ An intelligent agent**
- ⑤ Focus of this course**
- ⑥ Some interesting links**

Table of contents

- ① **What is Artificial Intelligence?**
- ② **Types of Artificial Intelligence**
- ③ **Main topics in Artificial Intelligence**
- ④ **An intelligent agent**
- ⑤ **Focus of this course**
- ⑥ **Some interesting links**

What is Artificial Intelligence?

To think like humans	To think rationally
	
To act like humans	To act rationally
	

To think like humans

**Making machines that think
like humans?**



To think like humans

Making machines that think like humans?

- Psychology
- Philosophy
- Neuroscience
- Cognitive science

To make machines with human-like minds in the full and literal sense

(Haugeland, 1985)



To think like humans



Human Brain Project

 Brain exploration	 Brain simulation	 Silicon Brains	 Understanding cognition
 Medicine	 Robots	 Massive computing	 Ethical considerations

To think rationally

**Making machines that think
rationally?**



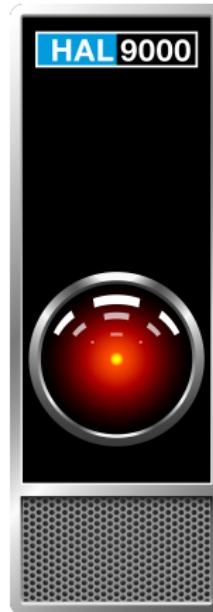
To think rationally

**Making machines that think
rationally?**

- Logic
- Knowledge & Reasoning

*The study of mental facilities through
the use of computational models*

(Charniak and McDermott, 1985)



To think rationally

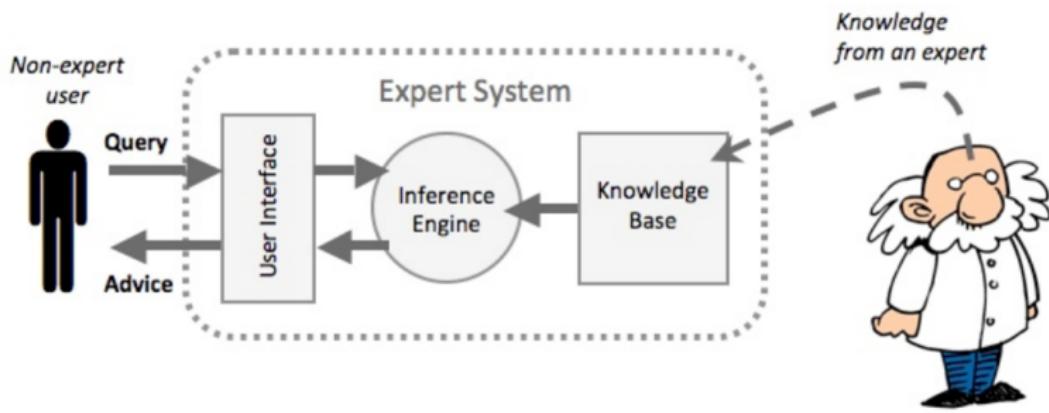


Diagram of an expert system

To think rationally

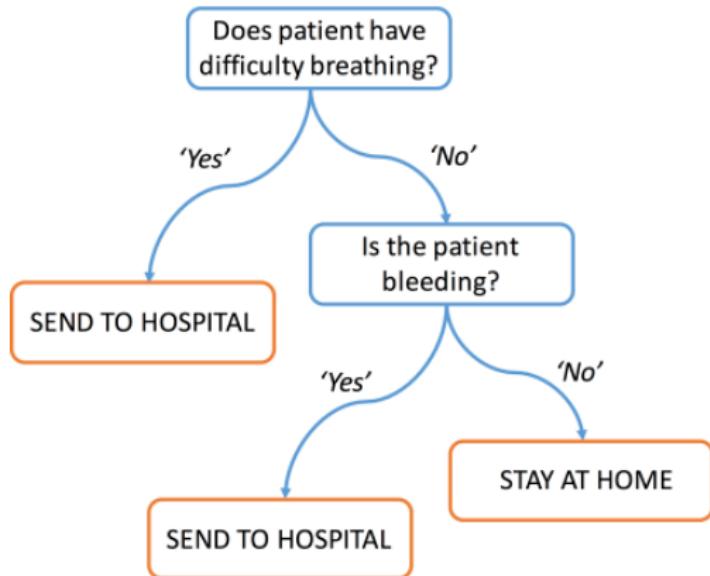
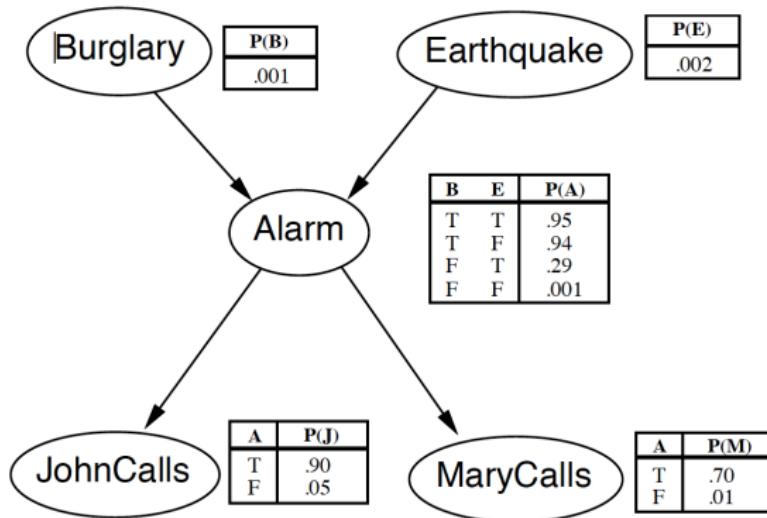


Diagram of an specific set of rules

To think rationally



A simple Bayesian network

To act like humans

**Making computers do things
that, at the moment, people
are better?**



To act like humans

Making computers do things that, at the moment, people are better?

- Computer engineering
- Machine learning
- Reinforcement learning

Creating machines to perform actions that require intelligence when performed by people

(Kurzweil)



To act like humans

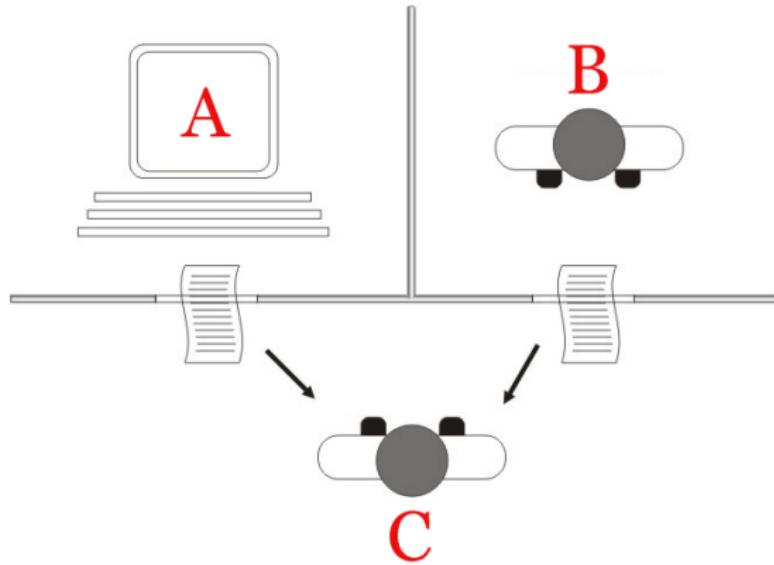


Diagram of the Turing test

To act like humans



Hi, how can I help?

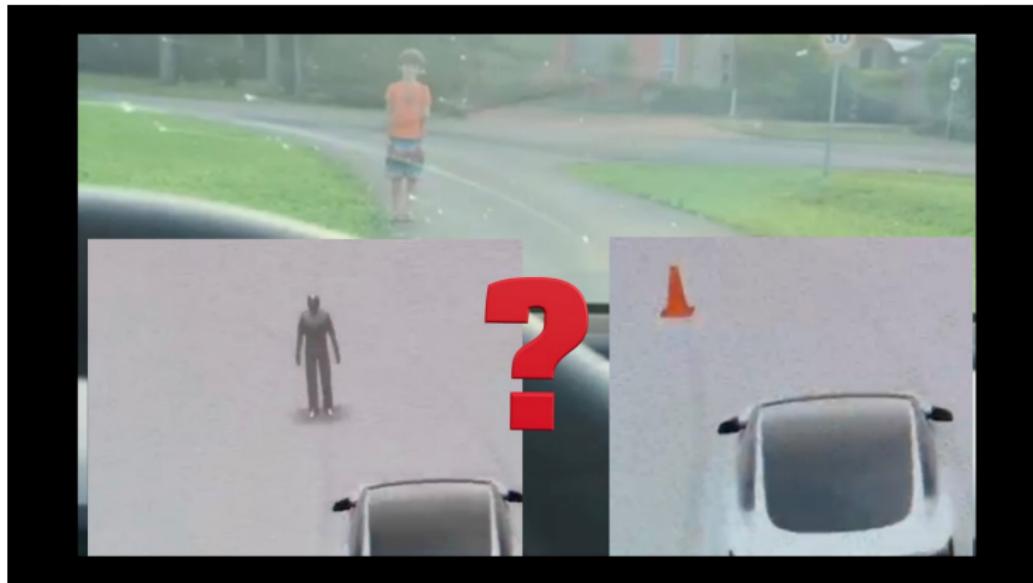
Google Assistant



To act like humans



To act like humans



To act rationally

Automating intelligent behaviour?



To act rationally

Automating intelligent behaviour?

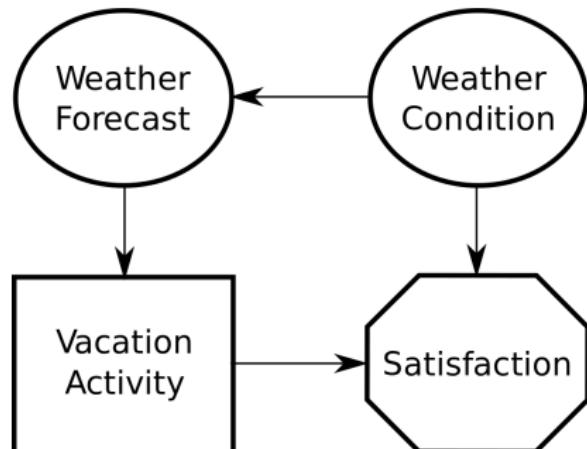
- Logic
- Decision theory
- Economics
- Machine learning

Rational agents perform the action with the optimal expected outcome

(Russell & Norvig, 2003)

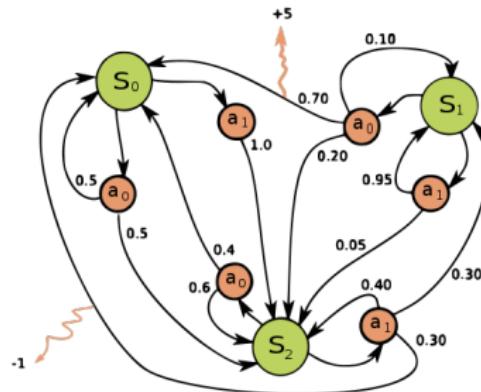


To act rationally



A simple influence diagram

To act rationally



A simple Markov decision process

What is Artificial Intelligence?

To think like humans	To think rationally
	
To act like humans	To act rationally
	

What is Artificial Intelligence?

AI foundations:

- Philosophy
- Psychology
- Neuroscience
- Mathematics
- Statistics
- Control theory & Cybernetics
- Linguistics

What is Artificial Intelligence?

Definition of AI:

- *The theory and development of computer systems able to perform tasks normally requiring human intelligence*
(Oxford dictionary)

Goals of AI:

- To develop machines that take over dangerous, tedious or difficult tasks from humans
- To help understand the principles of human intelligence

Table of contents

- ① What is Artificial Intelligence?
- ② Types of Artificial Intelligence
- ③ Main topics in Artificial Intelligence
- ④ An intelligent agent
- ⑤ Focus of this course
- ⑥ Some interesting links

Types of Artificial Intelligence

- Two types of AI given the **scope of its tasks**
- **Artificial Narrow Intelligence (ANI)**
 - Able to perform one or several specific tasks
 - There is no model of mind
 - All current AIs are narrow (Roomba, Siri, Alexa, etc)
- **Artificial General Intelligence (AGI)**
 - Able to perform all human cognitive functions
 - For the moment is simply science fiction (at least 50-100 years)
 - Ethical considerations → superintelligence (?)
- The industry is currently focused on **narrow AIs**

Table of contents

- ① What is Artificial Intelligence?
- ② Types of Artificial Intelligence
- ③ Main topics in Artificial Intelligence
- ④ An intelligent agent
- ⑤ Focus of this course
- ⑥ Some interesting links

Main topics in Artificial Intelligence

- Search
- Knowledge representation & reasoning
- Planning
- Learning
- Environment interaction (e.g. vision, speech recognition, robotics)
- Natural language processing

Search

What do we search (Goal):

- Possible answers, decisions, etc.

Where do we search:

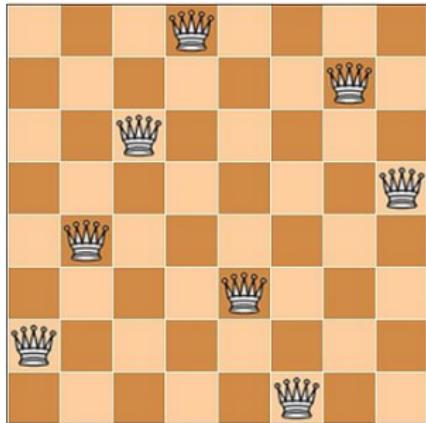
- Structured state space

How do we search:

- Set of actions with cost

Types of search:

- Blind
- Informed



Eight queens problem

Knowledge representation & reasoning

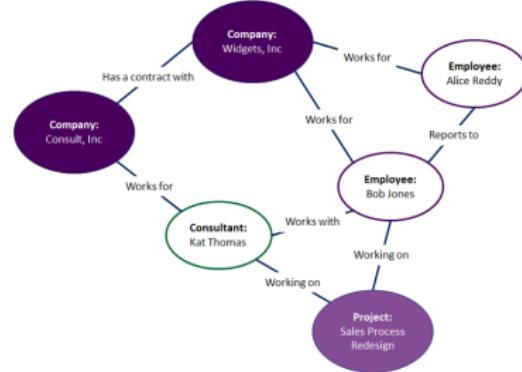
Intelligence requires knowledge

Two types of knowledge:

- Declarative (What is...)
- Procedural (How to...)

Reasoning = Inference

- Logical. *Is Socrates a mortal?*
- Probabilistic. *Probability of rain?*



A simple ontology graph

Planning

What do we have:

- A set of goals
- A very large search space

What do we want:

- To construct a sequence of actions that achieve those goals

What happens if the space changes while we execute the plan?



Amazon warehouse

Learning

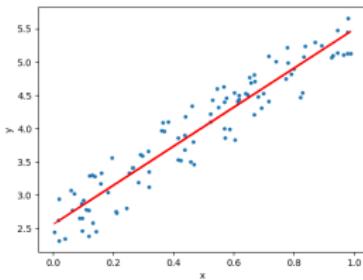
How do we recognize patterns in the environment?

How do we generate new concepts?

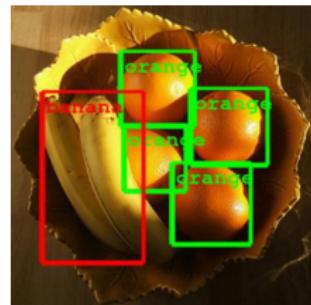
How do we improve our actions?

Three key elements:

- Data
- Algorithms
- Models



Environment interaction



Platforms

Boston Dynamics 



SpotMini

Spot

Atlas

Handle

Natural language processing

More Deeper Application of NLP

Group 1	Group 2	Group 3
Cleanup, Tokenization	Information Retrieval and Extraction (IR)	Machine Translation
Stemming	Relationship Extraction	Automatic Summarization/ Paraphrasing
Lemmatization	Named Entity Recognition (NER)	Natural Language Generation
Part of Speech Tagging	Sentiment Analysis/Sentance Boundary Dismbiguation	Reasoning over Knowledge Based
Query Expansion	World sense and Dismbiguation	Quation Answering System
Parsing	Text Similarity	Dialog System
Topic Segmentationand Recognition	Coreference Resolution	Image Captioning & other Multimodel Tasks
Morphological Degmentation (Word/Sentences)	Discourse Analysis	

Table of contents

- ① What is Artificial Intelligence?
- ② Types of Artificial Intelligence
- ③ Main topics in Artificial Intelligence
- ④ An intelligent agent
- ⑤ Focus of this course
- ⑥ Some interesting links

An intelligent agent

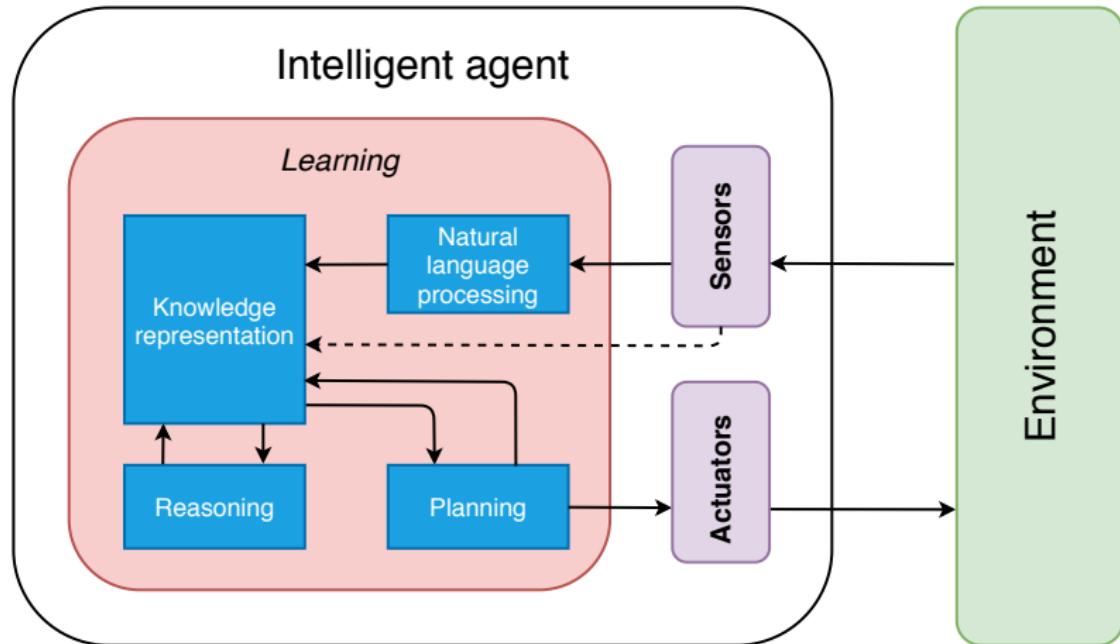


Table of contents

- ① What is Artificial Intelligence?
- ② Types of Artificial Intelligence
- ③ Main topics in Artificial Intelligence
- ④ An intelligent agent
- ⑤ Focus of this course
- ⑥ Some interesting links

Focus of this course

- Machine learning and data mining
- Deep learning*
- Reasoning with uncertainty

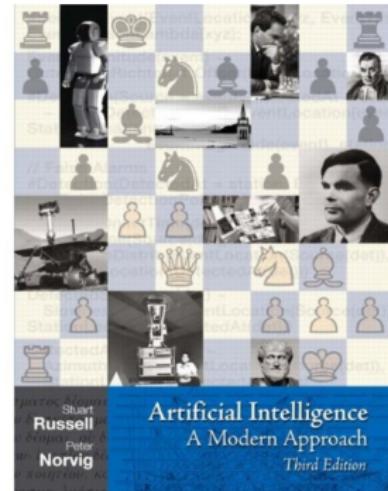
Table of contents

- ① What is Artificial Intelligence?
- ② Types of Artificial Intelligence
- ③ Main topics in Artificial Intelligence
- ④ An intelligent agent
- ⑤ Focus of this course
- ⑥ Some interesting links

Starting point in AI

Artificial Intelligence: A Modern Approach, Third Edition

Stuart Russell and Peter Norvig



Some interesting links

Talks:

- Pedro Domingos: The Master Algorithm
- Judea Pearl: The New Science of Cause and Effect
- Nick Bostrom: Superintelligence
- Stuart Russell: Long-term Future of AI

Webs:

- OpenAI
- Google AI blog (with 2019 recap)
- AI dungeon

Artificial Intelligence

Introduction

Fernando Rodríguez Sánchez

ferjorosa@gmail.com

Universidad Politécnica de Madrid

16/10/2020

