

CS4710: Artificial Intelligence

Intro to AI

What are some typical AI problems? How do we approach them? What are the different sub-fields of AI? Is true AI really achievable?



Topics

- ❖ What is AI?
- ❖ Summary of typical AI problems
 - ❖ Planning
 - ❖ Vision
 - ❖ Learning
 - ❖ Etc.
- ❖ Knowledge Representation Overview
- ❖ Is AI achievable?

What is AI?

Artificial Intelligence:

What do you all think it is?

Artificial Intelligence:

...is the intelligence exhibited by machines or software. It is an academic field of study which studies the goal of creating intelligence. Major AI researchers and textbooks define this field as "the study and design of intelligent agents", where an intelligent agent is a system that perceives its environment and takes actions that maximize its chances of success.

Typical AI Problems

A Simple Task

- ❖ Imagine you simply need to go shopping.
- ❖ What are some of the complex things you have to accomplish?
 - ❖ This is the part where we congratulate ourselves for simple tasks and realize how AMAZING humans are



A Simple Task



- ❖ Planning:
 - ❖ Formulating a sequence of actions
 - ❖ What directions to use, order of shops to visit
- ❖ Vision
 - ❖ Making sense of the world we see
 - ❖ Recognizing faces, etc.
- ❖ Robotics
 - ❖ Acting in the world and perceiving our environment directly
- ❖ Natural Language
 - ❖ Speaking and understanding others
- ❖ Learning
 - ❖ Adapting from our experiences

Planning

- ❖ Discovering a set of actions to take.
- ❖ Think of a robot that isn't moving yet, but is standing around planning out what it will do.
- ❖ This is very common if agent has a lot of information about its environment.
 - ❖ E.g., If I know all the information about roads, intersections, etc. I can write a GPS system that finds paths for me.
 - ❖ But what if I don't have that information?
 - ❖ What if that information is uncertain?



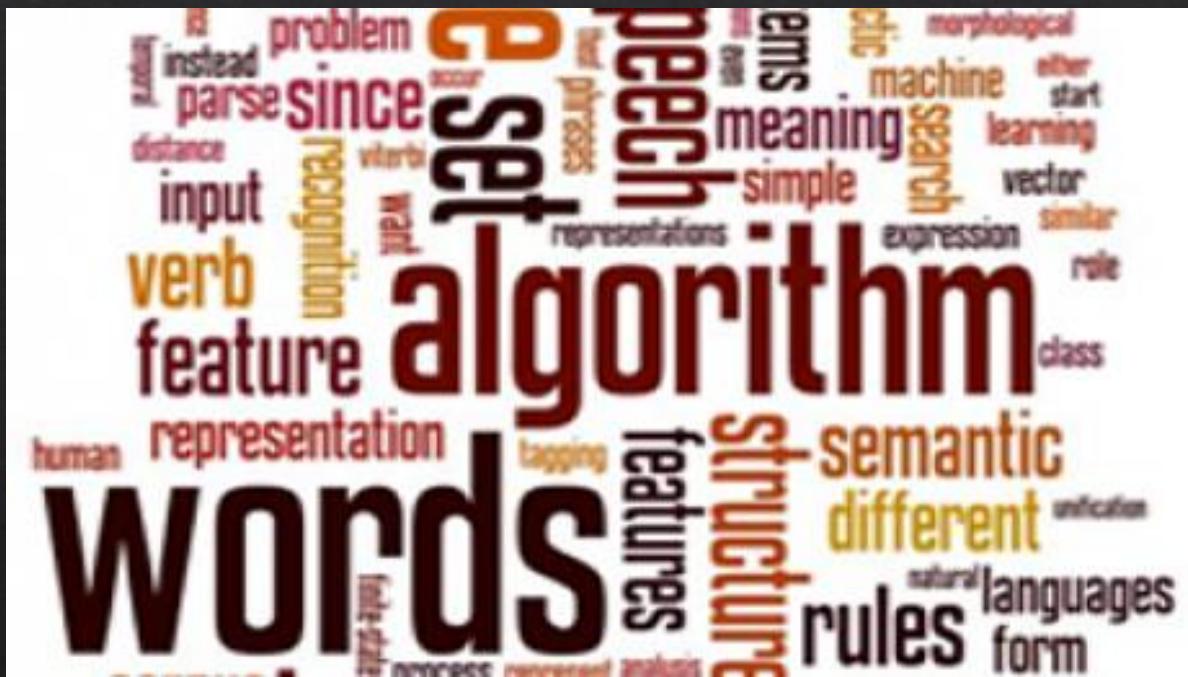


Vision

- ❖ Making sense of the world around us that we see.
- ❖ Can't plan a path if I have no information, might have to look around.
- ❖ Problems in this area:
 - ❖ Recognizing objects in a scene
 - ❖ Scene reconstruction
 - ❖ Motion Analysis
- ❖ Some other vision systems that you might use include...?

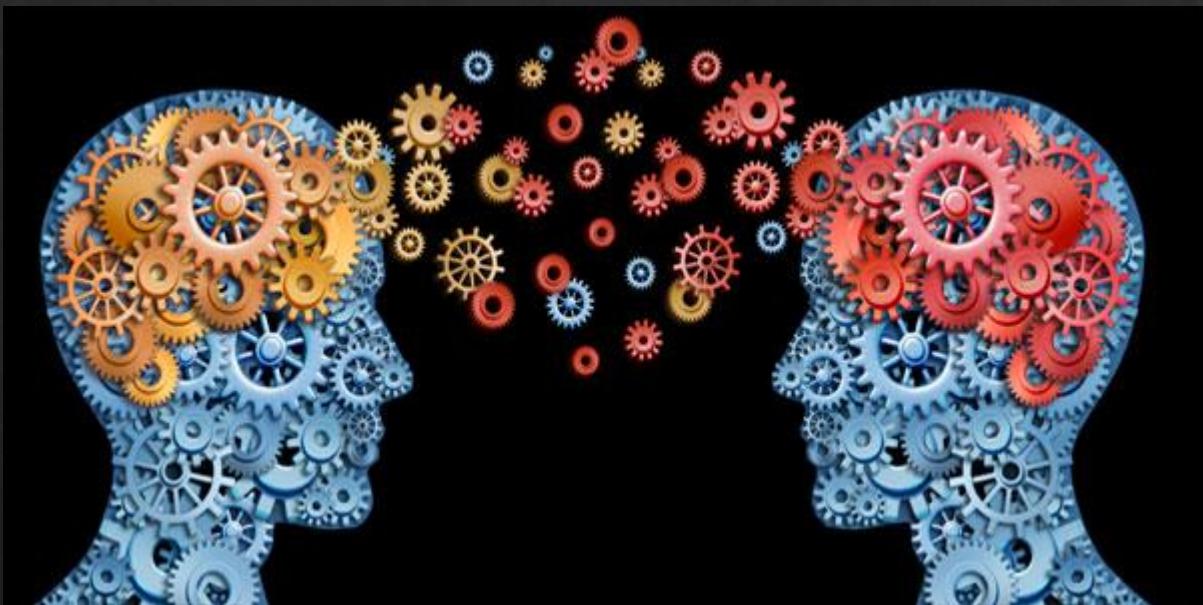
Natural Language

- ❖ Let's think for a second about how AMAZING natural language is.
- ❖ We are able to:
 - ❖ Listen to sounds, understand words, interpret meaning.
 - ❖ Create and construct new sentences on the fly.
 - ❖ I'm doing this right now.
 - ❖ This is literally incredible!
- ❖ Other NLP systems we use?



Learning

- ❖ What are some different ways in which we learn?
- ❖ What are some ways in which computers learn?
- ❖ What are some systems we use today that learn?



Defining Intelligence

- ❖ What are some of the running themes we are seeing so far?



Some tasks require experts



- ❖ Medical Diagnosis
- ❖ Equipment Repair
- ❖ Computer Configuration
- ❖ Financial Planning

- ❖ We can develop systems that do these things to!

Expert Systems



- ❖ Expert Systems attempt to simulate how an expert human goes about accomplishing a task.
- ❖ Why might development of these systems be difficult / different from other systems?

Knowledge Representation



Overview

- ❖ Most “intelligence” requires a lot of information.
- ❖ Need to represent this information somehow.
- ❖ Several different general approaches
- ❖ Required reading on Collab for this. Due next time!!



Formal Systems

- ❖ Use axioms and formal logic
- ❖ Logical statements evaluated to determine the systems output
- ❖ Usually perceives the world directly to evaluate truth value of certain inputs
- ❖ What are some uses of this type of system?



Ontologies

- ❖ Structuring knowledge in graph form
- ❖ Usually consists of nodes, interconnections, etc.
 - ❖ Many variations



Statistical Methods

- ❖ Some AI systems use statistics to make “educated guesses” about what action to take.
- ❖ EXAMPLE:
 - ❖ Learning systems can be shown pictures of 1000 faces and build a statistical model of how people look.
 - ❖ The system will then be able to probabilistically guess when it sees a face (or even detect who the person is)
- ❖ Some uses of this?

Is True AI Achievable?

Some thought experiments on whether AI is even possible. The Turing Test and other philosophical things.



Is “true” AI Possible?

- ❖ Guess we have to define “true”
- ❖ Let’s start with a preliminary definition:
 - ❖ An AI is intelligent if it acts like a human
 - ❖ Is this good enough?



The Turing Test

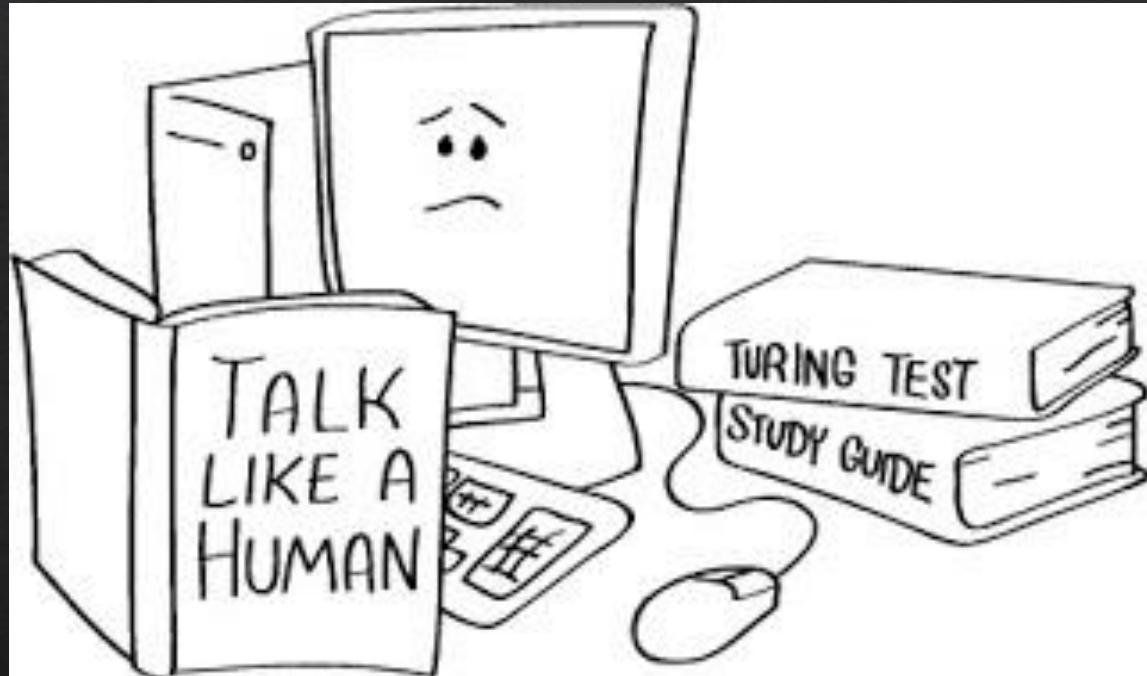
- ❖ Introduced by Alan Turing in 1950
- ❖ He called it “The Imitation Game”
 - ❖ WOAH! Like the movie!
- ❖ Simple Test
 - ❖ Examiner chats with an agent on a computer (via chat console)
 - ❖ Examiner must determine if the agent is a computer or a real human
 - ❖ The machine passes the test if it convinces examiner that it is a human



The Turing Test

- ❖ Corollary:
 - ❖ If a system acts as intelligently as a human being, then it is as intelligent as a human being
- ❖ Do you agree?

Determinism



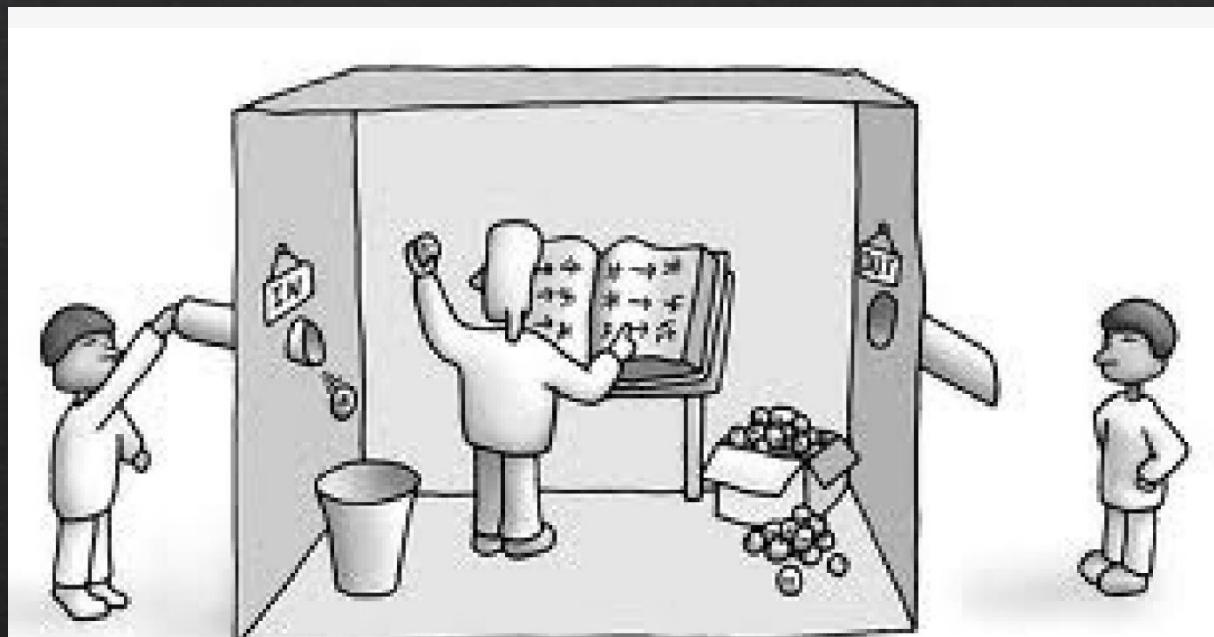
- ❖ Is the human mind deterministic?
- ❖ If so, then it seems we should be able to simulate it
- ❖ This starts to make us, as human beings, feel a bit insignificant

The Chinese Room Argument



- ❖ Introduced by John Searle
- ❖ Meant as a rebuttal to the Turing Test and to claims that intelligence is deterministic
- ❖ Formally, Searle was refuting this claim:
 - ❖ "The appropriately programmed computer with the right inputs and outputs would thereby have a mind in exactly the same sense human beings have minds."

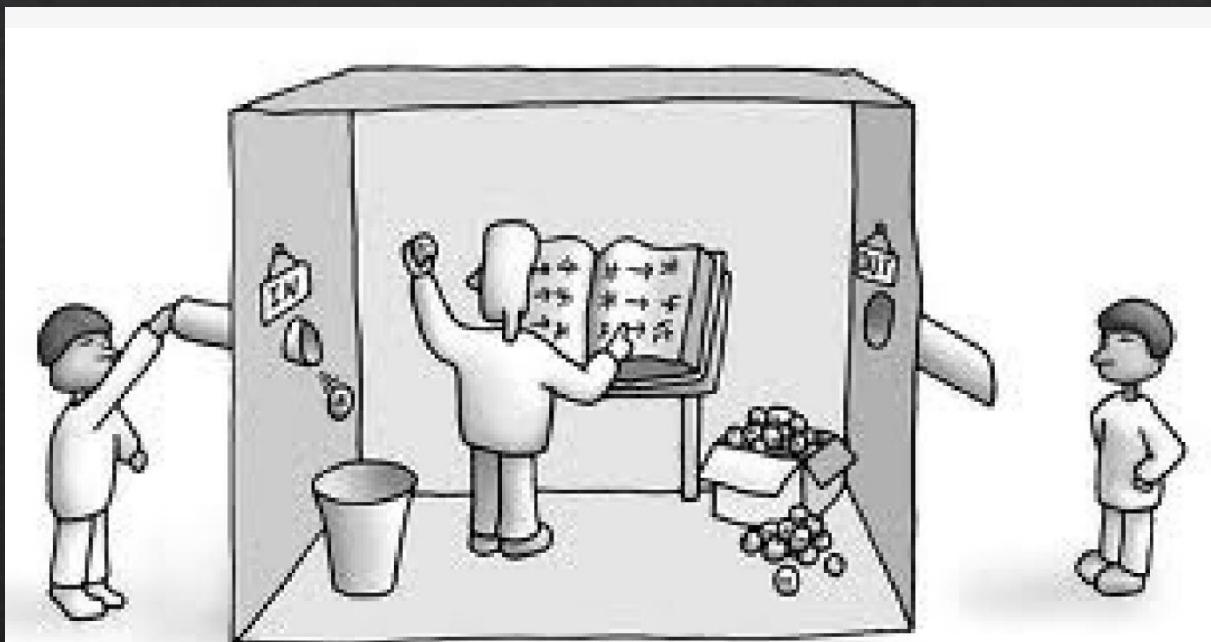
The Chinese Room Argument



Chinese Room

- ❖ Imagine you are in a room
- ❖ You have a book which:
 - ❖ Given series of Chinese symbols (which you can't read)
 - ❖ Maps to a new set of symbols
- ❖ There is a hole on each end

The Chinese Room Argument

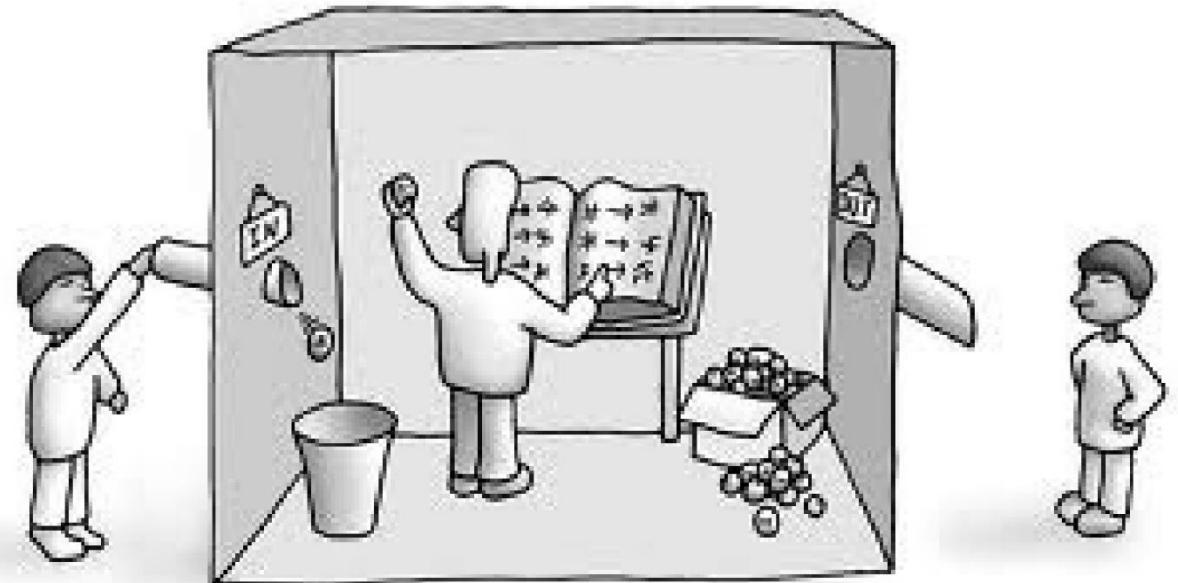


Chinese Room

- ❖ What are the results of this experiment?
- ❖ What are the implications?
- ❖ Is the Turing Test a valid test for intelligence?
- ❖ What would be a better test for intelligence?

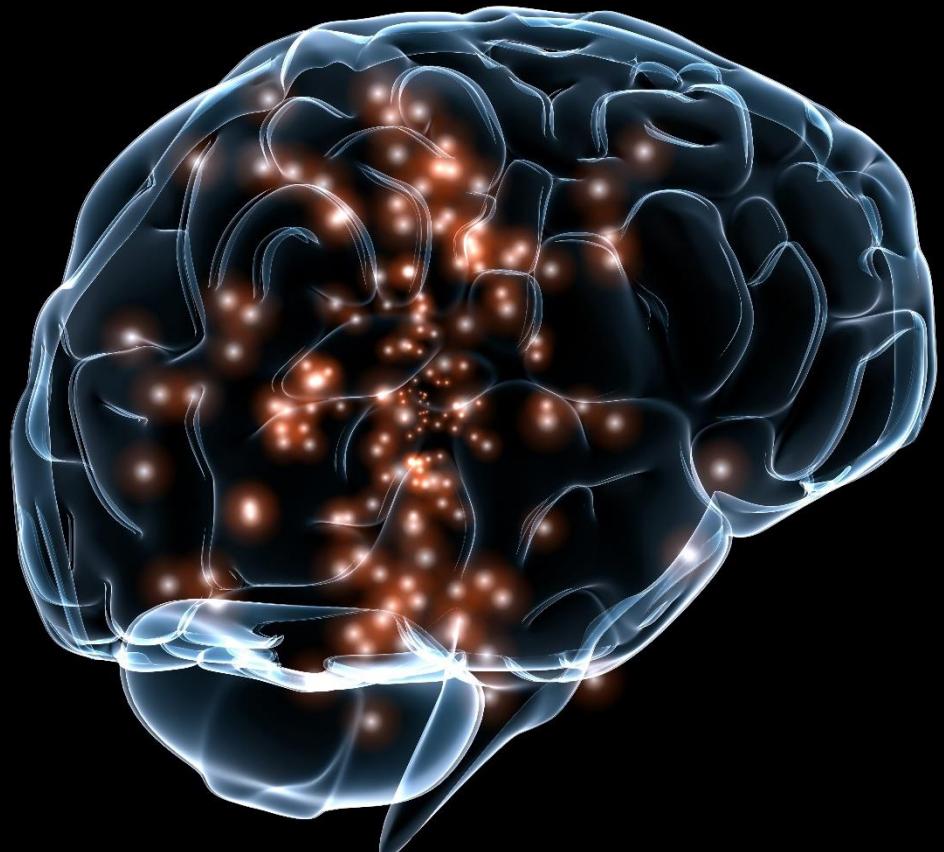
Emotions

- ❖ Can a system, then, feel emotions such as love?
- ❖ The determinist would still say yes...why?



Chinese Room

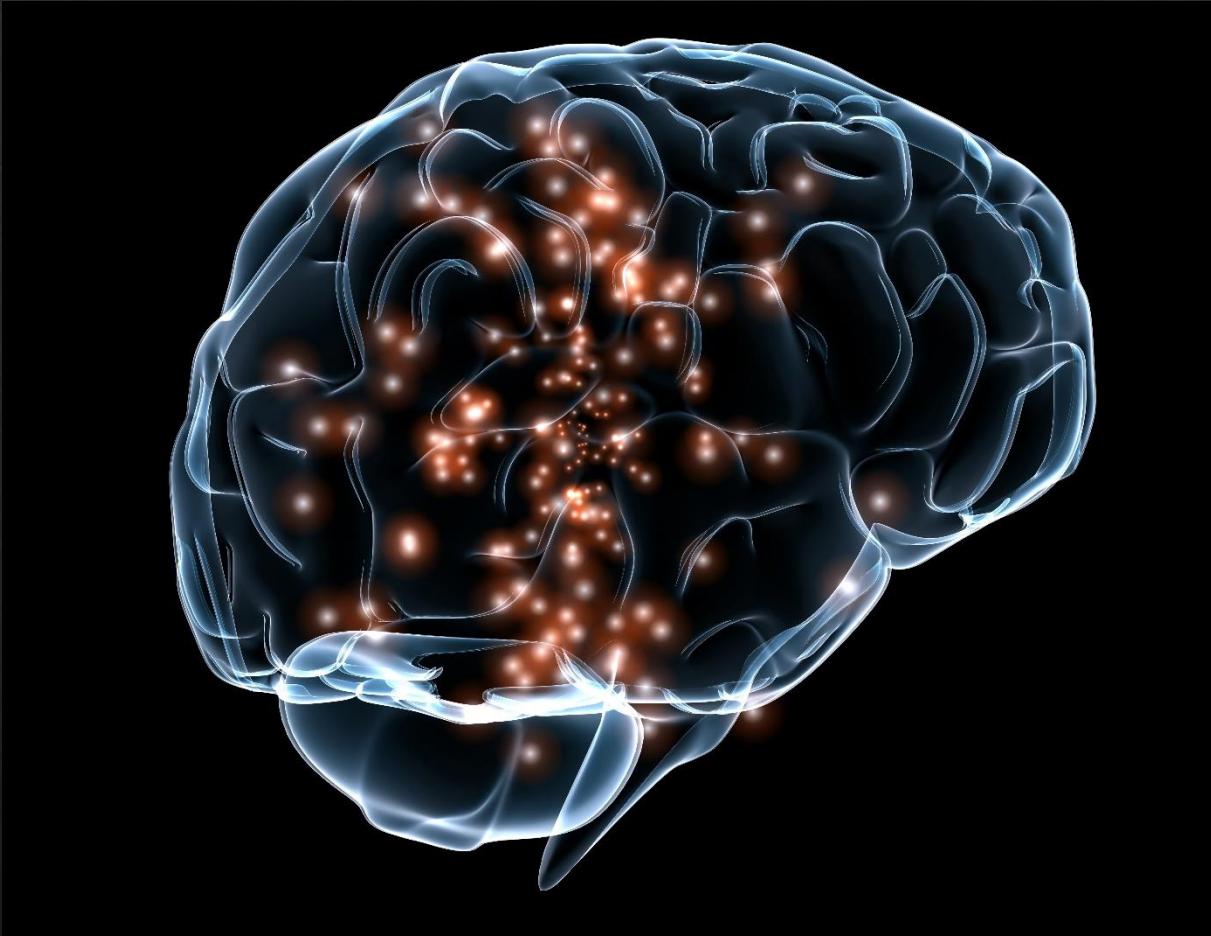
China Brain



- ❖ Another thought experiment
 - ❖ Lawrence Davis (1974)
 - ❖ Ned Block (1978)
- ❖ Assume our brain is intelligent (seems fine)
- ❖ Now assume someone is tasked with hitting a button to manually fire one neuron (because that neuron is otherwise broken)
 - ❖ Take this to the extreme (all neurons)
 - ❖ Are you still a human being? Intelligent?

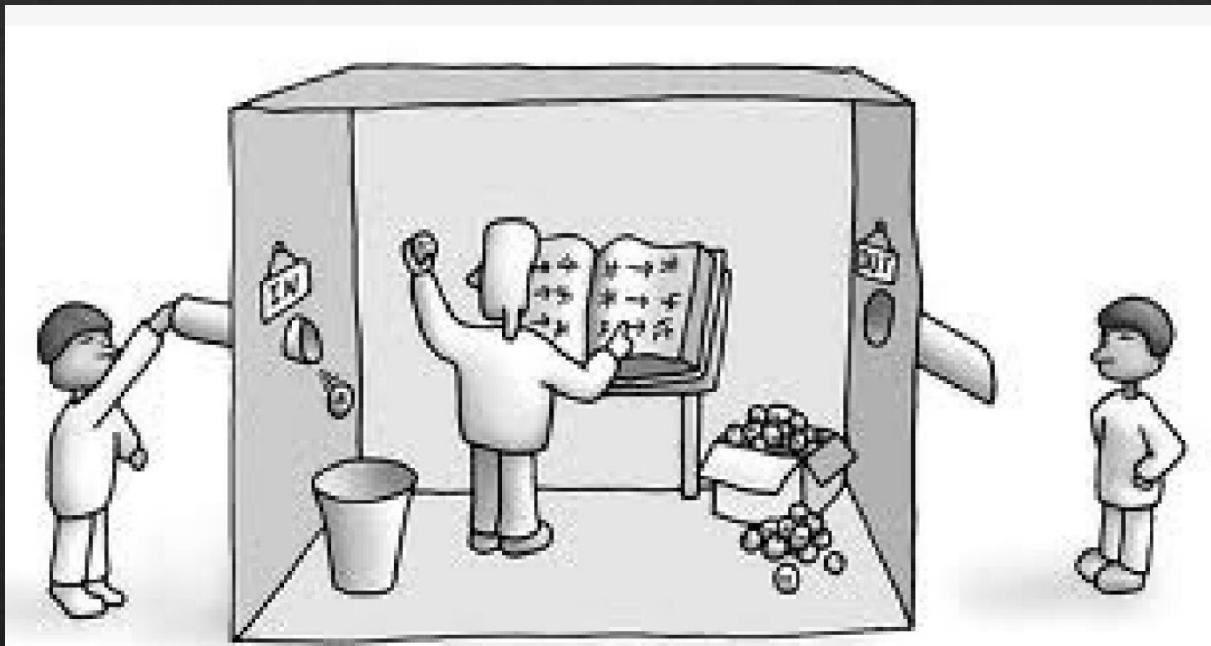
Summary

- ❖ The core philosophical question is whether intelligence is purely deterministic (and thus programmable)...
- ❖ ...Or if humans have something innately human that cannot be represented (consciousness, a soul, etc.)



Conclusion

AI in Practice

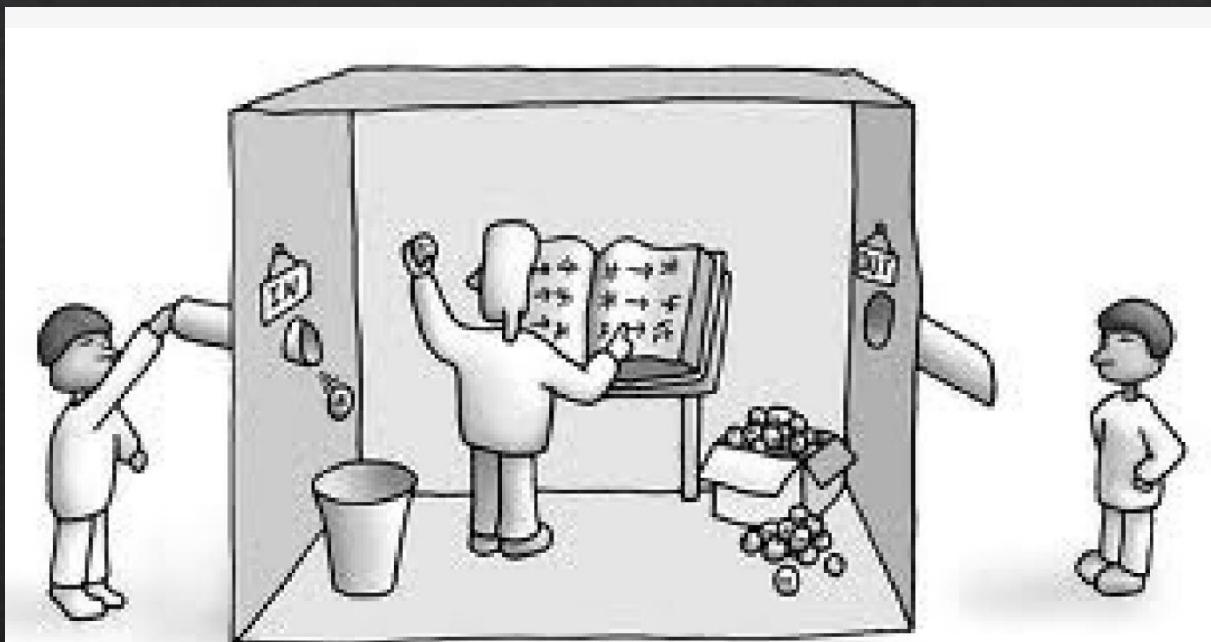


Chinese Room

19

- ❖ Isn't really mystifying
- ❖ We don't have the "secret" to human intelligence, and certainly haven't shown we can program it.
- ❖ However! We can use techniques to simulate human intelligence in various ways.
- ❖ No technique currently exists that gives a system a sense of "consciousness"
- ❖ A very philosophical concept as we've seen

AI in Practice



Chinese Room

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- ❖ So...AI is building systems that
 - ❖ Perceive their environment directly
 - ❖ Represent knowledge in a useful way
 - ❖ Execute algorithms
 - ❖ Produce an action (output) in the physical world (speech, robotics, etc)
- ❖ Which means much of AI is about how to represent knowledge (2150 is useful here) and how to construct algorithms that do something useful (“intelligent”)