Introductory Lecture

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National University of Ireland, Galway.

Layout of Talk

1. What is Artificial Intelligence?

Layout of Talk

1. What is Artificial Intelligence?
2. Breaking down the problem

Layout of Talk

1. What is Artificial Intelligence?
2. Breaking down the problem
3. Computer Conversations

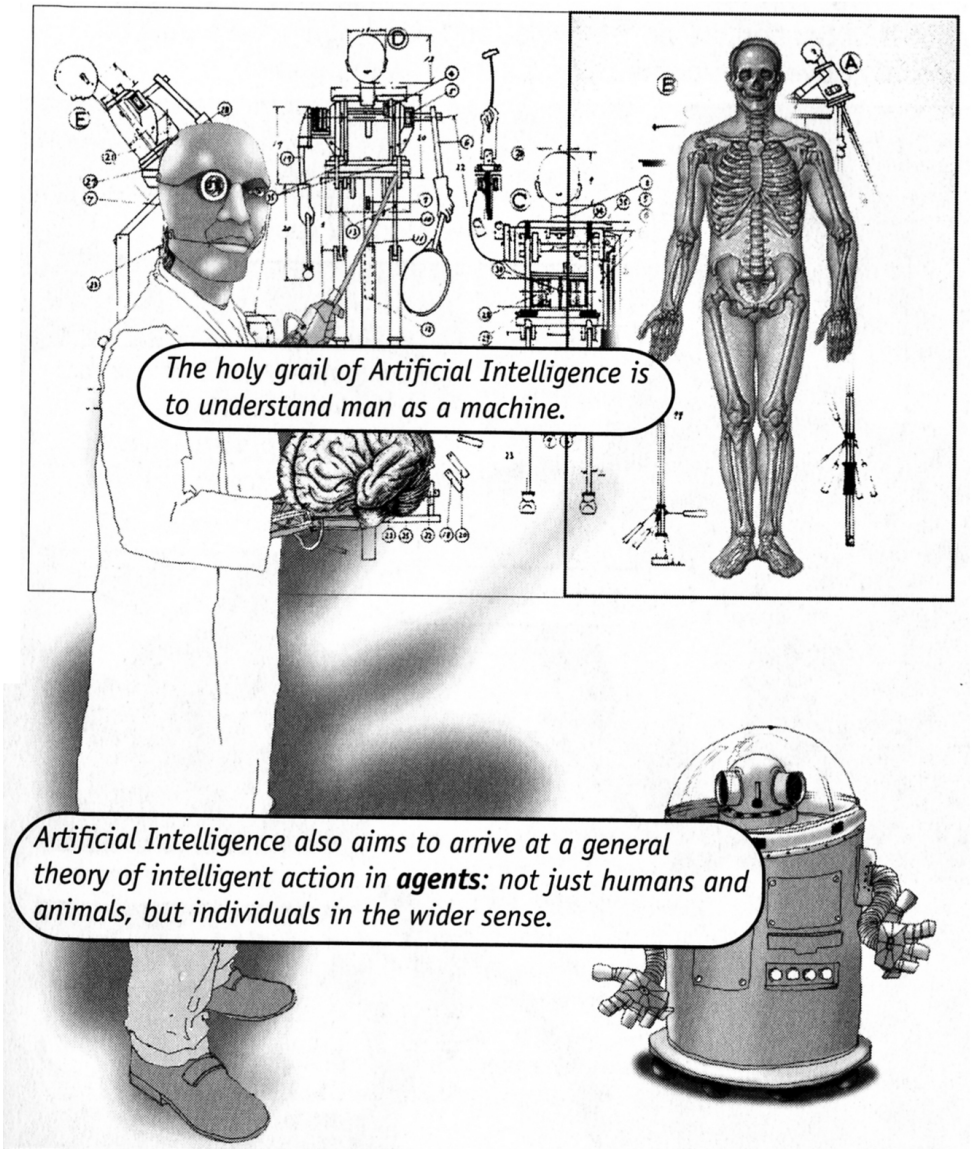
Layout of Talk

1. What is Artificial Intelligence?
2. Breaking down the problem
3. Computer Conversations
4. Computer Translation

Layout of Talk

1. What is Artificial Intelligence?
2. Breaking down the problem
3. Computer Conversations
4. Computer Translation
5. Ruining the fun of games.

1. What is Artificial Intelligence?



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> *The study of how computer systems or agents can* **simulate** *intelligent processes such as learning, reasoning, and understanding symbolic information in context.*

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Our Goal

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Our Goal

> *For a machine to simulate intelligent processes.*

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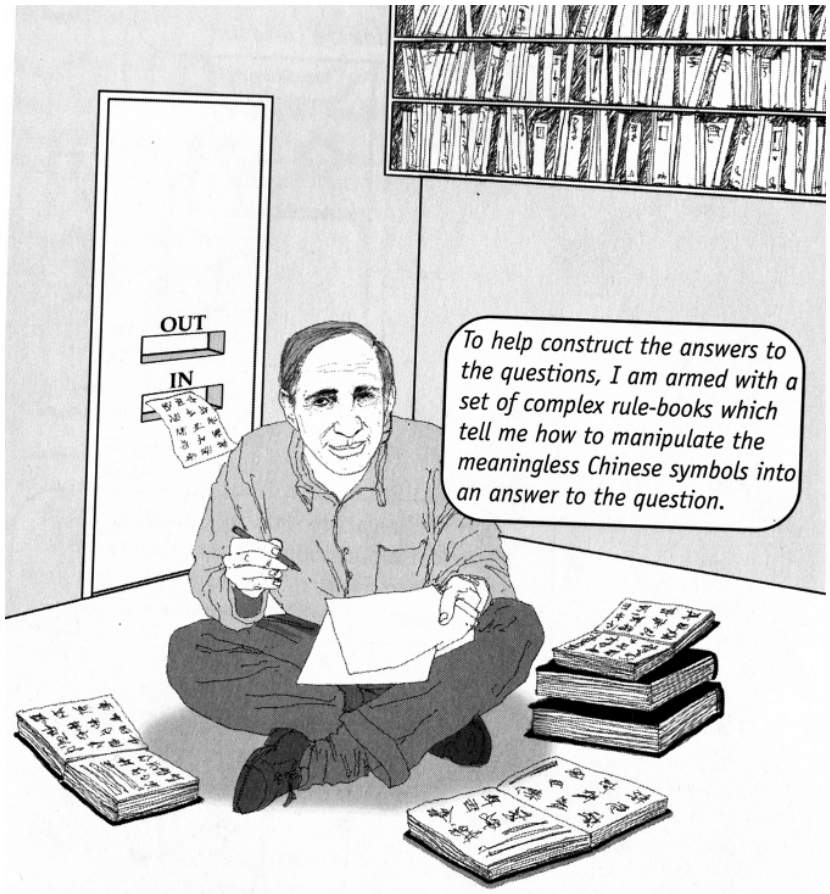

John Searle's Chinese Room Example

2. Breaking down the problem

Look at Natural Intelligence:

2. Breaking down the problem

Look at Natural Intelligence:

- Computer -vs- Brain

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- ability to adapt to new situations
- think for themselves

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Representation of knowledge

- relate real-life examples to something a computer can understand.
- Logical facts and rules
- Use laws of classical logic
- Infer knowledge $\longrightarrow$ Computer acting intelligently

2. Breaking down the problem

Classical Logic

- From knowledge base of facts and rules infer knowledge.

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Example

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Fact 1: *Mary is female.*

Fact 2: *Mary is a parent of John.*

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Not all knowledge available is certain or clear.

- Ignorance, e.g. limits of our knowledge
- Physical Randomness or Indeterminism, e.g. rolling a dice
- Vagueness, e.g. someone is classified as a mathematician, or they a group theorist, analyst, etc.?

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$$P(A_i \mid B) = \frac{P(A_i)P(B \mid A_i)}{\sum_{k=1}^{n} P(A_k)P(B \mid A_k)}$$

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- Fuzzy Logic:

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- Fuzzy Logic:

$\mu_A : X \to [0, 1]$ where
$\mu_A(x) = 1$ if x is totally in A;
$\mu_A(x) = 0$ if $x \notin A$;
$0 < \mu_A(x) < 1$ if x is partly in A.

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- Need clever search algorithms
- Use specialised search trees and heuristics

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Conclusion:

There will always be limitations on what a computer can prove?

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Natural Language Processing

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Turing Test

- Human judge asks questions via computer to remote computer and human.
- Computer & human respond.
- Judge should not be able to reliably tell the difference.
- No computer has passed this test to date

3. Computer Conversations

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We'll now engage in our first conversation with the computer.

3. Computer Conversations - Lion loose at NUIG.

```
smarter(lion, lecturer).
chases(lion, lecturer).
chases(lion, nuig_student).
deadend(nuig_student).
caught(Y) ← chases(X,Y) ∧ smarter(X,Y).
caught(Y) ← chases(X,Y) ∧ deadend(Y).
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FAIL!

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caught(Y) ← chases(X,Y) ∧ smarter(X,Y).
caught(Y) ← chases(X,Y) ∧ deadend(Y).

caught(X)?
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    caught(Y′) ← chases(X′, Y′) ∧ deadend(Y′).
    {Y′/X, X′/_}
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    chases(lion, nuig_student).
    {X′/lion, X/nuig_student}
yes(nuig_student) ← deadend(nuig_student).
```

Caught by lion:
lecturer

3. Computer Conversations - Lion loose at NUIG.

```
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chases(lion, lecturer).
chases(lion, nuig_student).
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We'll take a look at an example in Prolog.

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- Famous victory for Deep Blue over Gary Kasparov at Chess.

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Search trees are interesting in that they appear all over AI.

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Constraint Satisfaction Problems

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A triple $\langle X, D, C \rangle$:

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Examples

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- Timetabling

5. Ruining the fun of games - CSPs

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- Try all possible positions and backtrack when goal not reached

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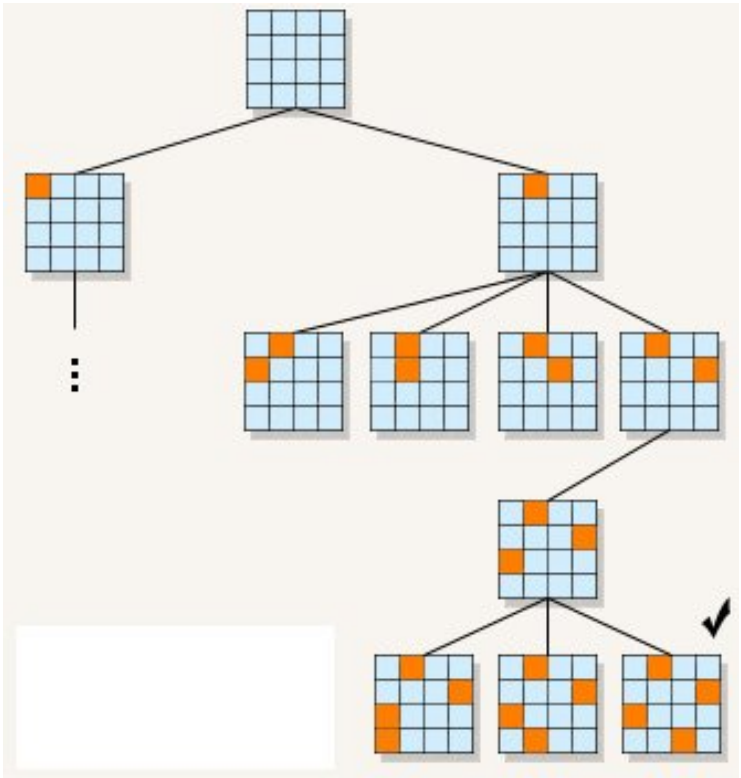

4-Queens problem with backtracking.

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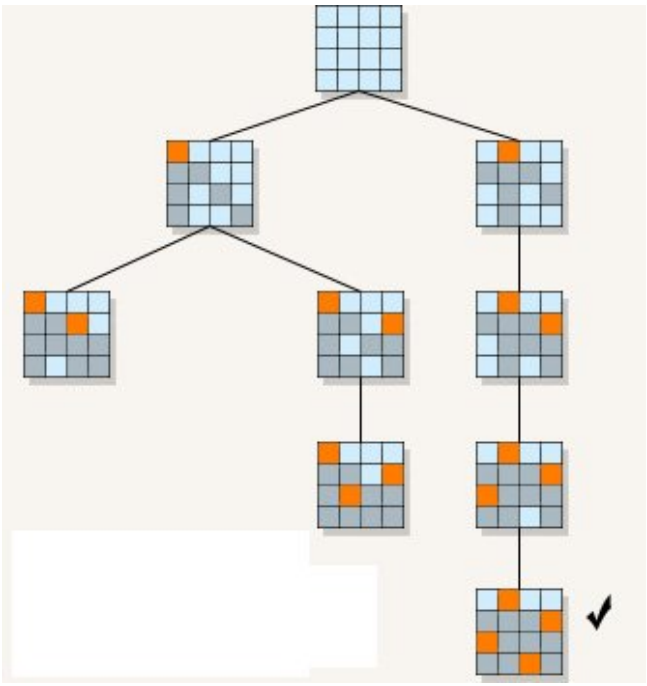

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Ask the robot!