INTRODUCTION TO AI

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What is AI

- Origin of AI: Dartmouth Workshop Proposal, 1956

An attempt will be made to find **how to make machines use language**, **form abstractions and concepts**, **solve kinds of problems now reserved for humans**, and **improve themselves**. We think that a significant advance can be made if we work on it together for a summer.

What is AI

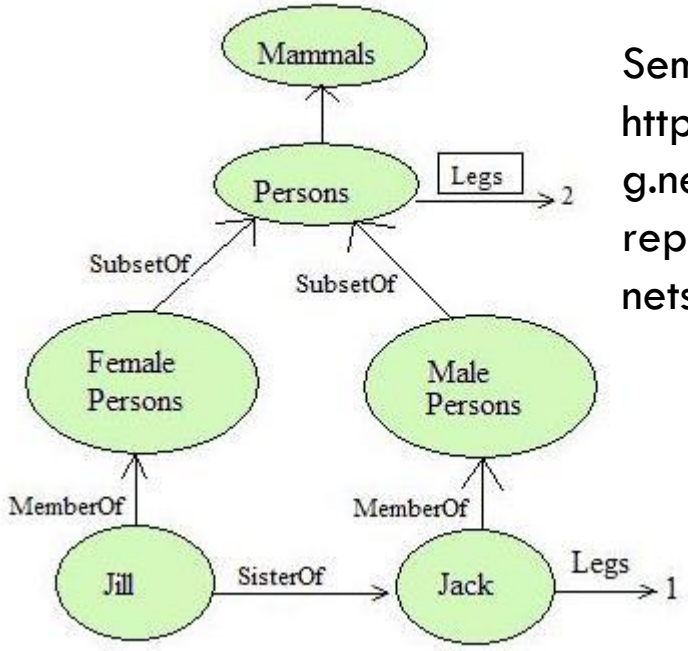
- The study of computer systems that attempt to model and apply the intelligence of the human mind
- For example, write a program to play chess in human (expert) level

AI in 1990's era

- Traditional AI (in 1990) from an AI textbook
  - Goal reduction and natural constants
  - Tree & search (dynamic programming, game trees)
  - Expert system (rule-based)
  - Logic and theorem proving (first-order logic)
  - Knowledge representation (e.g. semantic net)
  - Natural language understanding
  - Image and vision
  - Learning description from samples and rules from experience

What is in common in 1990's AI

- Mostly use symbols (such as text), but not numbers
- Sequential computing
- Knowledge is easily explainable (or even obvious)



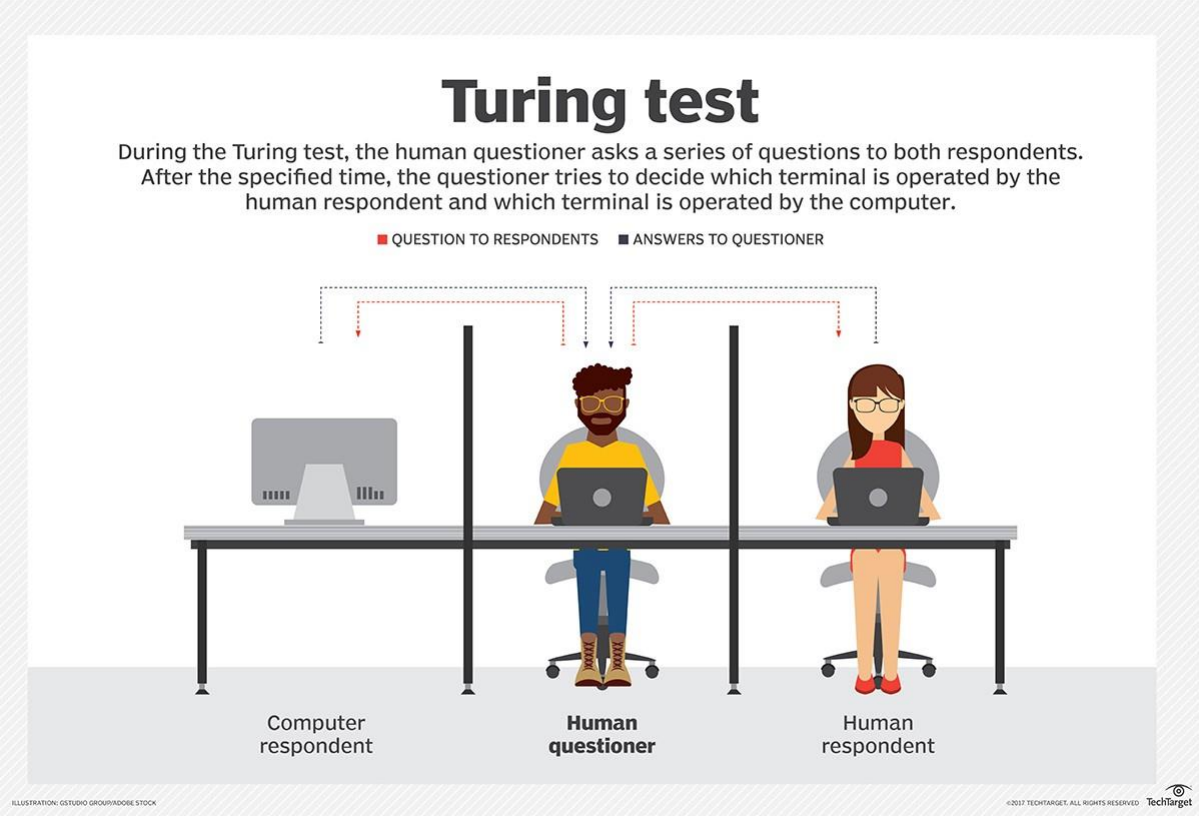
Semantic network
http://intelligence.worldofcomputing.net/knowledge-representation/semantic-nets.html#.X1dA2igzaww

Turing test

- The Turing test, developed by **Alan Turing** in 1950, is a test of a machine's ability to exhibit intelligent behavior equivalent to, or indistinguishable from, that of a human -- Wiki
- Alan Turing was a tragic genius (major contribution to break Enigma encryption)
- A well-known movie about Turing is **The Imitation Game**

Turing test

- One well-known approach (-- wiki)



Turing test

- Weak equivalence
  - With different underlying (internal) process
- Strong equivalence
  - Same internal process

Early Chatbot in 1966 (--wiki)

```
Welcome to
                EEEEEE  LL      IIII  ZZZZZZZ   AAAAA
                EE      LL       II       ZZ   AA   AA
                EEEEE   LL       II     ZZZ    AAAAAAA
                EE      LL       II    ZZ      AA   AA
                EEEEEE  LLLLLL  IIII  ZZZZZZZ  AA   AA

Eliza is a mock Rogerian psychotherapist.
The original program was described by Joseph Weizenbaum in 1966.
This implementation by Norbert Landsteiner 2005.


ELIZA: Is something troubling you ?
YOU:   Men are all alike.
ELIZA: What is the connection, do you suppose ?
YOU:   They're always bugging us about something or other.
ELIZA: Can you think of a specific example ?
YOU:   Well, my boyfriend made me come here.
ELIZA: Is it important to you that your boyfriend made you come here ?
YOU:   He says I'm depressed much of the time.
ELIZA: I am sorry to hear that you are depressed.
YOU:   It's true. I am unhappy.
ELIZA: Can you explain what made you unhappy ?
YOU:
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Computational intelligence

IEEE TRANSACTIONS ON NEURAL NETWORKS, VOL. 4, NO. 5, SEPTEMBER 1993

Editorial
Intelligence: Computational Versus Artificial

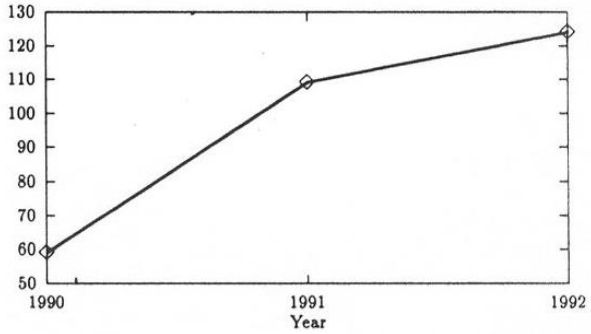


Fig. 1. Papers in the IEEE TRANSACTIONS ON NEURAL NETWORKS.

In order to distinguish *artificial intelligence* from neural networks and its sister fields, the term *computational intelligence* (CI) has been suggested.

plied by manufacturers and (does) not rely on 'knowledge'." Artificial intelligence, on the other hand, uses what Bezdek calls "knowledge tidbits." Heuristically constructed AI, such as expert systems, is an example.

Intelligence in 1990s

- Artificial intelligence
  - Based on symbols (text, not numbers)
  - Sequential computing
- Computational intelligence
  - Based on numbers
  - Distributed computing
  - Most well-known one is neural networks

Contemporary AI

- Course outline from CS 188 in UC Berkeley, 2019
  - Search (uniformed, A*, and heuristic) & tree (game)
  - **Markov decision process & Reinforcement learning**
  - Constraint satisfaction problem (Find solution that satisfies constraints)
  - Propositional logic and first-order logic
  - **Bayesian networks & hidden Markov model**
  - Decision network and **machine learning**
  - Robotics/language/vision

What is new in 2019 AI

- Machine learning (actually classification in supervised learning)
- Reinforcement learning
- Hidden Markov model
- A mix of symbol-based and number-based approaches

What will be covered in this course

- Almost only with **machine learning** (and reinforcement learning)
- Why
  - Traditional (symbolic-based) AI is mature (fewer opportunities)
  - Deep neural network is **way much powerful** than conventional one (Alpha GO)
- To be complete, I will also briefly review traditional AI (very brief)

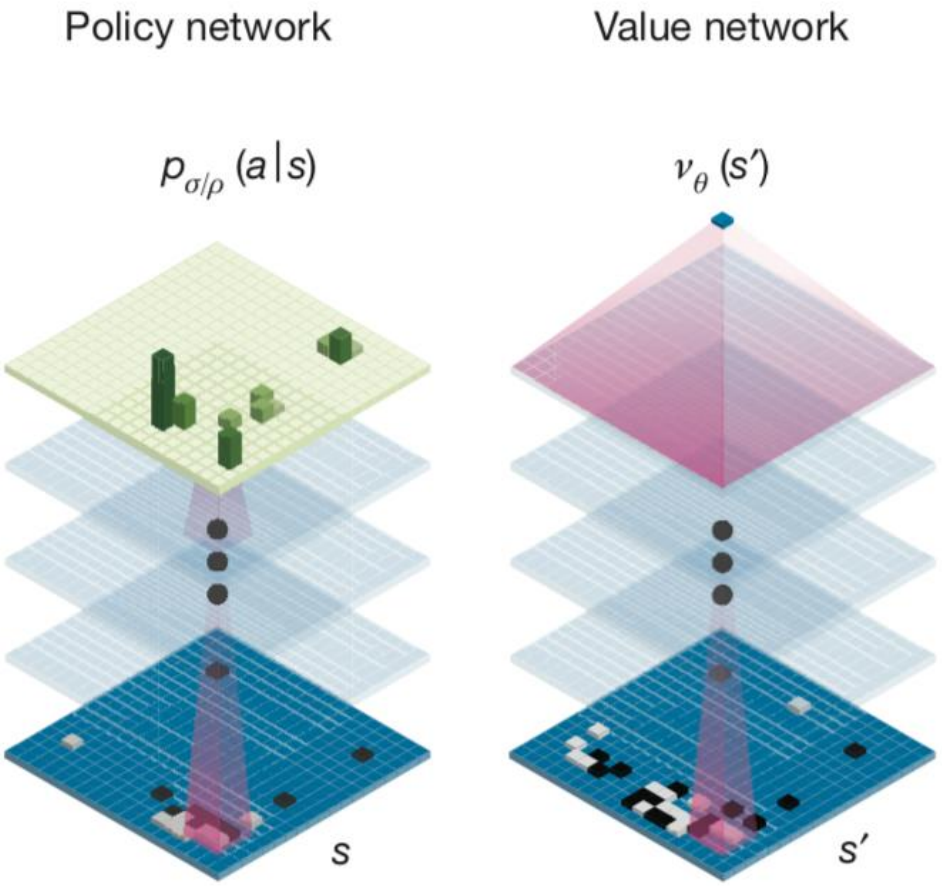
Alpha Go as example

- Go program with conventional AI reaches the level of 1D (業餘一段)
- 7D < 1P (職業初段)
- Alpha Go > 9P
  - Based on RL & NN

https://en.wikipedia.org/wiki/Go_(game)

Alpha Go

- Neural networks at work



https://hackernoon.com/the-3-tricks-that-made-alphago-zero-work-f3d47b6686ef