Syllabus etc
Monday, August 22, 2016   10:02 AM

CS 3600
Mark Riedl riedl@gatech.edu
TSRB 228

OH: Tues 2:30 - 4:30p

www.cc.gatech.edu/~riedl/classes/2016/cs3600/

PREREQS

<u>Data structures</u> — linked lists, trees, graphs

<u>Comp Complexity</u> — Big-Oh

                NP-Hard $O(K^n)$

Programming Mojo — algorithms + systems

          — Python

<u>Logistics</u>

                                    Extra Cred

- Lectures   it
- Reading — schedule   1.5%
- HW assignments — 4   60%   Max 2
          -HW0
- Exercises   0%

— Tests — Midterm/Final 20% each

An entity is intelligent if it performs behaviors that a person might <u>reasonably</u> believe requires intelligence.

Agents

Turing Test

1950

Judge   Pretend to be comp.   Pretend to be human
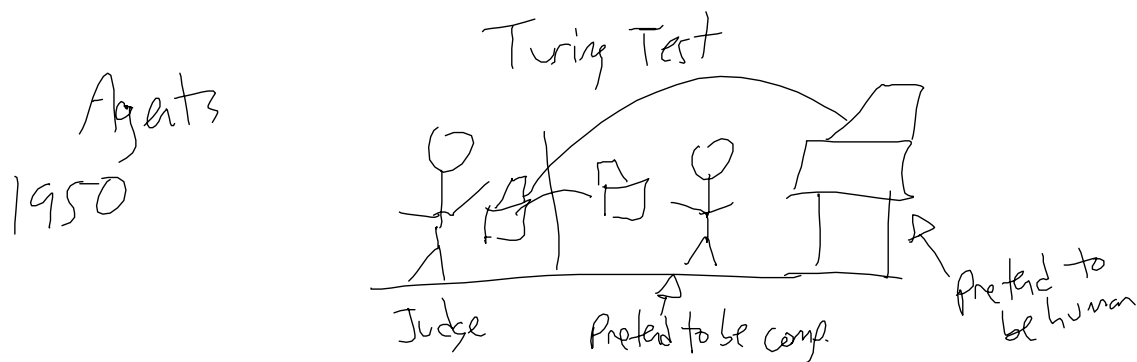
<u>Strong AI</u>:
- emulates humans
- broad & general
- beating the T.T.

<u>Weak AI</u>:
- Solving specific problems
- Narrow
- Automation
- Super - Intelligent

<u>Machine Learning</u>
- AI that self-improves
- Finding patterns in data & acting on it

AI is a moving target

Think like a human	Think rationally[1]
Act like a human	Act rationally

Think Rational

Logic ──────────→ Joe is a human
All humans are mortal
Mortal humans can be killed
Q: Can I Kill Joe?

Formal Representation

Alg. that manipulate facts & prove theorems

Q: Can I Kill Bob?
          Elmo?

Chess, checkers

Acting Rationally:

- Dont care how I get the answer
- Am I acting optimally
- Choose actions that lead to best outcomes
- Dont have right all the time

Memories

~~Think like a human~~:

- Cognitive Science
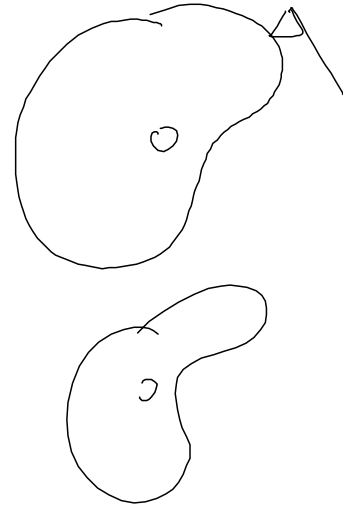- AI program is a hypothesis about the human mind

~~Acting like a human~~:

- Beating the   Turing Test
- Chatbots

History

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1200s
Automaton

~~1700s~~

1770

Computer ~~1750~~
1800

1950 Turing

1956 – AI coined

~~Dartmouth Conference.~~

Cognitive revolution

- **Early vision: Neanderthal AI (pre 1960s)**
  - Model human and everything they do
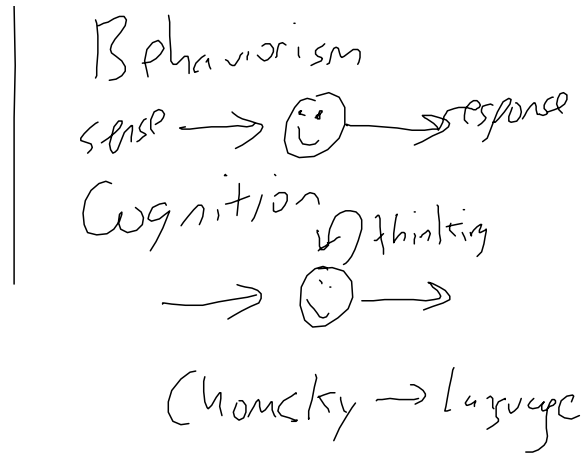   - Motor planning
    - Language
    - Prediction
    - Learning
    - Art

- Art
- Storytelling
- Humor
- Emotions

Behaviorism

sense ⟶ 😊 ⟶ response

Cognition ⟶ thinking

⟶ 😊 ⟶

Chomsky ⟶ language

· **Early successes: logic, symbolic reasoning**

- Late 1950s, early 1960s
- Theorem provers
- (Checkers) and chess
- Why? *(Well-Defined)*

· **Knowledge-based AI: 1970s-1980s**

- Humans don't solve all problems from scratch
- Model humans and their processes
- Expert systems (e.g., medical diagnosis)
- Rule-based systems
- Brittle

· **AI Winter: 1987-1993**

- Rebirth with a dose of realism *(?)*

Rebirth with a dose of realism

- Machine learning revolution

$\longrightarrow$ Data
$\longrightarrow$ Better Statistics
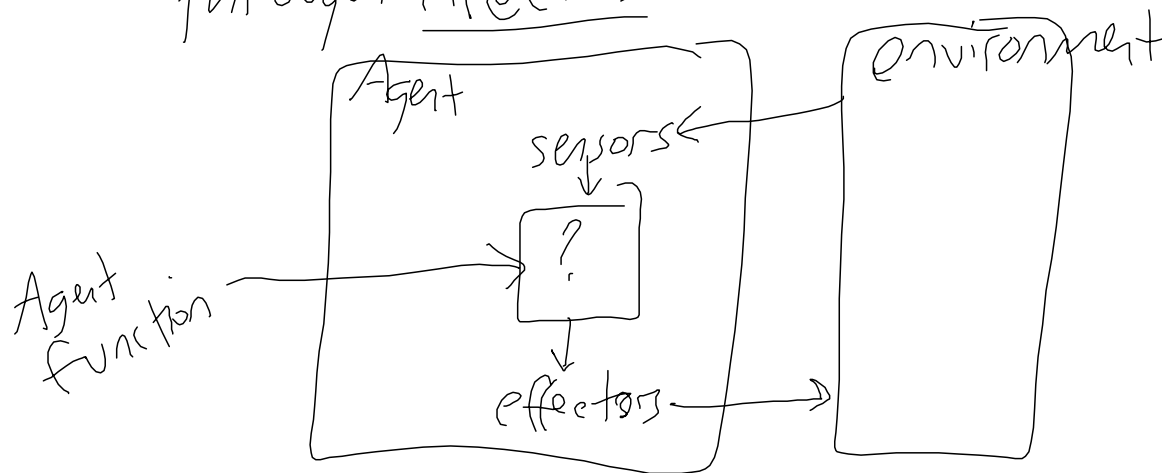$\longrightarrow$ Faster Machines

Weak A I
"Act Rationally"
Agents

Agents
Wednesday, August 24, 2016   8:47 AM

Anything that can perceive the environment through sensors and act on the env. through effectors

Agent function: A math. description of an agent's behaviors (response to the env.) mapping sensor percepts to actions through effectors.
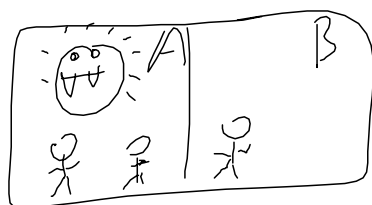
$$F: S \rightarrow A$$

Agent Program: A concrete implementation of the agent function.

Tabulate:

Percept sequence	Action
— — — — —	
— — — — —	

Vampire World

Vampires

2 locations
Robot
People

Action:
Suck
Left
Right

Percepts	Action
(A, empty)	R
(A, people)	Suck
(B, empty)	L
(B, people)	S
( ) ( )	?

- Table could be 🔁 or very large
- Not enough HD
- Too big to author

<u>Objective function</u>: What we want the agent to achieve
Agent to evaluate all actions against objective
and choose the "<u>best</u>" action.

<u>Rationality</u>:
Choosing the "best" action given what you <u>know</u>.

<u>What does an agent know?</u>
    Percept history
    built in knowledge
    Actions

What does best mean? It depends

Vampires:

Maximize blood sucked.
minimize movement
Empty house
Average emptiness over time —— Mediocre job all the time

flurry every every so often.

Vampire Agent:
- sensors: perceive location, perceive people
- Actions: R, L, Suck
- Prior: Map
- Objective fn: Greatest # of points over 1000 timesteps
- performance measure: 1 point for every empty room per timestep.
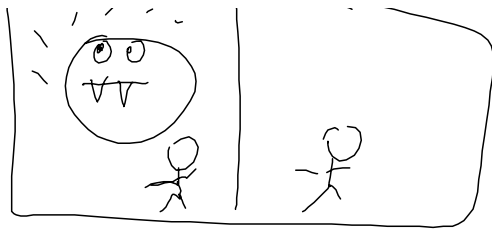
House stays empty
People enter house randomly
    - occasionally check rooms — fast as possible
People enter, moving costs 1 point

You don't have a map
        - explore
        - exploit
- sensors unreliable
- effectors "
- Both

HW1 Due 9/25

Sun 11:55pm

Max # points – 1 point/empty room/timeslice

     – 1 point each move

* Unreliable sensors
* Unreliable effectors
* sensors & effectors unreliable

Rational optimization $\neq$ theoretical optimal

Expected Max $\Longleftarrow$

What type of agent we build depends on
     the type of environment.

Environments

Observability

Fully Observable	Partially Observable
• Can sense everything in the environment without error	• Can only see some info
	• Two causes:
	• Incomplete data ←
	• Noise

Checkers
Computer games
logistics

Determinism

Randomness

Deterministic	Stochastic
• World only changes when agent acts	• World can change at other times
• World changes exactly as desired	• Randomness
	• Uncertain effectors/ sensors
	• P.O. world is stochastic

Static

Static	Dynamic
• World doesn't change when agent is deliberating	• World changes faster than you can think

Discreteness

| Discrete	Continuous
• World broken up into a finite number of discrete chunks	• Infinite number of chunks • Infinite gradiations of values

- Time

- Actions

- Percepts

Episodic

Episodic	Sequential
• History doesn't matter	• History matters

Agents

Single agent	Multi agent
• You are the only agent in the world	• Other agents in the world that are autonomous from you
	• Cooperative
	• Competitive

	Hanoi	Solitare	Chess	Pool	Poker	Driving
Observability?	F.O	P.O.	F.O.	F.O.	P.O.	P.O.
Determinism?	Det	Det/Sto	Det/Sto	Sto	Sto	Sto.
Episodic?	Seq/Ep	Ep/Seq	Seq.	Seq.	Seq.	Seq.
Static?	St.	St.	St.	St.	St.	Dyn.
Discrete?	Disc.	Disc	Disc.	Cont.	Disc.	Cont.
Agents?	S	S	M	M	M	M/S
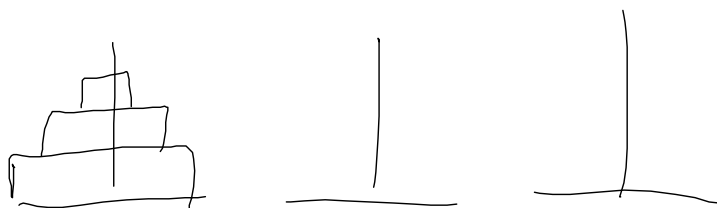
Easiest? F.O., Det, stat, disc, Ep, single-agent
Hardest? P.O, Sto, Dyn, cont, seq, multi-agent
  └ Real Word

Part I: "Classical"   Part II: Stochastic
 – Search & Problem Solving   – Problem solving
 – Planning   – Learning
 – Constraint Satisfaction
 – Logical Agents ←