

Harnessing Artificial Intelligence

CS4000

Fall 2019

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Coordinator

Logistics

- Monday and Wednesday Fall Quarter
- 1200 noon hour
- IN-122
 - Except Oct 15, Oct 16, Nov 4: GL-109
- Students who enroll get credit for 0-2 course
- Must attend 18 of the 20 lectures to get course credit
 - Checkin at table outside door

Our Purpose

- EXPLORE
 - What is AI?
 - What are its benefits and risks?
 - What is its military significance?

AND ALSO

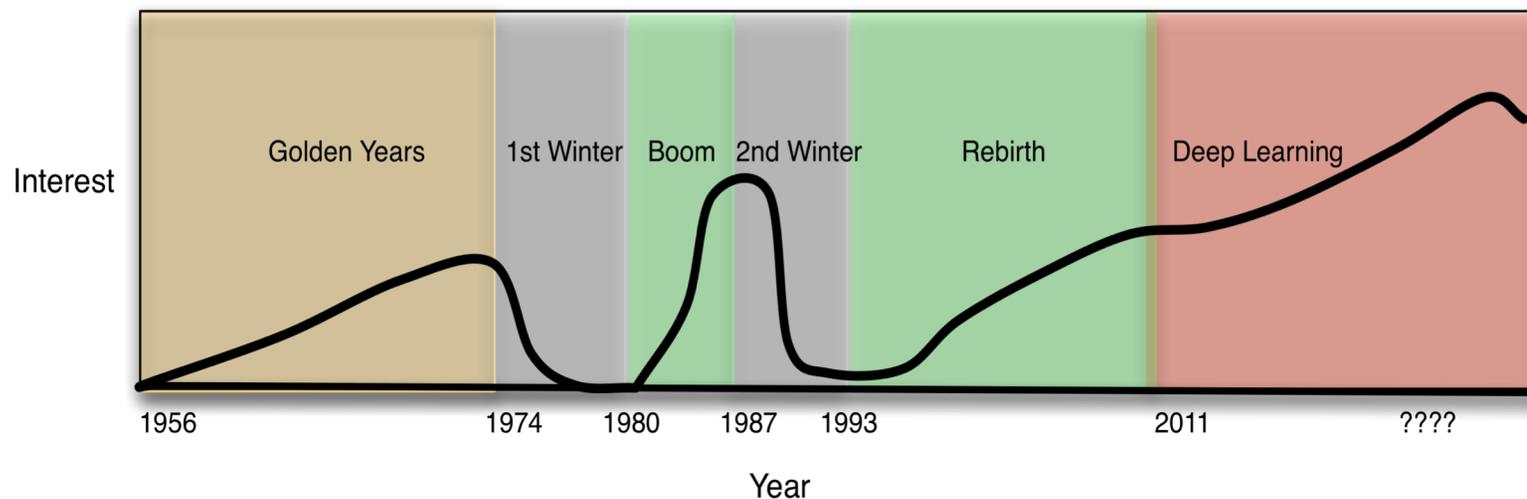
Establish a common language with precise definitions for discussing AI.

Cut through the hype.

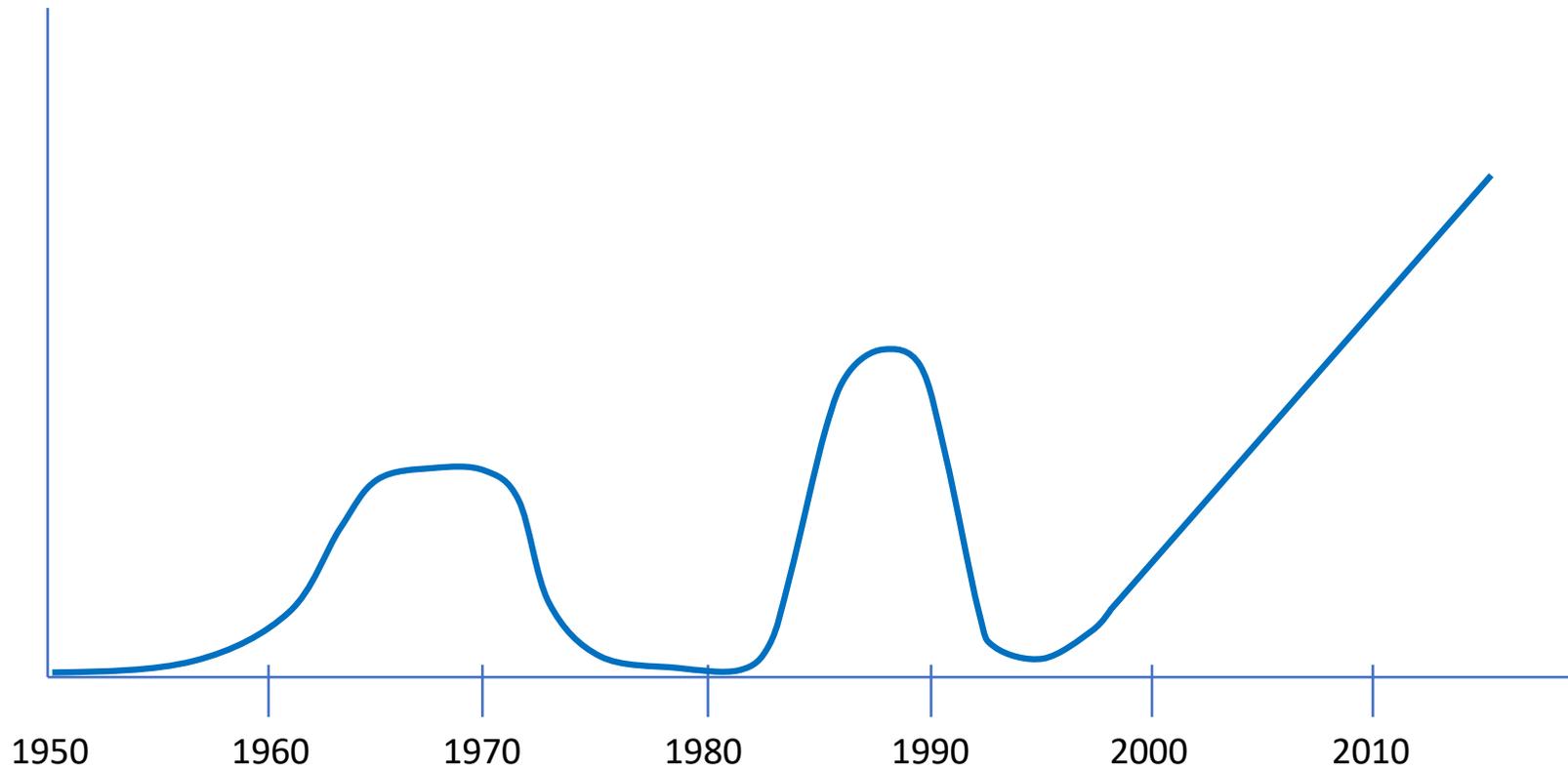
“Don’t mistake utility and speed for intelligence.”

AI field

- Founded 1956 to study how to build computing machines that perform intelligent functions
- Buoyed by enthusiasm, plagued by hype and over-promising



interest



speech recognition
board games (chess)
language translation
simple robots
problem solving systems
neural networks
perceptrons

expert systems
knowledge revolution
deep neural networks
statistical inference
automatic classification
sparse distributed memory
Grand Challenges
Fifth Generation Project

data analytics
deep learning
image recognition
conversationalists (Siri, Alexis)
grandmaster game players (Go, Poker)
human machine symbiosis
driverless vehicles
automatic fire control
swarms
cyber defense and offense

What is AI?



What is AI?

- Popular notions:
 - Thinking machines
 - Conversation machines
 - Puzzle-solvers
 - Games
 - Speech recognizers
 - Vision recognizers
 - Expert systems

What is AI?

- Hollywood
 - Terminator
 - Skynet
 - I, Robot
 - Battlestar Gallactica
 - Enders Game
 - Commander Data
 - R2D2

What is AI?

- Things that worry us about AI
 - Automatic weapon systems
 - Drone swarms becoming WMD
 - Mastering large battlespaces
 - AI cannot explain its recommendations
 - Mass surveillance and control
 - Massive unemployment

What is AI?

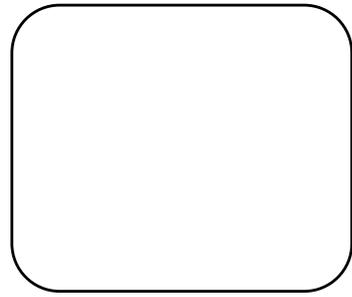
- Seriously, it's
 - Computers doing intelligent things
 - Computers doing tasks generally considered human intelligent tasks
- But wait ...
 - What is intelligence?

What is intelligence?

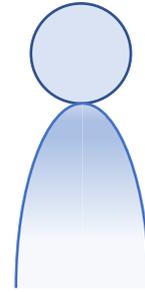
- Problem: intelligence is ill-defined
- Moving goalposts: “When a machine does it, we no longer think of it as intelligent”
- Intelligence is NOT speed
 - Machines do 1 Billion calculations per second
 - Humans do 1 calculation per second
- Your laptop and nearest supercomputer are not intelligent

Is simulated intelligence intelligent?

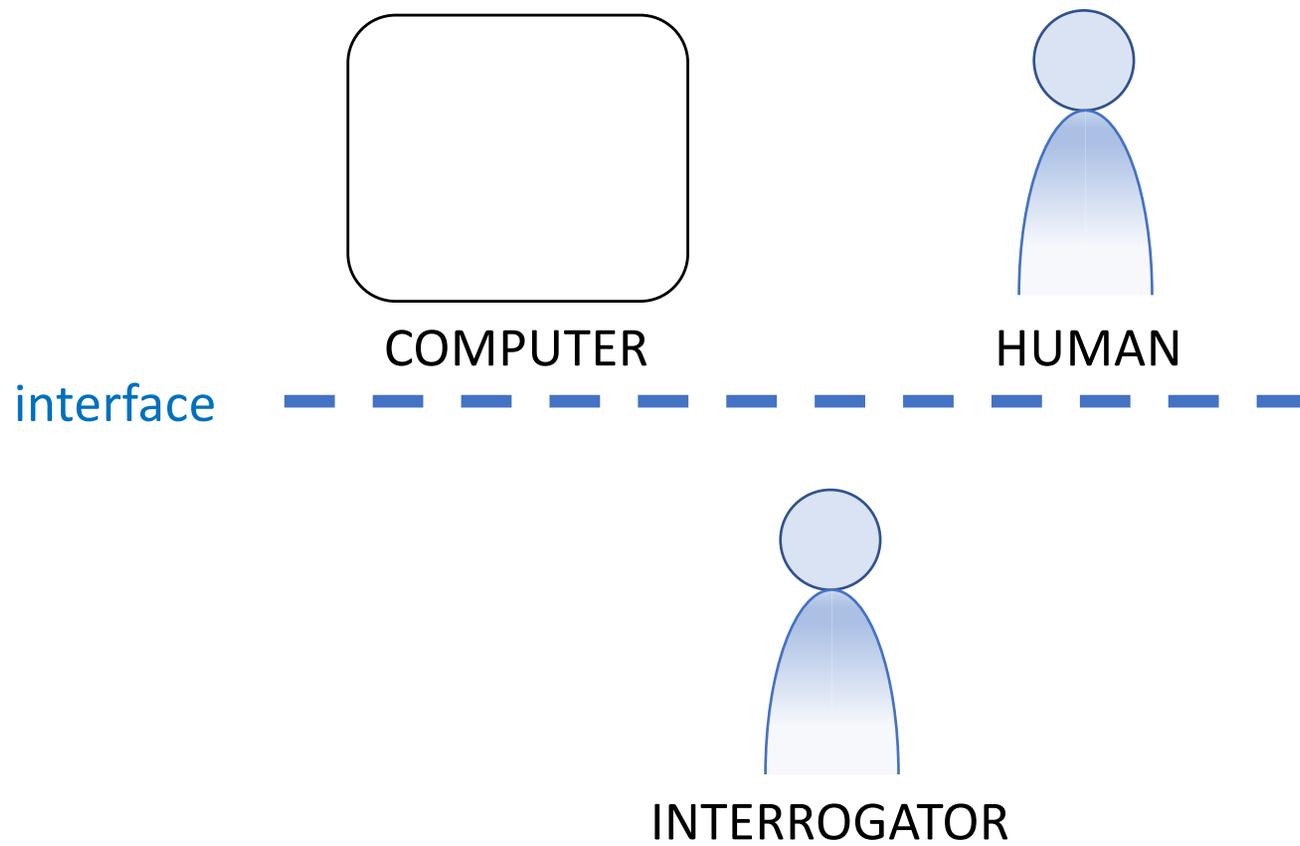
The Turing Test (1950)

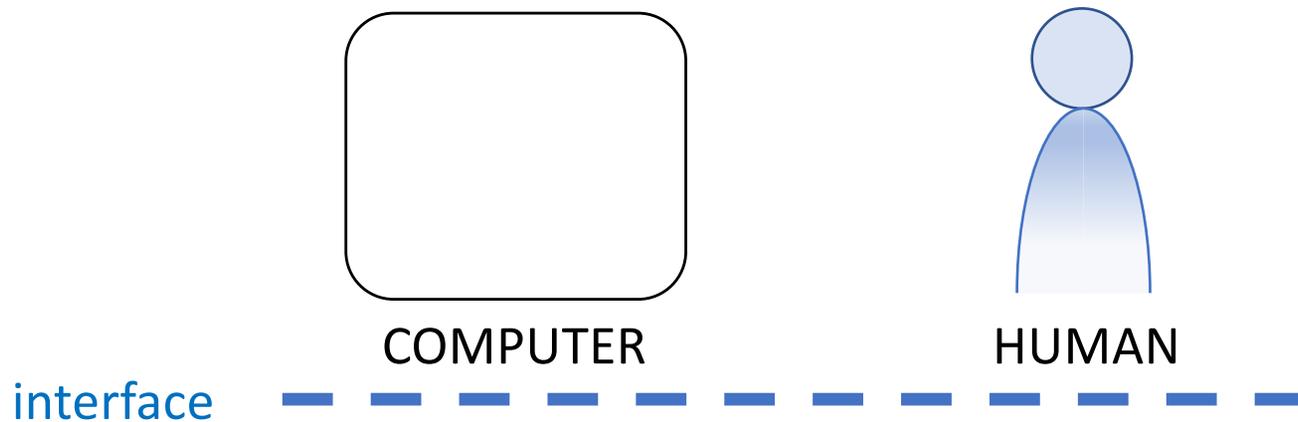


COMPUTER



HUMAN





How long does it take
interrogator to distinguish
computer from human?

INTERROGATOR

Even if indistinguishable,
is a simulation of
intelligence intelligent?

What is “artificial” intelligence?

- Intelligent behavior by a machine
 - Is simulated intelligent behavior intelligent?
 - If a machine says “I am intelligent” do we believe it?
- But wait ...
 - What is a machine?

What is a machine?

- Apparatus of components that automates a process humans want done
- Grants an advantage such as amplified force or speed that humans do not naturally have
- Human partially or fully out of the loop
- Computer is machine with hardware components controlled by software – implements input-output functions described by algorithms

Anthropomorphizing

- We love to project our ideas of intelligence into the machine:
 - “The computer is an electronic brain”
 - “The computer knew where I was”
 - “The computer thought the input was wrong”
 - “The computer understood my problem”
- But wait ...
 - It's only a machine
 - It's not a brain
 - Does not know, think, or understand

Humans -- Machines

- Social communities
- Empathy
- Compassion
- Commitments
- Judgments
- Invention
- Sensitive to context

- Calculations
- Logic
- Search
- Retrieval
- Comparisons
- Never bored
- Context free

The Context Problem

- Context: human ability to sense issues unstated in the background of our experience, bringing them forth to give meaning to what is around us

- Machines do not sense context
 - Their parts work “locally”: generate outputs (signals and symbols) and in response to inputs (signals and symbols)
 - Do not understand the meaning of any input or output
 - Source of their great speed
- No known way to formalize “bringing forth from the context” ... no way to get a machine to do it

The Challenge

- AI machines exist
- Most are (extremely) useful
- None is intelligent (despite claims)
- Explore and assess their powers without
 - A clear definition of intelligence
 - Anthropomorphizing
 - Expecting machines to sense context

Our approach

- Classify existing AI machines by learning power
 - Machine A is more powerful than machine B if
A can learn to perform a function that B cannot
- Learn: acquire a new capacity for action

Machines Hierarchy

- Introduced in the next lecture
- Explored individually in six lectures following

Our Hierarchy

- Level 0: Basic automation
- Level 1: Rule based systems
- Level 2: Supervised learning
- Level 3: Unsupervised learning
- Level 4: Human-machine teaming
- Level 5: Aspirational machines

Our Hierarchy

- Level 0: Basic automation (Joshua Kroll)
- Level 1: Rule based systems (Vinnie Monaco)
- Level 2: Supervised learning (Marko Orescanin)
- Level 3: Unsupervised learning (Chris Darken)
- Level 4: Human-machine teaming (Rudy Darken)
- Level 5: Aspirational machines (Neil Rowe)

Web Sites

<https://nps.edu/web/ai-consortium>

<https://nps.edu/web/harnessing-ai-course>