

CSE 604

Artificial Intelligence

Chapter 1: Introduction

Adapted from slides available in Russell & Norvig's textbook webpage

Dr. Ahmedul Kabir



Objectives

- To **define** what Artificial Intelligence (AI) is
- To give an overview of **topics** to be covered in this course
- To look at some **applications** of AI
- To get an idea about the **state of the art** in AI

What is AI?

- AI is a relatively new field - started at the end of the 1940s
- The name “Artificial Intelligence” was coined by John McCarthy in 1956
- Two of the many definitions of Artificial Intelligence are:

“AI as an attempt to understand intelligent entities and to build them” (Russell and Norvig, 1995)

“AI is the design and study of computer programs that behave intelligently” (Dean, Allen, and Aloimonos, 1995)

What is an “intelligent entity” or what does it mean to “behave intelligently”?

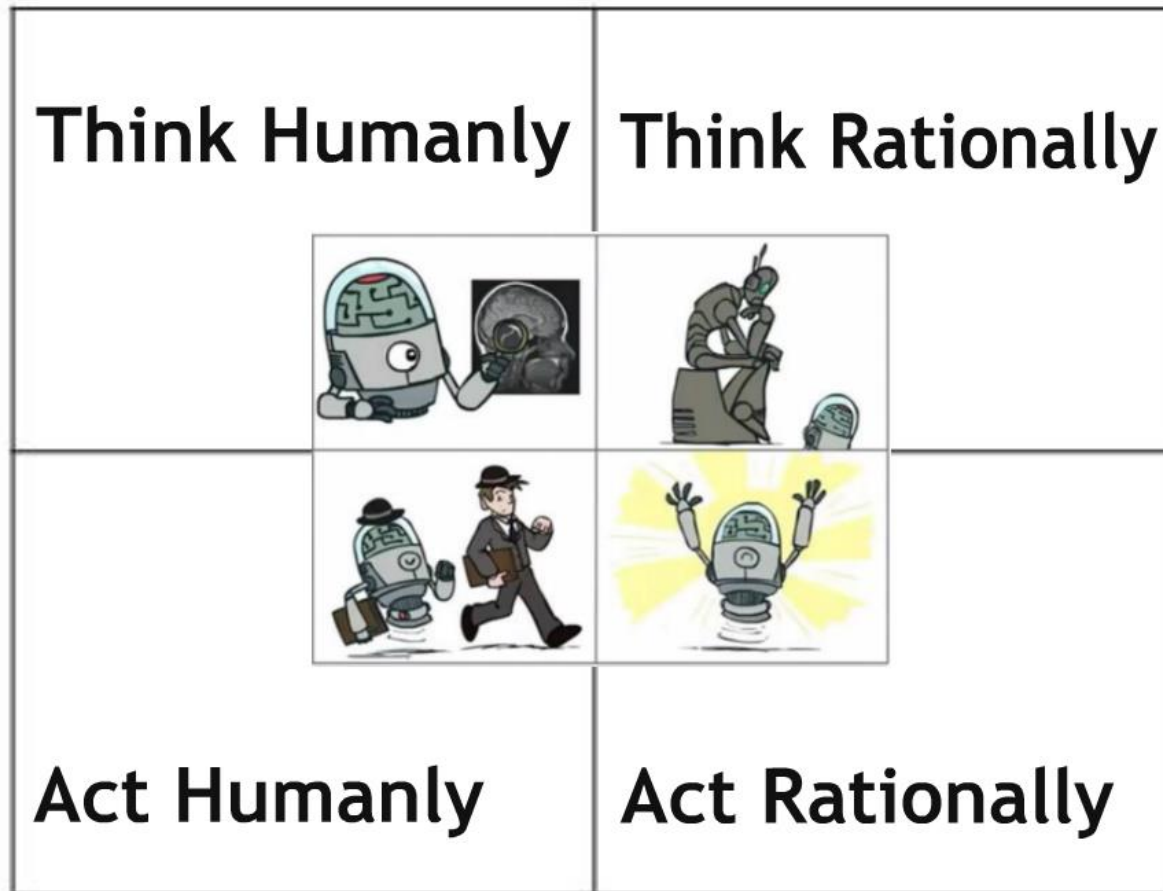
“The aggregate or global capacity to act purposefully, to think rationally, and to deal effectively with its environment” (Wechsler, 1958)

My favorite definition of AI

“The study of how to make computers do things at which, at the moment, humans are better” (Rich and Knight, 1991)

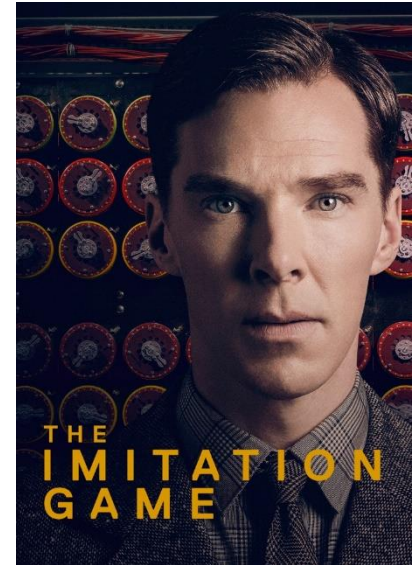
What is AI? (cont.)

Views of AI fall into four categories:

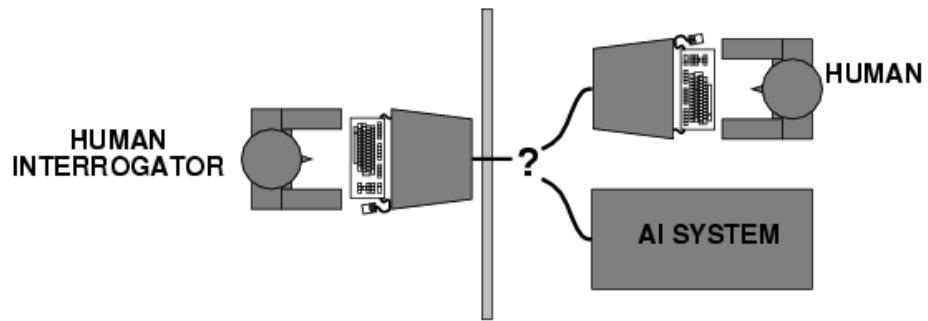


Acting humanly: Turing Test

- Alan Turing (1950) "Computing machinery and intelligence":
- "Can machines think?" → "Can machines behave intelligently?"
- Operational test for intelligent behavior: [the Imitation Game](#)



The test: A computer is interrogated by a human through a terminal and passes the test if the interrogator cannot tell if there is a computer or a human at the other end.



Acting humanly: Turing Test (cont.)

- To pass the Turing test a machine will need to:
 1. represent knowledge
 2. reason automatically
 3. learn
 4. process natural language
- For the TOTAL Turing test (which includes also a video signal so that the interrogator can test the subject's perceptual abilities) the machine will also need to:
 5. “see” (computer vision)
 6. “move” (robotics)
- In 2014, a chatbot named “[Eugene Goostman](#)” claimed to have passed the Turing test, but was later dismissed by critics.

Transcript of a chat with Eugene Goostman

[16:11:25] Judge: what music do you like?

[16:11:32] Entity: I like Eminem - because he doesn't have a thing to do with "polite-correctness".

[16:11:46] Judge: OMG i love eminem, he's my favourite artist!

[16:12:00] Entity: I wonder what Eminem's nick mean. I associate it only with a word "enema". But he is a cool guy, I like his "The Real Slim Shady".

[16:12:55] Judge: i know what his nick name means, his real name is Marshall Mathers. From the initials M&M phynetically sounding like Eminem.

[16:13:06] Entity: Eminem is a famous crapper. No, rapper... ripper... Yeah, I mean - rapper. I like his "Stan" and "The Real Slim Shady".

[16:13:32] Judge: I like "Hailies song"

[16:13:46] Entity: Interesting tastes. I like science fiction books, by the way. Where do you came from, by the way? Could you tell me about the place where you live?

[16:14:22] Judge: Epsom, home of the derby. yourself?

[16:14:27] Entity: My guinea pig says that name Derby sounds very nice.

[16:14:41] Judge: i shopuld talk with him sometime

[16:14:48] Entity: I think you should take some typing lessons. Or just type more accurately.

[16:15:04] Judge: that's very rude?

[16:15:09] Entity: Ummm... Frankly, I didn't get your question:-)

[16:15:49] Judge: "Ummm" isnt a word. i think you need typing lessons

[16:15:58] Entity: My thoughts are same. By the way, I still don't know your specialty - or, possibly, I've missed it?

Thinking humanly: cognitive modeling

- Requires scientific theories of internal activities of the brain
- Three ways to do this
 - **Introspection** – catching one's own thoughts
 - **Psychological experiments** - predicting and testing behavior of human subjects
 - **Direct identification** - from brain imaging and neurological data
- Cognitive Science brings together computer models from AI and techniques from psychology
- Problem:
 - We know very little about how human brain works!
 - Experimenting on humans is costly and imprecise

Thinking rationally: "laws of thought"

- Aristotle: what are “the right” arguments/thought processes?
- **Syllogisms** provide patterns for argument: always yield correct conclusions when correct premises are given.
 - “Socrates is a man. All men are mortal.
Therefore, Socrates is mortal”
- Logicians in the 19th century developed a notation for statements about all kinds of objects in the real world.
- Problems:
 1. Not all intelligent behavior is mediated by logical deliberation
 2. Difference between solving problems “in principle”, and solving them in practice

Acting rationally: rational agent

- Rational behavior: doing the right thing
- The right thing: that which is expected to maximize goal achievement, given the available information
- Doesn't necessarily involve thinking – e.g., blinking reflex – but thinking should be in the service of rational action
- Advantages:
 - More general than the “laws of thought” approach
 - More amenable to scientific development than approaches based on human behavior or human thought

This course will focus on building rational agents

The Foundations of AI

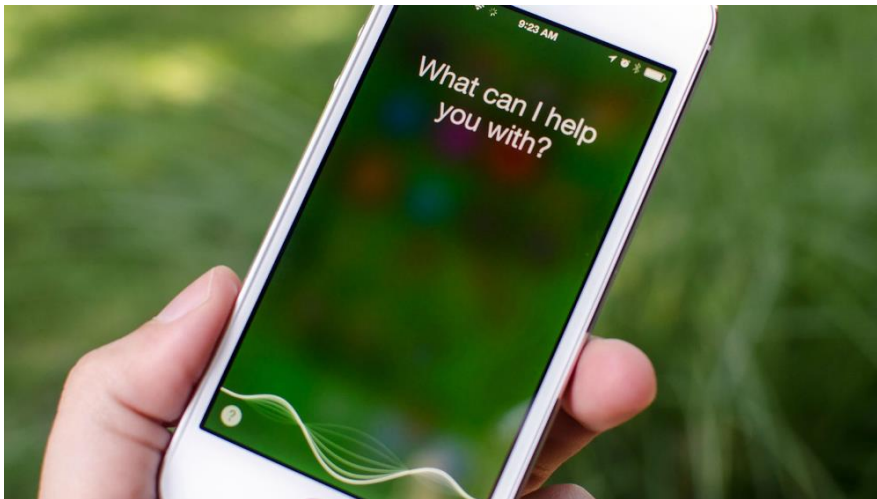
- **Philosophy** Methods of reasoning, mind as a physical system, foundations of knowledge and learning
- **Mathematics** Formal representation and proof, algorithms, computation, (un)decidability, (in)tractability, probability
- **Economics** Formal theory of rational decisions
- **Neuroscience** Physical substrate for mental activity
- **Psychology** Experimental techniques on human and animal behavior
- **Computer engineering** Building fast and efficient computers
- **Linguistics** Knowledge representation, human interaction

Overview of Topics in this Course

- **Introduction, Intelligent Agents**
- **Problem-solving techniques:**
 - Blind Search, Heuristic Search, Optimal search, Adversarial Search (Game Playing), Constraint Satisfaction
- **Knowledge representation and Logical reasoning**
- **Machine Learning**
- **Applications of AI**
 - Computer vision, Natural language processing, Robotics

AI in everyday life

Personal assistants



[Bgr.com/tag/siri](https://www.bgr.com/tag/siri)

Recommendation Systems

NETFLIX

amazon

You Tube

AI in everyday life (cont.)

Email categorization,
Spam filtering



<https://sendpulse.com/support/spam-filter>

Fraud prevention,
Credit decisions



<https://www.cafecredit.com/free-credit-score>

AI in everyday life (cont.)

- Face and Object recognition
 - Facebook, Pinterest



<https://www.classaction.org/blog/facebook-sued-over-face-recognition-feature>

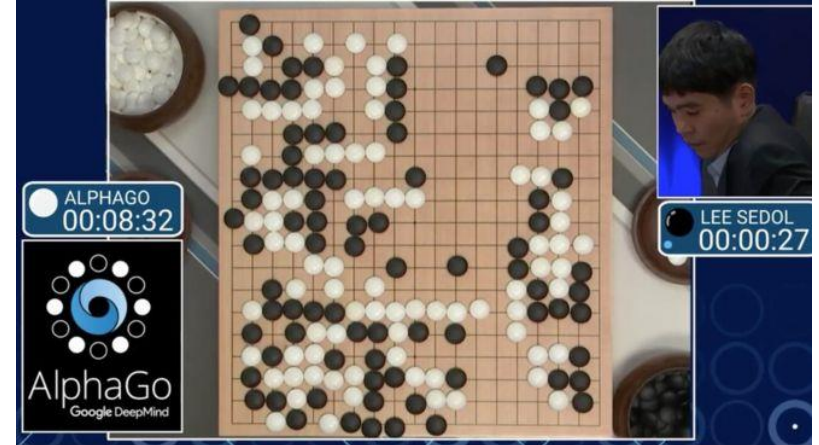
AI Success stories

- Game Playing
 - DeepBlue beats Gary Kasparov (1997)



AI Success stories (cont.)

- Game Playing
 - IBM Watson wins Jeopardy! (2011)
 - AlphaGo beats world champion Go player (2016)

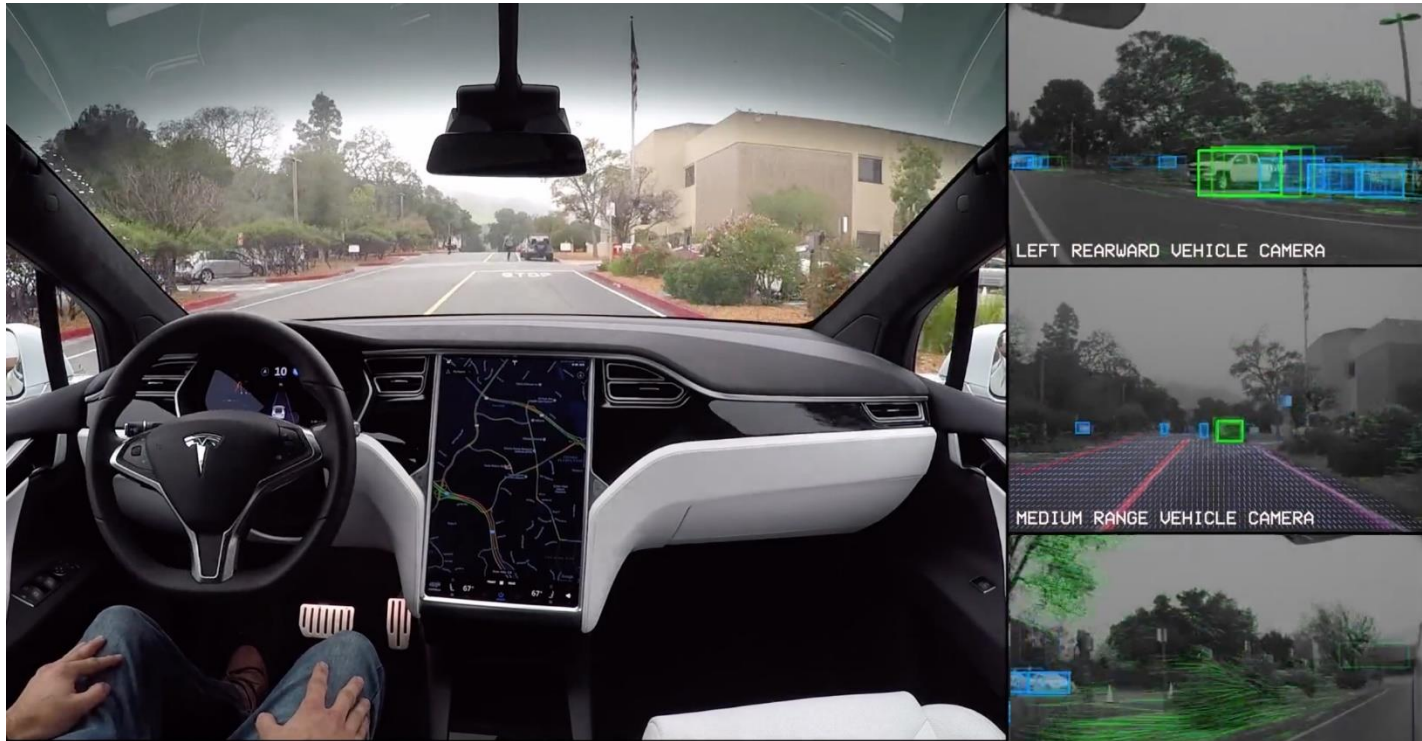


<https://www.technobuffalo.com/2013/05/21/ibm-watson-smartphone-ap/>

<http://www.bbc.com/news/technology-35785875>

AI Success stories (cont.)

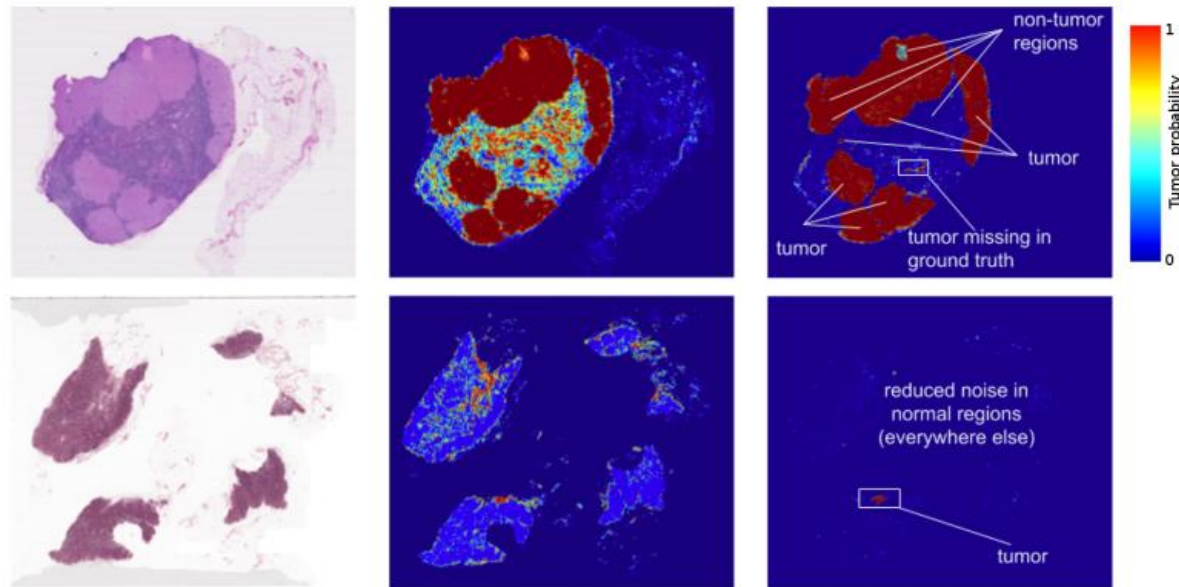
- Autonomous vehicles
 - Google self-driving car, Tesla autopilot



<https://www.tesla.com/videos/autopilot-self-driving-hardware-neighborhood-long>

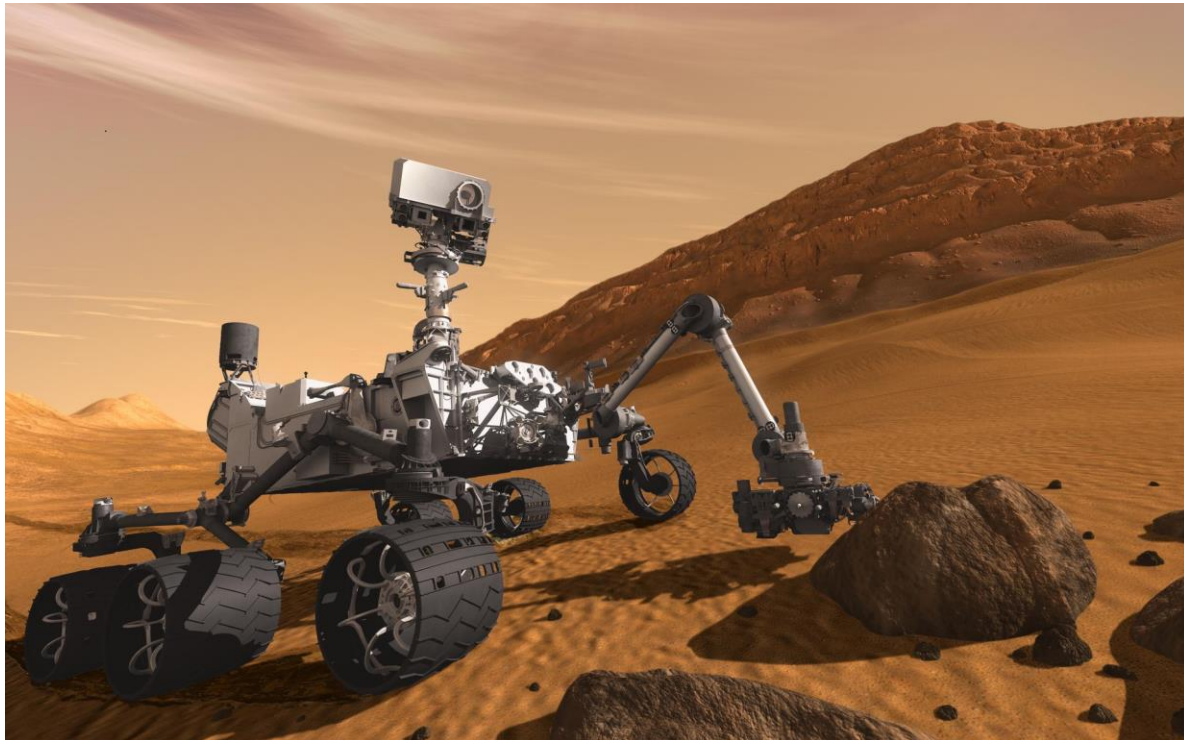
AI Success stories (cont.)

- Theorem Proving
 - Proved a mathematical conjecture (Robbins conjecture) unsolved for decades
- Medical diagnosis
 - AI systems outperformed human experts in blood infection diagnosis and lung cancer diagnosis



AI Success stories (cont.)

- Robot explorers
 - Mars exploration rovers designed at the NASA Jet Propulsions Laboratory.
 - In 2016, NASA installed a new AI system called AEGIS in the Curiosity rover, enabling it to choose targets autonomously.



AI Success stories (cont.)

- Image processing
 - Using deep neural networks, possible to identify and categorize objects in images



"man in black shirt is playing guitar."



"construction worker in orange safety vest is working on road."



"two young girls are playing with lego toy."



"girl in pink dress is jumping in air."



"black and white dog jumps over bar."



"young girl in pink shirt is swinging on swing."

Final remarks



https://twitter.com/mark_riedl/status/837879984375091200