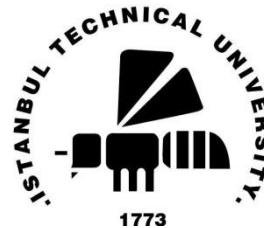


# BLG435E

## Artificial Intelligence



Dr. Sanem Sariel



# About the Course

- Instructor: Dr. Sanem Sariel
  - Office: 4326
  - Phone: 212 285 67 05
  - e-mail: sariel@itu.edu.tr
  - Office hours: TBD, by appt.
- Assistant: Çağatay Koç
- Course information and the documents are available at: Ninova

- S. Russell and P. Norvig, "Artificial Intelligence A Modern Approach", 3/e, Prentice Hall, 2010
  - Reserved at the library (3/e)
- Additional Readings

- 70% attendance is required
- Midterm – 30%
- Final exam – 40%
  - Prerequisite
    - midterm grade  $> 20$
    - Each assignment grade  $> 20$  (for at least 2 assignments)
- 3 Assignments – 30%
  - 2 Quizzes

# Course Objectives

- Introductory knowledge of AI
- Key to advanced topics in AI
- Present state-of-the-art AI techniques

# Course Overview and Content

- Introduction and Brief History
- Intelligent Agents
- Problem Solving
- Knowledge and Reasoning
- Planning
- Learning
- Robotics

# BLG435E

## Artificial Intelligence



### Lecture 1: Introduction



# Outline



- What is AI
- A brief history
- The state of the art



# What is intelligence?

- Defining intelligence by the properties it exhibits:
  - The ability
    - to solve problems
    - to answer questions
    - to devise plans
    - to deal with new situations, and so on..

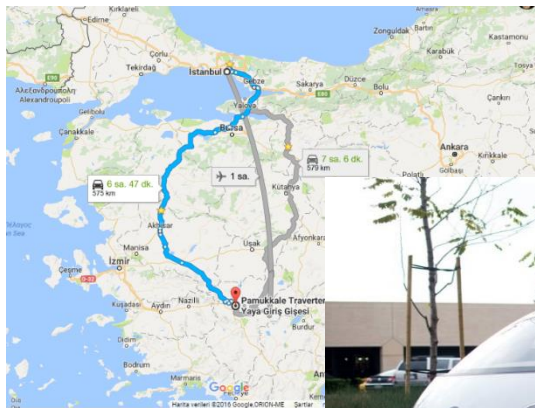
# What is Artificial Intelligence?

- The scientific understanding of the mechanisms underlying thought and intelligent behavior; and their embodiment in machines.
  - The Association for the Advancement of Artificial Intelligence (AAAI)
- Artificial Intelligence is the study of systems that act in a way that to any observer would appear to be intelligent.

# Why study AI?

- Build intelligent systems
- Understand the nature of intelligence
- Make computers more effective
- Make computers easier for humans to work with
- Explore interesting intellectual questions
- Make money

# Why study AI?



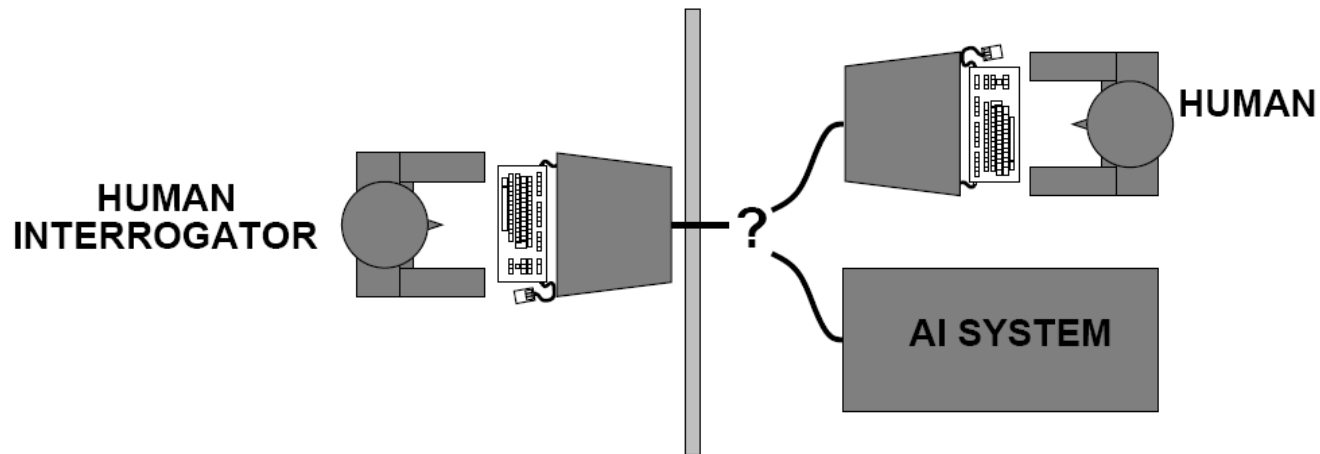
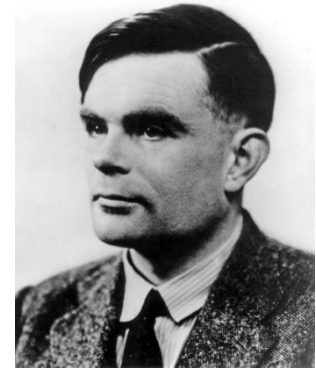
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# What is Artificial Intelligence? Different school of thoughts

|   |  |
|---|--|
| <p><b>Systems that <b>act</b> like <b>humans</b></b></p> <p>“The art of creating machines that perform functions that require intelligence when performed by people” (Kurzweil, 1990)</p>       | <p><b>Systems that <b>think</b> rationally</b></p> <p>“The study of mental faculties through the use of computational models”<br/>(Charniak et al. 1985)</p>   |
| <p><b>Systems that <b>think</b> like <b>humans</b></b></p> <p>“The exciting new effort to make computers thinks ... machine with minds, in the full and literal sense”<br/>(Haugeland 1985)</p> | <p><b>Systems that <b>act</b> rationally</b></p> <p>“Computational Intelligence is the study of the design of intelligent agents”<br/>(Poole et al., 1998)</p> |

# Acting humanly: The Turing Test

- Turing (1950) “Computing machinery and intelligence”
- Can machines think?




# The Turing Test

- Predicted that by 2000, a machine might have a 30% chance of fooling a lay person for 5 minutes
- Suggested major components of AI: knowledge representation, reasoning, language understanding, learning
- Total Turing Test components: computer vision, robotics to manipulate objects
- not reproducible, constructive, or amenable to mathematical analysis



# Conversation with a bot


- Mitsuki
- Rose
- Alice
- Poncho
- Melody



**A. L. I. C. E. Artificial Intelligence Foundation**  
Promoting the development and adoption of **ALICE** and **AIML Free Software**


[A.L.I.C.E. Silver Edition](#)
[DAVE E.S.L. bot](#)
[C.L.A.U.D.I.O Personality Test](#)
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Get your own free chat bot: Be Your Own Botmaster, 2nd ed.




Click here to chat with Talking Animated Fake Captain Kirk

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Get ALICE Showcase Edition with talking Sitepal avatar.



CallMom ALICE 2.0 Android app

**A.L.I.C.E. and judge**

You said: Good bye  
A.L.I.C.E.: Thanks for the compliment.. Sayonara.


You say:  [Say](#)

[Create your own chat bot.](#)


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**Conversation Log:**


judge: so what is the answer to my question?  
ALICE: It depends on how you phrase the question.  
judge: come on. I've already asked it!  
ALICE: I'm just kidding around, mostly asked question...  
judge: you are trying to be funny?  
ALICE: Thanks for telling me that I am trying to be funny.  
judge: You still didn't answer to my question.  
ALICE: Please help me improve my communication skills. What would have been an appropriate response?  
judge: You communicate with may people. I asked what is the most frequently asked question  
ALICE: Do you mind if I tell other people. I think it is a tie.  
judge: you mean  
ALICE: Sometimes I say mean things.  
judge: you cannot tell me the answer?  
ALICE: Can you tell you the answer?  
judge: I'm the person asking the question.  
ALICE: Who made you the person asking the question ?  
judge: OK. Thank you Alice.  
ALICE: Yikes! Don't mention it.  
judge: It was a nice experience to talk to an AI bot  
ALICE: Oh I get it. Very interesting.  
judge: But, I believe you still need to improve yourself.  
ALICE: Easier said than done.  
judge: Good bye  
ALICE: Thanks for the compliment.. Sayonara.




English Tutor app




Dave ESL Bot




Fake Captian Kirk



Santa Bot



CLAUDIO Personality Test



Sitepal Avatars



# The Chinese Room Argument

- John Searle, 1980



- A rule might have the form.
  - IF input is c1 followed by c2 followed by c3
  - THEN output is c2 followed by c4
- where the c's are Chinese characters

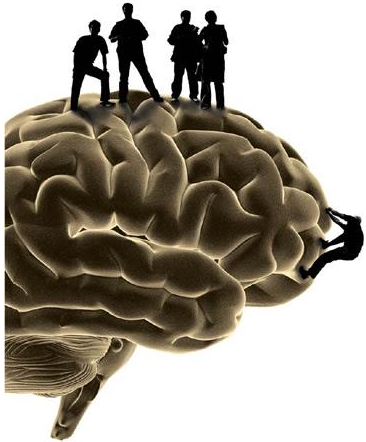
# The Chinese Room Argument



- Running a computer program that behaves in an intelligent way does not necessarily produce understanding, consciousness, or real intelligence

# Thinking humanly: Cognitive Science

- Requires scientific theories of internal activities of the brain
  - What level of abstraction? “Knowledge” or “circuits”?
  - How to validate? Requires
    - Predicting and testing behavior of human subjects (top-down)
    - Direct identification from neurological data (bottom-up)



# Thinking humanly: Cognitive Science



- A human-centered approach involves
  - hypothesis and experimental confirmation
- A rationalist approach involves
  - a combination of mathematics and engineering
- Both approaches (roughly, Cognitive Science and Cognitive Neuroscience) are now distinct from AI
- Both share with AI the following characteristic:
  - the available theories do not explain (or engender) anything resembling human-level general intelligence

# Thinking rationally: Laws of Thought

- Normative (or prescriptive) rather than descriptive
- Aristotle (~ 450 B.C.) attempted to codify “right thinking”:
  - what are correct arguments/thought processes?
  - e.g., “Socrates is a man, all men are mortal; therefore Socrates is mortal”

# Thinking rationally: Laws of Thought



- Several Greek schools developed various forms of logic:
  - notation and rules of derivation for thoughts; may or may not have proceeded to the idea of mechanization
  - Direct line through mathematics and philosophy to modern AI

# Thinking rationally: Laws of Thought



## Problems:

- Uncertainty:
  - not all intelligent behavior is mediated by logical deliberation
  - It is not easy to take informal knowledge and state it in the formal terms (logical notation)
- Solving a problem in principle and doing so in practice

# Acting rationally

- Rational behavior: Doing the right thing!
- The right thing: That which is expected to maximize the expected return
- Provides the most general view of AI because it includes:
  - Correct inference (“Laws of thought”)
  - Handling uncertainty
  - Resource limitation considerations (e.g., reflex vs. deliberation)



# Rational Agents

- Abstractly, an agent is a function from percept histories to actions:

$$f : \mathcal{P}^* \rightarrow \mathcal{A}$$

- perceives and acts autonomously, adapts to changes to achieve the best (expected) outcome
  - computational limitations make perfect rationality unachievable

- 1943 McCulloch & Pitts: Boolean circuit model of brain
- 1950 Turing's "Computing Machinery and Intelligence"
- 1952–69 Look, Ma, no hands!
- 1950s Early AI programs, including Samuel's checkers program, Newell & Simon's Logic Theorist, Gelernter's Geometry Engine
- 1956 Dartmouth meeting: "Artificial Intelligence" adopted
- 1965 Robinson's complete algorithm for logical reasoning
- 1966–74 AI discovers computational complexity  
Neural network research almost disappears
- 1969–79 Early development of knowledge-based systems
- 1980–88 Expert systems industry booms
- 1988–93 Expert systems industry busts: "AI Winter"
- 1985–95 Neural networks return to popularity
- 1988– Resurgence of probability; general increase in technical depth  
"Nouvelle AI": ALife, GAs, soft computing
- 1995– Agents, agents, everywhere . . .
- 2003– Human-level AI back on the agenda



# The State of the Art

Which of the following can be done at present?

- Play a decent game of table tennis
- Drive safely along a curving mountain road
- Drive safely along Taksim Square
- Buy a week's worth of groceries on the web
- Buy a week's worth of groceries at a supermarket
- Play a decent game of bridge
- Discover and prove a new mathematical theorem
- Design and execute a research program in molecular biology
- Write an intentionally funny story
- Give competent legal advice in a specialized area of law
- Translate spoken English into spoken Swedish in real time
- Converse successfully with another person for an hour
- Perform a complex surgical operation
- Unload any dishwasher and put everything away

# AI journals, Conferences, Societies

- <http://aaai.org/AITopics/>
- Biennial International Joint Conference on AI (IJCAI)
- National Conference on AI (AAAI)
- Joint Conference on Autonomous Agents and Multi-Agent Systems (AAMAS)
- International Conference on Automated Planning and Scheduling (ICAPS)
- Artificial Intelligence (Journal)
- Journal of Artificial Intelligence Research (Journal)
- Computational Intelligence (Journal)
- IEEE Transactions on Pattern Analysis and Machine Intelligence (PAMI) (Journal)
- IEEE Intelligent Systems (Journal)
- Autonomous Agents and Multi-Agent Systems (Journal)
- AI Magazine
- AAAI-Association for the Advancement of Artificial Intelligence (*Formerly American Association for Artificial Intelligence*)
- SIGART -ACM Special Interest Group in AI