# Artificial Intelligence (CS6380)

# Course logistics

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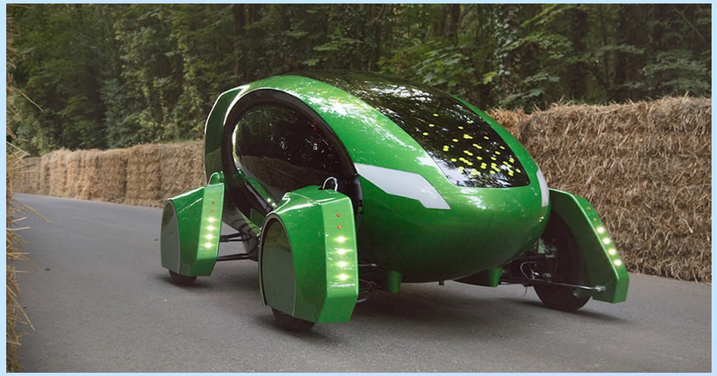
**Slot:** F Slot  (T: 5.00pm, W: 11.00am, Th: 9.00am, F: 8.00am)
**Venue:** SSB134

# AI is all around us

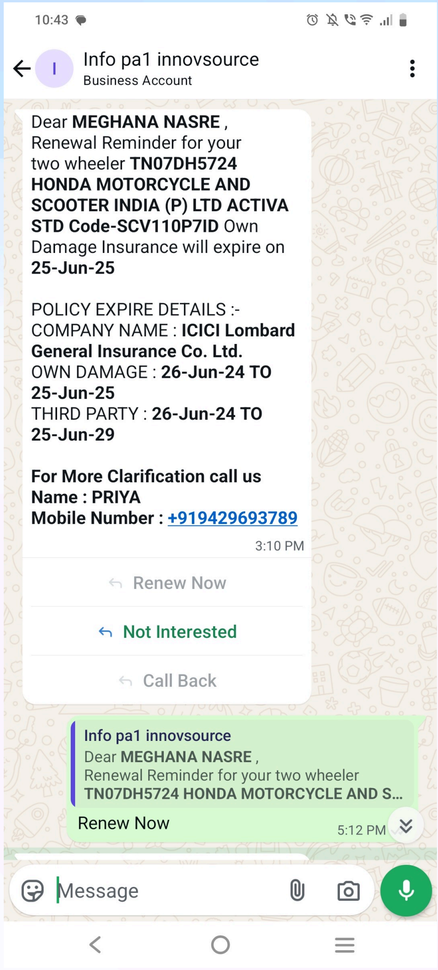
Amazon personalize



Kar-go in London delivering medicines


Swaayatt Robots : autonomous driving

Speech recognition



# What is Artificial Intelligence?

**Def. 1:** The exciting new effort to make computers think… *machines with minds,* in the full and literal sense. (Haugeland, 1985)

**Def. 2:** Study of how to make computers do things which, at the moment, people are better. (Rich and Knight 1991)

**Def. 3:** The study of mental faculties through the use of computational models. (Charniak and Mc Dermott, 1985)

**Def. 4:** Computational Intelligence is the study of design of intelligent agents. (Poole et al., 1998)

# What is Artificial Intelligence?

| | *Like Humans* | *vs* | *Rationally* |
|---|---|---|---|
| ***Think*** | **Def. 1:** The exciting new effort to make computers think… *machines with minds,* in the full and literal sense. (Haugeland, 1985) | | **Def. 3:** The study of mental faculties through the use of computational models. (Charniak and Mc Dermott, 1985) |
| ***vs*** | | | |
| ***Act*** | **Def. 2:** Study of how to make computers do things which, at the moment, people are better. (Rich and Knight 1991) | | **Def. 4:** Computational Intelligence is the study of design of intelligent agents. (Poole et al., 1998) |

# Thinking humanly : the cognitive modeling approach

How do humans think?

**Get inside the workings of human brain**

- Introspection (catch our thoughts)
- Psychological experiments

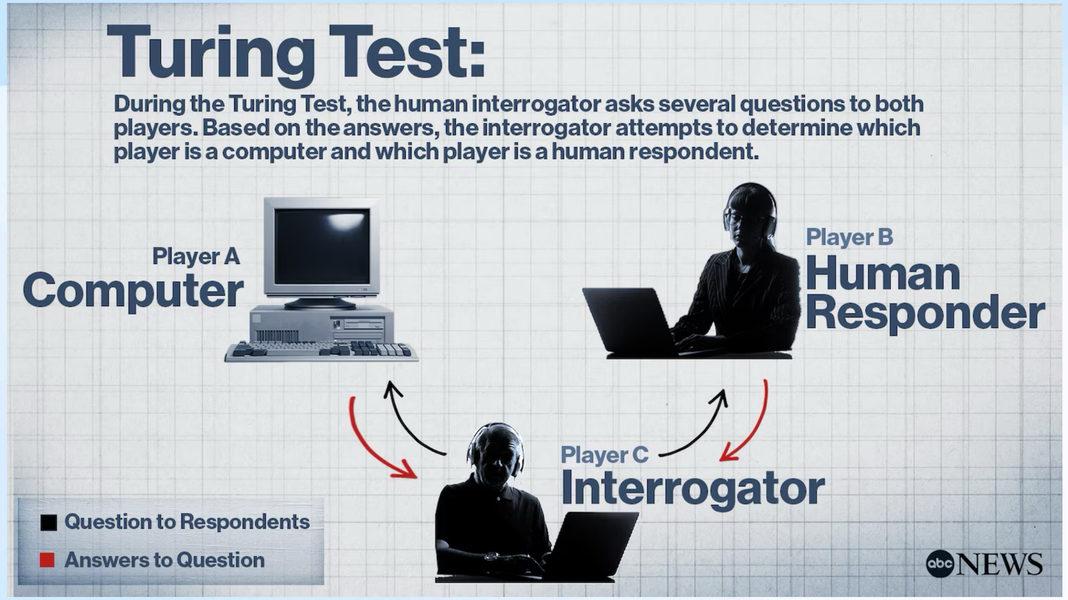
**Newell and Simon (General Problem Solver, 1961)**

- Not content with correct solutions to problems
- Wanted to understand the trace of reasoning of program and compare it with human reasoning.

# Acting humanly : The Turing Test approach

Alan Turing : Father of Computer Science

Devised the imitation game (1949–50)



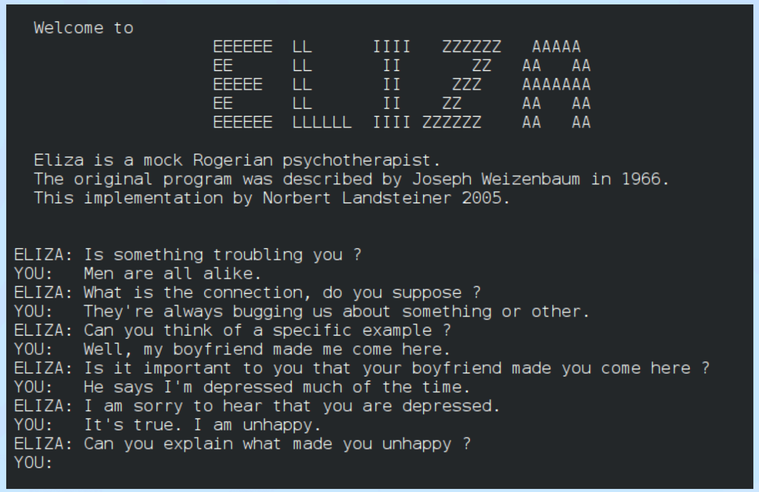

**Turing Test:** Computer passes the test if a human interrogator, after posing some written questions, cannot tell whether the written responses came from A or B.

Capabilities to pass the Turing Test:

- Natural language processing
- Knowledge representation
- Automated reasoning
- Machine learning
- Computer vision
- Robotics

Focus has been on studying underlying principles of intelligence

# Acting humanly : Turing test and other tests




**Winograd schema:** multiple choice questions that can be answered easily by humans but cannot be answered by computers using cheap tricks.

- The trophy wouldn't fit in the brown suitcase because it was too small. What was so small?

- The trophy wouldn't fit in the brown suitcase because it was too big. What was so big?

**Lobner prize:** Contest held every year (2003–2019)

- Format like Turing test
- Rules changed over the years
- Criticism : success depends on deception, chatbots can dot well using cheap tricks

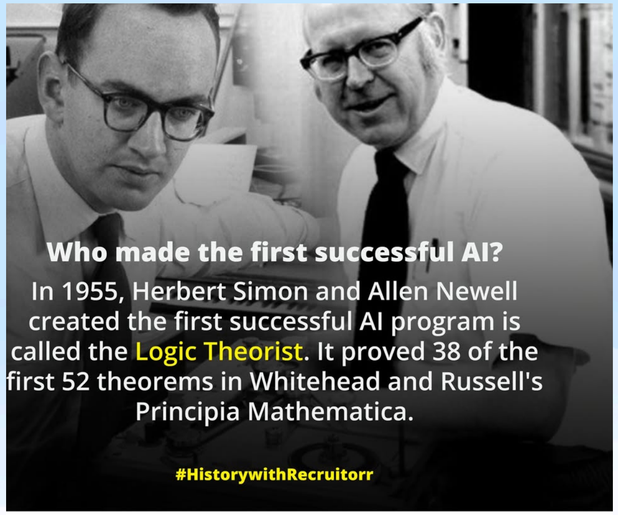
**Winograd schema challenge:** Held in IJCAI in July 2016.

- 6 entries, best system got 58% correct answers, humans get 90%.

# Thinking rationally: the laws of thought approach

**Syllogisms**

**Socrates is a man.**
**All men are mortal.**
**Implies: Socrates is mortal.**




**Aristotle: attempt to codify right thinking**

**LT: inference systems**

**Use logic programming to solve problems in AI**

- **Problems are translated into a set of facts and rules**
- **Declarative nature of logic programming**
  - **says what to do, not how to do**
- **Prolog, datalog, lisp, answer set programming, …**

**Issues: Computational complexity, dealing with uncertainty, ..**

# Acting rationally: the rational agent approach

**Agent** : one that acts *(agere: to do)*

**Computer agent** : perceive the env., operate autonomously, persist over time, adapt over time, set and pursue goals

**Rational agent** : one that acts to achieve the “best” outcome

**Rational agent approach vs other approaches**

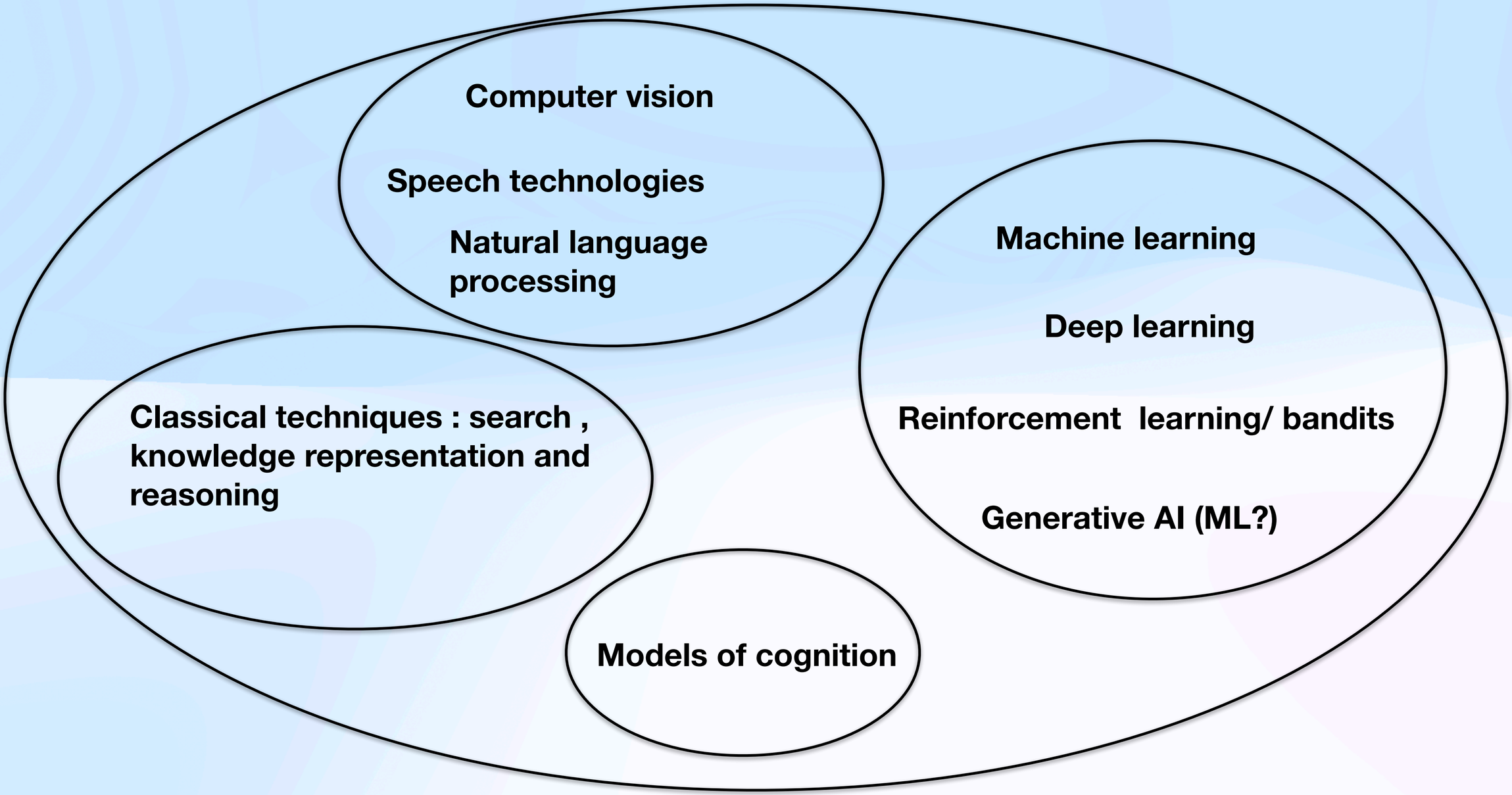
- Goes beyond explicit reasoning and Human cognition.
- Can be adapted to many real world problems.

**Focus in the course: study and design of agents that *do the right thing.***

Rational agents vs. beneficial machines

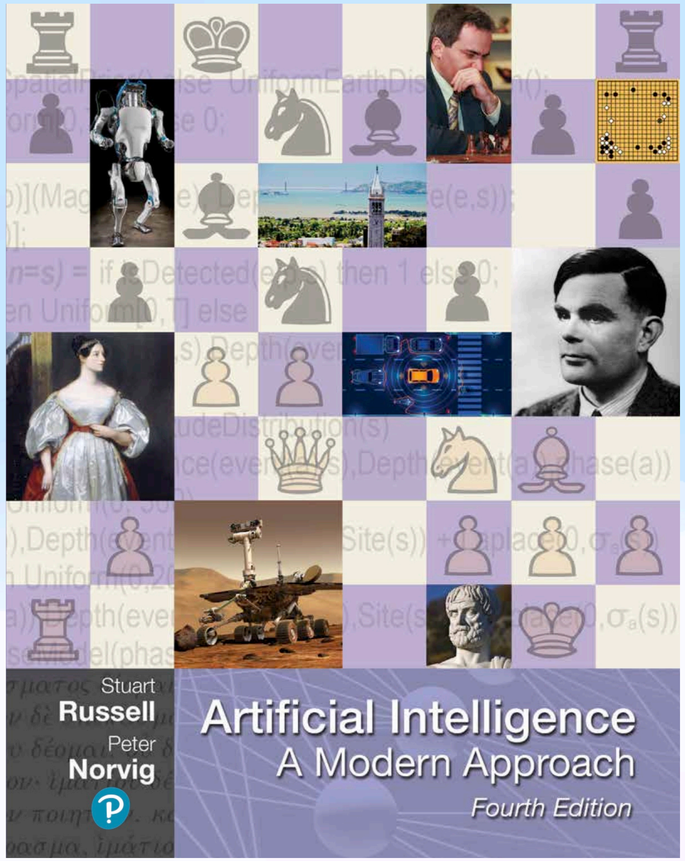
Agent objectives vs our objectives.

# AI / ML courses



# Course outline and logistics

- Agents and environments
- Problem solving
  - Search Methods for Problem Solving
  - Search in Complex Environments
  - Constraint Satisfaction Problems
  - Adversarial Search and Games
- Knowledge and Reasoning
  - Knowledge Based Gents
  - Propositional Logic and First Order Logic
  - Using logic to make inferences
- Planning
  - Knowledge Representation
  - Classical Planning: Algorithms, heuristics
  - Hierarchical Planning
- Data driven AI

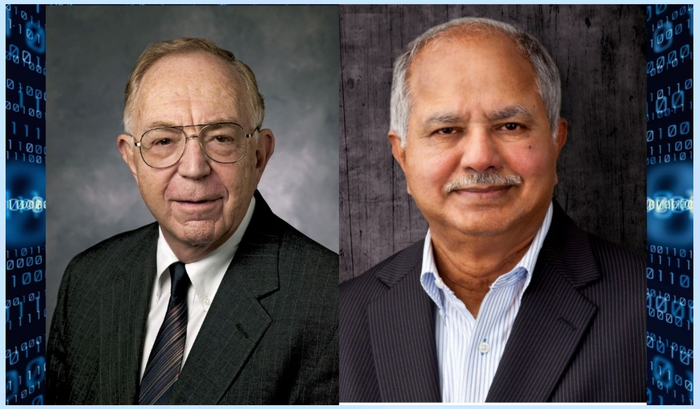



## Course evaluation plan

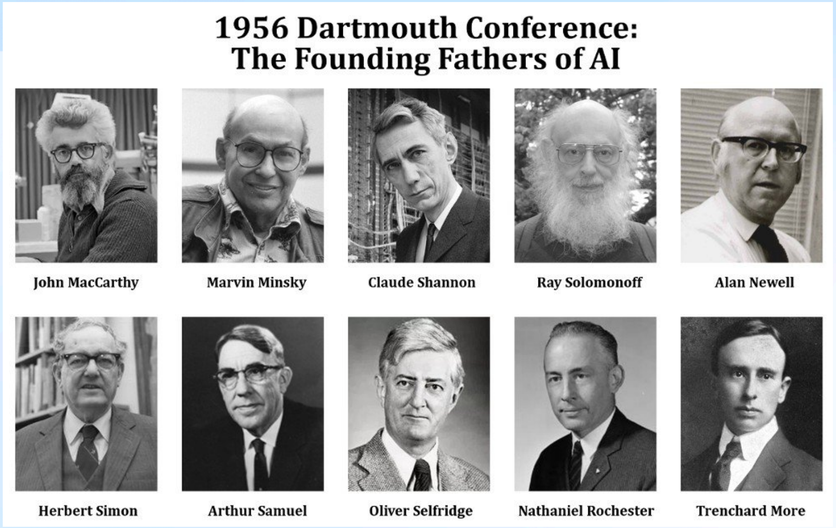
- Midsem (30), Endsem (40)
- Assignments + tutorials worth 30 marks.

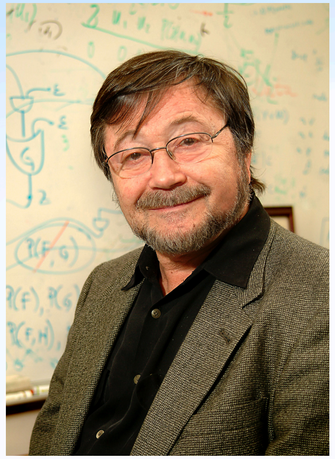
# Turing Award winners and historical perspective

- Marvin Minsky (1969) and John McCarthy (1971)
- Allen Newell and Herbert Simon (1975)
- Ed Feigenbaum and Raj Reddy (1994)
- Judea Pearl (2011)
- Yoshua Benigo, Geoffrey Hinton, Yang LeCun (2018)

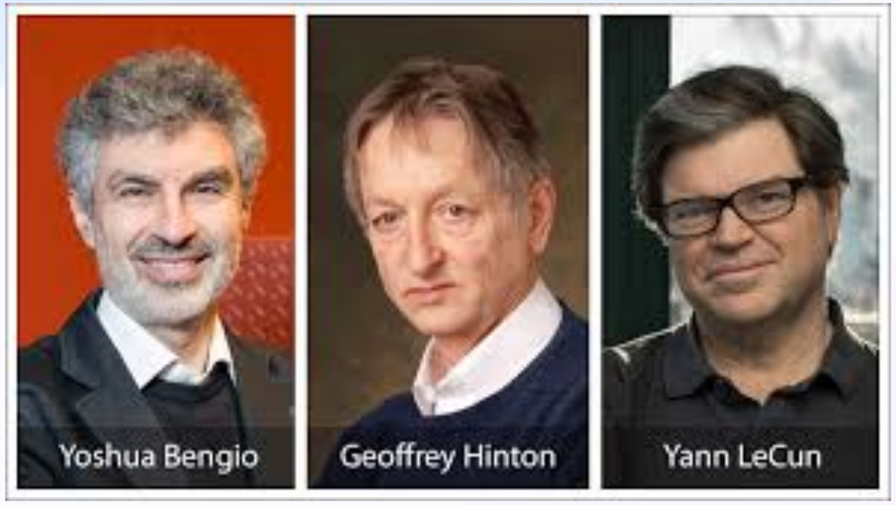


Ed Feigenbaum and Raj Reddy



Judea Pearl



# Artificial Intelligence Development History Timeline