



3 GOLDEN GLOBE NOMINATIONS BEST PICTURE

BEST ACTOR JOAQUIN PHOENIX

BEST SCREENPLAY SPIKE JONZE



"ONE OF THE BEST FILMS OF THE YEAR. EXQUISITE. THIS IS A MOVIE YOU WANT TO REACH OUT AND CARESS."

—James Berkeley, *The New York Times*

"'HER' IS THE BEST FILM IN YEARS. IT LEAVES YOU FULL OF WONDER. JOAQUIN PHOENIX GIVES THE BEST PERFORMANCE OF 2013 BY A COSMIC MARGIN."

—Lisa Schwarzbaum, *NYC Weekly*

"I LOVED 'HER'. A GORGEOUSLY SWEET ROMANCE. SCARLETT JOHANSSON IS SEDUCTIVE AND WINNING."

—Christopher T. Lee

"PERSONAL FILMMAKING DOESN'T GET BETTER OR MORE BRILLIANT, SEDUCING, ORIGINAL AND SCART-CRUSHING THAN THIS."

—Christopher T. Lee



her

A SPIKE JONZE LOVE STORY

JOAQUIN
PHOENIX

AMY
ADAMS

ROBERT
MAYNA

OLGA
WILDE

SCARLETT
JOHANSSON

FEATURING SCORE BY ARCADE FIRE



IN SELECT THEATERS DECEMBER
EVERYWHERE JANUARY 10



Artificial Intelligence

What is AI?

Some Definitions of AI

- “The scientific understanding of the mechanisms underlying thought and intelligent behavior and their embodiment in machines”

– American Association of Artificial Intelligence (AAAI)

- “Artificial Intelligence is the branch of computer science that is concerned with the automation of intelligent behavior”

– Luger and Stubblefield

- “AI strives to understand and build intelligent entities (also helps us to learn more about ourselves)”

– Russell and Norvig

Definitions of AI

- Based on theoretical and applied principles of CS
 - Data structures for knowledge representation
 - Algorithms needed to apply that knowledge
 - Languages and programming techniques used for implementation

Why is AI difficult?

(or is it easy?)

Intelligence

- AI definitions suffer from fact that intelligence itself is not very well defined or understood
 - Though study of intelligence is over 2000 yrs old (philosophers)
- However, it is easy to recognize intelligent behavior when we see it
 - Though “beauty is in the eye of the beholder”
- Difficult to define intelligence specific enough to evaluate a supposedly intelligent computer program
 - More later from Minsky

How Can it be?

- How can a slow and tiny brain (biological, technological)
 - Perceive
 - Understand
 - Predict
 - Manipulatea world far more complicated than itself???
- How can we build something with these properties?

Consider even a tiny spider!



Sub-Fields of AI

- Many sub-fields
 - Knowledge
 - Reasoning
 - Machine learning
 - Language
 - Robotics
 - Vision
 - ...

Four Categories of AI

Thinking humanly (Systems that think like humans)	Thinking rationally* (Systems that think rationally)
Acting humanly (Systems that act like humans)	Acting rationally* (Systems that act rationally)

* Rational system “does the right thing”
(People make mistakes)

Thinking Humanly

Cognitive (Neuro)Science

- “[The automation of] activities that we associate with human thinking, activities such as decision-making, problem solving, learning...” (Bellman, 1978)
- Get inside the actual workings of human minds
 - Introspection
 - Psychological experiments
- Cognitive modeling
- Requires scientific theories of brain
 - Behavior of human subjects (top-down)
 - Neurological data (bottom-up)

Thinking Rationally

- “The study of the computations that make it possible to perceive, reason, and act” (Winston, 1992)
- “The study of mental faculties through the use of computational models” (Charniak and McDermott, 1985)
- Laws of thought
 - Aristotle: What are correct reasoning processes?
 - Syllogism: Socrates is a man; all men are mortal; therefore Socrates is mortal
- Initiated the field of Logic
- Hard to put “uncertain” knowledge in logic terms

Acting Humanly

- “The art of creating machines that perform functions that require intelligence when performed by people” (Kurzweill, 1990)
- Turing Test (Alan Turing, 1950)
 - Operational definition of intelligence
 - Human-level performance in cognitive tasks and is sufficient to fool an interrogator
 - Imitation game
 - Computer interrogated by human via teletype/keyboard
 - Test if interrogator cannot tell if computer or human
 - Not amenable to mathematical analysis
- Computers need several capabilities
 - Language processing, reasoning, learning, knowledge

Computer AI passes Turing test in 'world first'



Eugene Goostman simulates a 13-year-old Ukrainian boy

A computer program called Eugene Goostman, which simulates a 13-year-old Ukrainian boy, is said to have passed the Turing test at an event organised by the University of Reading.

The test investigates whether people can detect if they are talking to machines or humans.

The experiment is based on Alan Turing's question-and-answer game **Can Machines Think?**

No computer has passed the test before under these conditions, it is reported.

However, some artificial intelligence experts have disputed the victory, suggesting the contest had been weighted in the chatbot's favour.

The 65-year-old **Turing Test** is successfully passed if a computer is mistaken for a human more than 30% of the time during a series of five-minute keyboard conversations.

On 7 June Eugene convinced 33% of the judges at the Royal Society in London that it was human.

Related Stories

[How the Turing Test inspired AI](#)

[Playing solitaire with Turing](#)

[Is artificial intelligence possible?](#)

Acting Humanly

- “Total” Turing Test
 - Includes video signal of interrogator
 - Test subject’ s (machine’ s) perceptual ability
 - Includes portal for interrogator to pass objects to the subject (machine)
 - Need
 - Computer vision to perceive objects
 - Robotics to manipulate objects

Acting Humanly



Acting Rationally

- Rational behavior = doing the right thing
 - The right thing maximizes some goal achievement, given available information
 - Correct inferences
- Rational behavior does not necessarily involve thinking (not inference)
 - Reflexes (e.g., pulling hand away from hot stove)

Rational Agents

- An AGENT is an entity that perceives and acts
 - Also a definition of a ROBOT
- Abstractly, agent is a function from percept histories to actions

$$f : P^* \rightarrow A$$

- Computational limitations in complicated environments make perfect rationality unachievable
 - Design best program for given machine resources

Foundations of AI

- AI itself is a new discipline (started in 1956), but many other disciplines have contributed ideas, viewpoints, and techniques to AI
- Philosophy
 - Going back to 400 B.C. (Aristotle)
 - Considered ideas that the mind is in some ways like a machine
 - Operated on knowledge
 - Thought/knowledge and goals used to decide right actions
 - Hume's principle of induction (1700's)
 - General rules are acquired by exposure to repeated associations

Foundations of AI

- Mathematics
 - What things can be computed
 - Intractability and exponential growth
 - Tools for formal logic
 - Probabilistic manipulation with uncertain information
- Economics
 - Decision theory (probability with utility)
 - Make decisions that maximize payoff
 - Handling situation when payoff is far in future
- Neuroscience
 - Examines how the brain processes information
 - Neural networks
 - Study EEG, fMRI

Foundations of AI

- Psychology
 - Cognitive psychology
 - “A cognitive theory should be like a computer program” (Anderson 1980)
 - View brain as information-processing device
 - Humans (and animals) are information processing machines
- Computer science and engineering
 - Efficient computational systems
 - Make AI applications possible
 - Hardware and software

Foundations of AI

- Control Theory and Cybernetics
 - Viewed purposive behavior as arising from regulatory mechanism trying to minimize “error” between current state and goal state
 - Maximize some mathematical objective function over time
 - AI: Design systems that behave optimally
- Computational linguistics
 - Natural language processing
 - Understanding language also needs understanding of subject matter and context (not just syntax)
 - Relate language to thought

History of AI

- **1943** McCulloch & Pitts: Boolean circuit model of brain
 - Artificial neurons, Neural Networks
- **1950** Turing's "Computing Machinery and Intelligence"
- **1952-69** "A machine can never do X" period
- **1950's** Early AI programs
 - Newell & Simon's Logic Theorist: proved theorem in fewer steps, paper with LT as author (rejected)
- ***1956*** Dartmouth workshop: "Artificial Intelligence" coined
- **1958** John McCarthy created LISP (high-level AI language) MIT AI Memo 1
- **1958** Machine evolution (genetic algorithms)
- **1960's** Microworld domains (blocks world)
- **1962** Rosenblatt's perceptron learning (simple NN)
- **1969** *Perceptrons* by Minsky and Papert
- **1970's** Knowledge-based systems
- **1980's** Expert systems
- **Now** Autonomous systems, robotics, probability, machine learning

What is Artificial Intelligence?

Basic questions answered by
John McCarthy

<http://www-formal.stanford.edu/jmc/whatisai/whatisai.html>

Q: What is Artificial Intelligence?

- It is the science and engineering of making intelligent machines, especially intelligent computer programs.
- It is related to the similar task of using computers to understand human intelligence, but AI does not have to confine itself to methods that are biologically observable.

Q: Yes, but what is intelligence?

- Intelligence is the computational part of the ability to achieve goals in the world.
- Varying kinds and degrees of intelligence occur in people, many animals, and some machines.

Q: Don't some people say that AI is a bad idea?

- The philosopher John Searle says that the idea of a non-biological machine being intelligent is incoherent.
- The philosopher Hubert Dreyfus says that AI is impossible.
- The computer scientist Joseph Weizenbaum says the idea is obscene, anti-human, and immoral.
- Various people have said that since AI hasn't reached human level by now, it must be impossible.
- Still other people are disappointed that companies they invested in went bankrupt.

Q: Does AI aim to put the human mind into the computer?

- Some researchers say they have that objective, but maybe they are using the phrase metaphorically.
- The human mind has a lot of peculiarities, and I'm not sure anyone is serious about imitating all of them.

Note: Strong AI view = build a mind in a computer

Weak AI view = not a mind, but good
intelligent process

Does AI aim at human-level intelligence?

- Yes.
- The ultimate effort is to make computer programs that can solve problems and achieve goals in the world as well as humans.
- However, many people involved in particular research areas are much less ambitious.

Major AI Outlets

- Societies
 - American Association of Artificial Intelligence (AAAI)
 - Check out www.aaai.org
 - ACM SIG in Artificial Intelligence (SIGART)
- Conferences
 - International Joint Conference on AI (IJCAI)
 - National Conference on AI (AAAI)
- Journals
 - *Artificial Intelligence*
 - *Computational Intelligence*
 - *IEEE Transactions on Pattern Analysis and Machine Intelligence (PAMI)*
 - *Journal of Artificial Intelligence Research*

AI in OSU CSE Dept.

- Research groups
 - Computer Vision
 - Jim Davis
 - Audition
 - Leon Wang
 - Speech and Language
 - Eric Fosler-Lussier, Alan Ritter
 - Machine Learning
 - Mikhail Belkin, Brian Kulis
- AI meetings/talks