Artificial Intelligence

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Outline of Lecture 01

- Introduction to artificial intelligence
  - Definition of artificial intelligence
  - Learning objectives of artificial intelligence
  - History of artificial intelligence
- Introduction to COMP 4431
  - General information
  - Subject learning outcomes
  - Course presentation
- Consulting time for the course add/drop

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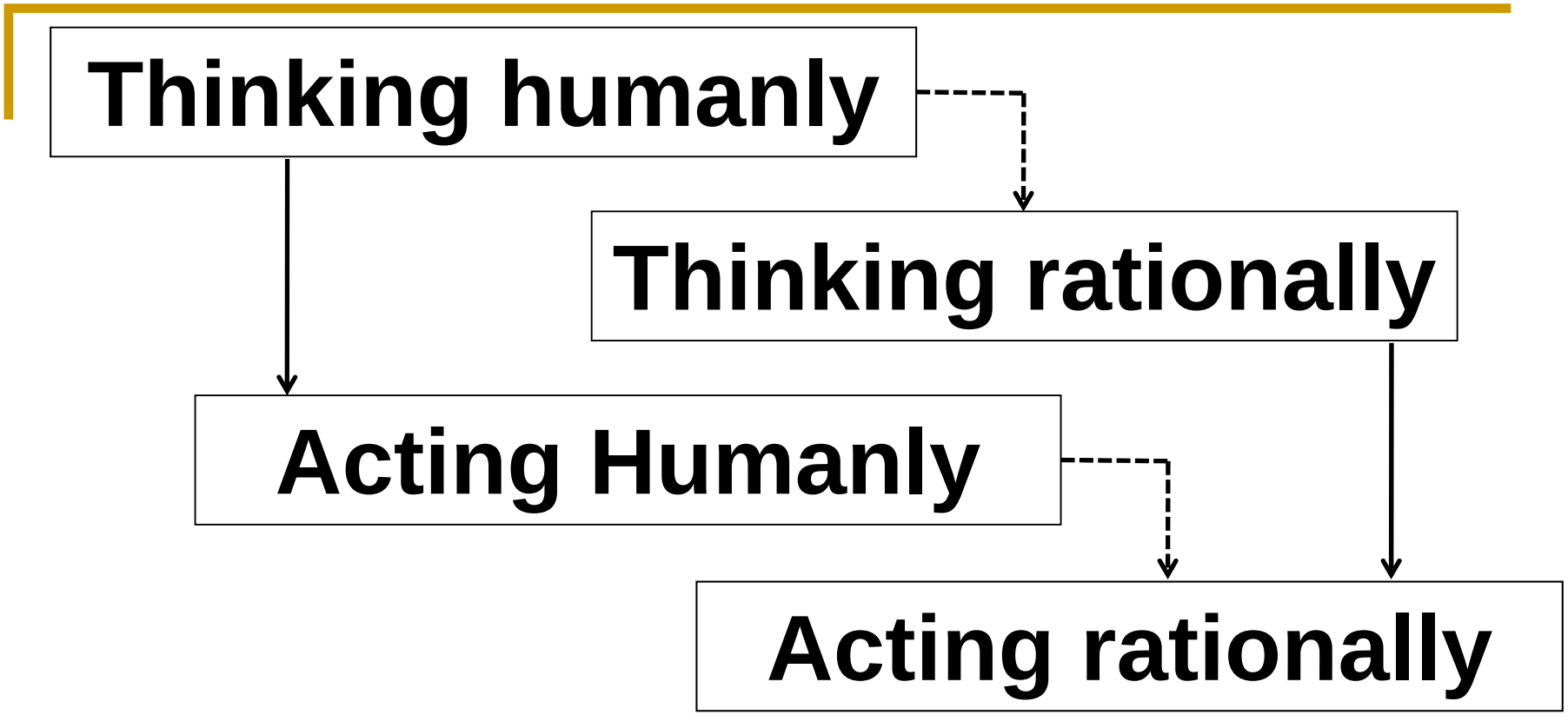
What is Artificial Intelligence

- Artificial Intelligence
  - Is concerned with the design of intelligence in an artificial device
  - Term coined by McCarthy in 1956
- Artificial device
  - Limited to computer system in our lecture
- What is intelligence
  - Behave as intelligently as a human?
  - Behave in the best possible manner?
  - Thinking?
  - Acting?

What is Artificial Intelligence



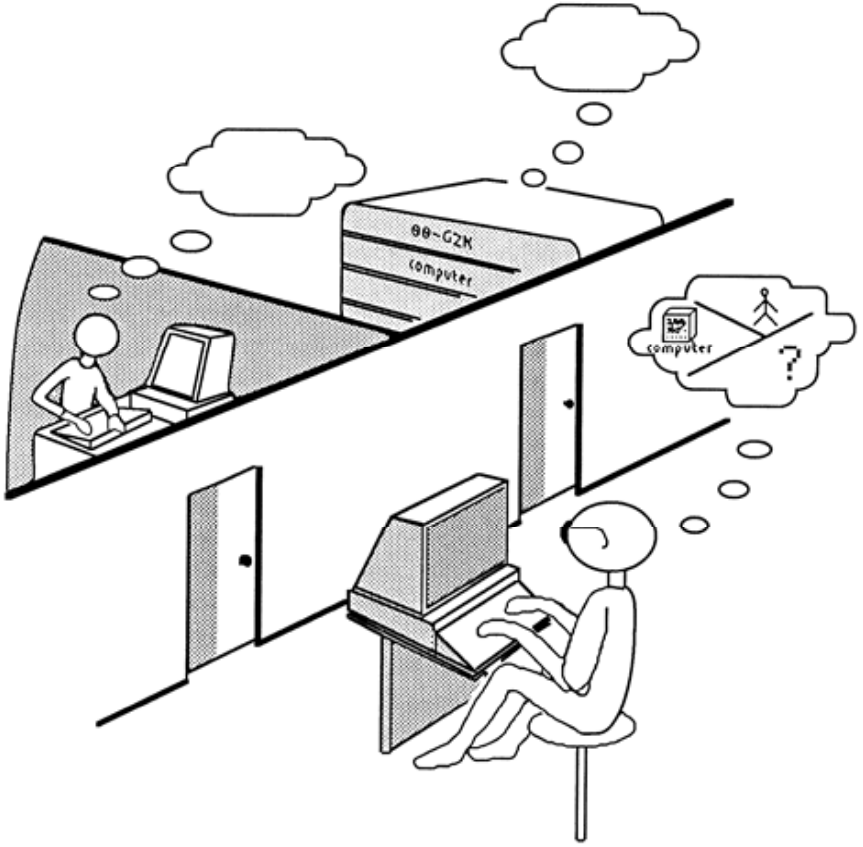
- Rationality: Ideal concept of intelligence

Acting Humanly

- Aim to solve the problem
  - Can machines behave intelligently as the human
- The Turing test
  - Operational test for intelligent behavior
    - Proposed in 1950 and anticipated all major argument against AI in following 60 years
    - Predicted that by 2000, a machine might have a 30% chance of fooling a lay person for 5 minutes
  - Limitation
    - Not reproducible and amenable to mathematical analysis

Turing Test

- Human
  - Types in questions
  - Receives answers on screen
- Computer/human
  - Processes questions
  - Returns answers
- Judge
  - Computer or human?



Alan Turing

- Born
  - In 1912 at United Kingdom
- Died
  - In 1954 (Aged 41)
- Education
  - Undergraduate at King's College in mathematics
  - PhD from Princeton University
- Turing machine
  - Give a definition of computation
  - Absolute limitation on what computation could achieve
- Contribution to artificial intelligence
  - Propose that modification of behavior could be adapted from learning brain to learning machine in 1948
  - Design Turing test in 1950
  - Propose the idea of 'the electronic brain'

Turing Award

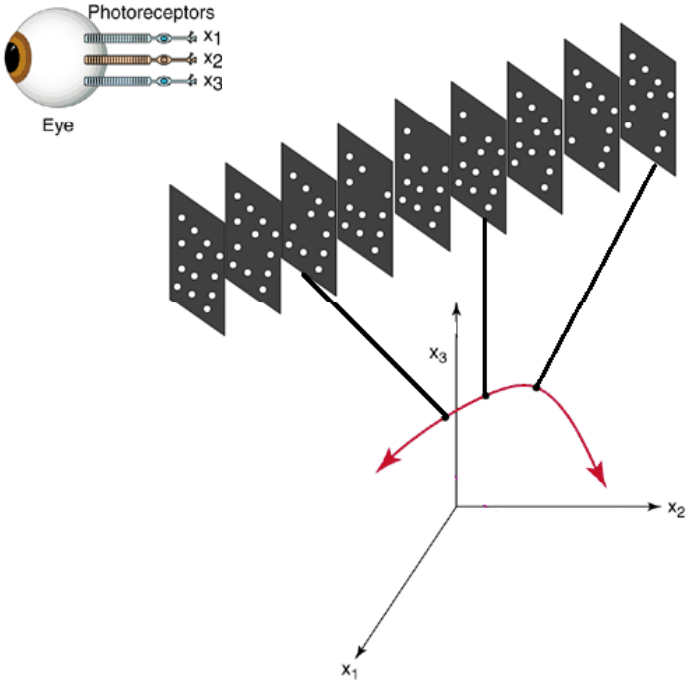
- The A.M. Turing Award
  - Referred to as the Nobel Prize of Computing
  - An annual prize given by ACM
  - To an individual selected for contributions of a technical nature made to the computing community
  - The contributions should be of lasting and major technical importance to the computer field
- There are total 62 recipients from 1966 to 2014

Thinking Humanly

- Aim to solve the problem
  - Scientific theories of internal activities of the brain
- How to validate
  - Predicting and testing behavior of human subjects
    - Cognitive science
  - Direct identification from neurological data
    - Neuroscience
  - Both are now distinct from AI
    - The available theories can't explain anything resembling human-level general intelligence

Example of Cognitive Science

- Human visual perception
  - The retinal image is a collection of signals from photoreceptor cells
  - The faces trace out nonlinear manifolds when they rotate



$\mathbf{x}$

Manifold Learning

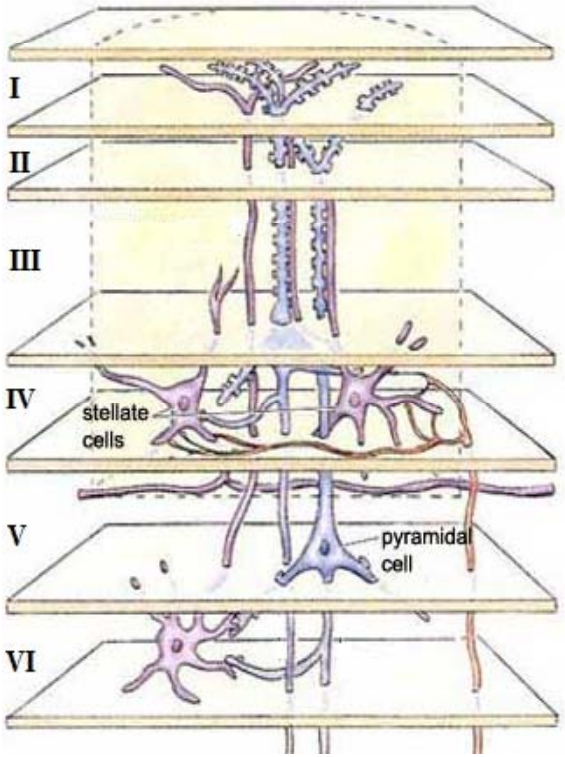
$\Phi : \mathbf{x} \rightarrow \mathbf{y}$

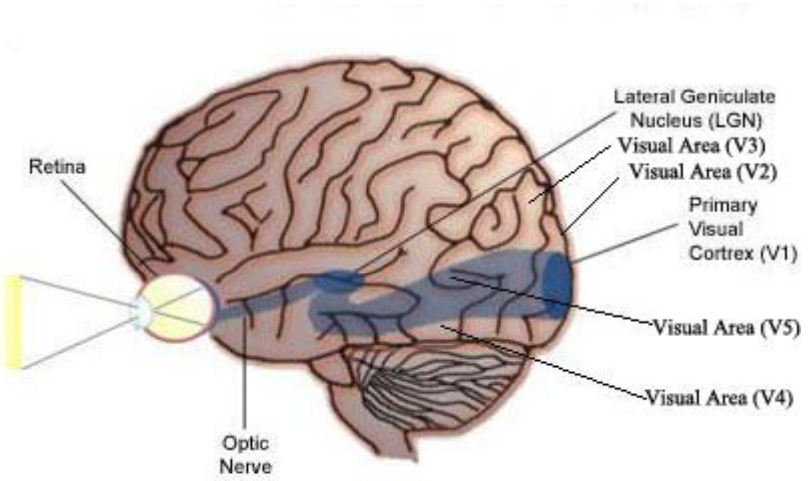
76	43	18
3	37	73
91	94	95

$\mathbf{y}$

Example of Neuroscience

- Human visual cortex





Thinking Rationally

- Aim to solve the problem
  - Correct argument/thought processes
- Some tentative work
  - Several Greek schools developed various forms of logic: notation and rules of derivation for thoughts
- Problems
  - What is the purpose of thinking
  - What thoughts should I have out of all the thoughts that I could have
- Direct line though mathematics and philosophy to modern AI
  - Little widely accepted conclusion has been made

Action Rationally

- Aim to solve problem
  - Doing the right thing
  - Which is expected to maximize goal achievement, given the available information
- Rational agent
  - An agent is an entity that perceives and acts
  - An agent is a function from percept histories to actions:

$$[f: \mathcal{P}^{\star} \rightarrow \mathcal{A}]$$

  - For any given class of environments and tasks, we seek the agent (or class of agents) with the best performance

Human Intelligence vs. Machine Intelligence

Human Intelligence	Machine Intelligence
Perception	Singal Processing
Decision Making	Traditional Artificial Intelligence
Memory	Database
Attention	Information Retrieval
Communication	Human Computer Interaction
Adaption	Machine Learning
Intuition	Pattern Recognition? Data Mining?
Creativity	? ? ?

John McCarthy

- Get Turning Award in 1971
- Professor at Stanford University
- Contribution to artificial intelligence
  - Propose artificial intelligence in 1956
  - Created the LISP language in 1958
  - His students developed the first computer program to convincingly play chess
- Contribution to other areas
  - Came up with a scheme for creating general purpose timesharing

The History of Artificial Intelligence

- 1956 – 1974
  - Search technology
  - Natural language processing
  - Computer vision
- 1980 – 1987
  - Artificial neural networks
  - Expert systems
  - Industry robots
- 1993 – 2003
  - Support vector machine
  - Machine learning
  - Automatic cars
- 2012 –
  - …
  - …
  - …

Opportunity and Challenging

- From artificial intelligence
  - Few fundamental breakthrough
  - Optimization is not everything
- From social value
  - Mood problem
  - Aging society
- New path for cross-area research
  - Better machine
  - Better human beings
  - More friendly human computer society

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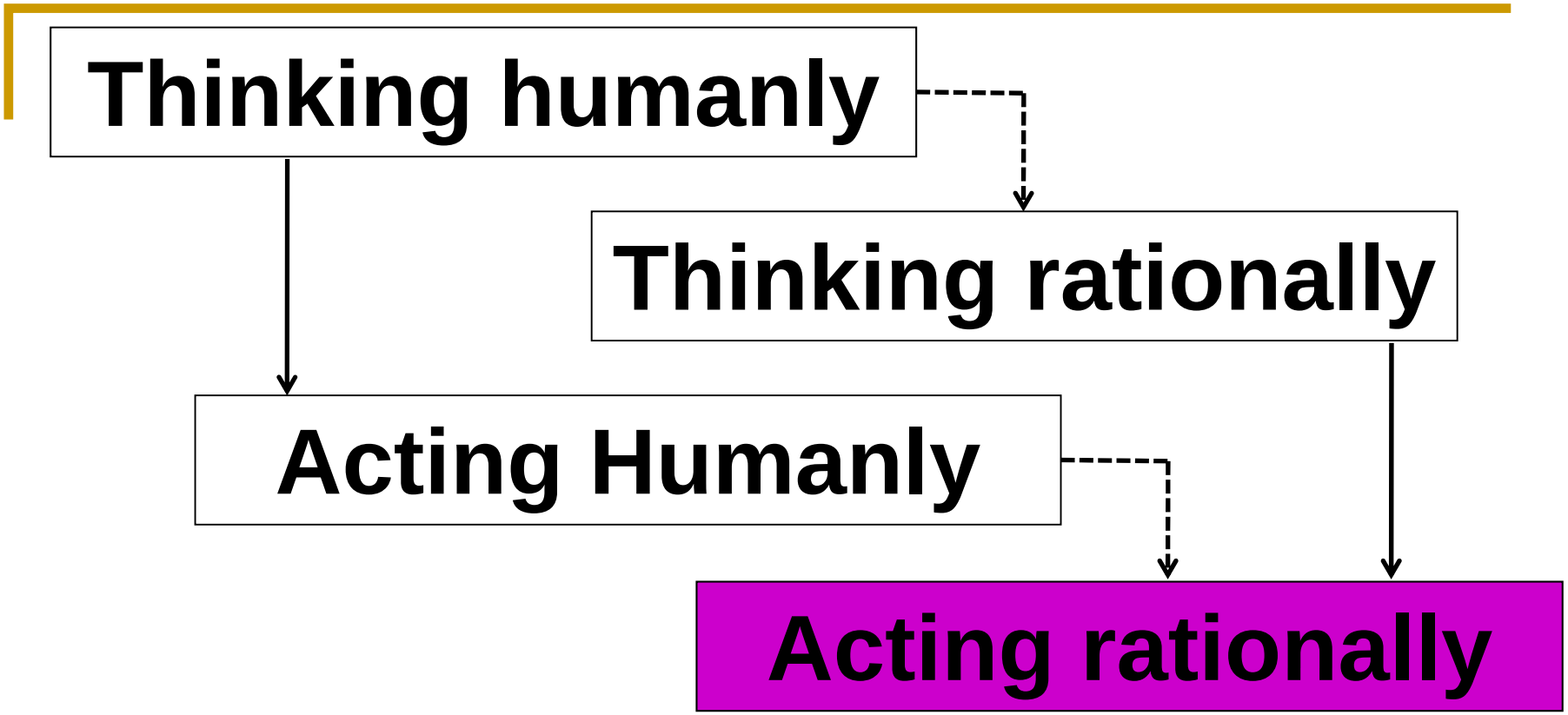

- Rationality: Ideal concept of intelligence

General Information

- Text book
  - Stuart Russell and Peter Norvig, “Artificial Intelligence A Modern Approach”, third edition.
- Course web page
  - The notes for lectures will be available online by Mon.
  - http://www.comp.polyu.edu.hk/~csyliu/course/comp406/main.html
  - View the course web page at least once a week
  - Important announcement will be posted there
- Part 1 of our class
  - Tue. 15:30 – 17:20
  - Y401
- Part 2 of our class
  - Tue. 17:30 – 18:20
  - QT402
  - Start from next week

Subject Learning Outcomes

- Basic knowledge of artificial intelligence
  - Individual work
    - Four quiz 20%
    - Final examination 45%
- Basic skill of implementation
  - Individual work
    - Lab attendance 10%
  - Group work with 1 – 4 person(s) each group
    - Course project 15%
- Basic learning ability for artificial intelligence
  - Group work with 1 – 4 person(s) each group
    - Course presentation 10%

Fiona Yan Liu

- Associate professor in Department of Computing
  - Director of cognitive computing lab
  - PhD from Columbia University in USA in 2005
  - Brain modeling, multimedia computing, artificial intelligence
- Lecturer
  - Subject design
  - Lecture teaching
  - Course presentation grading
  - Final examination grading
  - Overall performance evaluation
- Contact with me
  - csyliu@comp.polyu.edu.hk

Songtao Wu

- PhD student in Department of Computing
  - Majoring in brain modeling, artificial intelligence, image hiding
- Teaching assistant
  - Course project design
  - Lab teaching
  - Course project grading
  - Quiz grading
- Contact with Songtao Wu
  - csstwu@comp.polyu.edu.hk

Course Presentation

- 10 minutes presentation
  - Brief introduction of the movie related with artificial intelligence
  - Brief introduction of artificial intelligence concepts, techniques, or/and systems appearing in the movie
  - Why do you choose this movie
  - What is your comment to the movie
  - What is your comment to the artificial intelligence concepts, techniques, or/and systems appearing in the movie
- 100 points and 10% for the final grading
  - 20 points: understanding of the movie
  - 20 points: understanding of the technology
  - 20 points: comment to the movie
  - 20 points: comment to the technology
  - 20 points: presentation organization

Course Presentation

- Introduction to a movie related with artificial intelligence
  - Group work with 1 – 4 person(s) each group
  - Every group should work on different movies
  - No requirement of report
  - Send the presentation slides to TA after the presentation
- Send email to TA including the following information
  - Group member name and student ID
  - Movie name
  - Before Oct. 13 2015
- Presentation date
  - Oct. 27 2015 at 15: 30
  - The confirmed presentation order is announced on Oct. 20
- TA's email
  - csstwu@comp.polyu.edu.hk

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