Introduction to Artificial Intelligence

Faculty of DS & AI
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Business AI Lab

About

- Bio
  - 02.2025: *PhD., Chonnam National Univ., Korea.*
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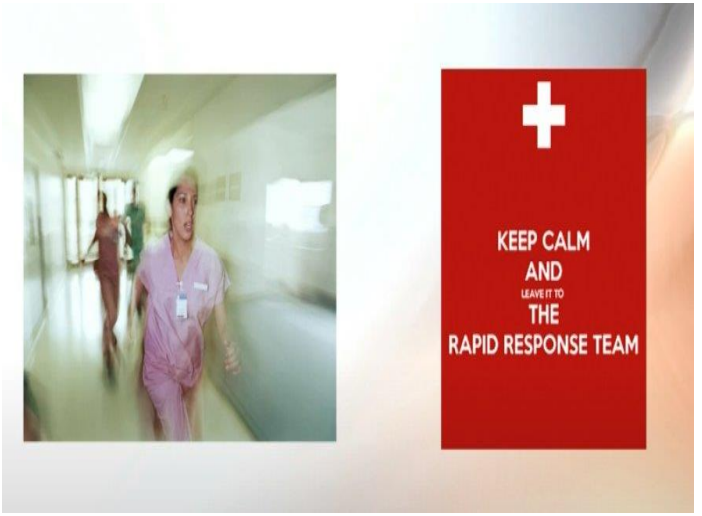
- Research Interest
  - Computer vision
  - ML/ AI
  - Time-series analysis

Person Re-identification

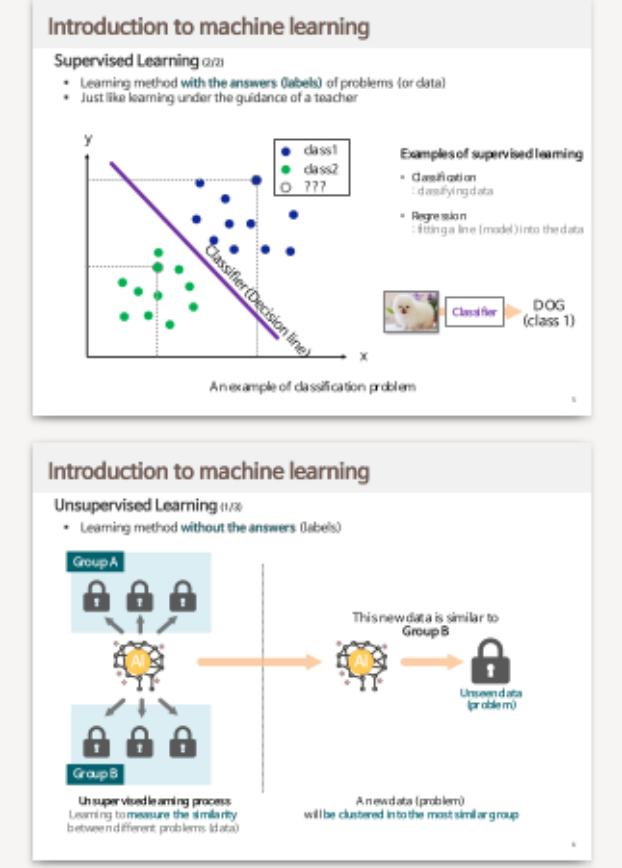
Smart Aquaculture



Clinical Emergency Medicine

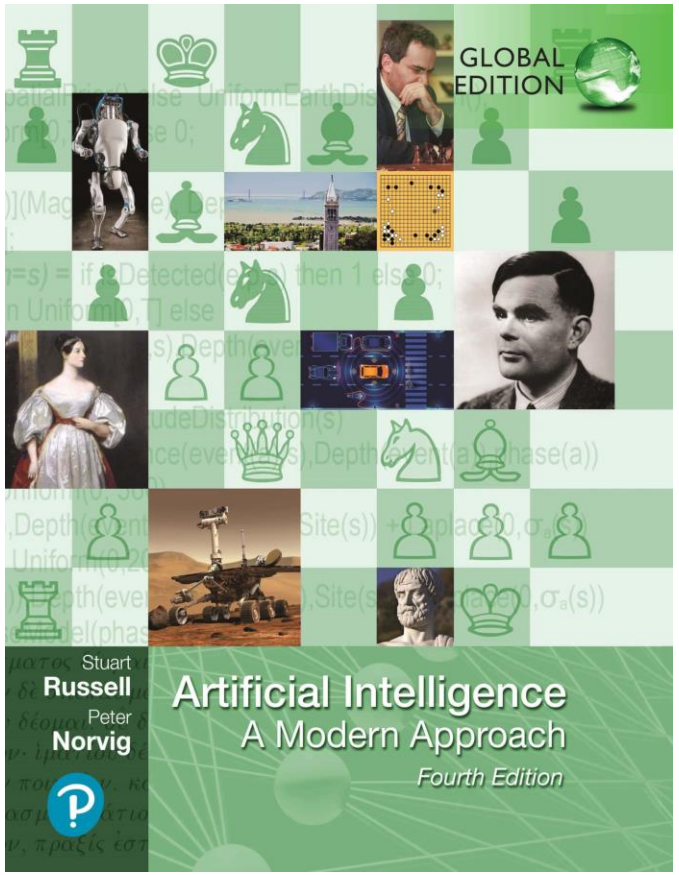
Textbooks

- Main



PPT

- Supplementary



E-book

- This class is...

VIE	ENG

70% English

Lecture Overview

- Course Introduction
  Objectives & assessment methods
- What is AI
  Definitions & approaches
- History of AI
  From 1950 to present
- Current AI Applications
  Current AI Applications
- Summary & Next steps
  Summary & Next Steps

Learning Objectives

Learning Objectives

19.2 Supervised Learning . . . 671
19.3 Learning Decision Trees . . . 675
19.4 Model Selection and Optimization . . . 683
19.5 The Theory of Learning . . . 690
19.6 Linear Regression and Classification . . . 694
19.7 Nonparametric Models . . . 704
19.8 Ensemble Learning . . . 714
19.9 Developing Machine Learning Systems . . . 722
Summary . . . 732
Bibliographical and Historical Notes . . . 733

20 Knowledge in Learning 739
20.1 A Logical Formulation of Learning . . . 739
20.2 Knowledge in Learning . . . 747
20.3 Explanation-Based Learning . . . 750
20.4 Learning Using Relevance Information . . . 754
20.5 Inductive Logic Programming . . . 758
Summary . . . 767
Bibliographical and Historical Notes . . . 768

21 Learning Probabilistic Models 772
21.1 Statistical Learning . . . 772
21.2 Learning with Complete Data . . . 775
21.3 Learning with Hidden Variables: The EM Algorithm . . . 788
Summary . . . 797
Bibliographical and Historical Notes . . . 798

Assessment Methods

- Class Participation: 30%
  Homework, group presentation, etc.
- Midterm Exam: 30%
  Could be project (flexible)
- Final Exam: 40%
  Focus knowledge

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What is Artificial Intelligence?

> *"Artificial Intelligence is the study of how to make computers do things at which, at the moment, people are better."*
>
> — *Elaine Rich, 1983*

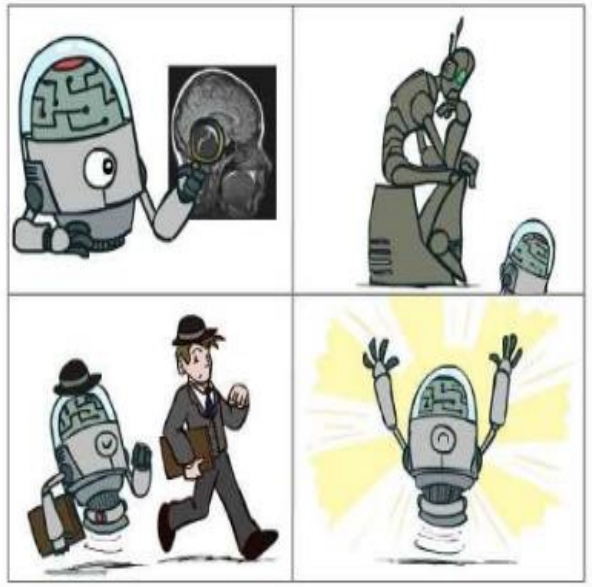
Artificial Intelligence is the field of study that focuses on creating computer systems capable of performing tasks that typically require human intelligence.

Core Concepts:

- Learning from experience
- Solving complex problems
- Pattern recognition
- Intelligent decision making

Four Categories of AI

Think like people



Think rationally

Act like people

Act rationally

Acting Humanly

Systems that act like humans

Turing Test: Systems that behave indistinguishably from humans

Examples: Chatbots, virtual assistants

Thinking Humanly

Systems that think like humans

Cognitive Modeling: Modeling the human thought process

Examples: Artificial neural networks

Thinking Rationally

Systems that think rationally

Laws of Thought: Using logic and reasoning

Examples: Expert systems, logic programming

Acting Rationally

Systems that act rationally

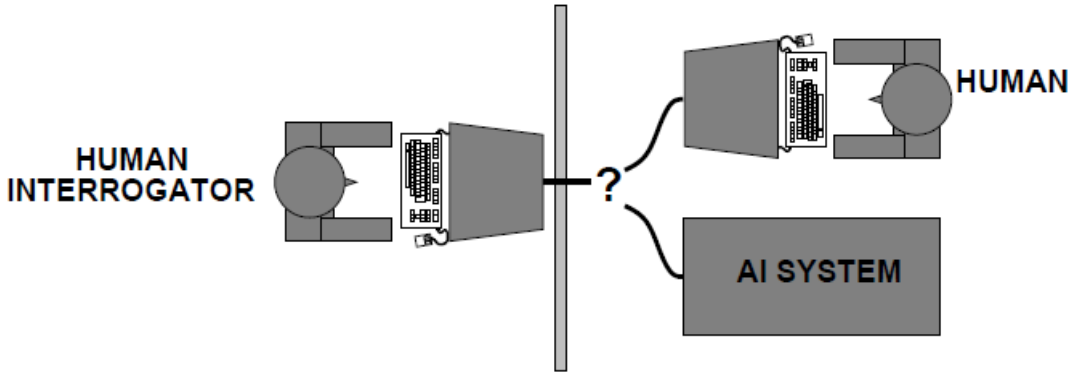
Rational Agents: Acting optimally in an environment

Examples: Autonomous vehicles, game-playing AI

(1) 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



- 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, reasoning, language understanding, learning
- Total Turing test: computer vision, robotics

(2) Thinking Humanly – Cognitive Science

Cognitive Revolutions in 1960s

Get inside: introspection, psychological experiments, brain imaging

Requires scientific theories of internal activities of the brain
- What level of abstraction? "Knowledge" or "circuits"?
- How to validate? Requires
  1) Predicting and testing behavior of human subjects (top-down)
  or 2) Direct identification from neurological data (bottom-up)

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 anything resembling human-level general intelligence**. Hence, all three fields share one principal direction!

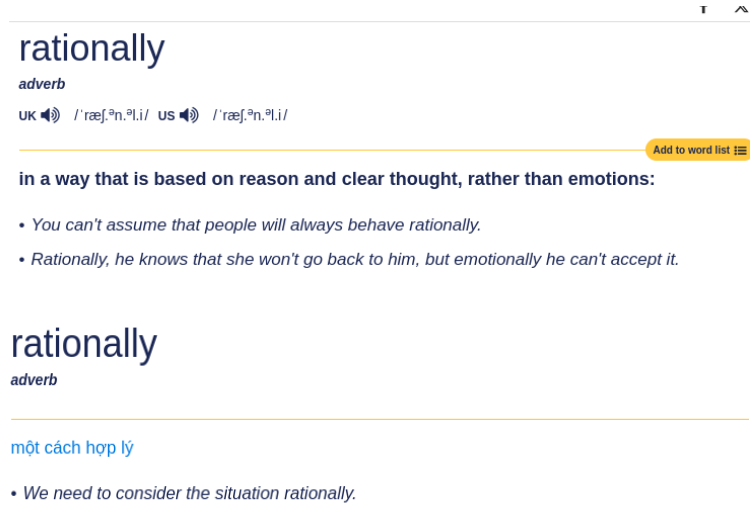
(3) Thinking Rationally – Laws of Though

Aristotle Syllogism – "Right Thinking"

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

Logicist tradition withi AI hopes to build on such programs to create intelligent systems.

Problems:
1) Not all intelligent behavior is mediated by logical deliberation
2) What is the purpose of thinking? What thoughts should I have out of all the thoughts (logical or otherwise) that I could have?

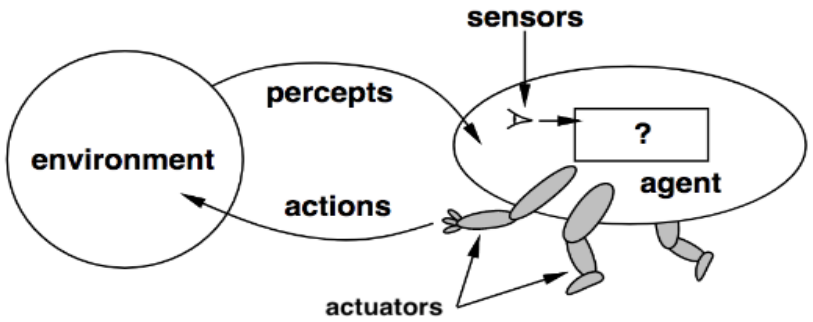


(4) Acting Rationally – Intelligent Agent

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



Rational Agent

An agent is a function from percept histories to actions:

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

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

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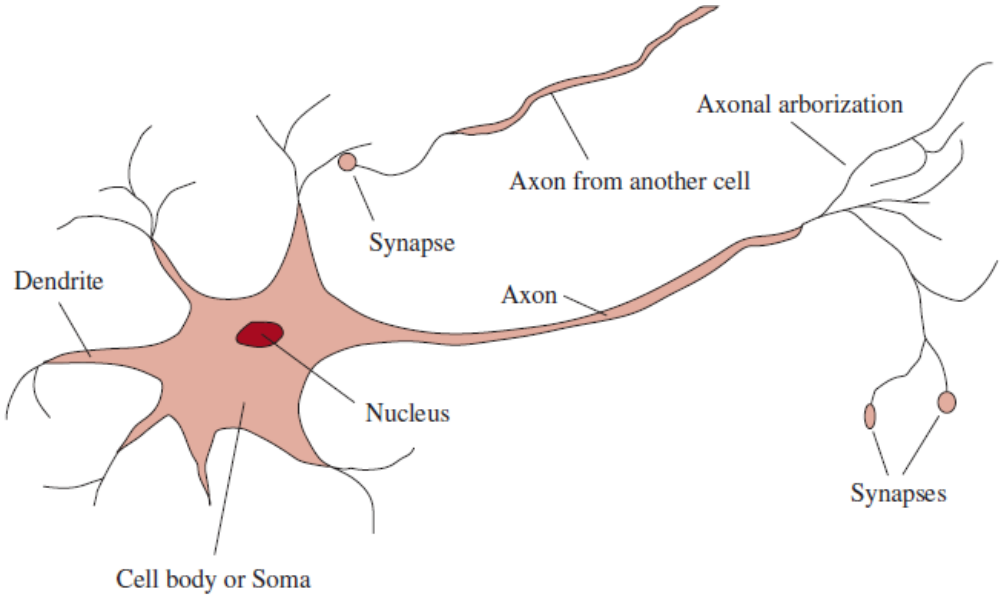
The Foundations of AI

Philosophy	logic, methods of reasoning
	mind as physical system
	foundations of learning, language, rationality
Mathematics	formal representation and proof
	algorithms, computation, (un)decidability, (in)tractability
	probability
Psychology	adaptation
	phenomena of perception and motor control
	experimental techniques (psychophysics, etc.)
Economics	formal theory of rational decisions
Linguistics	knowledge representation
	grammar
Neuroscience	plastic physical substrate for mental activity
Control theory	homeostatic systems, stability
	simple optimal agent designs

The Foundations of AI

Neuroscience vs Deep Learning

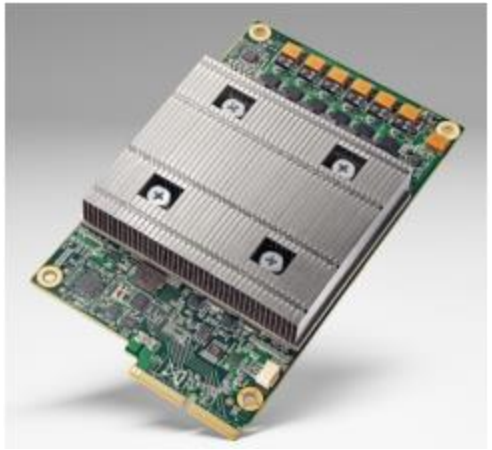


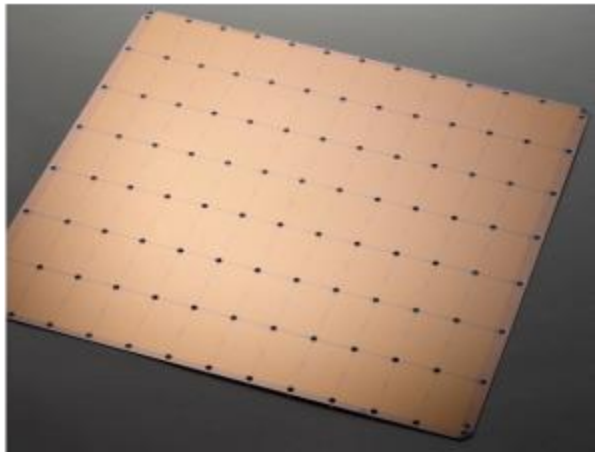
	Supercomputer	Personal Computer	Human Brain
Computational units	10^6 GPUs + CPUs	8 CPU cores	10^6 columns
	10^{15} transistors	10^{10} transistors	10^{11} neurons
Storage units	10^{16} bytes RAM	10^{10} bytes RAM	10^{11} neurons
	10^{17} bytes disk	10^{12} bytes disk	10^{14} synapses
Cycle time	10^{-9} sec	10^{-9} sec	10^{-3} sec
Operations/sec	10^{18}	10^{10}	10^{17}

The Foundations of AI

Computer Engineering

- Moore's law: performance doubled every 18 months (1960~2012)
- GPU, TPU, WSE: performance doubled every 100 days (2012~)
  > a full day training in 2014 → 2 minutes training in 2018





- Quantum Computing
  > far greater accelerations

The History of AI

The gestation (1943~1956)

- 1943, MeCulloch & Pitts, model of neurons
- 1946, Hebb, Hebbian learning for updating the connection strengths
- 1950, Alan Turing, Turing Test, machine learning, reinforcement learning
- 1956, McCarthy et al., Dartmouth College, 2-months Workshop

  > birth of 'Artificial Intelligence'

AI@50 conference (2005) :
Trenchard More,
John McCarthy, Marvin Minsky, Oliver SelfridgeRay Solomonoff

The History of AI

Early enthusiasm, great expectations (1952~1969)

- Logic Theroist, General Problem Solver, Playing checkers
- McCarthy: LISP(1958), Time sharing(1959), Advice Taker
- Minsky: Microworld problmes, algebra story problems, blocks world
- Rosenblatt: Perceptron(1962)
- Block et al., Perceptron Convergence Theorem(1962)

The History of AI

A dose of reality (1966~1973)

- Friedberg, Machine evolution (genetic programming)
- Sputnix(1966), Translate Russian scientific paper
- Minsky(1969), Perceptron, limitation of perceptrons

MYCIN

Have you obtained positive cultures?

Yes.

What type of infection is it?

Primary bacteremia.

When did the symptomps first appear?

May 5

I recommend gentamycinn using a doze of ....

Expert Systems (1969~1986)

- DNEDRAL, MYCIN
- Prolog(1972)
- Minsky, Frames and OOP
- Japan(1981), 5th Generation Computer, 10-year project for a prolog machine
- McDermott(1982), R1, the first successful commercial expert system

The History of AI

The return of neural networks (1986~present)

- Rummelhart and McClelland (1986), Back-propagation learning algorithm
- Multi-layer Perceptrons
- complements the symbolic approaches

Probabilistic reasoning and machine learning (1987~present)

- Hidden Markov models, 1980s
- Bayesian networks, J. Pearl

The History of AI

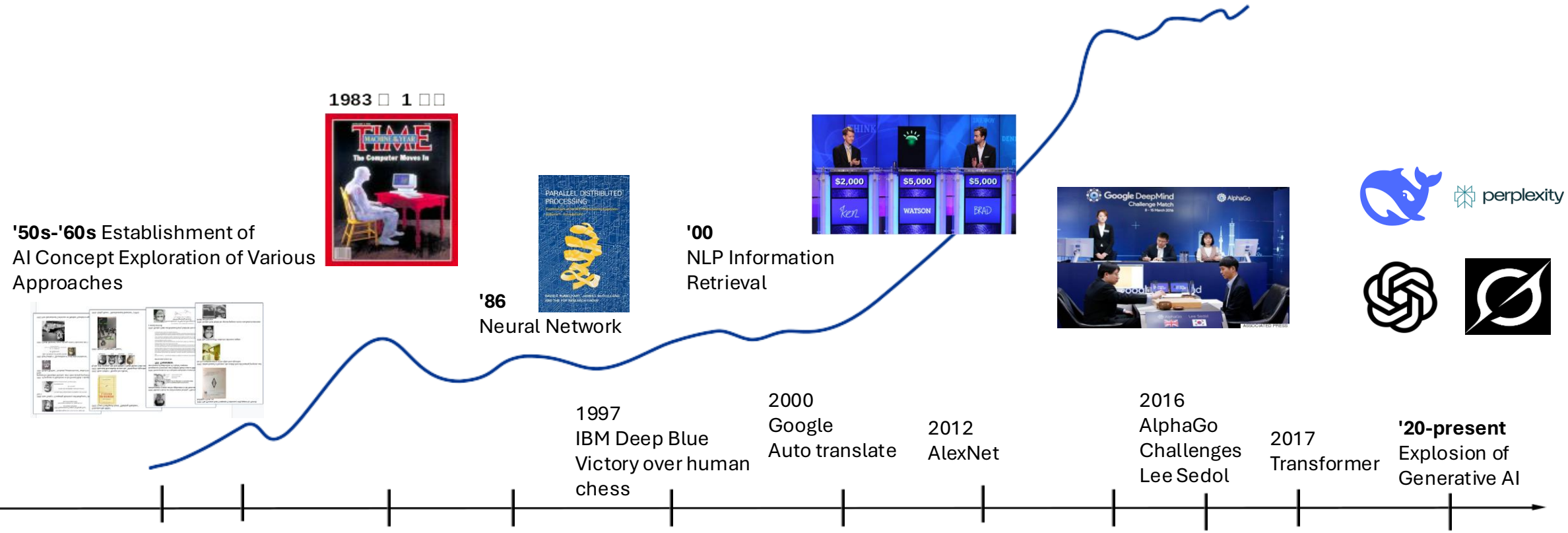
Big data (2001~present)

- Advances in computing power and IoT's with WWW → Big data
- IBM Watson, winner of Jeopardy (2011)

Deep learning (2011~present)

- Convolutional Neural Networks, LeCun(1995)
- Winner of ImageNet challenge J. Hinton(2012)
- AlphaGo, Silver et al. (2016)
- GPU, TPU, FPGA

The History of AI



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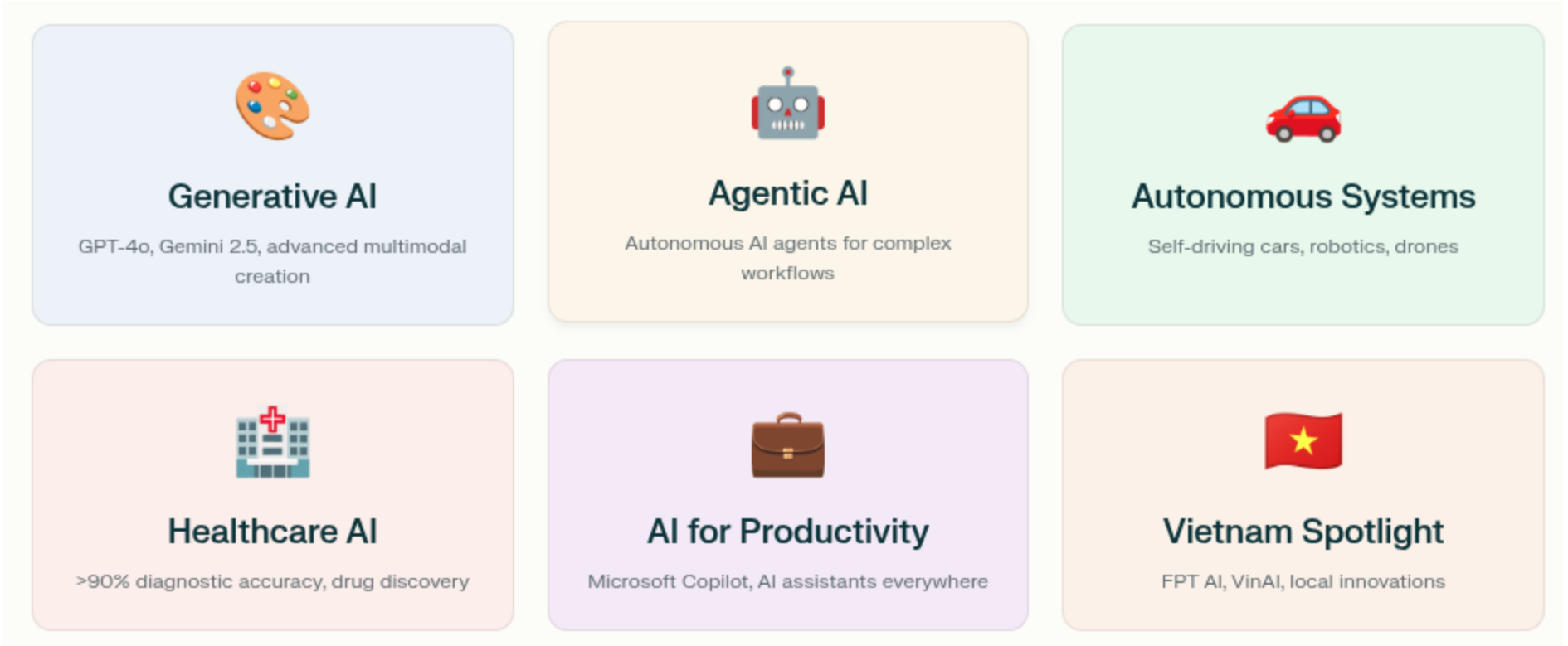
Current AI Application



Current AI Application

🎨 Generative AI Leaders 2025

📝 Text & Conversation AI

🚀 ChatGPT GPT-4o

Real-time voice, vision, text

- Multimodal conversations
- Code generation & debugging
- Real-time problem solving

🔍 Google Gemini 2.5

Advanced reasoning & integration

🧠 Claude 3

Constitutional AI with safety focus

⚡ Grok-3

Real-time X (Twitter) integration

🎬 Image & Video Generation

🎨 Midjourney v7

Photorealistic image generation

- Style consistency
- Character reference
- Brand integration

🖼️ DALL·E 3

Precise text-to-image generation

📹 OpenAI Sora

60-second video generation

- Complex scene understanding
- Physics simulation
- Temporal consistency

🎥 Google Veo

High-quality video synthesis

Current AI Application

🤖 Agentic & Productivity AI 2025

💼 Office AI Integration

📊 Microsoft Copilot

Integrated across Office suite

- Word: Document drafting & editing
- Excel: Data analysis & charts
- PowerPoint: Presentation creation
- Outlook: Email composition & scheduling

🔍 Google Workspace Gemini

Smart assistance in Docs, Sheets, Gmail

⚡ Workflow Automation

📝 Notion Q&A

AI assistant for knowledge bases

🔗 Zapier AI Agents

Autonomous workflow automation

- Multi-step task execution
- Cross-platform integration
- Natural language automation

🎤 Meeting & Coding Assistants

📹 Fathom AI

Meeting transcription & summaries

⏰ tl;dv

Video meeting insights & clips

💻 GitHub Copilot

AI pair programming

- Code completion & generation
- Bug fixing suggestions
- Multi-language support

✨ Cursor

AI-first code editor

Current AI Application

🏭 Industry Breakthroughs 2025

🏥 Healthcare AI Revolution

🔬 Diagnostic Excellence >90%

- **Cambridge Coeliac AI:** Gut disease detection
- **Early Cancer Detection:** Radiology AI systems
- **Pathology AI:** Tissue analysis automation
- **Drug Discovery:** Molecule design acceleration

🚗 Autonomous Transportation

🚕 Waymo One Robotaxi
Fully autonomous rides in major cities

🚙 Tesla FSD v12
Full Self-Driving capabilities

- End-to-end neural networks
- City street navigation
- Real-time decision making

🤖 Boston Dynamics Spot
Industrial robotics & inspection

🇻🇳 Vietnam AI Innovations

🏢 FPT AI Agents
Enterprise automation solutions

- Conversational AI platforms
- Document processing OCR
- Customer service automation

📱 Viettel eKYC & AI Camera
Identity verification & surveillance

🚗 VinAI Autonomous Driving
Self-driving research & development

Current AI Application

💬 Group Discussion: "AI Around Us"

Instructions:

1. Form groups of 4-5 students
2. Choose one discussion topic
3. Discuss for 10 minutes
4. Present key insights (3 minutes per group)

🤖 Generative AI Impact

- How has ChatGPT/AI changed your daily life?
- Which AI tool do you find most valuable?
- What are the risks of AI dependency?

🇻🇳 AI in Vietnamese Context

- What Vietnamese AI products do you use?
- How can Vietnam compete globally in AI?
- What AI careers exist in Vietnam?

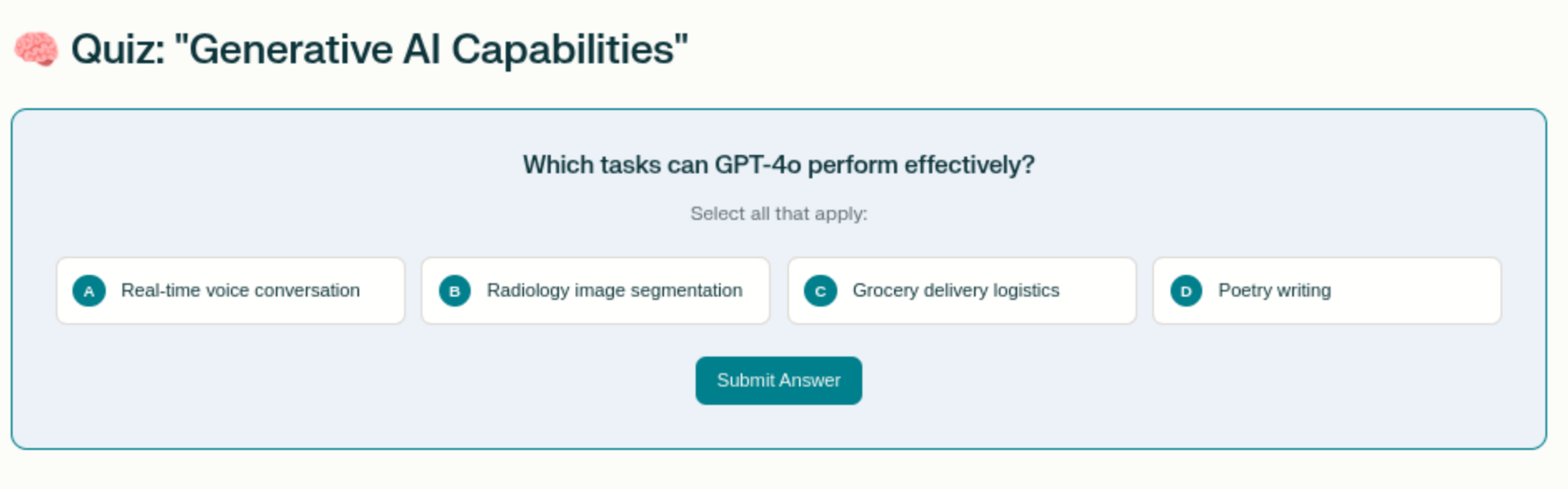
⚖️ AI Ethics & Society

- Should AI replace human teachers/doctors?
- How to prevent AI bias and misinformation?
- What rules should govern AI development?

🔮 Future of Human-AI Collaboration

- Which jobs will AI enhance vs replace?
- How to stay relevant in an AI world?
- What skills should students focus on?

Current AI Application



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Summary of key points

AI Definition

Four approaches: Acting/Thinking Humanly vs Rationally

Historical Evolution

From symbolic AI to modern generative AI breakthroughs

2025 AI Landscape

GPT-4o, autonomous systems, 90%+ diagnostic accuracy

Reading Assignment

📚 Required Reading

Russell & Norvig "AI: A Modern Approach" 4th Edition

For Next Class:

- **Chapter 3:** Solving Problems by Searching
- Focus on: Problem-solving agents, search algorithms
- Pay attention to: State space, search strategies

💡 Reading Tips

📝 Take Notes
Write down key concepts and questions

🤔 Think Critically
Consider real-world applications

💬 Discuss
Talk with classmates about concepts

🔍 Research
Look up unfamiliar terms

Thank you!

You're now ready to explore the exciting world of AI!
Next Lecture: Search and Problem Solving