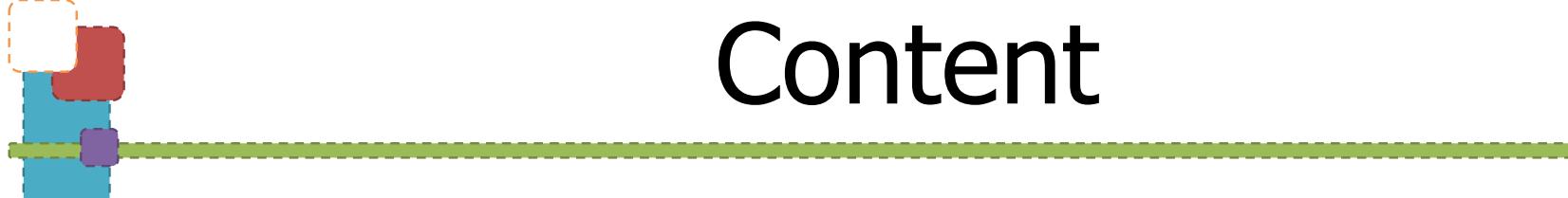


# Introduction to Artificial Intelligence

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[nongausian@hanyang.ac.kr](mailto:nongausian@hanyang.ac.kr)



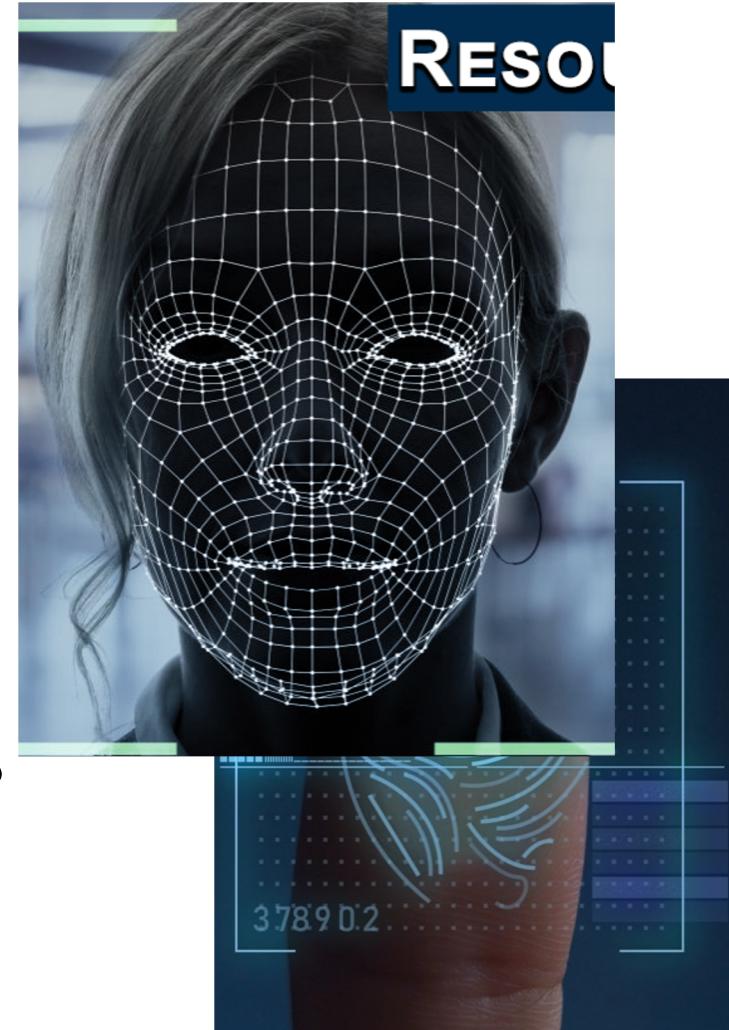
# Content

- Topics on AI
  - Importance of AI
  - Definition of AI
  - Human vs. AI
  - Brain vs. AI
  - Reason of studying AI
  - Categories of AI and machine learning



# Importance of AI In Our Lifestyle

- We already spend a large portion of our everyday life interacting with smart systems
  - Biometric e.g., facial recognition
  - Speech recognition
  - Coding
- AI is the heart of all this



# Claude 3.5 AI Game Development





# What is AI(Artificial Intelligence)

- **AI is defined by how it perceives intelligence**
  - **Broad and optimistic definition:** A machine performing a task that requires intelligence
  - **Narrow and skeptical definition:** A machine can closely mimic human intelligence

Is AlphaGo is an AI? Give optimistic and skeptical answers.



Optimistic: Alphago is an AI

Skeptical: Alphago is not an AI

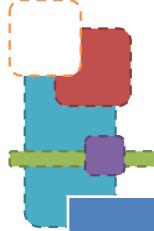


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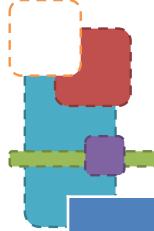


Is ChatGPT is an AI?



# AI vs. Algorithm

	정의	비교
A.I.	<ul style="list-style-type: none"><li>AI는 일반적으로 인간의 지능이 필요한 작업을 수행할 수 있는 시스템</li><li>자연어 이해, 패턴 인식, 문제 해결, 의사 결정 등</li></ul>	<ul style="list-style-type: none"><li>AI는 인식, 추론, 학습, 자연어 상호작용 등 인간의 능력을 모방하거나 증강하는 데 중점</li><li>AI는 기계가 인간과 유사한 지능을 모방하거나 시뮬레이션할 수 있도록 함</li></ul>
ALG.	<ul style="list-style-type: none"><li>문제를 해결하거나 작업을 완료하기 위한 단계별 절차 또는 공식</li><li>알고리즘은 간단할 수도 있고(예: 리스트 정렬), 복잡할 수도 (예: 역전파 알고리즘 - 딥러닝 모델을 학습시키기 위한 알고리즘)</li></ul>	<ul style="list-style-type: none"><li>인간이 할 수 없는 작업에만 국한되지 않으며, 인간이 수작업으로 수행하기에는 비현실적인 작업을 대규모로 수행할 수 있도록 설계</li><li>알고리즘은 기계가 단순하거나 복잡한 다양한 작업을 수행할 수 있게 하는 기본 메커니즘</li><li>인간이 수행하는 작업일 수도 있고, 인간이 수작업으로는 수행하기 어려운 작업일 수도</li></ul>



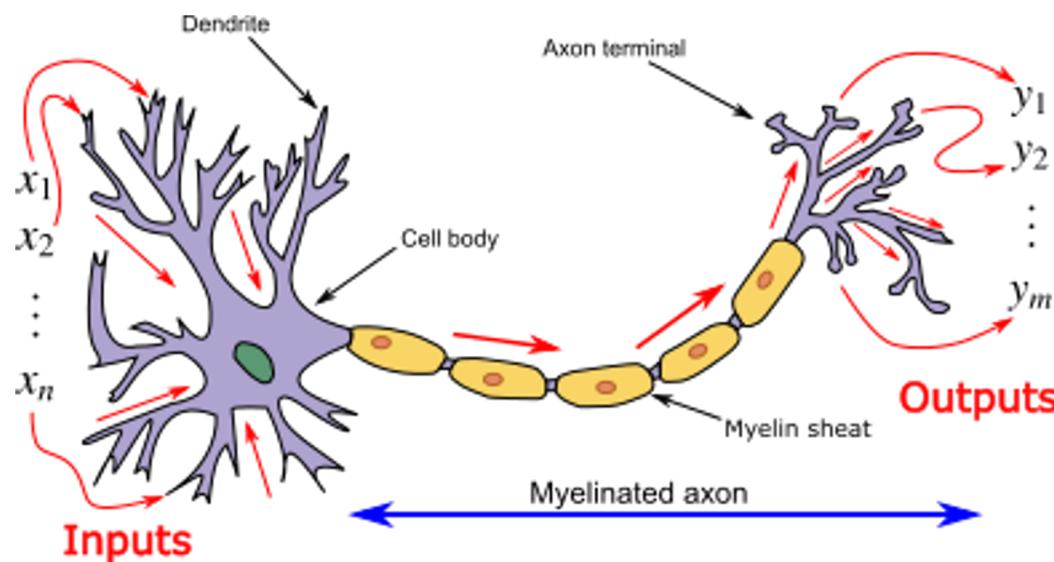
# Benefit of Using AI and Algorithm

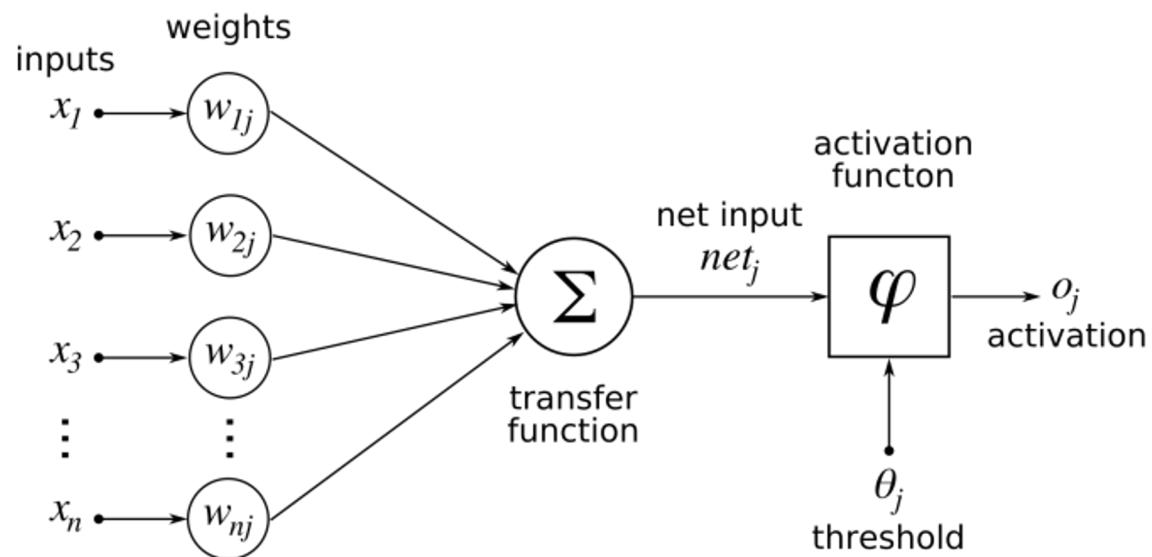
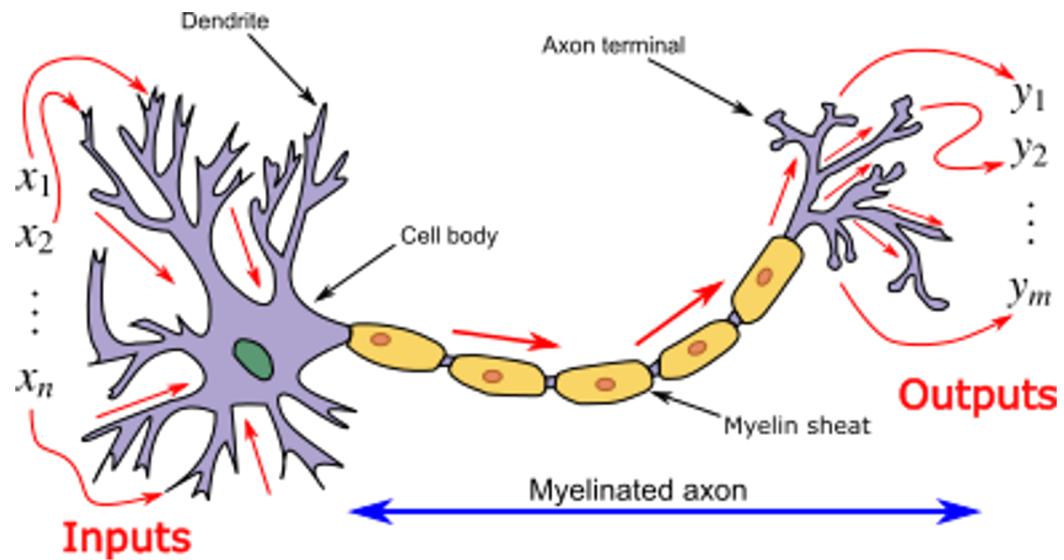
	vs. 인간	이점
A.I.	<ul style="list-style-type: none"><li>반복적이거나 시간이 많이 소요되거나 복잡한 작업을 자동화하여 인건비를 절감</li><li>예를 들어, AI는 챗봇을 통해 고객 서비스를 처리하거나, 데이터 입력을 자동화하거나, 복잡한 의사결정 과정을 지원함으로써 대규모 인력의 필요성을 줄일 수</li></ul>	<ul style="list-style-type: none"><li>비용을 절감하고 효율성을 높일 수 있으며, 특히 반복적이거나 복잡하거나 데이터 집약적인 작업에서 인간의 노동을 대체</li></ul>
ALG.	<ul style="list-style-type: none"><li>대규모 데이터 처리, 실시간 분석 또는 복잡한 계산을 포함하여, 인간이 수작업으로 수행하기에 비현실적이거나 불가능한 작업을 가능하게</li><li>예를 들어, 알고리즘은 검색 엔진을 구동하고, 공급망을 최적화하며, 대량의 금융 거래를 즉시 처리</li><li>이러한 작업은 인간이 수작업으로 시도할 경우 너무 복잡하거나 시간이 많이 걸리거나 오류가 발생하기 쉬울 수</li></ul>	<ul style="list-style-type: none"><li>대량의 데이터를 처리하거나 고속 처리가 필요한 작업에서, 인간이 처리하기 어렵거나 불가능한 작업을 가능하게</li></ul>

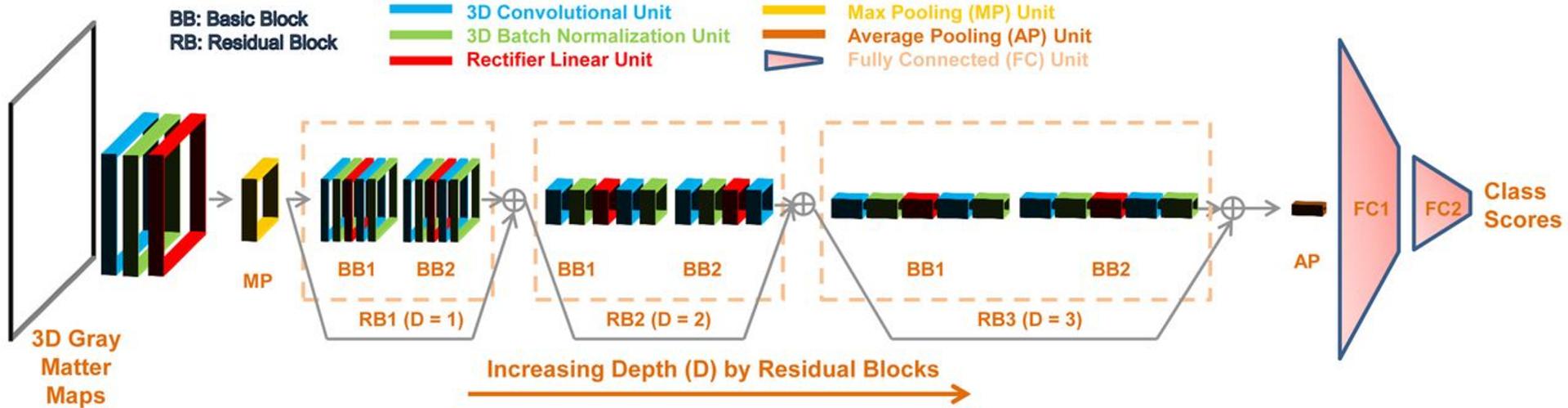
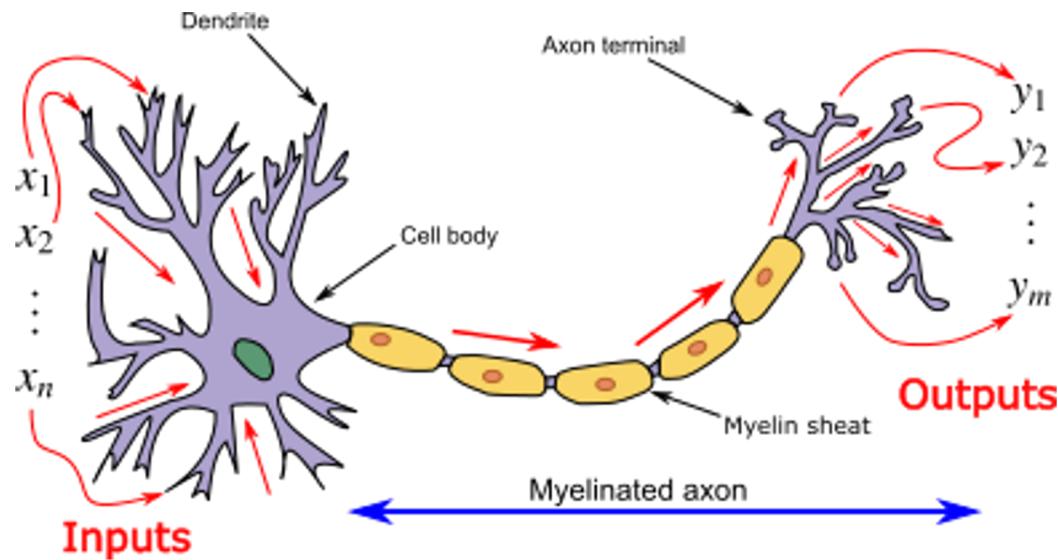


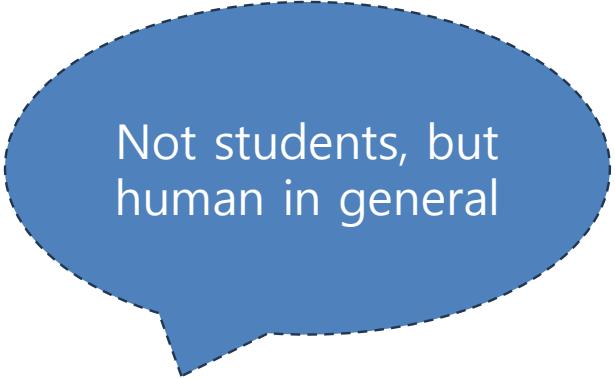
# Brain and AI

- AI는 일면 뇌를 연구하는 과학의 한 분야
- 과학자들은 AI를 통해 신경과학과 같은 분야에서 영감을 받아 뇌의 일부 시스템과 메커니즘을 컴퓨팅에 적용









Not students, but  
human in general

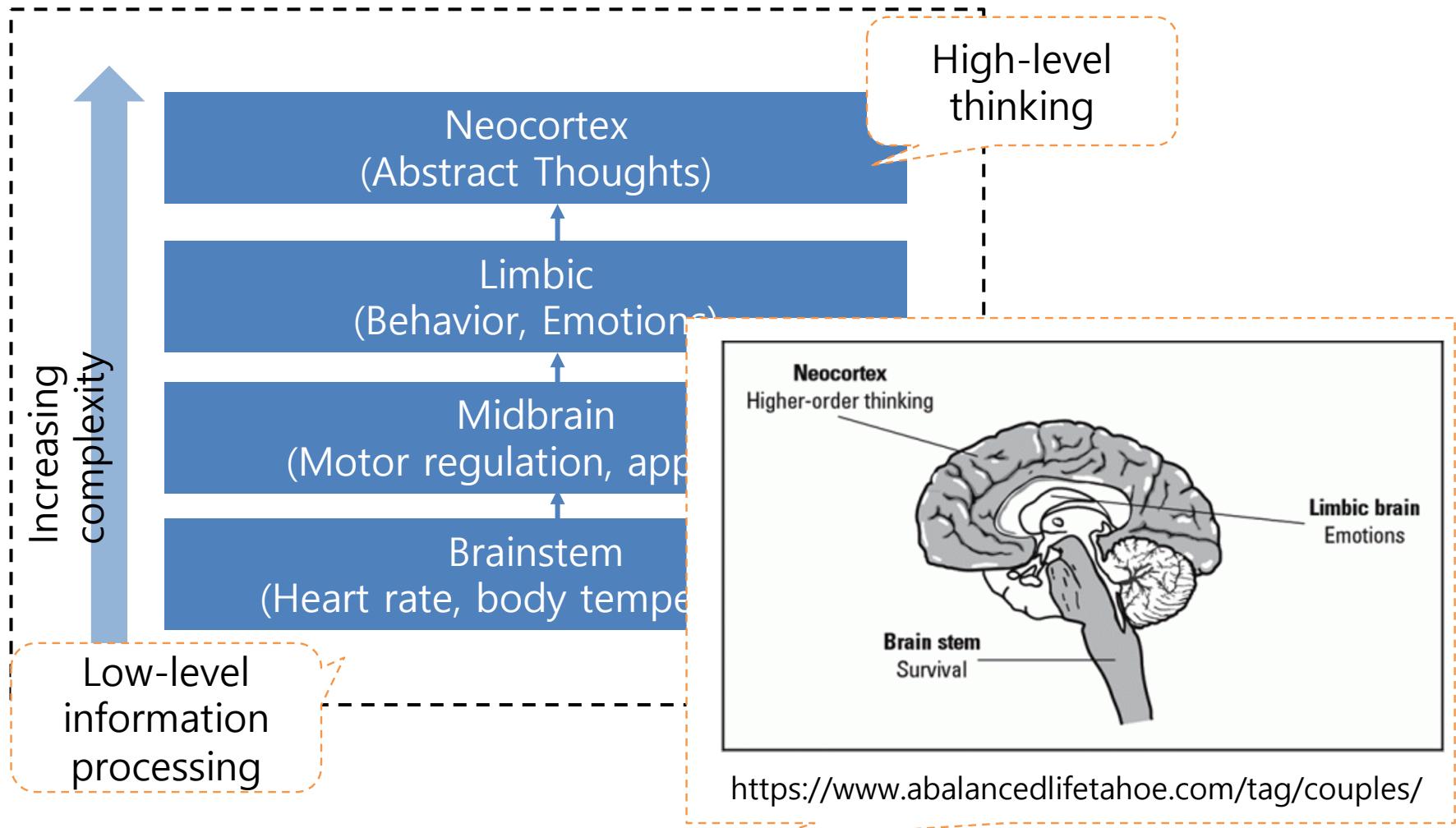
## **WHY DO WE NEED TO STUDY AI**

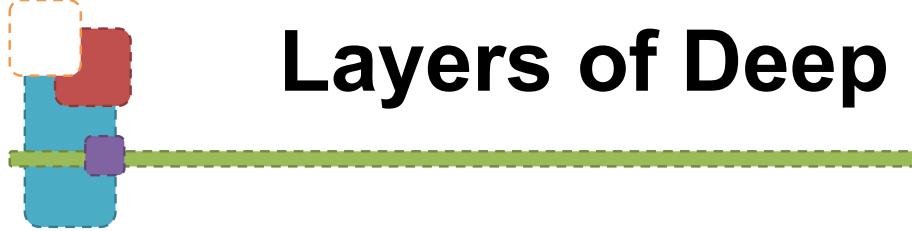


# 1) To Understand the Intelligence

- AI와 신경과학의 교차점
  - 인공지능 신경망이 인간 뇌의 작동 방식을 시뮬레이션하고 이해하고 탐구하는 데 강력한 도구로 사용
  - 이러한 연구들은 우리의 뇌에 대한 지식을 향상시킬 뿐만 아니라, 보다 정교하고 뇌와 유사한 AI 시스템 개발에도 기여

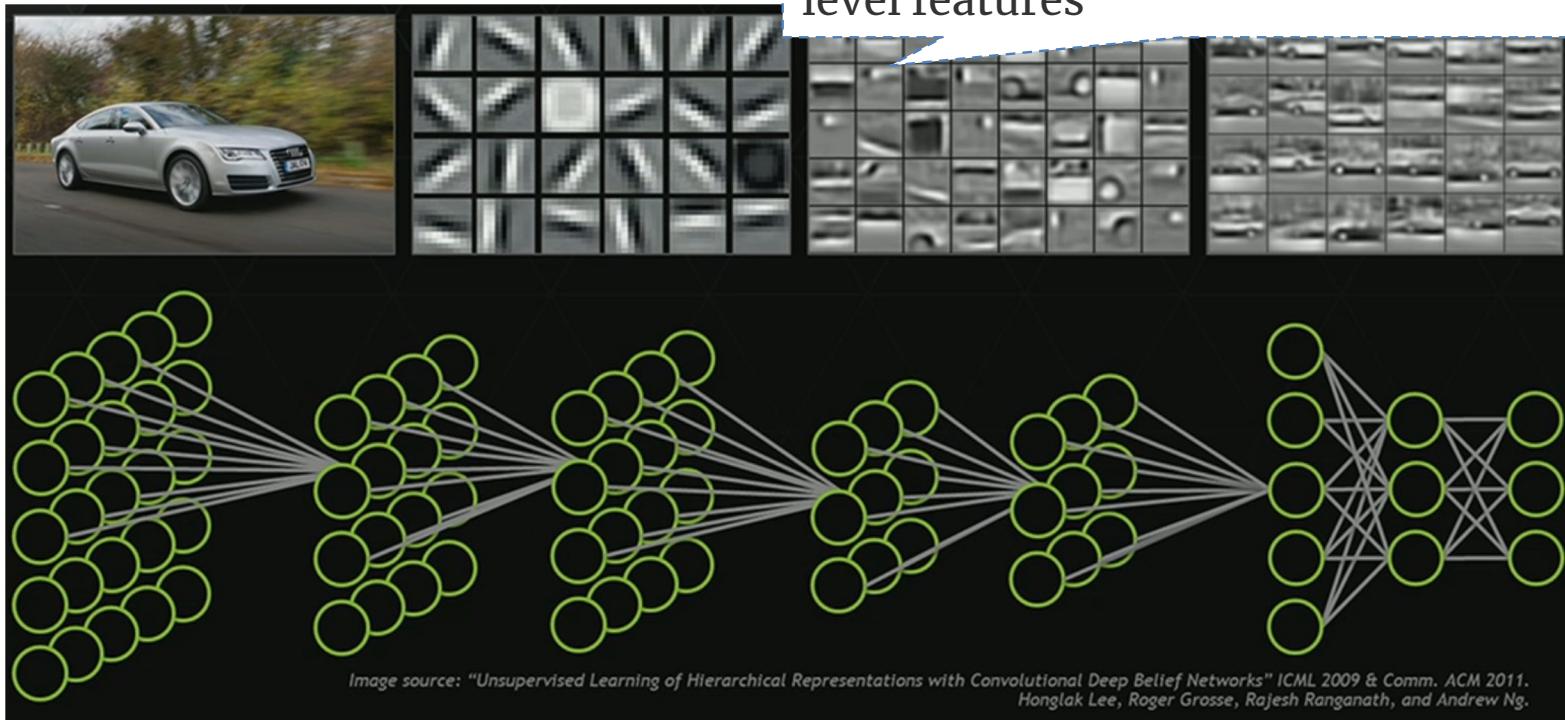
# Layers of Human Brain





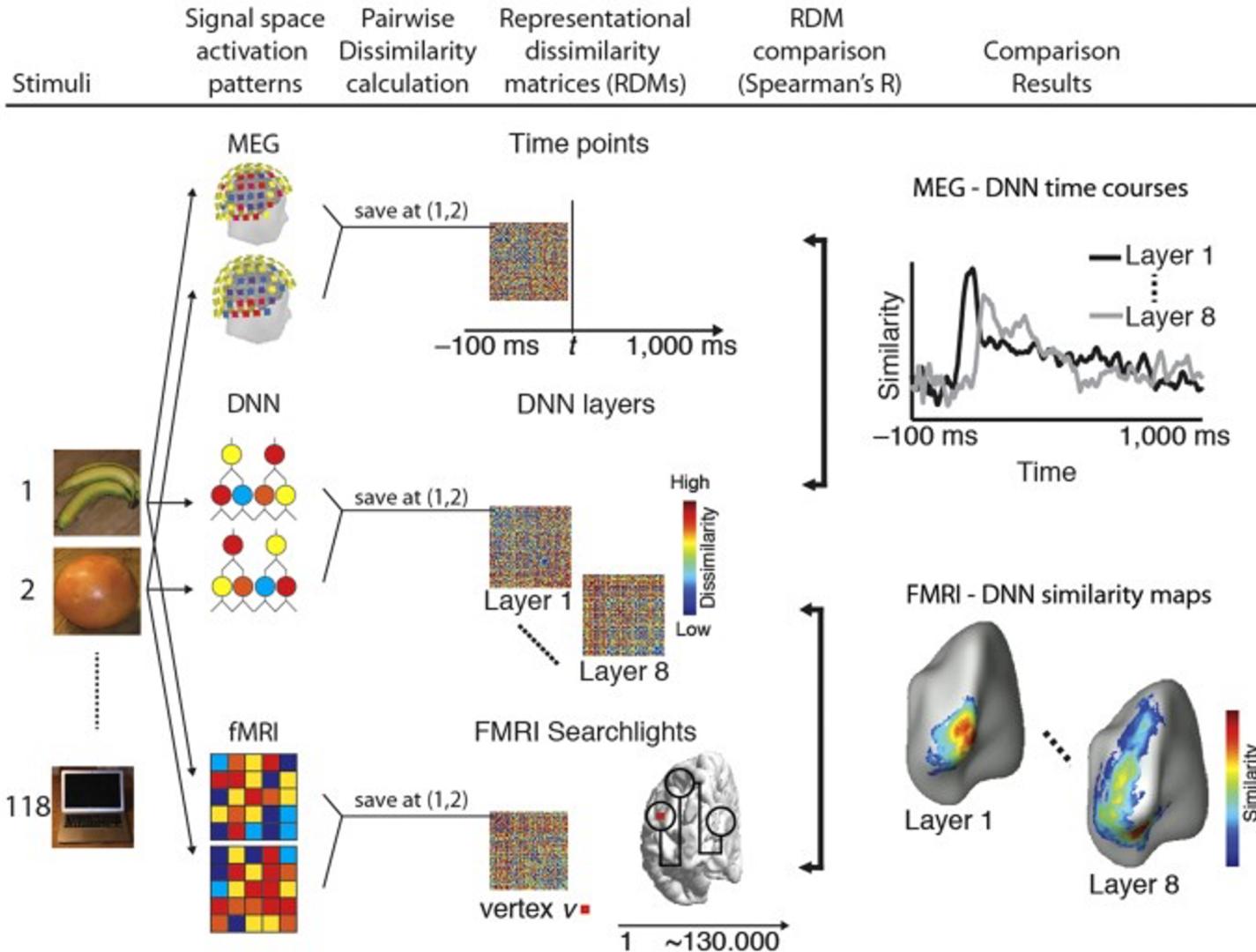
# Layers of Deep Neural Networks

The networks learns progressively higher-level features until the final layer, which acts as a linear classifier over these high-level features



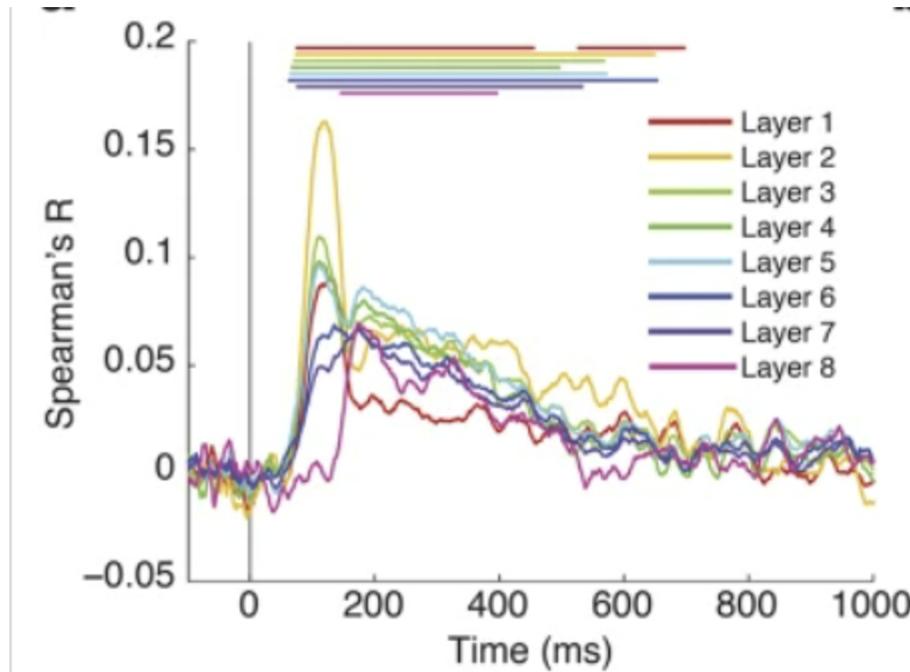
[https://gradientscience.org/robust\\_reps/](https://gradientscience.org/robust_reps/)

# Similarity Between Brain and Deep Neural Networks





# Similarity Between Brain and Deep Neural Networks



Cichy, R., Khosla, A., Pantazis, D. et al. Comparison of deep neural networks to spatio-temporal cortical dynamics of human visual object recognition reveals hierarchical correspondence. *Sci Rep* **6**, 27755 (2016). <https://doi.org/10.1038/srep27755>



## 2) Dealing with Data

- One of the main reasons we want to study AI is to automate things

In the real world, human can't deal with the following	Machine can be designed the following
Deal with <b>huge</b> amount of data	<u>Handle large amounts of data</u> in an efficient way
Data originates from <b>multiple sources</b> simultaneously, which is unorganized and chaotic	<u>Process data simultaneously</u> from multiple sources without any lag
Knowledge data must <b>be updated constantly</b> because the data itself keeps changing	Learn from new data and update constantly <u>using the right learning algorithms</u>
Sensing and actuation must be processed <b>in real-time</b>	<u>Continue with tasks</u> without getting tired or needing breaks



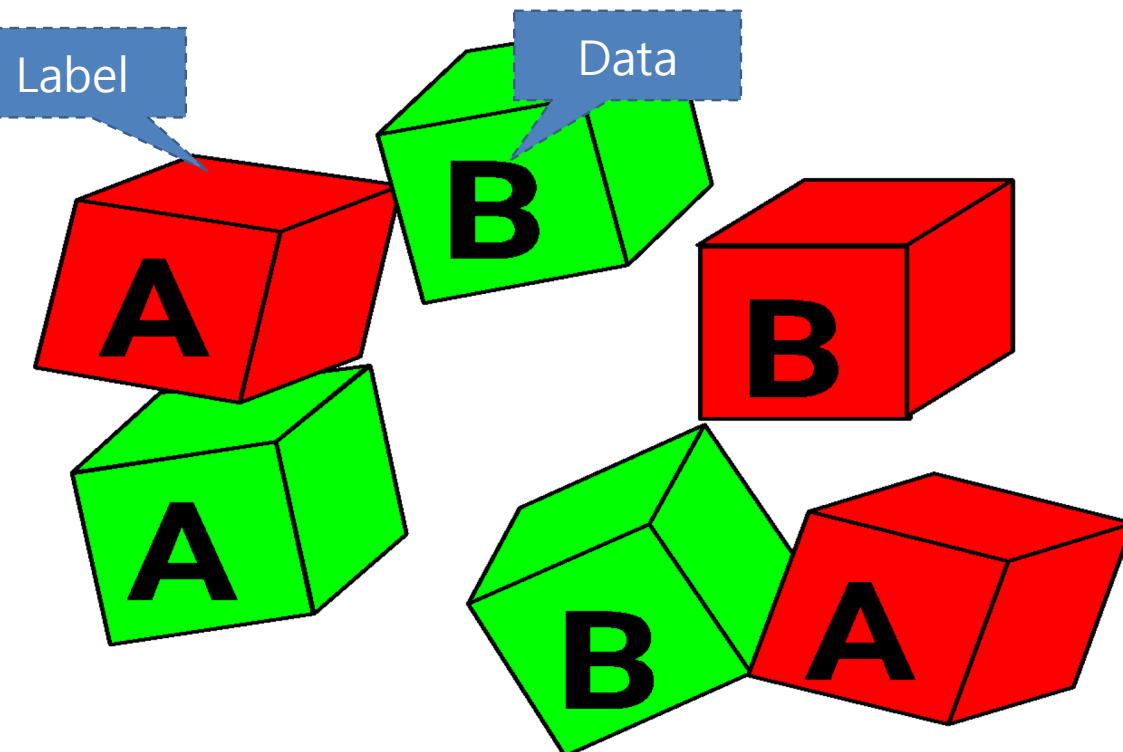
# Branches of Machine Learning

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- There are several ways to classify the different branches of AI:
  - Supervised learning vs. unsupervised learning vs. reinforcement learning vs. ...
  - By human function:
    - Machine vision
    - Speech recognition
    - Text to speech
    - Natural language processing
    - Machine translation



# Supervised Learning

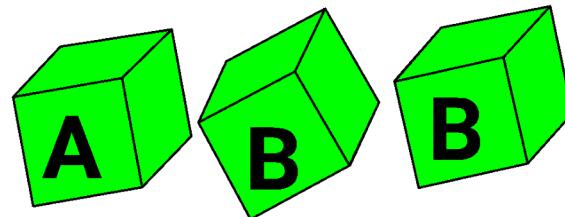
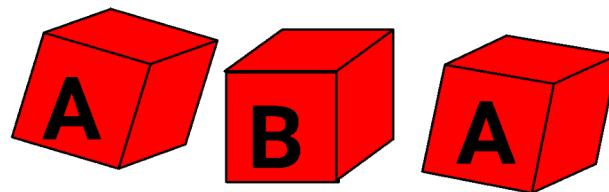


$$f(\boxed{A})$$



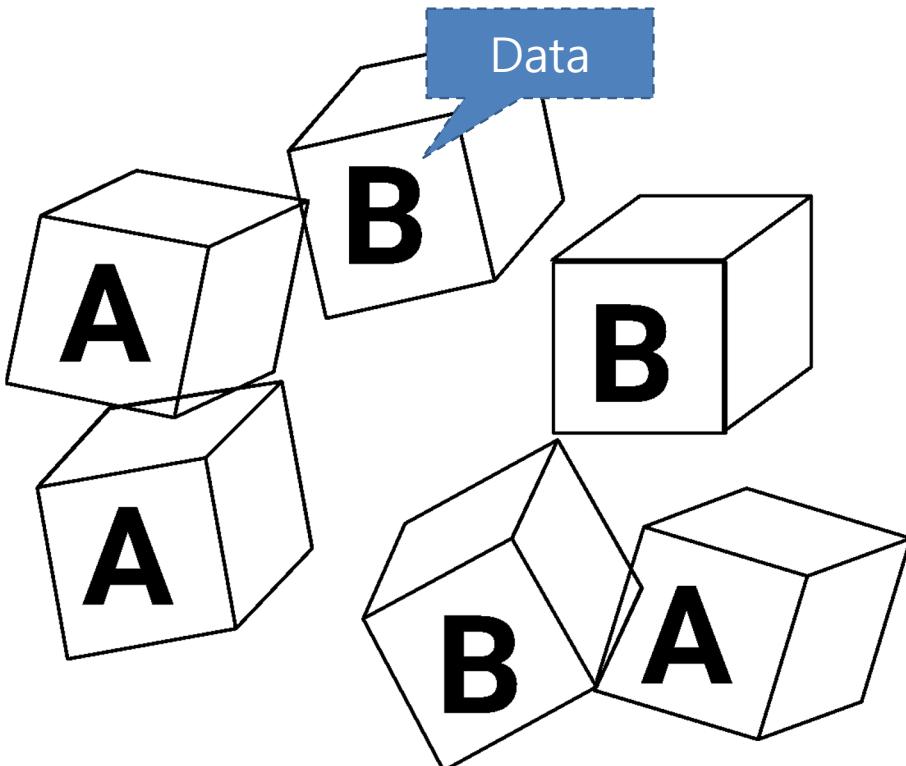
# Classification

Classification = If the data is A, then classify it as RED  
Otherwise, it is GREEN





# Unsupervised Learning

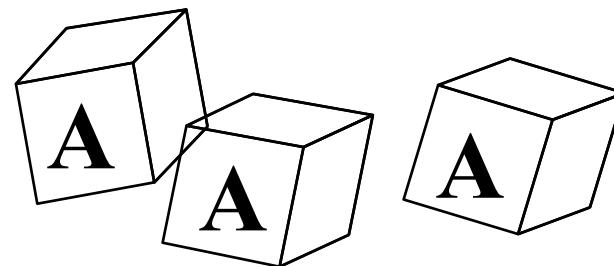
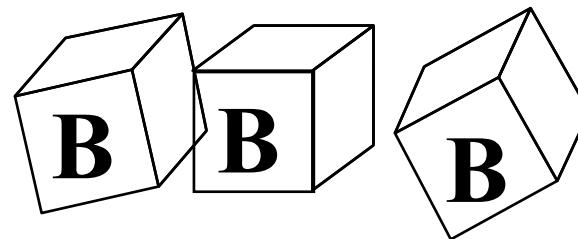


$$d(A, B)$$



# Clustering

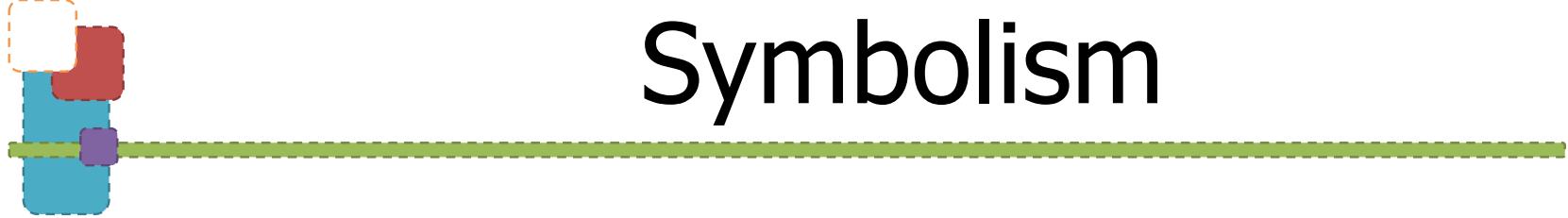
Clustering = group objects with similar data



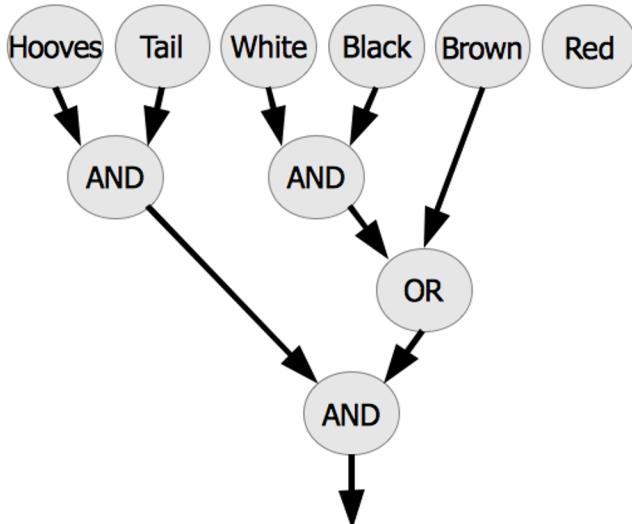


# Five Tribes of AI

Tribe	Origins	Dominant algorithm
Symbolists	Logic and Philosophy	Inverse deduction
Connectionists	Neuroscience	Backpropagation
Evolutionarist	Biology	Genetic programming
Bayesians	Statistics	Expectation-Maximization Algorithm



# Symbolism

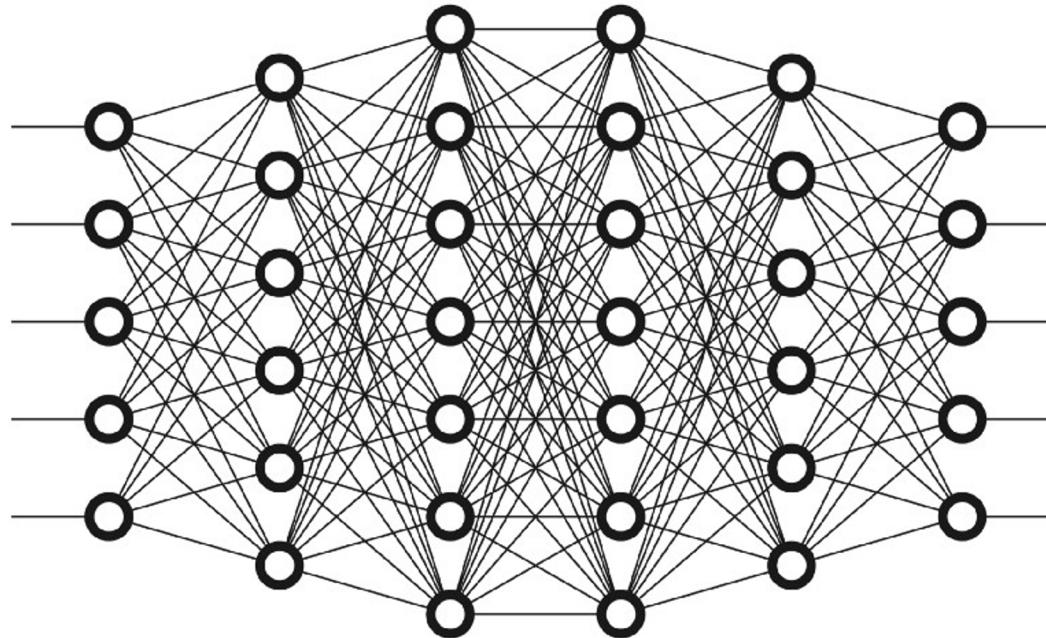


Chapter 6.  
Logic Programming

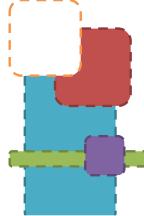
$$(Hooves \wedge Tail) \wedge ((White \wedge Black) \vee Brown) \rightarrow Horse$$



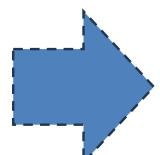
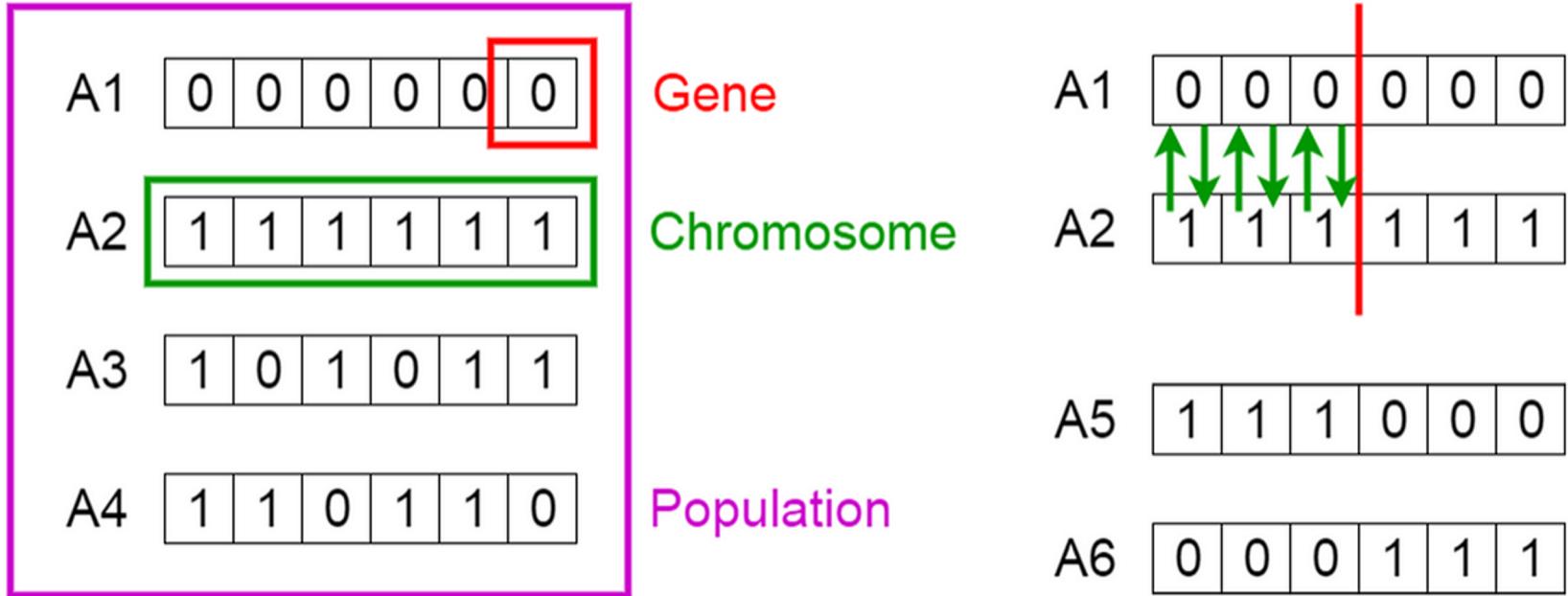
# Connectionism



 Chapter 9.  
Artificial Neural Networks and  
Deep Learning

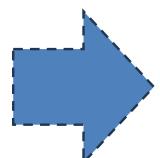
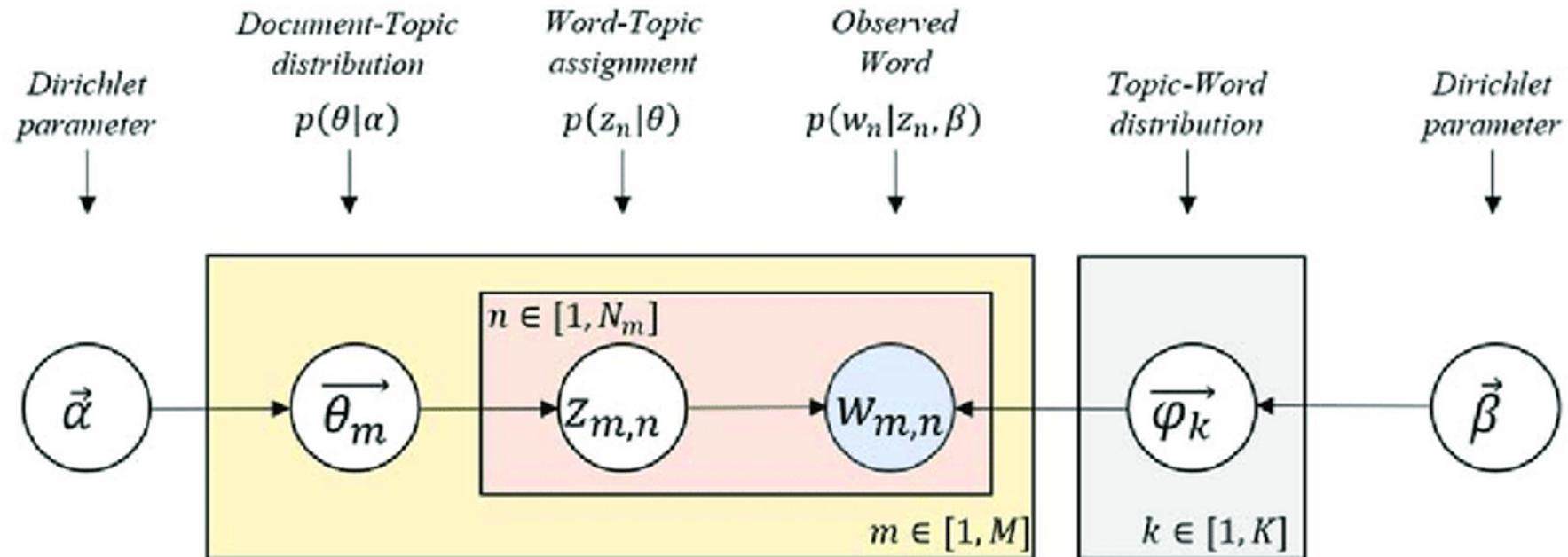


# Evolutionalism



(대학원)인공지능융합학과  
유전알고리즘

# Bayesianism



(대학원)인공지능융합학과  
빅데이터처리



# Branches of AI

- Traditional classification
  - Machine learning and pattern recognition
  - Logic-based AI
  - Search / heuristic search
  - Knowledge representation
  - Planning
  - Expert system
  - Genetic programming