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Hands on Tips for Deep Learning & Case-Based Reasoning Solution Development

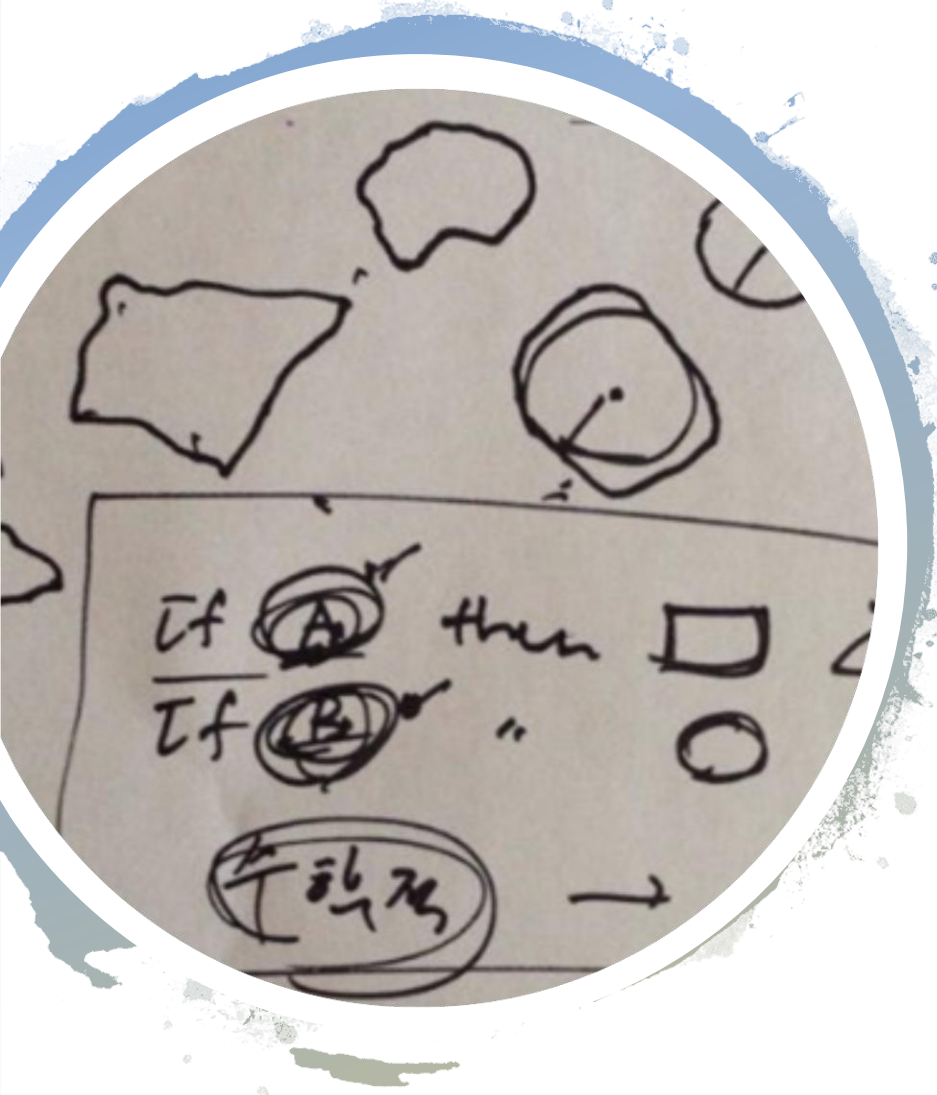
AI, Machine Learning, Deep Learning
Machine Learning vs Classical Programming
Machine Learning & Deep Learning Core Concepts
Why Deep Learning is Popular
Tensorflow.js
What is CBR (Case-Based Reasoning)
CBR 4R Process
Car Repair Example
CBR Agent Service
Deep Learning or CBR or Rule?
[Quiz](#)

AI ?

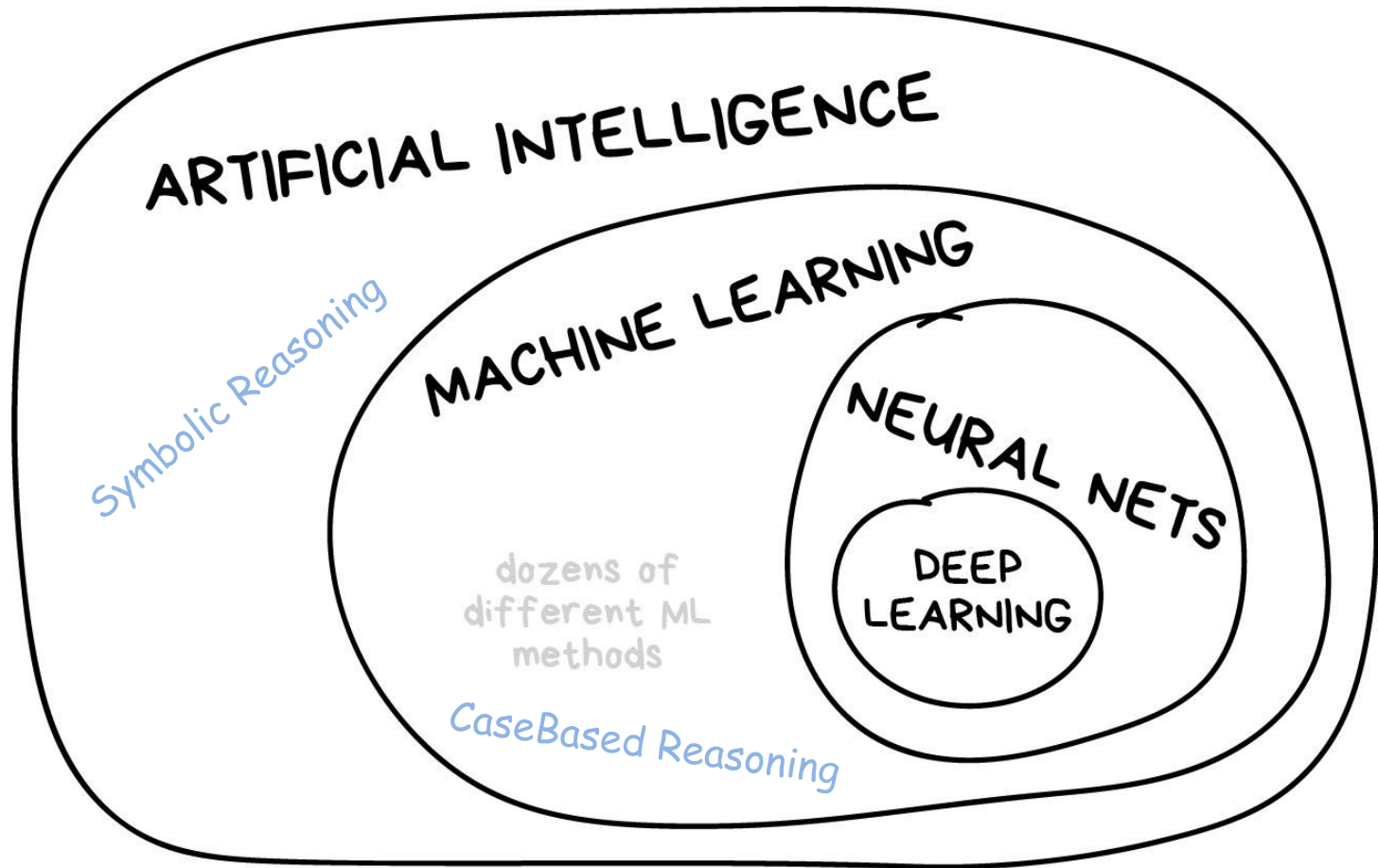
- What is Intelligent or Smart?
 - Classify, Discern, Discriminate
 - Dog or Cat
 - Circle, Triangle, Rectangle

NOT EASY !

- Learn & Smarter



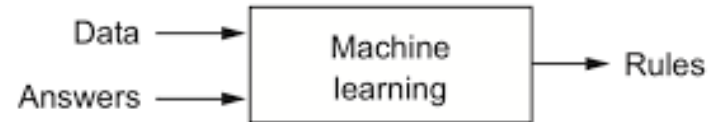
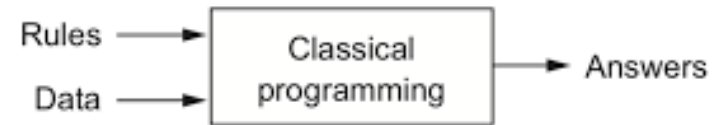
AI, ML, DL



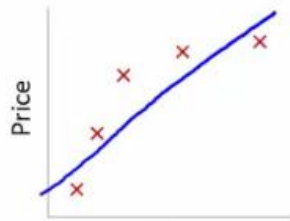
Machine Learning

Data & Answers => Image & Tag
Rules => Parameter / Weight Matrix

Machine Learning vs Classical Programming

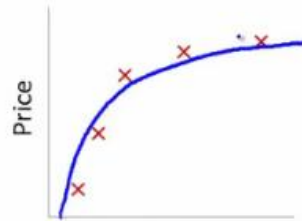


Machine Learning Core Concepts 1



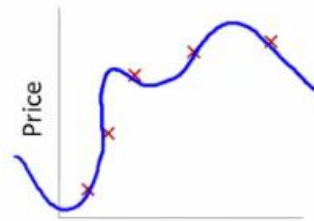
$$\theta_0 + \theta_1 x$$

High bias
(underfit)



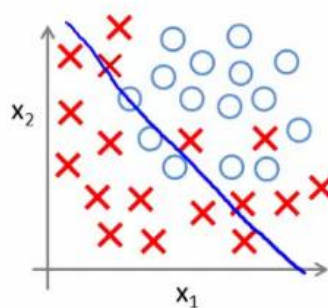
$$\theta_0 + \theta_1 x + \theta_2 x^2$$

"Just right"



$$\theta_0 + \theta_1 x + \theta_2 x^2 + \theta_3 x^3 + \theta_4 x^4$$

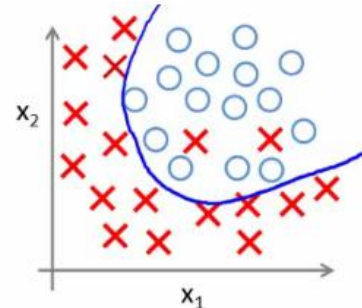
High variance
(overfit)



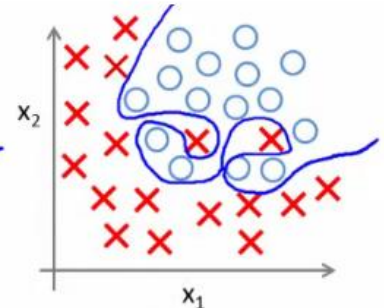
$$h_{\theta}(x) = g(\theta_0 + \theta_1 x_1 + \theta_2 x_2)$$

(g = sigmoid function)

UNDERFITTING
(high bias)



$$g(\theta_0 + \theta_1 x_1 + \theta_2 x_2 + \theta_3 x_1^2 + \theta_4 x_2^2 + \theta_5 x_1 x_2)$$

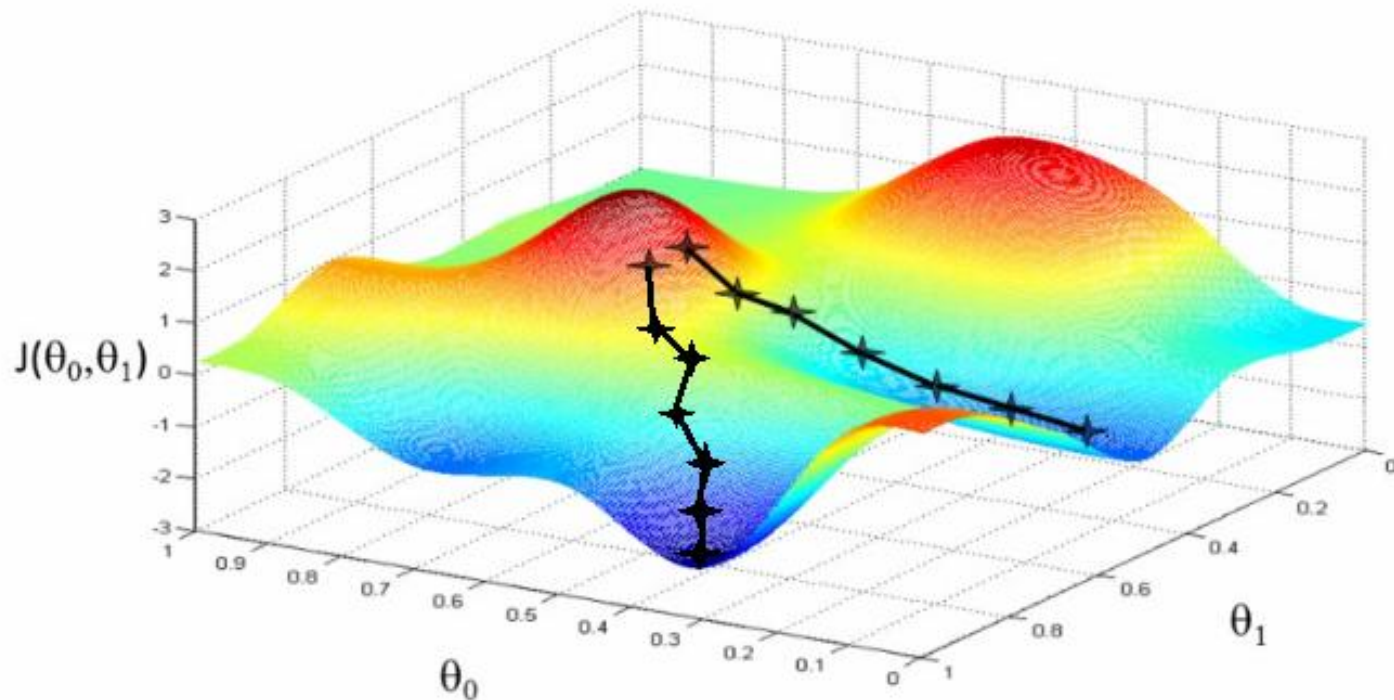


$$g(\theta_0 + \theta_1 x_1 + \theta_2 x_1^2 + \theta_3 x_1^2 x_2 + \theta_4 x_1^2 x_2^2 + \theta_5 x_1^2 x_2^3 + \theta_6 x_1^3 x_2 + \dots)$$

OVERFITTING
(high variance)

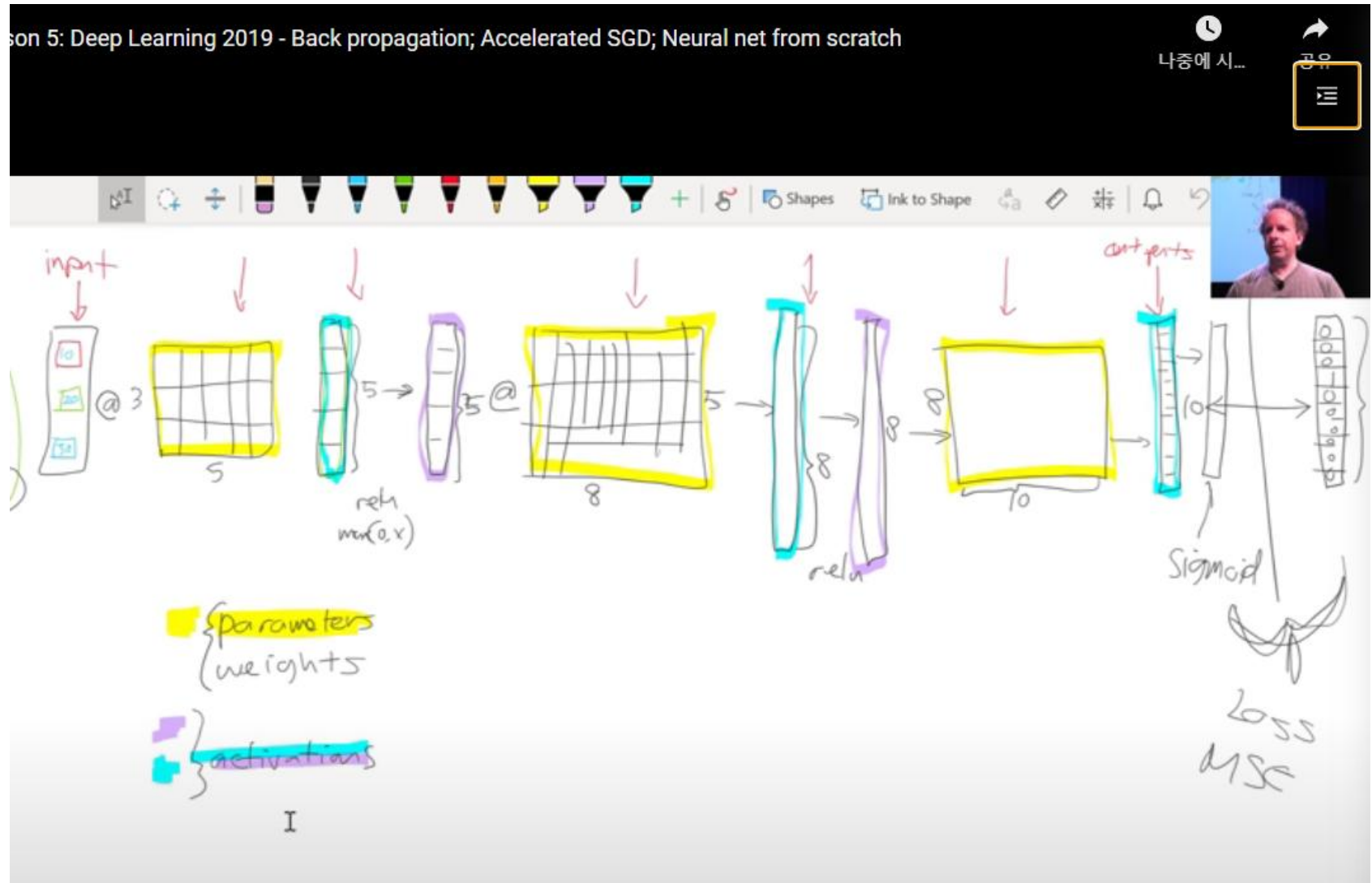
Machine Learning Core Concepts 2

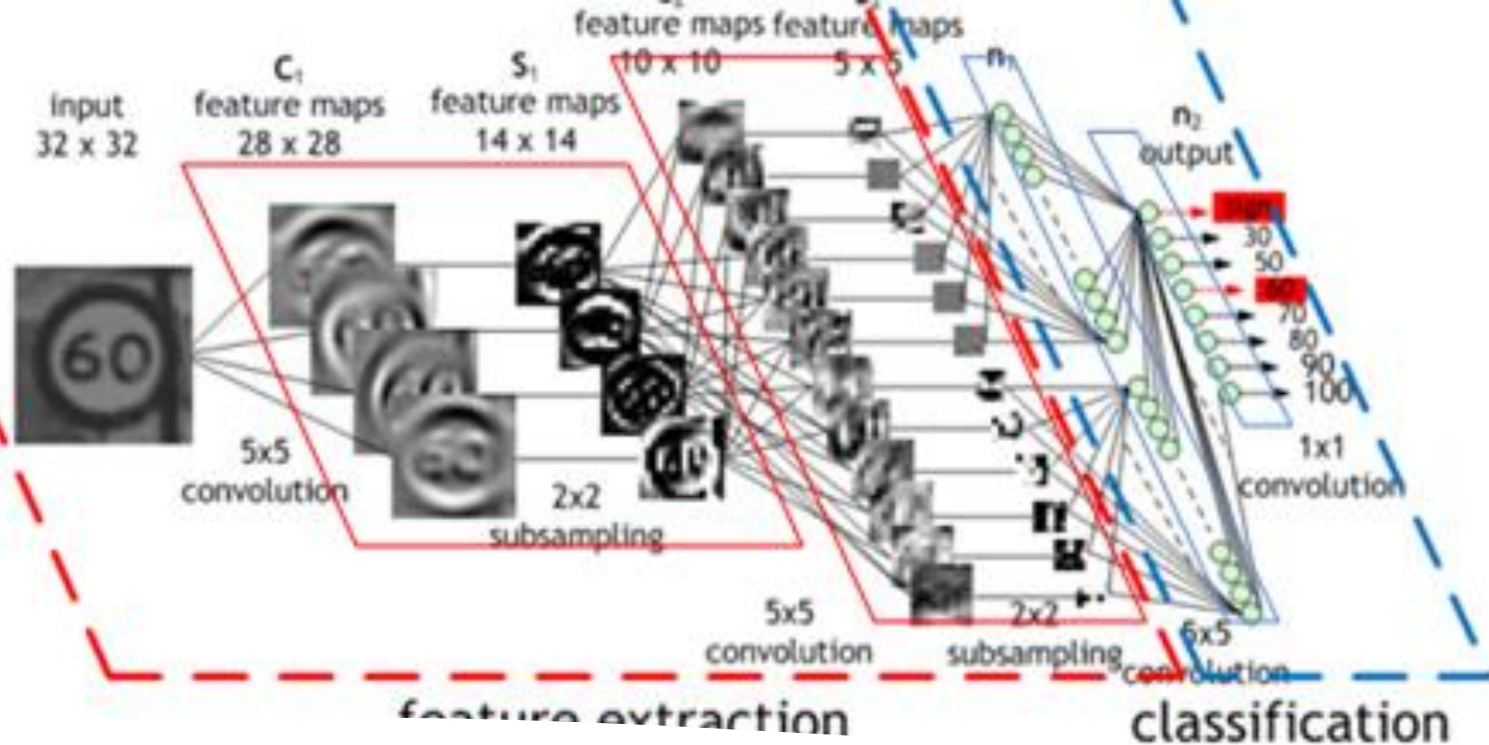
- Where you start can determine which minimum you end up



- Here we can see one initialization point led to one local minimum
- The other led to a different one

Deep Learning Core Concept





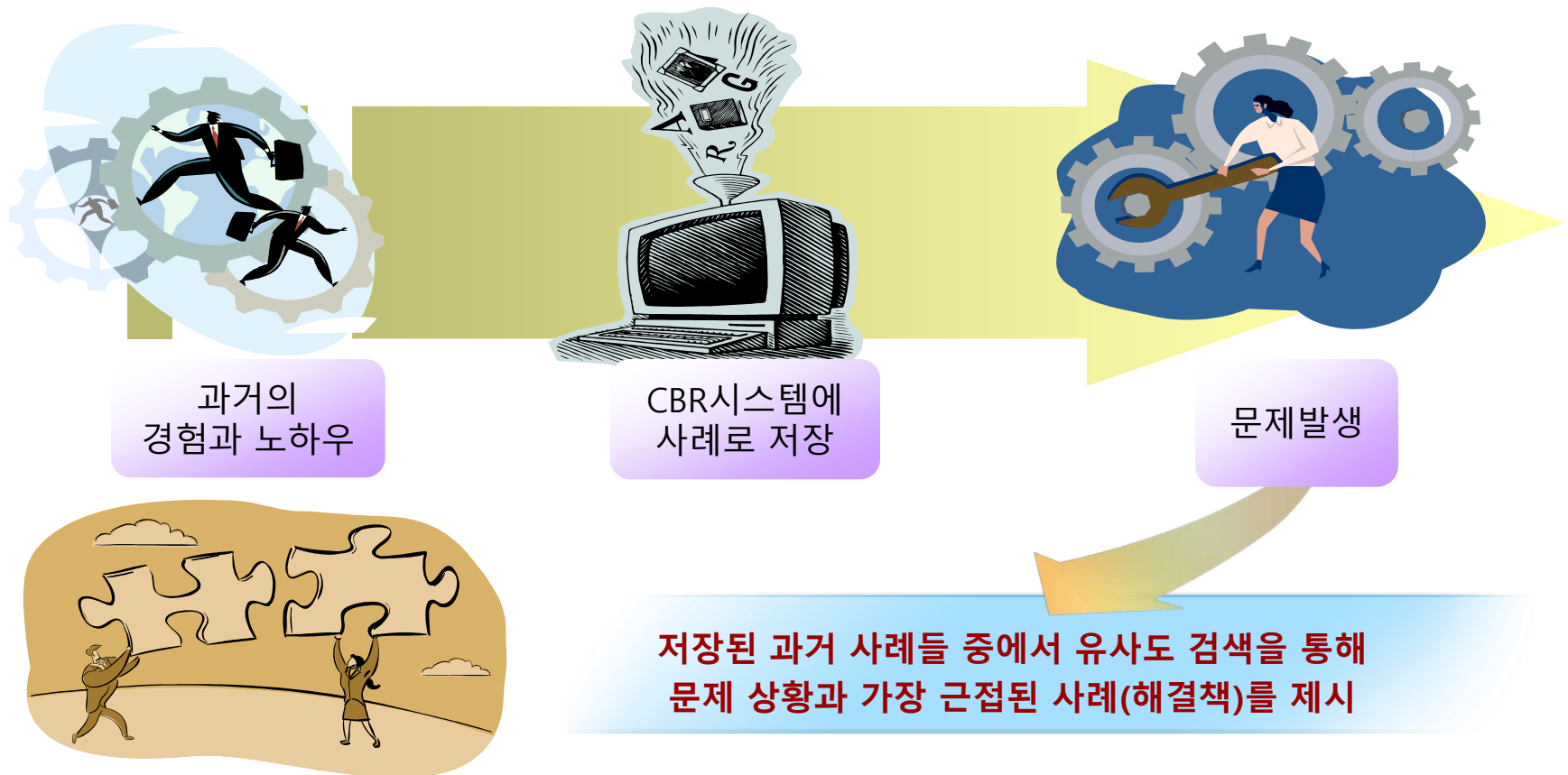
Why Deep Learning is Popular

- New fancy word of Neural Net
 - Fast = cheap graphic card
 - Data = huge tagged data
 - Easy = CNN (auto feature extraction)
- Vision
 - 97% accuracy better than human expert 95%
 - <http://cs231n.stanford.edu/>

Tensorflow.js

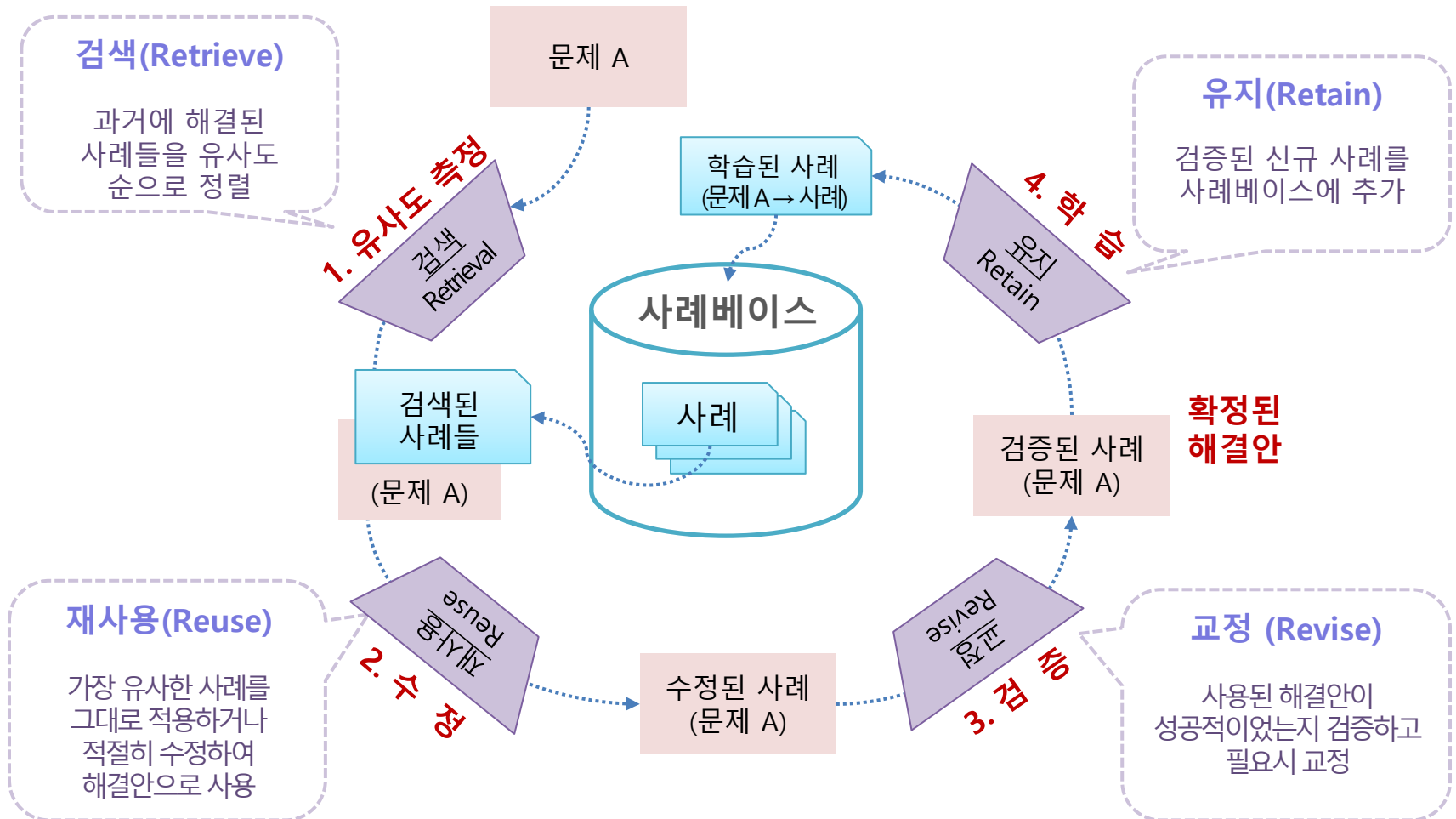
- Why Tensorflow.js
 - ✓ Easy – chromium browser debugger
 - ✓ Fast - webGL, wasm backend
 - ✓ Secure – embedded model in app
- Javascript
 - ✓ Full stack developer language (web, server, ai)
 - ✓ Simple, functional, modular
 - ✓ The good parts - Douglas Crockford
- Best courses
 - ✓ Andrew Ng, <https://www.coursera.org/learn/machine-learning>
 - ✓ Jeremi Howard, <https://course.fast.ai/>
 - ✓ Stanford CNN Course, <http://cs231n.stanford.edu/>

What is CBR (Case-Based Reasoning)



사람이 문제를 해결하기 위하여 추론하는 프로세스를 모델링 한 방법 (Bergmann, 1998)

CBR 4R Process



Car Repair Example 1

| | |
|------|--|
| 신규문제 | <u>문제 증상 (Description / Search Attributes)</u> <ul style="list-style-type: none">• 증상 : 브레이크등이 작동 안됨• 차종 : 렉서스• 년식 : 2005년식• 배터리 전압 : 12.6V• 전구상태 : 이상 없음• 전구스위치 상태 : ??? |
| | <u>해결 방법 (Solution / Info Attributes)</u> <ul style="list-style-type: none">• 진단 : ???• 수리 : ??? |

Car Repair Example 2

| | | |
|--|---|--|
| <p><u>문제 증상</u></p> <ul style="list-style-type: none"> • 증상 : 브레이크등이 작동 안됨 • 차종 : 렉서스 • 년식 : 2005년식 • 배터리 전압 : 12.6V • 전구상태 : 이상 없음 | <p style="text-align: center;">사 례 1</p> | <p><u>문제 증상</u></p> <ul style="list-style-type: none"> • 증상 : 전조등이 작동 안됨 • 차종 : 소나타 • 년식 : 2005년식 • 배터리 전압 : 13.6V • 전구상태 : 이상 없음 • 전구스위치 상태 : 이상 없음 |
| | | <p><u>해결 방법</u></p> <ul style="list-style-type: none"> • 진단 : 전조등 퓨즈 결함 • 수리 : 전조등 퓨즈 교체 |

- 가중치를 적용한 유사도 산출
 - 유사도 (New, Case1) = $(5 \times 0.8 + 1 \times 0.4 + 1 \times 1.0 + 4 \times 0.8 + 5 \times 1.0) / 16 = 0.85$

매우 중요한 속성 : 가중치 = 5

중요하지 않은 속성 : 가중치 = 1



Car Repair Example 3

| | | |
|--|---|--|
| <p><u>문제 증상</u></p> <ul style="list-style-type: none"> • 증상 : 브레이크등이 작동 안됨 • 차종 : 렉서스 • 년식 : 2005년식 • 배터리 전압 : 12.6V • 전구상태 : 이상 없음 | <p style="text-align: center;">사 례 2</p> | <p><u>문제 증상</u></p> <ul style="list-style-type: none"> • 증상 : 전조등이 작동 안됨 • 차종 : 렉서스 • 년식 : 2005년식 • 배터리 전압 : 12.9V • 전구상태 : 전구표면 손상 • 전구스위치 상태 : 이상 없음 |
| | | <p><u>해결 방법</u></p> <ul style="list-style-type: none"> • 진단 : 전구 결함 • 수리 : 전구 교체 |

- 가중치를 적용한 유사도 산출
 - 유사도 (New, Case2) = $(5 \times 0.8 + 1 \times 1.0 + 1 \times 1.0 + 4 \times 0.9 + 5 \times 0.1) / 16 = 0.63$

매우 중요한 속성 : 가중치 = 5

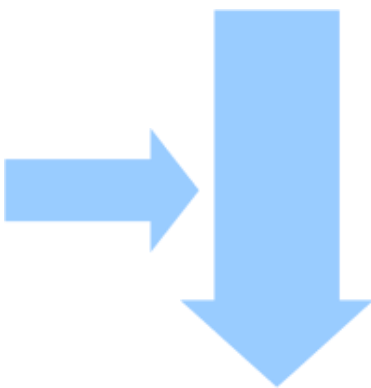
중요하지 않은 속성 : 가중치 = 1



Car Repair Example 4

| | |
|-----------------|--|
| 사 례 1 | <u>문제 증상</u> <ul style="list-style-type: none">• 증상 : 전조등이 작동 안됨• 차종 : 소나타• 년식 : 2005년식• 배터리 전압 : 13.6V• 전구상태 : 이상 없음• 전구스위치 상태 : 이상 없음 |
| | <u>해결 방법</u> <ul style="list-style-type: none">• 진단 : 전조등 퓨즈 결함• 수리 : 전조등 퓨즈 교체 |

| |
|---|
| <u>문제 증상</u> <ul style="list-style-type: none">• 증상 : 브레이크등이 작동 안됨• 차종 : 렉서스• 년식 : 2005년식• 배터리 전압 : 12.6V• 전구상태 : 이상 없음 |
|---|

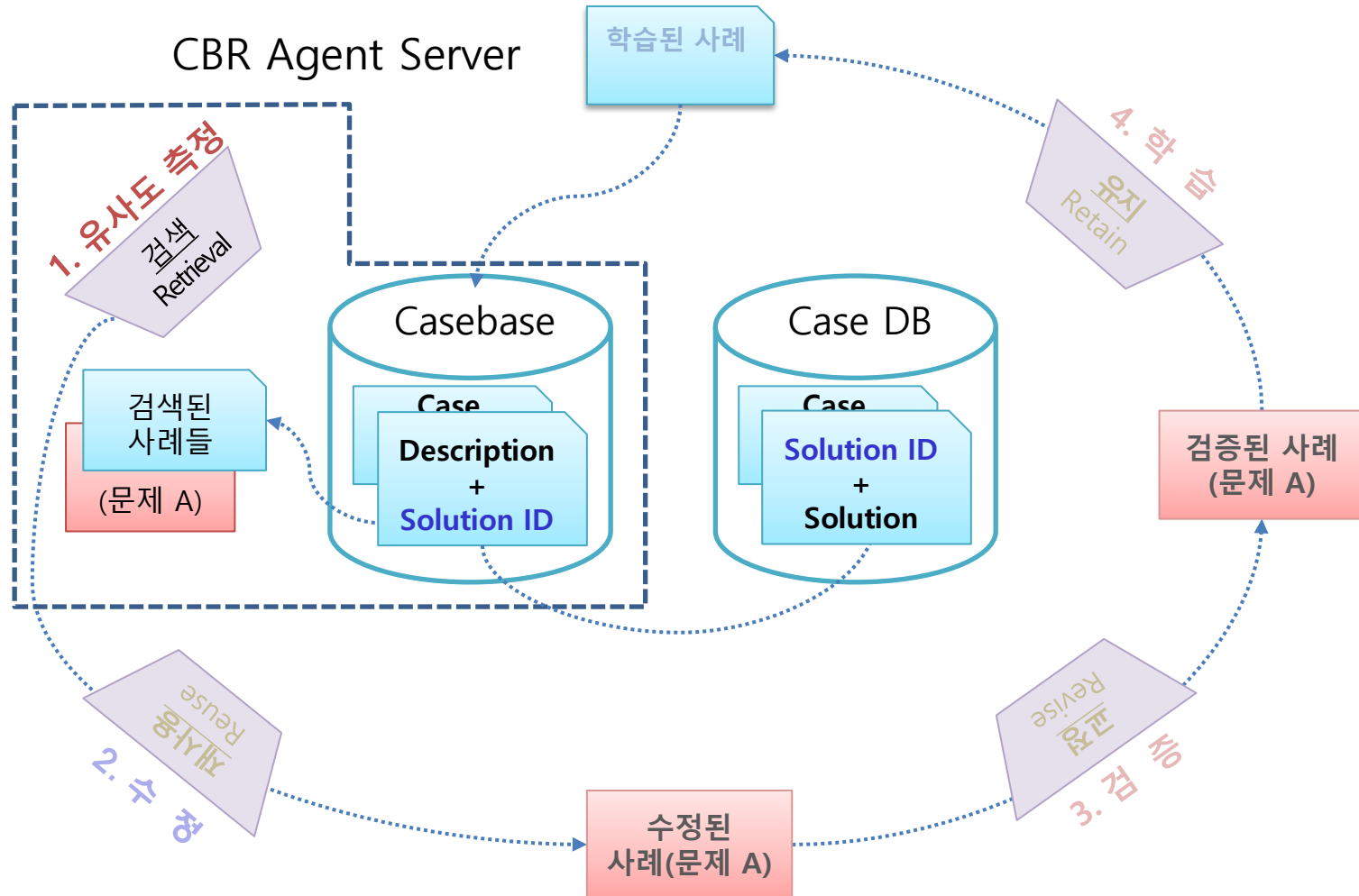


사례1 해결방법을 현문제에 맞도록 변형

신규 문제 해결

- 진단 : 브레이크등 퓨즈 결함
- 수리 : 브레이크등 퓨즈 교체

CBR Agent Service



DL or CBR or Rule?

if *Expert & Know-How* available

if *General & Stable*

Classical Coding (rules)

- exact match

else *Diverse & Changing*

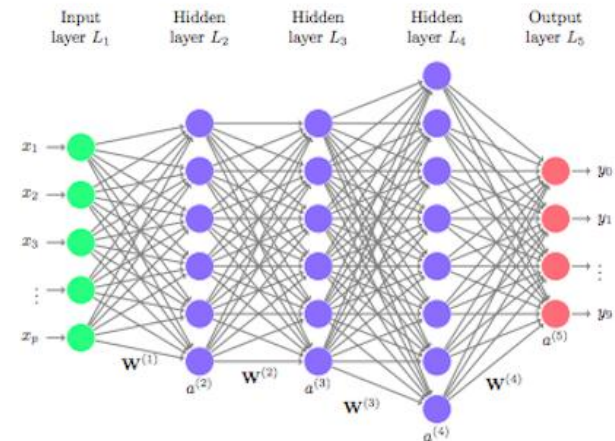
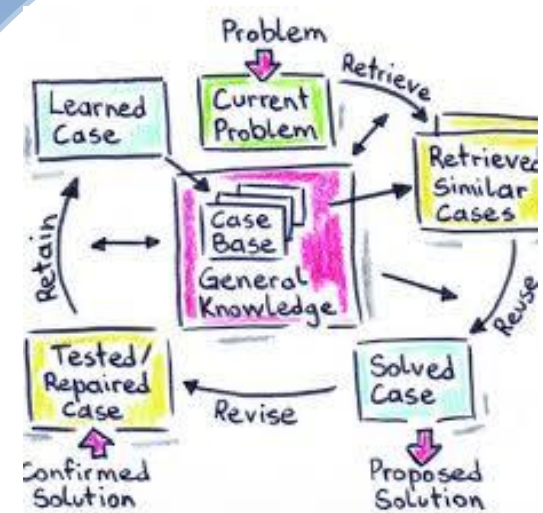
CBR

- most similar case
- evidence

else (*only information*)

Deep Learning

- prediction
- no evidence



Quiz

1. Personalized Vitamin Recommendation
2. Amazon Recommendation
3. My Apartment Finder
4. Health Improvement Prediction
5. Cancer Detection & Treatment
6. Metabolic Syndrome Detection

