아티스트를 위한 머신러닝 & 딥러닝

텐서플로를 활용한 딥러닝 #1

서울대학교 & V.DO / 김대식

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딥러닝
Blah blah 이전에..

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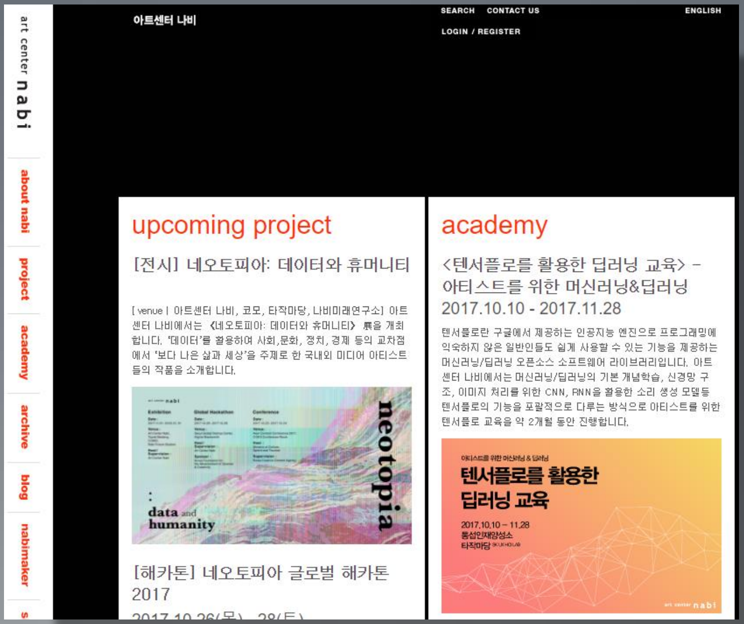
누가 이 수업을 들을까?

과연 들으려는 사람이 있을까?



upcoming project

[전시] 네오토피아: 데이터와 휴머니티

[venue | 아트센터 나비, 코모, 타작마당, 나비미래연구소] 아트센터 나비에서는 《네오토피아: 데이터와 휴머니티》 展을 개최합니다. '데이터'를 활용하여 사회,문화, 정치, 경제 등의 교차점에서 '보다 나은 삶과 세상'을 주제로 한 국내외 미디어 아티스트들의 작품을 소개합니다.

[해카톤] 네오토피아 글로벌 해카톤 2017

2017.10.26(목) - 28(토)

academy

<텐서플로를 활용한 딥러닝 교육> - 아티스트를 위한 머신러닝&딥러닝

2017.10.10 - 2017.11.28

텐서플로란 구글에서 제공하는 인공지능 엔진으로 프로그래밍에 익숙하지 않은 일반인들도 쉽게 사용할 수 있는 기능을 제공하는 머신러닝/딥러닝 오픈소스 소프트웨어 라이브러리입니다. 아트센터 나비에서는 머신러닝/딥러닝의 기본 개념학습, 신경망 구조, 이미지 처리를 위한 CNN, RNN을 활용한 소리 생성 모델등 텐서플로의 기능을 포괄적으로 다루는 방식으로 아티스트를 위한 텐서플로 교육을 약 2개월 동안 진행합니다.

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Why Here?

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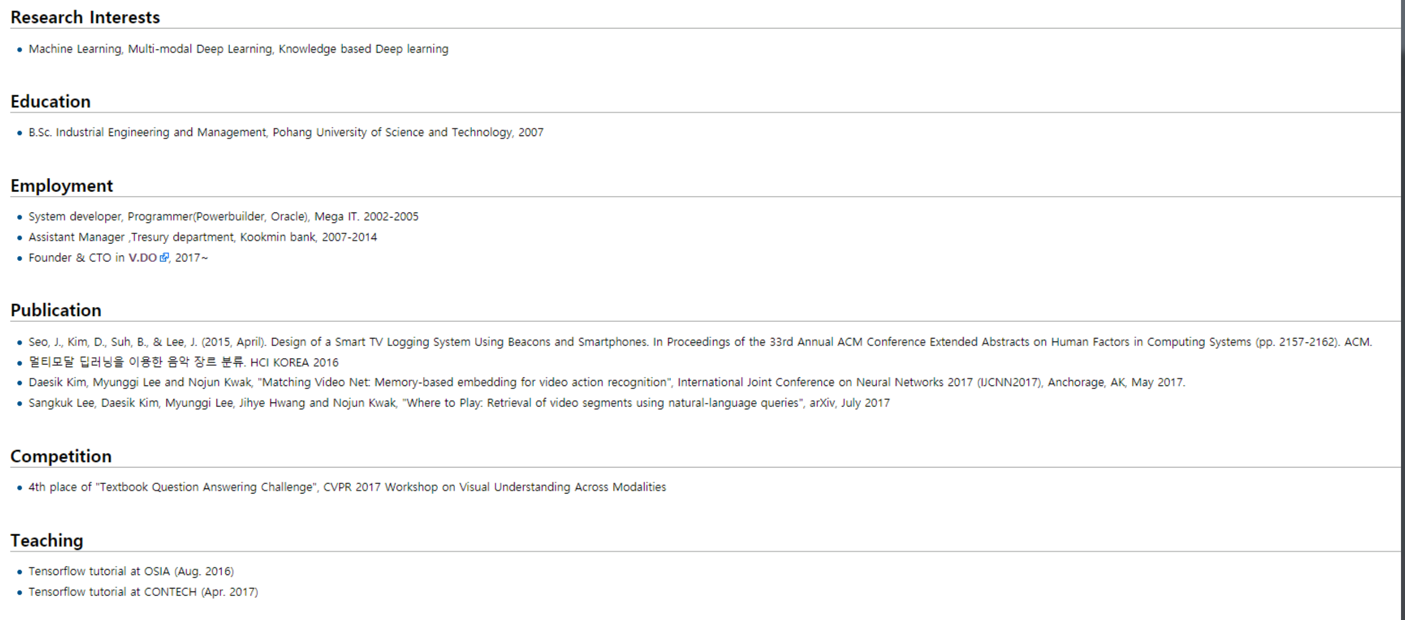
저의 소개

PhD candidate in SNU
CTO in V.DO



Research Interests

- Machine Learning, Multi-modal Deep Learning, Knowledge based Deep learning

Education

- B.Sc. Industrial Engineering and Management, Pohang University of Science and Technology, 2007

Employment

- System developer, Programmer(Powerbuilder, Oracle), Mega IT. 2002-2005
- Assistant Manager ,Tresury department, Kookmin bank, 2007-2014
- Founder & CTO in V.DO, 2017~

Publication

- Seo, J., Kim, D., Suh, B., & Lee, J. (2015, April). Design of a Smart TV Logging System Using Beacons and Smartphones. In Proceedings of the 33rd Annual ACM Conference Extended Abstracts on Human Factors in Computing Systems (pp. 2157-2162). ACM.
- 멀티모달 딥러닝을 이용한 음악 장르 분류. HCI KOREA 2016
- Daesik Kim, Myunggi Lee and Nojun Kwak, "Matching Video Net: Memory-based embedding for video action recognition", International Joint Conference on Neural Networks 2017 (IJCNN2017), Anchorage, AK, May 2017.
- Sangkuk Lee, Daesik Kim, Myunggi Lee, Jihye Hwang and Nojun Kwak, "Where to Play: Retrieval of video segments using natural-language queries", arXiv, July 2017

Competition

- 4th place of "Textbook Question Answering Challenge", CVPR 2017 Workshop on Visual Understanding Across Modalities

Teaching

- Tensorflow tutorial at OSIA (Aug. 2016)
- Tensorflow tutorial at CONTECH (Apr. 2017)

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인공지능
딥러닝

현재 가장 핫한 키워드

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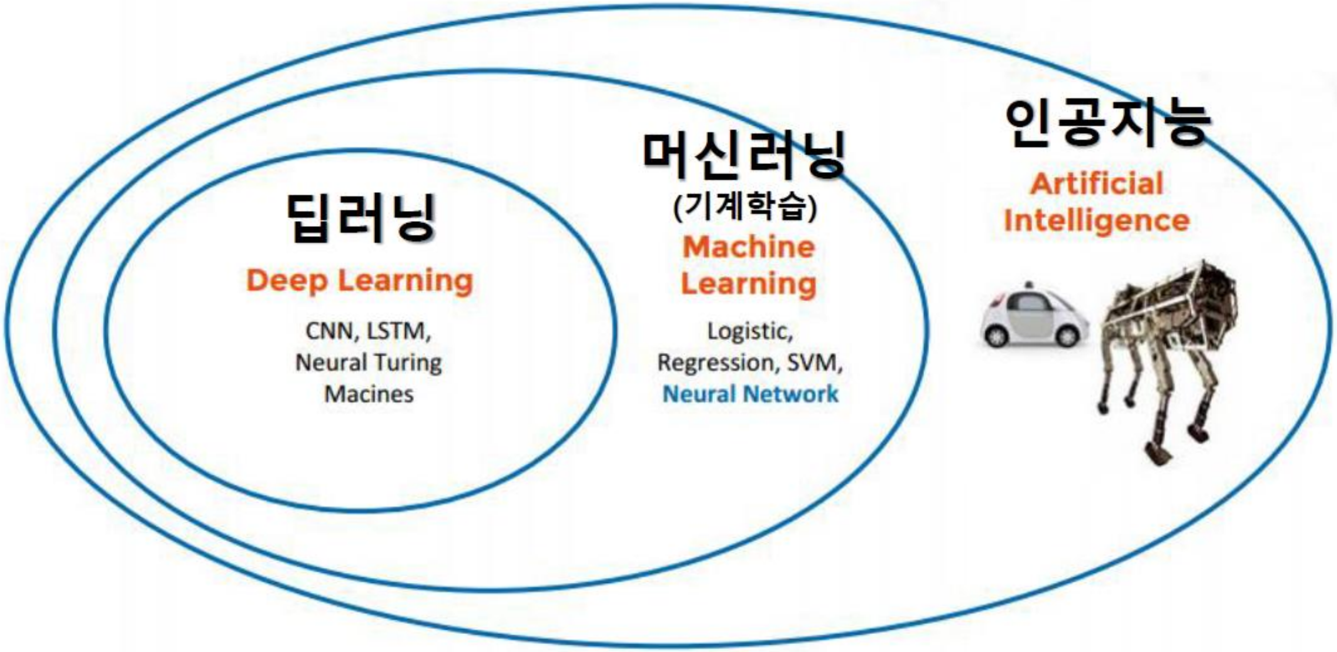
인공지능 ≠ 딥러닝



인공지능

Artificial Intelligence

머신러닝

(기계학습)

Machine Learning

Logistic, Regression, SVM, Neural Network

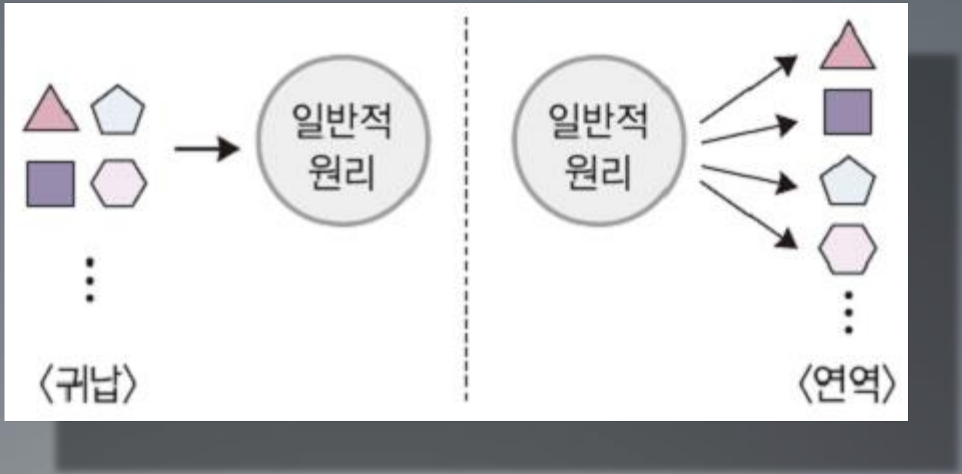
딥러닝

Deep Learning

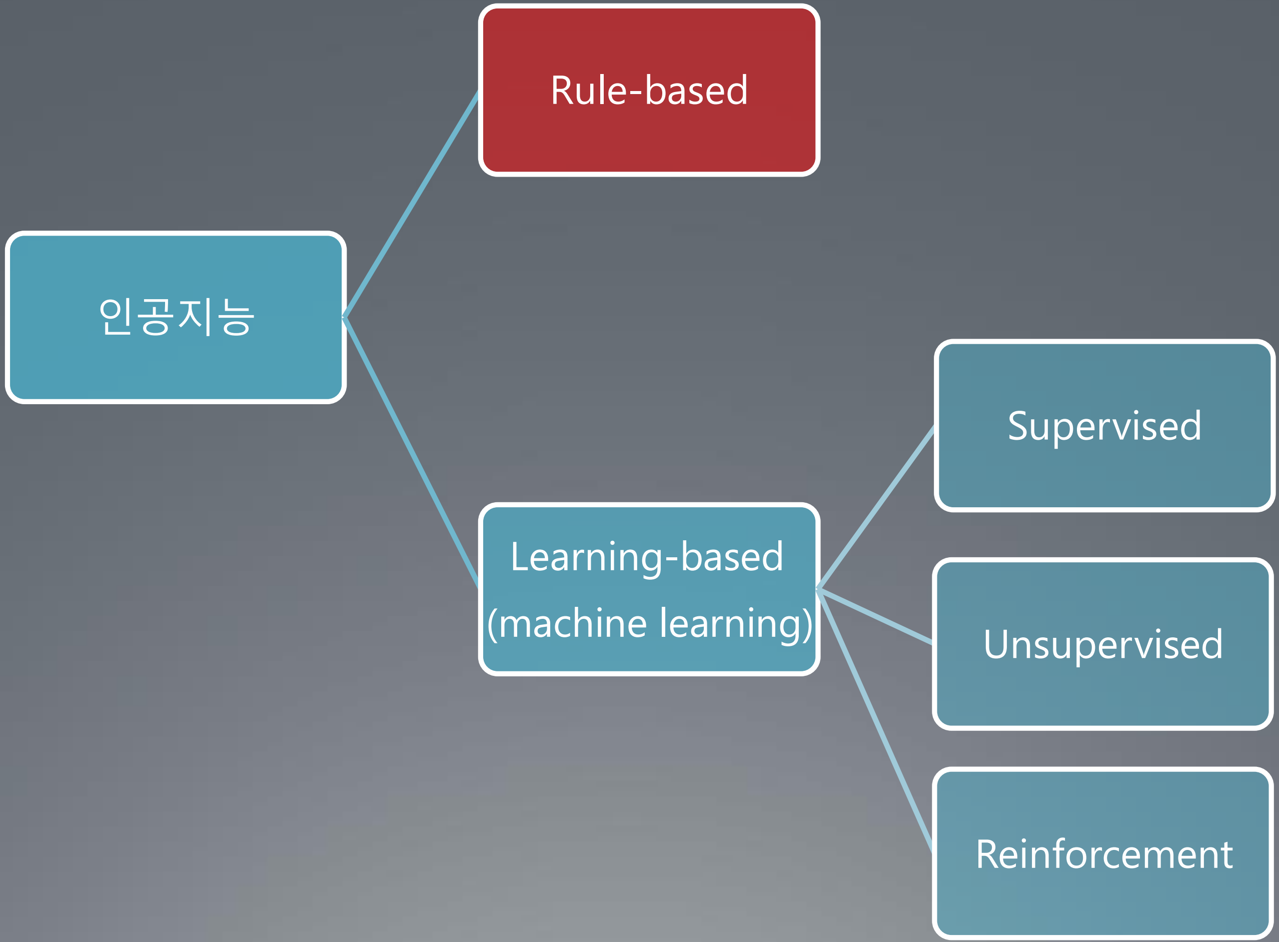
CNN, LSTM, Neural Turing Macines

Slide by Jiqiong Qiu at DevFest 2016
http://www.slideshare.net/SfeirGroup/first-step-deep-learning-by-jiqiong-qiu-devfest-2016

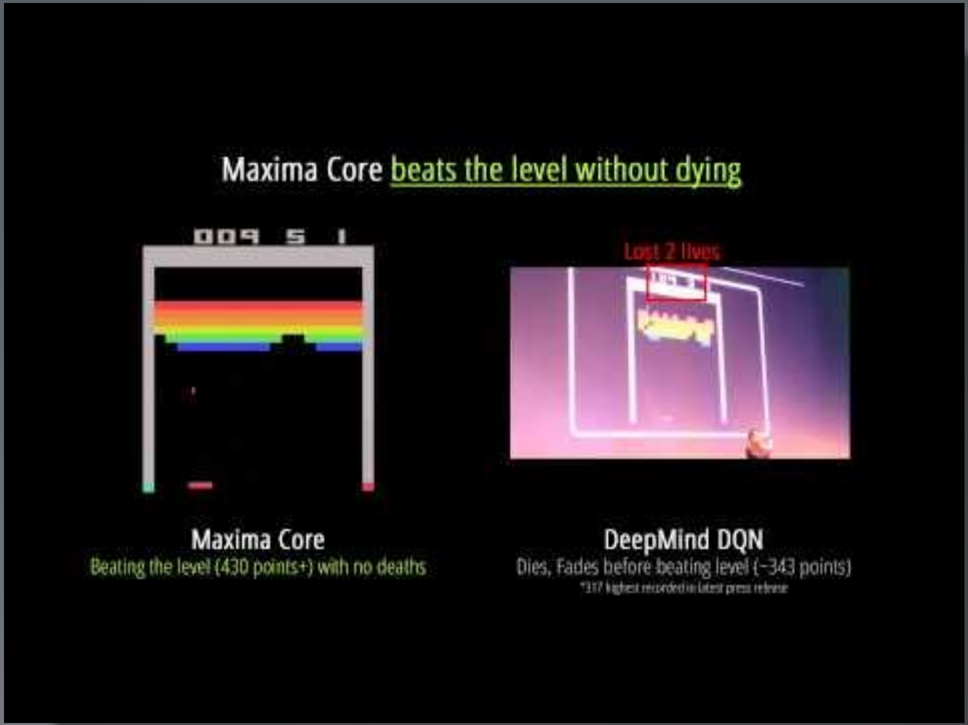
연역법 vs 귀납법
Deduction vs Induction



인공지능?



인공지능
Rule-based
Learning-based
(machine learning)
Supervised
Unsupervised
Reinforcement



Maxima Core beats the level without dying

Maxima Core
Beating the level (430 points+) with no deaths

DeepMind DQN
Dies, Fades before beating level (~343 points)
*317 highest recorded in latest press release

인공지능?

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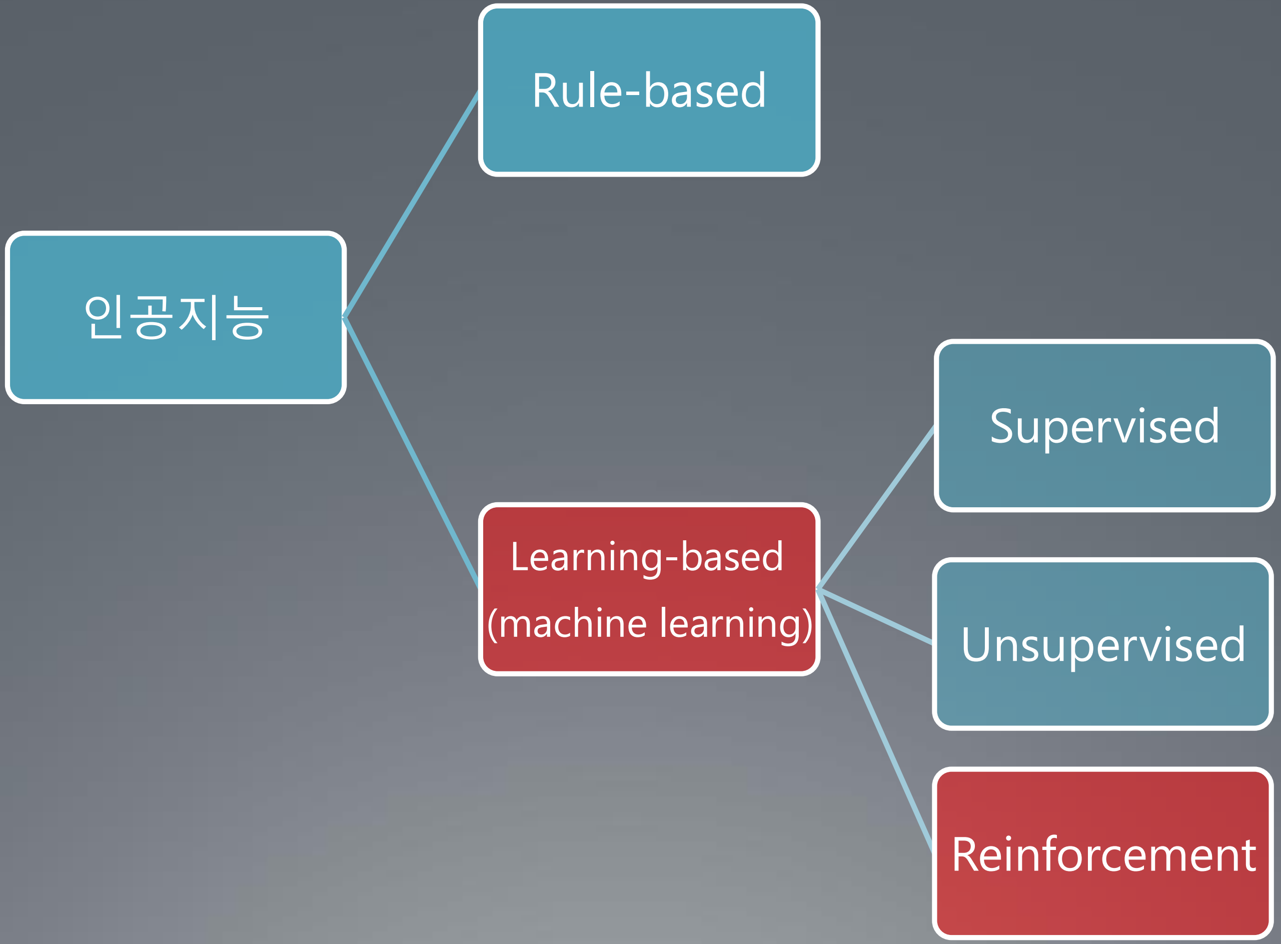

인공지능

Rule-based

Learning-based (machine learning)

Supervised

Unsupervised

Reinforcement

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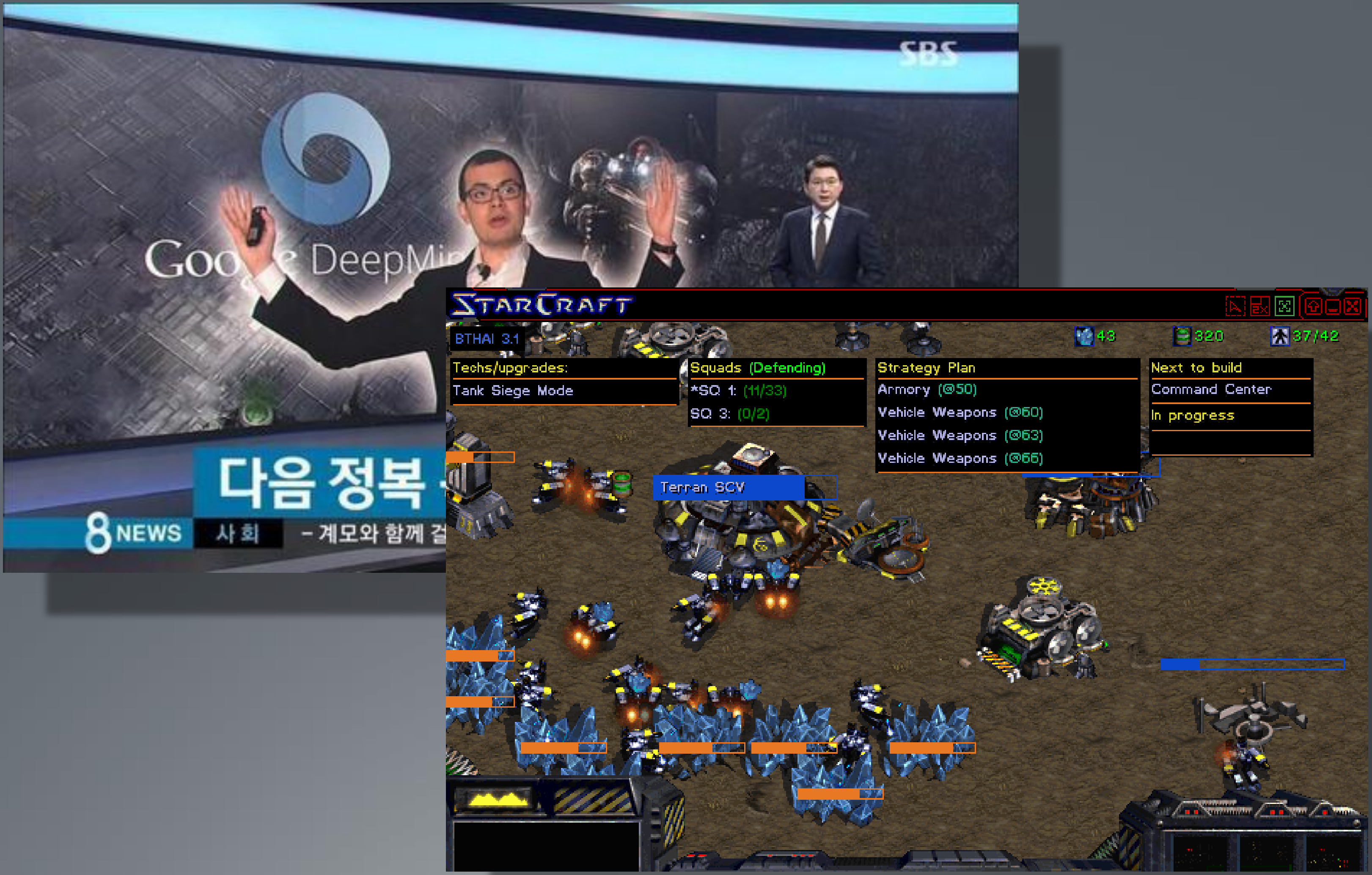

Techs/upgrades:
Tank Siege Mode

Squads (Defending)
*SQ 1: (11/33)
SQ 3: (0/2)

Strategy Plan
Armory (@50)
Vehicle Weapons (@60)
Vehicle Weapons (@63)
Vehicle Weapons (@66)

Next to build
Command Center
In progress

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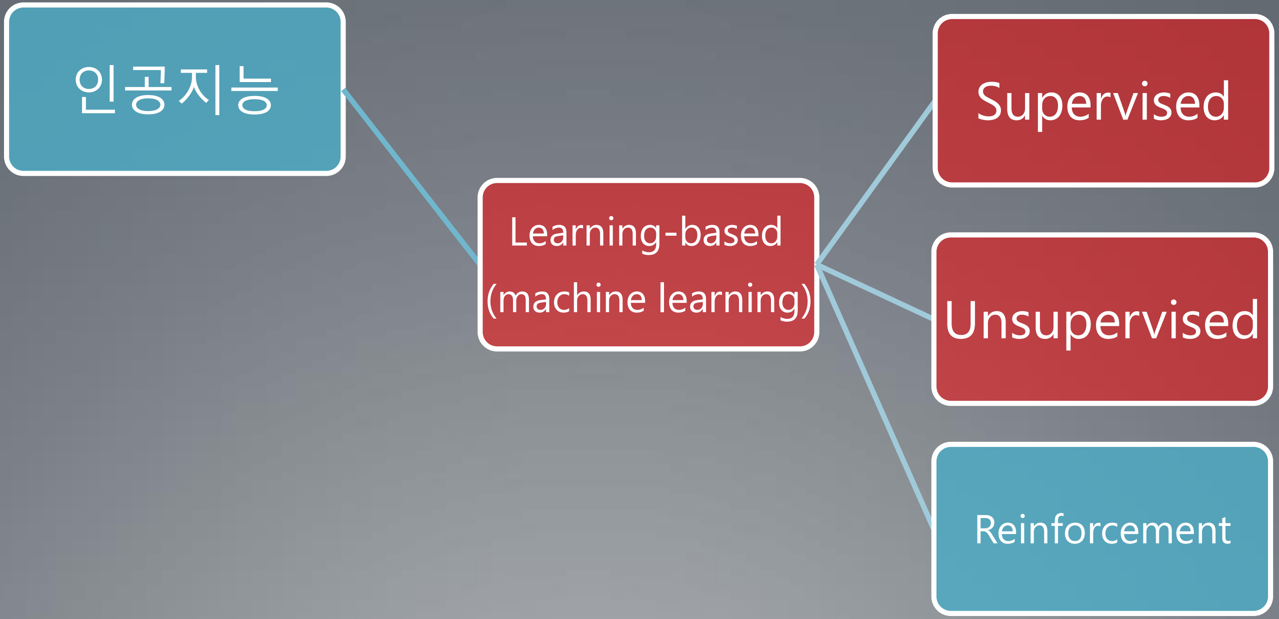
AlphaGo

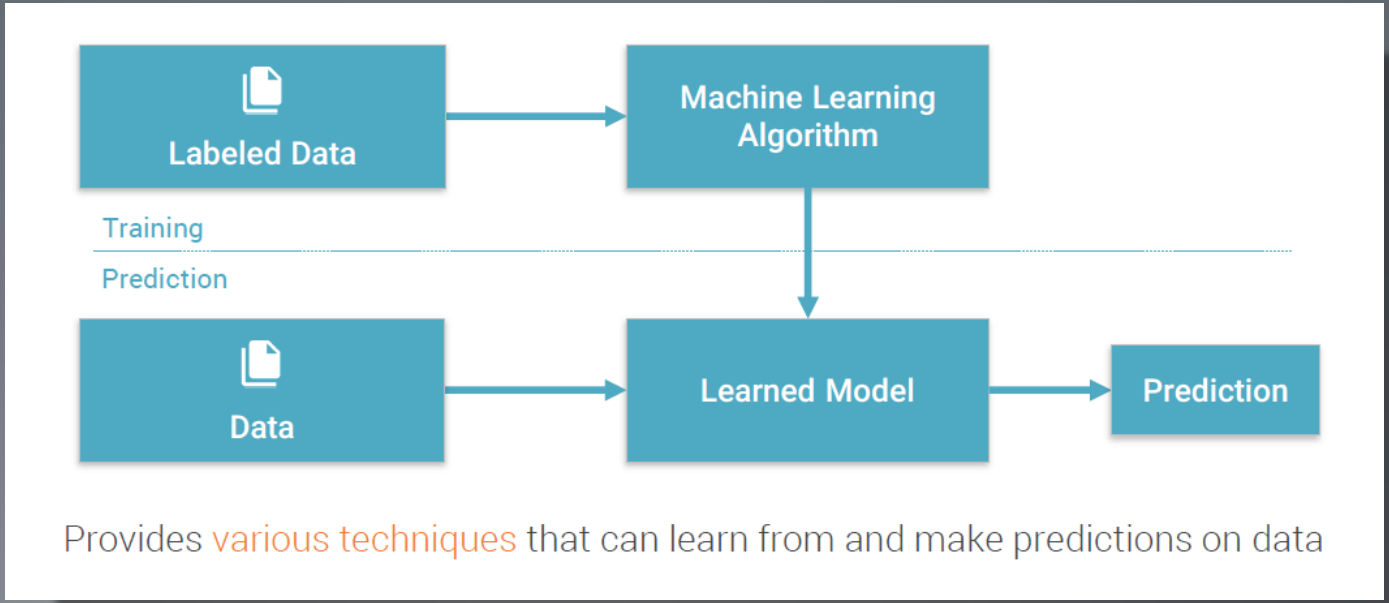
=

Rule-based + Reinforcement learning

우린 Learning 배웁니다

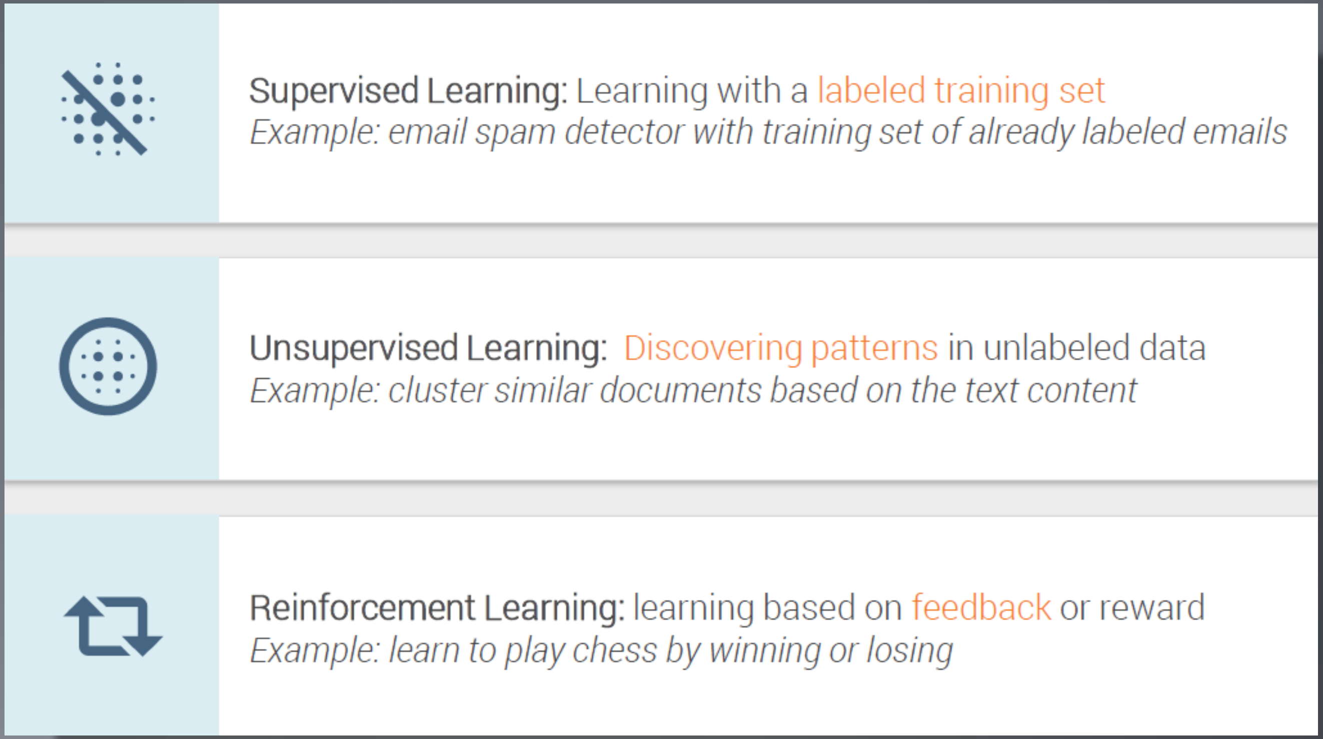


Machine Learning



Provides various techniques that can learn from and make predictions on data

Machine Learning

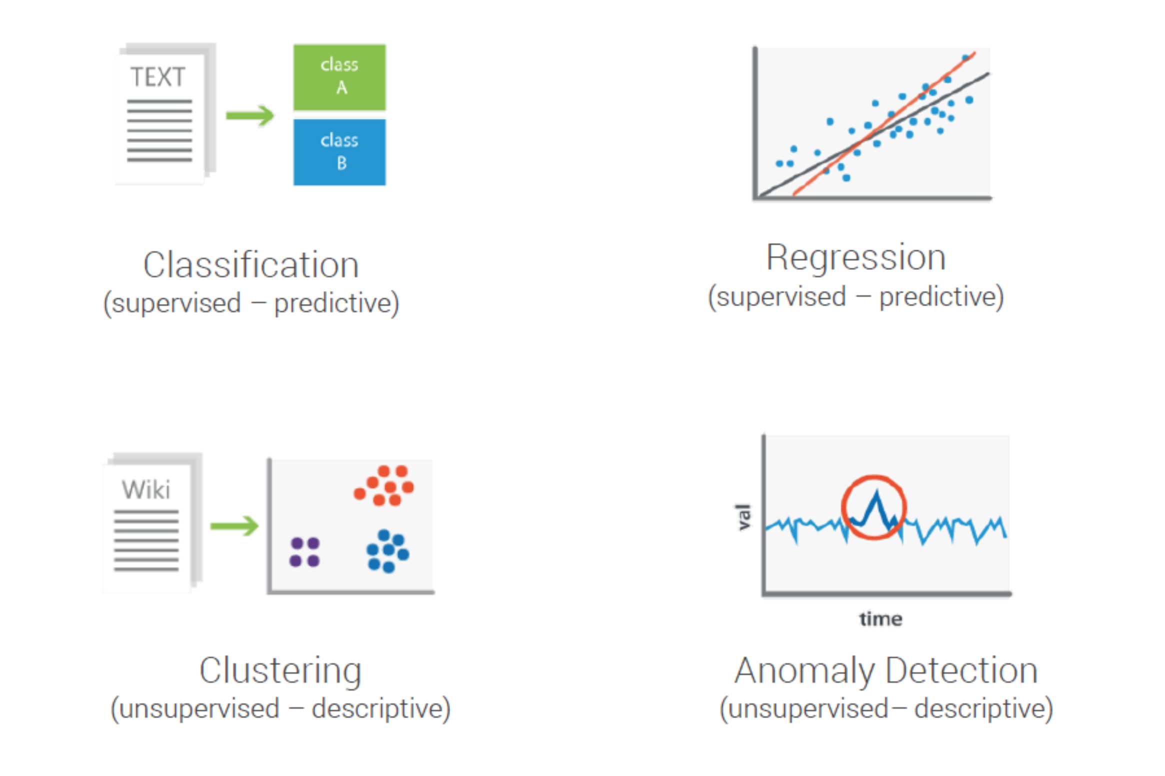


Supervised Learning: Learning with a labeled training set
Example: email spam detector with training set of already labeled emails

Unsupervised Learning: Discovering patterns in unlabeled data
Example: cluster similar documents based on the text content

Reinforcement Learning: learning based on feedback or reward
Example: learn to play chess by winning or losing

Types of Machine Learning



Classification
(supervised – predictive)

Regression
(supervised – predictive)

Clustering
(unsupervised – descriptive)

Anomaly Detection
(unsupervised– descriptive)

딥러닝의 위엄

https://www.youtube.com/watch?v=pW6nZXeWlGM&feature=youtu.be

https://www.youtube.com/watch?v=gjGOcl17bzg

https://www.youtube.com/watch?v=YRm_kqClsFY

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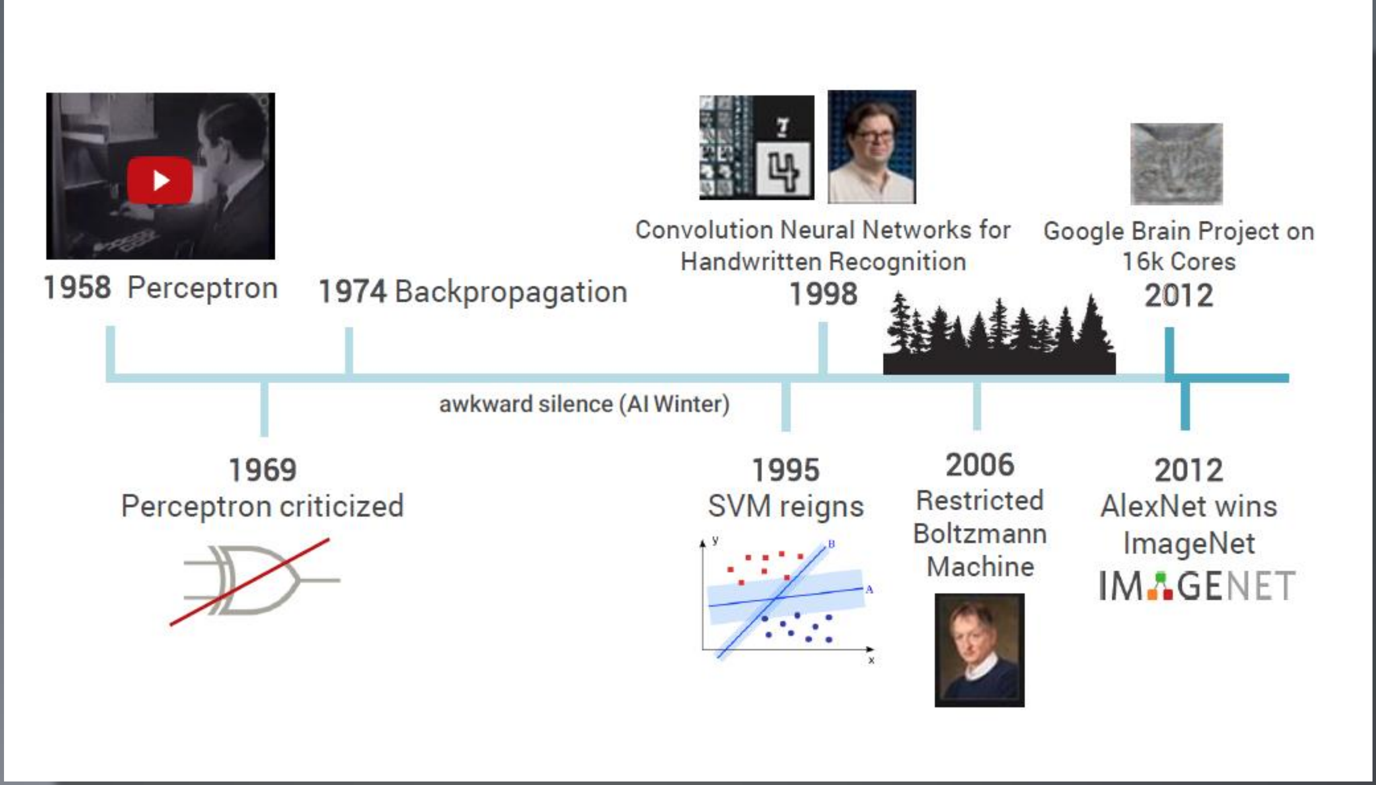
왜 기존에 안되었던 것들이 되기 시작 할까?



1958 Perceptron

1974 Backpropagation

Convolution Neural Networks for Handwritten Recognition
1998

Google Brain Project on 16k Cores
2012

awkward silence (AI Winter)

1969
Perceptron criticized

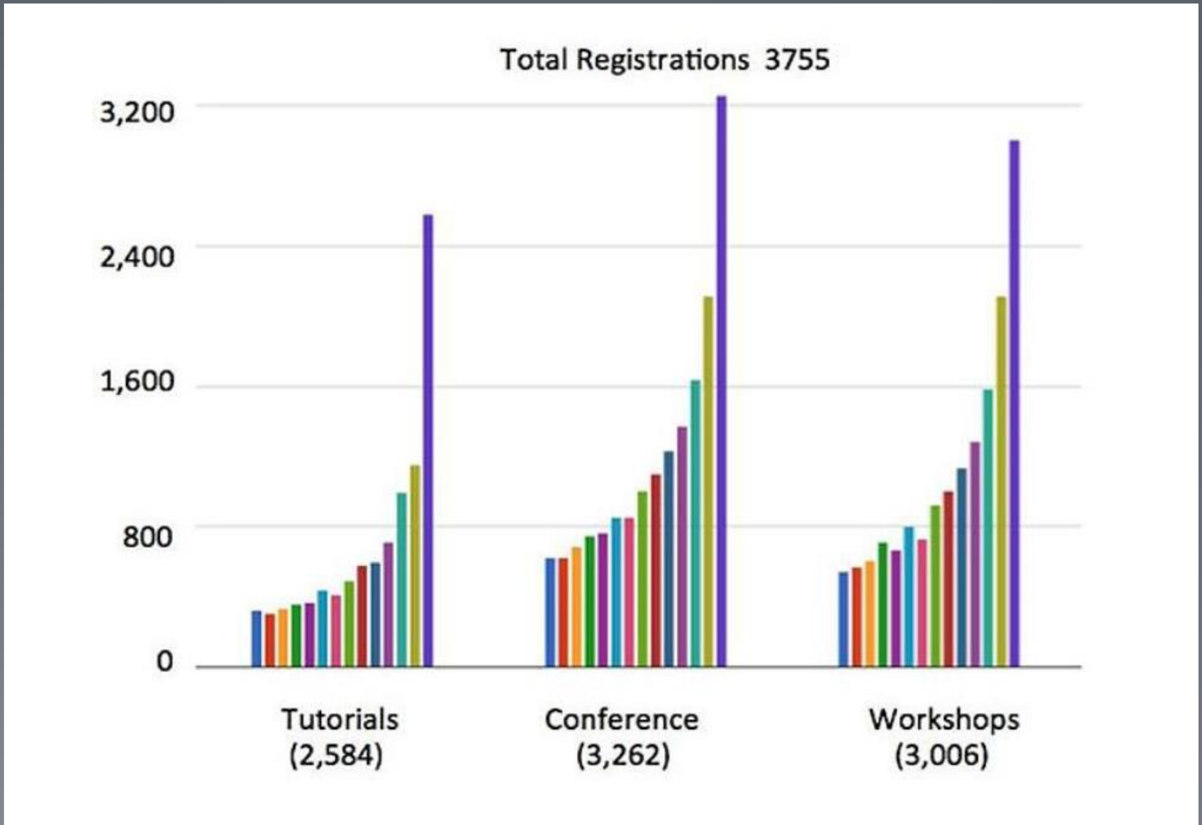
1995
SVM reigns

2006
Restricted Boltzmann Machine

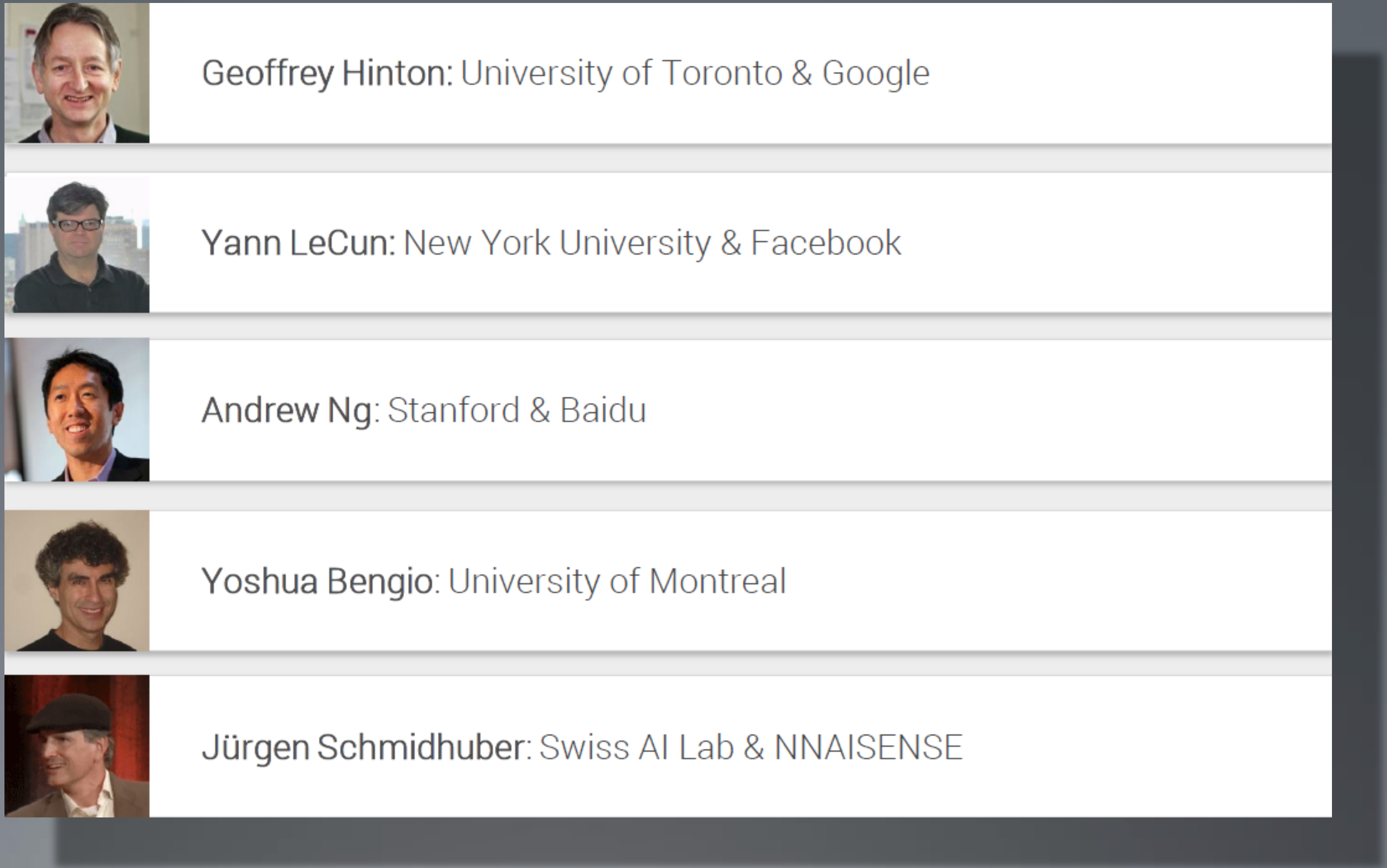
2012
AlexNet wins ImageNet

IMAGENET

NIPS: 딥러닝 최고 학회



Superstars



Geoffrey Hinton: University of Toronto & Google

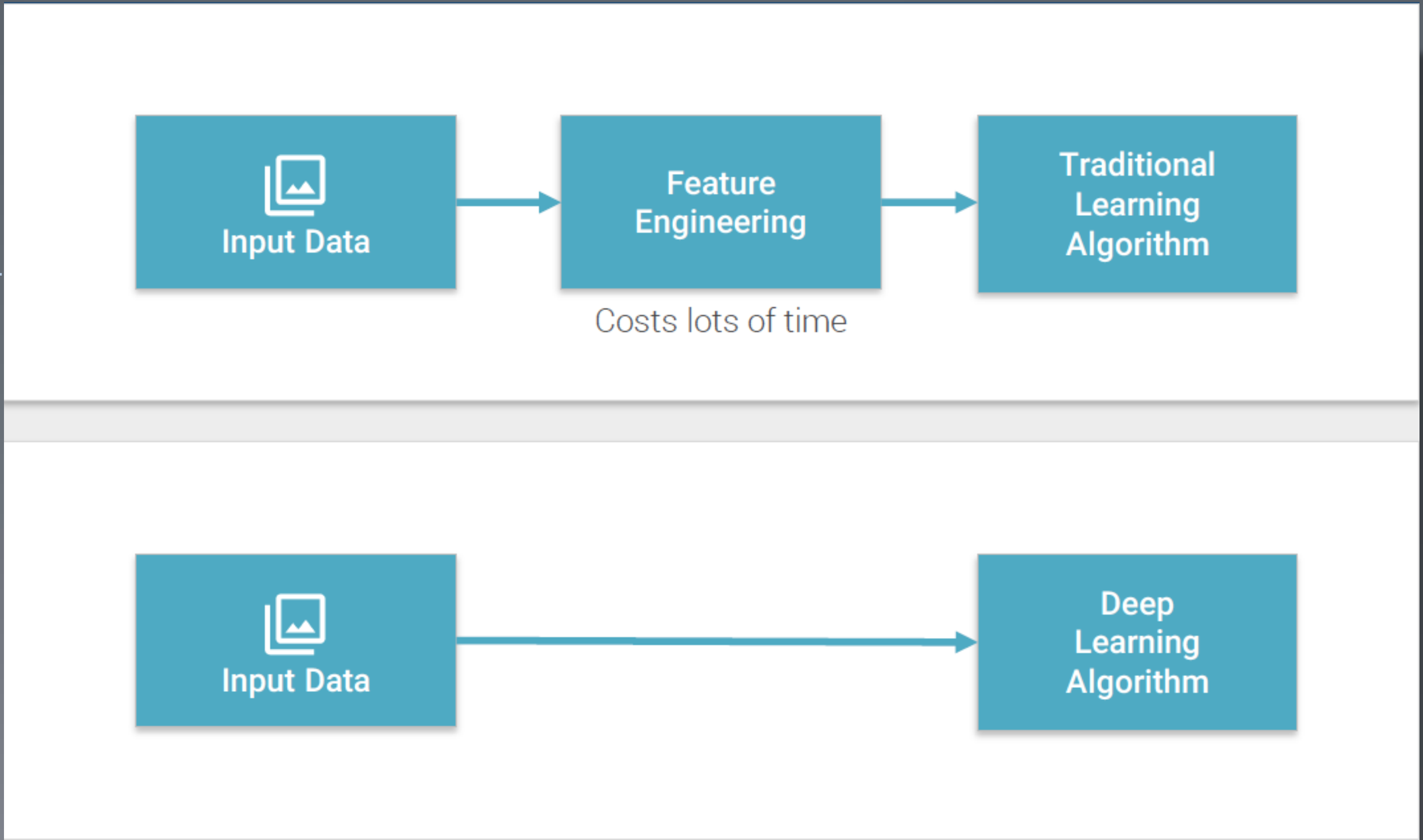
Yann LeCun: New York University & Facebook

Andrew Ng: Stanford & Baidu

Yoshua Bengio: University of Montreal

Jürgen Schmidhuber: Swiss AI Lab & NNAISENSE

Paradigm의 변화

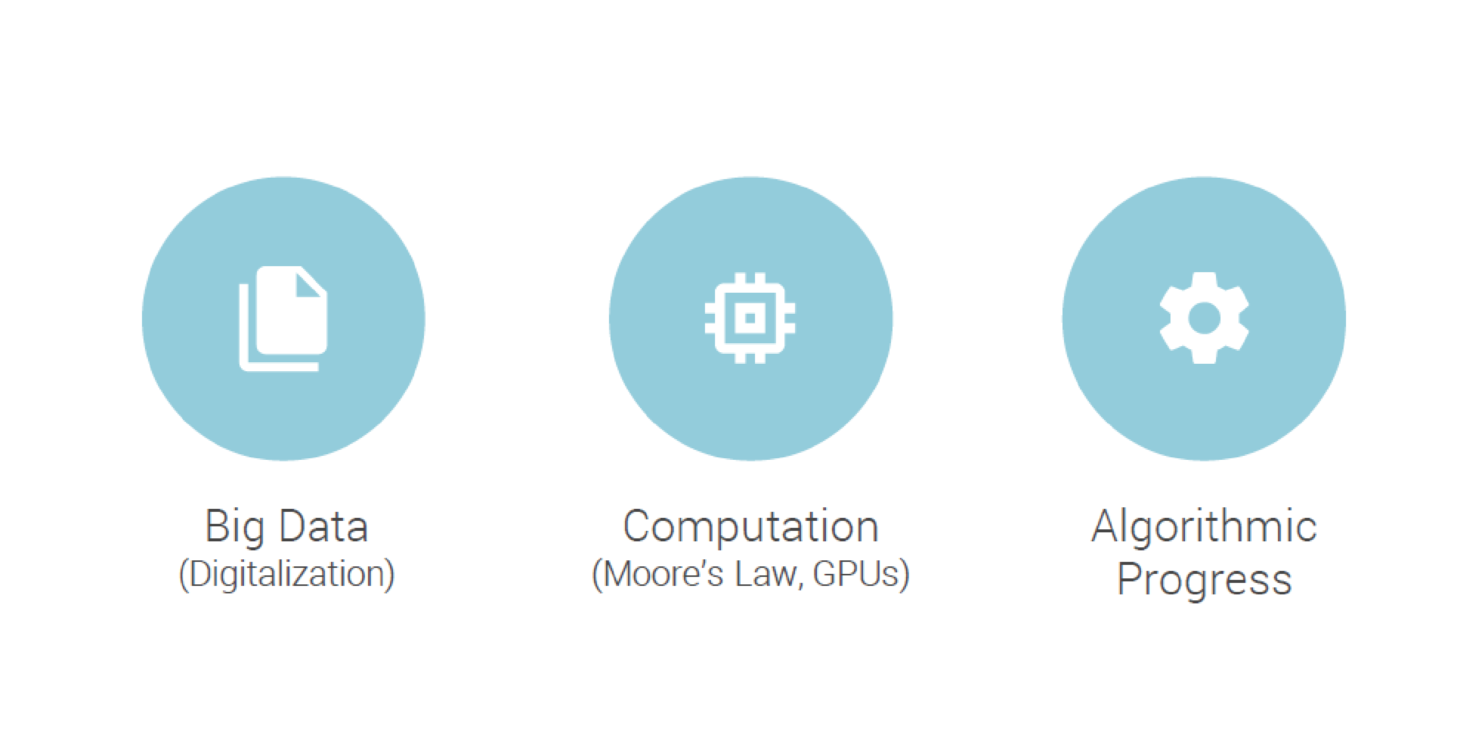


Input Data → Feature Engineering → Traditional Learning Algorithm

Costs lots of time

Input Data → Deep Learning Algorithm

Paradigm의 변화

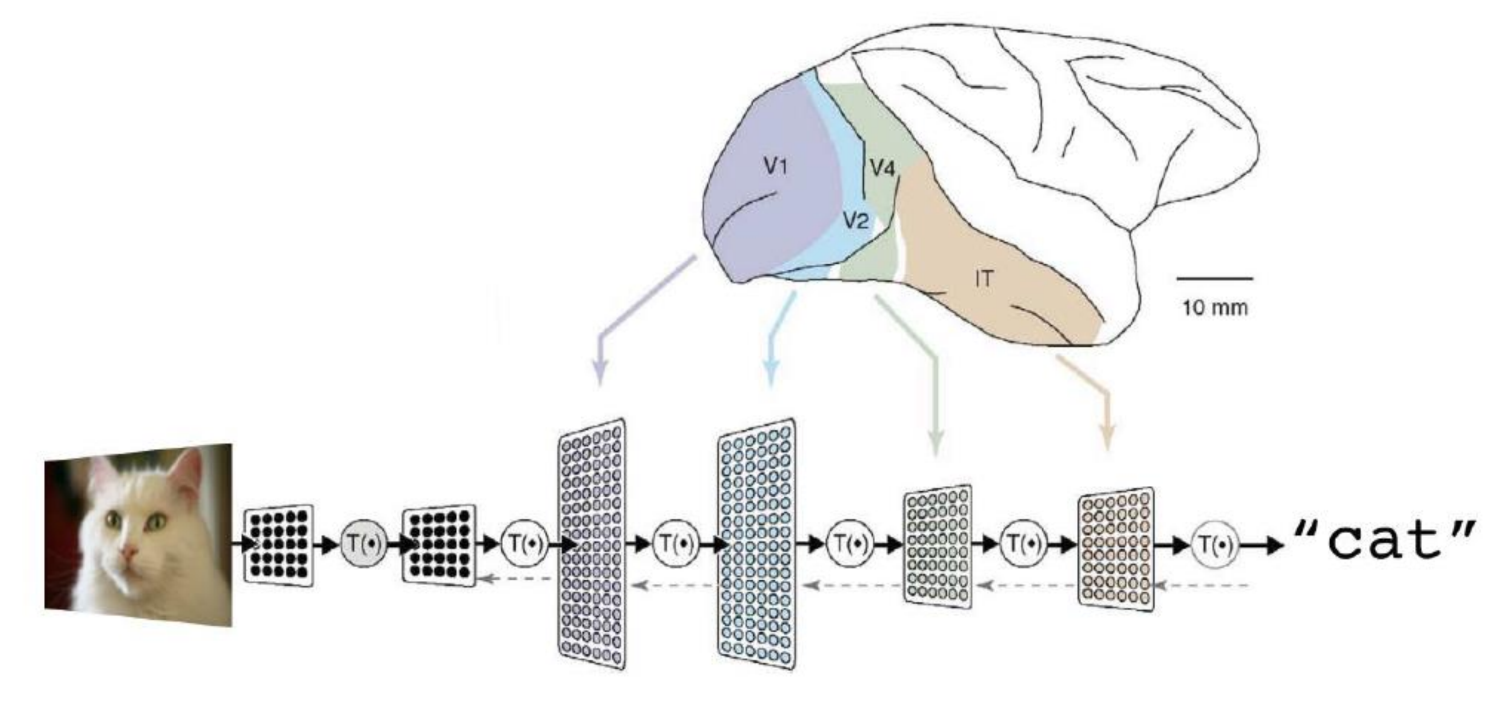


Big Data
(Digitalization)

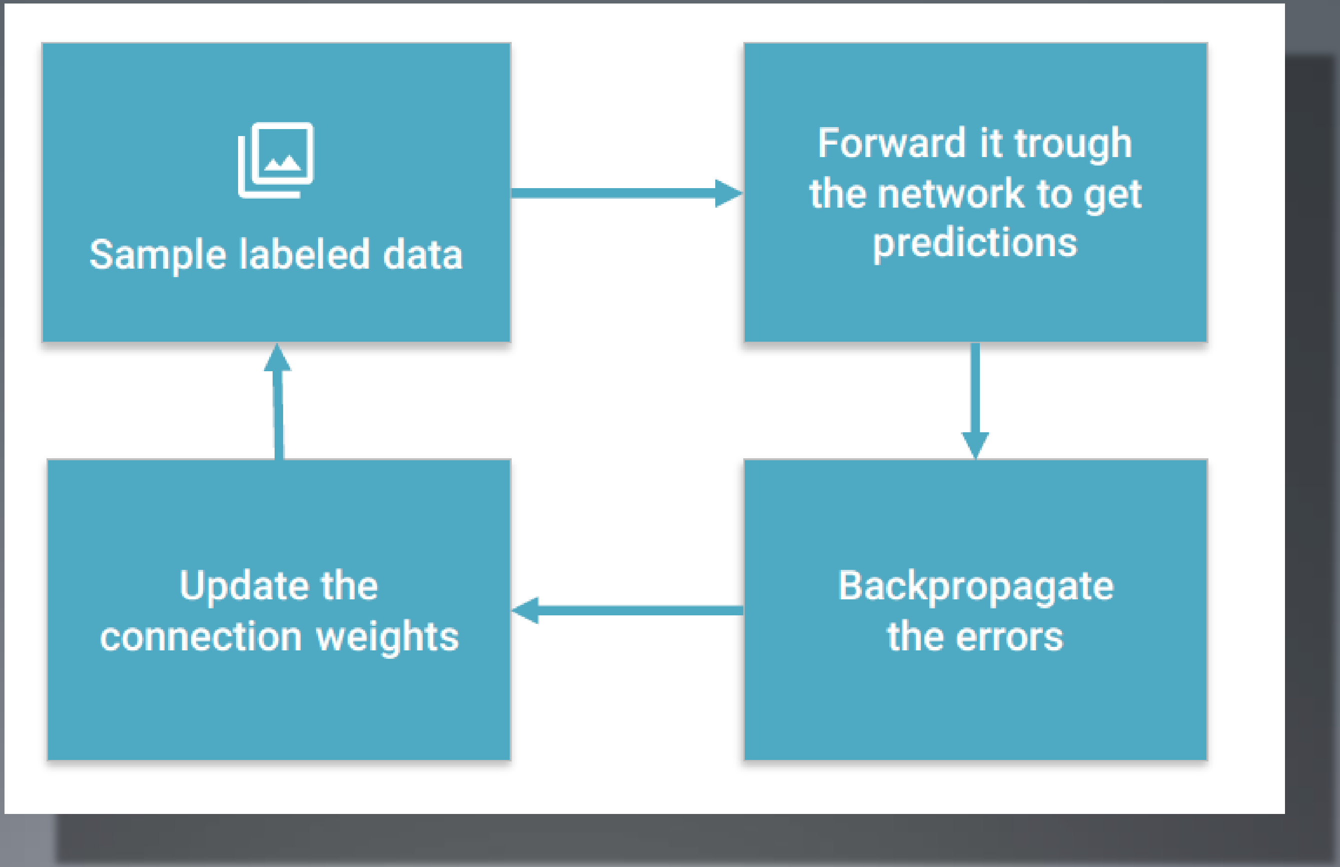
Computation
(Moore's Law, GPUs)

Algorithmic
Progress

아키텍처

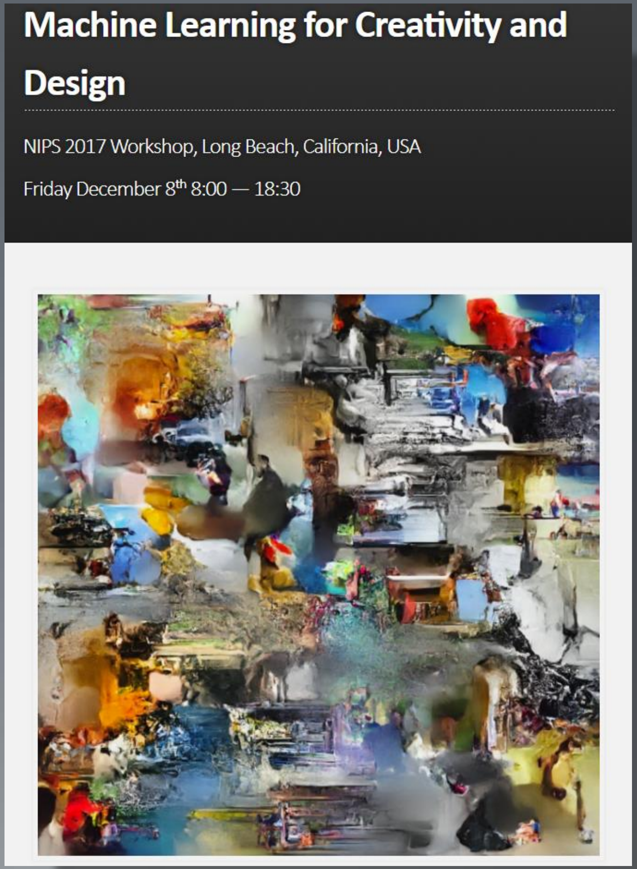


딥러닝 학습 프로세스



Sample labeled data
Forward it trough the network to get predictions
Backpropagate the errors
Update the connection weights

딥러닝 + ART



Machine Learning for Creativity and Design

NIPS 2017 Workshop, Long Beach, California, USA

Friday December 8th 8:00 — 18:30

https://nips2017creativity.github.io/

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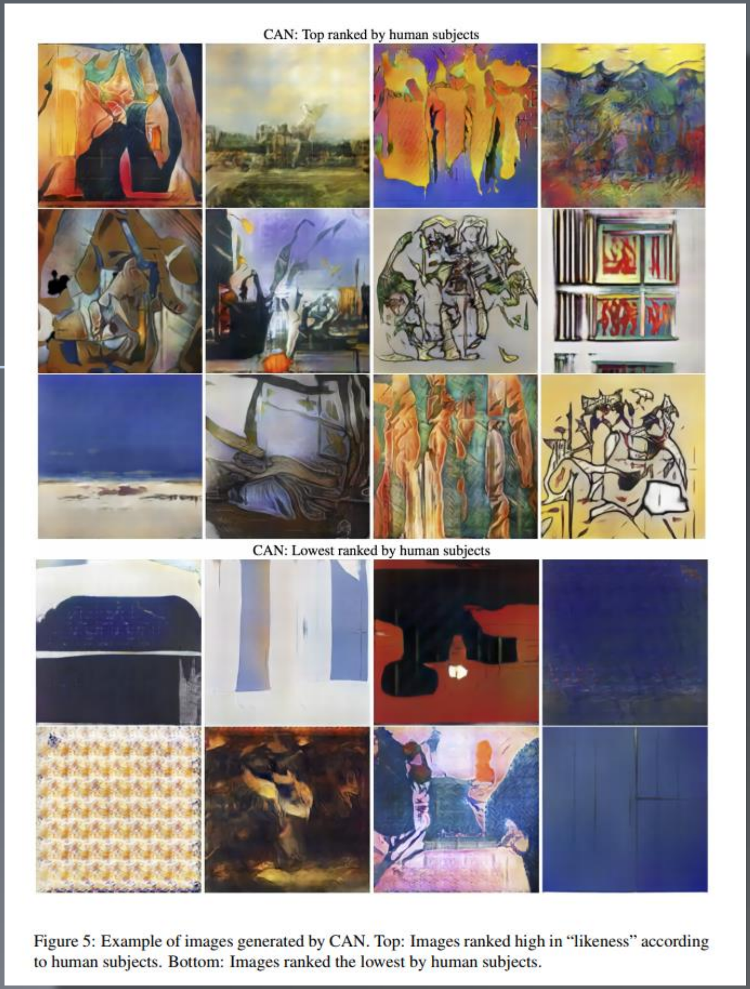
딥러닝 + ART



CAN: Top ranked by human subjects

CAN: Lowest ranked by human subjects

Figure 5: Example of images generated by CAN. Top: Images ranked high in "likeness" according to human subjects. Bottom: Images ranked the lowest by human subjects.

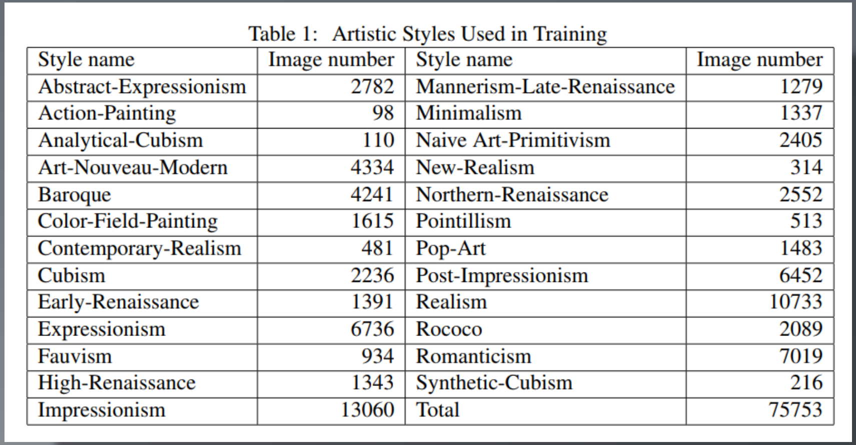


Table 1: Artistic Styles Used in Training

Style name	Image number	Style name	Image number
Abstract-Expressionism	2782	Mannerism-Late-Renaissance	1279
Action-Painting	98	Minimalism	1337
Analytical-Cubism	110	Naive Art-Primitivism	2405
Art-Nouveau-Modern	4334	New-Realism	314
Baroque	4241	Northern-Renaissance	2552
Color-Field-Painting	1615	Pointillism	513
Contemporary-Realism	481	Pop-Art	1483
Cubism	2236	Post-Impressionism	6452
Early-Renaissance	1391	Realism	10733
Expressionism	6736	Rococo	2089
Fauvism	934	Romanticism	7019
High-Renaissance	1343	Synthetic-Cubism	216
Impressionism	13060	Total	75753

CAN : Creative Adversarial Network
https://arxiv.org/pdf/1706.07068.pdf

딥러닝님께서
모든 문제를 해결?
새로운 것을 창조?

딥러닝

=

매우 높은 차원의 함수

+

매우 많은 양의 데이터

창조

∧

모방

텐서플로(Tensorflow)

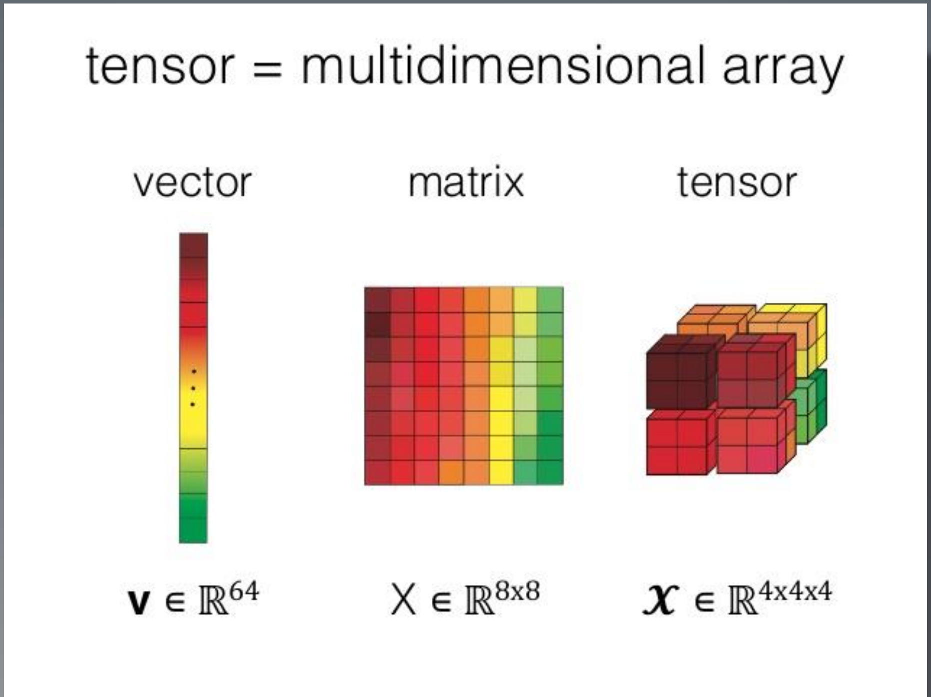
https://www.tensorflow.org/

Tensorflow

=Tensor + Flow

Tensor :

3차원 이상의 matrix



tensor = multidimensional array

vector

matrix

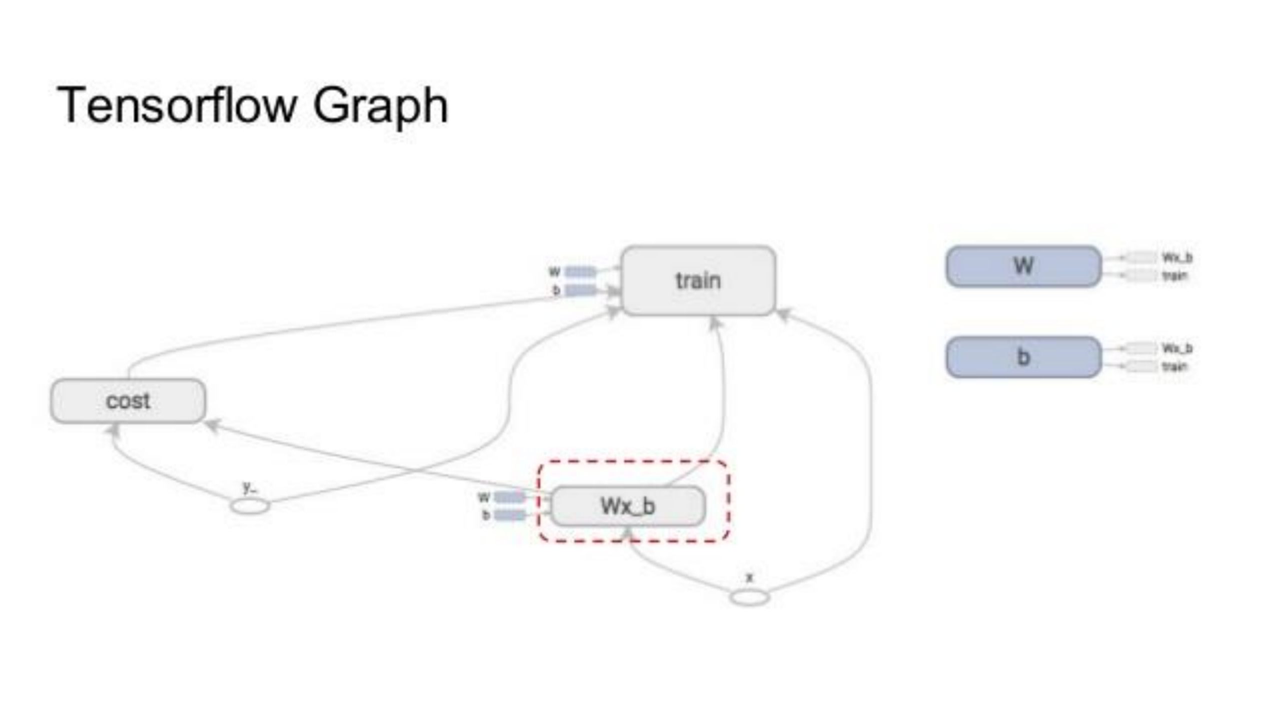
tensor

$\mathbf{v} \in \mathbb{R}^{64}$

$X \in \mathbb{R}^{8x8}$

$\boldsymbol{\mathcal{X}} \in \mathbb{R}^{4x4x4}$

Flow into Graph

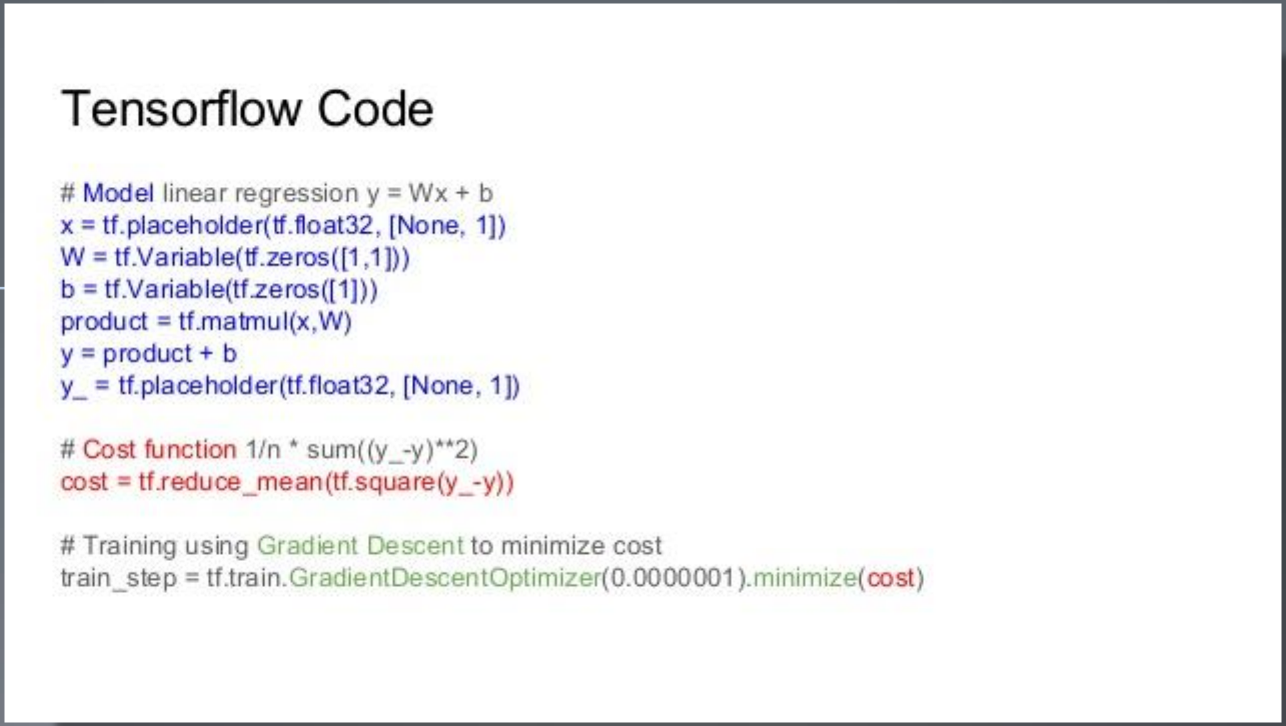


Tensorflow Graph

Tensor : 3차원 이상의 matrix
모양의 DATA
Flow : Graph형태의 Algorithm

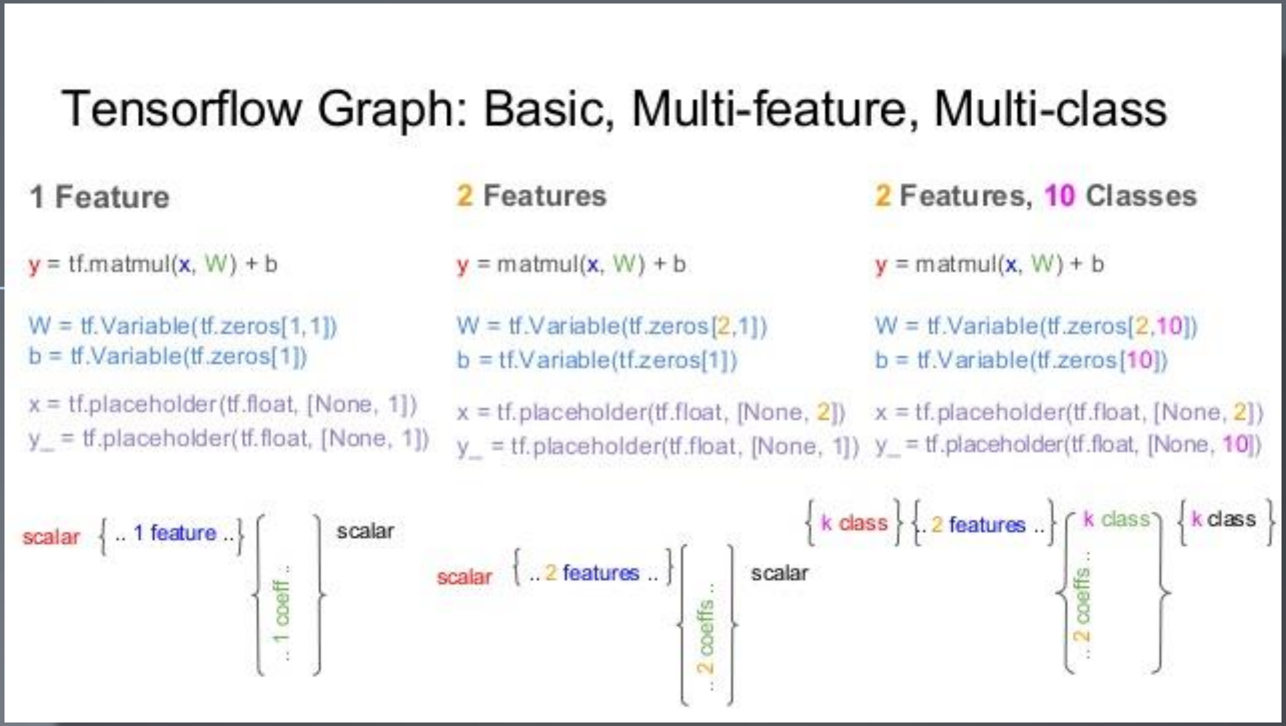
텐서플로를 한다는 것:

주어진 DATA 를
구현한 Algorithm 에
흘려 학습하는 과정



Tensorflow Code

```
# Model linear regression y = Wx + b
x = tf.placeholder(tf.float32, [None, 1])
W = tf.Variable(tf.zeros([1,1]))
b = tf.Variable(tf.zeros([1]))
product = tf.matmul(x,W)
y = product + b
y_ = tf.placeholder(tf.float32, [None, 1])

# Cost function 1/n * sum((y_-y)**2)
cost = tf.reduce_mean(tf.square(y_-y))

# Training using Gradient Descent to minimize cost
train_step = tf.train.GradientDescentOptimizer(0.0000001).minimize(cost)
```



Tensorflow Graph: Basic, Multi-feature, Multi-class

1 Feature

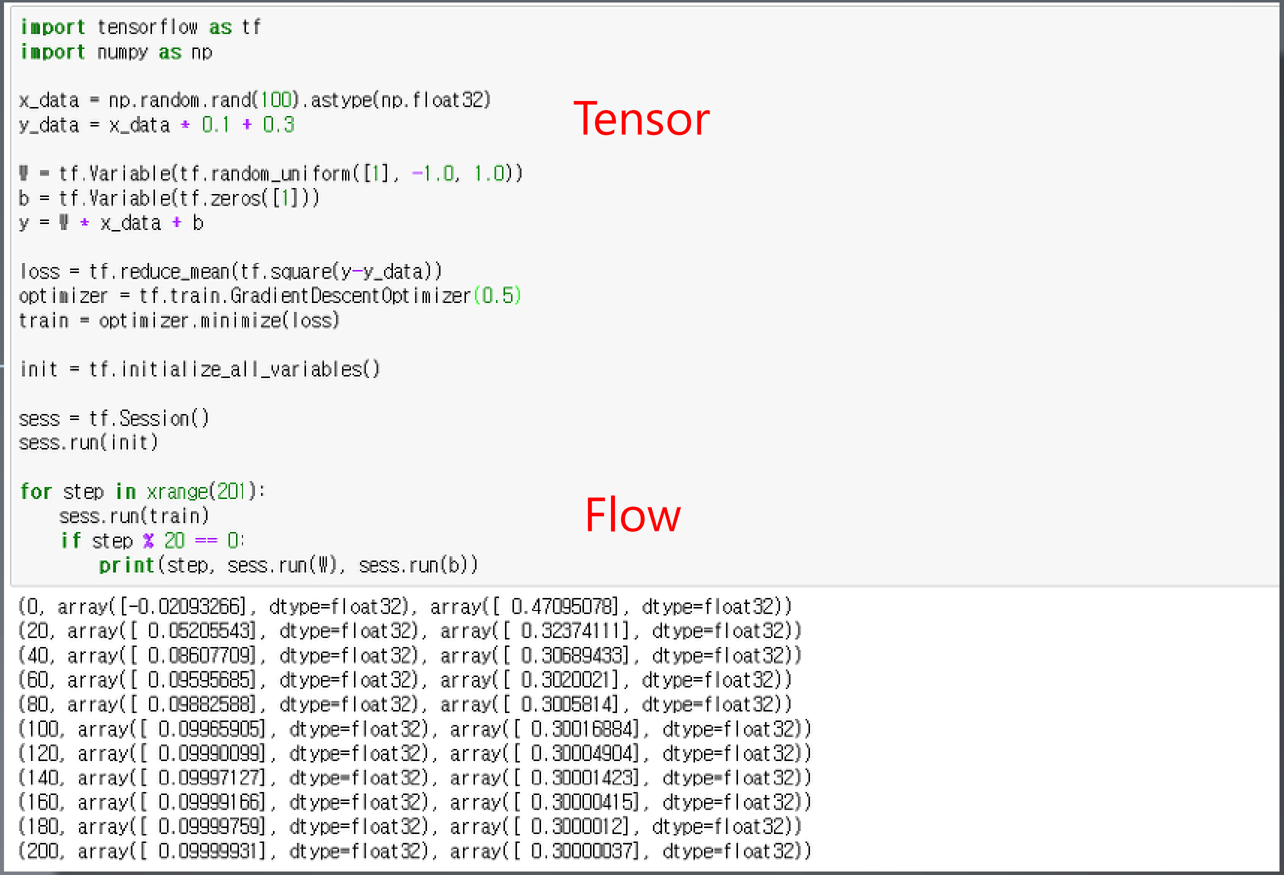
```
y = tf.matmul(x, W) + b

W = tf.Variable(tf.zeros[1,1])
b = tf.Variable(tf.zeros[1])

x = tf.placeholder(tf.float, [None, 1])
y_ = tf.placeholder(tf.float, [None, 1])
```

2 Features

```
y = matmul(x, W) + b

W = tf.Variable(tf.zeros[2,1])
b = tf.Variable(tf.zeros[1])

x = tf.placeholder(tf.float, [None, 2])
y_ = tf.placeholder(tf.float, [None, 1])
```

2 Features, 10 Classes

```
y = matmul(x, W) + b

W = tf.Variable(tf.zeros[2,10])
b = tf.Variable(tf.zeros[10])

x = tf.placeholder(tf.float, [None, 2])
y_ = tf.placeholder(tf.float, [None, 10])
```



```
import tensorflow as tf
import numpy as np

x_data = np.random.rand(100).astype(np.float32)
y_data = x_data * 0.1 + 0.3

W = tf.Variable(tf.random_uniform([1], -1.0, 1.0))
b = tf.Variable(tf.zeros([1]))
y = W * x_data + b

loss = tf.reduce_mean(tf.square(y-y_data))
optimizer = tf.train.GradientDescentOptimizer(0.5)
train = optimizer.minimize(loss)

init = tf.initialize_all_variables()

sess = tf.Session()
sess.run(init)

for step in xrange(201):
    sess.run(train)
    if step % 20 == 0:
        print(step, sess.run(W), sess.run(b))
```

```
(0, array([-0.02093266], dtype=float32), array([ 0.47095078], dtype=float32))
(20, array([ 0.05205543], dtype=float32), array([ 0.32374111], dtype=float32))
(40, array([ 0.08607709], dtype=float32), array([ 0.30689433], dtype=float32))
(60, array([ 0.09595685], dtype=float32), array([ 0.3020021], dtype=float32))
(80, array([ 0.09882588], dtype=float32), array([ 0.3005814], dtype=float32))
(100, array([ 0.09965905], dtype=float32), array([ 0.30016884], dtype=float32))
(120, array([ 0.09990099], dtype=float32), array([ 0.30004904], dtype=float32))
(140, array([ 0.09997127], dtype=float32), array([ 0.30001423], dtype=float32))
(160, array([ 0.09999166], dtype=float32), array([ 0.30000415], dtype=float32))
(180, array([ 0.09999759], dtype=float32), array([ 0.3000012], dtype=float32))
(200, array([ 0.09999931], dtype=float32), array([ 0.30000037], dtype=float32))
```

Tensor

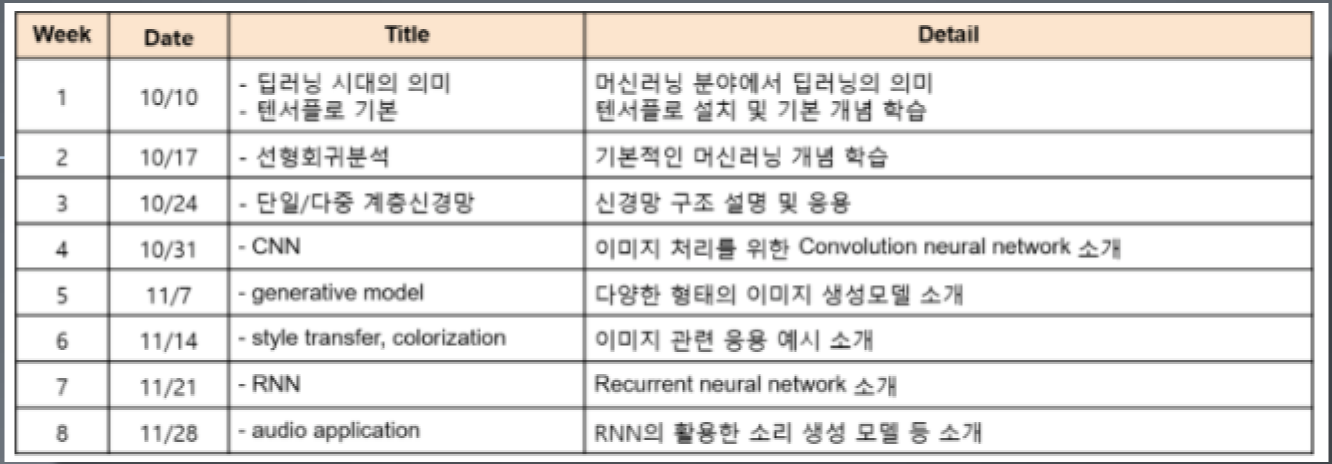
Flow

Tensorflow 설치

https://www.tensorflow.org/install/

Window 10

http://naver.me/59PQvkxa



Week	Date	Title	Detail
1	10/10	- 딥러닝 시대의 의미 - 텐서플로 기본	머신러닝 분야에서 딥러닝의 의미 텐서플로 설치 및 기본 개념 학습
2	10/17	- 선형회귀분석	기본적인 머신러닝 개념 학습
3	10/24	- 단일/다중 계층신경망	신경망 구조 설명 및 응용
4	10/31	- CNN	이미지 처리를 위한 Convolution neural network 소개
5	11/7	- generative model	다양한 형태의 이미지 생성모델 소개
6	11/14	- style transfer, colorization	이미지 관련 응용 예시 소개
7	11/21	- RNN	Recurrent neural network 소개
8	11/28	- audio application	RNN의 활용한 소리 생성 모델 등 소개

감사합니다