จุฬาลงกรณ์มหาวิทยาลัย
Chulalongkorn University
Pillar of the Kingdom

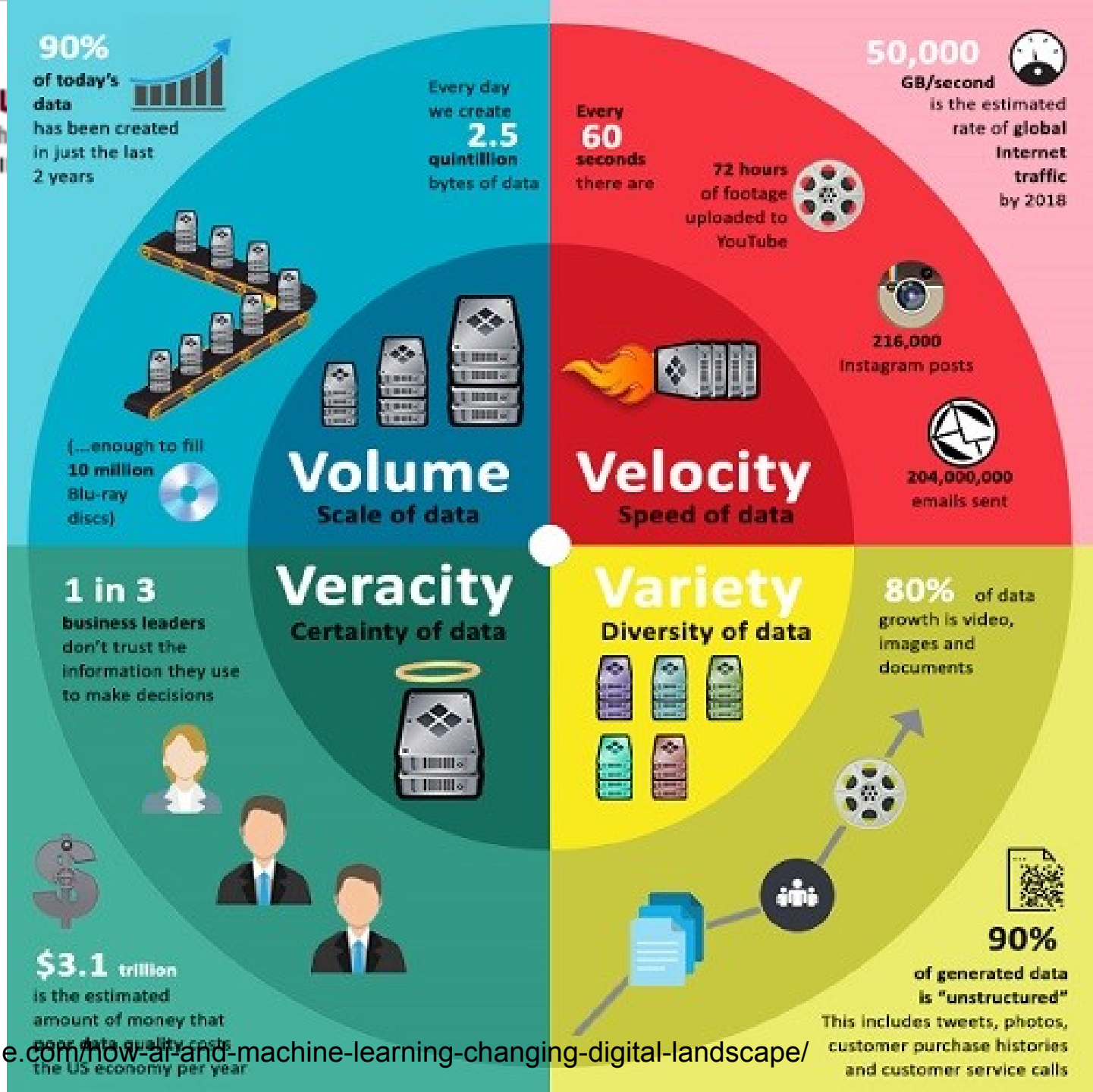
2301648 Architecture of Deep learning

จุฬาลงกรณ์มหาวิทยาลัย
Chulalongkorn University
Pillar of the Kingdom

Outline

1. Big data
2. AI-ML-DL
3. History of DL
4. DL model
5. Topics

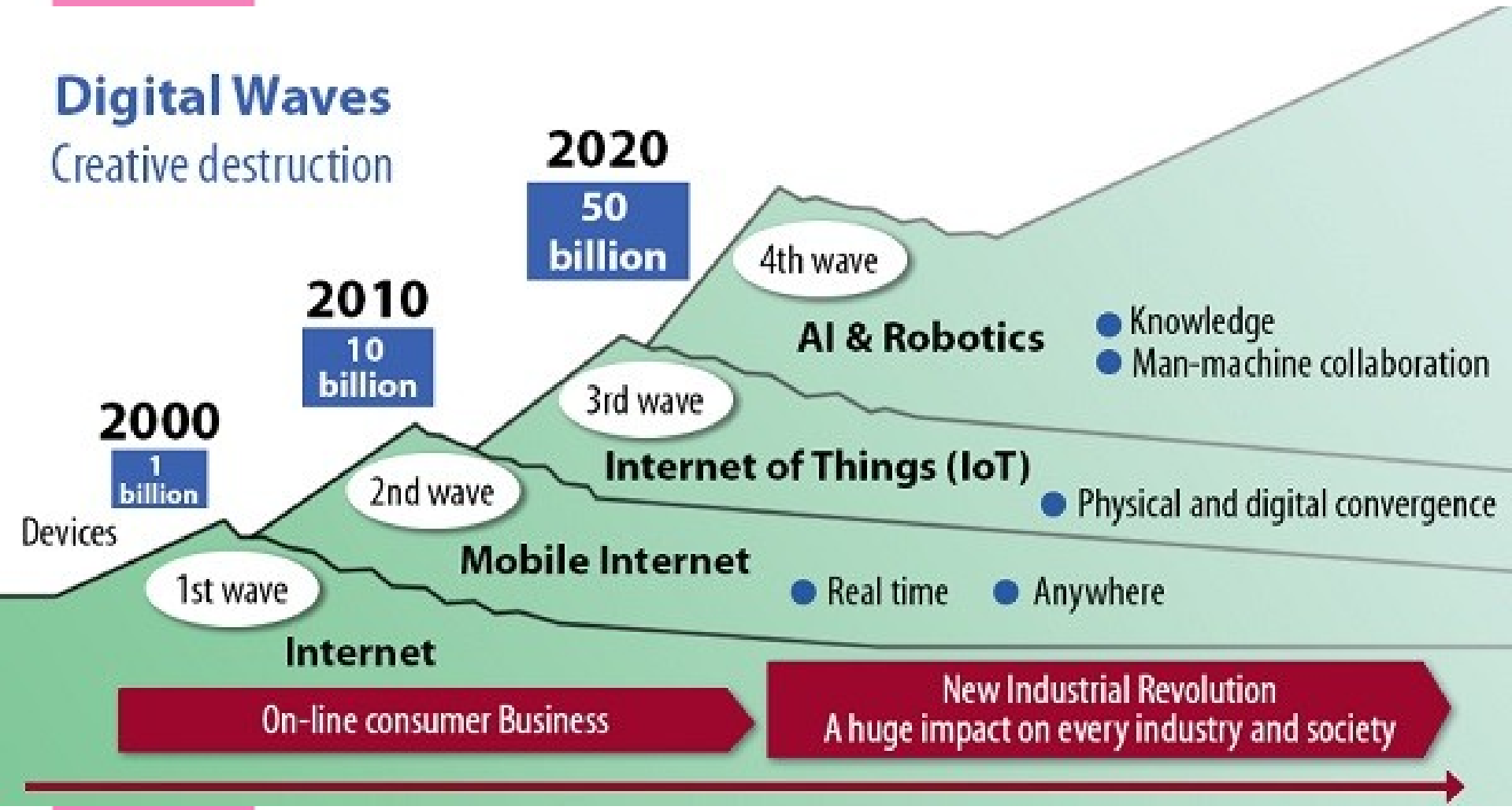
Big Data 4V



https://www.crewmachine.com/how-ai-and-machine-learning-changing-digital-landscape/

จุฬาลงกรณ์มหาวิทยาลัย
Chulalongkorn University
Pillar of the Kingdom

Digital Waves



https://www.crewmachine.com/how-ai-and-machine-learning-changing-digital-landscape/

จุฬาลงกรณ์มหาวิทยาลัย
Chulalongkorn University
Pillar of the Kingdom

AI → ML → DL

- **Artificial Intelligence** (1950s) – Giving intelligence to machine
- **Machine Learning** (1980s) – realizing artificial intelligence (speech recognition, image recognition, playing go, dialogue)
- **Deep Learning** (2006) – for machine learning for higher prediction accuracy
  - A powerful class of machine learning model
  - Modern reincarnation of artificial neural network
  - Collection of simple, trainable mathematical functions

จุฬาลงกรณ์มหาวิทยาลัย
Chulalongkorn University
Pillar of the Kingdom

History of DL

- 1958: Rosenblatt's **Perceptron** algorithm
- 1969: Minksky showed **Perceptron** could not solve the XOR problem, connectedness, parity.
- 1986: Rumelhart developed **Backpropagtion** algorithm to train neural network
- Mid 90's: Cortes and Vapnik published paper on **Support Vector Machines**
- 2006: Hinton and Salakhutdinov proposed using **Restricted Blotzmann Machine** for pre-train Deep Neural Network
- 2007: Fei-Fei Li's **ImageNet** assembling a databse of 14 million labled images (Data drives learning)

จุฬาลงกรณ์มหาวิทยาลัย
Chulalongkorn University
Pillar of the Kingdom

History of DL

- 2011: Microsoft explored **Speech recognition** and IBM's **Watson**
- 2014: Google acquired **DeepMind**, combing deep learning and reinforcement learning
- 2016: DeepMind's **AlphaGo** defeated world champion Lee Sedol

จุฬาลงกรณ์มหาวิทยาลัย
Chulalongkorn University
Pillar of the Kingdom

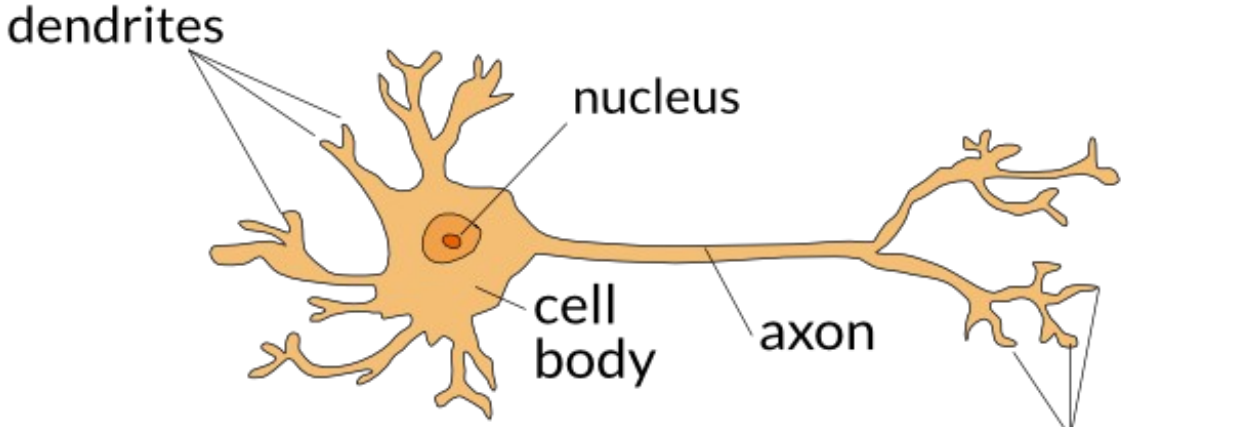
DL Application

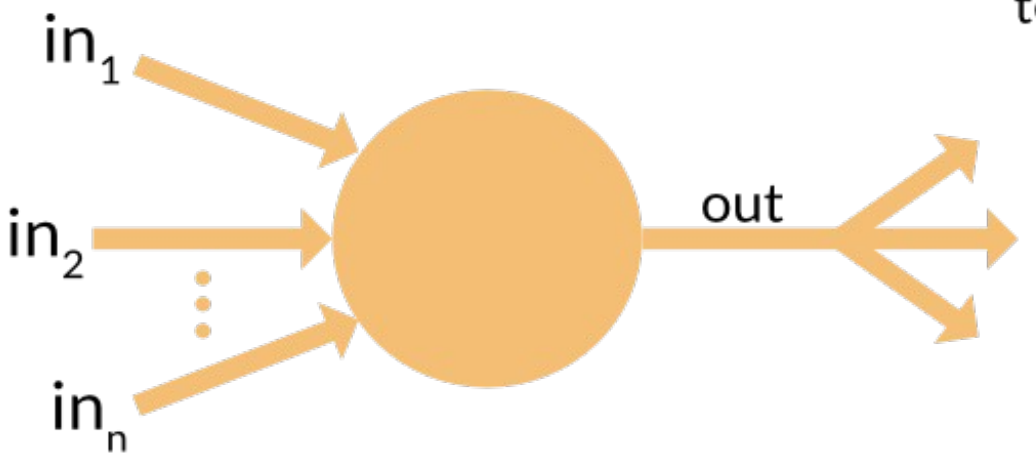
- **Google**: 2011 launched deep-learning focused project. 2014 bought DeepMind with AlphaGo.
- **Microsoft**: strong in speech-recognition and translation
- **Facebook**: translate user posts in more than 40 languages
- **Baidu**: for speech recognition, translation, photo search and self-driving car project

จุฬาลงกรณ์มหาวิทยาลัย
Chulalongkorn University
Pillar of the Kingdom

DL model

- **Perceptron**: Axons send signals to other cells while dendrites receive them.

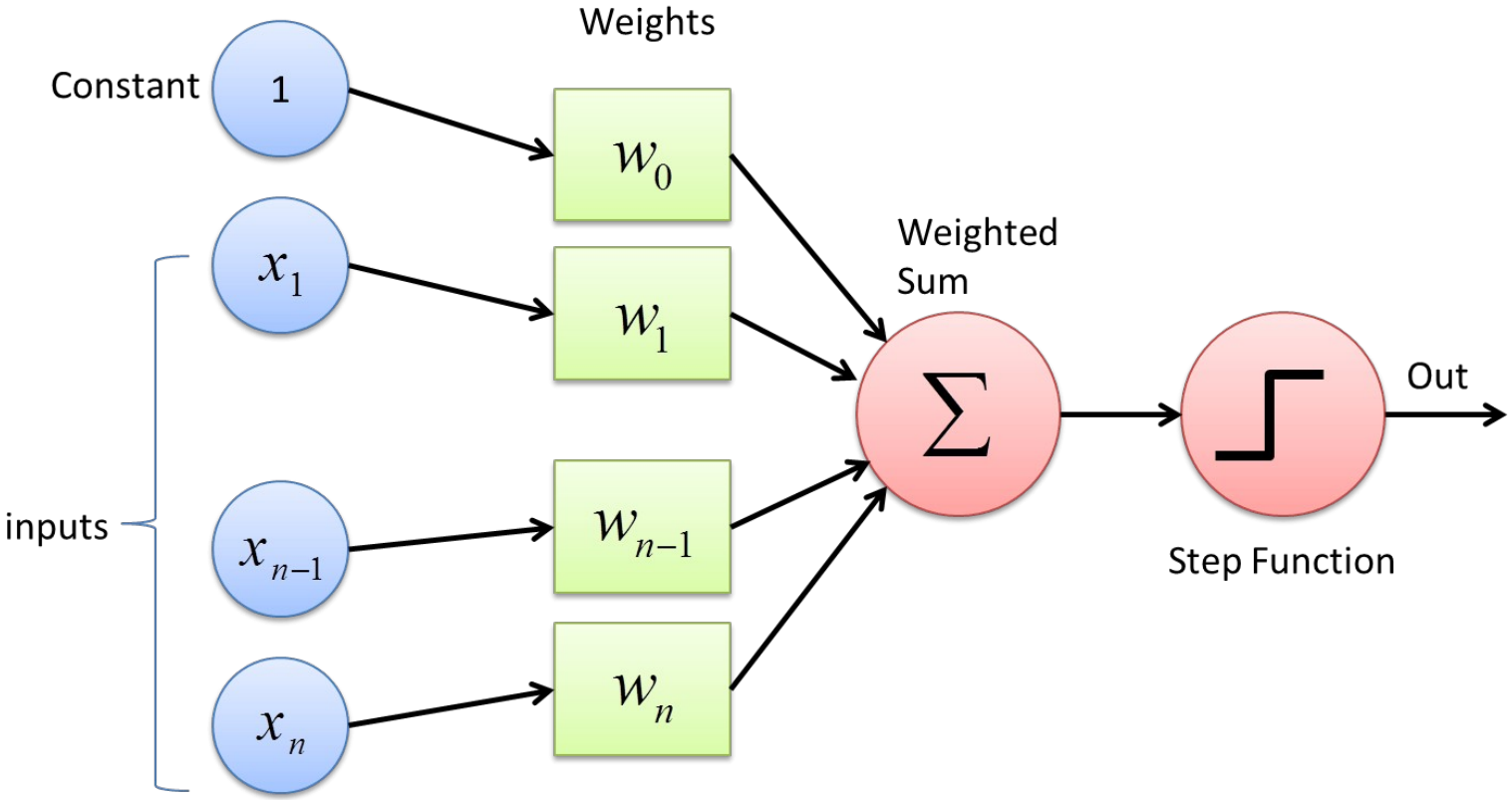




จุฬาลงกรณ์มหาวิทยาลัย
Chulalongkorn University
Pillar of the Kingdom

Neural network

- Weights are the important elements in neural network model.

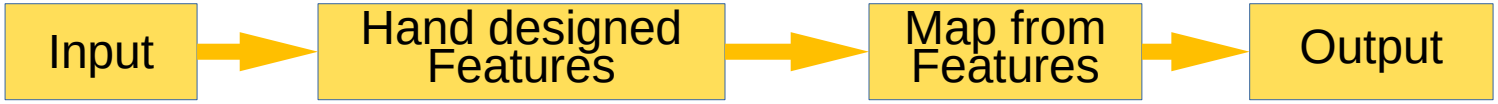


จุฬาลงกรณ์มหาวิทยาลัย
Chulalongkorn University
Pillar of the Kingdom

ML vs. DL

Rules Based System

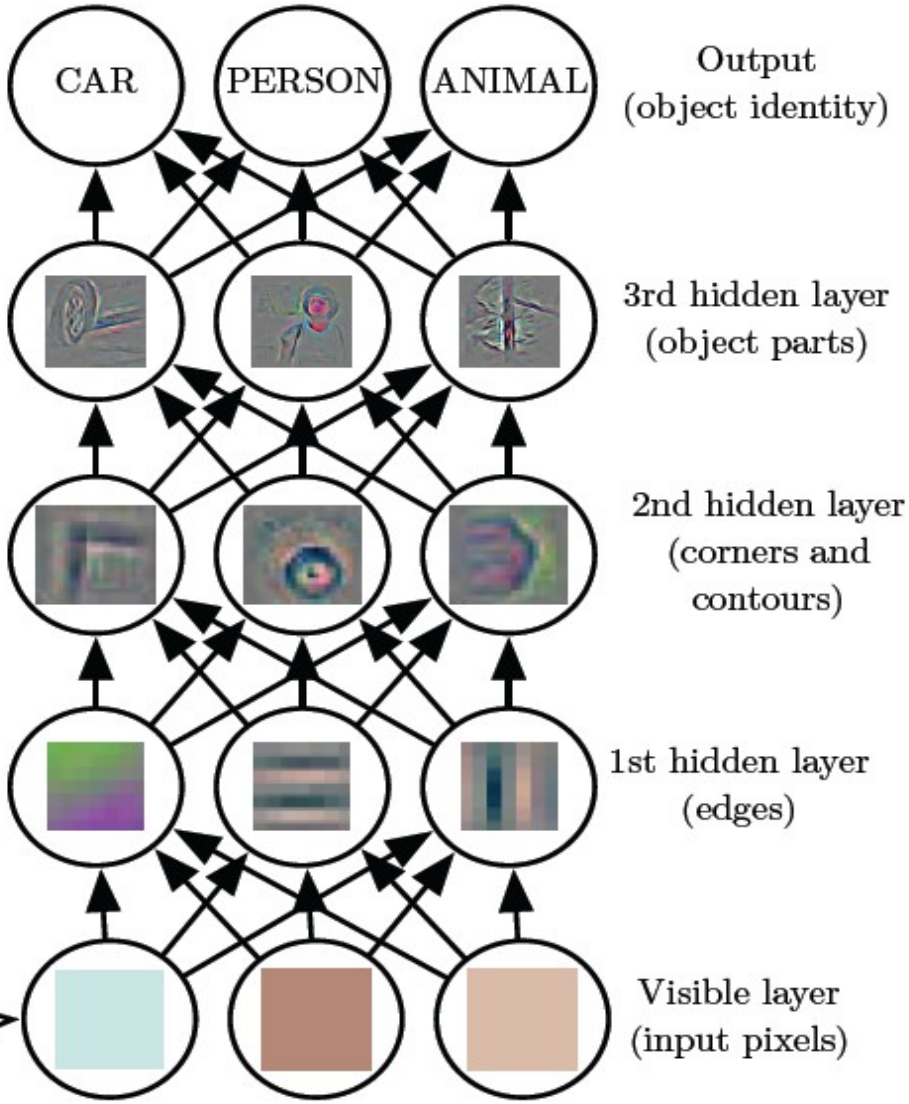
Classic Machine Learning



Deep Learning

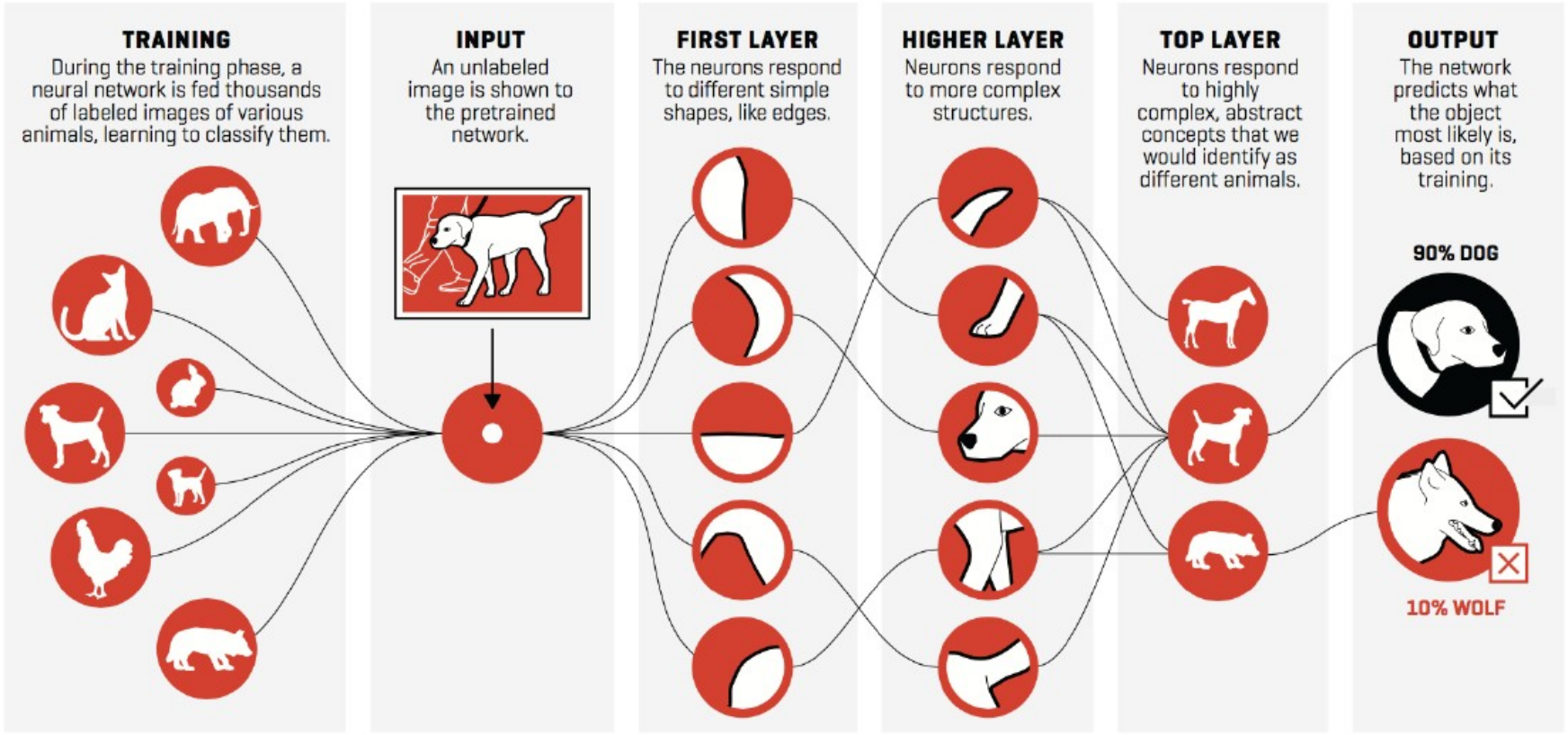
จุฬาลงกรณ์มหาวิทยาลัย
Chulalongkorn University
Pillar of the Kingdom

DL model



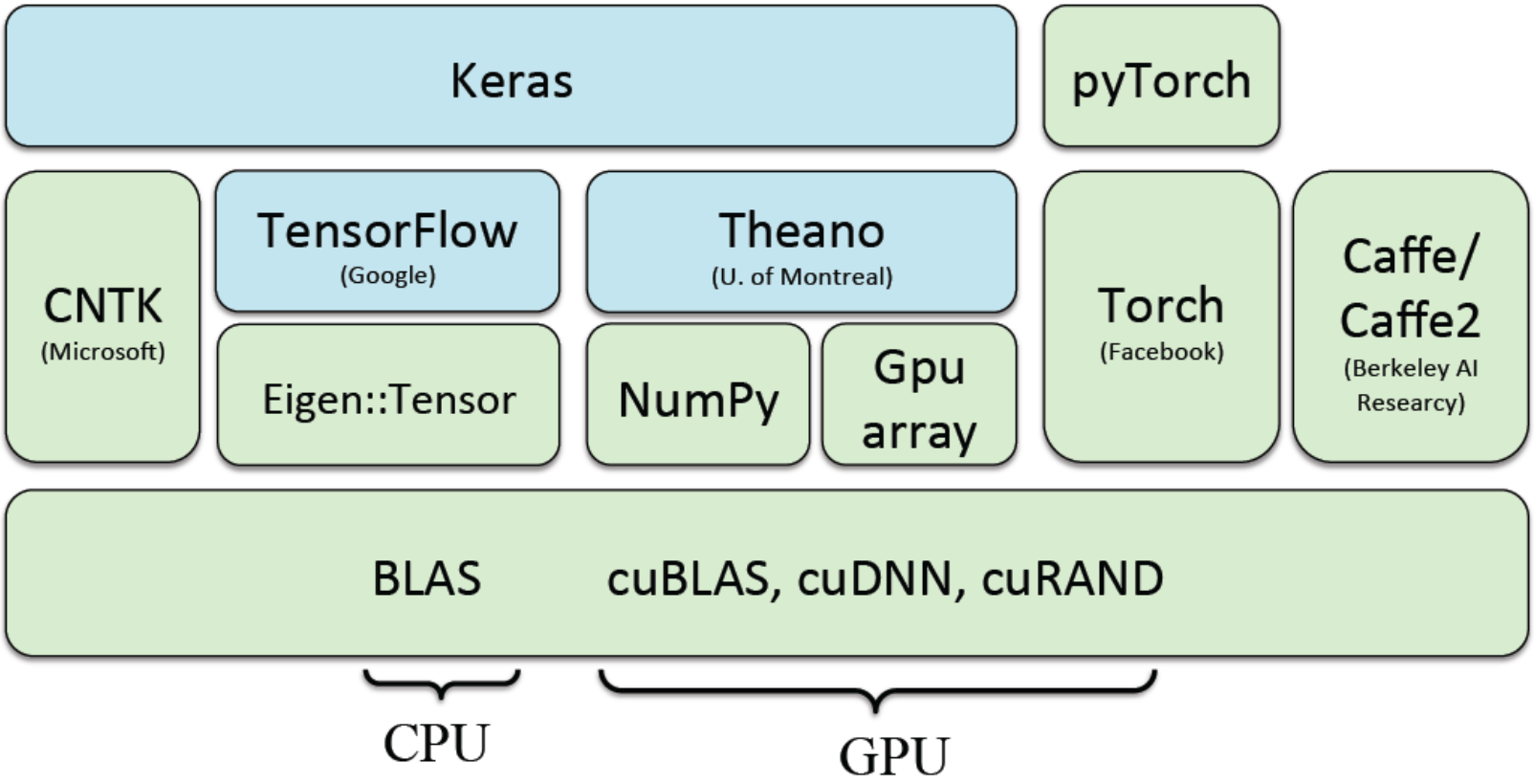
จุฬาลงกรณ์มหาวิทยาลัย
Chulalongkorn University
Pillar of the Kingdom

DL model



จุฬาลงกรณ์มหาวิทยาลัย
Chulalongkorn University
Pillar of the Kingdom

DL software



จุฬาลงกรณ์มหาวิทยาลัย
Chulalongkorn University
Pillar of the Kingdom

Topics

- Introduction to deep learning
- Background: Ndarray, linear algebra, probability, automatic differentiation
- Implementation of a linear regression and a logistic regression
- Softmax regression and regularization
- Perceptron and multilayer perceptron
- Convolutional neural network
- Architecture of CNNs:Alexnet, VGG
- Recurrent neural network
- Nonlinear optimization
- Gradient descent and stochastic gradient descent

จุฬาลงกรณ์มหาวิทยาลัย
Chulalongkorn University
Pillar of the Kingdom

Register 2301648

Contact me

Assoc. Prof. Krung Sinapiromsaran
MHVH 1208/6
254 Phayathai Road, Pathumwan,
Bangkok Thailand. 10330
https://math.sc.chula.ac.th/faculty/krung-s/
Email:Krung.S@chula.ac.th
Phone:02-218-7123