

# 디지털 트랜스포메이션 시대에 인공지능과 AI머신러닝

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# Industrial Revolution:

automates manual work

1,2차산업혁명

# Information Revolution:

automates mental work

3차산업혁명

# Machine Learning Revolution:

automates automation itself

4차산업혁명

Artificial Intelligence

인공지능

Machine Learning

머신러닝

Deep Learning

딥러닝

# Machine Learning

# McKinsey Global Institute - May 2011

By 2018, the United States alone could face a shortage of 140,000 to 190,000 people (machine learning) with deep analytical skills as well as 1.5 million managers and analysts (data scientists) with the know-how to use the analysis of big data to make effective decisions.

Source: <http://www.mckinsey.com>

# ML is all about ...

- **Prediction** (generalization, supervised learning)
- **Semantics** (representation learning, unsupervised learning)
- **Sequential decision making** (deep reinforcement learning)

# Google

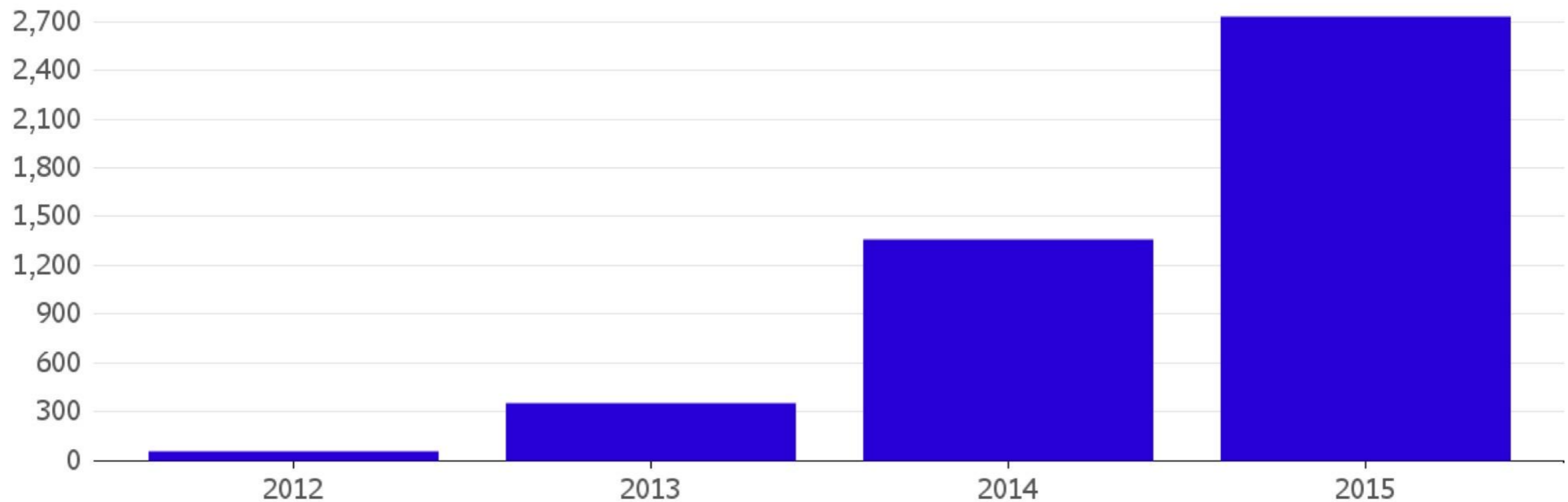
Search (검색)

Mobile first

AI first

## Artificial Intelligence Takes Off at Google

Number of software projects within Google that uses a key AI technology, called Deep Learning.



Source: Google

Note: 2015 data does not incorporate data from Q4

# Deep Learning

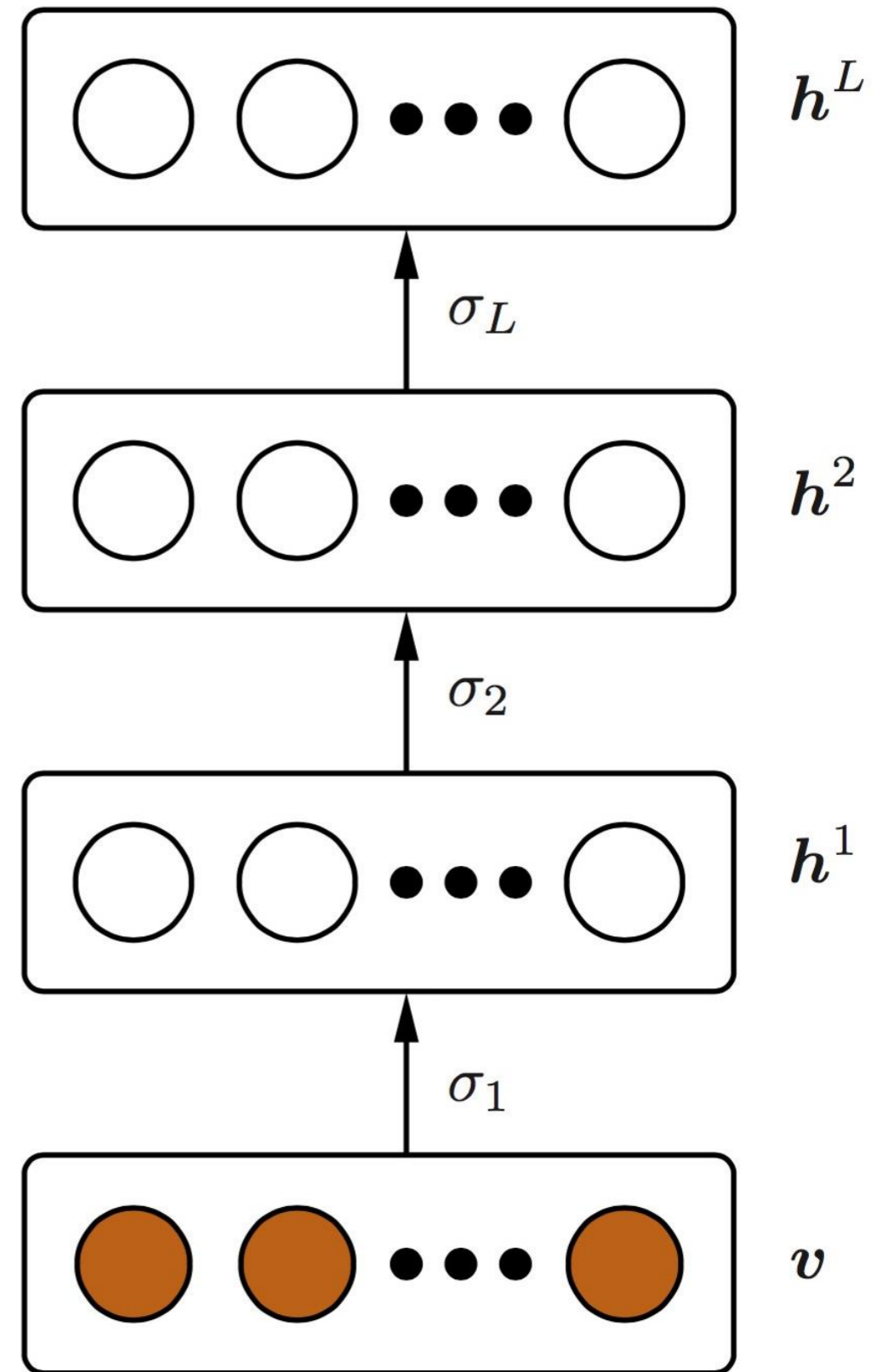


# 핫테크 3분: Deep Learning

오늘 머신러닝의 세계에 대해 알아주세요

**End-to-End  
Learning**

**Data in,  
Solution out**



**Deep learning allows  
computers to recognize speech**

Speech Recognition

# Speech Recognition

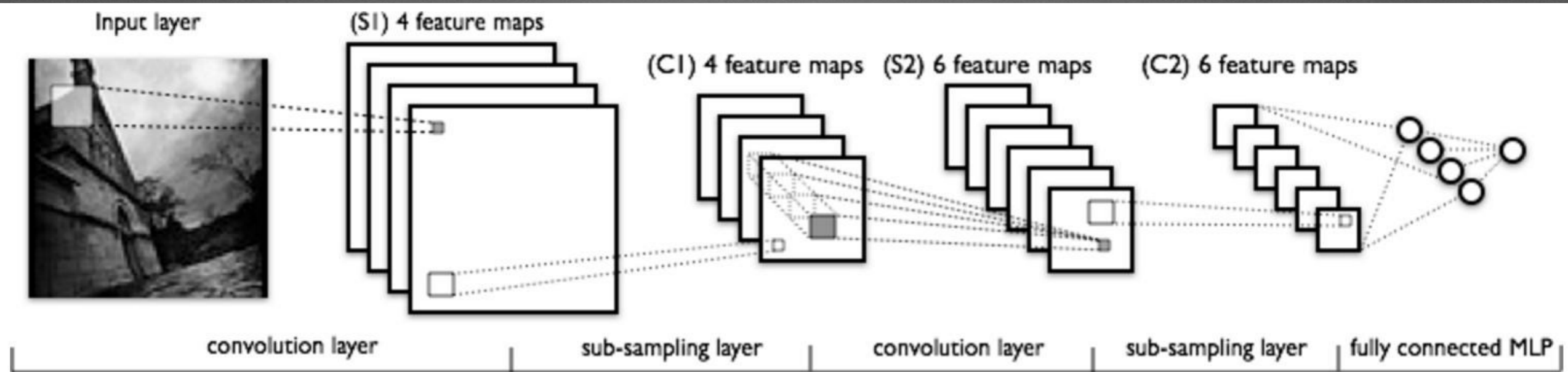


Amazon Alexa is everywhere in CES 2017

Google Now  
MS Cortana  
Apple Siri

# Alexa Built in

- LG: Smart InstaView Refrigerator
- Ford: in-vehicle Alexa controls for cars
- C by GE Lamp with Alexa
- Lenovo Smart Assistant Speaker
- Samsung Powerbot VR7000
- Coway Airmega Smart Air Purifier
- Whirlpool announced that its entire suite of connected appliances will sync up with Alexa this year
- And many ...



**Deep learning allows  
computers to recognize images**

Computer Vision

# Smart Cart by IMAGR

A woman with blonde hair, wearing a white t-shirt and a dark blue vest, is looking upwards in a supermarket aisle. The shelves are filled with various products, and the background is slightly blurred. The text "YOU'RE AT THE SUPERMARKET" is overlaid on the image in a white, bold, sans-serif font, enclosed in a white rectangular border.

**YOU'RE AT THE SUPERMARKET**

Trained algorithms: (1) on images of grocery products; (2) to learn to recognize products put into or removed from the cart ; (3) on barcodes to learn prices.

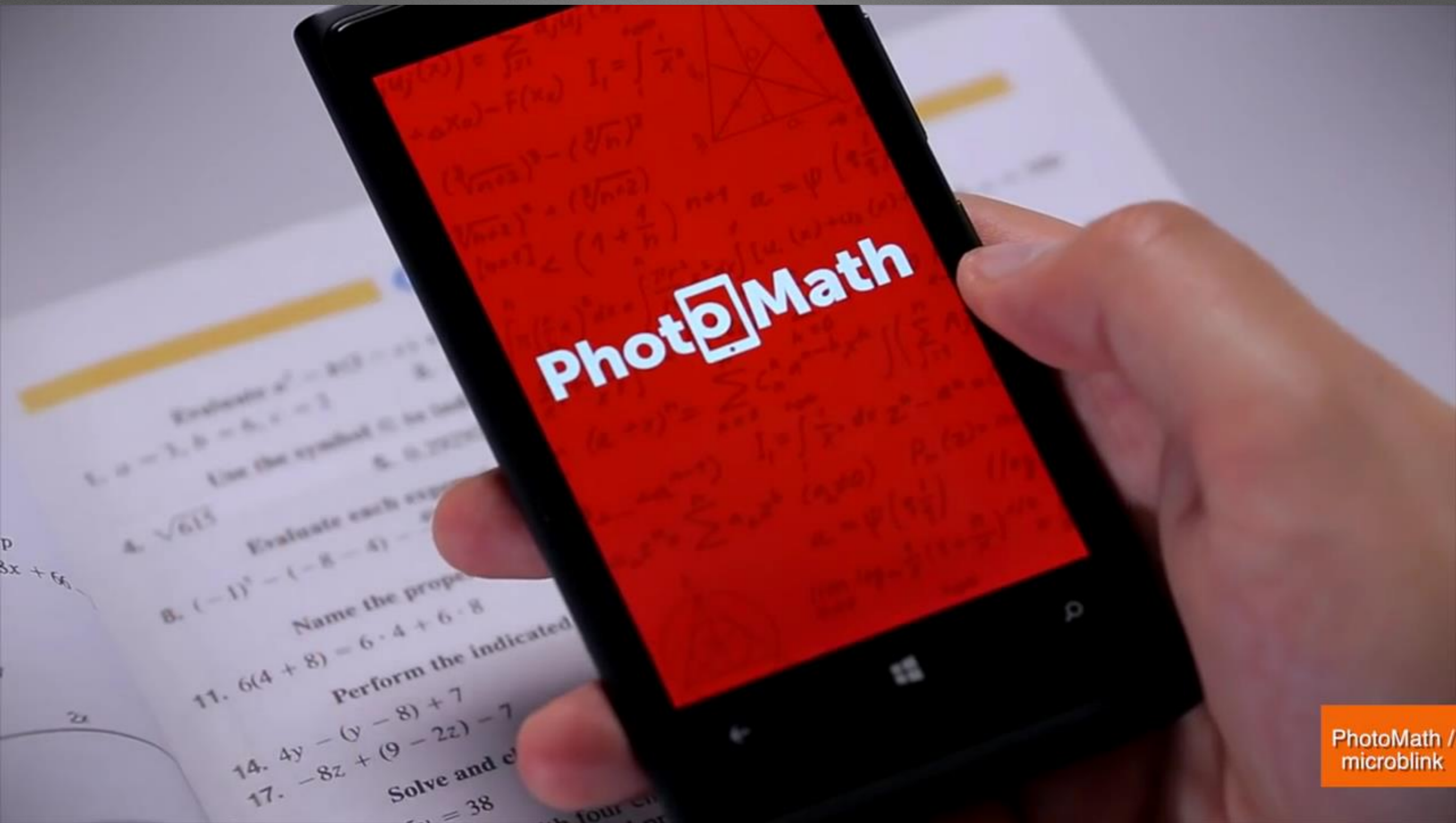
# Regirobo by Lawson and Panasonic



This Lawson convenience store is in collaboration with Panasonic.

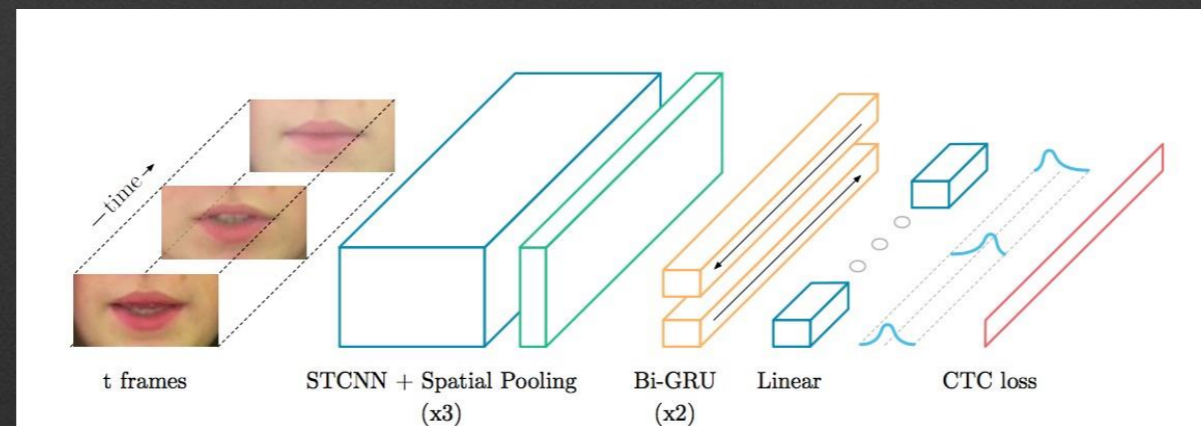


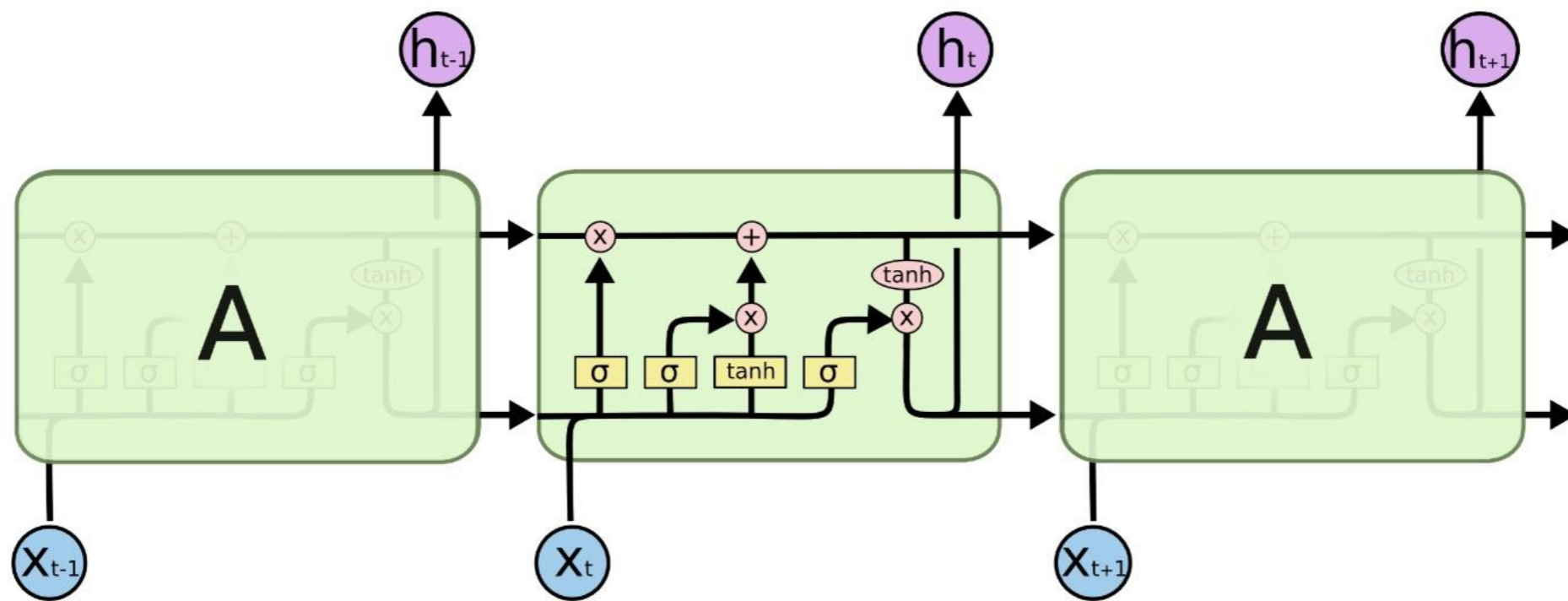
# PhotoMath App



PhotoMath /  
microblink

# LipNet by Oxford and DeepMind





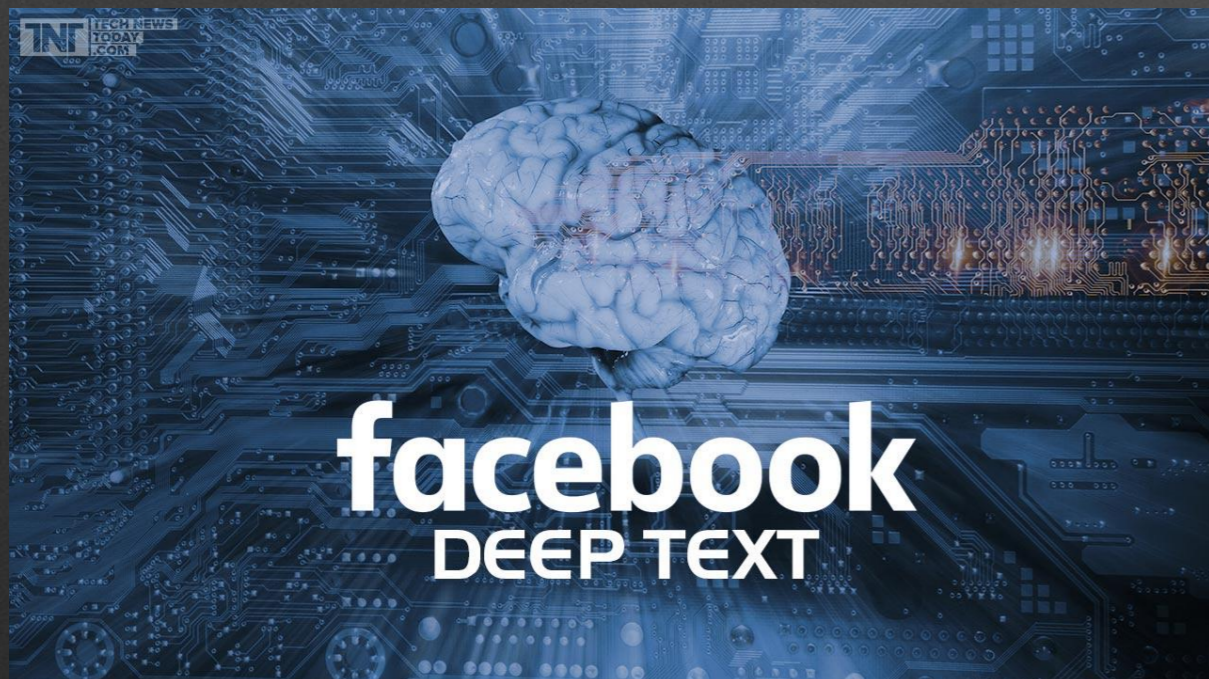
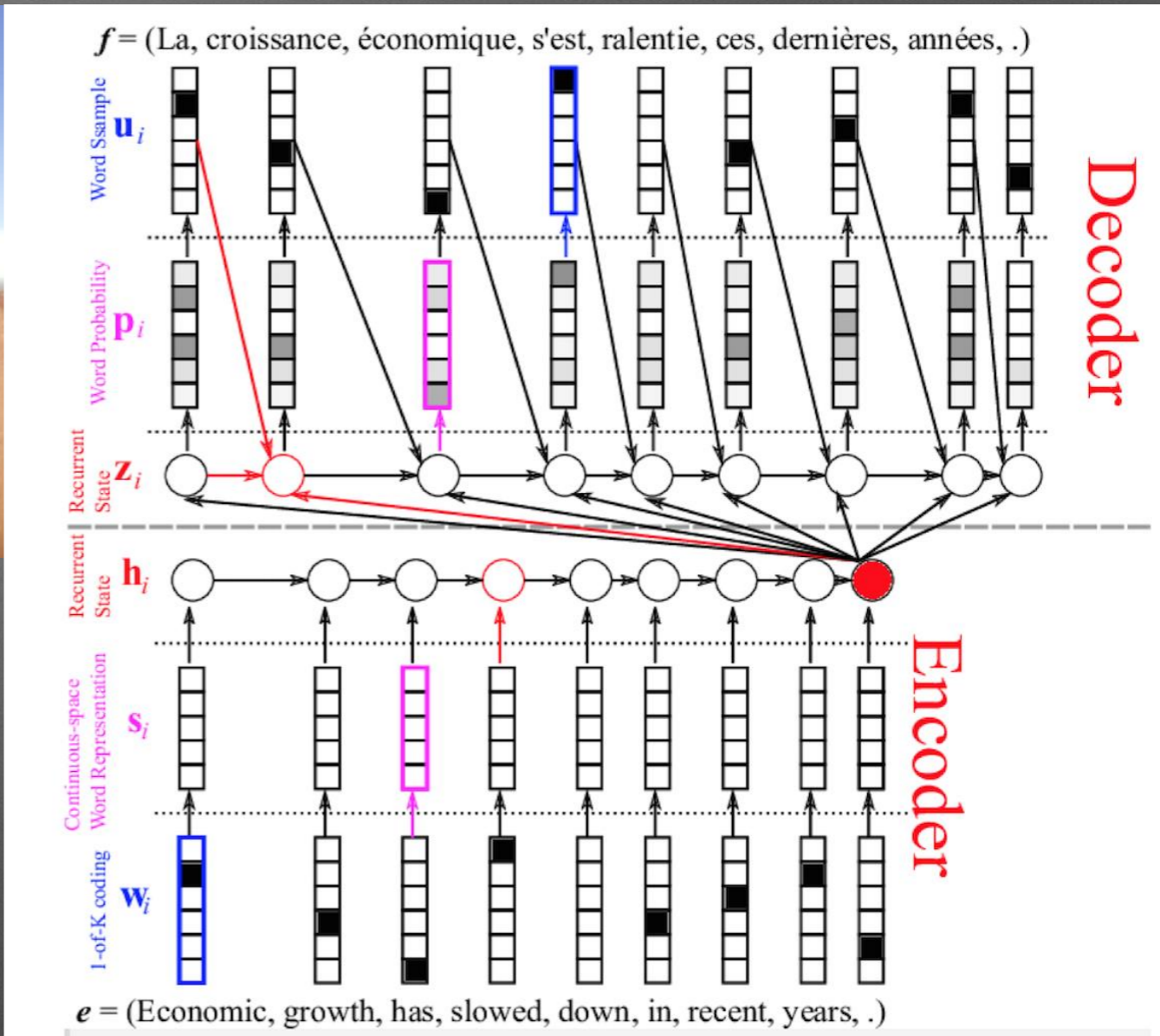
**Deep learning allows  
computers to understand  
languages**

Natural Language Processing

LSTM, figure source: <http://colah.github.io/posts/2015-08-Understanding-LSTMs/>



# Neural Machine Translation



Understand the language in several thousand Facebook posts a second, across over 20 different languages

# Deep Learning for Precision Agriculture

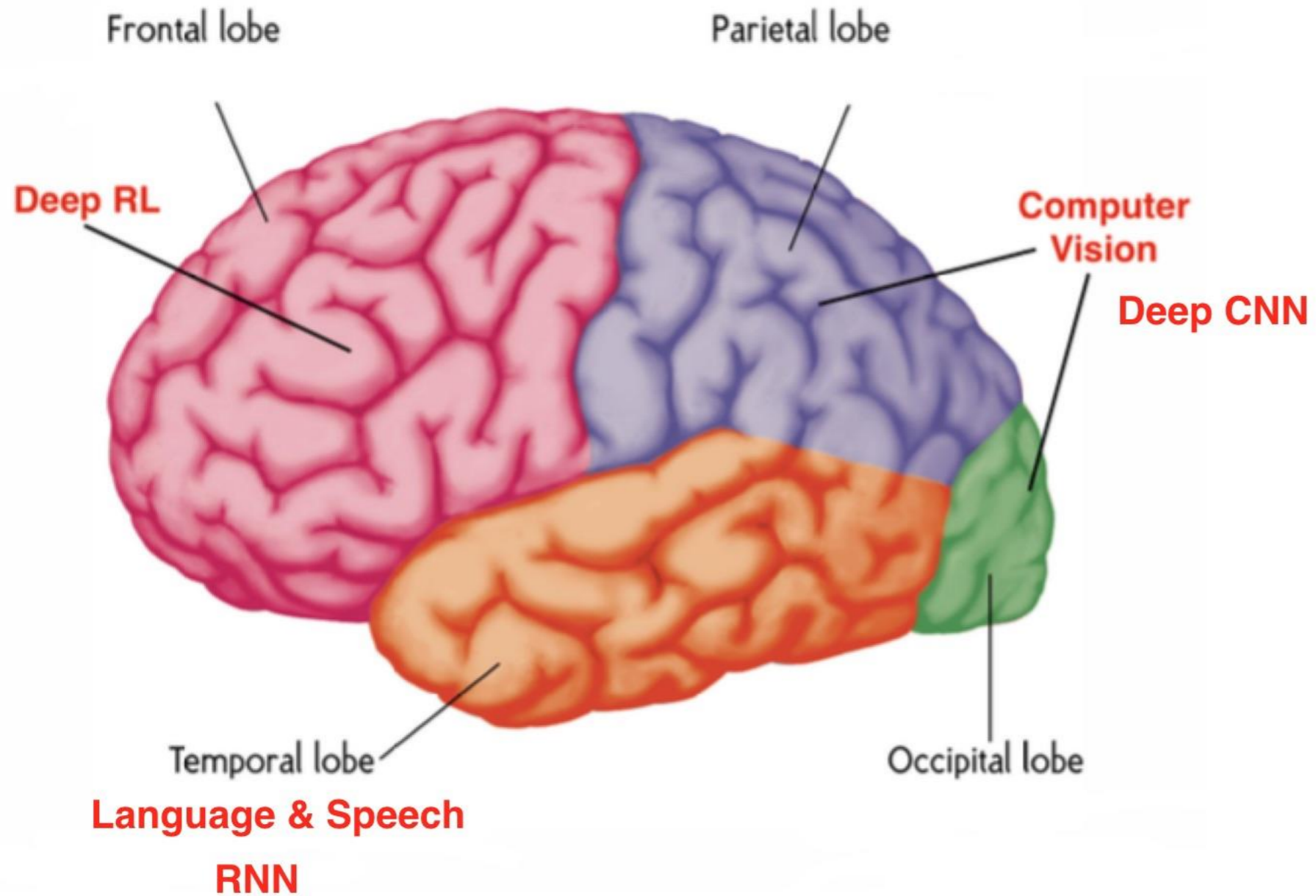
# RIPPA: University of Sydney



**Horticulture  
Innovation  
Australia**

Autonomous Row Following  
Lettuce, Lindenow, VIC, Australia

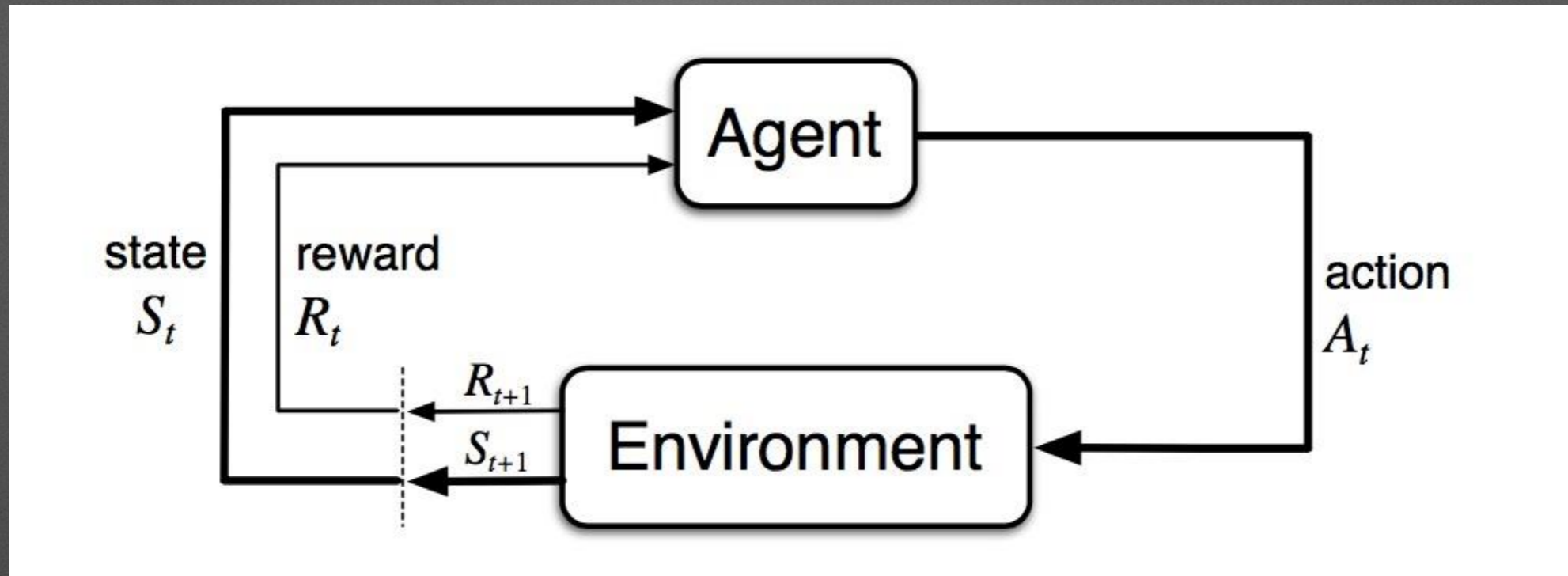
# Deep learning is a good pattern recognizer



보고

듣고

읽고



# Deep RL

RL + deep learning (nonlinear function approximation)

Figure source: Sutton and Barto's



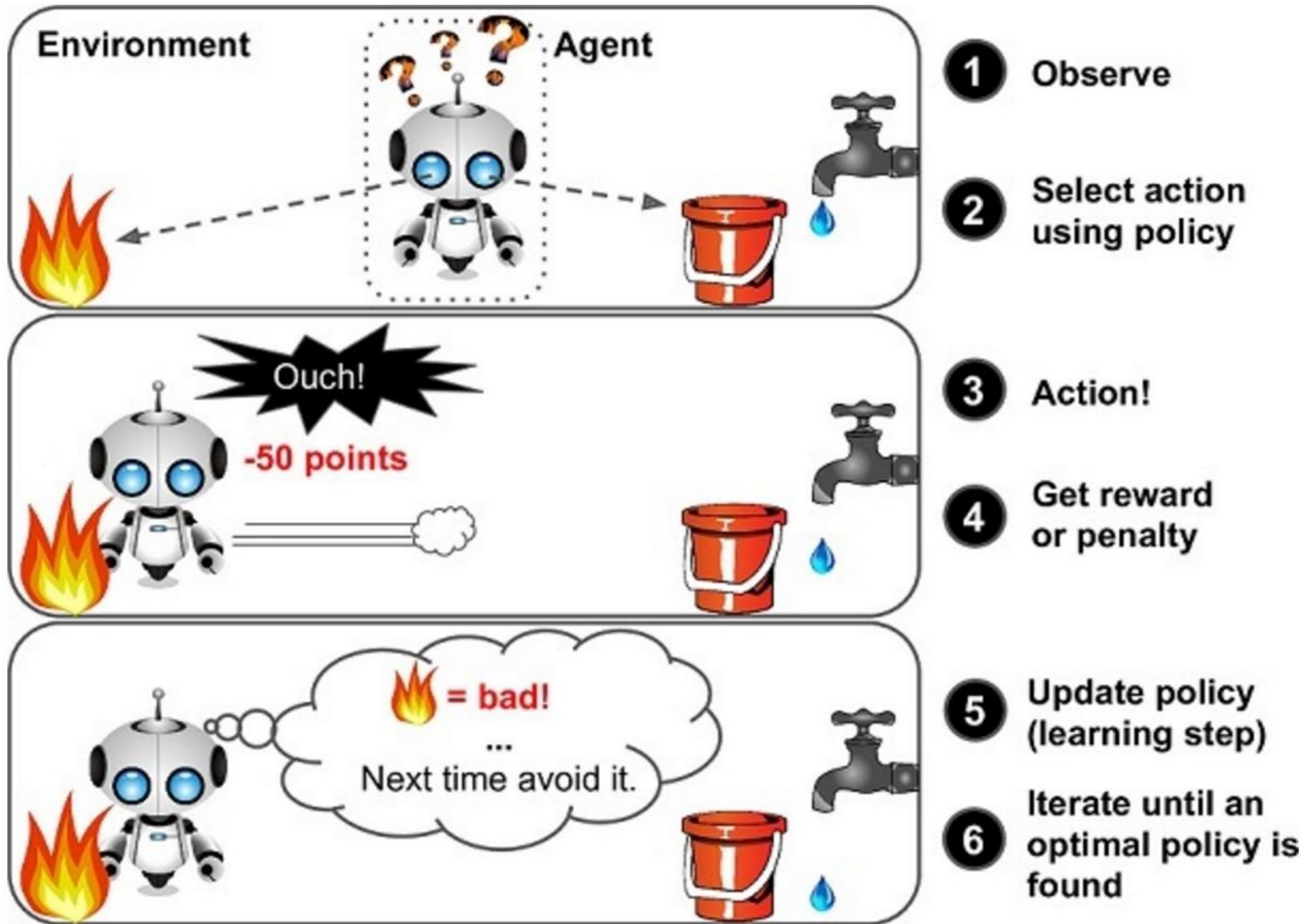


Figure source: <http://www.marutitech.com/businesses-reinforcement-learning/>

# RL in Business

- Self-training robots (for instance, a robot made by 'Fanuc')
- Space management in warehouse
- Dynamic pricing
- E-commerce personalization:
- Fleet cost minimization for customer delivery.
- Financial investment decision

**Starting out - 10 minutes of training**

**The algorithm tries to hit the ball back, but  
it is yet too clumsy to manage.**

Google DeepMind:

Atari Breakout

Deep Q Learning

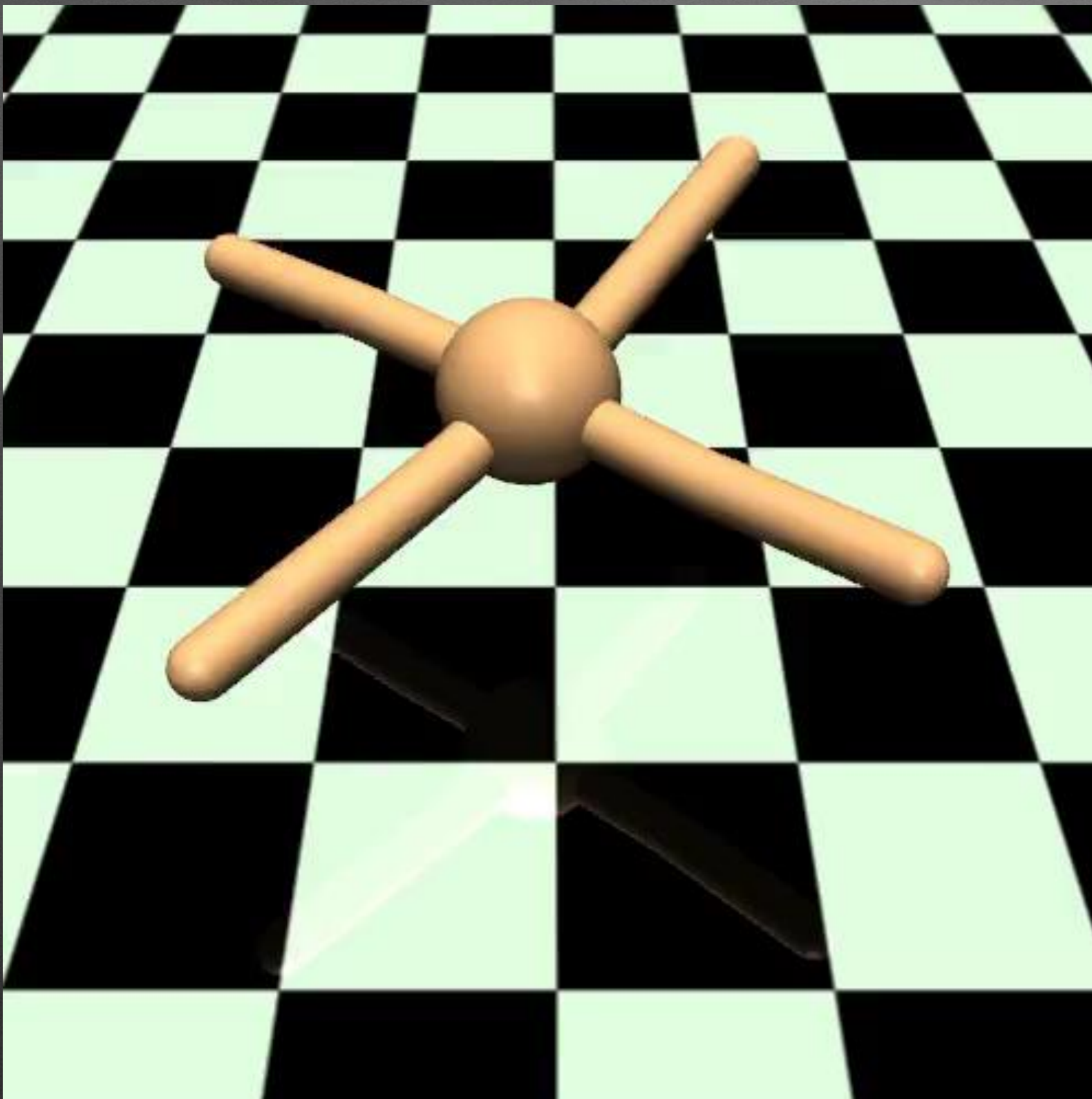
# Google: Robots are training themselves



# Learning from Demonstrations

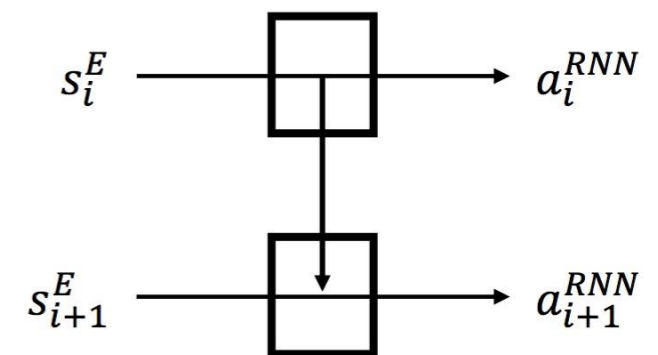
Behavior cloning, imitation learning,  
and apprenticeship learning

# Behavior Cloning

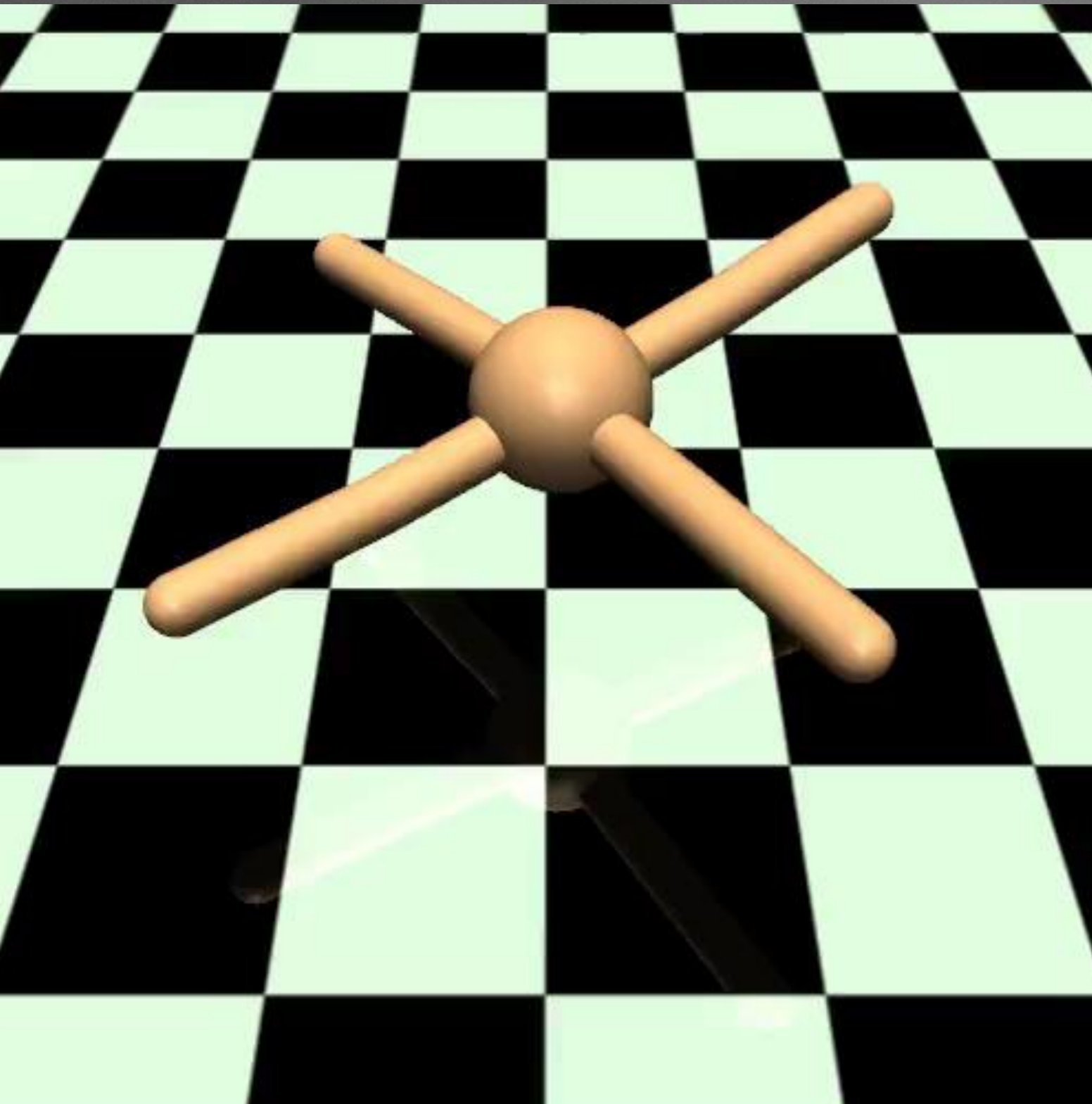


## Behavior Cloning

Expert Trajectory =  $(s_1^E, a_1^E, s_2^E, a_2^E, \dots, s_T^E, a_T^E)$

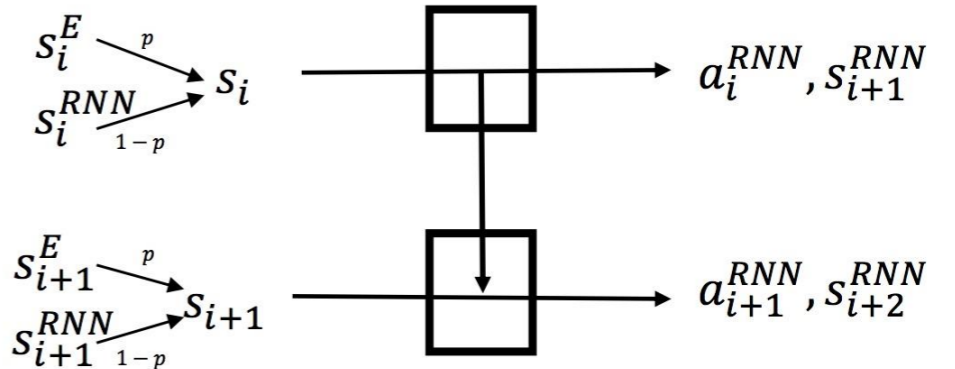


# Imitation Learning via curriculum learning



## Scheduled Sampling

Expert Trajectory =  $(s_1^E, a_1^E, s_2^E, a_2^E \dots, s_T^E, a_T^E)$



# Machine learning is a matchmaker

Preference Learning

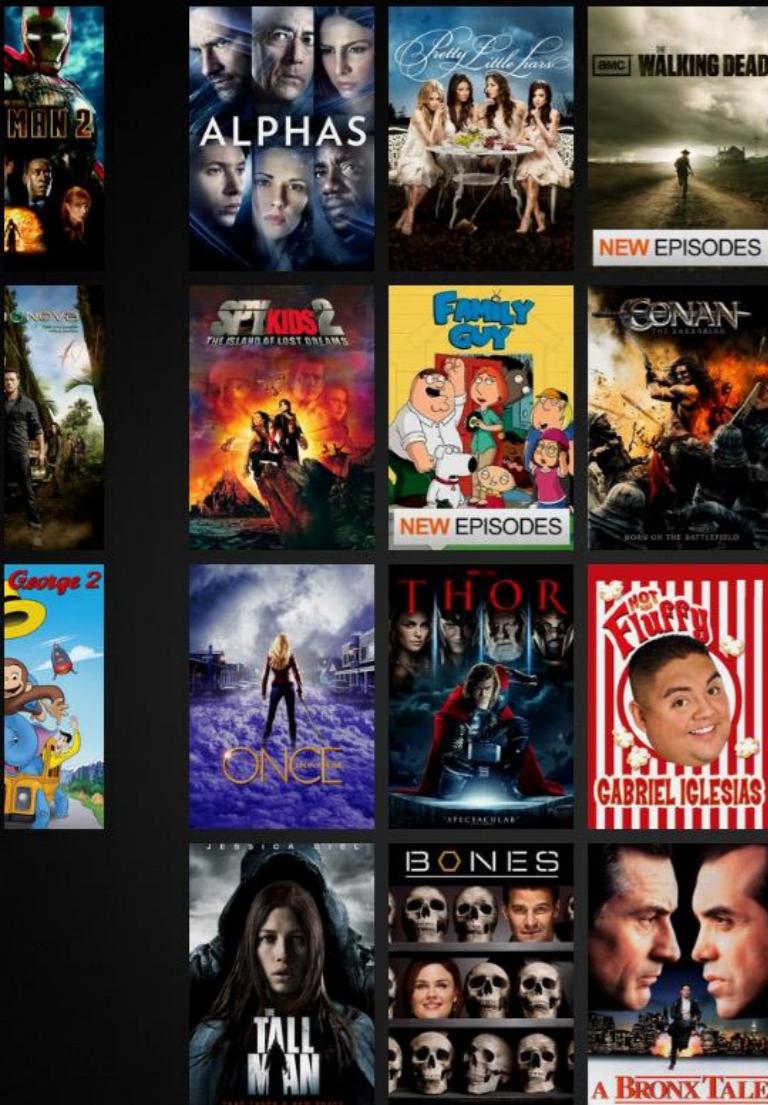


- **Small scale**
  - Owner of small business can do everything for consumers
- **Medium scale**
  - Automation via computers
  - Hard to satisfy individual consumer
- **Large scale**
  - Need machine learning for management, recommendation, and so on

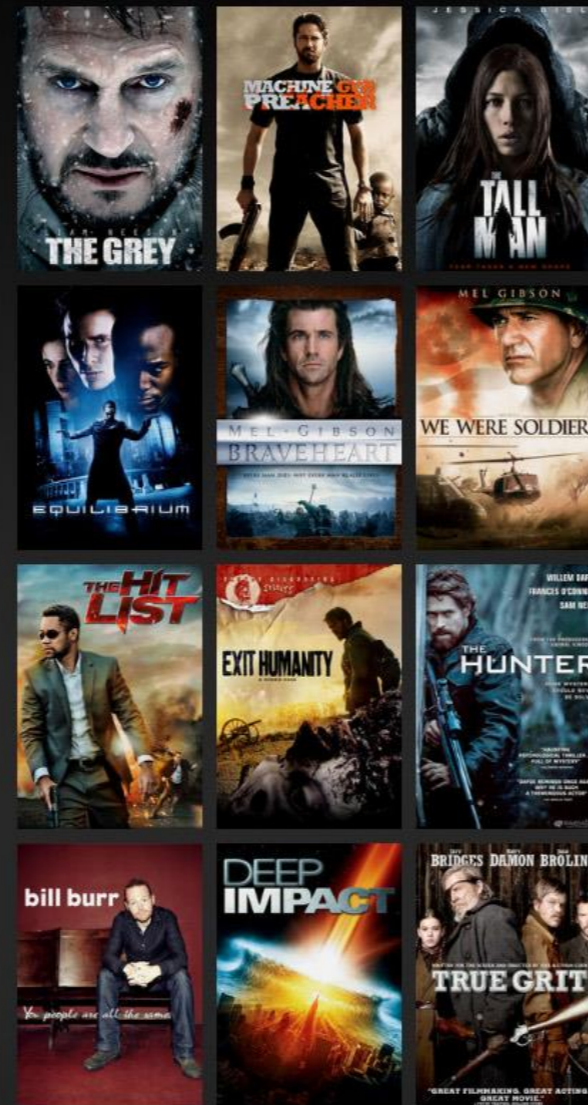
# Netflix

NETFLIX

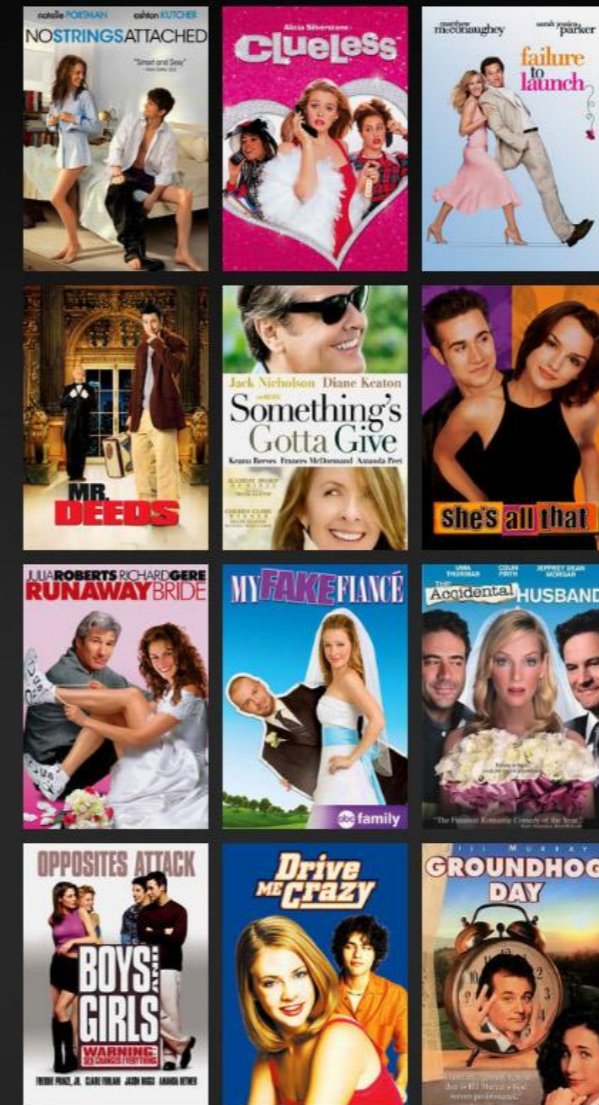
Popular on Netflix



Dark Movies



Romantic Opposites-Attract...



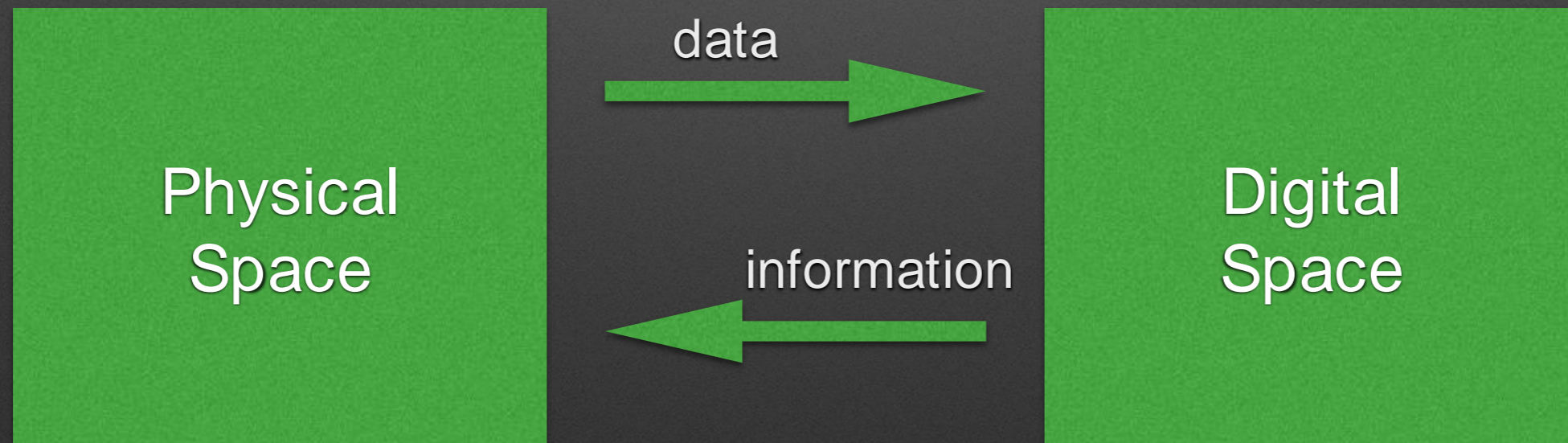
Emotional Movies



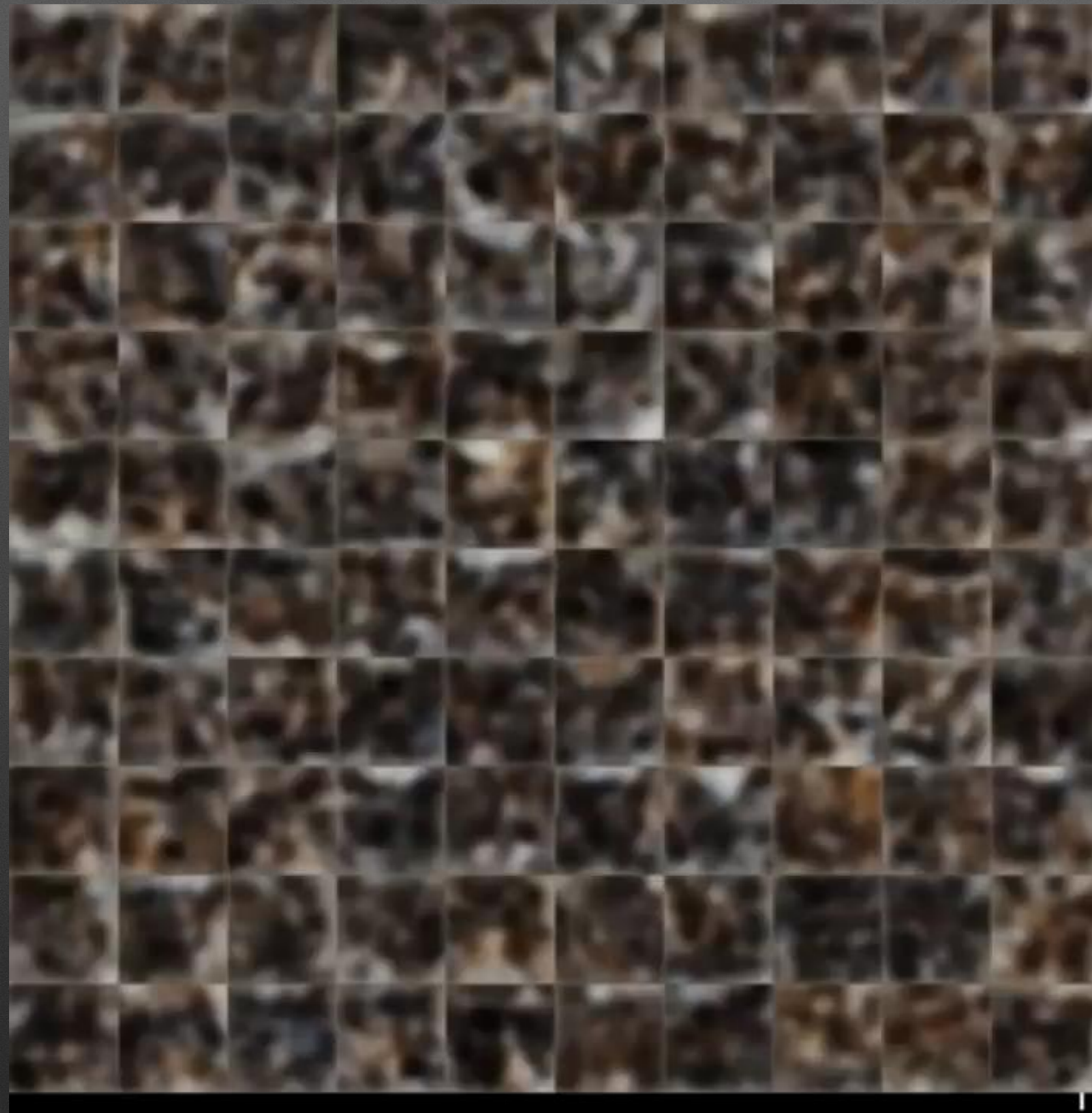
# Digital Twins

# Digital Twins

Digital twins refer to **computerized companions** of physical assets that can be used for various purposes. Digital twins **use data from sensors** installed on physical objects to represent their near real-time status, working condition or position.



**Need a good generative  
model?**

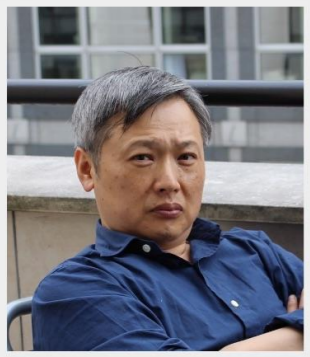


# Generative Adversarial Network (GAN)

Learning to  
generate  
cat images

# **POSTECH**

## **ML Center and ML Group**



Machine Learning Center (MLC) has been founded in April 2014, to develop an efficient and effective algorithm for lifelong machine learning, which is an extension of multi-task learning paradigm. MLC is funded by a basic research IT program from Institute for Information & Technology Promotion (IITP). MLC is composed of highly excellent professors and graduate students in machine learning and its closely related areas from POSTECH, KAIST, SNU, Korea, and Yonsei university. Moreover, MLC recruited the four technically innovative companies: Diquest, Daumsoft, Swink, and Soso.

The primary goal of MLC is to release SMILE (Software for Machine Intelligence with Lifelong machine Learning) platform, which is composed of the four key components: (1) Bayesian learning for lifelong machine learning, (2) deep learning on Spark platform, (3) multi-modal learning, and (4) healthcare system. Each component has been carefully chosen to achieve our goal, which is to develop an efficient and effective

algorithm for lifelong machine learning. We are trying to do our best to make SMILE platform be the #1 lifelong machine learning platform in the world. If you are interested in SMILE platform, feel free to contact us.

Director of Machine Learning Center  
Prof. Seungjin Choi



Machine Learning Center, Pohang University of Science and Technology,  
77 Cheongam-ro, Nam-gu, Pohang 790-784, Korea

# 미래부지원 머신러닝센터 2014-현재 Lifelong Learning Bayesian and Deep





## NEWS

★ Congratulations on our accepted paper by AAI-2017. Saehoon Kim and Seungjin Choi (2017), "Binary embedding with additive homogeneous kernels," in Proceedings of ...

Congratulations to Saehoon Kim for winning the 2016 NAVER fellowship.

Congratulations to Saehoon Kim for winning the 2016 NAVER fellowship.

★ Congratulations on our paper accepted by NIPS-2016. Finite-dimensional BFRY priors and variational Bayesian inference for power law models Juho Lee, Lancelot F. ...

★ Congratulations to three of our former members who will start as an assistant professor

Congratulations to three of our former members who will start as an assistant professor: 1. ...

**Our goal** is to develop real unsupervised learning algorithms in the sense that they have real intelligence. We would like to call a family of these algorithms as self-evaluation algorithms.

미래부, IITP 지원  
SW 스타랩: Deep Meta Learning (2017-2025)