

# Introduction to AI and ML

## & Brief History of AI

อ. ปรัชญ์ ปิยะวงศ์วิศาล

Pratch Piyawongwisal

# Today

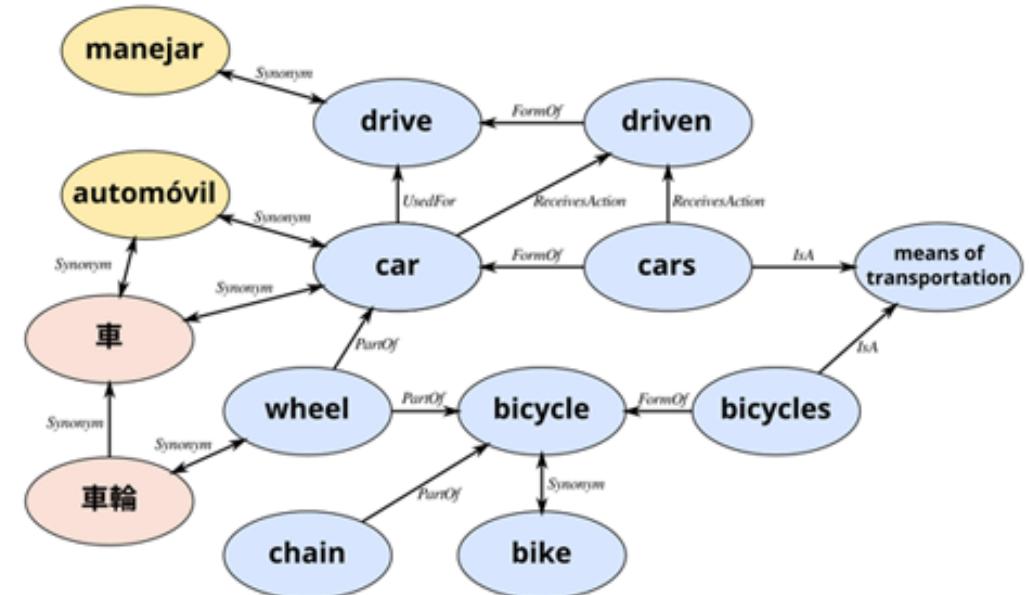
- What is AI?
- Brief history of AI (1950 - today)
- What makes AI hard?
- What is ML?
- Lab: Supervised Learning

# What is Artificial Intelligence (AI)?

- Study of how to make machines do tasks that require human intelligence
  - Such machines are called “Intelligent Agents”
- Goals (debatable)
  - Do we want a machine that perfectly mimics human?
    - Also making the same mistakes as human
  - Do we want a machine that thinks and acts rationally?
    - Always maximizing the chance of achieving a goal

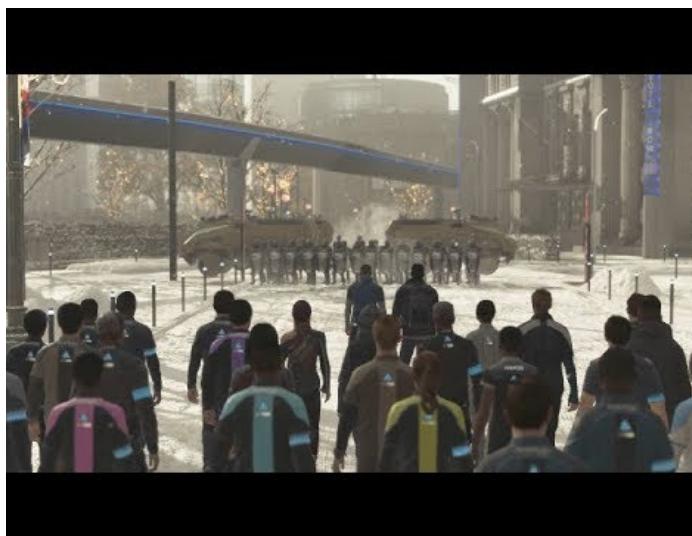
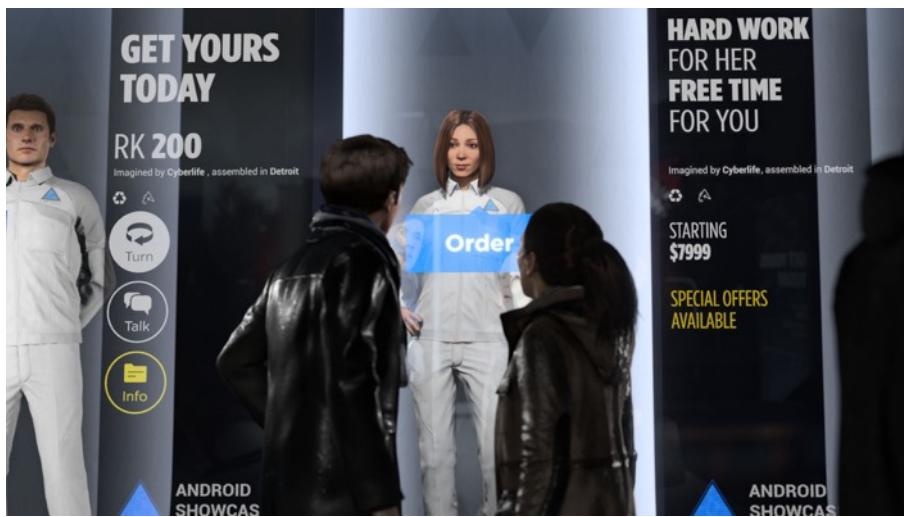
# Strong AI vs Weak AI

- **Strong AI** (AGI: Artificial General Intelligence) is the AI that can perform all tasks as well as or better than human
  - Reasoning
  - Representing Knowledge
  - Learning
  - Planning
  - Communicating



Example of Knowledge Representation (ConceptNet)

# Strong AI in Science Fictions



# Strong AI vs Weak AI

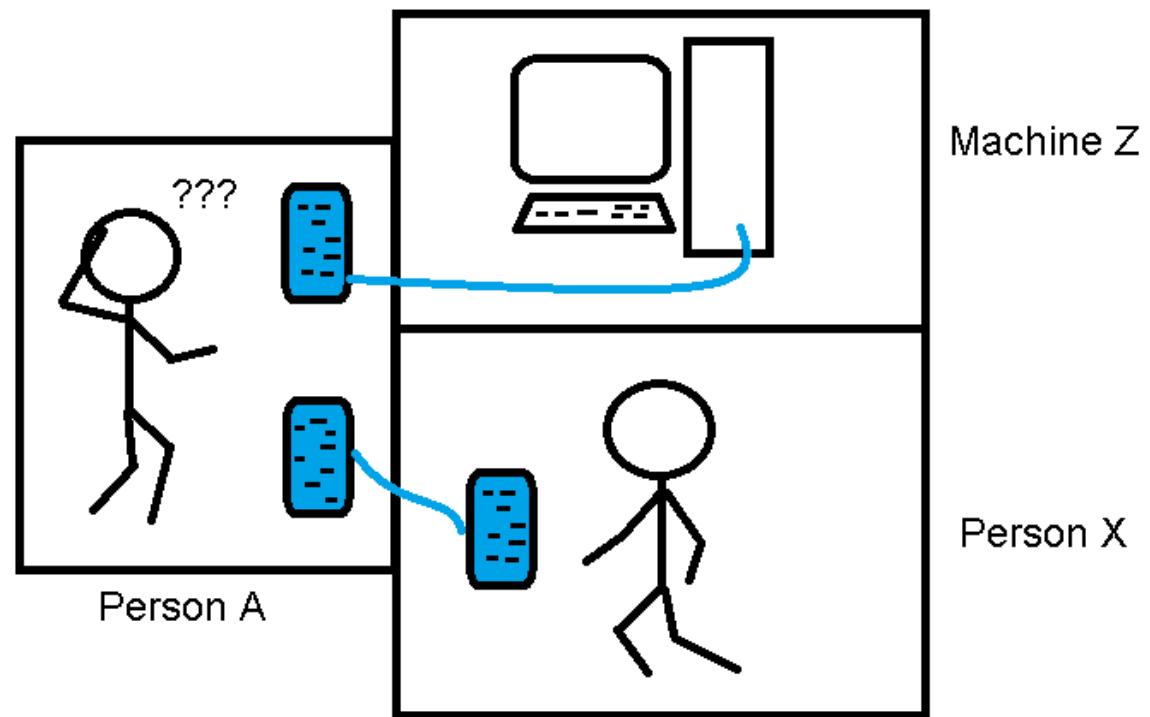
- **Weak AI** (Narrow AI) is the AI that focuses on only **one** task, e.g.
  - Image Recognition
  - Translation
  - Playing Chess, Atari games
- Most of AI today are considered weak
- This course mostly concerns with weak AI

# Strong AI vs Weak AI

- **Turing Test** is a simple test to see if a machine has achieved general intelligence

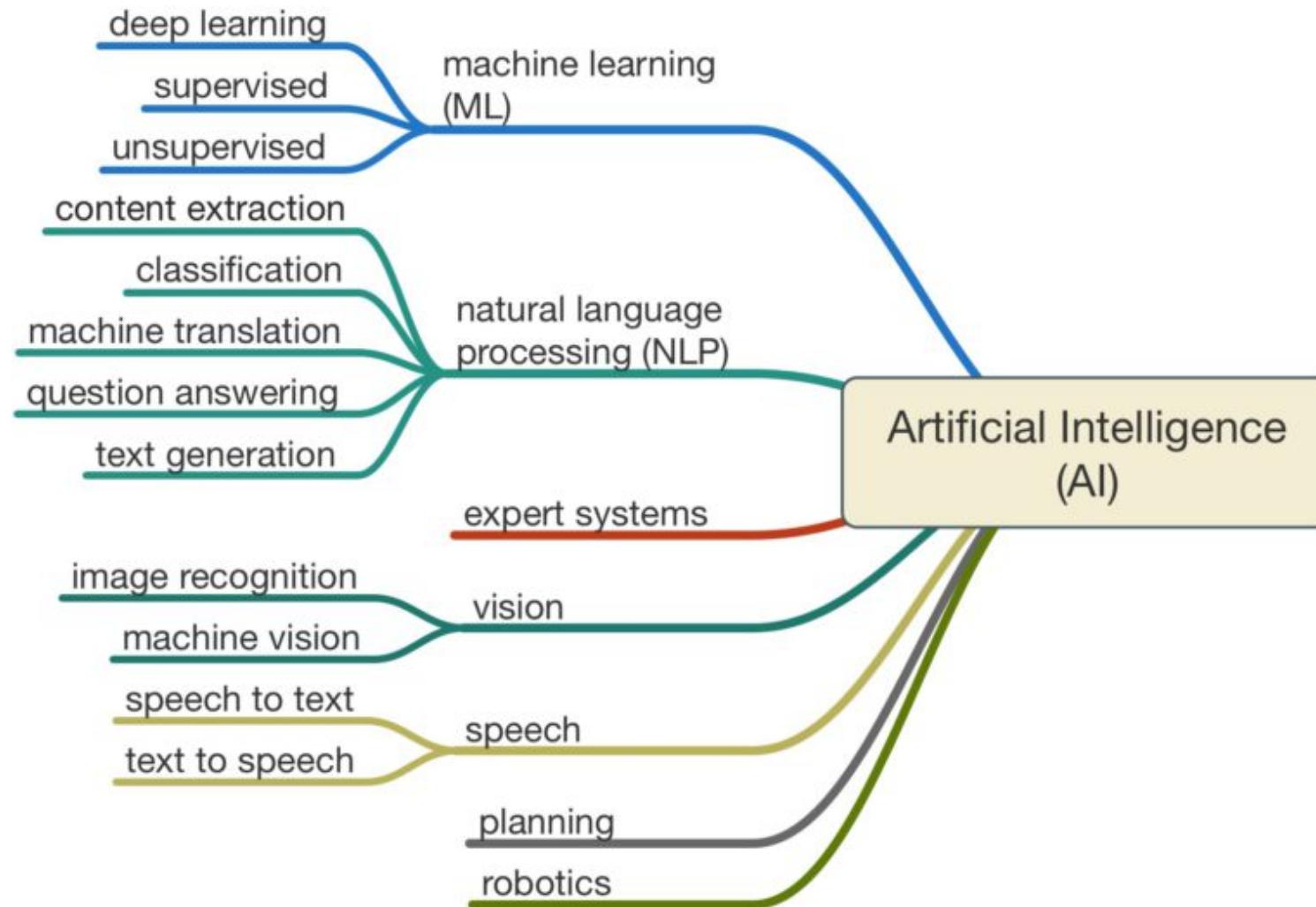


Alan Turing, 1950



# Branches of AI

<http://www.legalexecutiveinstitute.com/artificial-intelligence-in-law-the-state-of-play-2016-part-1/>



# Brief History of AI

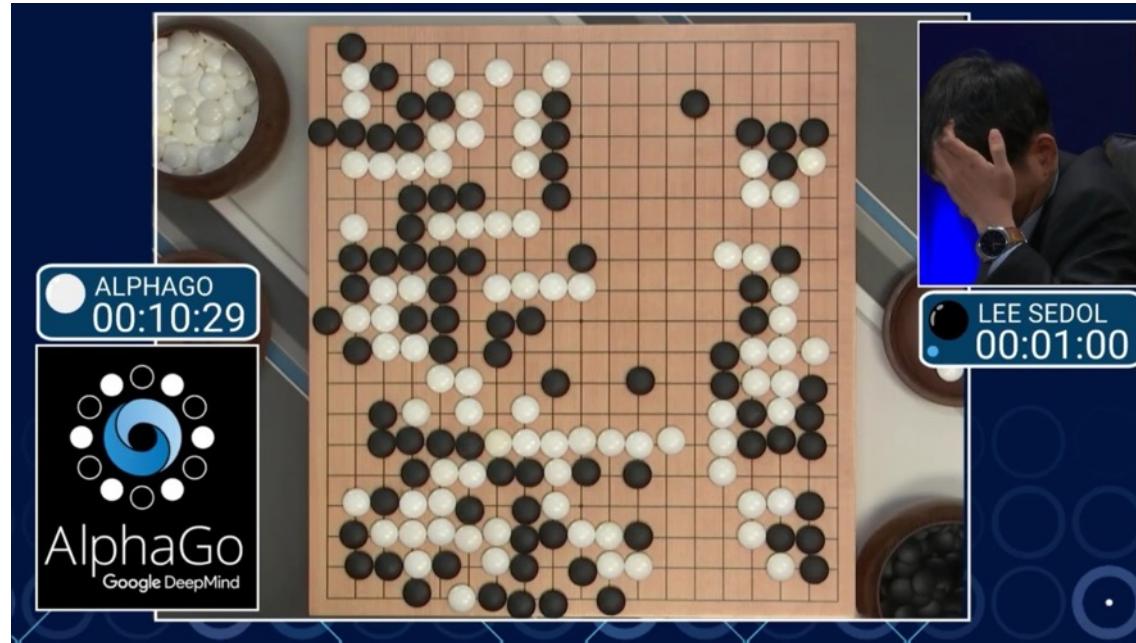
- 700 BC เทพนิยายเกี่ยวกับ **Hephaestus** เทพผู้สร้างหุ่นยนต์ **Talos**
- 400 BC อริสโตเตลคิดค้นศาสตร์การให้เหตุผลเชิงตรรกية (**formal reasoning**)
- 1837 Charles Babbage/Ada Lovelace สร้างเครื่องคำนวณสั่งงานผ่านโปรแกรม
- 1943 Warren McCulloch คิดค้นแนวคิดเกี่ยวกับ **Neural Network**
- 1950 Alan Turing คิดค้น **Turing Test** สำหรับวัดความฉลาดของ AI
- 1955 กำหนดศาสตร์ “AI” (โดย **John McCarthy** ร่วมกับ **Marvin Minsky**)
- 1964 หุ่นยนต์คุยกับคนได้ **ELIZA**
- 1969 นักวิจัยทดสอบทิ้ง **Neural Net** เมื่อเจอข้อจำกัดของวิธี
- 1974-80 AI Winter ข้อจำกัดทางเทคนิคทำให้การพัฒนา AI หยุดชะงัก

# Brief History of AI (cont.)

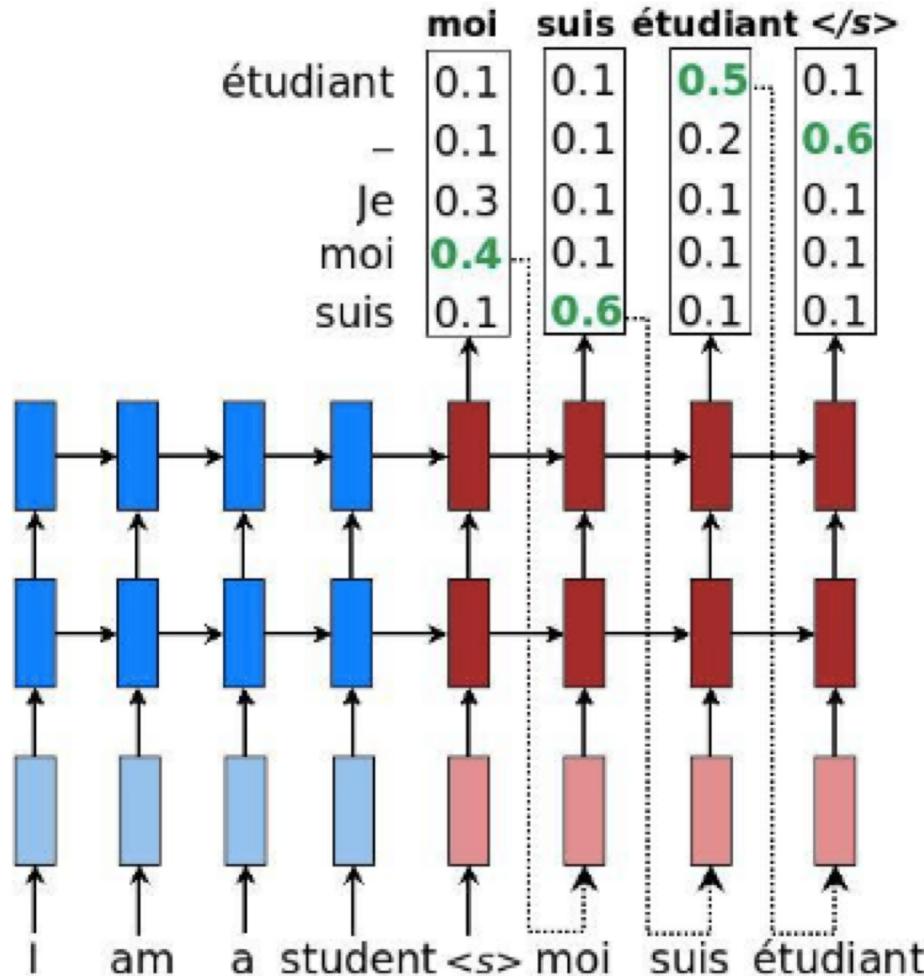
- 1980-87 ยุคของระบบผู้เชี่ยวชาญ (expert system) พัฒนาด้วยภาษา Lisp
- 1986 Neural Net กลับมาด้วยอัลกอริทึม Backpropagation  
แต่ก็ແປ່ໄປໃນຊ່ວງປີ 2000
- 1997 Deep Blue ຂອງ IBM/CMU ເລີ່ມທຳກຽດກູກຈະແໜ່ງປິໂລກ Garry Kasparov
- 2009 Google ສ້າງ self-driving car
- 2011 IBM Watson ຈະແໜ່ງປິເກມ Jeopardy!
- 2012 AlexNet ຈະກາຣແຂງຂັ້ນ ImageNet ທຳให້ Neural Net ກລັບມາເພື່ອງຝູ

# Today's AI

- In 2016, Google DeepMind's AlphaGo used **deep neural networks** and **reinforcement learning** to beat 9-dan professional Lee Sedol 4-1
- Beat World No. 1 Ke Jie in 2017



# Machine Translation



<https://www.tensorflow.org/tutorials/seq2seq>

# Drawing Classification

← Back

You were asked to draw squirrel

You drew this, and the neural net recognized it.

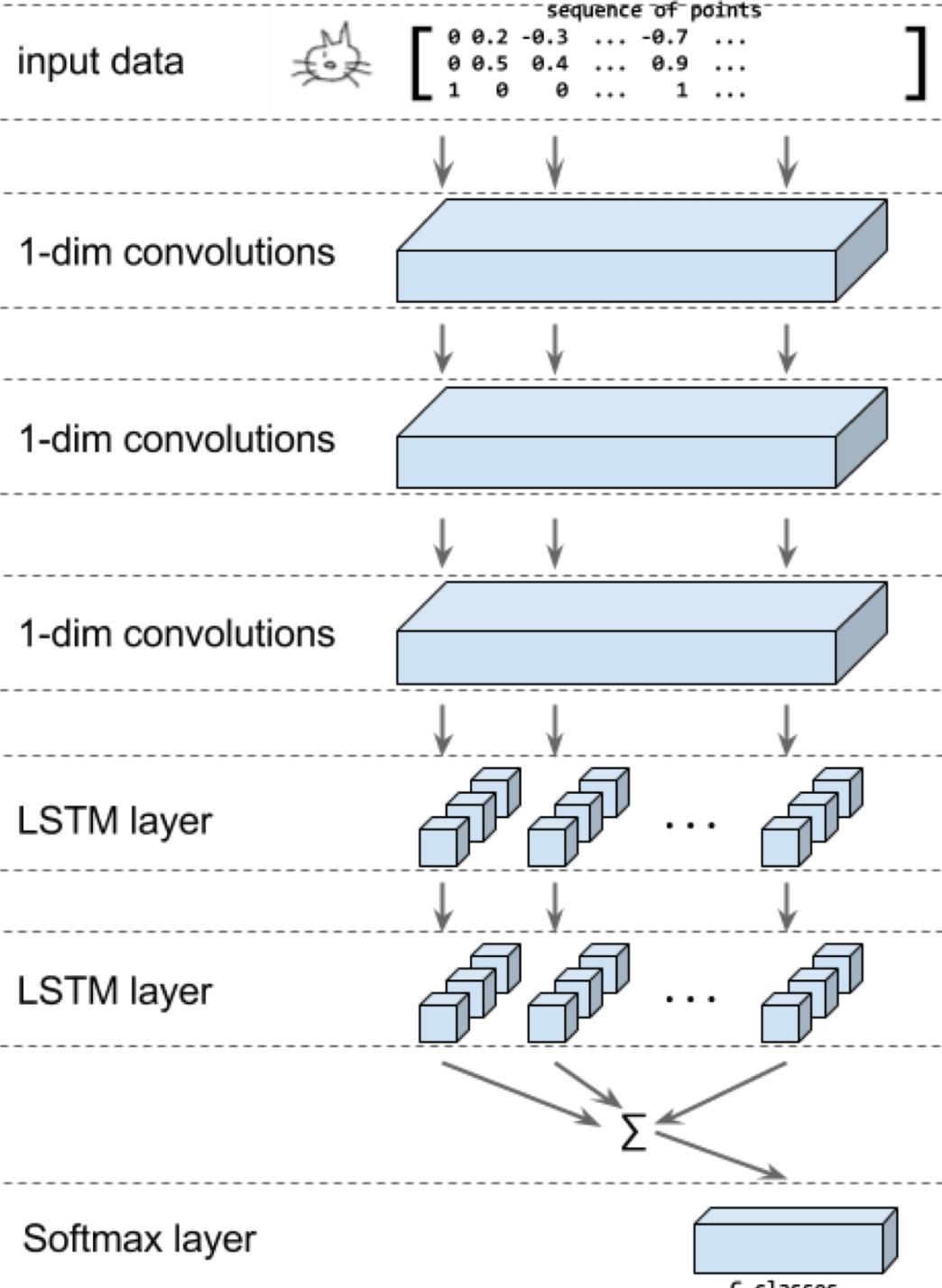


It also thought your drawing looked like these:

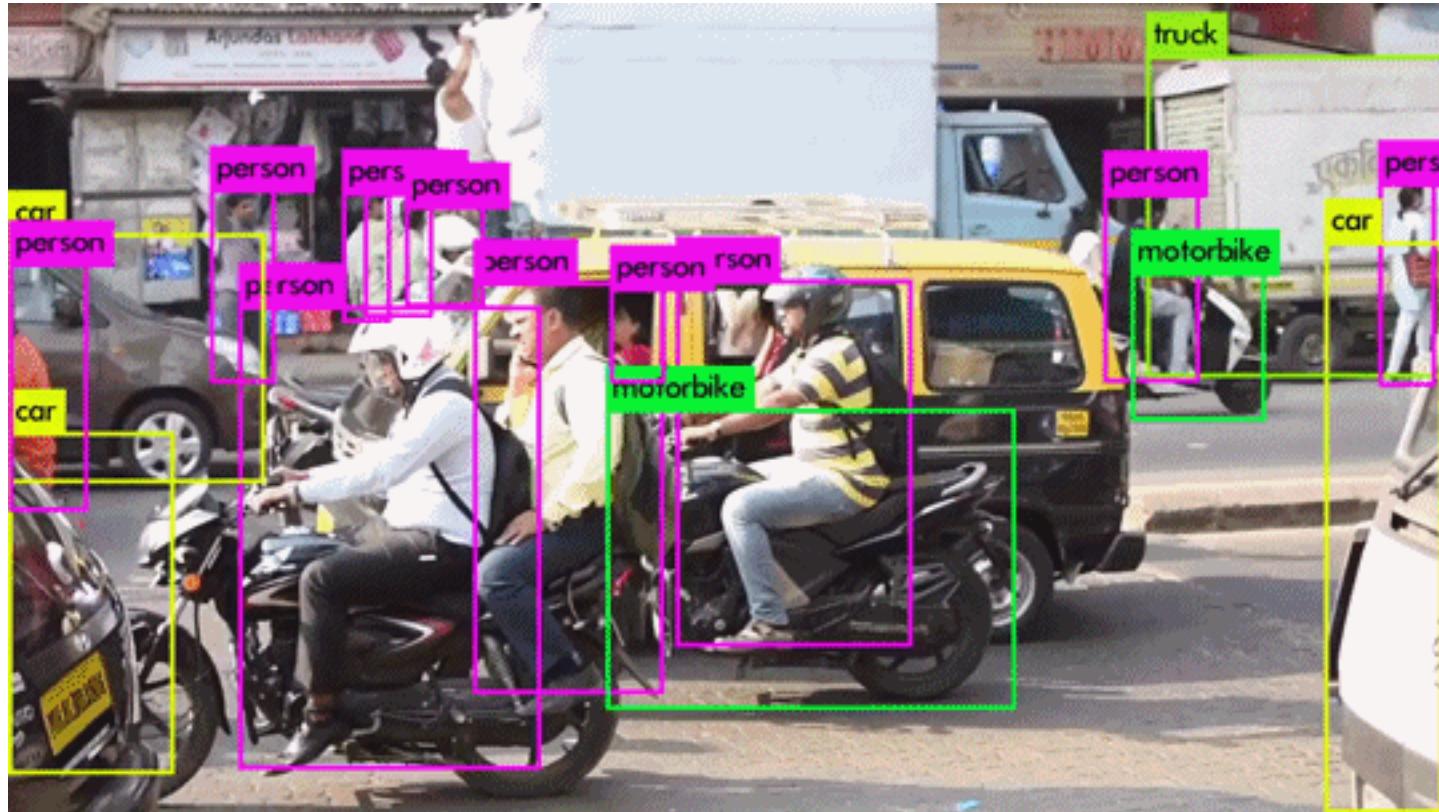


How does it know what squirrel looks like?  
It learned by looking at these examples drawn by other people.

[https://www.tensorflow.org/tutorials/recurrent\\_quickdraw](https://www.tensorflow.org/tutorials/recurrent_quickdraw)  
<https://quickdraw.withgoogle.com/data>

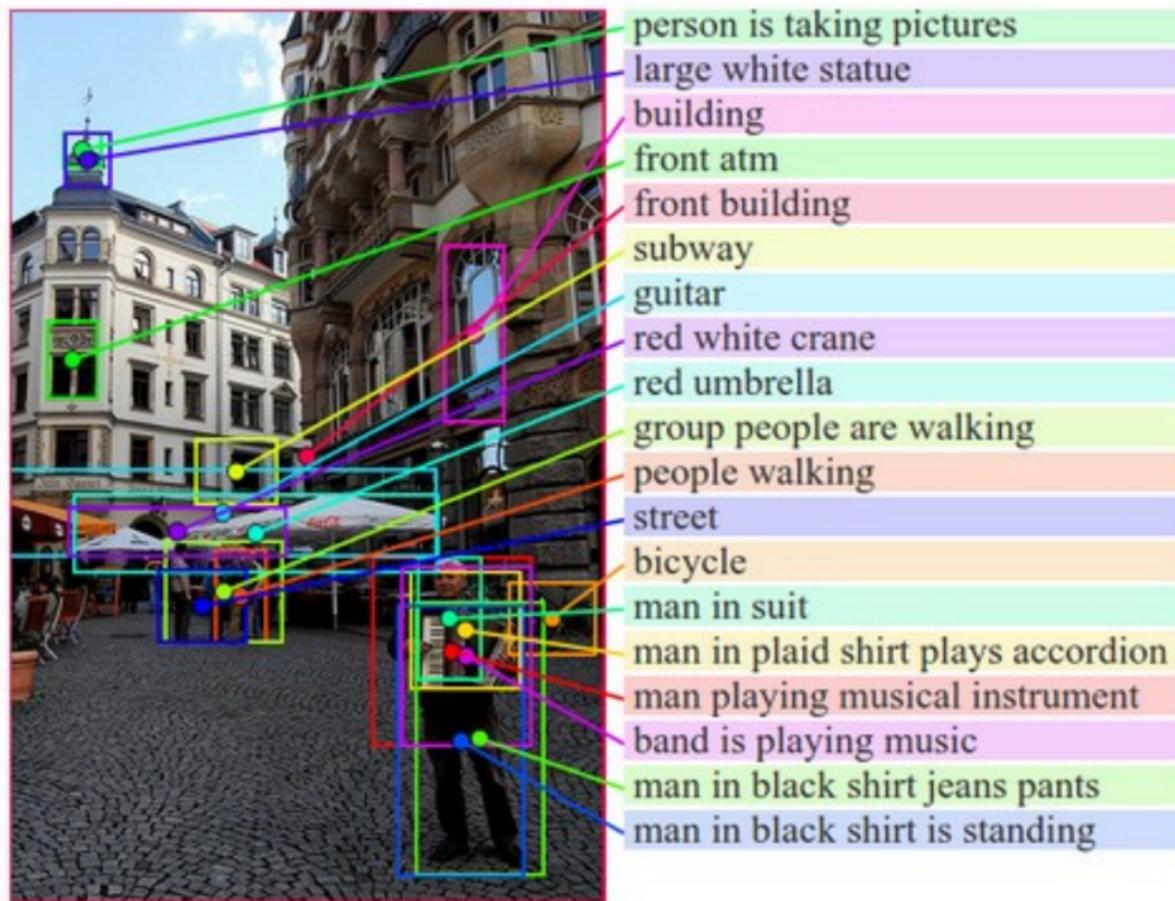


# Real-time Image Recognition



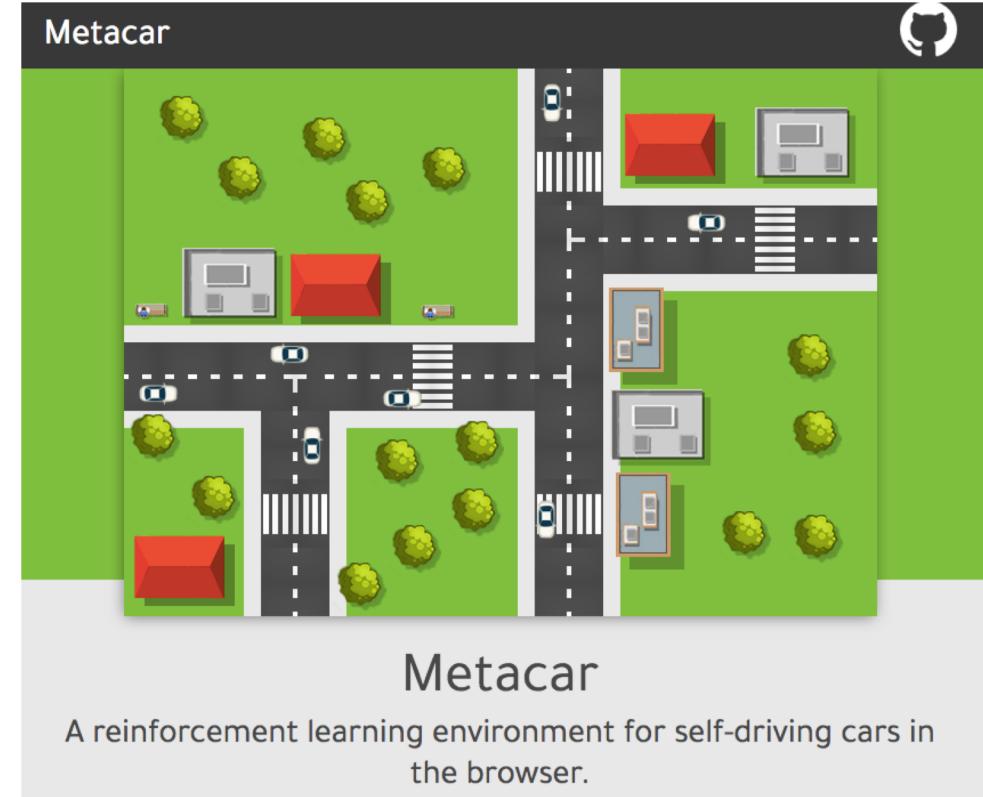
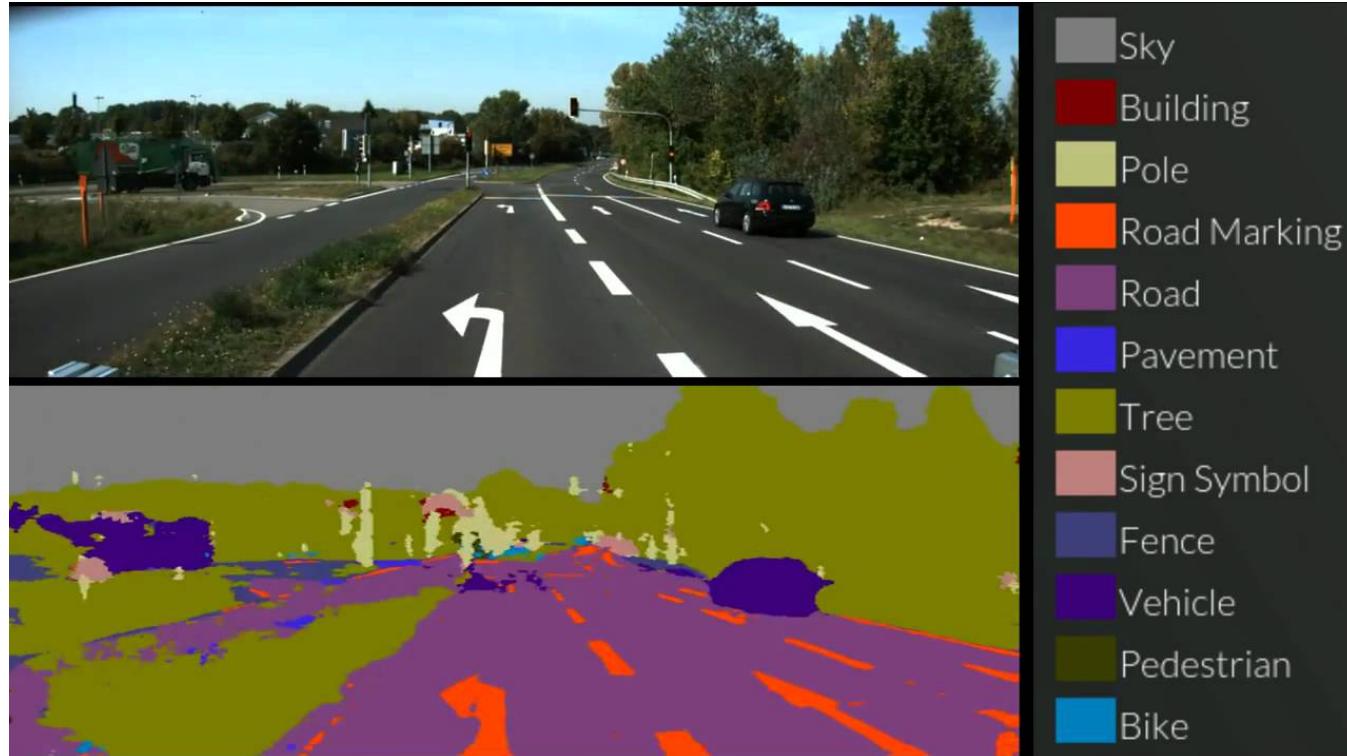
<https://pjreddie.com/darknet/yolo/>

# Image Description



[Karpathy 2015] <https://cs.stanford.edu/people/karpathy/cvpr2015.pdf>

# Self-Driving Cars



<https://www.metacar-project.com/>  
<https://selfdrivingcars.mit.edu/>

# Image Generation

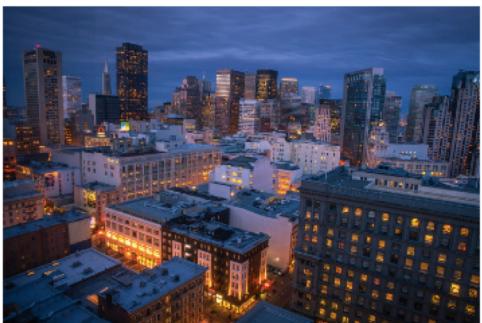
Text description	This bird is red and brown in color, with a stubby beak	The bird is short and stubby with yellow on its body	A bird with a medium orange bill white body gray wings and webbed feet	This small black bird has a short, slightly curved bill and long legs	A small bird with varying shades of brown with white under the eyes	A small yellow bird with a black crown and a short black pointed beak	This small bird has a white breast, light grey head, and black wings and tail
64x64 GAN-INT-CLS [22]							
128x128 GAWWN [20]							
256x256 StackGAN							

Figure 3. Example results by our proposed StackGAN, GAWWN [20], and GAN-INT-CLS [22] conditioned on text descriptions from CUB test set. GAWWN and GAN-INT-CLS generate 16 images for each text description, respectively. We select the best one for each of them to compare with our StackGAN.

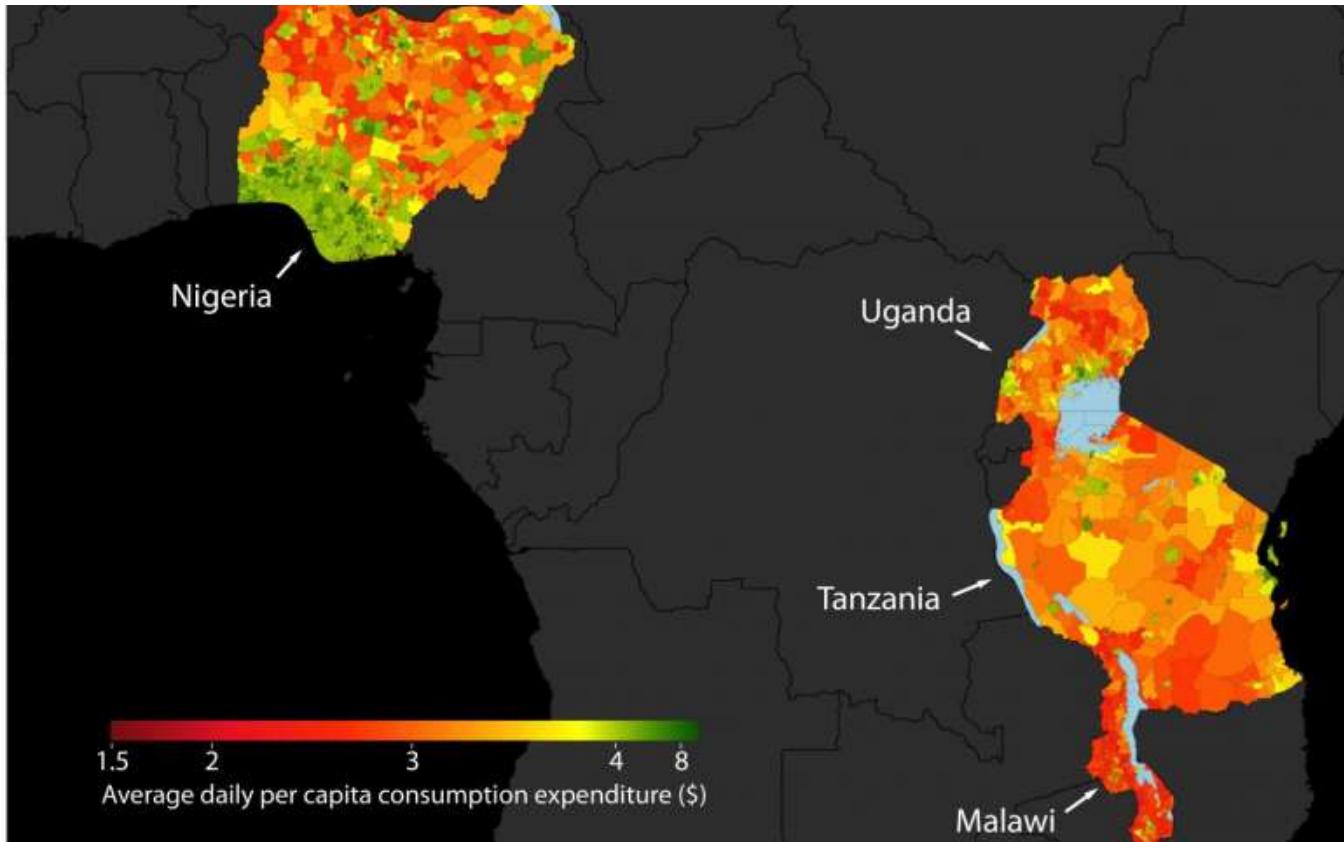
# Art Style Transfer



<https://github.com/fzliu/style-transfer>



# Predicting Poverty



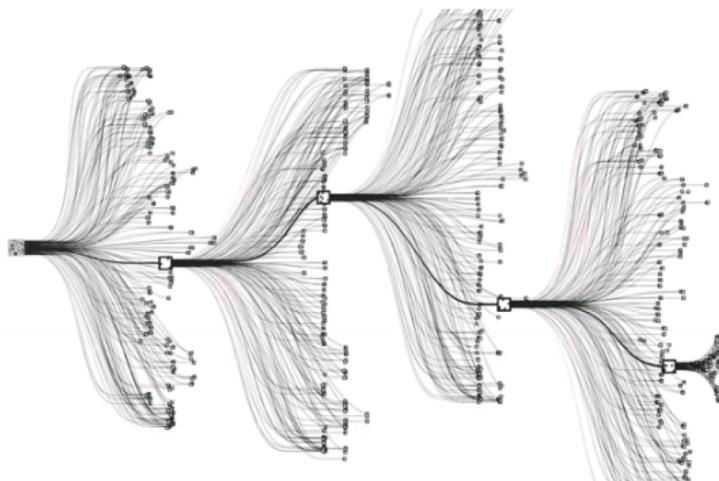
<https://phys.org/news/2016-08-scientists-combine-satellite-machine-poverty.html>

# What makes AI hard?

- Two sources of complexity



这是什么意思?



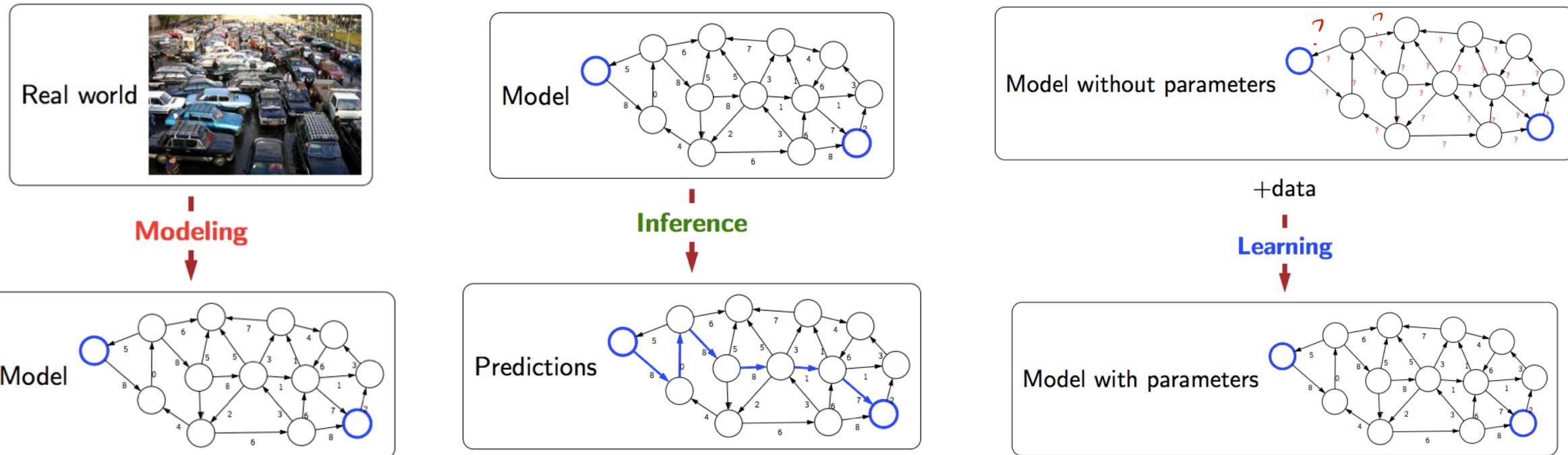
**Computational Complexity**  
(need more CPUs)

**Information Complexity**  
(need more data)

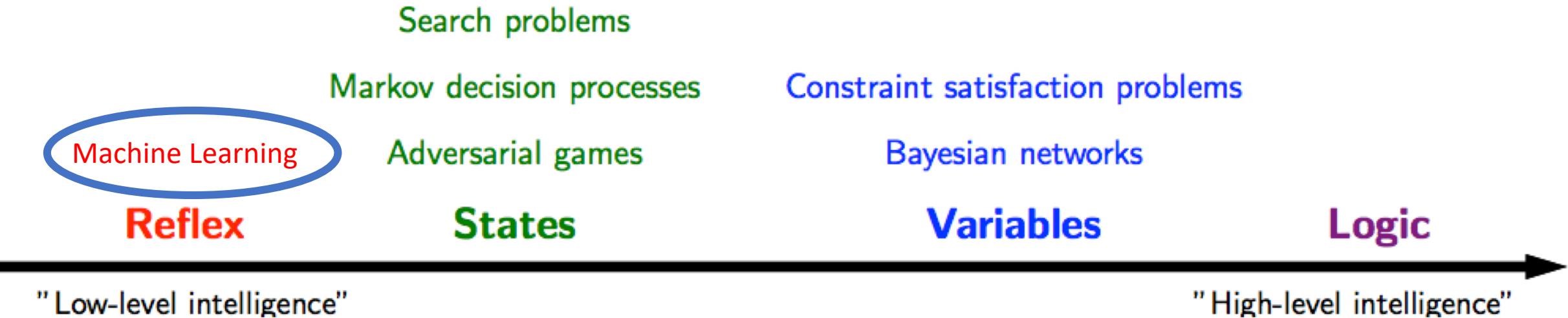
# How to solve hard AI tasks?

- **Model-Inference-Learning** paradigm

- Model                    simplify real world into math objects
- Inference              answer questions of interest using the model
- Learning                use data to build more accurate model

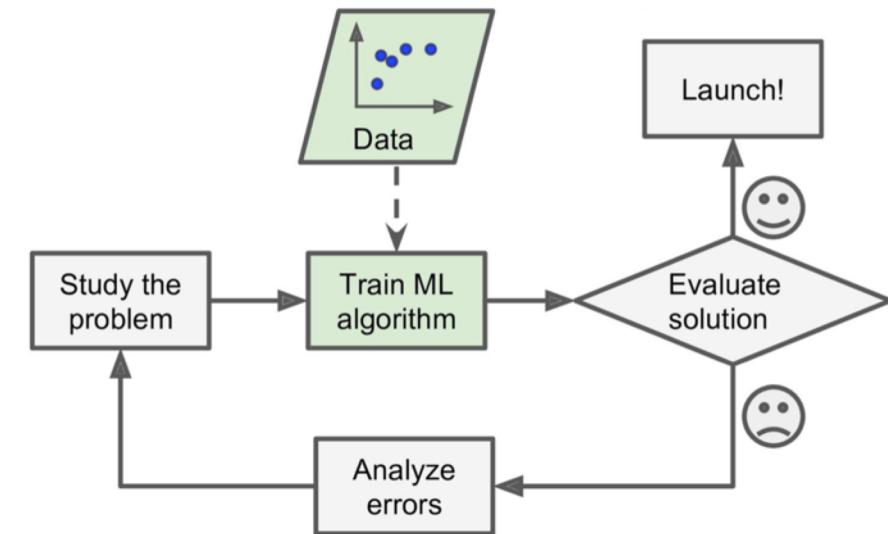


# AI Solution Space



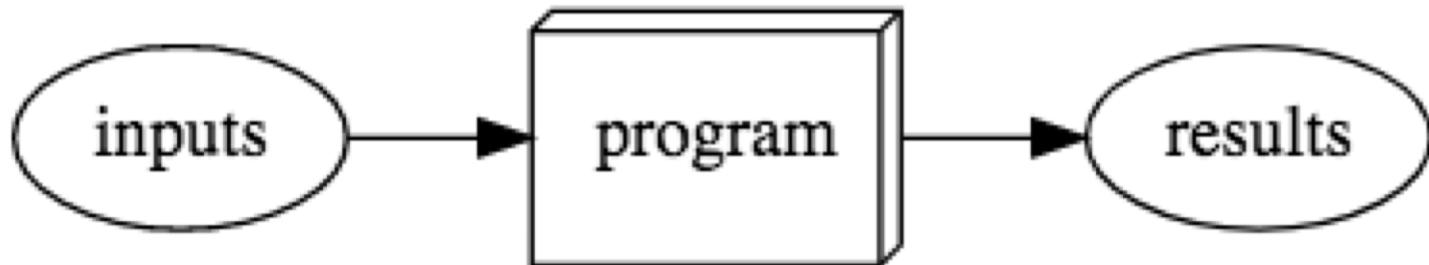
# What is Machine Learning?

- The science of getting machines to “learn” from **data** and make predictions **without being explicitly programmed**
  - Solves specific AI tasks
  - Uses statistical techniques
- การเรียนรู้ของเครื่อง คือการฝึกให้เครื่องเรียนรู้การแก้ปัญหาได้ เอง จากข้อมูลที่ป้อนให้ แทนการเขียนโปรแกรมสั่งการแบบ **manual** ในทุกๆ ขั้นตอน
  - ใช้สร้าง AI แบบใช้กับงานที่เฉพาะเจาะจง
  - อัดกริทึมส่วนใหญ่ใช้หลักทาง **สถิติ**ในการหา pattern ในข้อมูล



# How traditional programming works

มนุษย์ต้องเขียนโปรแกรมสั่งการอย่าง  
ละเอียดยิบ เพื่อให้คอมทำงานได้ถูกต้อง

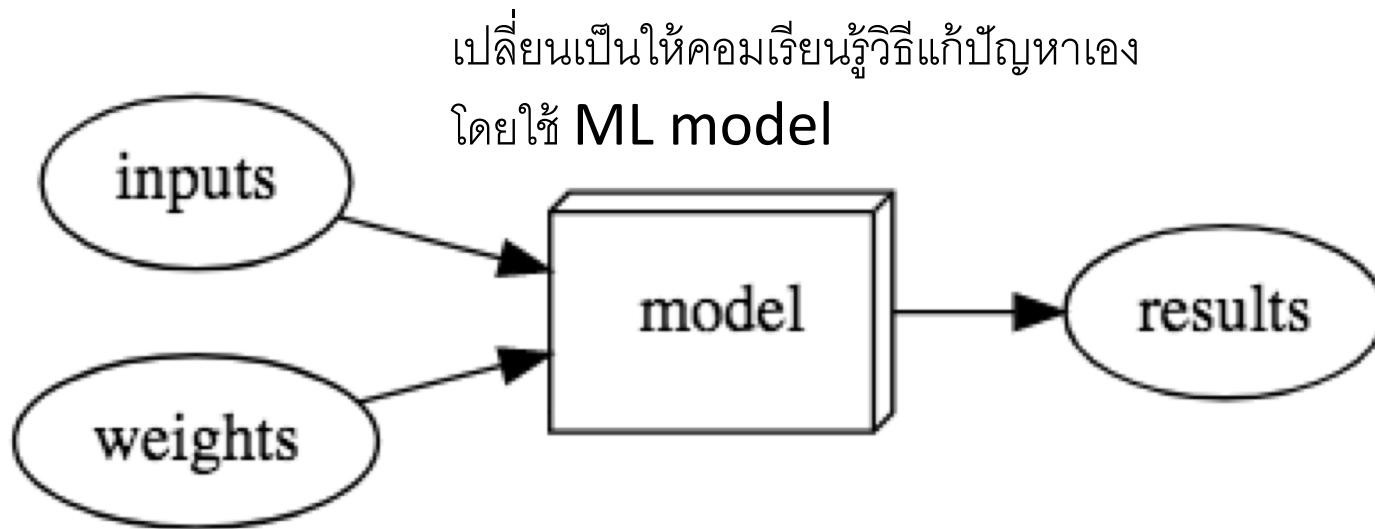


This is a cat

vs



# How ML works (Arthur Samuel, 1949)



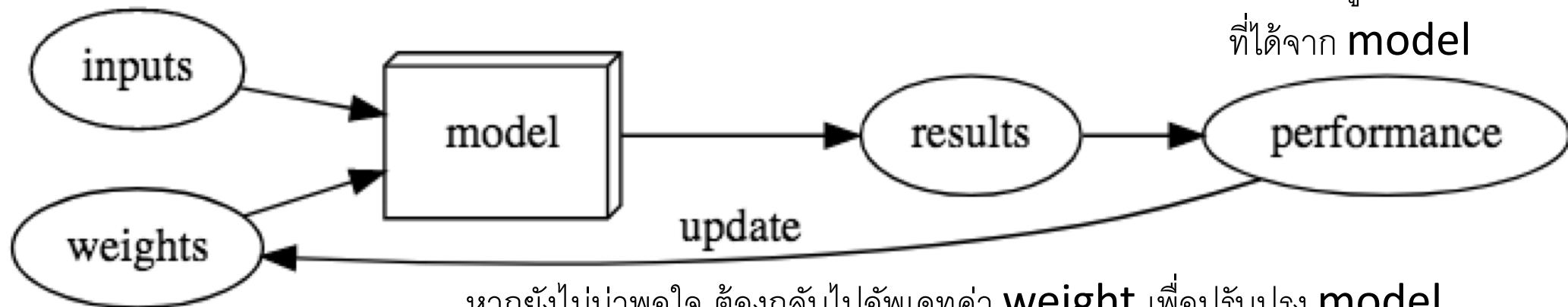
**Weight** คือค่าถ่วงน้ำหนักใน **model**

เป็นส่วนสำคัญที่ทำให้ **model** ทำงานได้ถูกต้อง

# How ML works (Arthur Samuel, 1949)

## Training the model

ส่งข้อมูล **input** หลายๆ แบบให้ **model** ดู

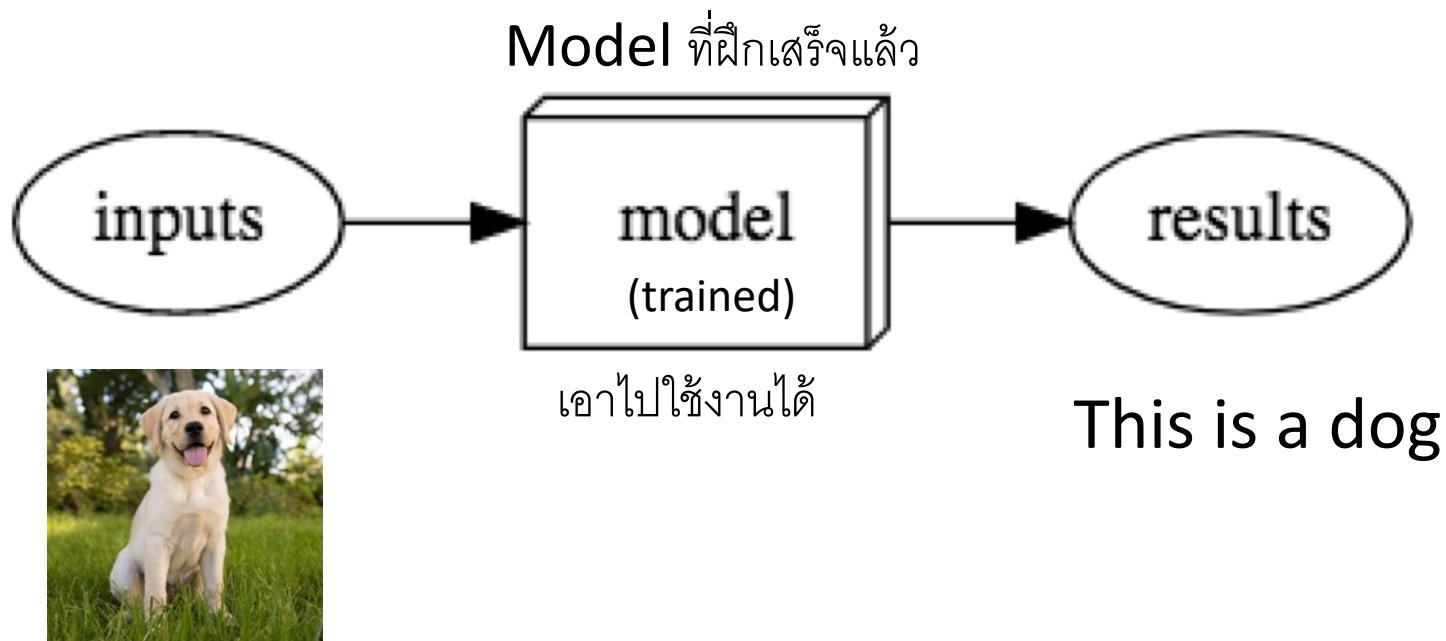


วัดความถูกต้องของ **result**  
ที่ได้จาก **model**

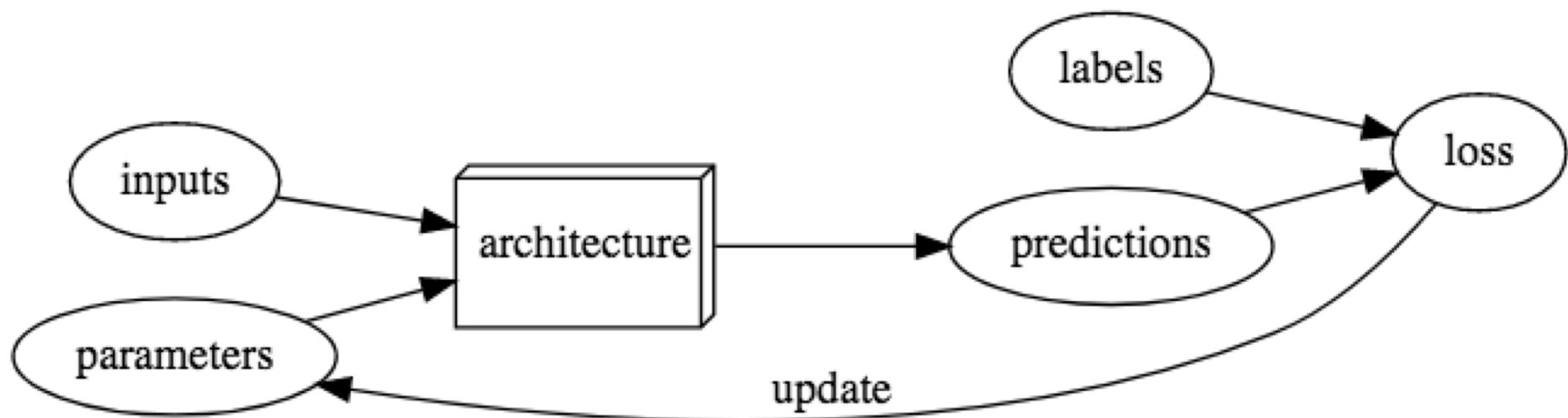
หากยังไม่น่าพอใจ ต้องกลับไปอัพเดตค่า **weight** เพื่อปรับปรุง **model**  
นี่คือ กระบวนการฝึก (train)

# How ML works (Arthur Samuel, 1949)

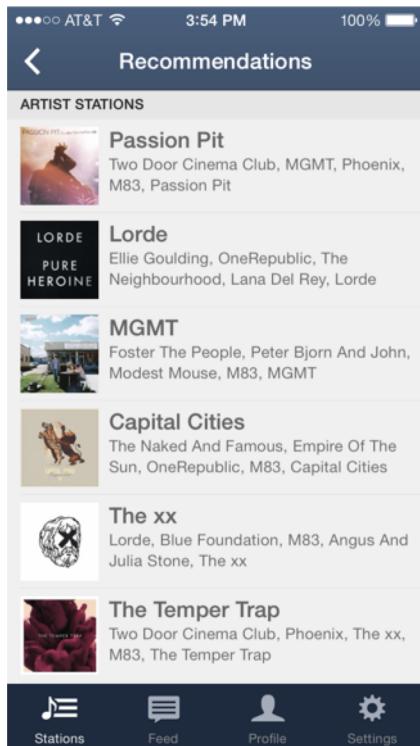
## Using the trained model



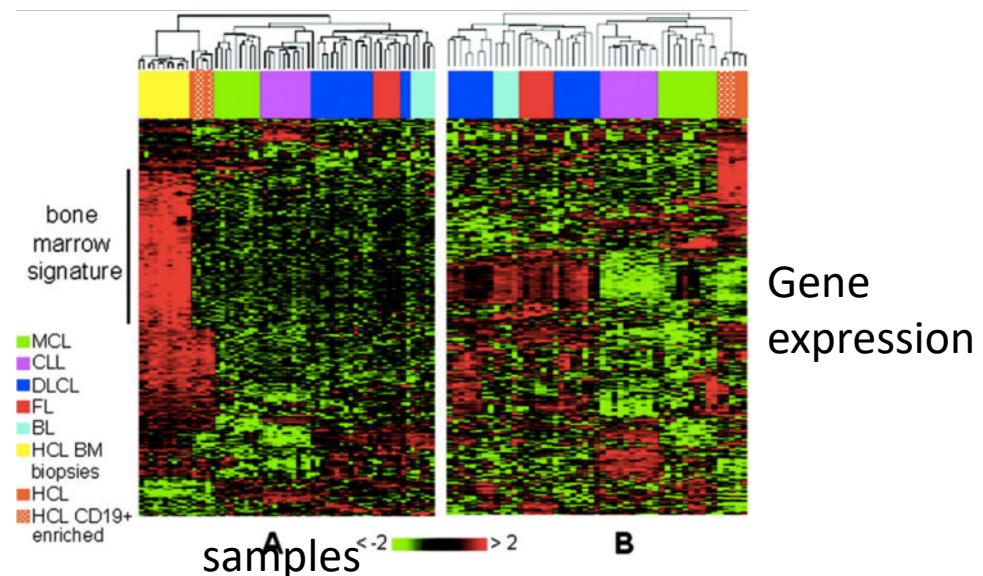
# Deep Learning (in modern terms)



# Machine Learning เป็นสิ่งใกล้ตัว



A screenshot of the Amazon.com website. The main heading is 'Recommended for You'. Below it, a message says 'Amazon.com has new recommendations for you based on items you purchased or told us you own.' There are three book covers with 'LOOK INSIDE!' buttons: 'Google Apps Deciphered: Compute in the Cloud to Streamline Your Desktop', 'Google Apps Administrator Guide: A Private-Label Web Workspace', and 'Googlepedia: The Ultimate Google Resource (3rd Edition)'.



A screenshot of a web page displaying a grid of 24 images of various Japanese dishes, such as sushi, sashimi, and ramen. Overlaid on the top right is a 'Recommended for You' section with the text 'รูปทั้งหมดร้าน ชูชิ มาสະ ราชเทวี' and a 'เพิ่มรูปภาพ' button. Below the grid, there are tabs for 'ทั้งหมด', 'อาหารหรือเครื่องดื่ม', 'น้ำยาหรือสมุนไพร', 'หน้าร้าน', 'บรรยายกาศ', and 'อื่นๆ'.

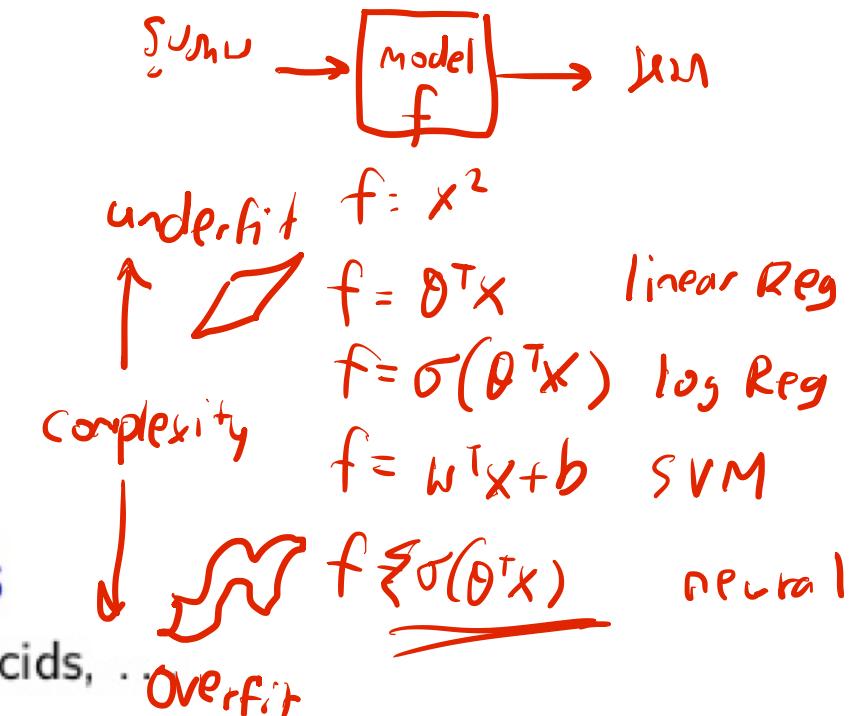
A screenshot of a translation interface. The top part shows the Japanese sentence '正義は視点の問題です' with an edit button and a speaker icon. Below it, the English translation 'Justice is a matter of perspective' is displayed. At the bottom, there are language selection dropdowns for 'Japanese' and 'English', and icons for feedback and sharing.

# What is Machine Learning?

- More formally...

$$f : \mathcal{X} \rightarrow \mathbb{R}$$

- inputs  $\mathcal{X}$  can be **any kind of objects**
  - images, text, audio, sequence of amino acids, ...
- output  $y$  is a **real number**
  - classification, regression, ...
- many way to construct  $f$ :
  - $f(x) = a \cdot \varphi(x) + b$ ,
  - $f(x)$  = decision tree,
  - $f(x)$  = neural network



# 2 Types of ML Systems

## ⇒• Supervised Learning

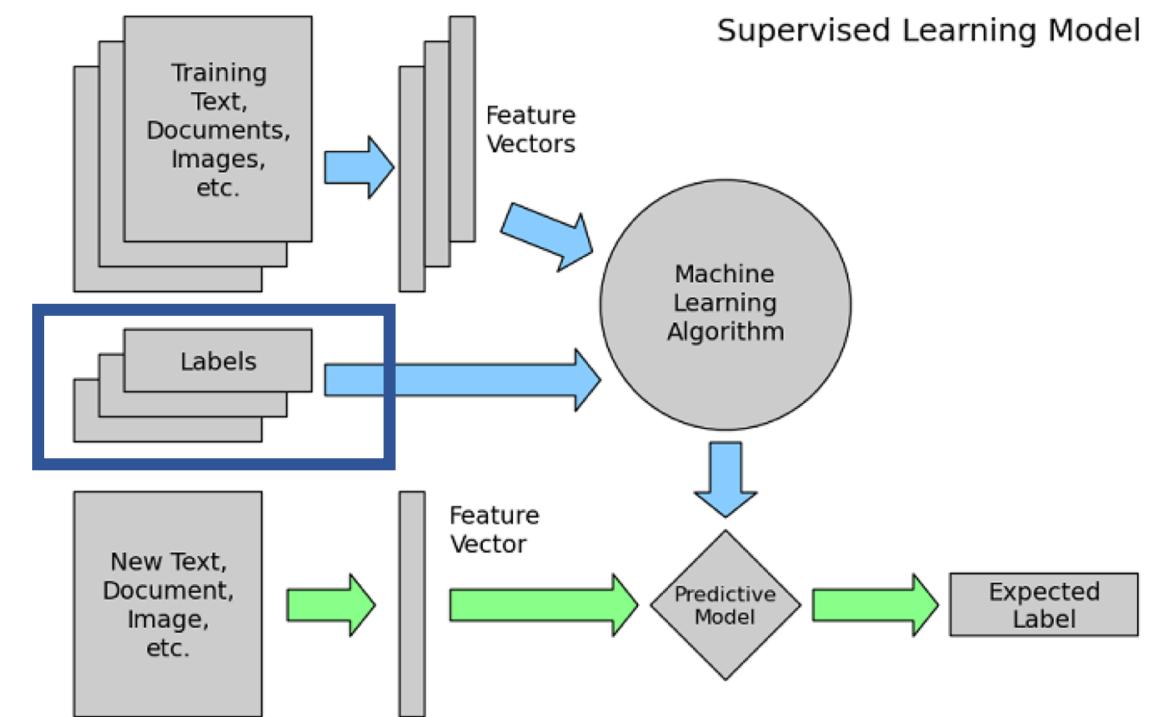
- Trained **with** human supervision
- Training set has **labels**

## • Unsupervised Learning

- Trained **without** human supervision
- No class labels

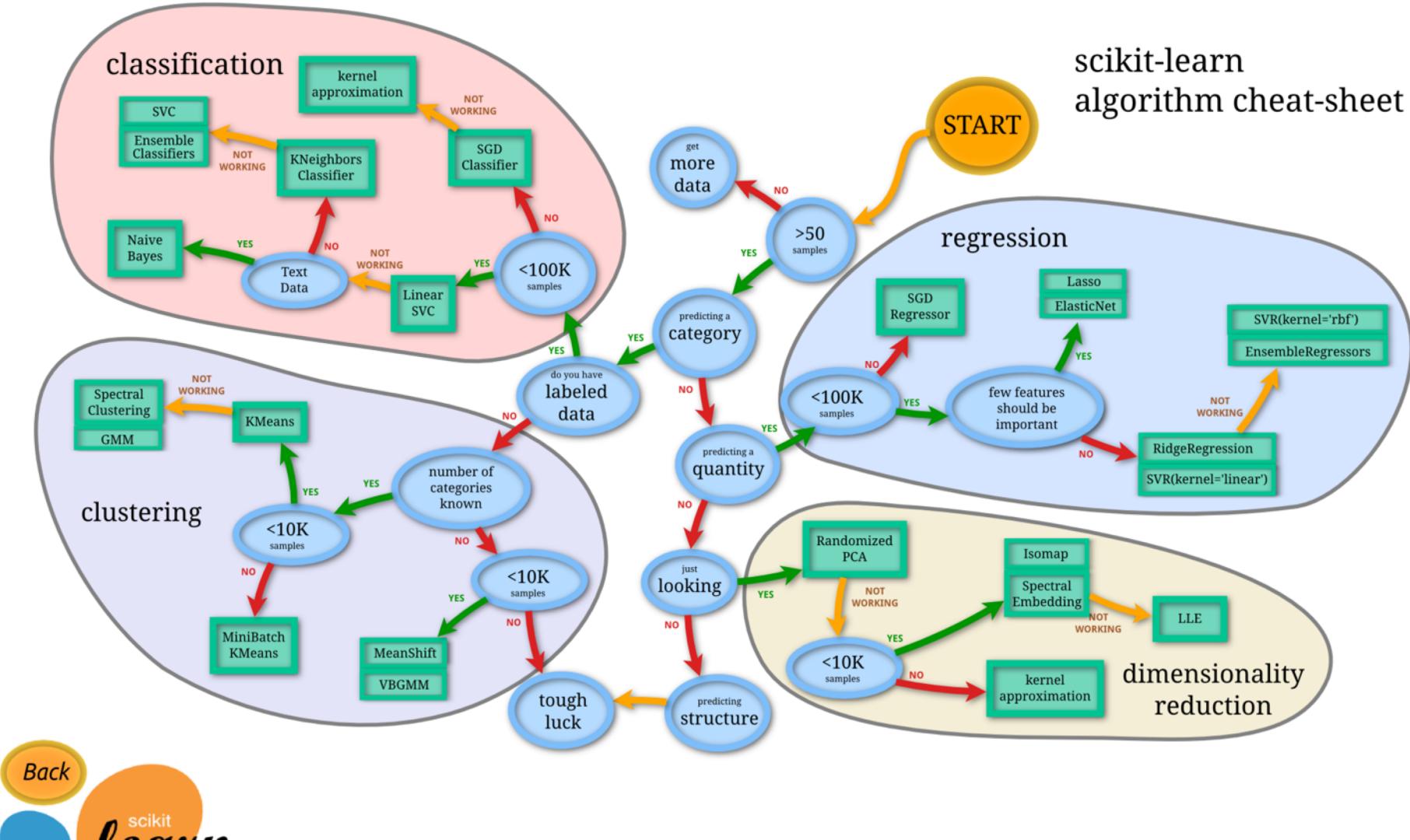
## • Reinforcement Learning

- Agent learns from interaction with the environment



# ML Techniques

[http://scikit-learn.org/stable/tutorial/machine\\_learning\\_map/index.html](http://scikit-learn.org/stable/tutorial/machine_learning_map/index.html)



# Recap: Exercises

- Weak AI ต่างจาก Strong AI อย่างไร
- Turing Test มีจุดมุ่งหมายเพื่อทดสอบอะไร ด้วยวิธีการใด
- การที่ AlphaGo สามารถเล่นเกม Go ชนะแชมป์โลก Lee Sedol ได้นั้น แสดงว่า AlphaGo ถือเป็น Weak AI หรือ Strong AI
- การเขียนโปรแกรมควบคุม bot ในเกม Pong โดยสั่งให้แผ่นกระดาんเลื่อนไปตามตำแหน่งลูกบอล นับว่าเป็น Machine Learning หรือไม่

# Lab

- ML basics and Supervised Learning