

Artificial Intelligence and Machine Learning

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Today

- Course Overview & Logistics
- What is AI?
- What is ML?
- AI-related jobs
- Homework

Course Goals

- ศึกษาเกี่ยวกับ ปัญญาประดิษฐ์ และ การเรียนรู้ของเครื่อง
 - ประวัติความเป็นมาของ AI
 - การค้นหา การแทนความรู้ การอนุมาน
 - การแทนความรู้
 - การเรียนรู้แบบมีผู้สอน
 - การเรียนรู้เชิงลึก ข่ายงานประสาทเทียม
 - การประยุกต์ใช้ในด้าน
- ควรลงมาก่อน: Data Structure, Prob & Stats, Calculus

Topics to be covered

- Models, Inference, Learning
- Python Tutorial
- Symbolic AI (aka. Good Old-Fashioned AI or GOFAI)
 - Searching
 - Dynamic Programming
 - Knowledge Representation
 - Logic and Inference
 - Game Playing

===== MIDTERM =====

- Machine Learning
 - Linear Classification
 - Stochastic Gradient Descent
 - Features
 - K-Means
 - Neural Network, Deep Learning

Tools

- Language: Python
- Libraries: Scikit-learn, Keras/Tensorflow
- Course site: https://pratch.github.io/ml_course/
- LINE



Grading

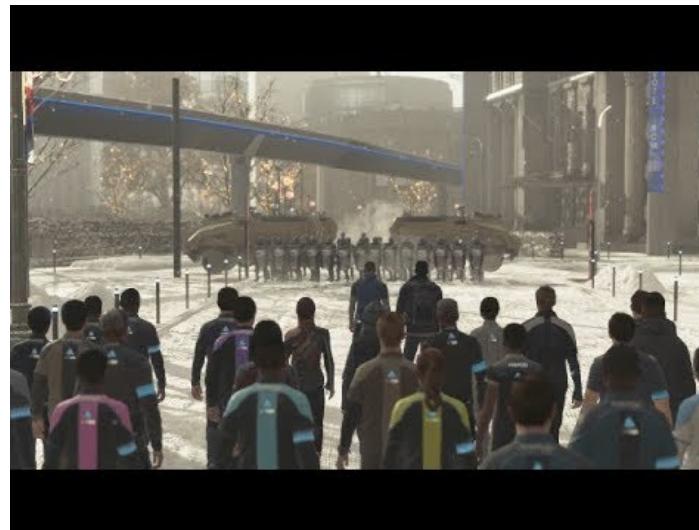
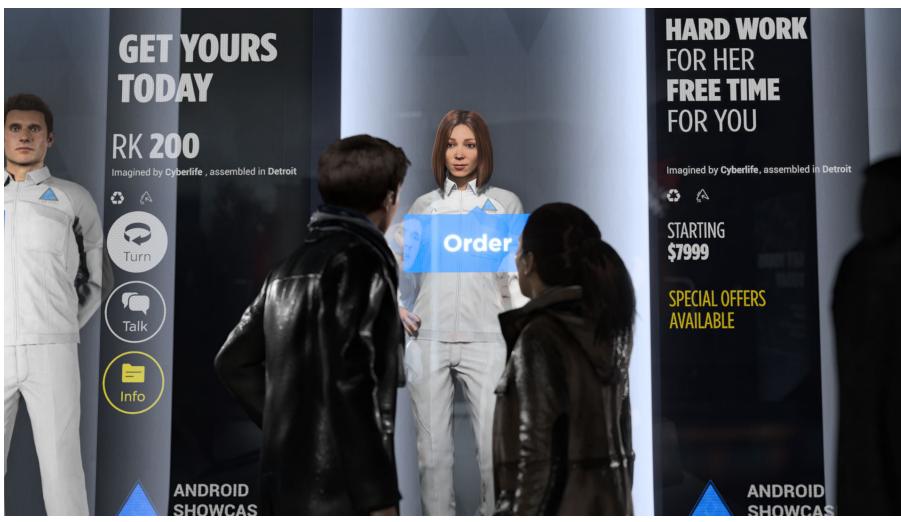
- Programming (40%)
- Midterm (25%)
- Final (25%)
- Attendance (10%)

Lecture Time

- SEC1
 - **Lecture** **Fri** **14.00 – 17.00**
 - ห้อง: ทค.1-101 (ย้ายไป 2-202?)

What is Artificial Intelligence (AI)?

- Study of how to make machines do things that require human intelligence
 - Such machines are called “Intelligent Agents”
- Goal (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

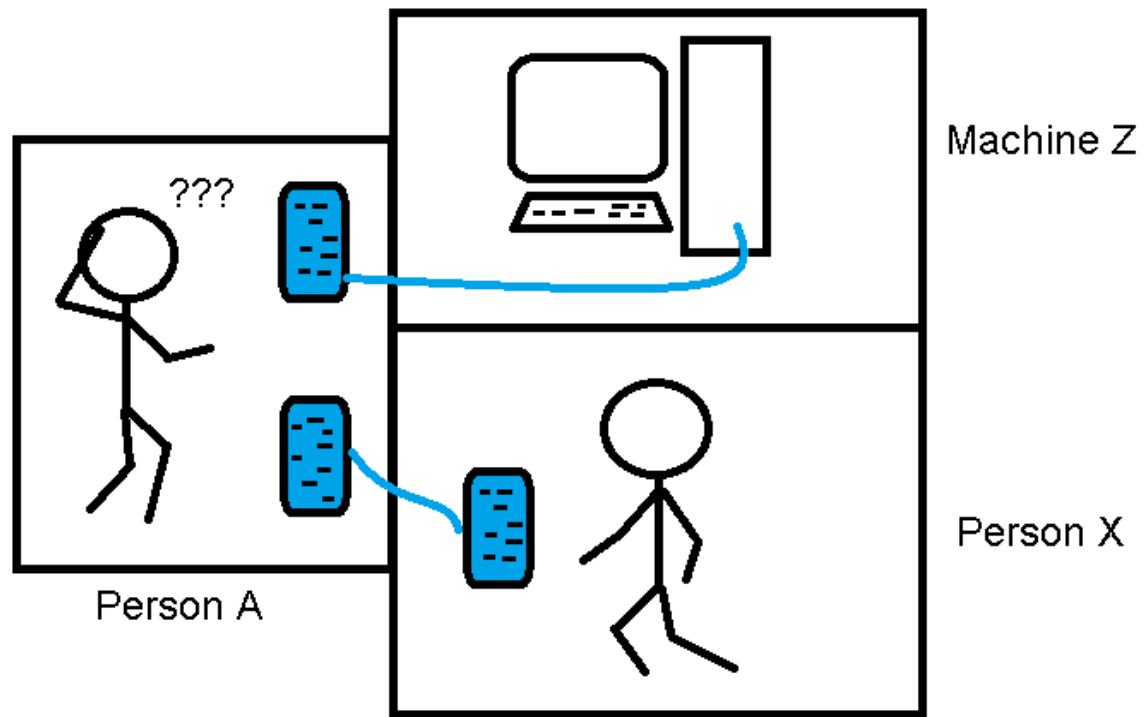
- **Strong AI** (Artificial General Intelligence) is the AI that can perform all tasks as well as or better than human
 - Reasoning
 - Learning
 - Planning
 - Communicating

Strong AI vs Weak AI

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



Alan Turing, 1950

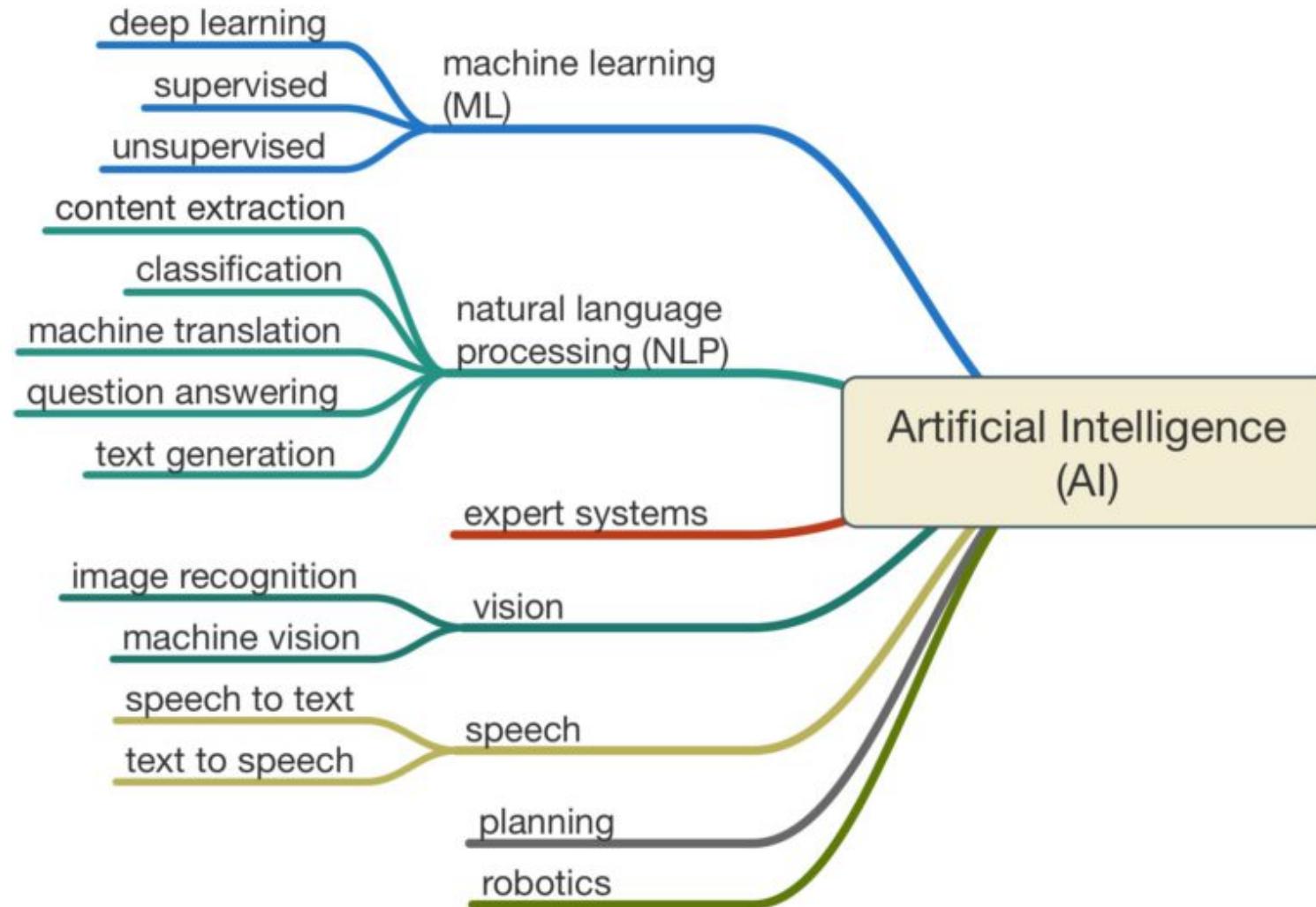


Strong AI vs Weak AI

- **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

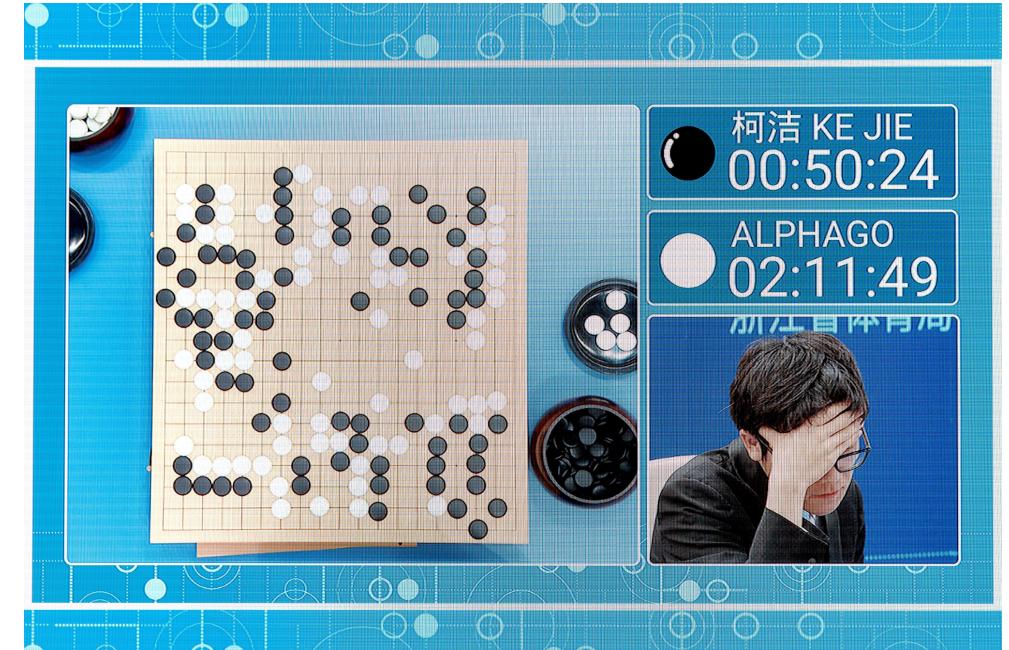
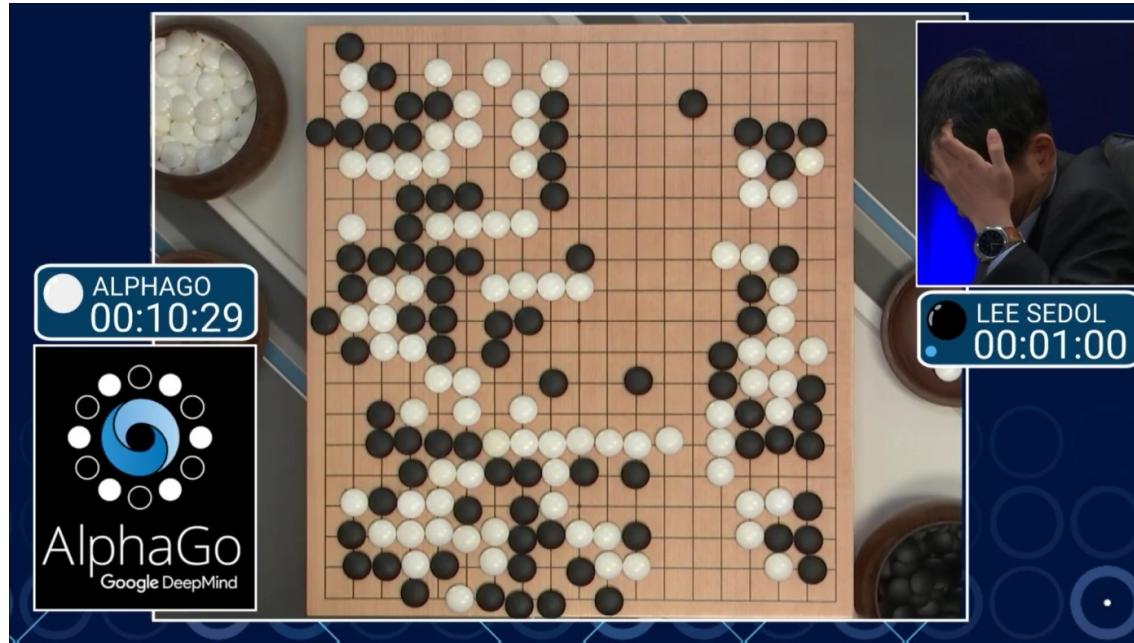
Branches of AI

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

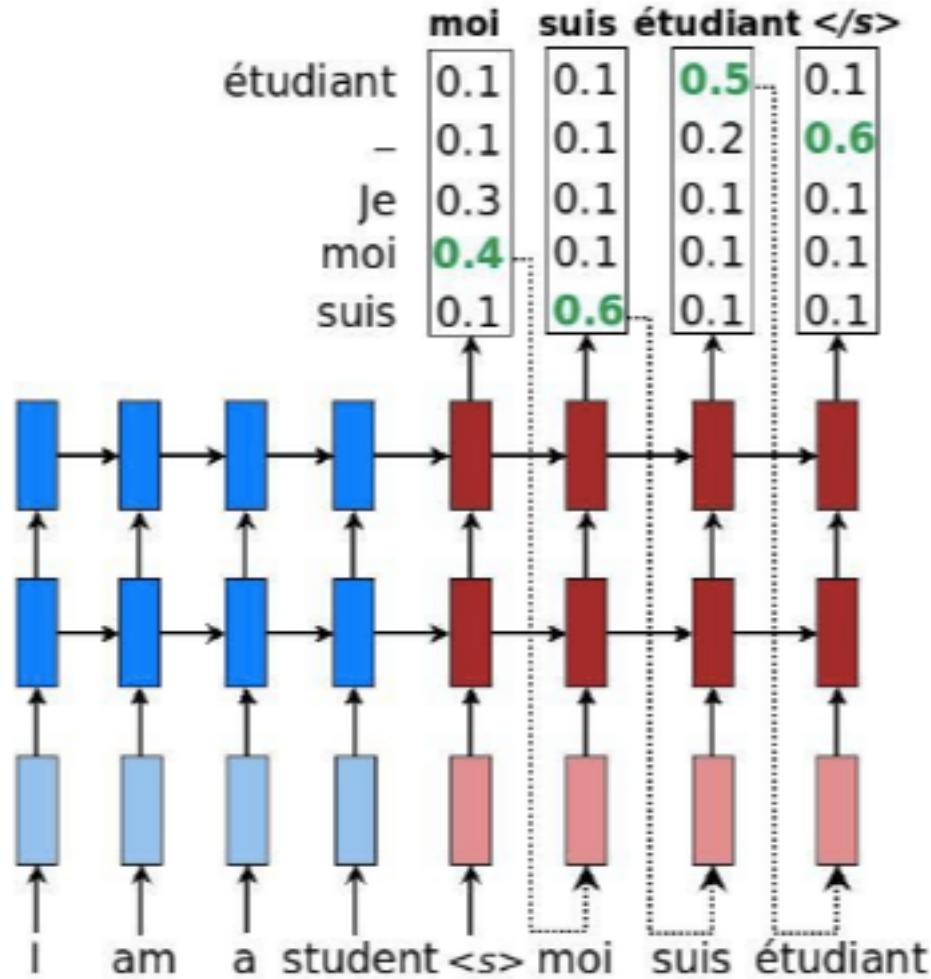


Today's AI

- 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:

Correct match squirrel



2nd closest match kangaroo

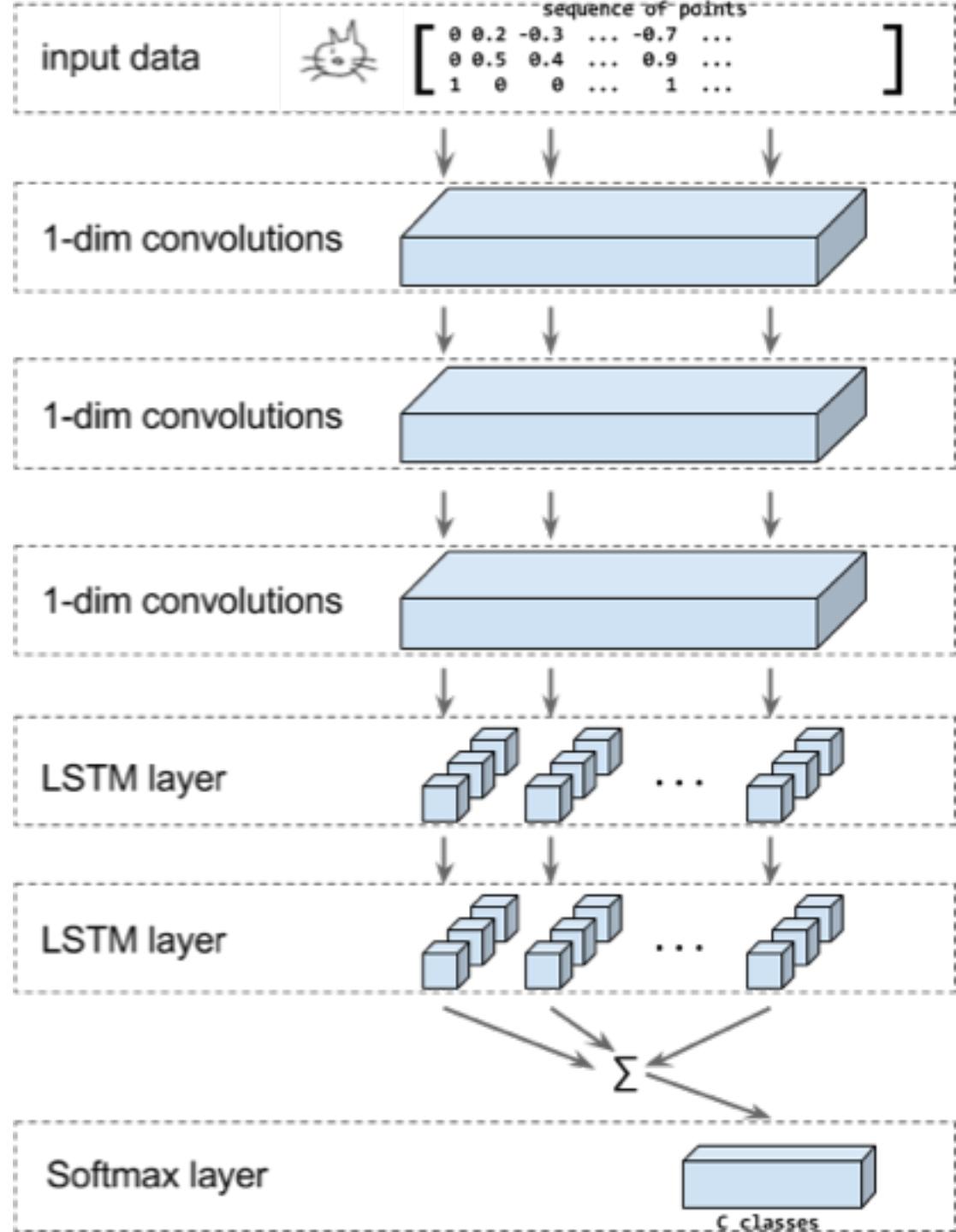


3rd closest match elbow

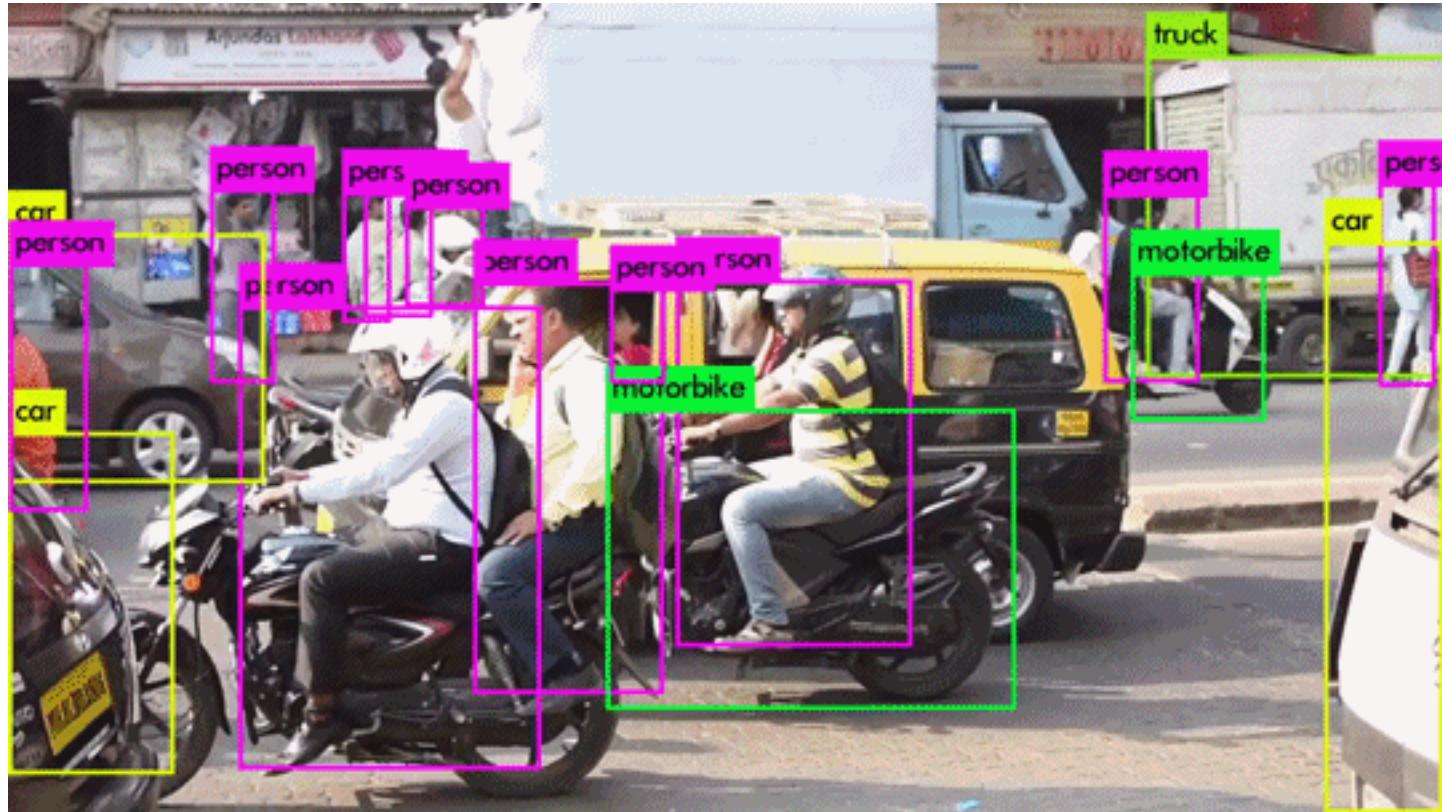


How does it know what squirrel looks like?
It learned by looking at these examples drawn by other people.

https://www.tensorflow.org/tutorials/recurrent_quickdraw
<https://quickdraw.withgoogle.com/data>

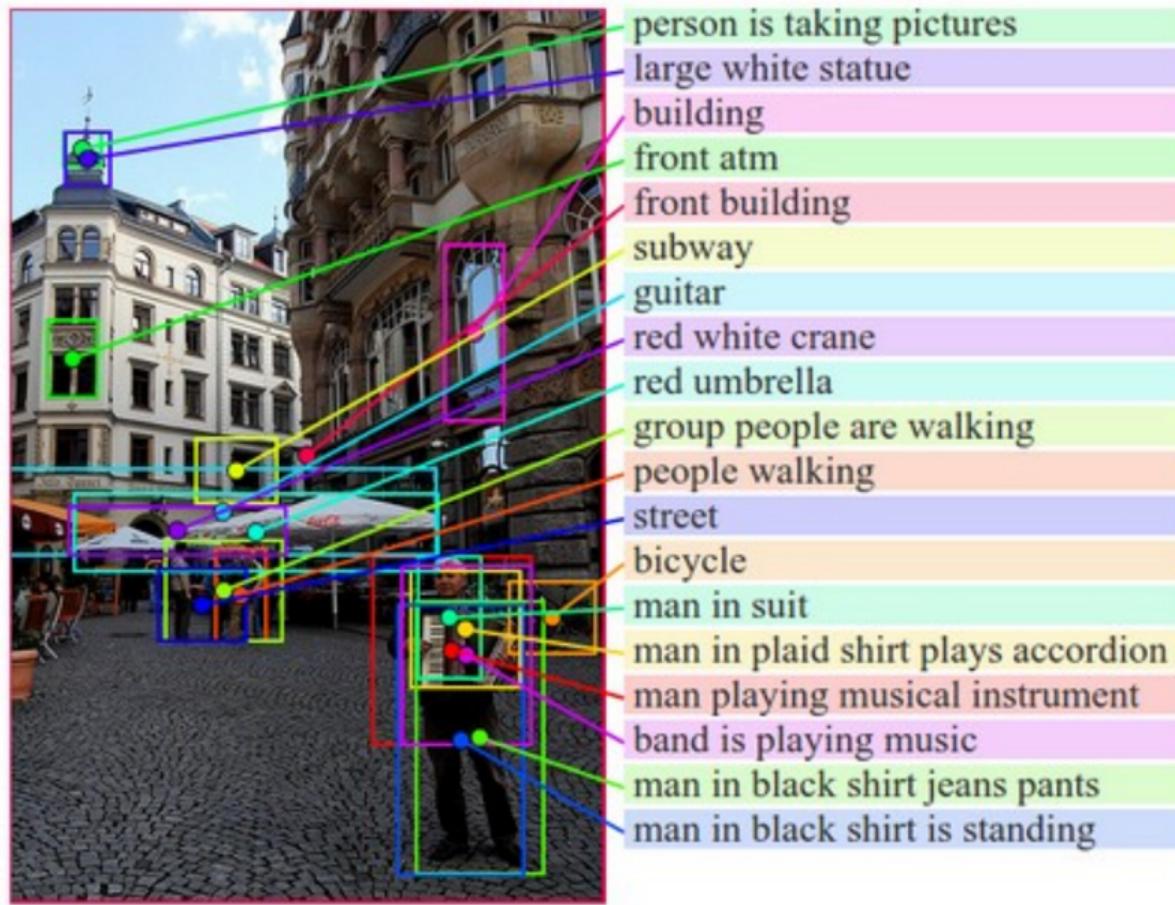


Real-time Image Recognition



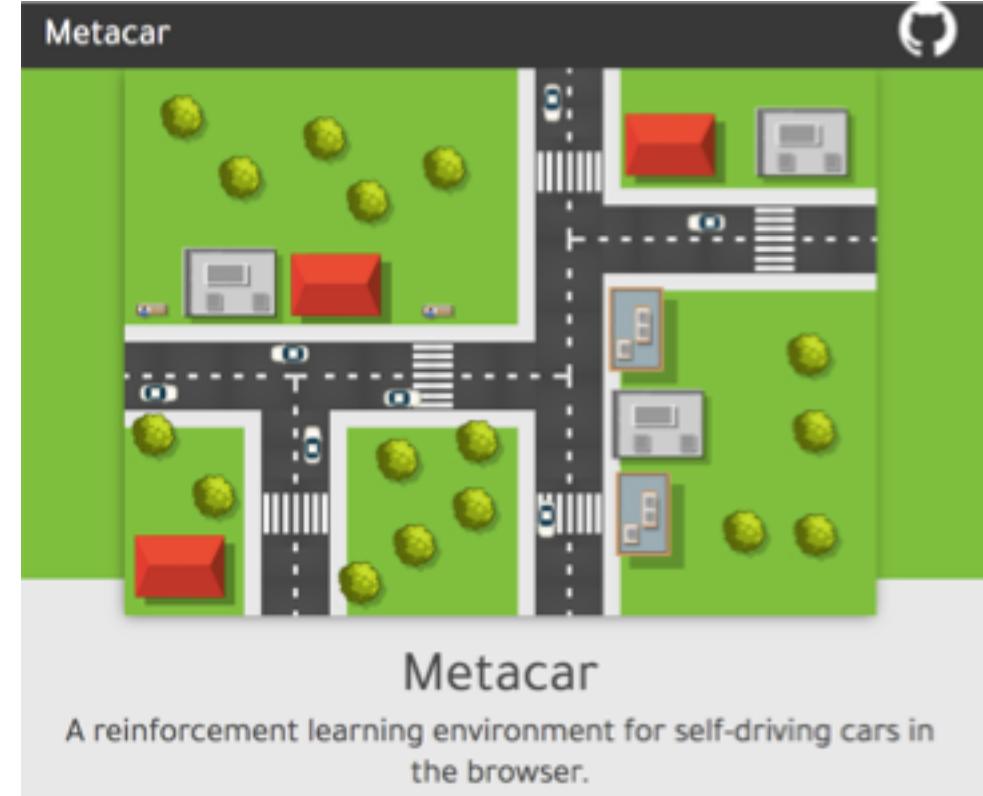
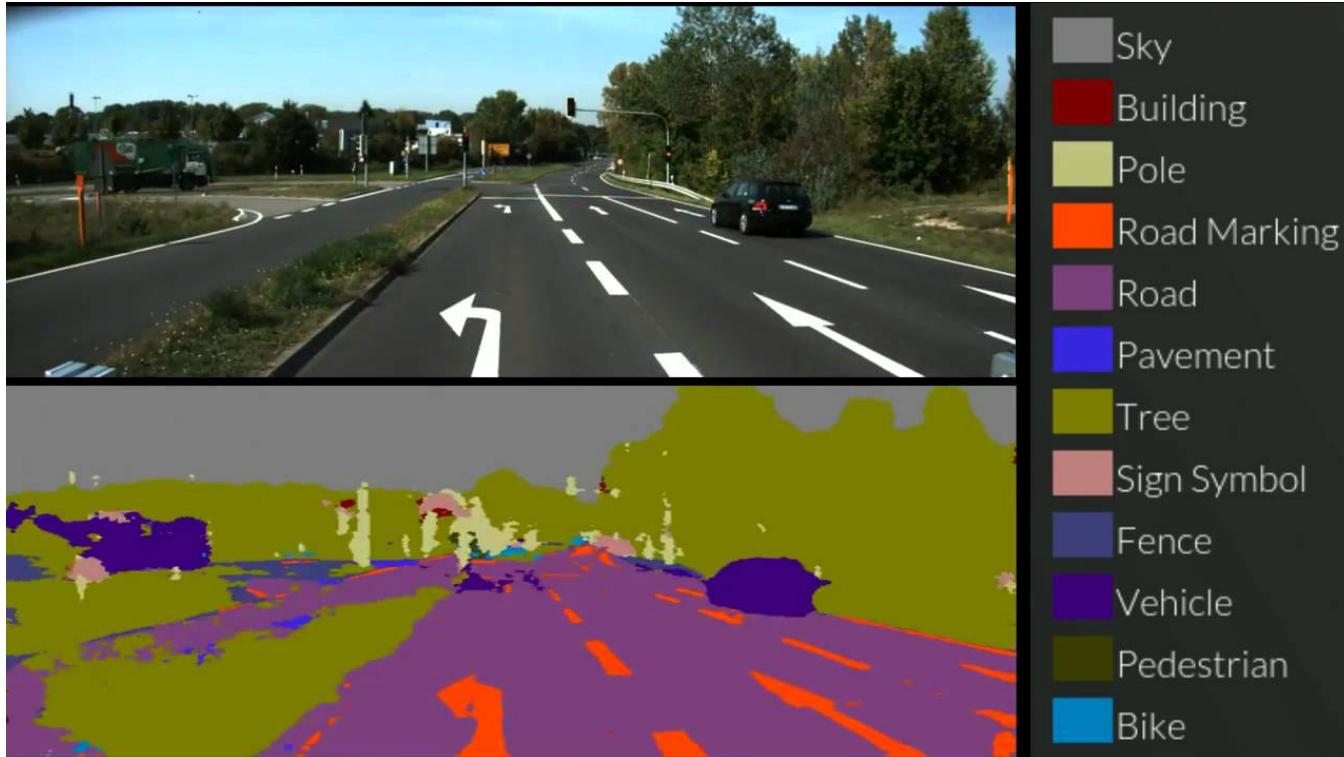
<https://pjreddie.com/darknet/yolo/>

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

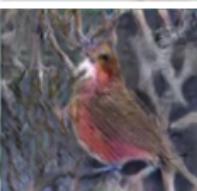
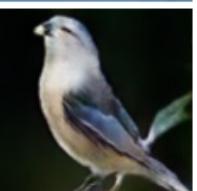
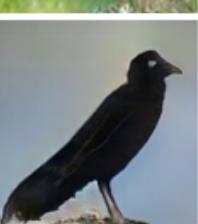
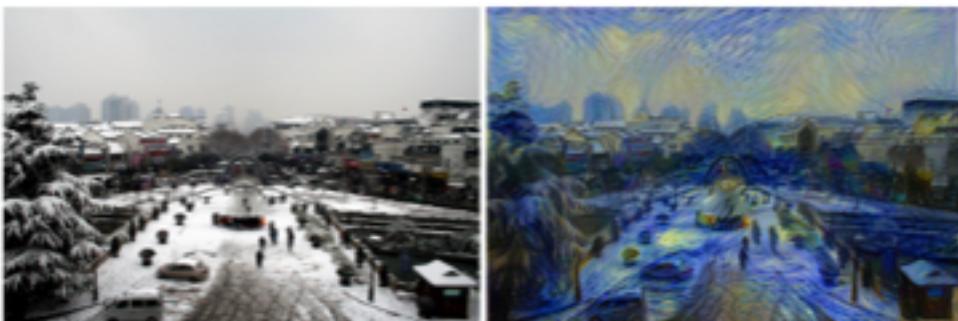
Text description	This bird is red and brown in color, with a stubby beak	The bird is short and stubby with yellow on its body	A bird with a medium orange bill white body gray wings and webbed feet	This small black bird has a short, slightly curved bill and long legs	A small bird with varying shades of 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.

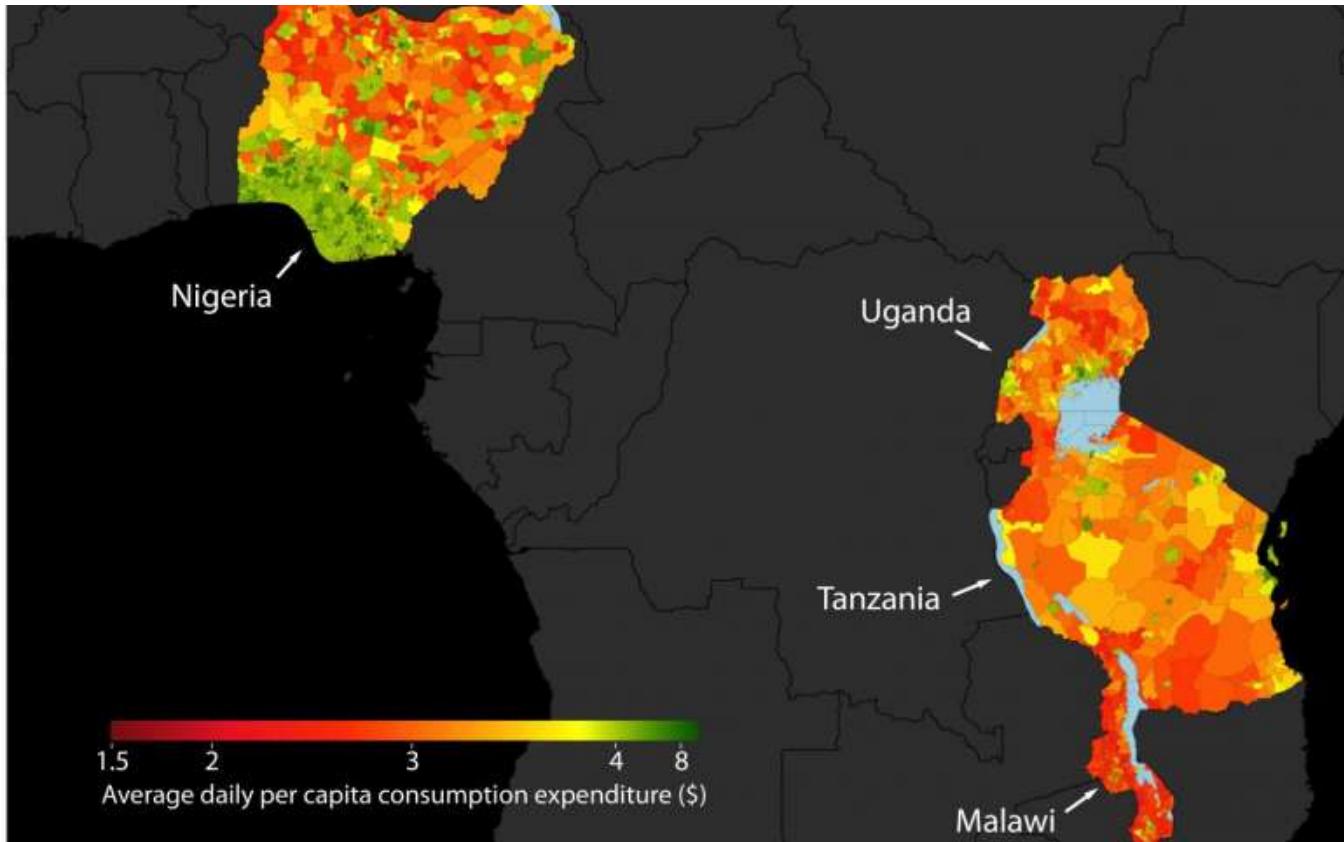
Art Style Transfer



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



Predicting Poverty



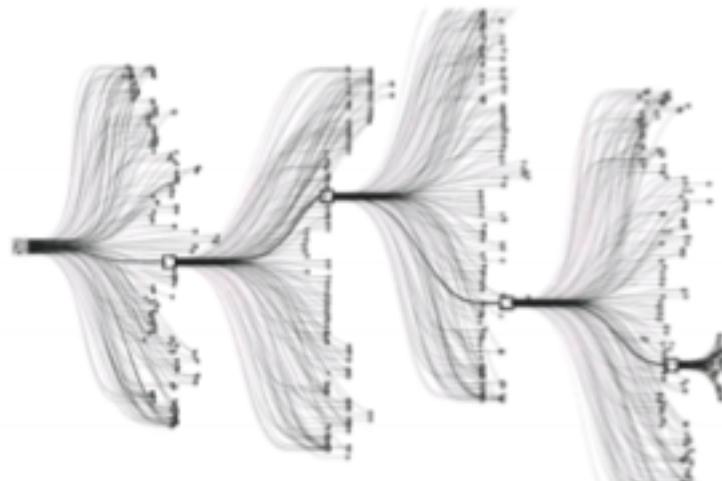
<https://phvs.org/news/2016-08-scientists-combine-satellite-machine-poverty.html>

What makes AI hard?

- Two sources of complexity



这是什么意思?



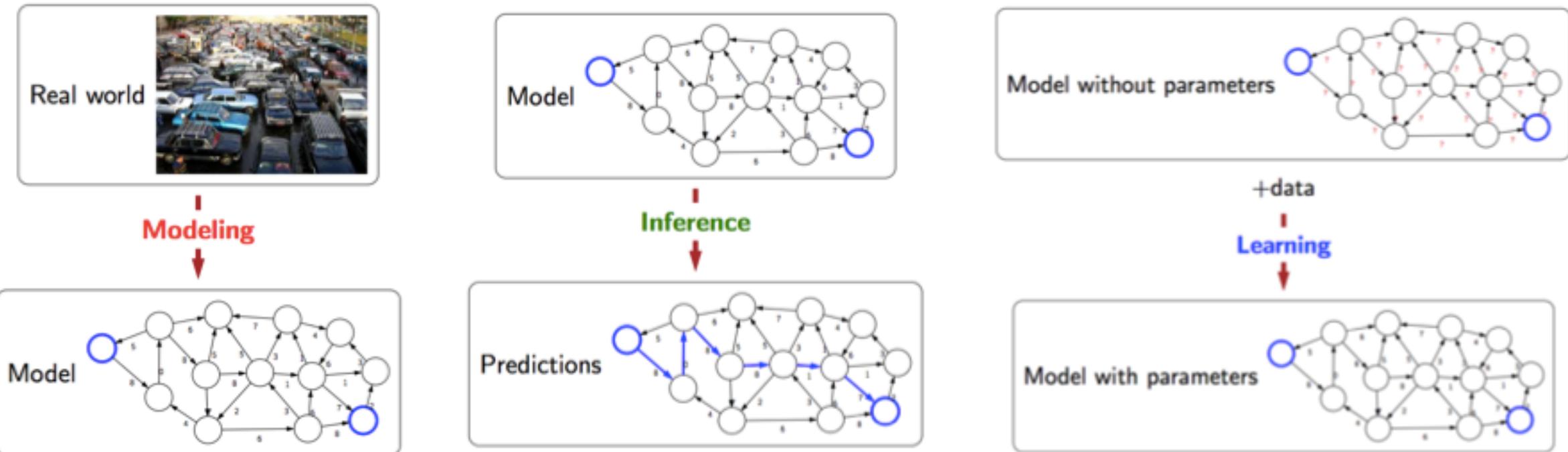
Computational Complexity
(need more CPUs)

Information Complexity
(need more data)

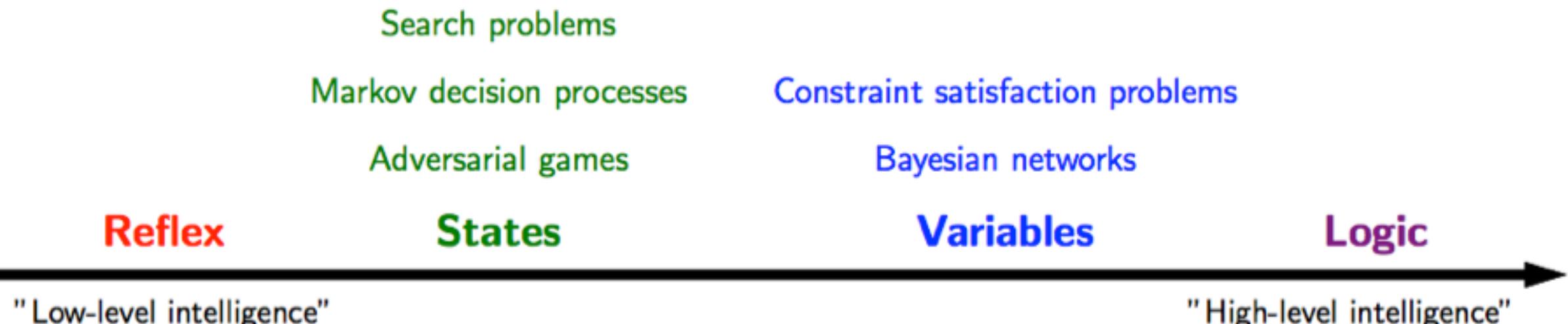
How to solve hard AI tasks?

- **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

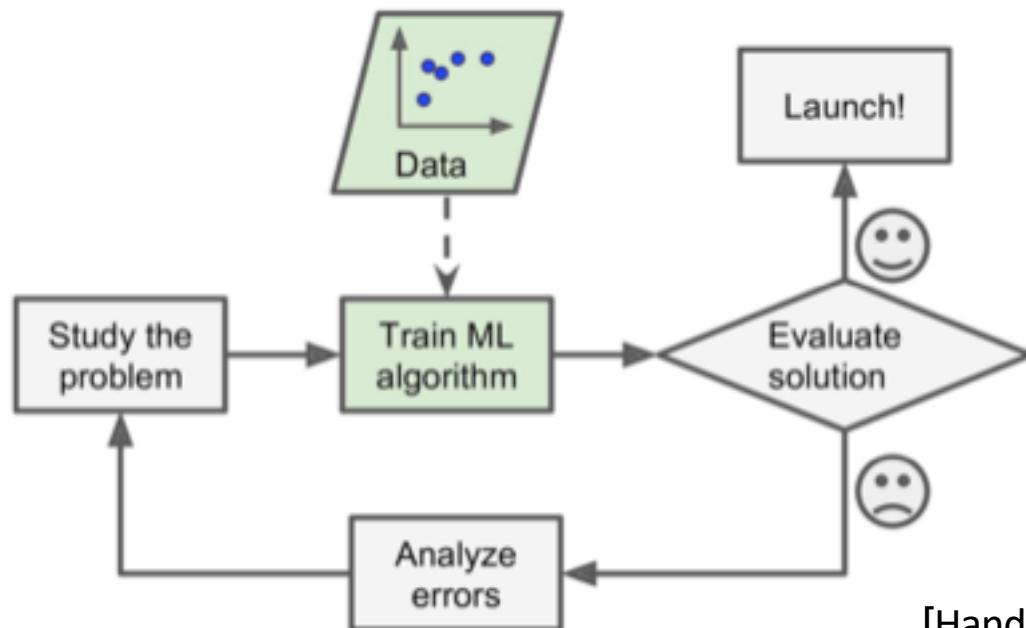


AI Solution Space



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



What is Machine Learning?

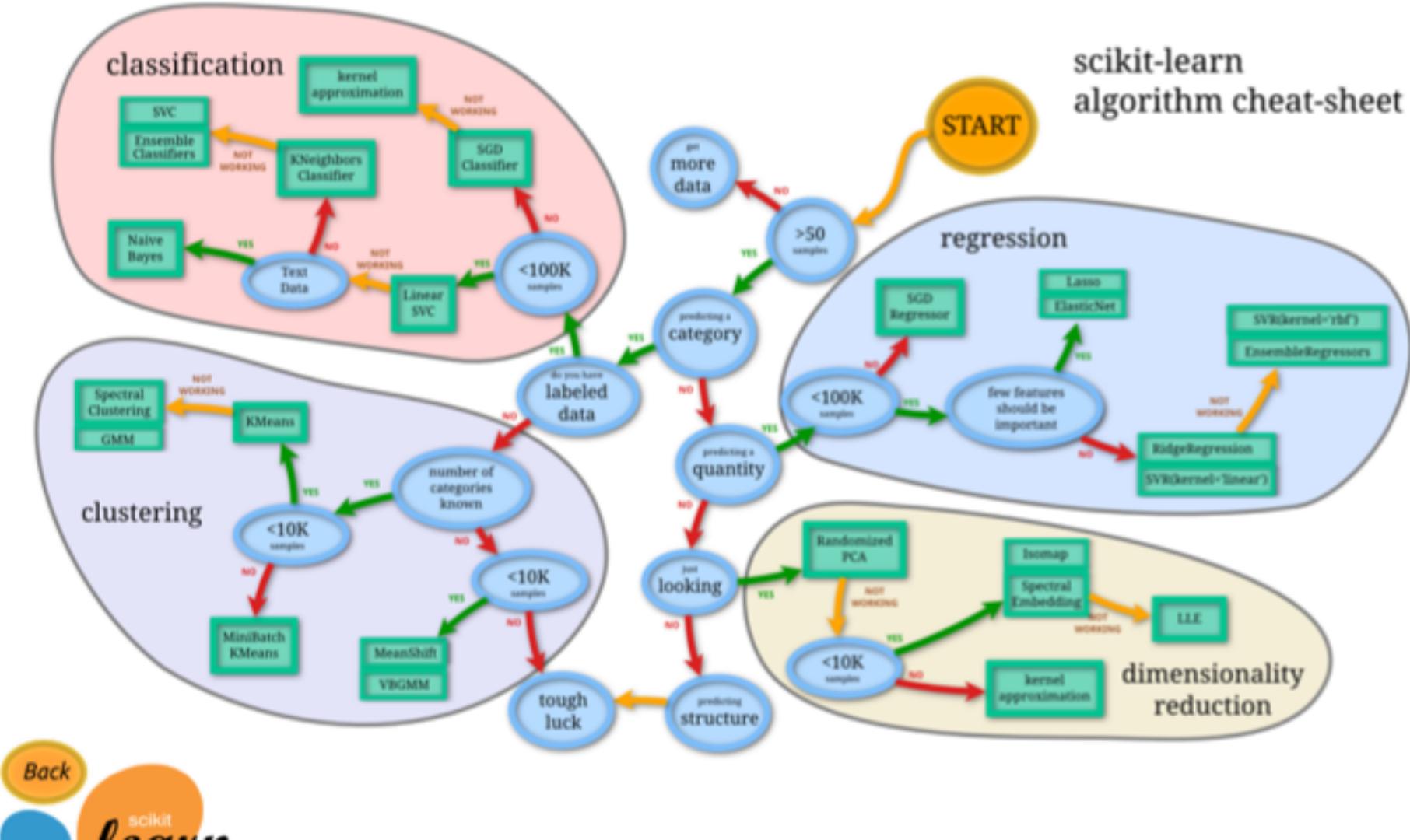
- More formally...

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

- 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 :
 - ▶ $f(x) = a \cdot \varphi(x) + b,$
 - ▶ $f(x) = \text{decision tree},$
 - ▶ $f(x) = \text{neural network}$

ML Techniques

http://scikit-learn.org/stable/tutorial/machine_learning_map/index.html



Why learn ML?

-- AI related jobs

- Data Scientist
- Data Engineer
- Researcher
- Professor
- Game Programmer

https://www.glassdoor.com/List/Best-Jobs-in-America-LST_K0.20.htm

50 Best Jobs in America

This report ranks jobs according to each job's Glassdoor Job Score, determined by combining three factors: number of job openings, salary, and overall job satisfaction rating.

United States | 2018 | 0 shares | [f](#) [t](#) [in](#) [e](#)

Rank	Job Title	Job Score	Job Satisfaction	Median Base Salary	Job Openings
1	Data Scientist	4.8 / 5	4.2 / 5	\$110,000	4,524
2	DevOps Engineer	4.6 / 5	4.0 / 5		

Awards

- Best Places to Work
- Top CEOs
- Best Places to Interview

Lists

- Best Jobs
- Best Cities for Jobs
- Highest Paying Jobs
- Oddball Interview Questions

Trends

- Overview
- Job Trends



Recap: Topics to be covered

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Next week

- Python Tutorial
- Searching
- Homework 1
- Form group of 3