

# Introduction of this course

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# ARTIFICIAL INTELLIGENCE

Early artificial intelligence stirs excitement.

人工智慧

目標



人類設定好的  
天生本能

## MACHINE LEARNING

Machine learning begins to flourish.

機器學習

手段



## DEEP LEARNING

Deep learning breakthroughs drive AI boom.

深度學習



1950's

1960's

1970's

1980's

1990's

2000's

2010's

Since an early flush of optimism in the 1950s, smaller subsets of artificial intelligence – first machine learning, then deep learning, a subset of machine learning – have created ever larger disruptions.

# 人類設定好的天生本能

- E.g. You want to build a Chat-bot ...
  - If there is “turn off” in the input, then “turn off the music” (hand-crafted rules)
    - You can say “Please turn off the music” or “Can you turn off the music?”. Smart?
    - What if someone says “Please don’t turn off the music” .....
- Weakness of hand-crafted rules
  - Hard to consider all possibilities
    - 永遠無法超越創造者
  - Lots of human efforts (not suitable for small industry)

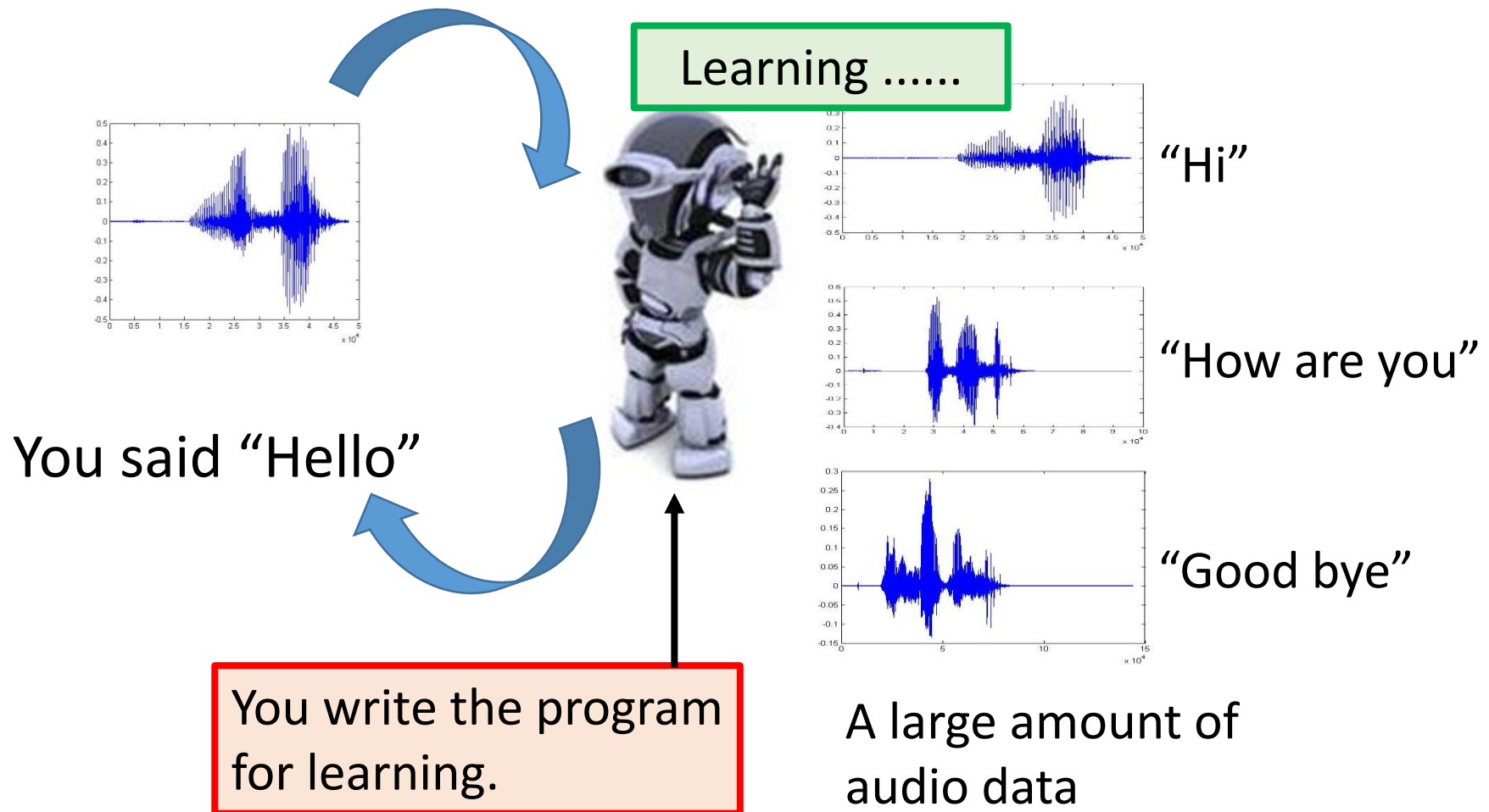
# 人類設定好的天生本能

- AI?

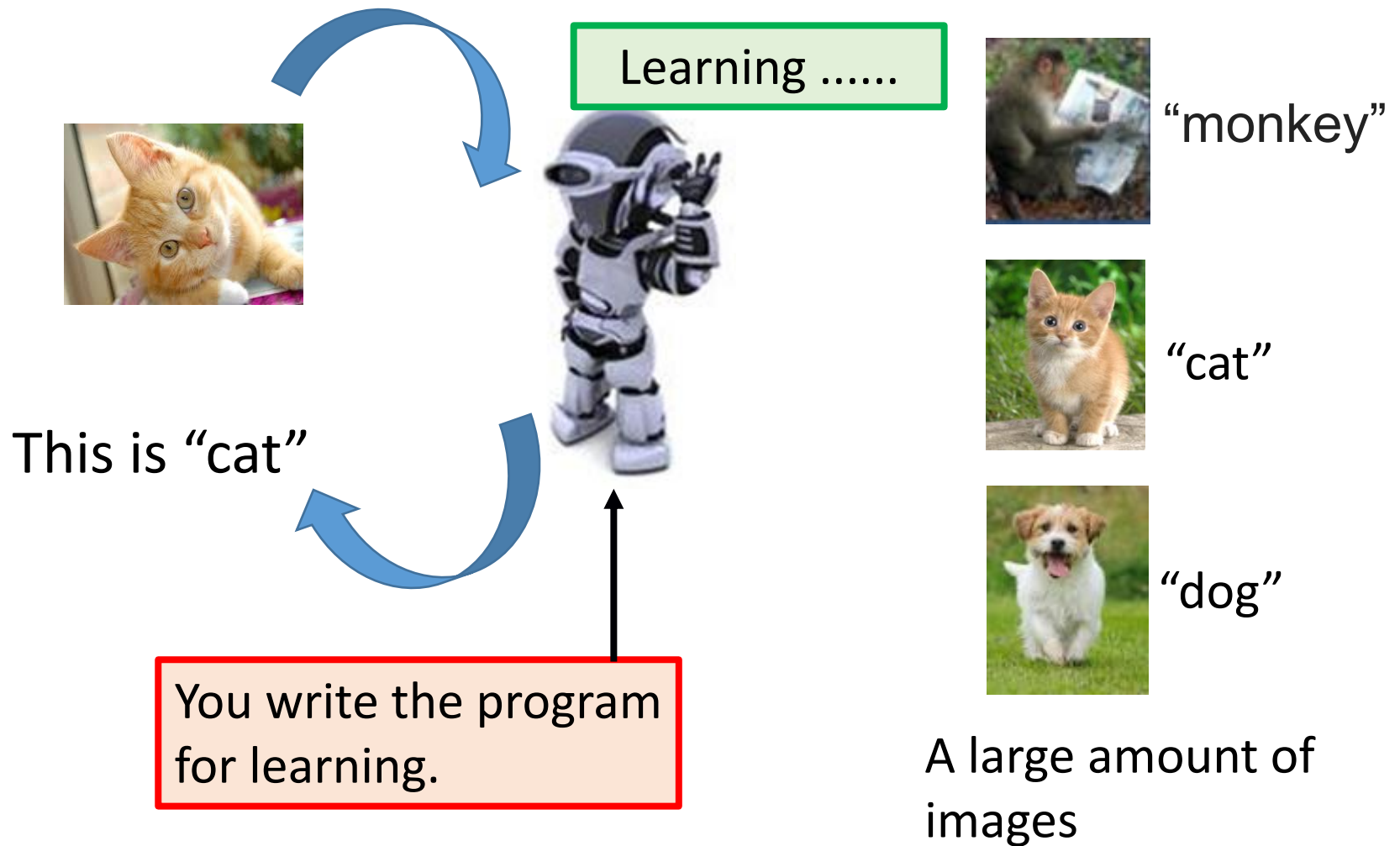
<http://www.commissionerstrip.com/en/2017/06/07/ai-inside/>

Shared on Yann  
LeCun's FB

# What is Machine Learning?



# What is Machine Learning?



# Machine Learning

## ≈ Looking for a Function

- Speech Recognition

$$f\left(\text{[Waveform]}\right) = \text{"How are you"}$$

- Image Recognition

$$f\left(\text{[Cat Image]}\right) = \text{"Cat"}$$



- Playing Go

$$f\left(\text{[Go Board Image]}\right) = \text{"5-5"} \quad (\text{next move})$$



- Dialogue System

$$f\left(\begin{array}{c} \text{"Hi"} \\ \text{(what the user said)} \end{array}\right) = \begin{array}{c} \text{"Hello"} \\ \text{(system response)} \end{array}$$

# Framework

Image Recognition:

$$f\left(\text{img}\right) = \text{"cat"}$$



$$f_1\left(\text{img}\right) = \text{"cat"}$$

$$f_2\left(\text{img}\right) = \text{"money"}$$

$$f_1\left(\text{img}\right) = \text{"dog"}$$

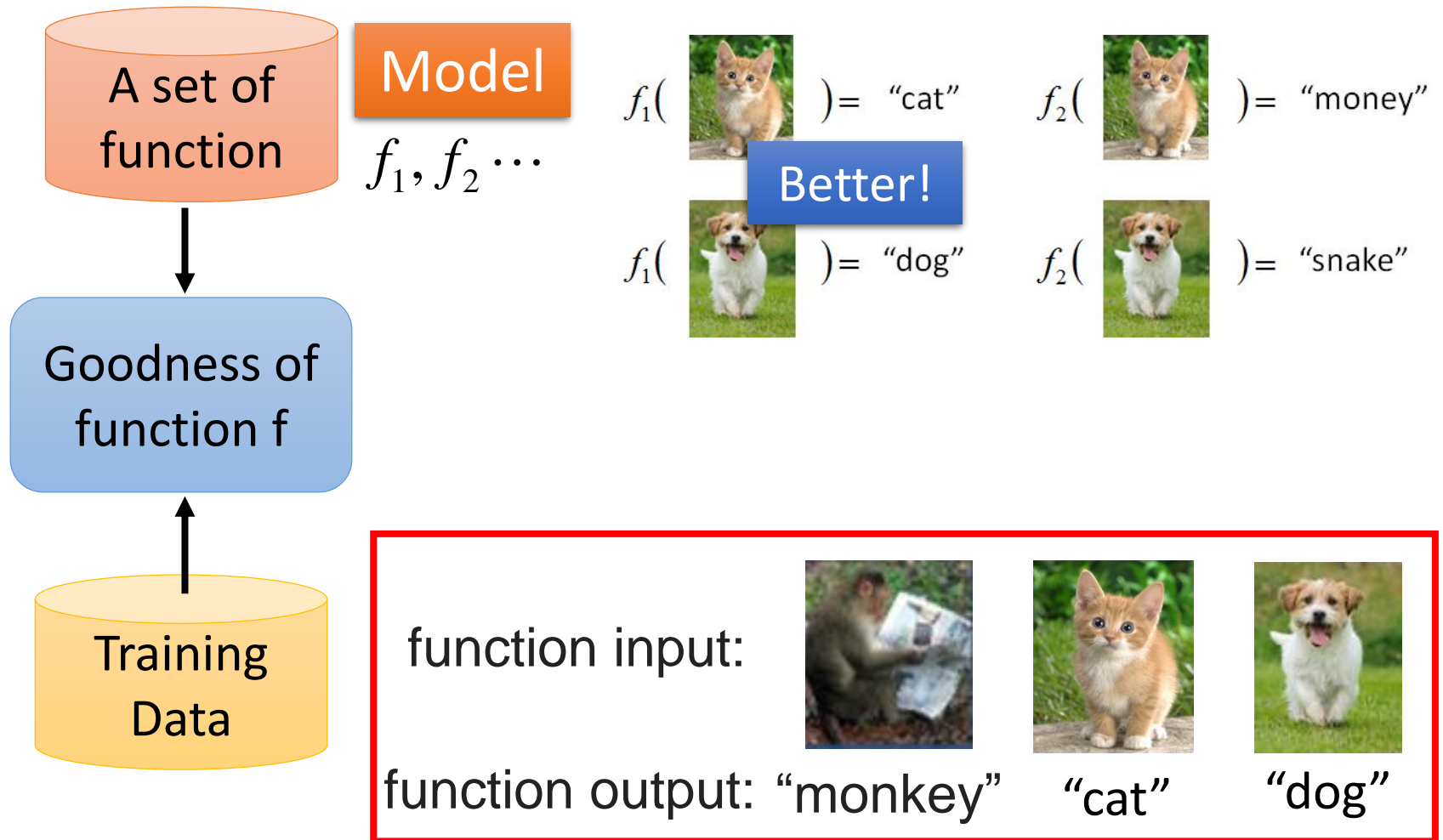
$$f_2\left(\text{img}\right) = \text{"snake"}$$



# Framework

Image Recognition:

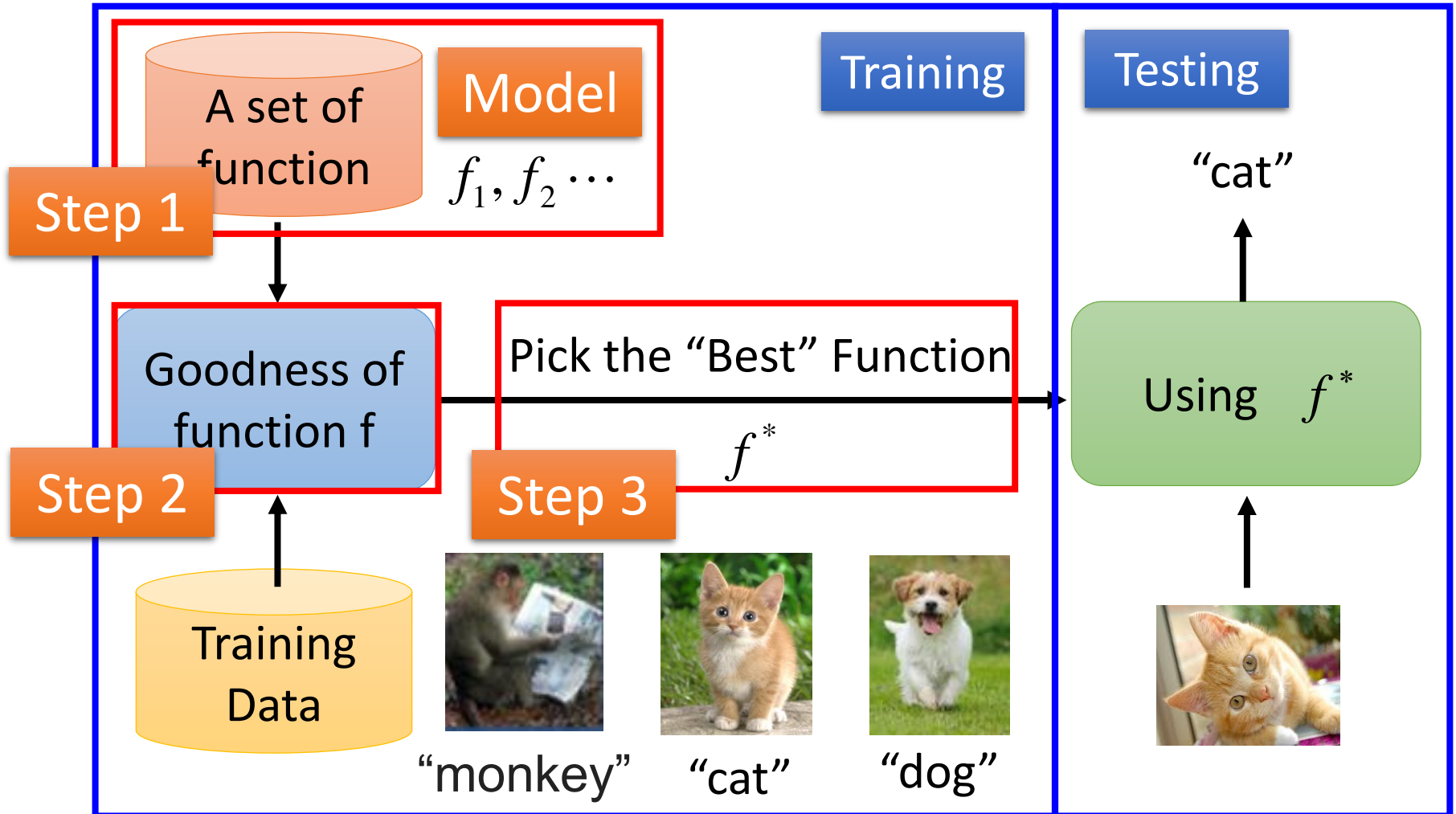
$$f(\text{img\_cat}) = \text{"cat"}$$



## Image Recognition:

# Framework

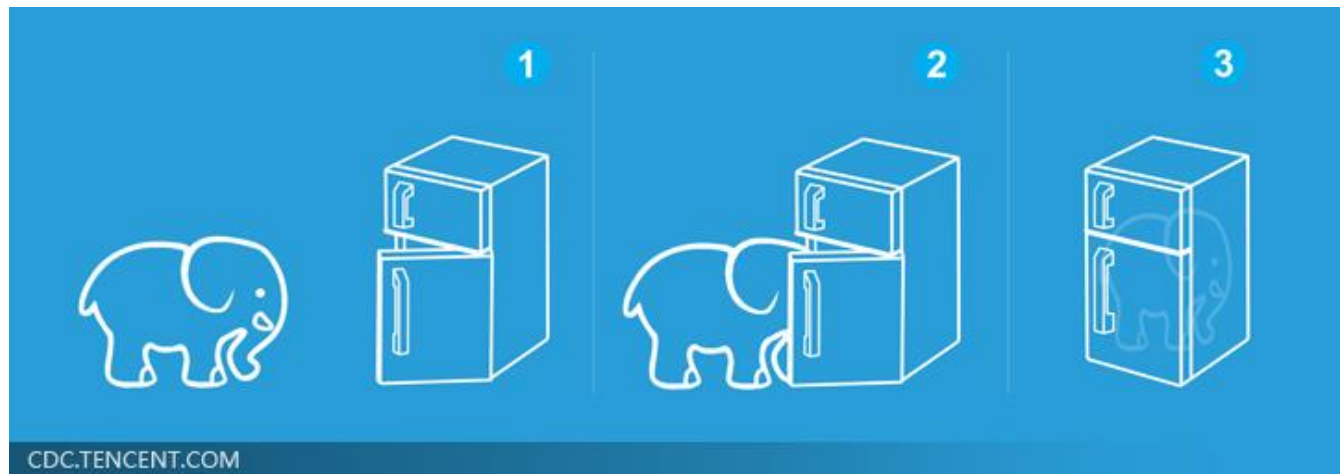
$$f\left(\text{Image of a cat}\right) = \text{"cat"}$$



# Machine Learning is so simple .....



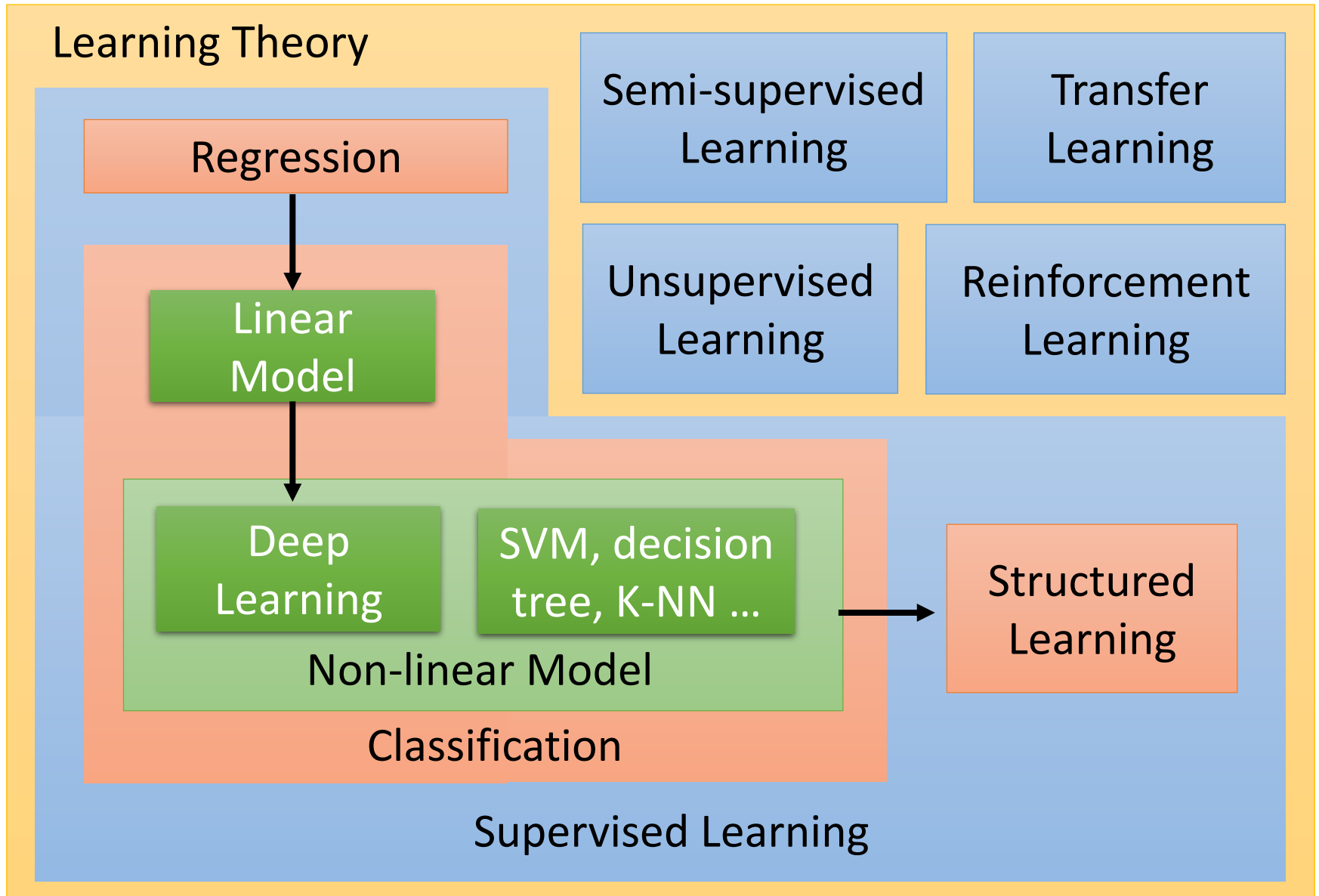
就好像把大象放進冰箱 .....



# Learning Map

# Learning Map

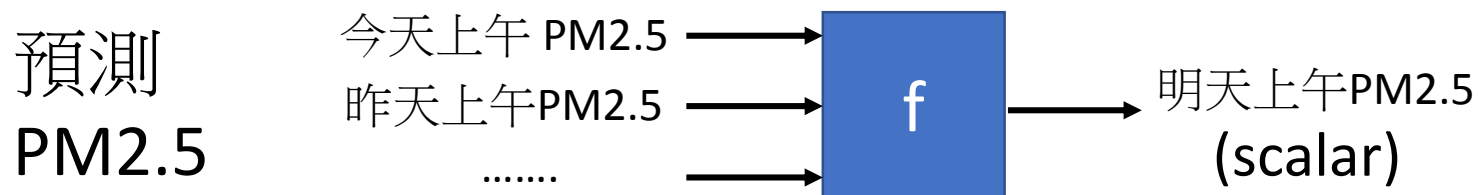
scenario task method



# Learning Map

Regression

The output of the target function  $f$  is “scalar”.



## Training Data:

Input:

9/01 上午 PM2.5 = 63    9/02 上午 PM2.5 = 65

Output:

9/03 上午 PM2.5 = 100

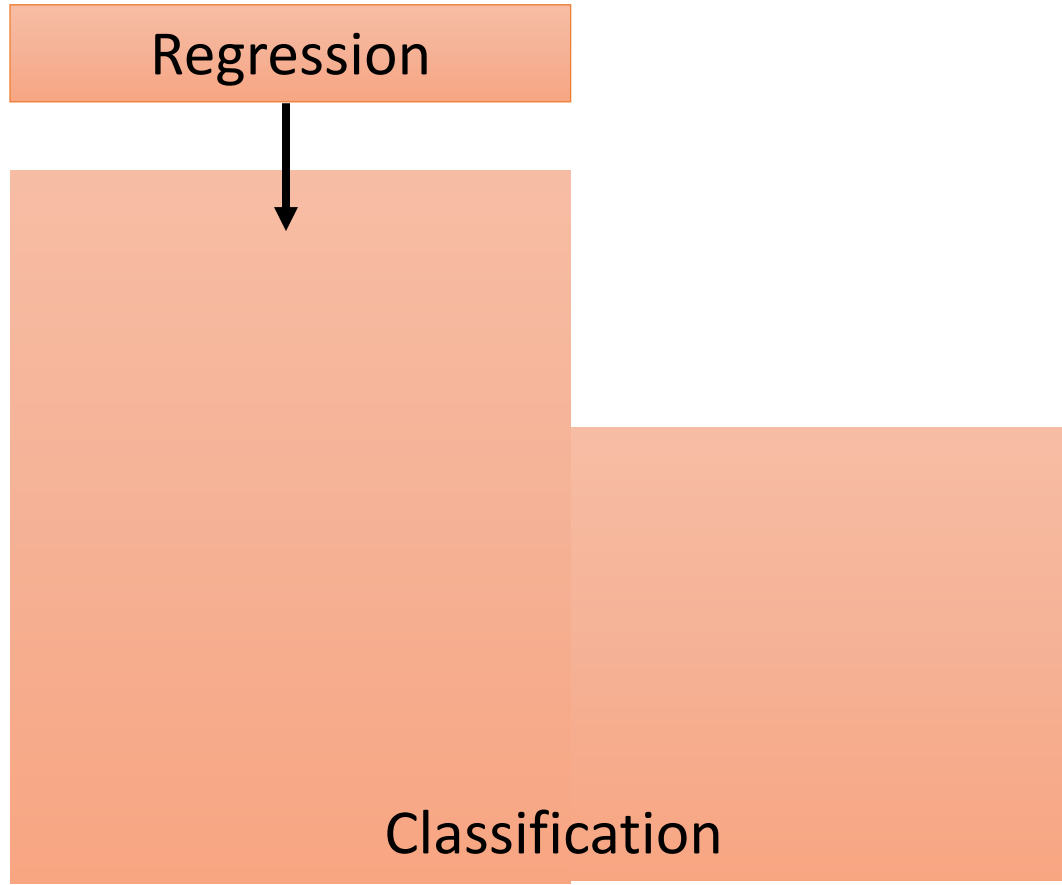
Input:

9/12 上午 PM2.5 = 30    9/13 上午 PM2.5 = 25

Output:

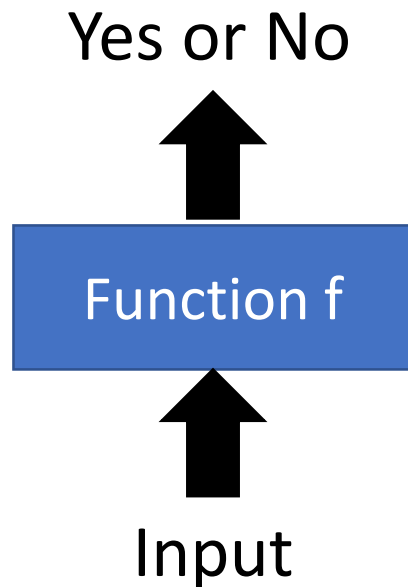
9/14 上午 PM2.5 = 20

# Learning Map

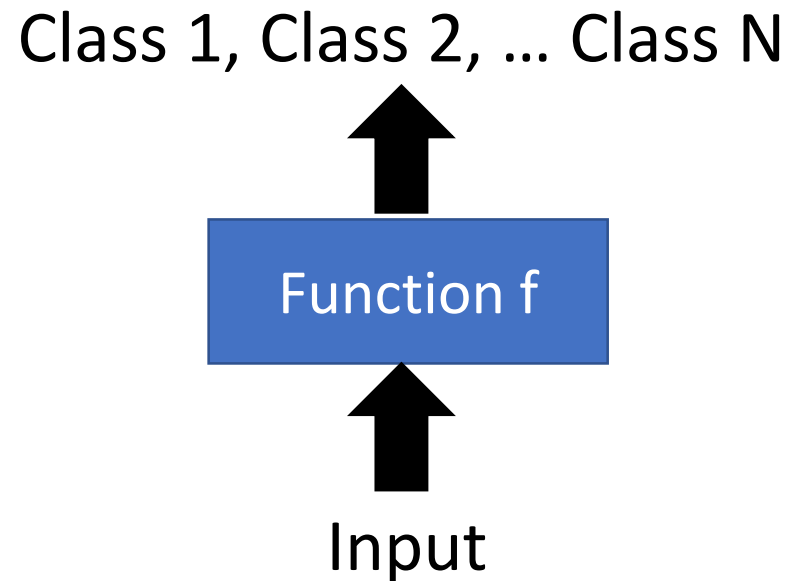


# Classification

- Binary Classification



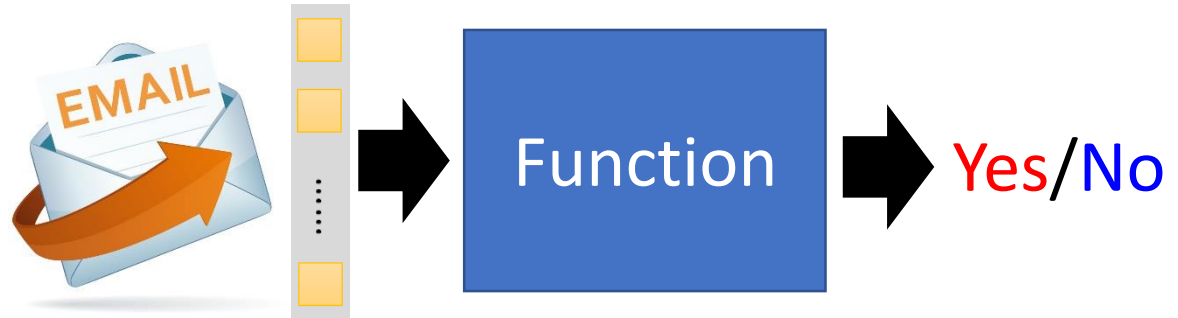
- Multi-class Classification





# Binary Classification

Spam  
filtering

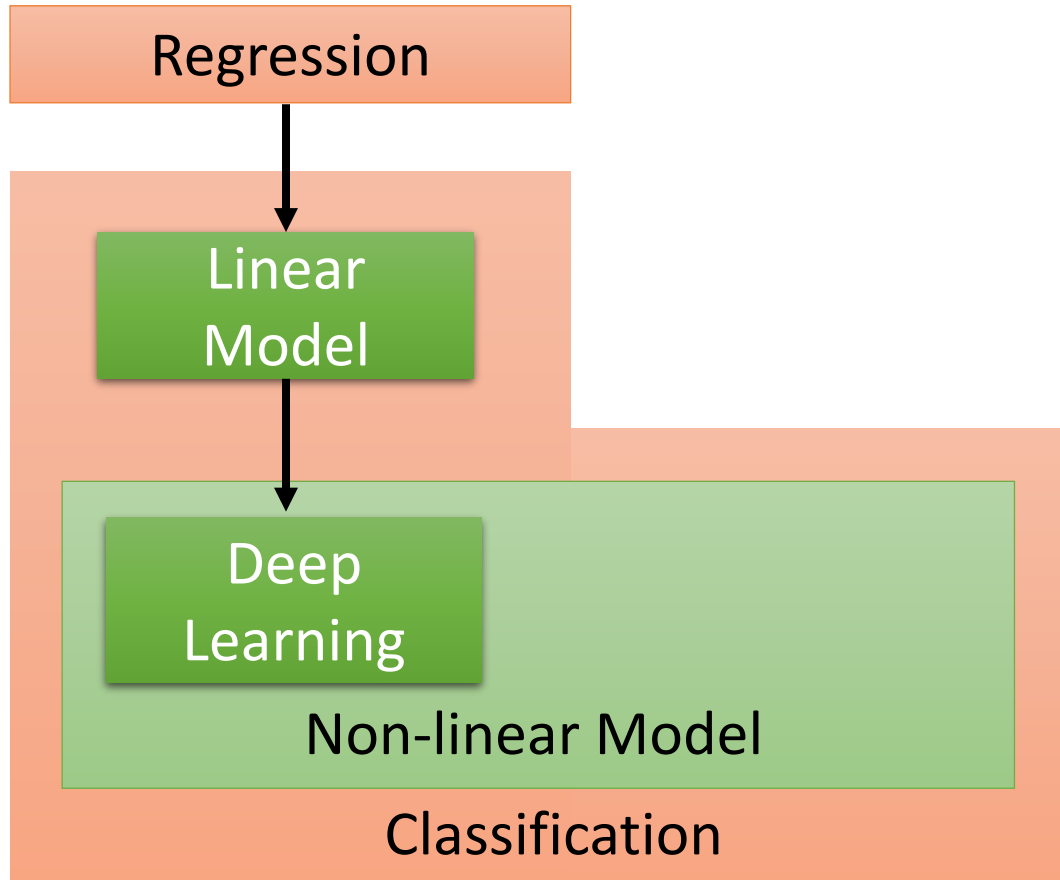


# Multi-class Classification

## Document Classification

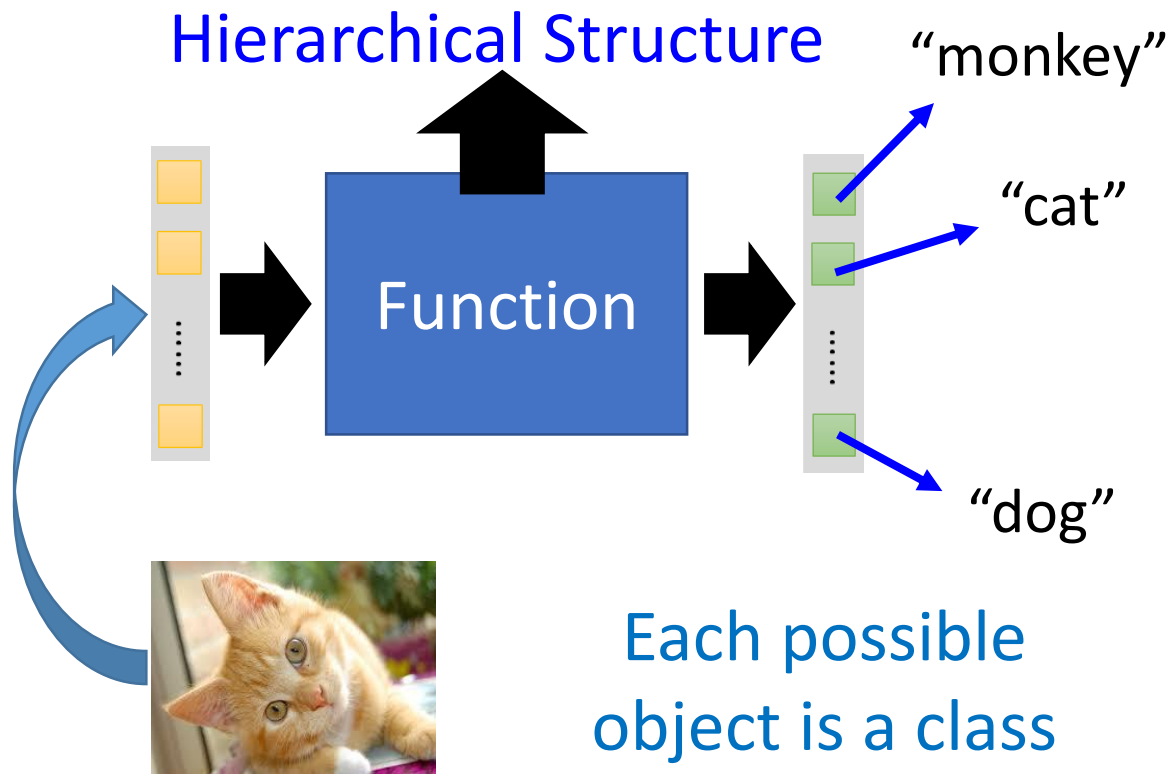


# Learning Map



# Classification - Deep Learning

- Image Recognition



## Training Data



“monkey”



“cat”



“dog”

# Classification - Deep Learning

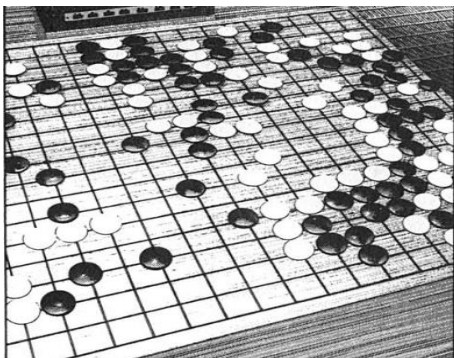
- Playing GO



Function

Next move  
Each position  
is a class  
(19 x 19 classes)

## Training Data



一堆棋譜

進藤光 v.s. 社清春

黑: 5之五 → 白: 天元 → 黑: 五之5



# Classification - Deep Learning

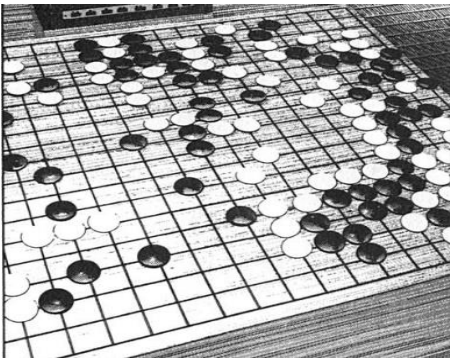
- Playing GO



Function

Next move  
Each position  
is a class  
(19 x 19 classes)

## Training Data



一堆棋譜

進藤光 v.s. 社清春

黑: 5之五 → 白: 天元 → 黑: 五之5

Input:

黑: 5之五



Output:

天元

Input:

黑: 5之五、白: 天元

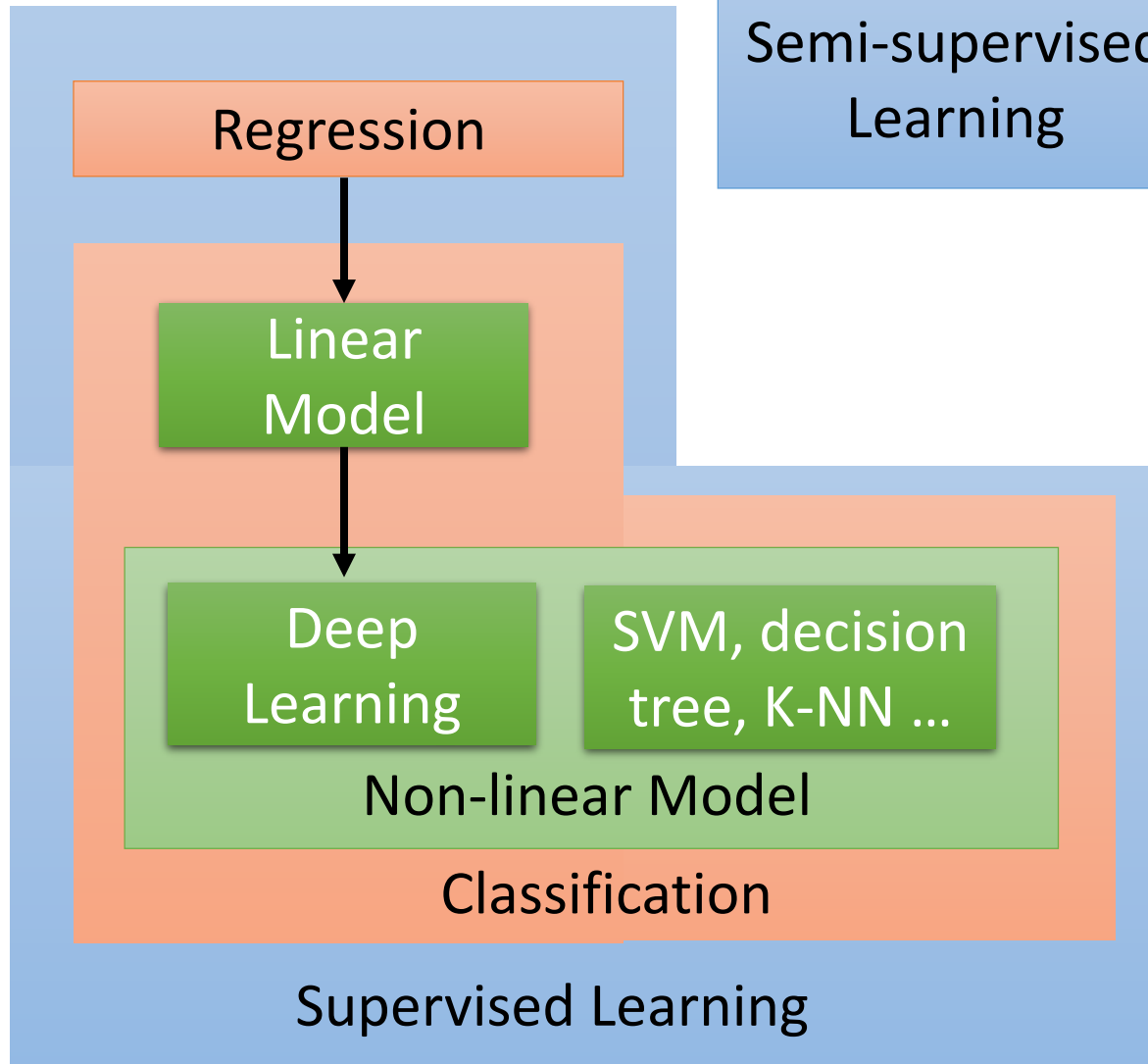


Output:

五之5

# Learning Map

Hard to collect a large  
amount of labelled data



Training Data:

Input/output  
pair of target  
function

Function  
output = label



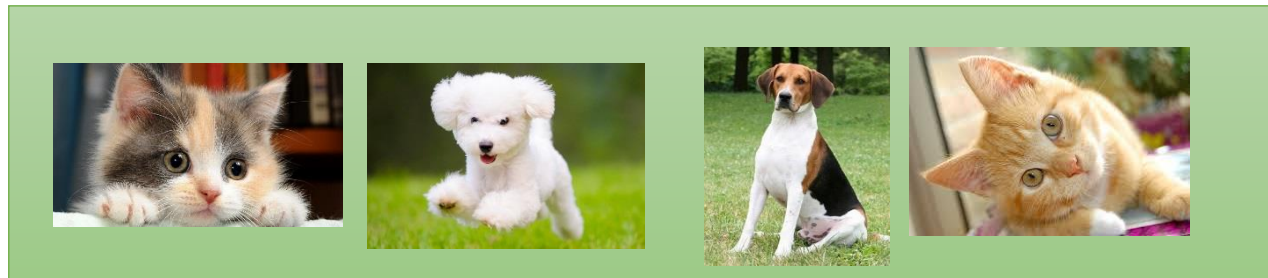
# Semi-supervised Learning

For example, recognizing cats and dogs

Labelled  
data



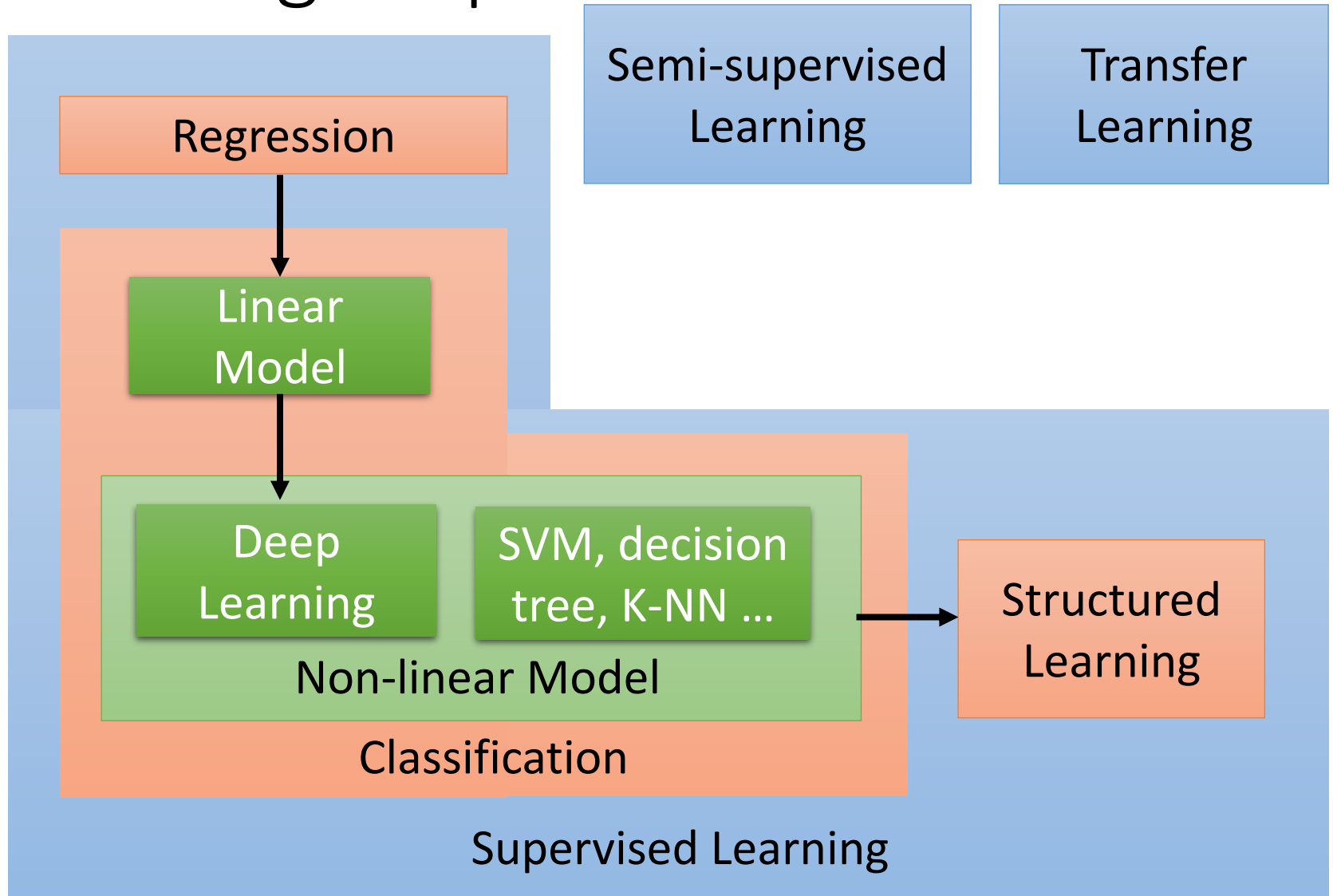
Unlabeled  
data



(Images of cats and dogs)



# Learning Map



# Transfer Learning

For example, recognizing cats and dogs

Labelled  
data



cat



dog



elephant

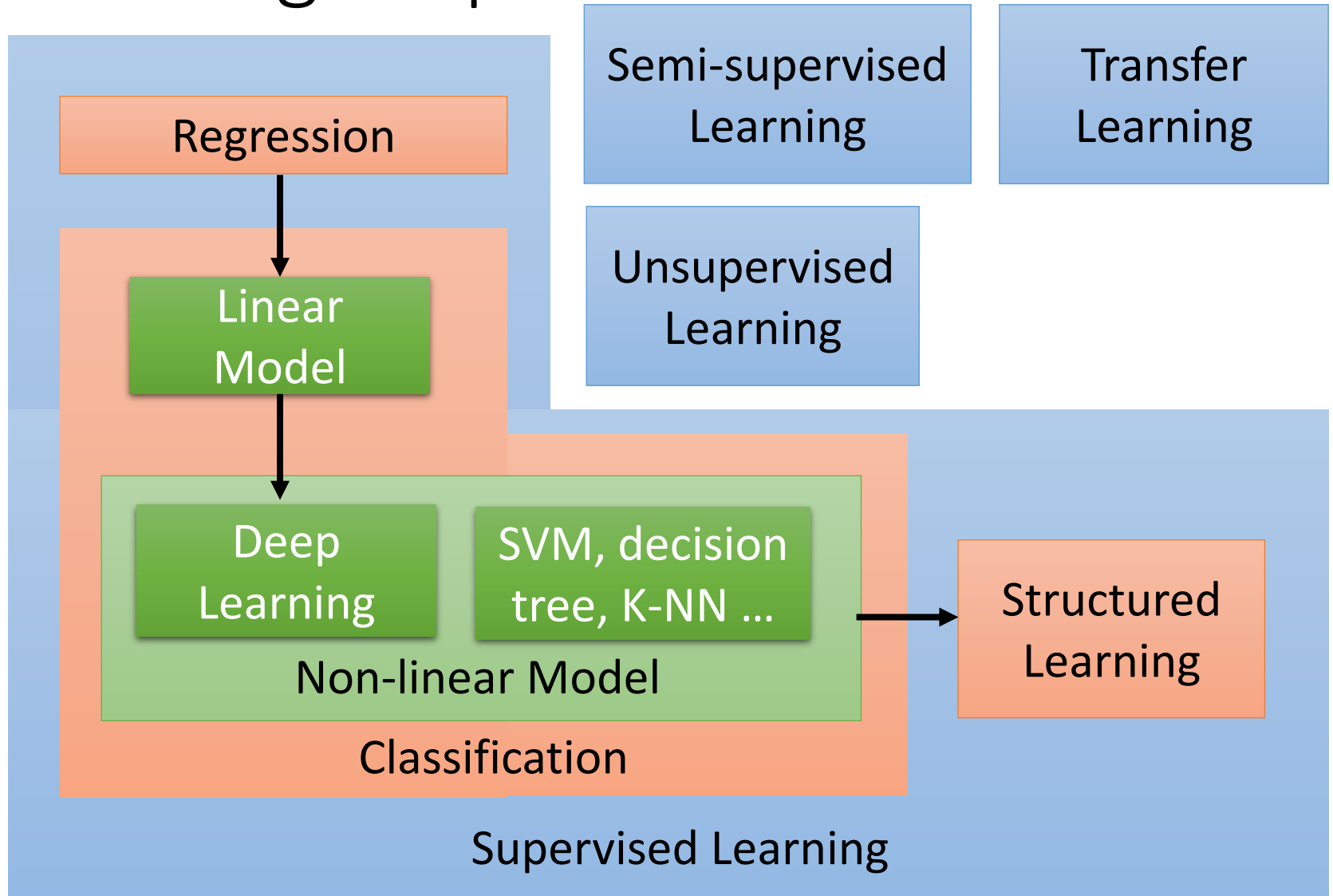


Haruhi



Data not related to the task considered  
(can be either labeled or unlabeled)

# Learning Map



# Unsupervised Learning

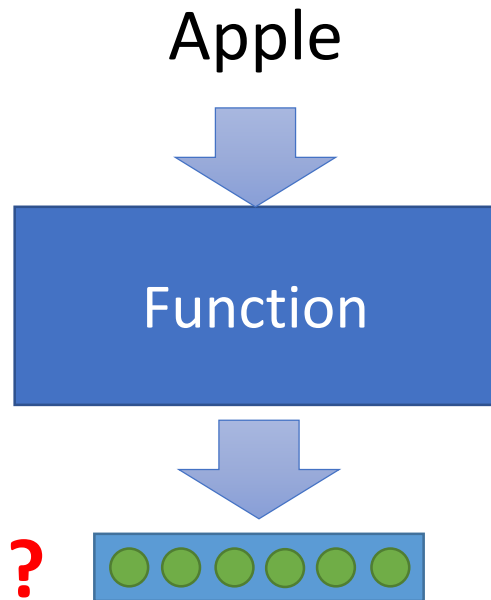
- Machine Reading: Machine learns the meaning of words from reading a lot of documents



<http://top-breaking-news.com/>

# Unsupervised Learning

- Machine Reading: Machine learns the meaning of words from reading a lot of documents



Training data is a lot of text



<https://garavato.files.wordpress.com/2011/11/stacksdocuments.jpg?w=490>

# Unsupervised Learning



Draw something!

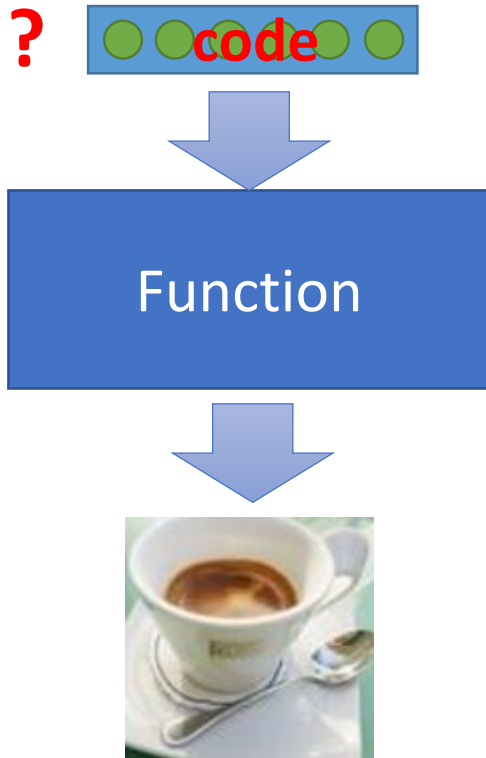


<http://ttic.uchicago.edu/~klivescu/MLSLP2016/>  
(slides of Ian Goodfellow)

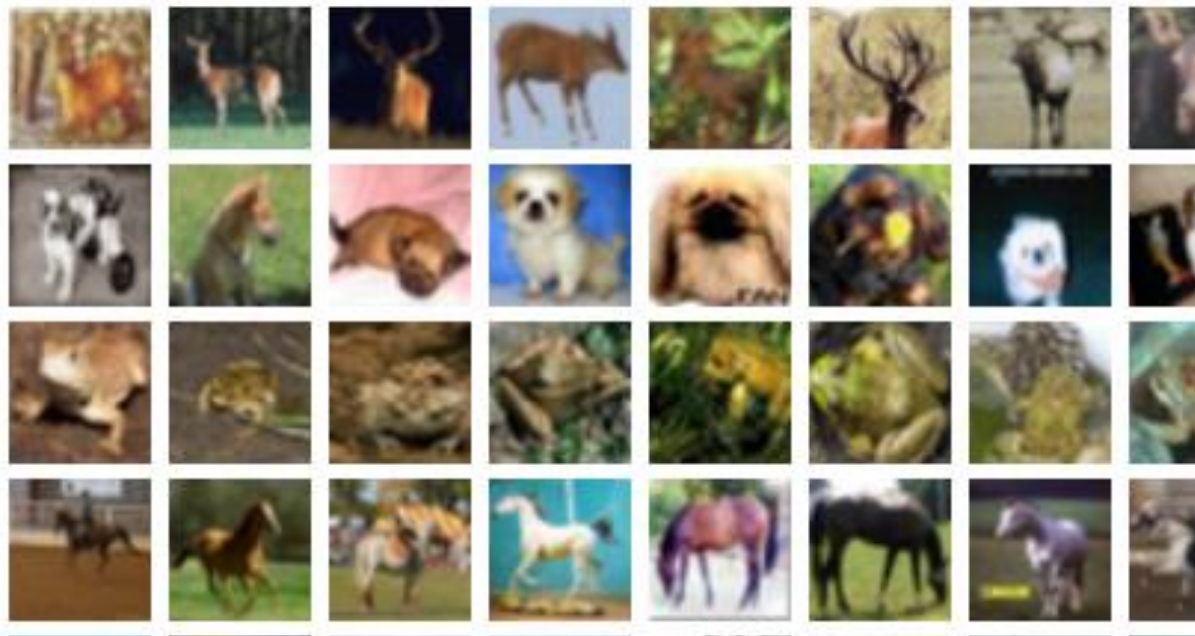


# Unsupervised Learning

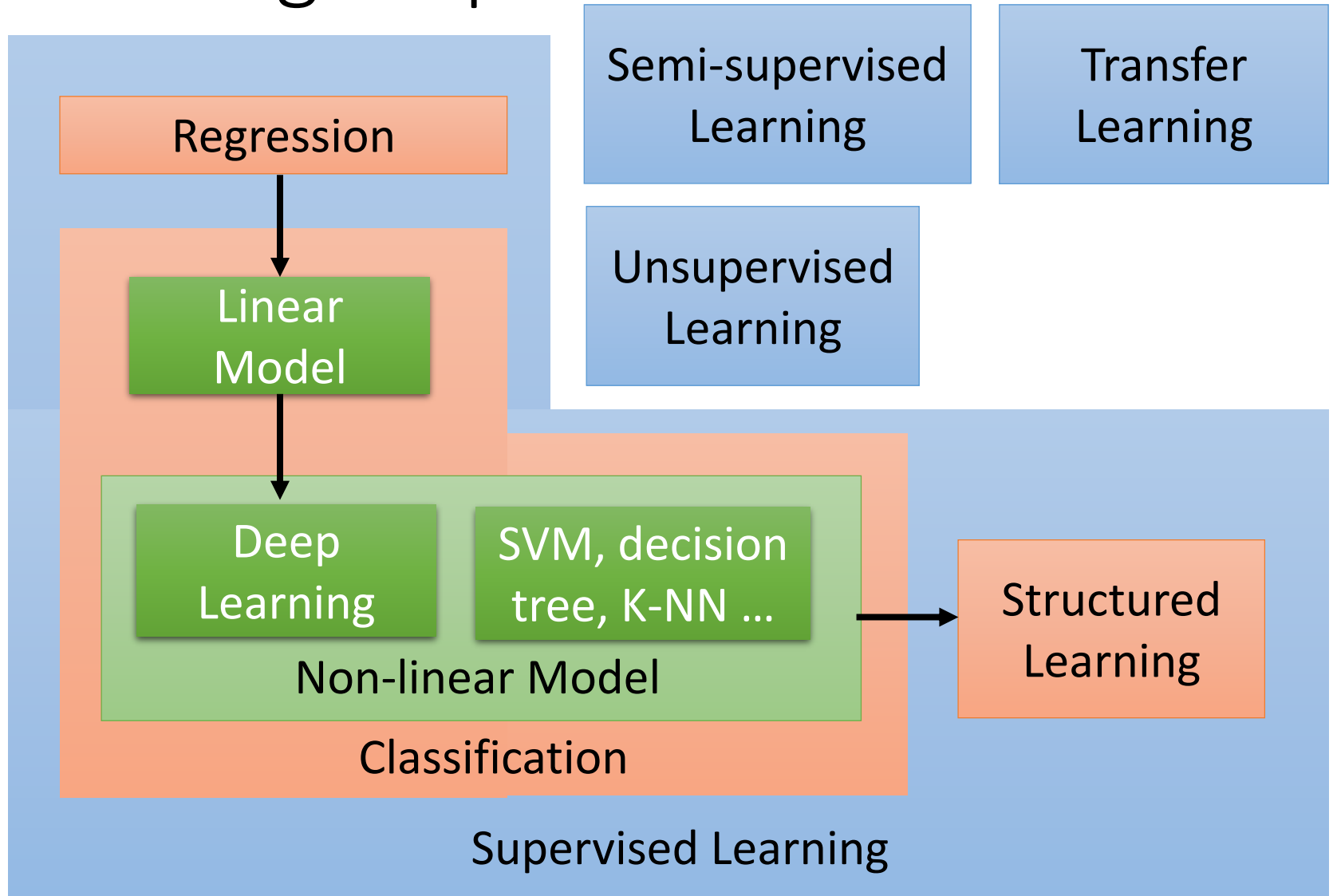
- Machine Drawing



Training data is a lot of images



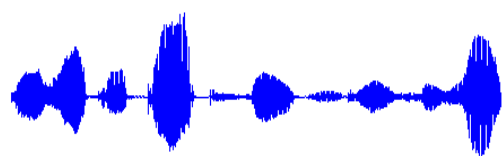
# Learning Map





# Structured Learning

## - Beyond Classification



“大家好，歡迎大家來修機器學習”

Speech Recognition

“機器學習”



“Machine Learning”

Machine Translation

人臉辨識

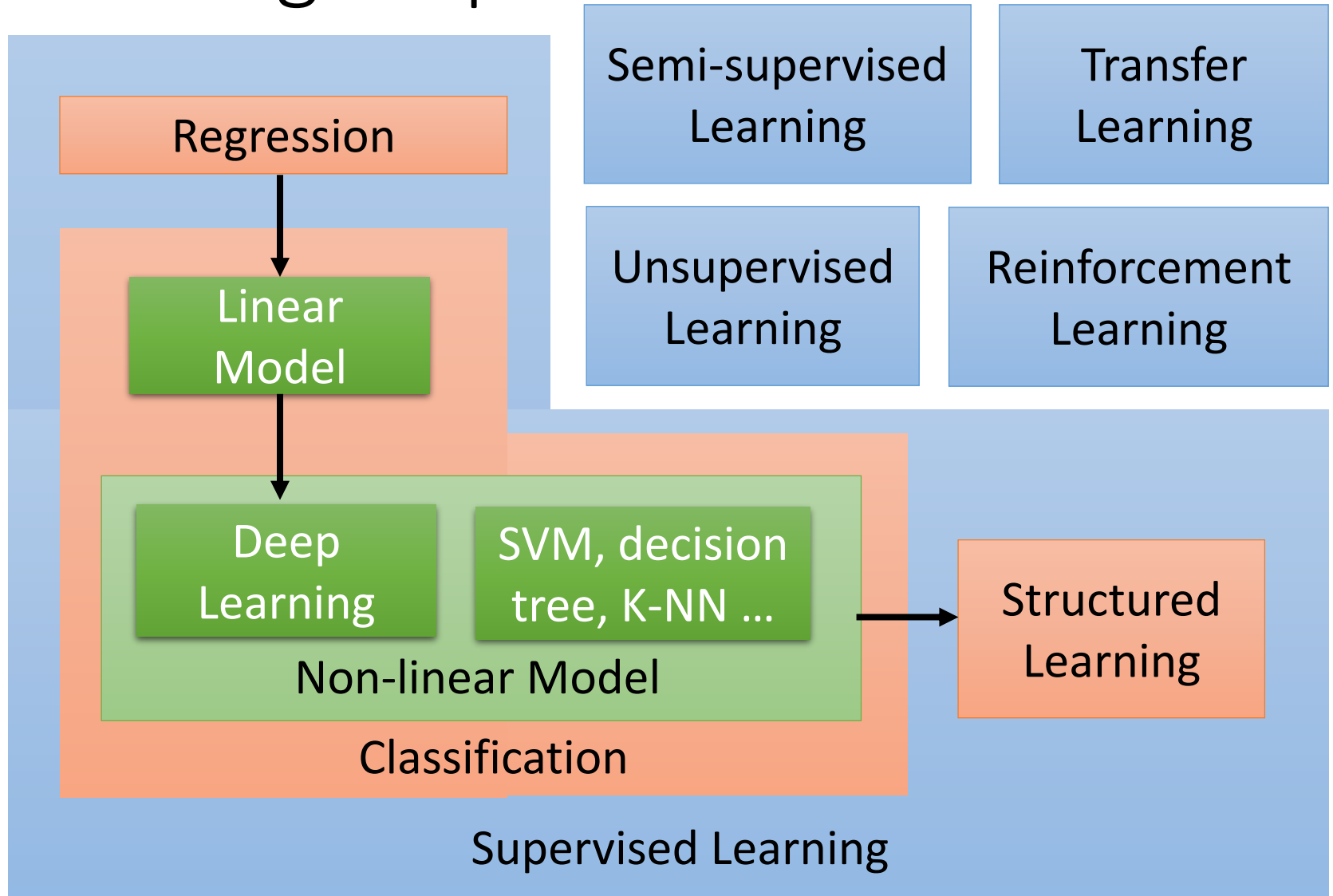
長門



春日

實玖瑠

# Learning Map



# Reinforcement Learning



# Supervised v.s. Reinforcement

- Supervised

Learning from  
teacher



"Hello"

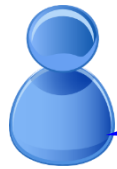
Say "Hi"



"Bye bye"

Say "Good bye"

- Reinforcement



.....



.....

.....



Bad

Learning from  
critics

Hello 😊

Agent

.....

Agent

# Supervised v.s. Reinforcement

- Supervised:



Next move:  
"5-5"



Next move:  
"3-3"

- Reinforcement Learning

First move → ..... many moves ..... → Win!

Alpha Go is supervised learning + reinforcement learning.

# Learning Map



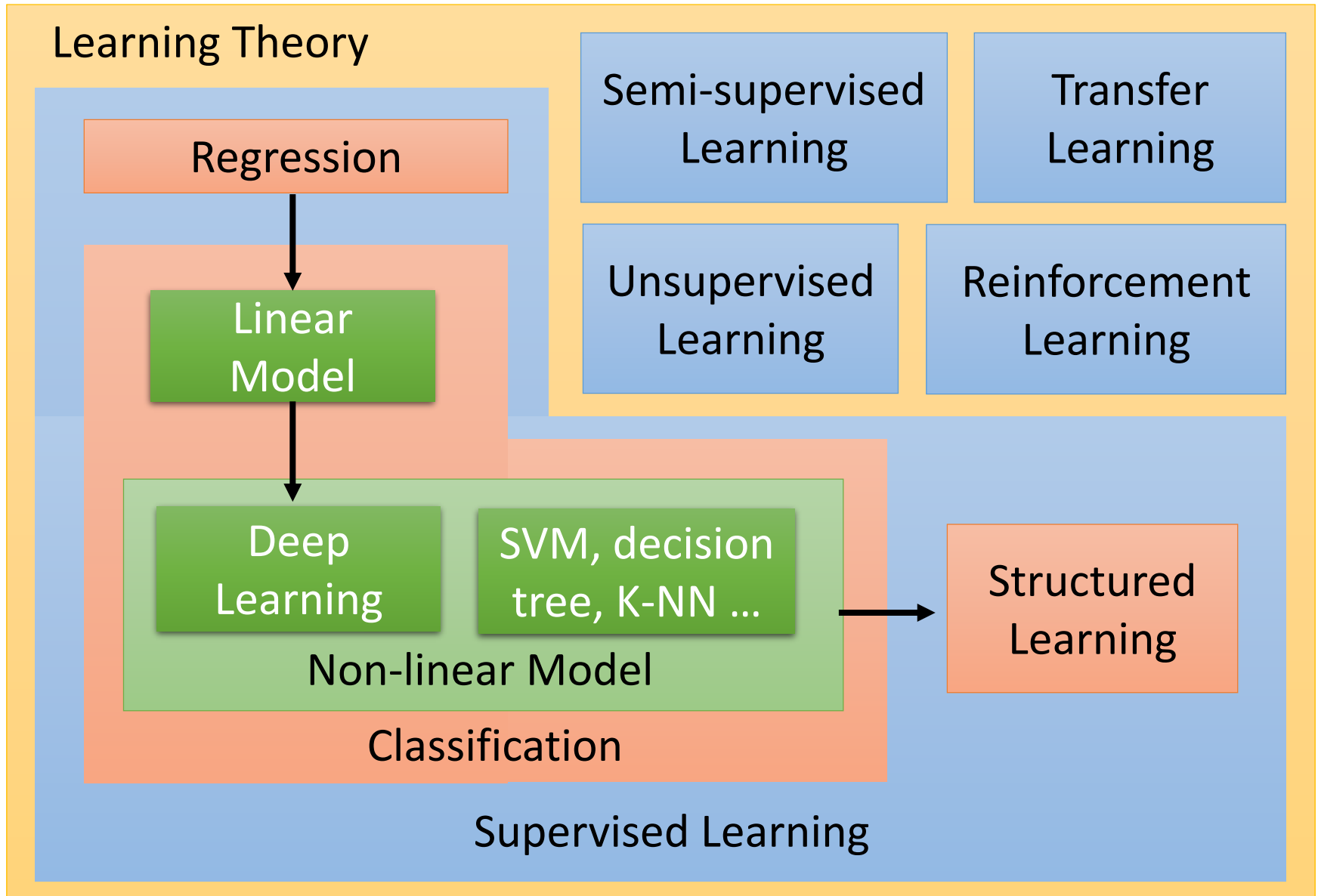
scenario



task



method







<http://www.express.co.uk/news/science/651202/First-step-towards-The-Terminator-becoming-reality-AI-beats-champ-of-world-s-oldest-game>

# Why we need to learn Machine Learning?

AI 即將取代部分的工作？ 新工作：AI 訓練師

# AI 訓練師

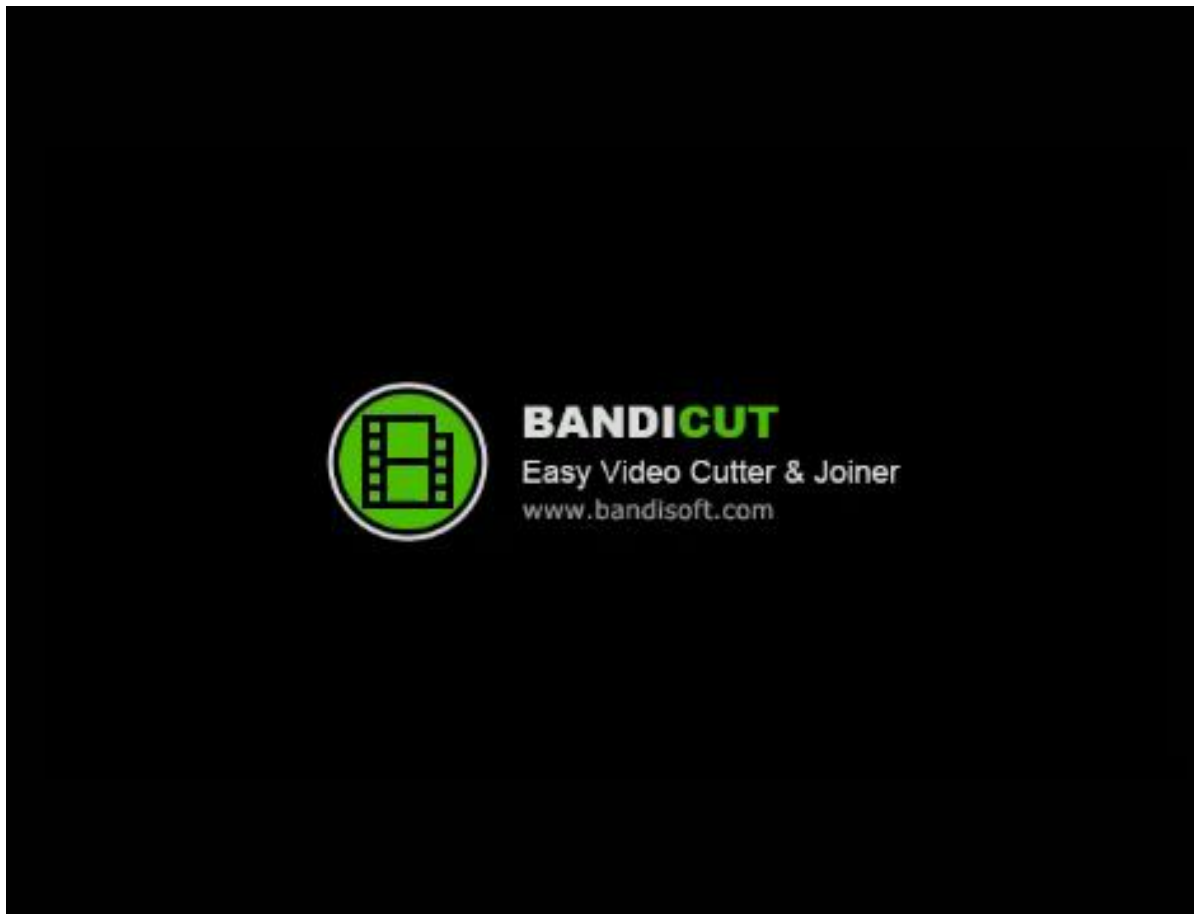


機器不是自己會學嗎？  
為什麼需要 AI 訓練師

戰鬥是寶可夢在打，  
為什麼需要寶可夢訓練師？



# 神奇寶貝第5集 尼比市的決鬥



[https://www.youtube.com/watch?v=uUOZZb8eJ\\_k](https://www.youtube.com/watch?v=uUOZZb8eJ_k)

# AI 訓練師

Step 1:  
define a set  
of function



Step 2:  
goodness of  
function



Step 3: pick  
the best  
function

## 寶可夢訓練師

- 寶可夢訓練師要挑選適合的寶可夢來戰鬥
  - 寶可夢有不同的屬性

## AI 訓練師

- AI訓練師要挑選合適的 model, loss function
  - 不同 model, loss function 適合解決不同的問題

# 神奇寶貝第106集 噴火龍·就決定是你了



**BANDICUT**

Easy Video Cutter & Joiner

[www.bandisoft.com](http://www.bandisoft.com)

[https://www.youtube.com/watch?v=4G\\_aoKiCDc4](https://www.youtube.com/watch?v=4G_aoKiCDc4)

# AI 訓練師

Step 1:  
define a set  
of function



Step 2:  
goodness of  
function



Step 3: pick  
the best  
function

## 寶可夢訓練師

- 寶可夢訓練師要挑選適合的寶可夢來戰鬥
  - 寶可夢有不同的屬性
- 召喚出來的寶可夢不一定聽話
  - E.g. 小智的噴火龍
  - 需要有經驗的寶可夢訓練師

## AI 訓練師

- AI訓練師要挑選合適的 model, loss function
  - 不同 model, loss function 適合解決不同的問題
- 不一定能找出 best function
  - E.g. Deep Learning
  - 需要有經驗的 AI 訓練師

# 大家還記得寶可夢的開場嗎？



<https://www.youtube.com/watch?v=NyCNkq4ByzY>

# AI 訓練師

- 厲害的 AI ， AI 訓練師功不可沒
- 讓我們一起朝 AI 訓練師之路邁進

