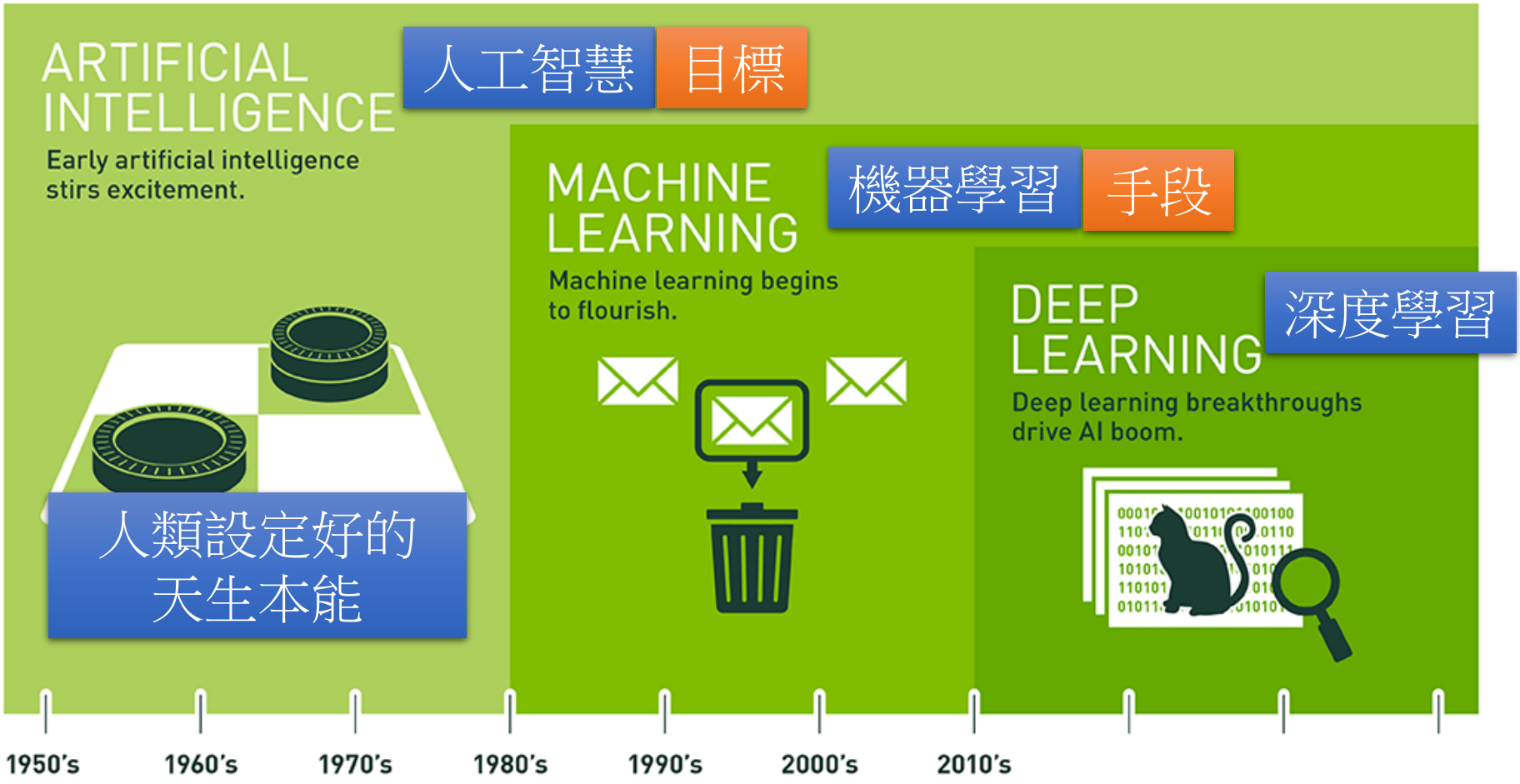
# Introduction of this course

李宏毅

Hung-yi Lee




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.

https://blogs.nvidia.com.tw/2016/07/whats-difference-artificial-intelligence-machine-learning-deep-learning-ai/

# 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 没有free style
  - Lots of human efforts (not suitable for small industry)

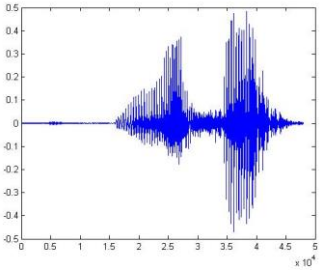
# 人類設定好的天生本能

- AI?

http://www.commitstrip.com/en/2017/06/07/ai-inside/?

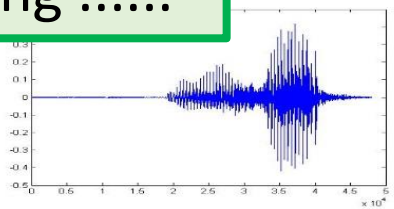
Shared on Yann LeCun's FB

# What is Machine Learning?

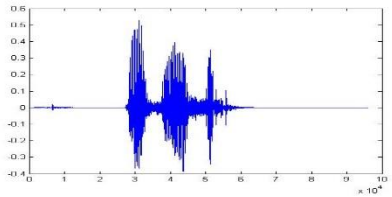


You said “Hello”

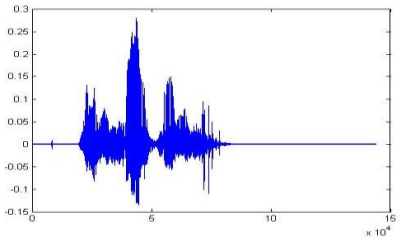
Learning ……



“Hi”



“How are you”



“Good bye”

A large amount of audio data

You write the program for learning.

# What is Machine Learning?

Learning .....

This is “cat”

You write the program for learning.

“monkey”

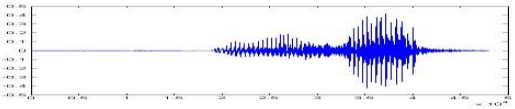
“cat”

“dog”

A large amount of images

# Machine Learning ≈ Looking for a Function

- Speech Recognition

$f($  $)=$ “How are you”

- Image Recognition

$f($ $)=$ “Cat”

- Playing Go

$f($ $)=$ “5-5” (next move)

- Dialogue System

$f($ “Hi” $)=$ “Hello”

(what the user said) (system response)

# Framework

Image Recognition:

$f($ $)=$ “cat”

A set of function

Model

$f_1, f_2 \cdots$

通过概率统计的方法来提供我们指导 选择合适的 function set

$f_1($ $)=$ “cat”

$f_2($ $)=$ “money”

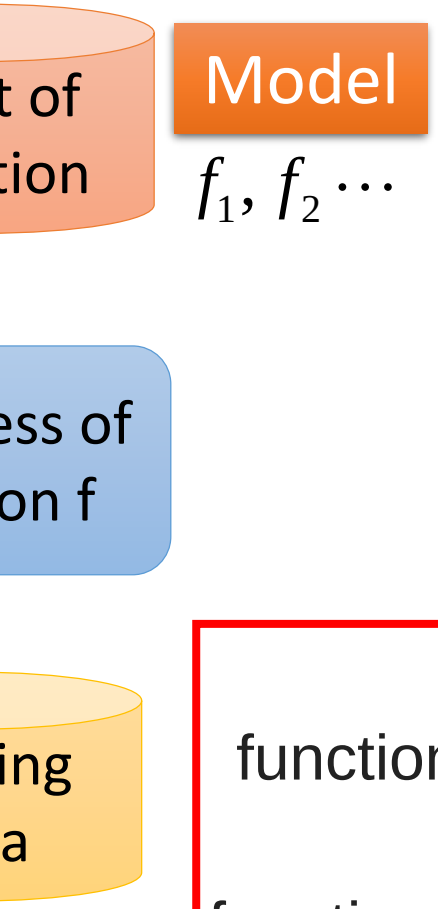
$f_1($ $)=$ “dog”

$f_2($ $)=$ “snake”

# Framework

Image Recognition:

$f($ $) =$ "cat"




$f_1($ $) =$ "cat"

$f_2($ $) =$ "money"

Better!

$f_1($ $) =$ "dog"

$f_2($ $) =$ "snake"

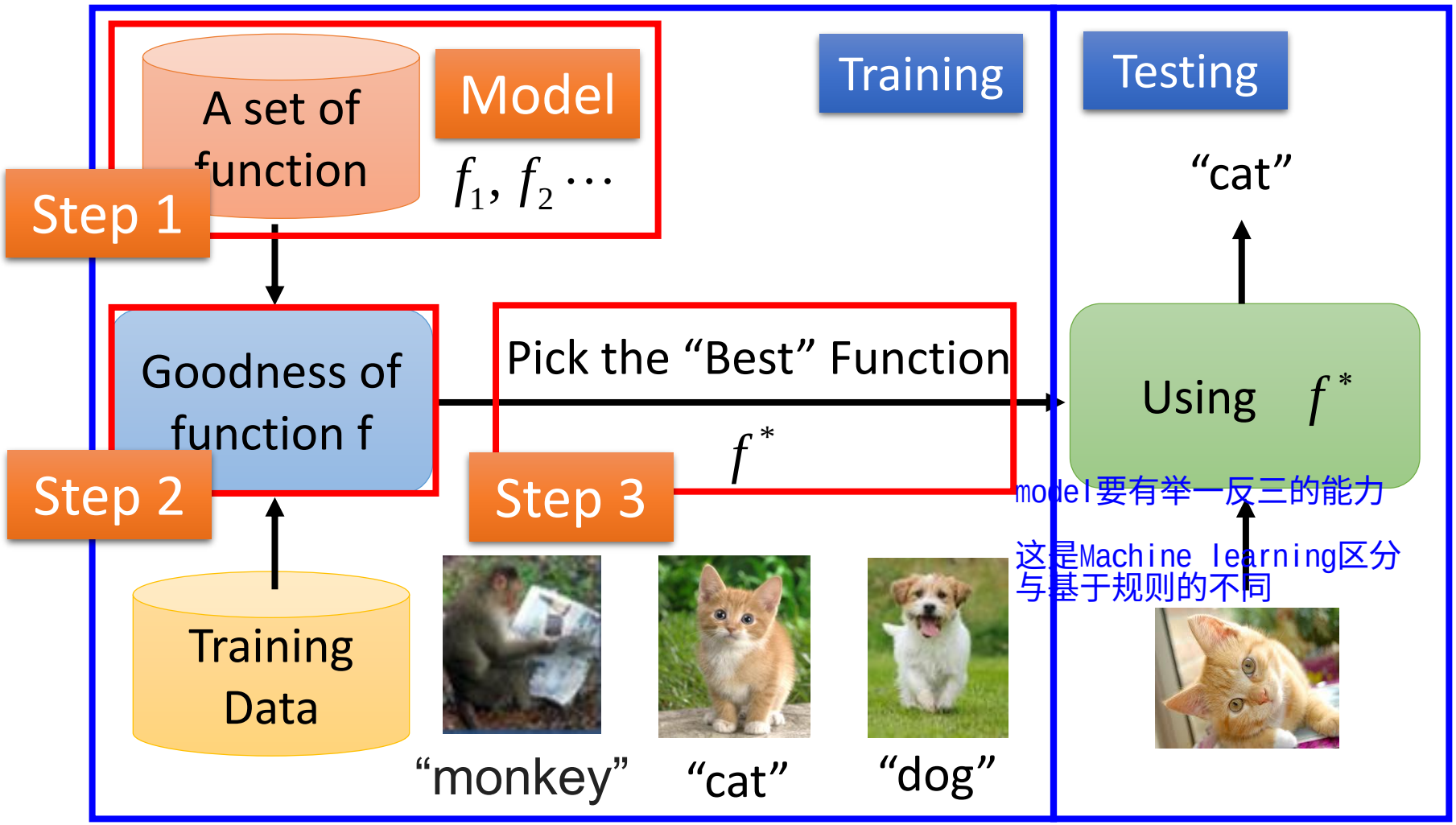
function input:

function output: "monkey" "cat" "dog"

# Framework

Image Recognition:

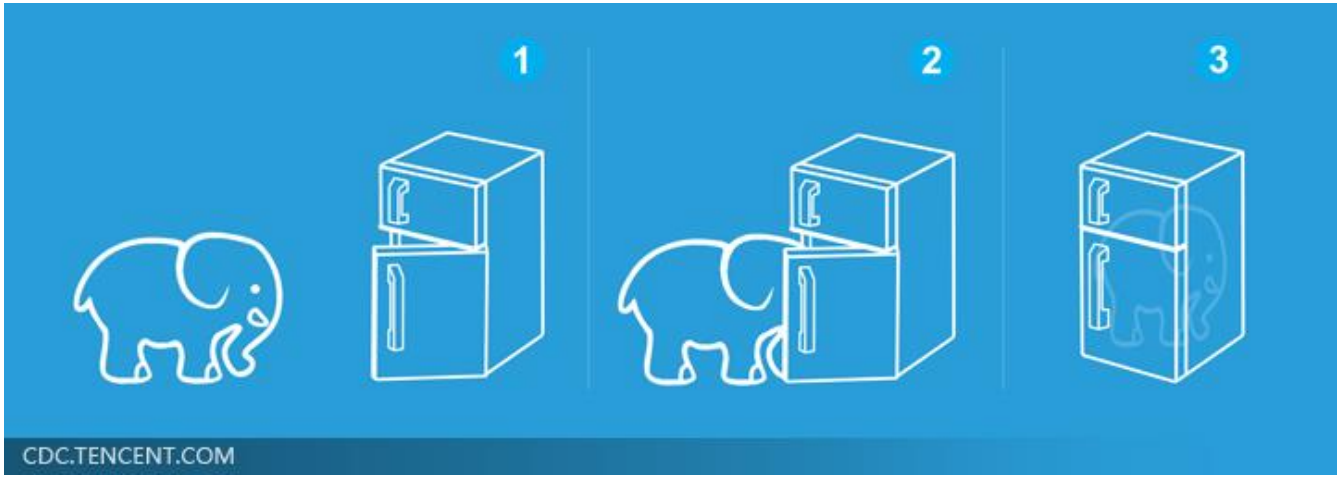
$f($ $) =$ "cat"



# Machine Learning is so simple ……

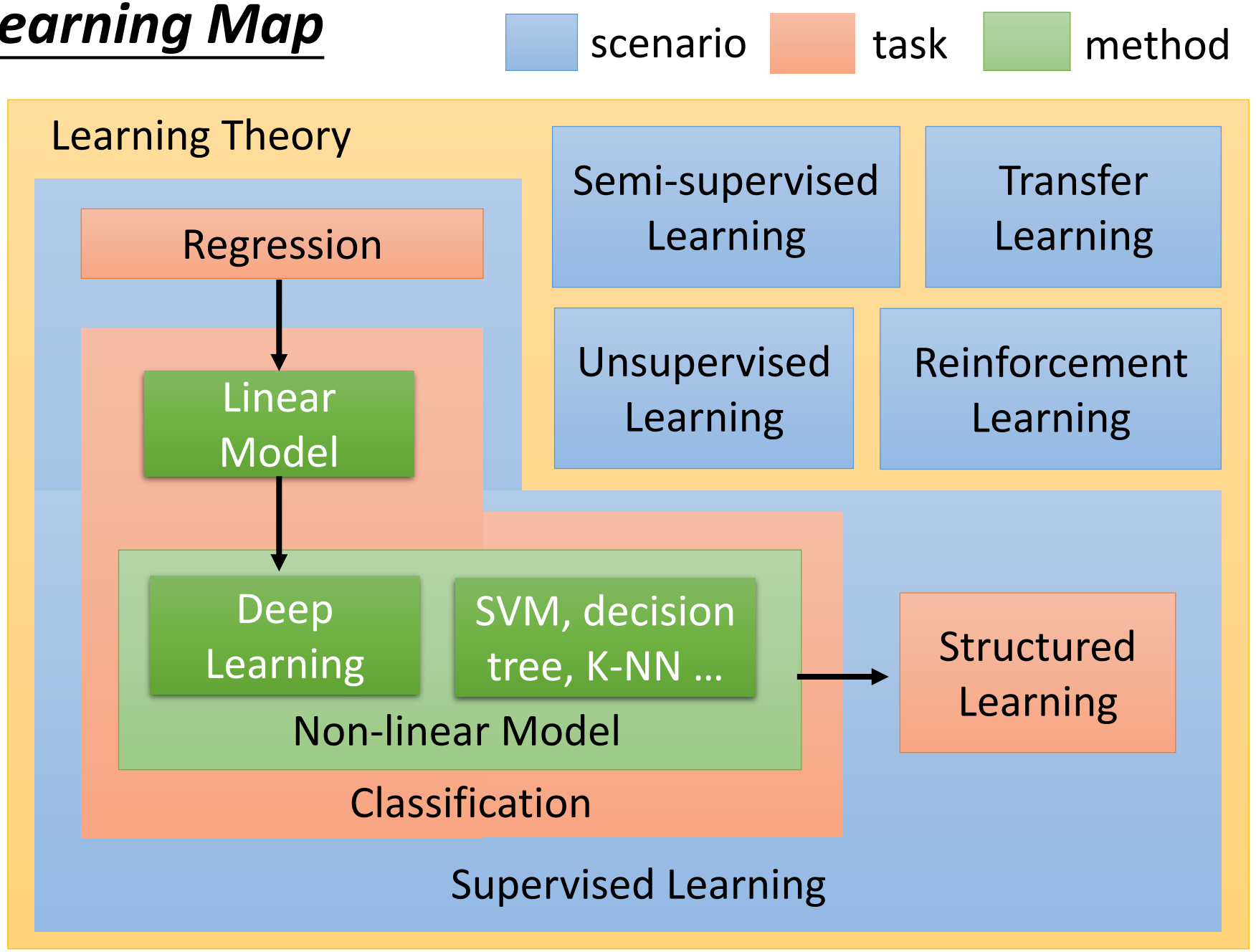
Step 1: define a set of function → Step 2: goodness of function → Step 3: pick the best function

就好像把大象放進冰箱 ……



# Learning Map

# Learning Map

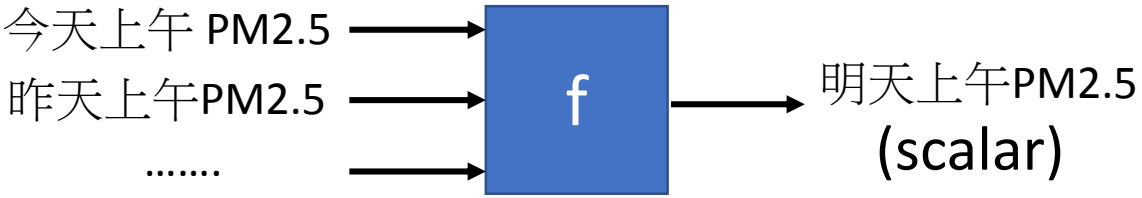


# Learning Map

Regression

The output of the target function $f$ is "scalar".

預測 PM2.5




## 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

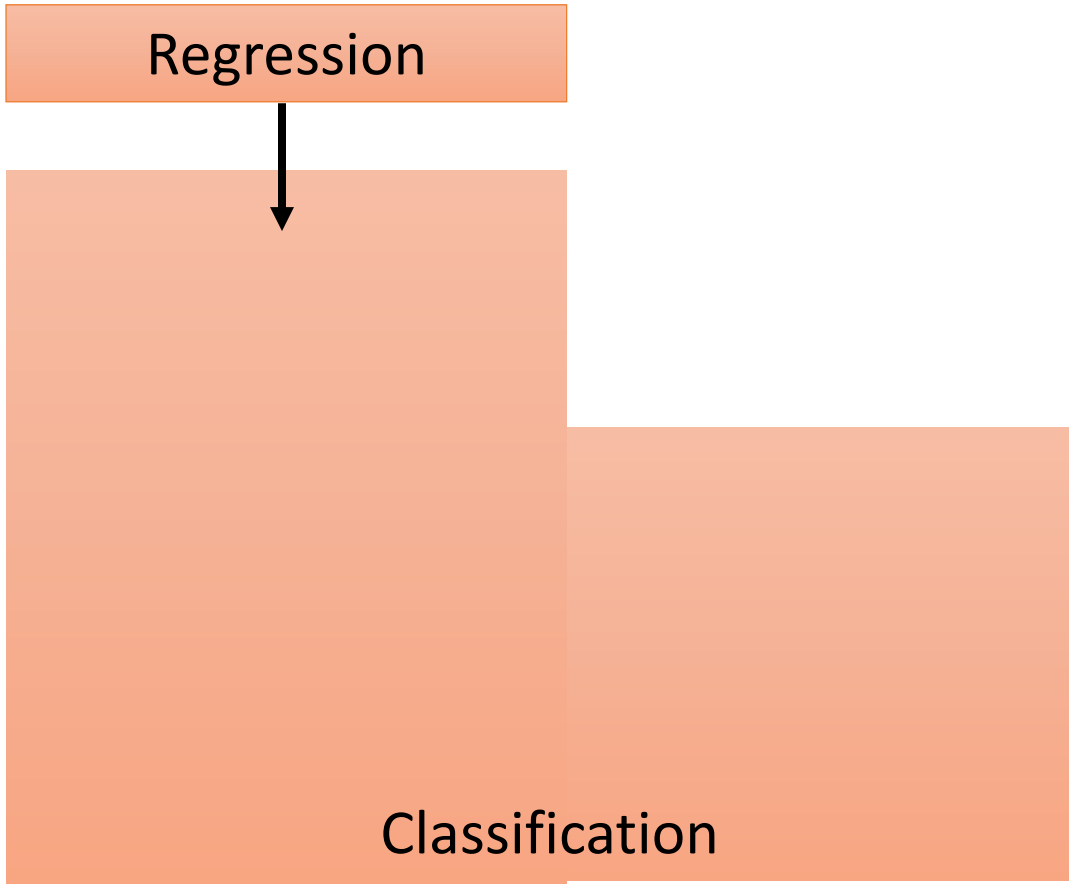
Input:

9/12 上午 PM2.5 = 30　9/13 上午 PM2.5 = 25

Output:

9/14 上午 PM2.5 = 20

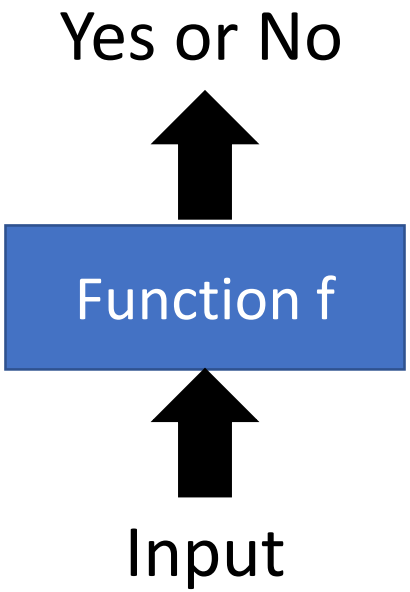
# Learning Map

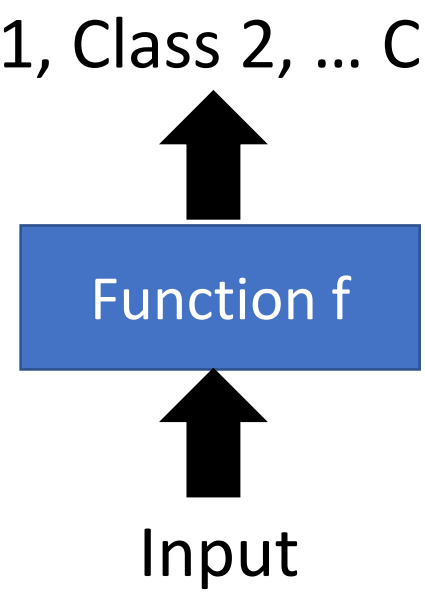


# Classification

- Binary Classification
- Multi-class Classification

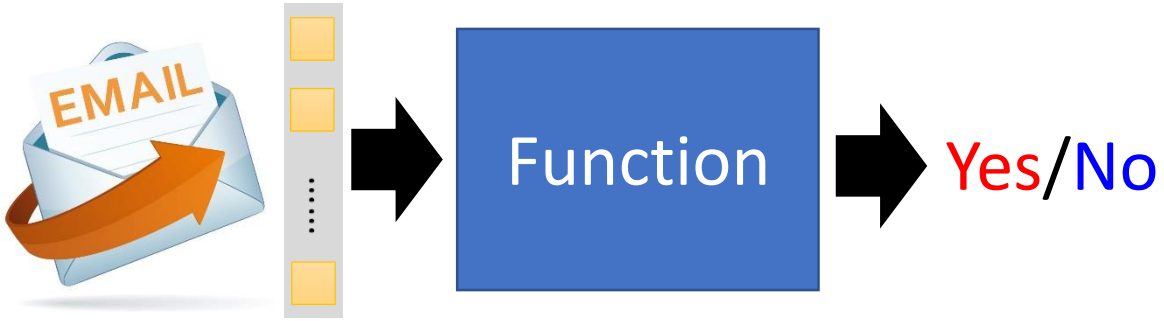
怎么表示这些不同的类，都无所谓，可以用不同的值，只要能相互区分就可以了



# Binary Classification

***Spam filtering***




Training Data

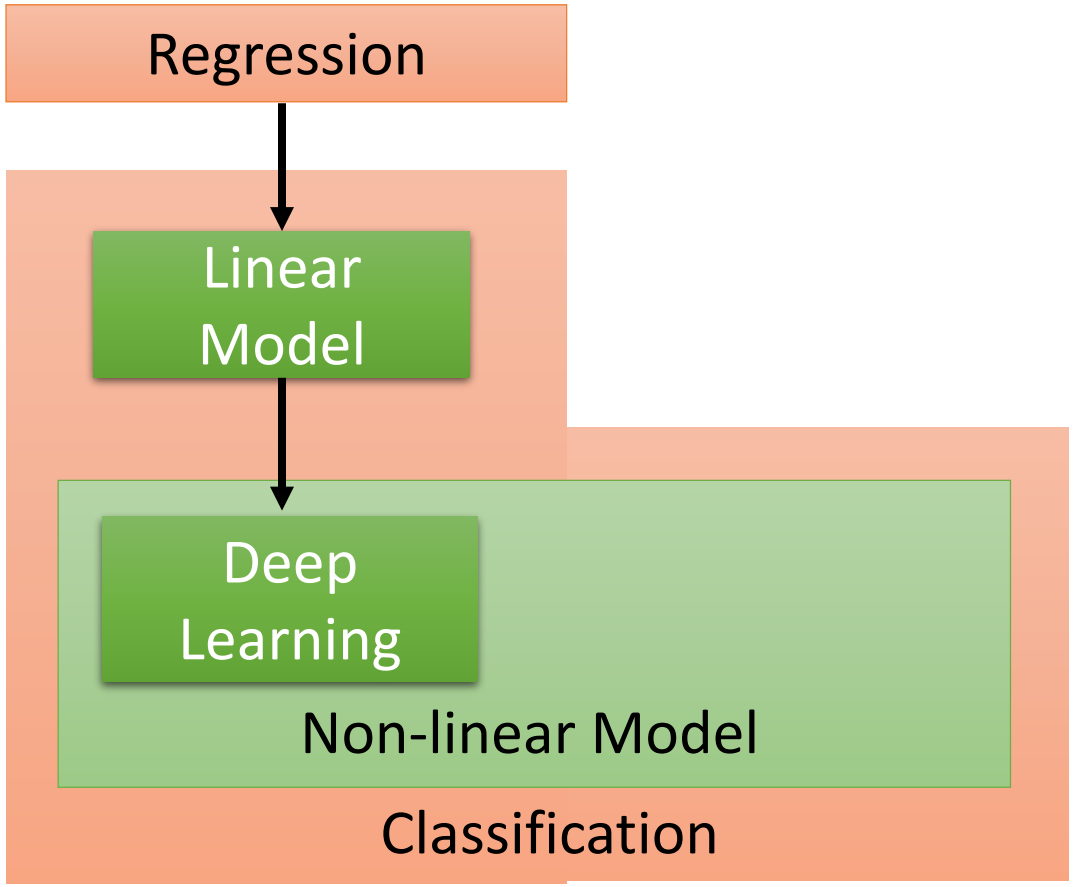
(http://spam-filter-review.toptenreviews.com/)

# Multi-class Classification

***Document Classification***

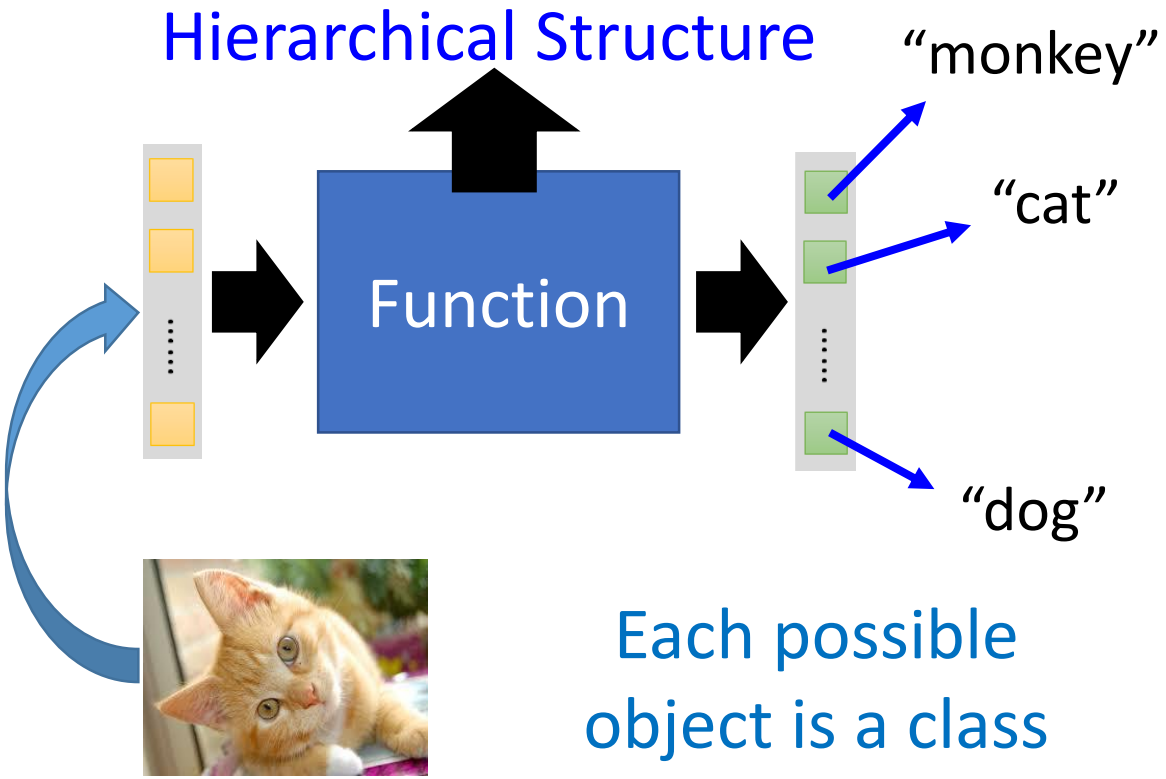
http://top-breaking-news.com/

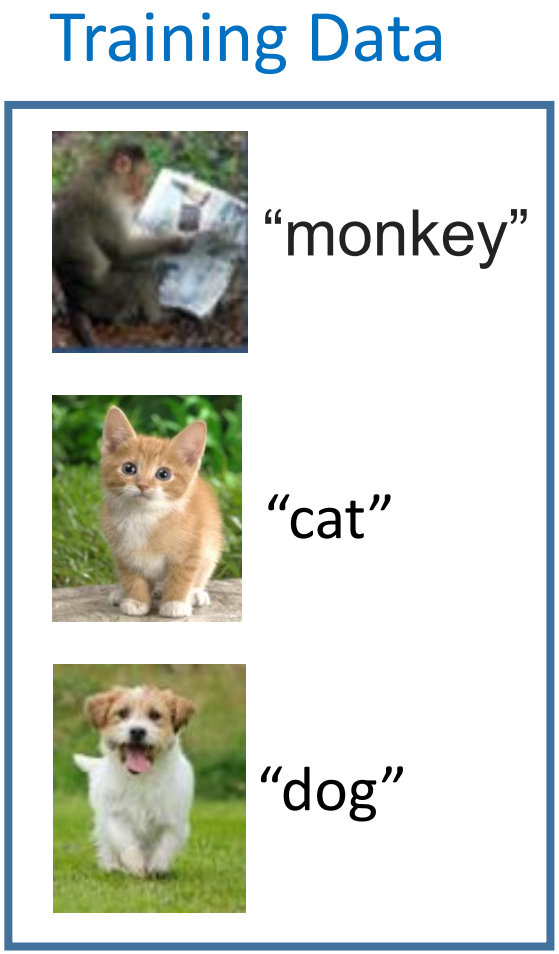
# Learning Map



# Classification - Deep Learning

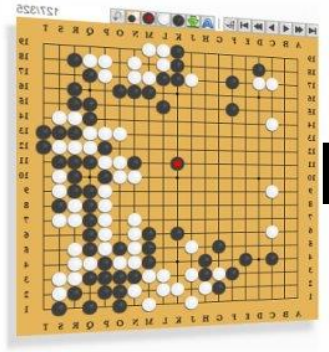
- Image Recognition



# Classification - Deep Learning

- Playing GO



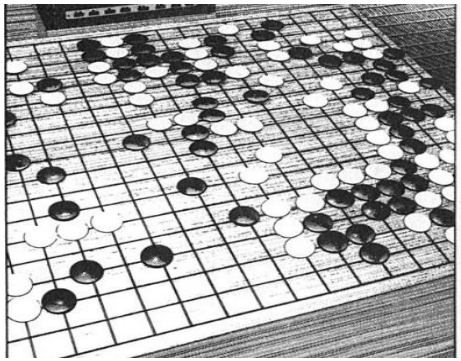
Function

Next move

Each position is a class

(19 x 19 classes)

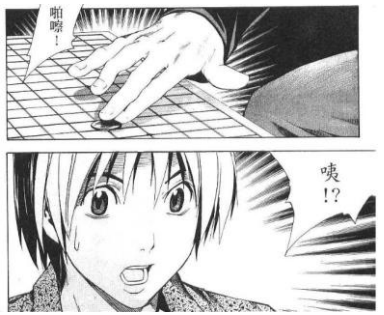
## Training Data



一堆棋譜

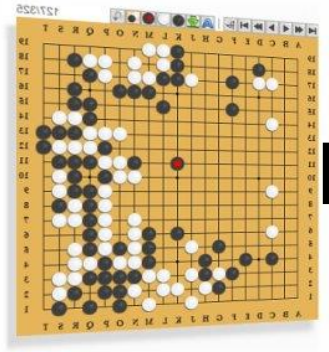
進藤光 v.s. 社清春

黑: 5之五 ⟶ 白: 天元 ⟶ 黑: 五之5



# Classification - Deep Learning

- Playing GO



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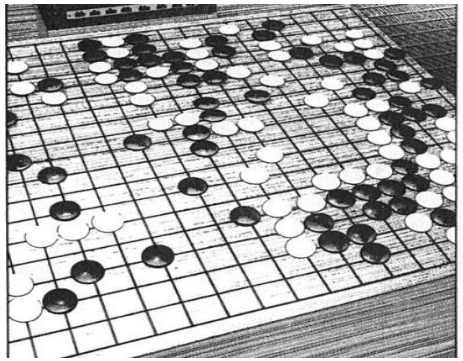


一堆棋譜

進藤光 v.s. 社清春

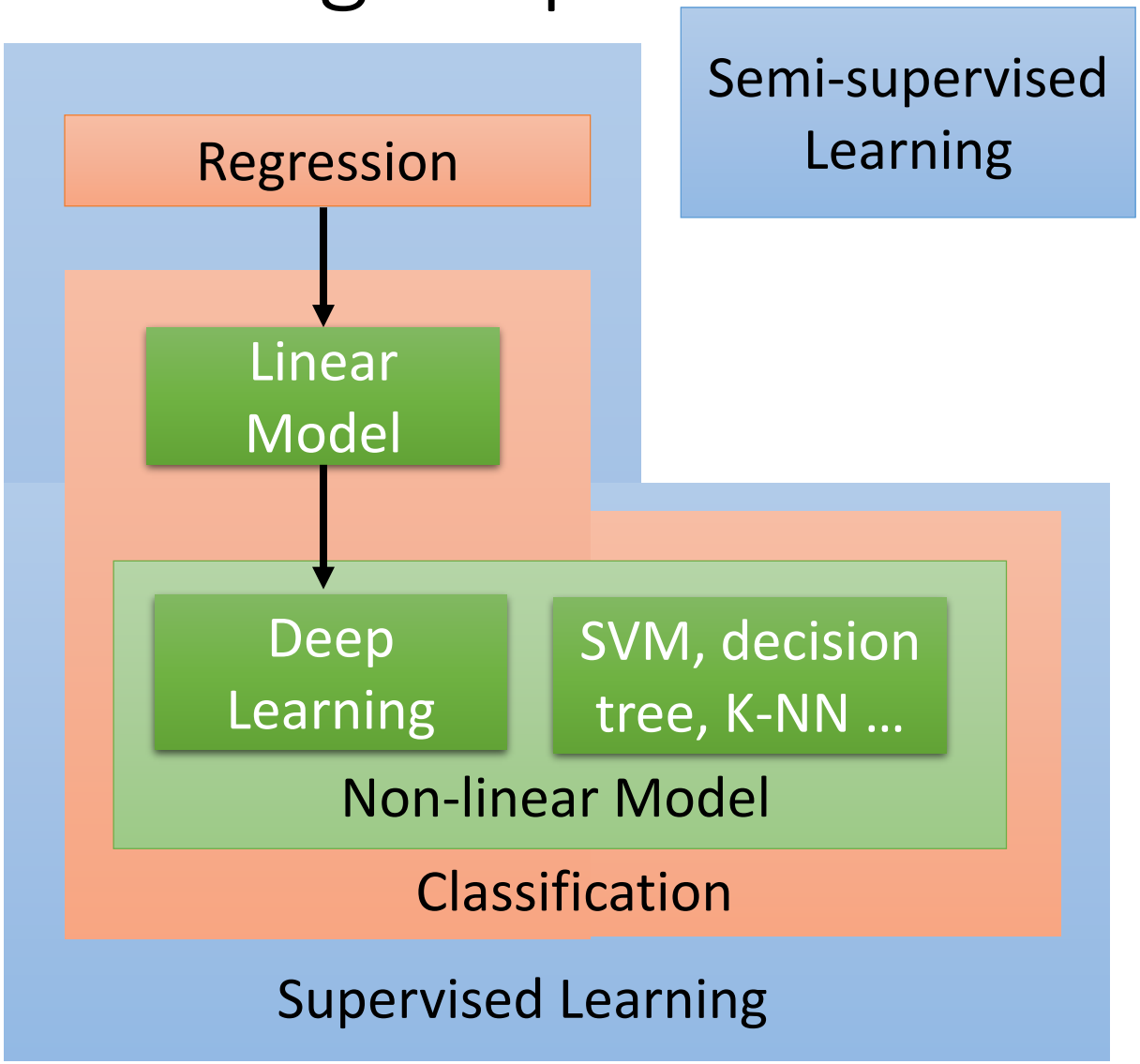
黑: 5之五 → 白: 天元 → 黑: 五之5

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:

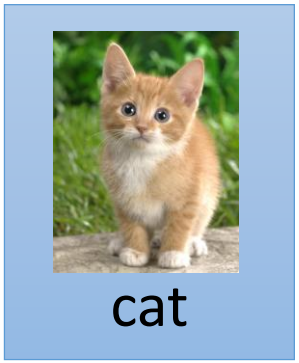
Input/output pair of target function

Function output = label

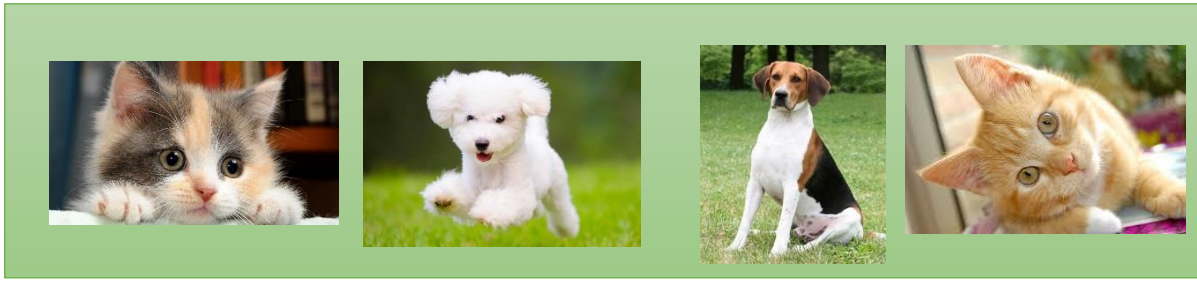
# Semi-supervised Learning

For example, recognizing cats and dogs

Labelled data

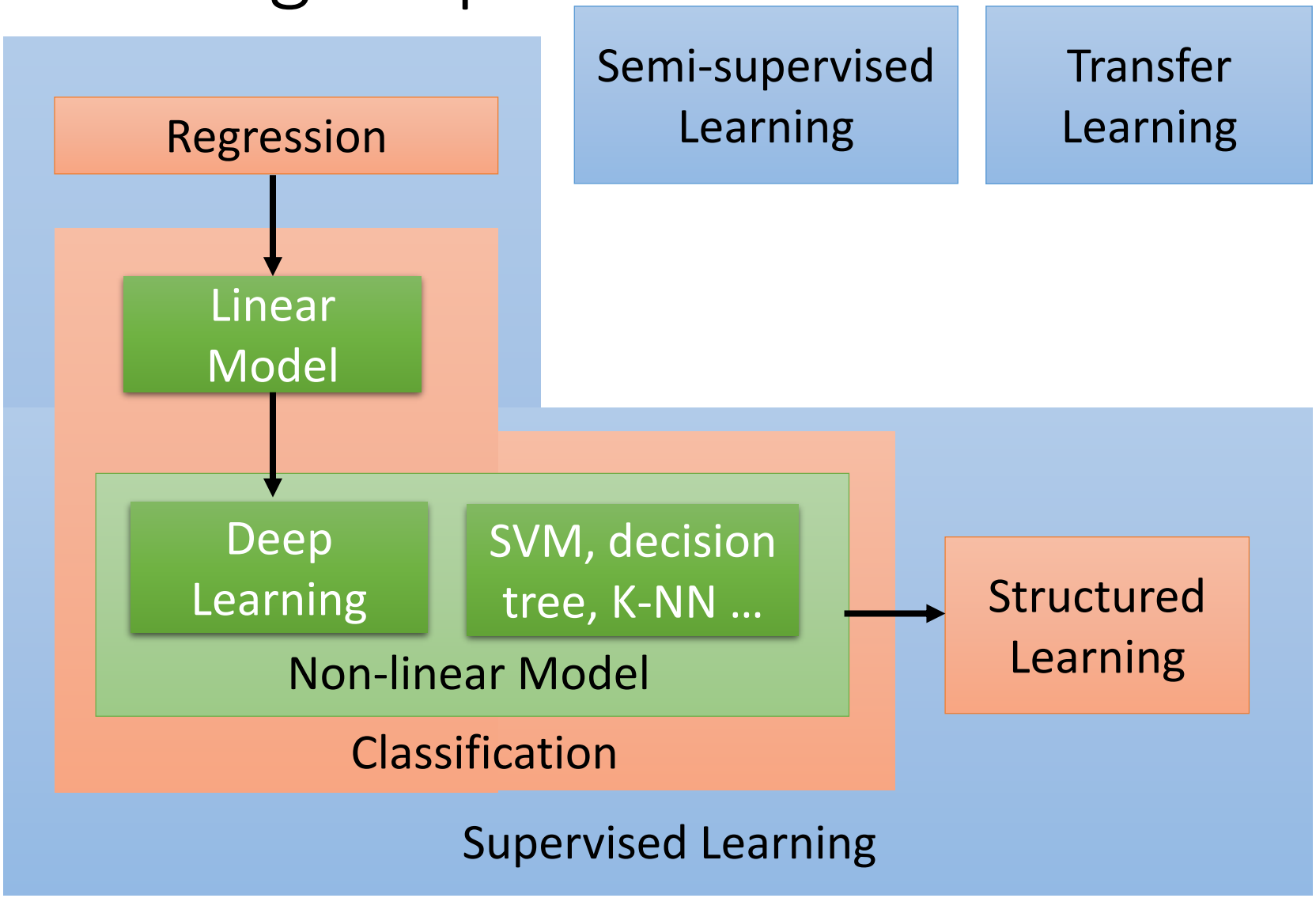


Unlabeled data



(Images of cats and dogs)

# Learning Map



# Transfer Learning

For example, recognizing cats and dogs

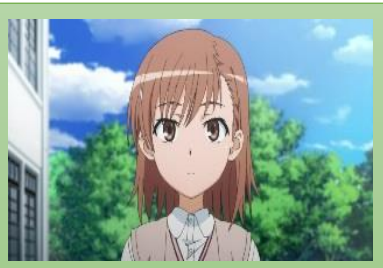
Labelled data

cat

dog

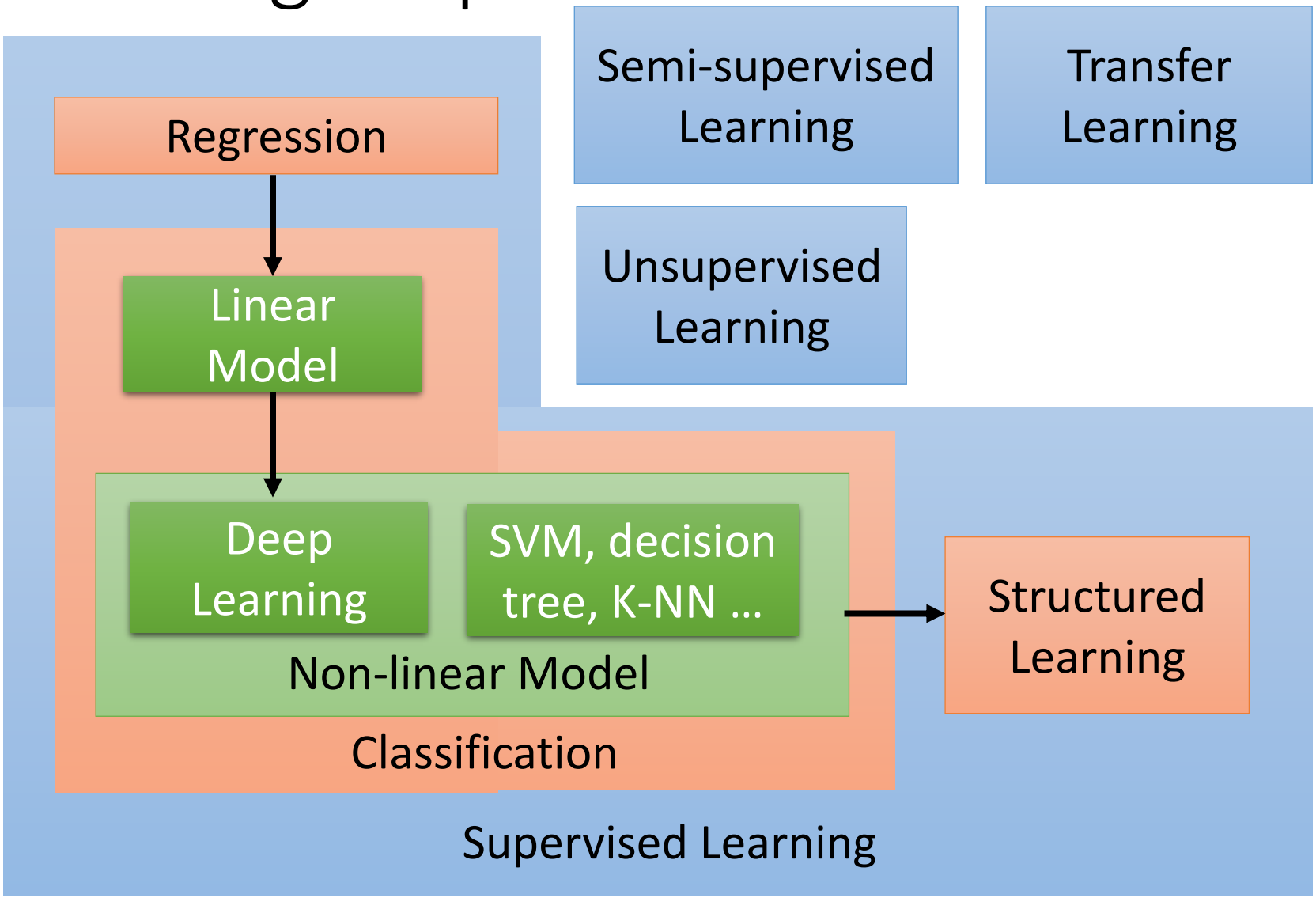
elephant

Haruhi



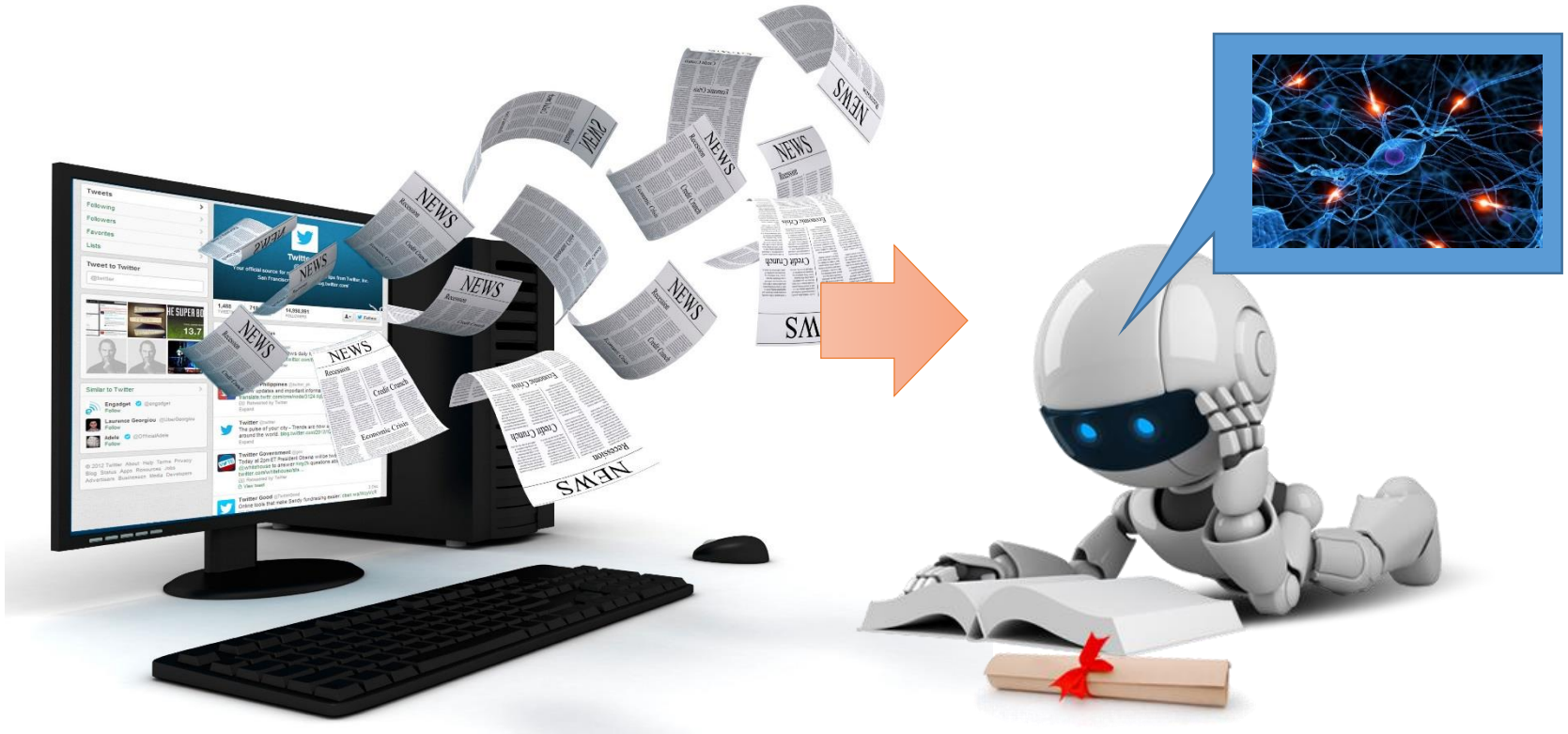
Data not related to the task considered
(can be either labeled or unlabeled)

# 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

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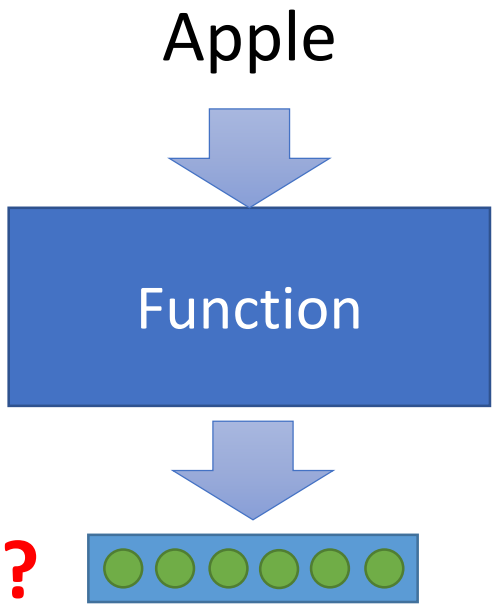



Training data is a lot of text

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

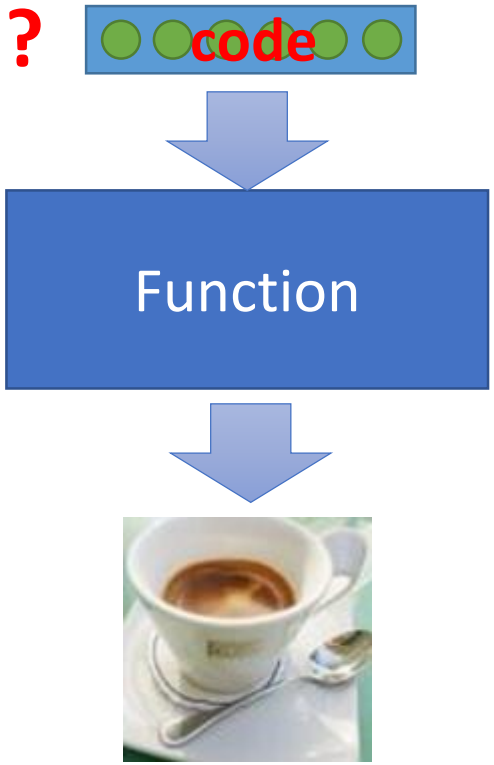
# Unsupervised Learning

Draw something!

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

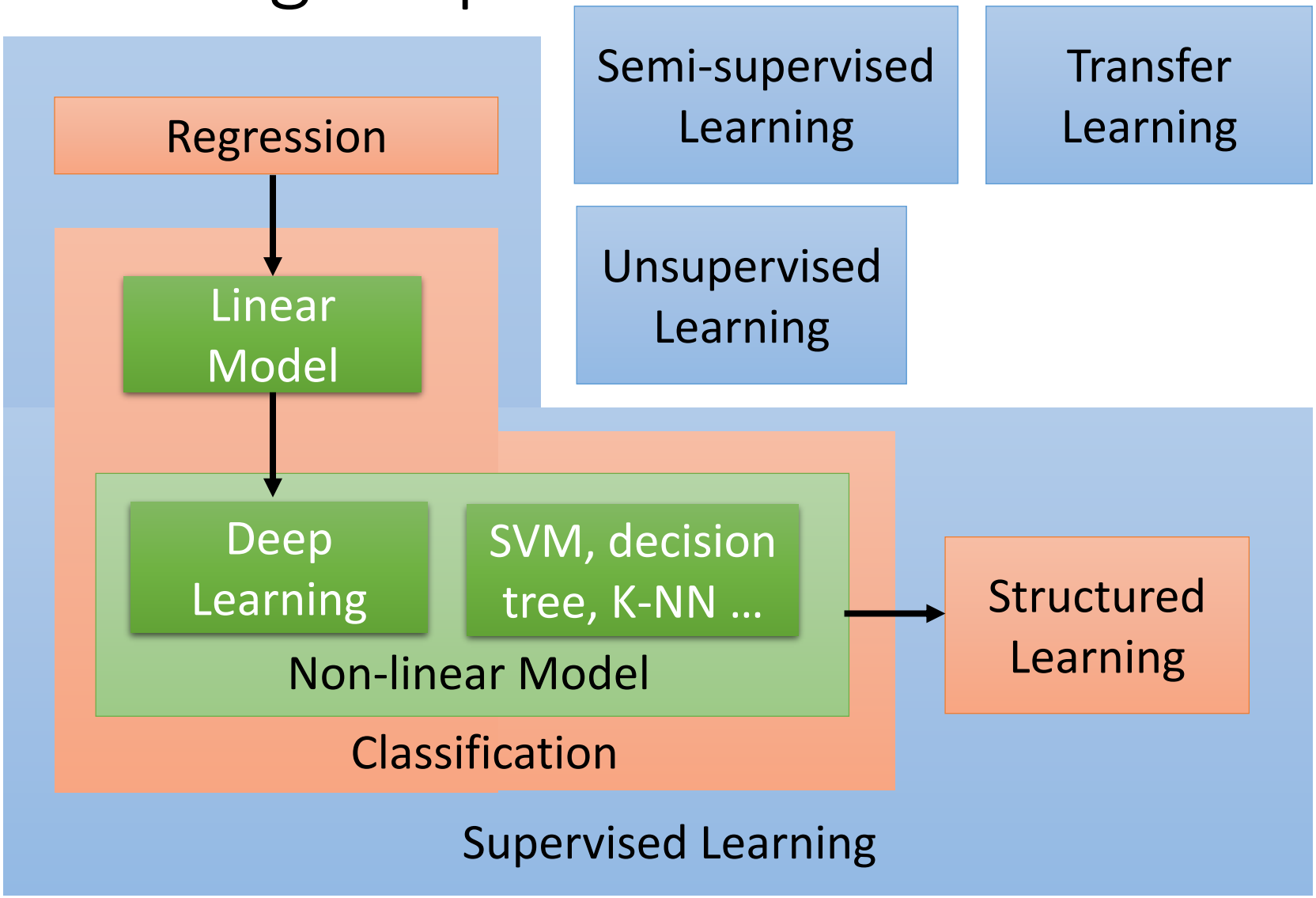
# Unsupervised Learning

- Machine Drawing

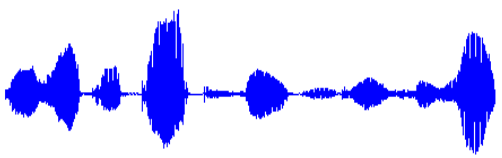



Training data is a lot of images

# Learning Map



# Structured Learning - Beyond Classification



f

“大家好，歡迎大家來修機器學習”

Speech Recognition

“機器學習”

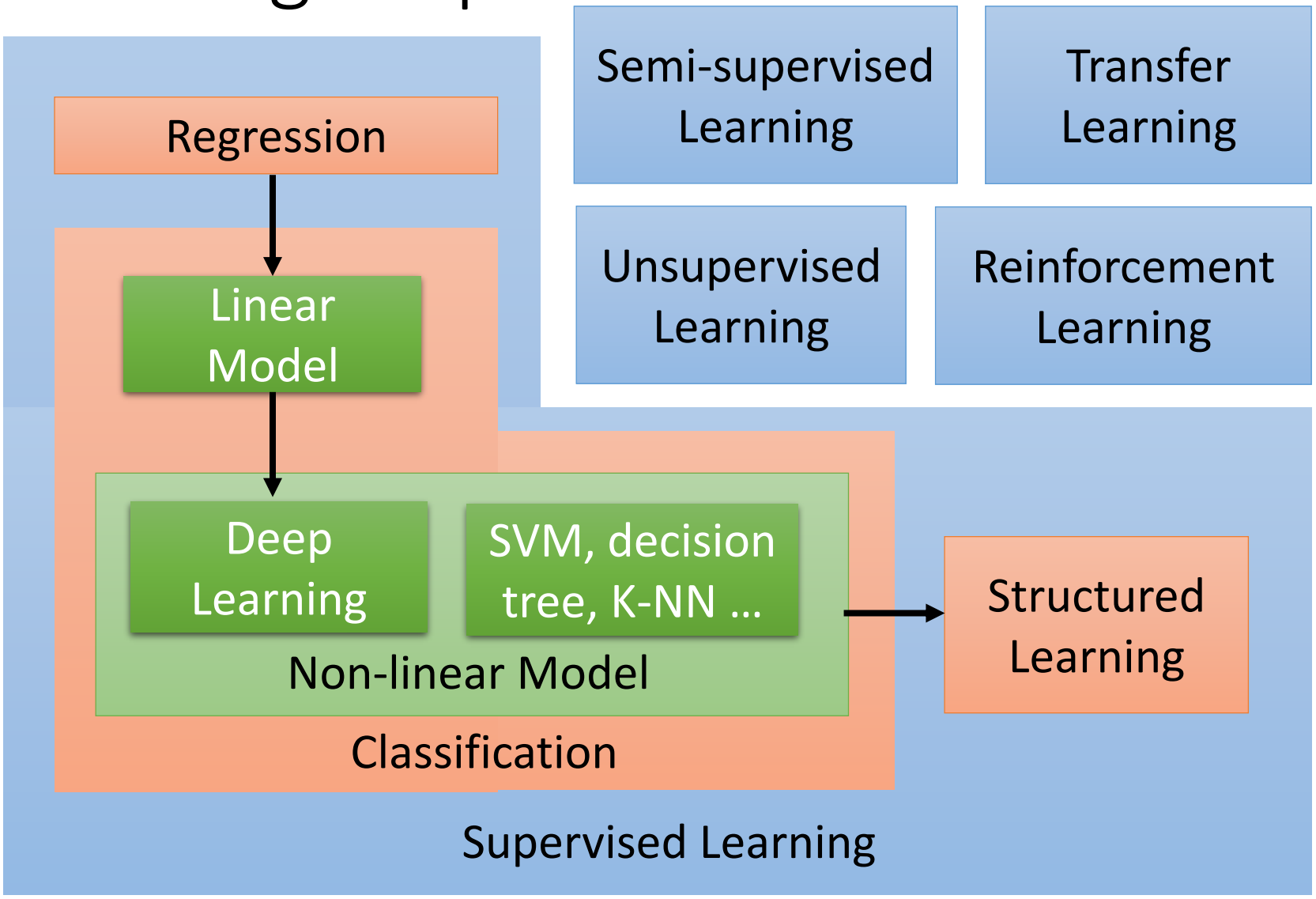
f

“Machine Learning”

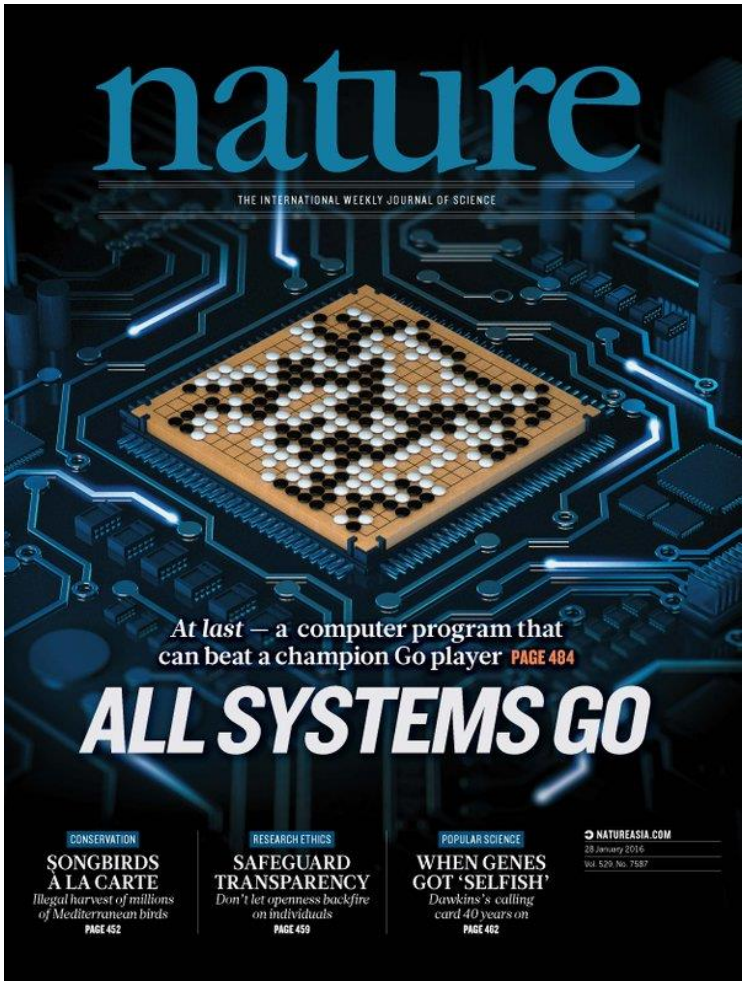
Machine Translation

人臉辨識

# Learning Map



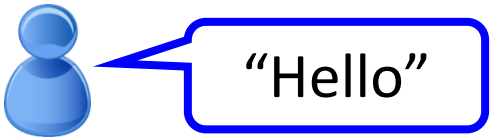
# Reinforcement Learning



# Supervised v.s. Reinforcement

- Supervised

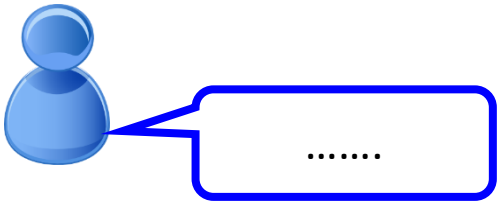
Learning from teacher

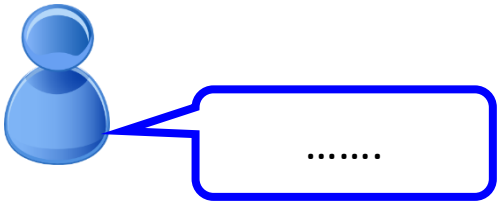



Say "Hi"

Say "Good bye"

- Reinforcement

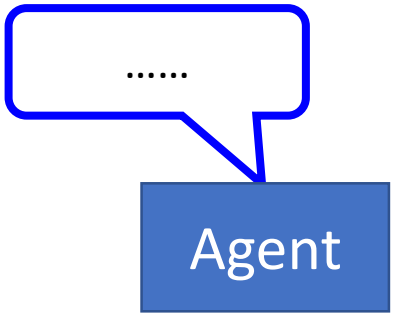



.....

Bad

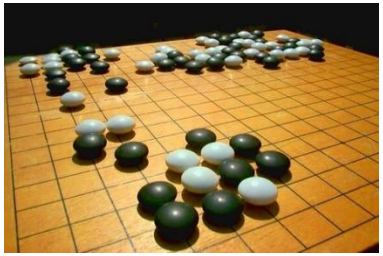
Learning from critics



# Supervised v.s. Reinforcement

- Supervised:

Next move:
"5-5"



Next move:
"3-3"

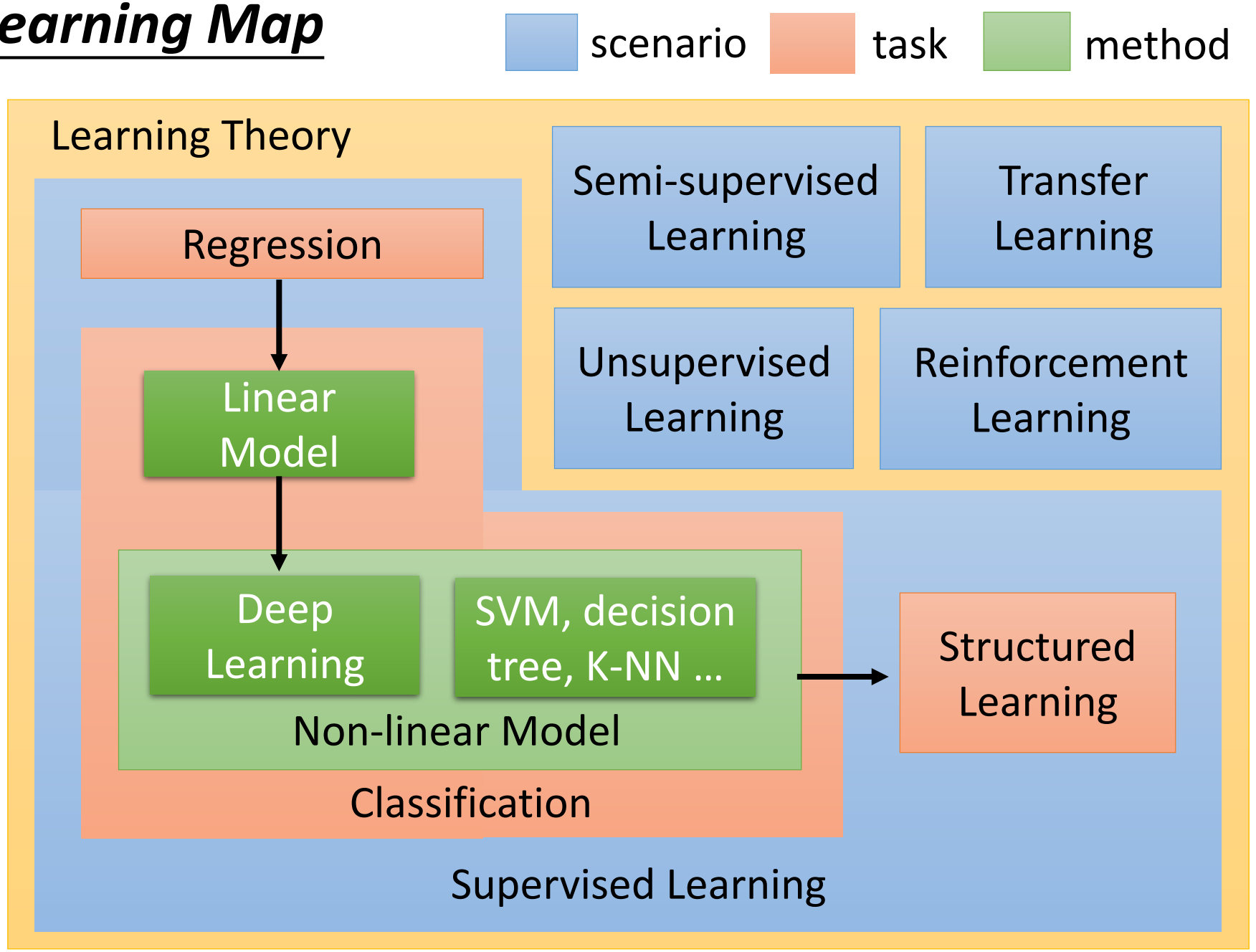
- Reinforcement Learning

Alpha Go开始先利用棋谱进行有监督的训练，然后再用RL来强化能力

First move → …… many moves …… → Win!

Alpha Go is supervised learning + reinforcement learning.

# Learning Map



# 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

# AI 訓練師

## 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

https://www.youtube.com/watch?v=4G_aoKiCDc4

# AI 訓練師

## 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

http://www.gvm.com.tw/webonly_content_10787.html

# 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