Learning Map
Learning Map

- Supervised Learning
  - Regression
    - Linear Model
  - Deep Learning
    - Non-linear Model
- Semi-supervised Learning
- Transfer Learning
- Unsupervised Learning
- Reinforcement Learning
- Structured Learning
- Classification
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

Regression

Classification
Classification

• Binary Classification

• Multi-class Classification

Yes or No

Class 1, Class 2, ... Class N

Function $f$

Input

Function $f$

Input
Binary Classification

Spam filtering

Function

Yes/No

Training Data

Yes

HW2

No

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

Document Classification

Function

Training Data

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

Regression

Linear Model

Deep Learning

Non-linear Model

Classification
Classification - Deep Learning

• Image Recognition

Convolutional Neural Network (CNN)

Training Data

Each possible object is a class

HW3

“monkey”

“cat”

“dog”

“monkey”

“cat”

“dog”
Classification - Deep Learning

• Playing GO

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

Training Data

進藤光 v.s. 社清春

黑: 5之五 → 白: 天元 → 黑: 五之5

一堆棋譜
Classification - Deep Learning

• Playing GO

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

Training Data

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

Supervised Learning

Regression

Linear Model

Deep Learning

SVM, decision tree, K-NN...

Non-linear Model

Classification

Semi-supervised Learning

Training Data:
Input/output pair of target function
Function output = label
Semi-supervised Learning

For example, recognizing cats and dogs

Labelled data
- **cat**
- **dog**

Unlabeled data
(Images of cats and dogs)
Learning Map

Supervised Learning

Regression

Linear Model

Deep Learning

SVM, decision tree, K-NN ...

Non-linear Model

Classification

Structured Learning

Semi-supervised Learning

Transfer Learning
Transfer Learning

For example, recognizing cats and dogs

Labelled data

- cat
- dog

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

- elephant
- Haruhi
Unsupervised Learning

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

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

Apple

Neural Network

Training data is a lot of text

Unsupervised Learning

Draw something!

Ref: https://openai.com/blog/generative-models/
Unsupervised Learning

• Machine Drawing

Training data is a lot of images
Learning Map

- **Supervised Learning**
  - Regression
    - Linear Model
  - Semi-supervised Learning
  - Unsupervised Learning
  - Transfer Learning

- **Classification**
  - Deep Learning
    - Non-linear Model
  - SVM, decision tree, K-NN...

- **Structured Learning**
Structured Learning
- Beyond Classification

Speech Recognition

Machine Translation

人臉辨識
Reinforcement Learning
Supervised v.s. Reinforcement

- **Supervised**
  - Learning from teacher

- **Reinforcement**

  - “Hello”
  - “Bye bye”

  - Say “Hi”
  - Say “Good bye”

  - Learning from critics

  - Agent
  - Agent

- Bad
Supervised v.s. Reinforcement

- Supervised:
  - Next move: “5-5”

- Reinforcement Learning:
  - First move ...... many moves ...... Win!

Alpha Go is supervised learning + reinforcement learning.