

Introduction of this course

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What are we going to learn?

本課程內容和《機器學習》沒有重疊

課程名稱解釋

機器學習
及其深層與結構化

Machine Learning
and having it Deep and Structured



Method

Deep Learning 可以解決一切 ...

遇到問題，~~用c4~~ 就對了！

用 deep learning “硬train一發”

萬事皆可 train



Practice of Deep Learning

- Previous machine learning developers
 - Carefully design your algorithm
 - Theoretically know its performance
- Deep learning
 - Try first
 - Many results contradict our intuition
 - Find some reasons to explain what we observed
 - More like chemistry
 - Or even worse

From: Boris

To: Ali

"On Friday, someone on another team changed the default rounding mode of some Tensorflow internals (from "truncate toward 0" to "round to even").

Our training broke. Our error rate went from <25% error to ~99.97% error (on a standard 0-1 binary loss)."

Ali Rahimi, Test of Time Award, NIPS 2017

Theory of Deep Learning

Theory 1: Expressiveness

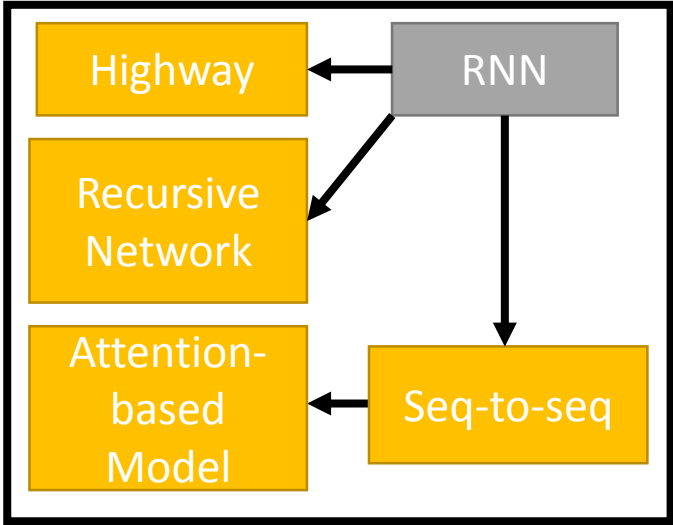
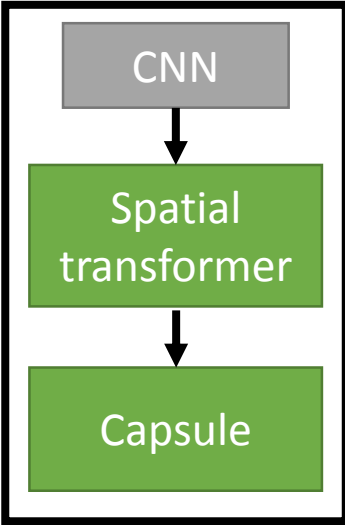
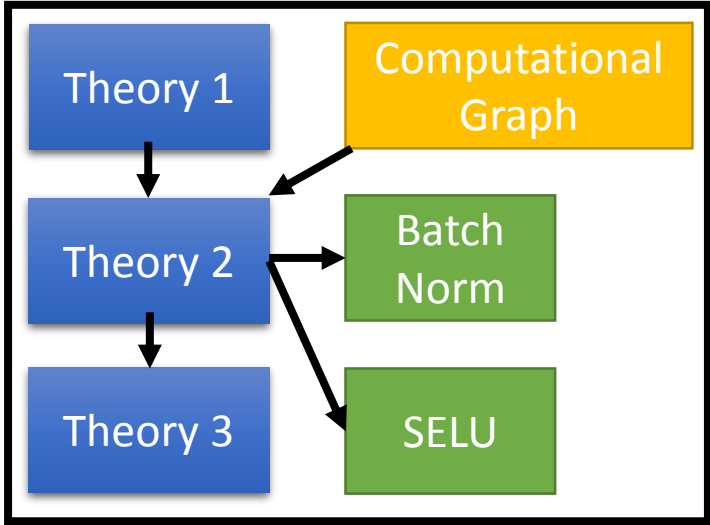
- A network structure defines a function set
- Is deep better than shallow?

Theory 2: Optimization

- How can we optimize by gradient descent?
- There are local minima

Theory 3: Generalization

- Why deep network does not overfit?
- Although it can



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Task

Structured Learning

Machine learning is to find a function f

$$f : X \rightarrow Y$$

Regression: output a scalar

Classification: output a “class” (one-hot vector)

1	0	0
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Class 1

0	1	0
---	---	---

Class 2

0	0	1
---	---	---

Class 3

Structured Learning/Prediction: output a sequence, a matrix, a graph, a tree

Output is composed of components with dependency

Output Sequence

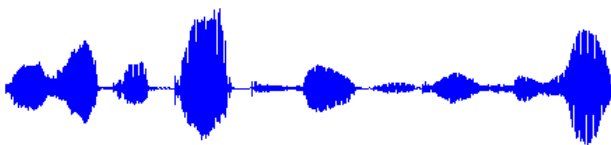
$$f : X \rightarrow Y$$

Machine Translation

X : “機器學習及其深層與結構化”
(sentence of language 1)

Y : “Machine learning and having it deep and structured”
(sentence of language 2)

Speech Recognition

X : 
(speech)

Y : 感謝大家來上課”
(transcription)

Chat-bot

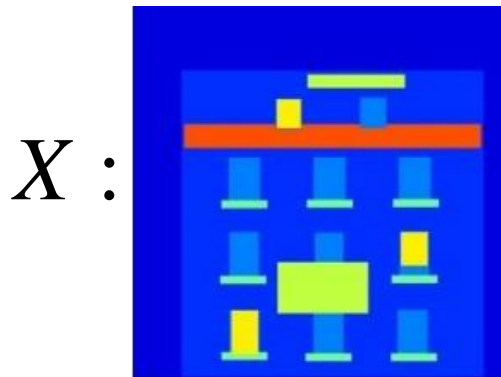
X : “How are you?”
(what a user says)

Y : “I’m fine.”
(response of machine)

Output Matrix

$$f : X \rightarrow Y$$

Image to Image



Ref: <https://arxiv.org/pdf/1611.07004v1.pdf>

Colorization:



Text to Image

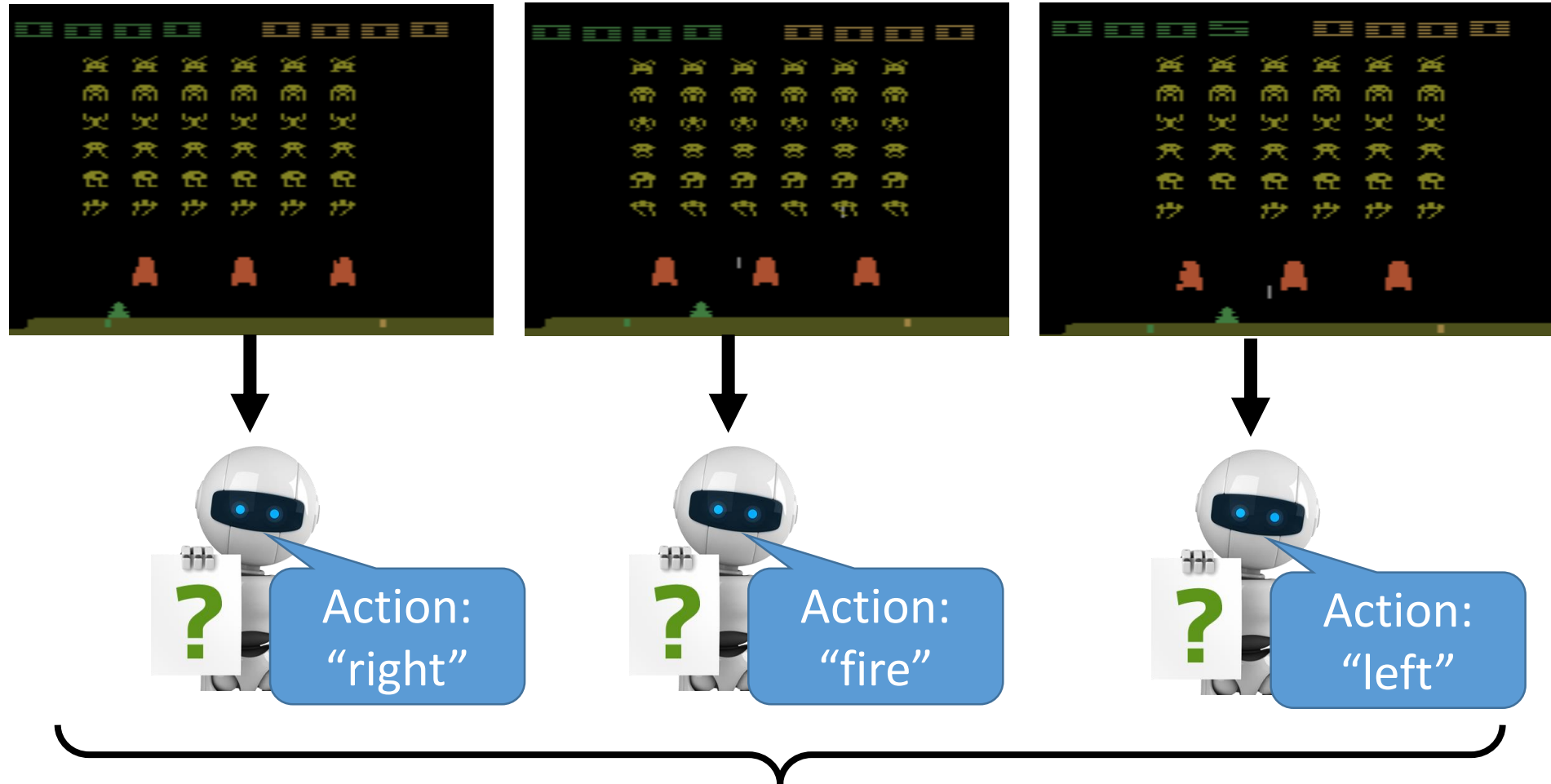
$X :$ “this white and yellow flower have thin white petals and a round yellow stamen”

$Y :$

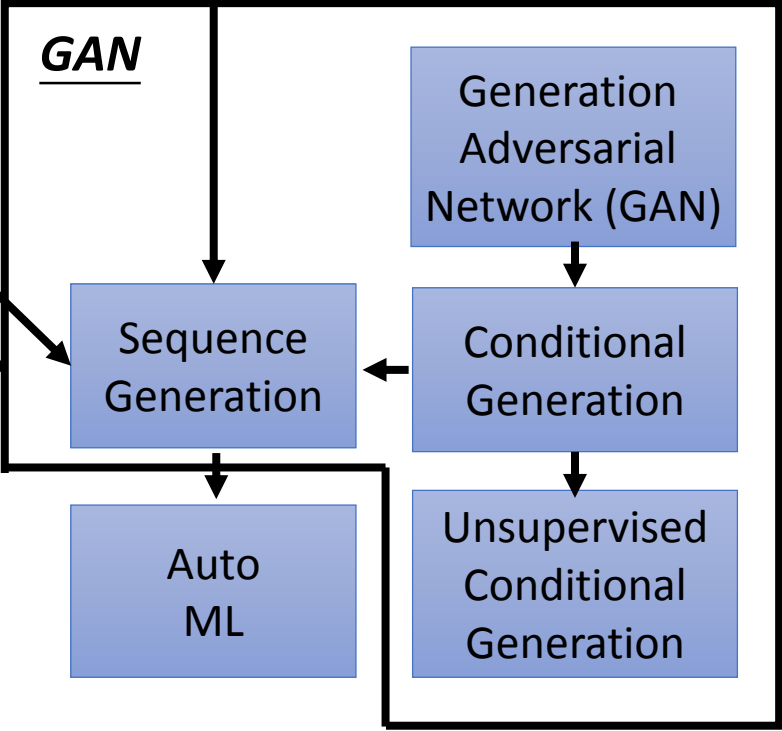
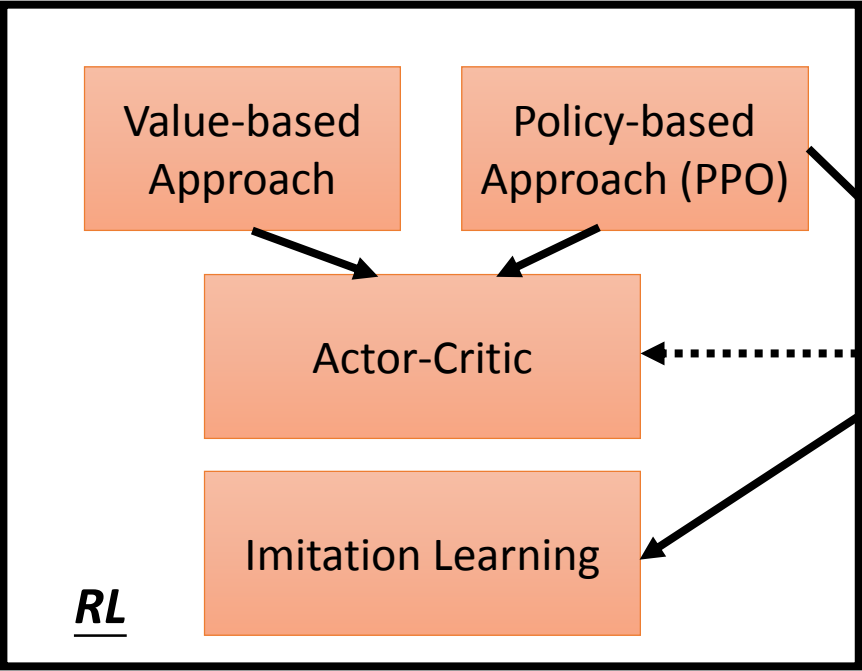
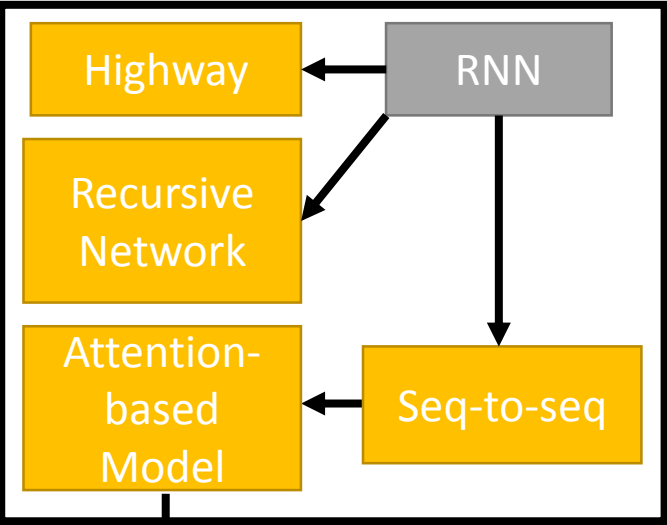
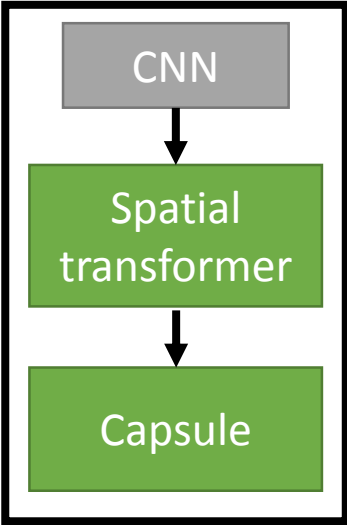
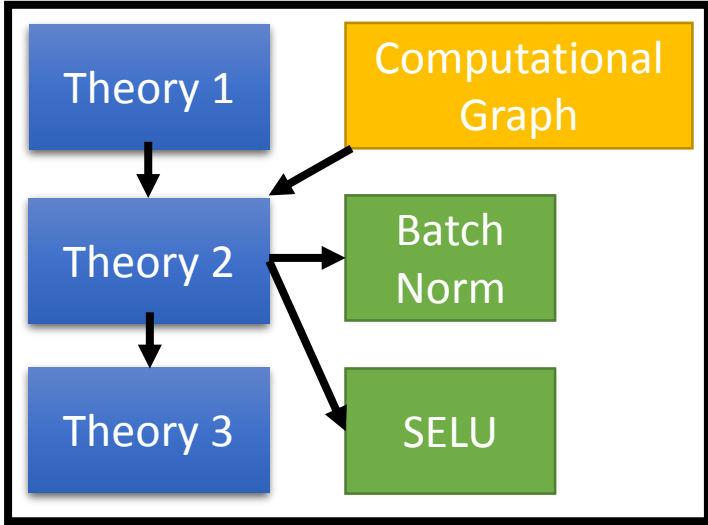


ref: <https://arxiv.org/pdf/1605.05396.pdf>

Reinforcement Learning



A sequence of decisions



參考書籍

Original image:
<http://www.danielambrosi.com/Grand-Format-Collection/i-jbhqVhS/A>
<http://www.deeplearningbook.org/>

