

經濟部工業局

AI產業實戰應用人才淬煉計畫

人工智慧及資安應用實務訓練課程

深度學習(DL)

Deap Learning

https://en.wikipedia.org/wiki/Deep_learning

- Deep learning (also known as **deep structured learning**) is part of a broader family of machine learning methods based on artificial neural networks with representation learning.
- Learning can be **supervised**, **semi-supervised** or **unsupervised**.
- Deep-learning architectures such as deep neural networks, deep belief networks, deep reinforcement learning, **recurrent neural networks(RNN)** and **convolutional neural networks(CNN)** have been applied to fields including computer vision, speech recognition, natural language processing, machine translation, bioinformatics, drug design, medical image analysis, climate science, material inspection and board game programs, where they have produced results comparable to and in some cases surpassing human expert performance

Artificial Intelligence:

Mimicking the intelligence or behavioural pattern of humans or any other living entity.

Machine Learning:

A technique by which a computer can "learn" from data, without using a complex set of different rules. This approach is mainly based on training a model from datasets.

Deep Learning:

A technique to perform machine learning inspired by our brain's own network of neurons.

範例

MNIST handwritten digit

MNIST 手寫數字資料集

訓練集為 60,000 張 28x28 圖元灰度圖像，
測試集為 10,000 同規格圖像，
總共 10 類數字標籤。

label = 5



label = 0



label = 4



label = 1



label = 9



label = 2



label = 1



label = 3



label = 1



label = 4



label = 3



label = 5



label = 3



label = 6



label = 1



label = 7



label = 2



label = 8



label = 6

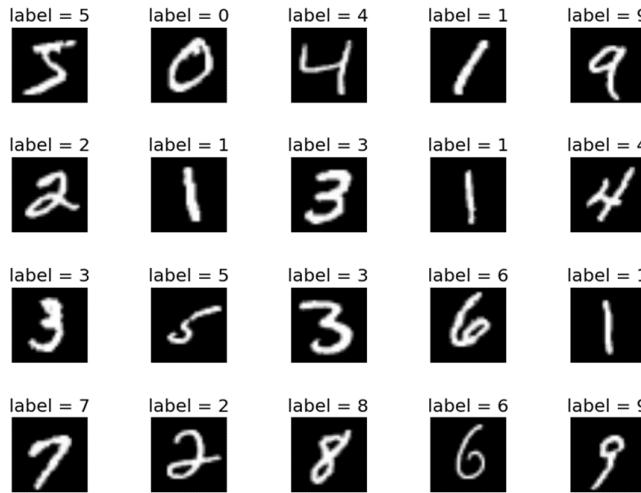


label = 9



MNIST handwritten digit

MNIST 手寫數字資料集



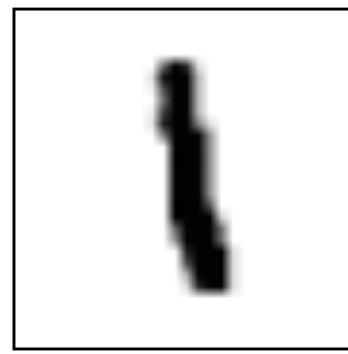
訓練集為 60,000 張 28x28 圖元灰度圖像，
測試集為 10,000 同規格圖像，
總共 10 類數字標籤。

MLP CNN RNN GAN

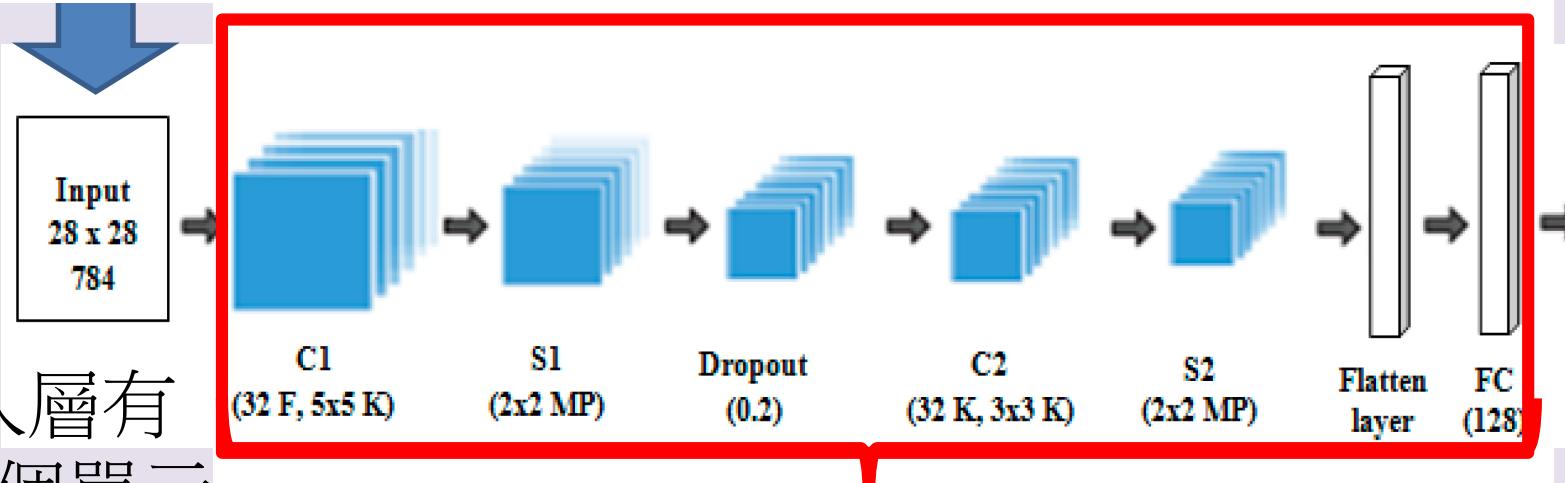
Attention mechanism Implementation for Keras

<https://github.com/philipperemy/keras-attention-mechanism>

每一張手寫的數字都是
28*28(=784) 用28*28矩陣來代表一張圖



$$\approx \begin{bmatrix} 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & .6 & .8 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & .7 & 1 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & .7 & 1 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & .5 & 1 & .4 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 1 & .4 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 1 & .4 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 1 & .7 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 1 & 1 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 1 & .1 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 1 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 1 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 1 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 1 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 1 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 1 & 0 \end{bmatrix}$$

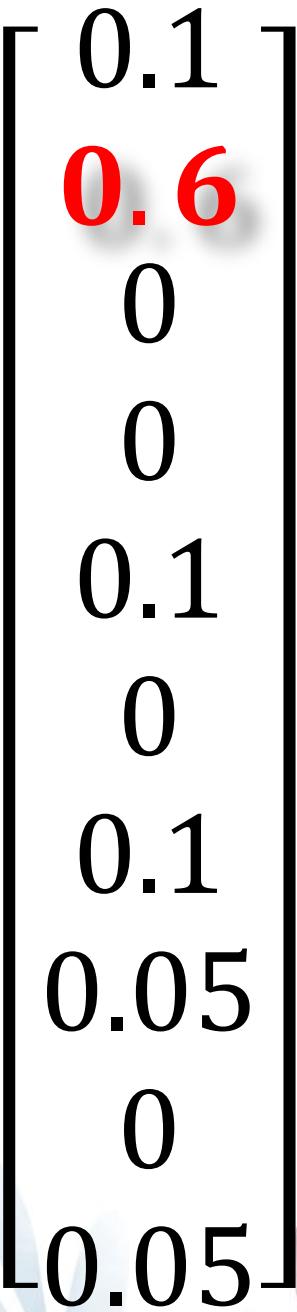
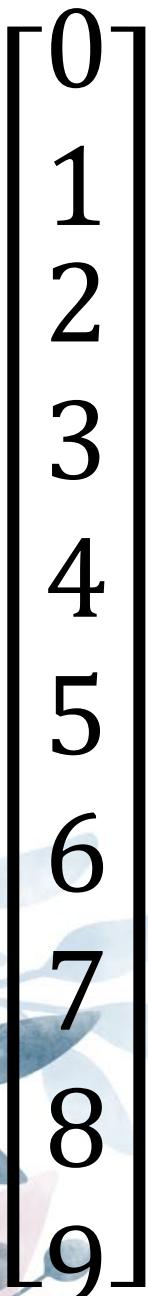


輸入層有
784個單元

網路架構設計:使用那些層
Convolution? Pooling? Dropout? Dense?

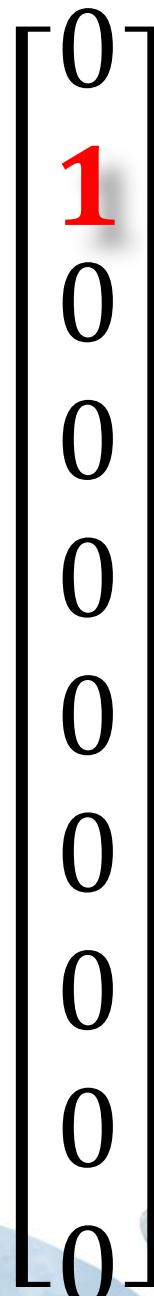
計算的答案

真實的答案



機率最高的就判定是哪個數字

全部加起來的機率為1



one-shot encoding

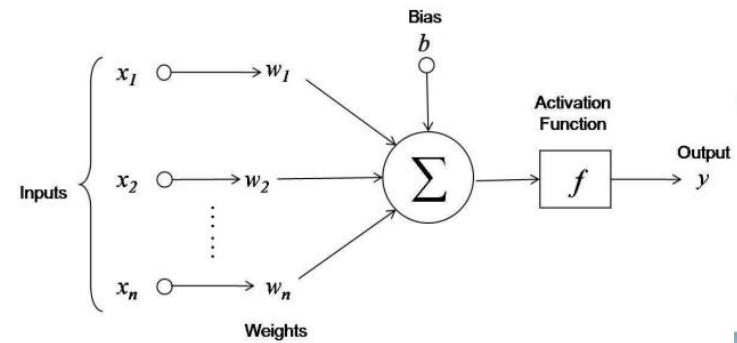
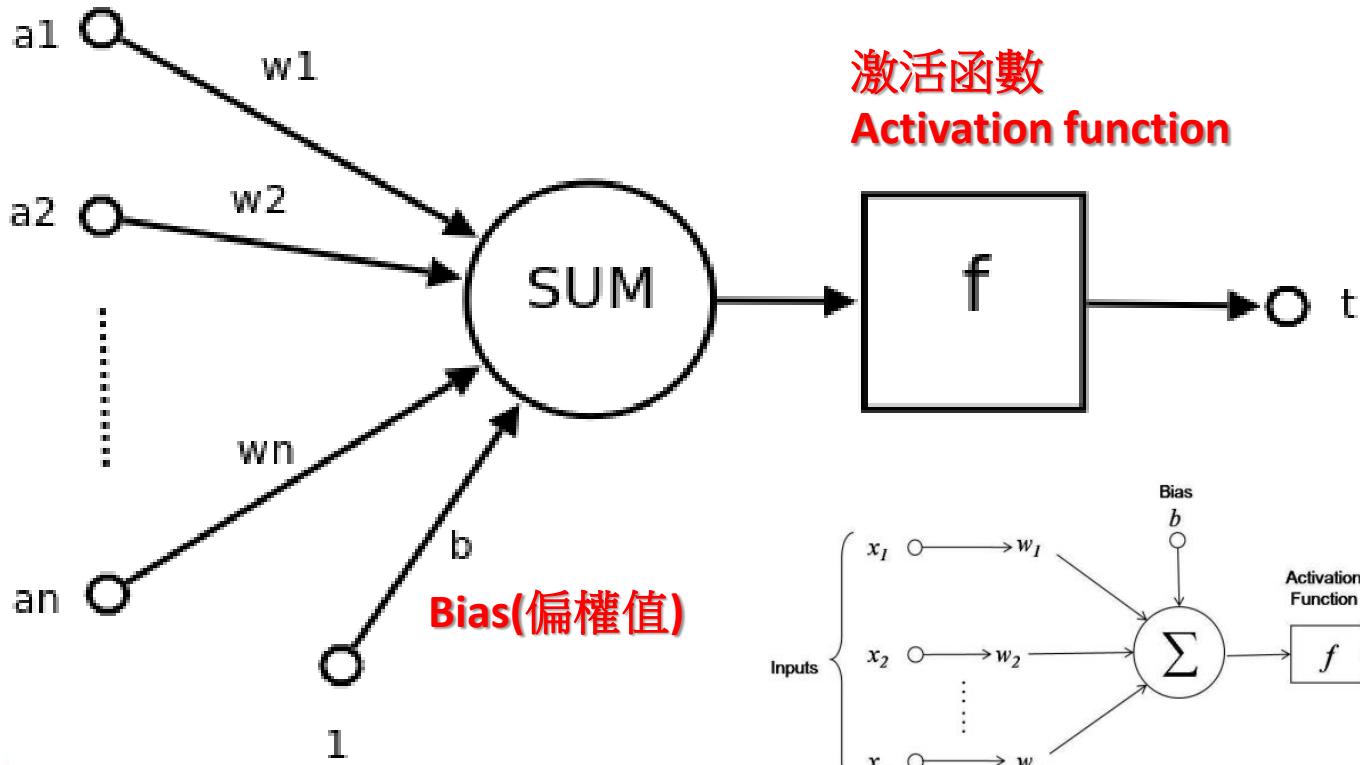
DEEP DEEP Learning

Artificial neural network(ANN)

模型化 → 類神經網路

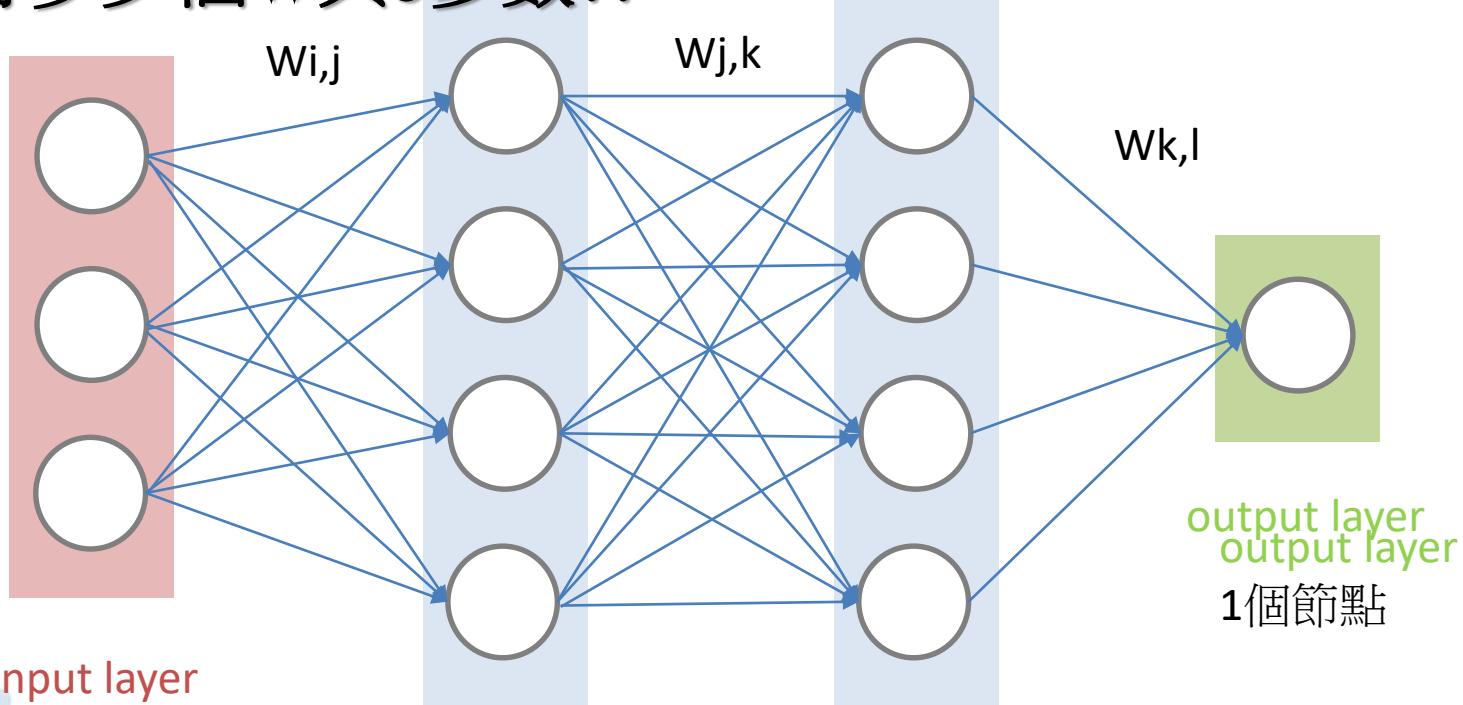
感知機 perceptron

Weight(權重)



多層感知機 Multilayer perceptron, MLP

有多少個W與b參數??



Input layer

Input layer
100個節點

hidden layer 1

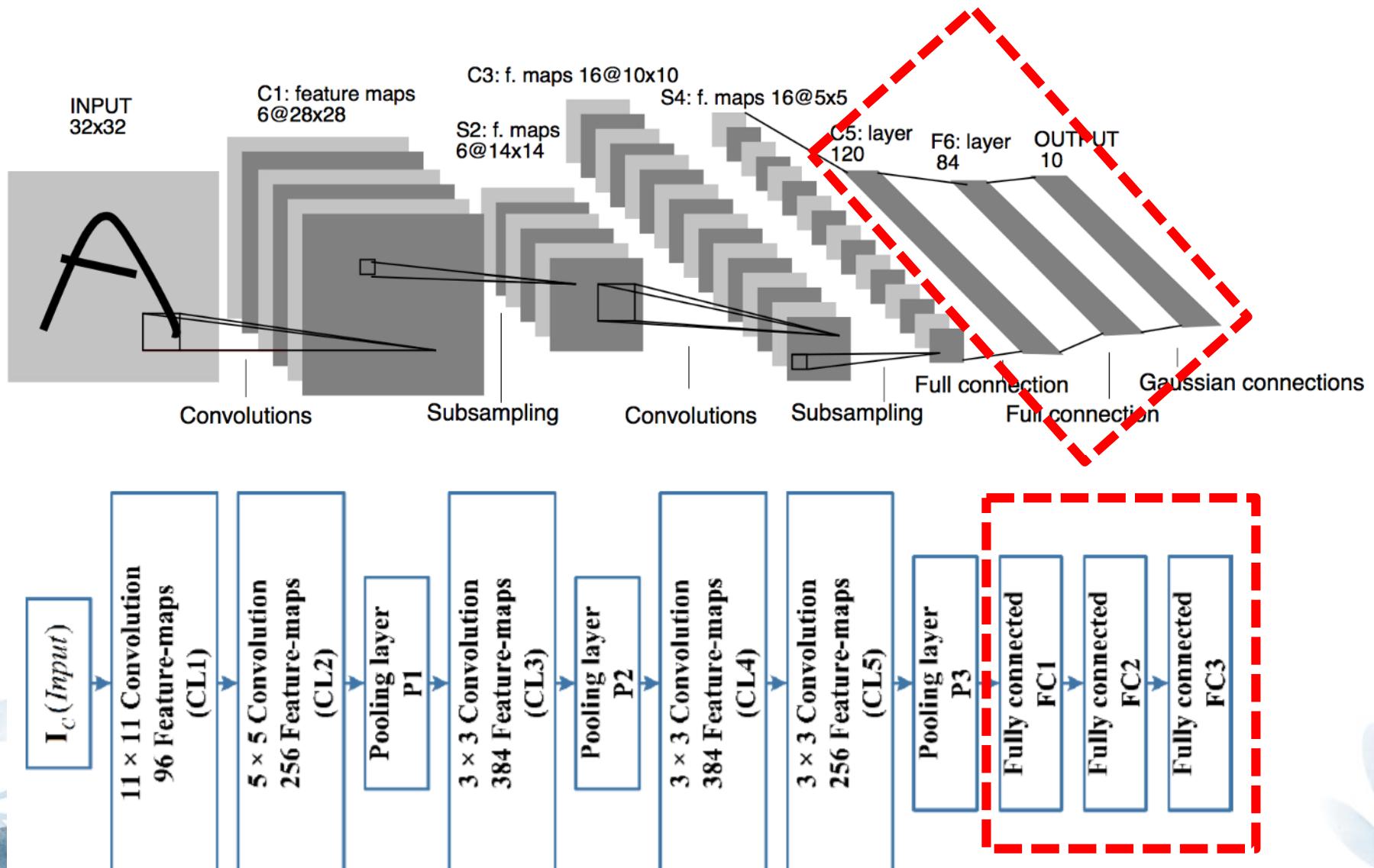
Hidden layer 1
1000個節點

hidden layer 2

Hidden layer 2
1000個節點

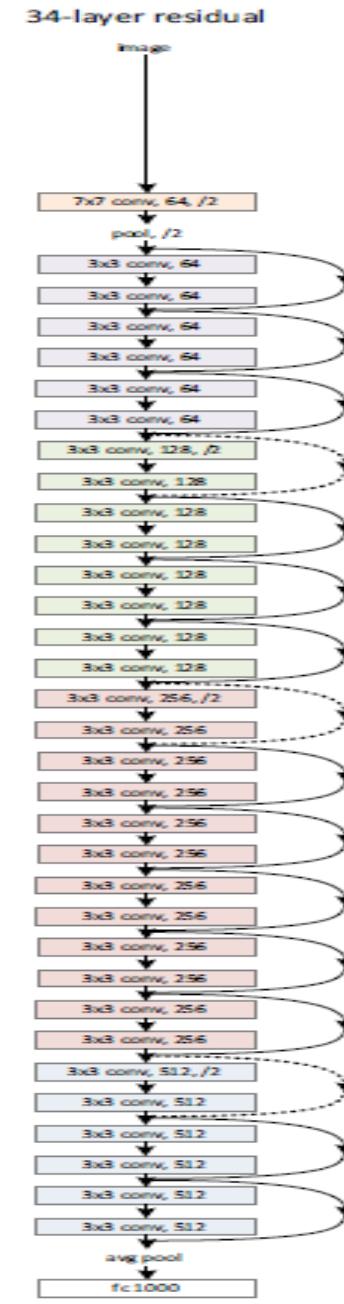
如何快速計算
W與b參數的更新??

Backpropagation
誤差反向傳播法



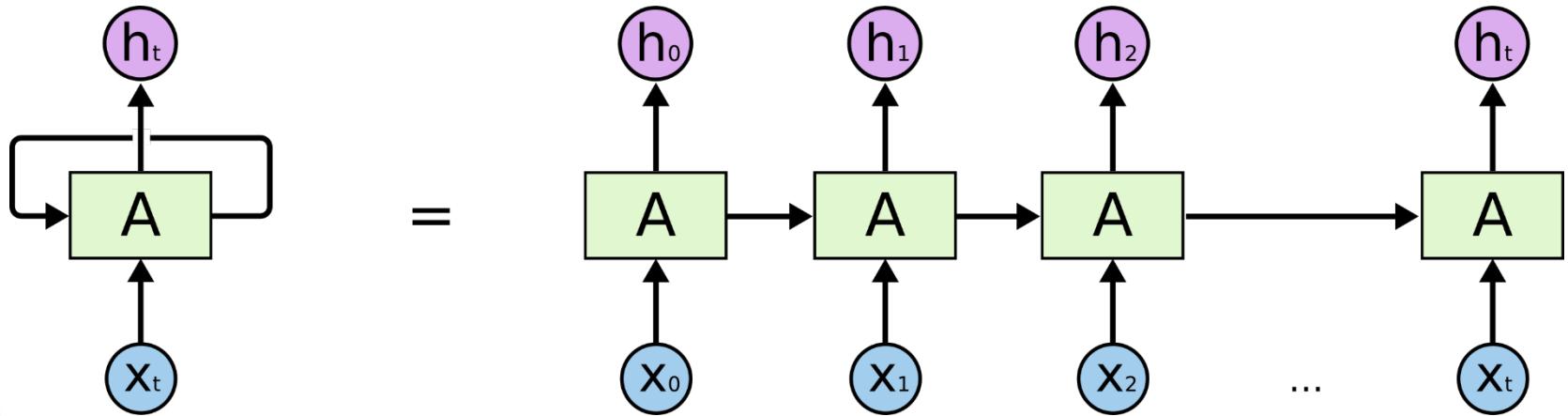
ResNet(2015) Deep Residual Learning

最深的model
採用的152層



遞歸神經網絡 Recurrent Neural Network

A recurrent neural network can be thought of as multiple copies of the same network, each passing a message to a successor.

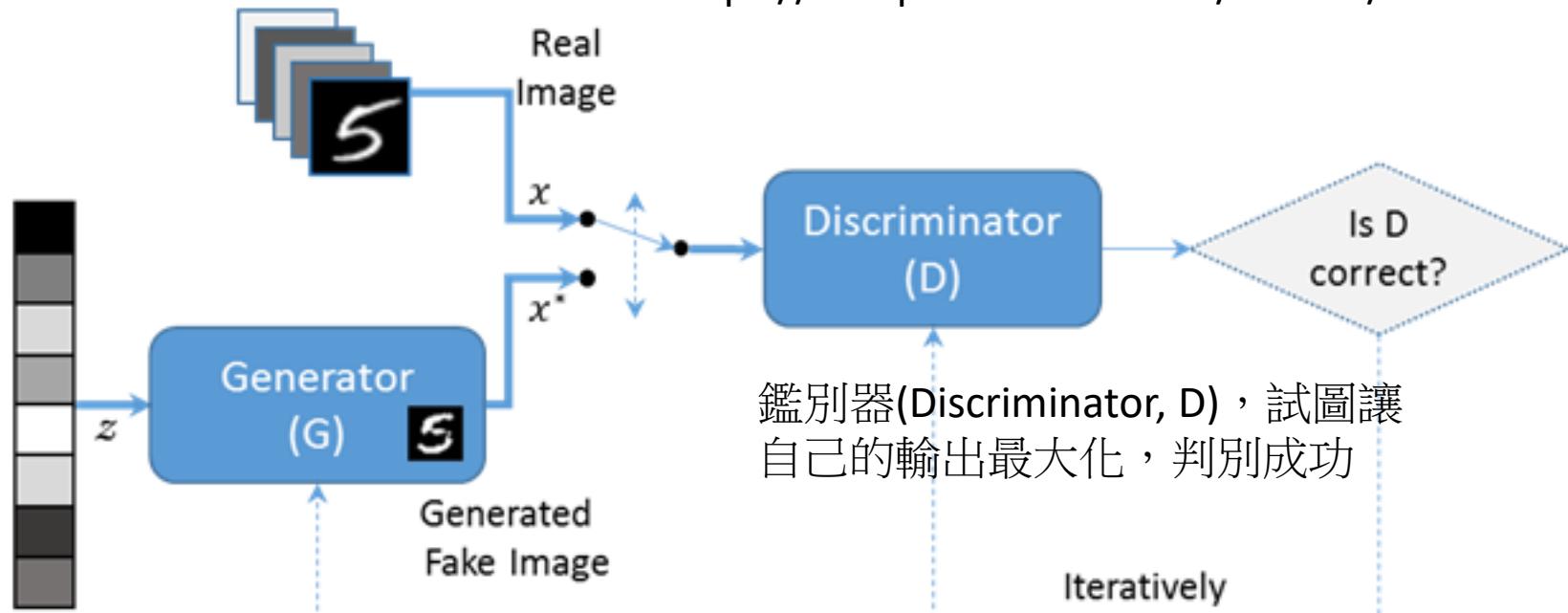


This chain-like nature reveals that recurrent neural networks are intimately related to sequences and lists.

They're the natural architecture of neural network to use for such data.

生成對抗網路(Generative Adversarial Network, GAN)

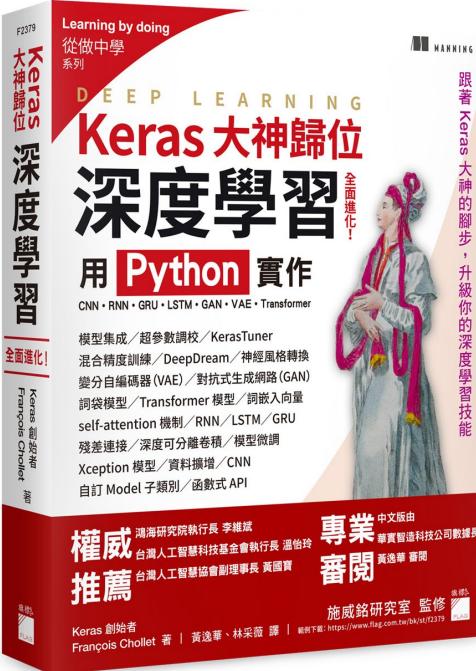
<https://ithelp.ithome.com.tw/articles/10196828>



訓練過程反覆進行，GAN 兩個神經網路最後會收斂到一個平衡點，得到一個生成模型輸入隨機數字後可產生相似於 MNIST 資料集的生成圖像。

開發環境

<https://www.tenlong.com.tw/products/9789863127017>

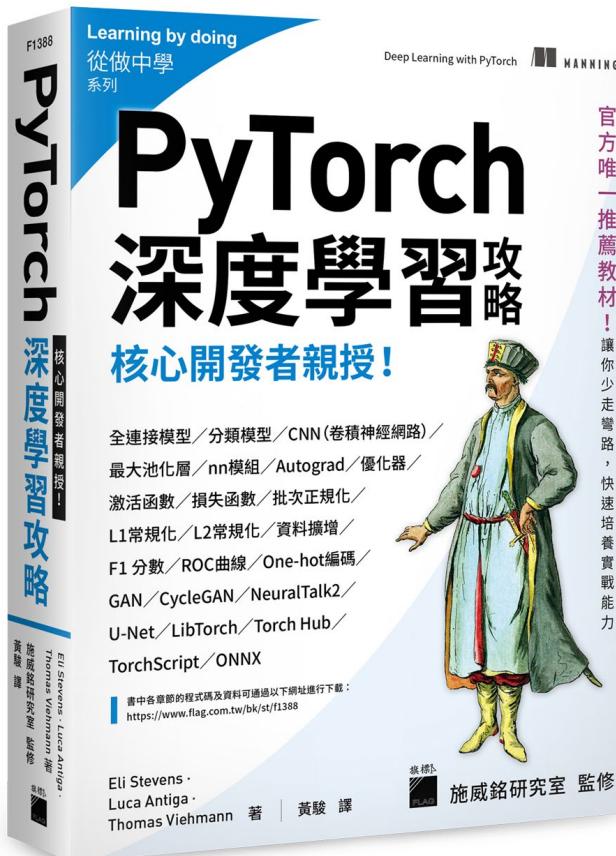


<https://www.tensorflow.org/tutorials>

The screenshot shows the TensorFlow tutorials homepage. The navigation bar includes 'Install', 'Learn', 'API', 'Resources', 'Community', and 'Why TensorFlow'. The main content area is titled 'For beginners' and 'For experts'. It features sections for 'Beginner quickstart', 'Keras basics', 'Load data', 'Advanced quickstart', 'Customization', 'Distributed training', 'Images', 'Text', and 'Videos'. Each section includes a brief description and a link to a notebook example. At the bottom, there are video thumbnails for 'Intro to Machine Learning' and 'TensorFlow 2.0 and Keras #AskTen...'. The page is set against a background of stylized blue and pink leaves.

<https://github.com/fchollet/deep-learning-with-python-notebooks>

https://www.tenlong.com.tw/products/9789863126737?list_name=srh



<https://pytorch.org/>

[See all Projects >](#)

ECOSYSTEM FEATURE PROJECTS

Explore a rich ecosystem of libraries, tools, and more to support development.

Captum

Captum ("comprehension" in Latin) is an open source, extensible library for model interpretability built on PyTorch.

PyTorch Geometric

PyTorch Geometric is a library for deep learning on irregular input data such as graphs, point clouds, and manifolds.

skorch

skorch is a high-level library for PyTorch that provides full scikit-learn compatibility.

COMMUNITY

Join the PyTorch developer community to contribute, learn, and get your questions answered.

PyTorchDiscuss

Browse and join discussions on deep learning with PyTorch.

Slack

Discuss advanced topics. Request access:
<https://bit.ly/ptslack>

中文文档

Docs and tutorials in Chinese, translated by the community.

파이토치(PyTorch)

Tutorials in Korean, translated by the community.

日本語(PyTorch)

Tutorials in Japanese, translated by the community.

Maintainers

Learn about the PyTorch core and module maintainers.

ContributionGuide

Learn how you can contribute to PyTorch code and documentation.

DesignPhilosophy

PyTorch design principles for contributors and maintainers.

Governance

Learn about the PyTorch governance hierarchy.

<https://www.manning.com/books/deep-learning-with-pytorch>

<https://github.com/deep-learning-with-pytorch/dlwpt-code>

https://pytorch.org/tutorials/beginner/deep_learning_60min_blitz.html

PyTorch

Get Started Ecosystem Mobile Blog Tutorials Docs Resources GitHub

PyTorch Recipes [+] Tutorials > Deep Learning with PyTorch: A 60 Minute Blitz Shortcuts

Introduction to PyTorch [-] DEEP LEARNING WITH PYTORCH: A 60 MINUTE BLITZ Deep Learning with PyTorch: A 60 Minute Blitz

Learn the Basics What is PyTorch?

Quickstart Goal of this tutorial:

Tensors

Datasets & DataLoaders

Transforms

Build the Neural Network

Automatic Differentiation with `torch.autograd`

Optimizing Model Parameters

Save and Load the Model

Introduction to PyTorch on YouTube [-]

Introduction to PyTorch - YouTube Series

Introduction to PyTorch

Introduction to PyTorch Tensors

The Fundamentals of Autograd

Building Models with PyTorch

PyTorch TensorBoard Support

Training with PyTorch

Model Understanding with Captum

Learning PyTorch [-]

Deep Learning with PyTorch: A 60 Minute Blitz

Learning PyTorch with Examples

What is `torch.nn` really?

Visualizing Models, Data, and Training with TensorBoard

Image and Video [-]

TorchVision Object Detection Finetuning Tutorial

Transfer Learning for Computer Vision Tutorial

Adversarial Example Generation

DCGAN Tutorial

Spatial Transformer Networks Tutorial

Optimizing Vision Transformer Model for Deployment

Audio [+]

Text [+]

Reinforcement Learning [-]

PyTorch Tutorial: A Quick Preview

到以下平台觀看： YouTube

What is PyTorch?

PyTorch is a Python-based scientific computing package serving two broad purposes:

- A replacement for NumPy to use the power of GPUs and other accelerators.
- An automatic differentiation library that is useful to implement neural networks.

Goal of this tutorial:

- Understand PyTorch's Tensor library and neural networks at a high level.
- Train a small neural network to classify images

NOTE

Make sure you have the `torch` and `torchvision` packages installed.

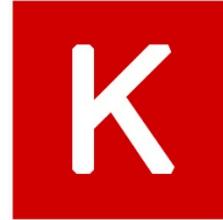
Tensors

A Gentle Introduction to `torch.autograd`

Neural Networks

Keras 開發模式

keras



Easy to learn and use



TensorFlow

Interface of
TensorFlow or
Theano

theano

更多範例學習請詳參

<https://github.com/fchollet/keras/tree/master/examples>

<https://keras.io/zh/>

The screenshot shows the left sidebar of the Keras Chinese documentation website. At the top is a blue header bar with the text "Keras 中文文档" and a search bar labeled "Search docs". Below the header is a black navigation bar with the word "主页". The sidebar contains several links: "Keras: 基于 Python 的深度学习库", "你恰好发现了 Keras。", "指导原则", "快速开始：30 秒上手 Keras", "安装指引", "配置你的 Keras 后端", "技术支持", "为什么取名为 Keras?", "为什么选择 Keras?", "快速开始", "Sequential 顺序模型指引", "函数式 API 指引", and "FAQ 常见问题解答". At the bottom of the sidebar is a small link "进阶 API".

Docs » 主页 [Edit on GitHub](#)

Keras: 基于 Python 的深度学习库



你恰好发现了 Keras。

Keras 是一个用 Python 编写的高级神经网络 API，它能够以 TensorFlow, CNTK, 或者 Theano 作为后端运行。Keras 的开发重点是支持快速的实验。能够以最小的时延把你的想法转换为实验结果，是做好研究的关键。

如果你在以下情况下需要深度学习库，请使用 Keras：

Keras內建的資料庫

keras-team / keras

Watch 2,014 Star 40,807 Fork 15,508

Code Issues 2,325 Pull requests 55 Projects 1 Wiki Insights

Branch: master [Create new file](#) [Upload files](#) [Find file](#) [History](#)

fchollet Fix datasets. Latest commit 3423197 11 days ago

..

init.py	Fashion mnist dataset (#7809)	2 years ago
boston_housing.py	Fix datasets.	11 days ago
cifar.py	#9287 Fix most of the file-handle resource leaks. (#9309)	a year ago
cifar10.py	Formatting fixes.	a year ago
cifar100.py	Formatting fixes.	a year ago
fashion_mnist.py	Formatting fixes.	a year ago
imdb.py	Fix np.load call for np v1.16.3 (#12714)	11 days ago
mnist.py	Fix datasets.	11 days ago
reuters.py	Fix datasets.	11 days ago

MNIST 手寫字元資料集	訓練集為 60,000 張 28x28 圖元灰度圖像，測試集為 10,000 同規格圖像，總共 10 類數字標籤。
Fashion-MNIST 時尚物品資料集	訓練集為 60,000 張 28x28 圖元灰度圖像，測試集為 10,000 同規格圖像，總共 10 類時尚物品標籤。該資料集可以用作 MNIST 的直接替代品。
CIFAR10 小圖像分類資料集	50,000 張 32x32 彩色訓練圖像資料，以及 10,000 張測試圖像資料，總共分為 10 個類別
CIFAR100 小圖像分類資料集	50,000 張 32x32 彩色訓練圖像資料，以及 10,000 張測試圖像資料，總共分為 100 個類別
IMDB 電影評論情感分類資料集	資料集來自 IMDB 的 25,000 條電影評論，以情緒（正面/負面）標記。評論已經過預處理，並編碼為詞索引（整數）的序列表示。
路透社新聞主題分類	資料集來源於路透社的 11,228 條新聞文本，總共分為 46 個主題。與 IMDB 資料集一樣，每條新聞都被編碼為一個詞索引的序列（相同的約定）
Boston 房價回歸資料集	資料集來自卡內基梅隆大學維護的 StatLib 庫。 樣本包含 1970 年代的在波士頓郊區不同位置的房屋資訊，總共有 13 種房屋屬性。 目標值是一個位置的房屋的中值（單位：k\$）。