淺度學習深度學習

大綱

幹什麼吃的

「通過最多點」遊戲

Gradient Descent

圖片辨識

http://clarifai.com

Predicted Tags

winter snow frost cold

Christmas fir frozen ice

season pine

圖片說明

http://cs.stanford.edu/people/karpathy/deepimagesent/generationdemo/

a baseball player swinging a bat at a ball
logprob: -4.30

a woman holding a baby in a stable
logprob: -10.34

回答問題

Human: The color of sky is?
Machine: Blue.

Human: 1 + 1 equal to?
Machine: 2.

Human: what is the purpose of life?
Machine: to serve the greater good.

Human: what is the purpose of living?
Machine: to live forever.

Human: what is the purpose of existence?
Machine: to find out what happens when we get to the planet earth.

類比推理

日本 + (台灣 - 台北) = ???
東京

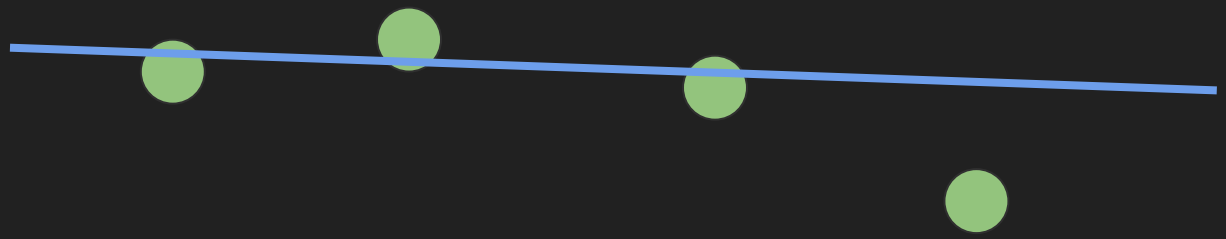
王子 + (國王 - 皇后) = ???
公主

台灣 + (日本 - 濱崎步) = ???
...

有信心從事研究
Deep Learning

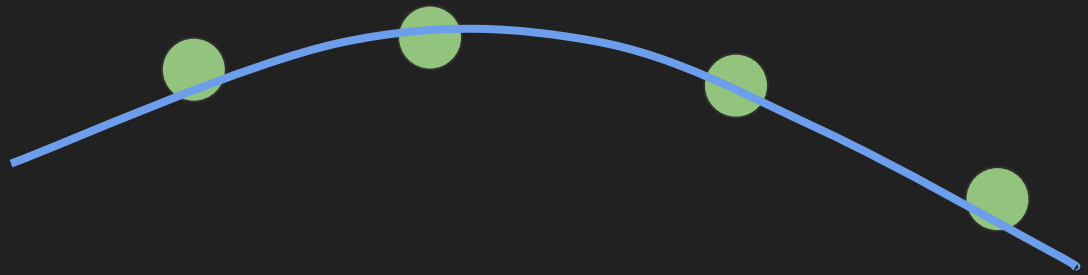
畫一條直線 y = ax + b 通過最多點

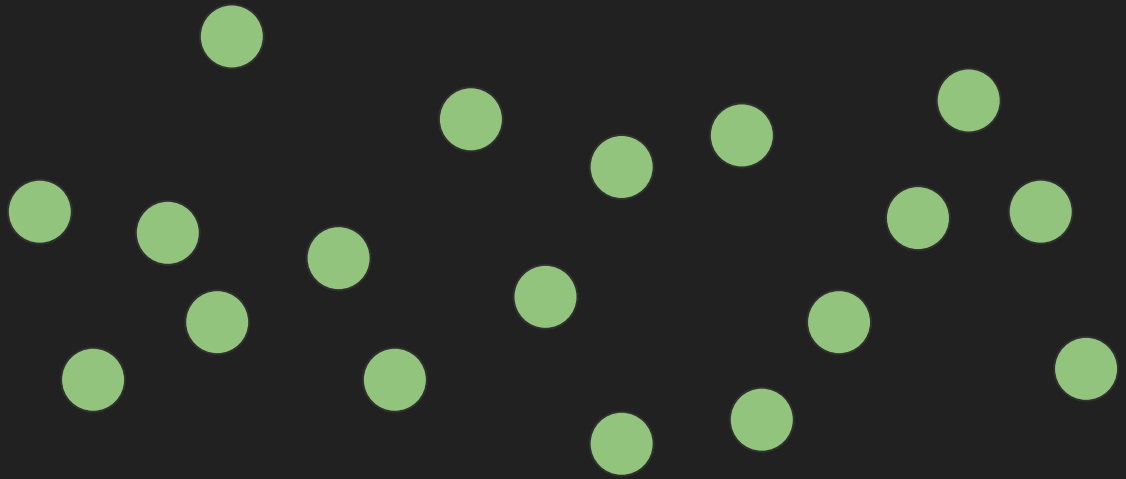
畫一條直線 y = ax + b 通過最多點

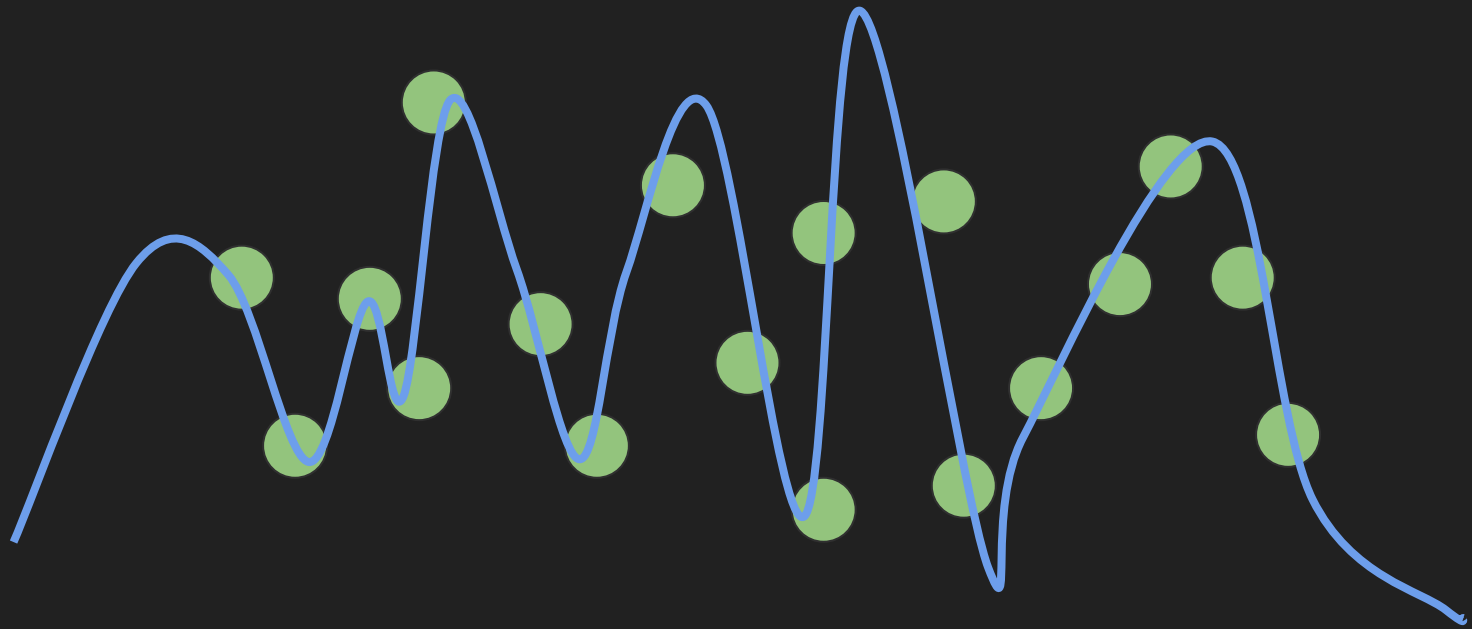


畫一條曲線 $y = ax + bx^2 + c$ 通過最多點

畫一條曲線 $y = ax + bx^2 + c$ 通過最多點







一次方程式過平面上兩點

二次方程試過平面上三點

…

n 次方程式過平面上 n + 1 點

只要方程式次數夠高
什麼函數你都能模擬

f() = 1

f() = 1

f() = 1

f() = 2

f() = 2

f() = 2

f() = 1

f() = 1

f() = 1

f() = 2

f() = 2

f() = 2

$$f(x1, x2, x3, \ldots) = +\ 3.48\ x_1^5 x_2^5 x_3^5 - 1.18\ x_1^5 x_2^5 x_3^4 + 1.88\ x_1^5 x_2^5 x_3^3 - \ldots$$
$$+\ 2.10\ x_1^5 x_2^4 x_3^5 + 0.21\ x_1^5 x_2^4 x_3^4 - 0.04\ x_1^5 x_2^4 x_3^3 - \ldots$$
$$\ldots$$

f() = 1

f() = 1

f() = 1

f() = 2

f() = 2

f() = 2

$$f(x1, x2, x3, \ldots) = + 3.48\, x_1^5 x_2^5 x_3^5 - 1.18\, x_1^5 x_2^5 x_3^4 + 1.88\, x_1^5 x_2^5 x_3^3 - \ldots$$
$$+ 2.10\, x_1^5 x_2^4 x_3^5 + 0.21\, x_1^5 x_2^4 x_3^4 - 0.04\, x_1^5 x_2^4 x_3^3 - \ldots$$
$$\ldots$$

f( ,W) = 1

f( ,W) = 1

f( ,W) = 1

f( ,W) = 2

f( ,W) = 2

f( ,W) = 2

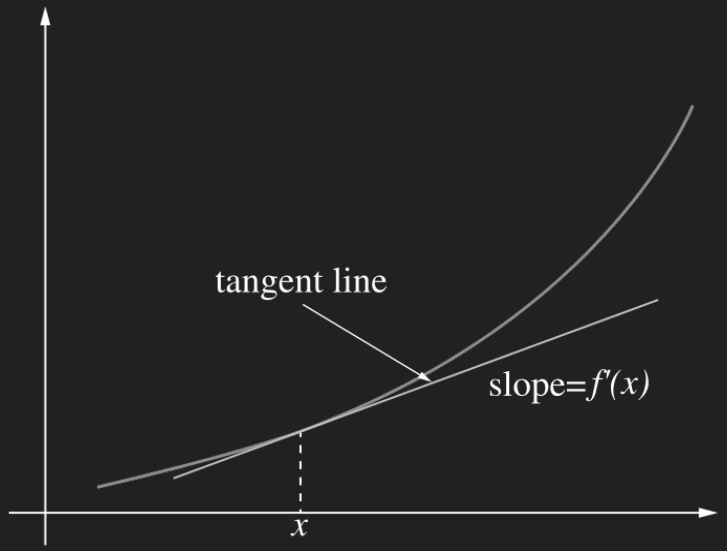
$$f(x1, x2, x3, W) = +\ 3.48\ x_1^5 x_2^5 x_3^5 - 1.18\ x_1^5 x_2^5 x_3^4 + 1.88\ x_1^5 x_2^5 x_3^3 - \ldots$$
$$+\ 2.10\ x_1^5 x_2^4 x_3^5 + 0.21\ x_1^5 x_2^4 x_3^4 - 0.04\ x_1^5 x_2^4 x_3^3 - \ldots$$
$$\ldots$$

Machine Learning

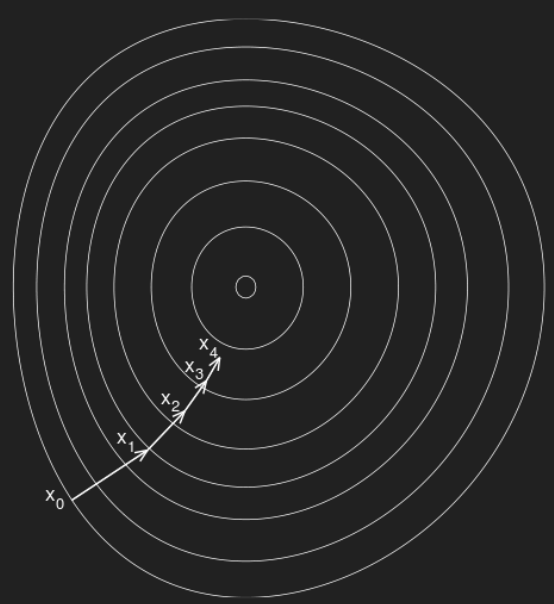
就是「自動調數字」

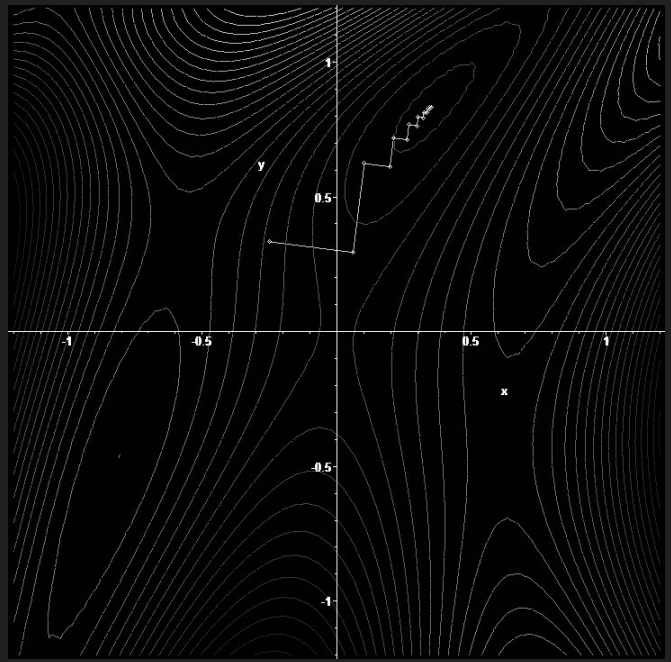
函數最小值

函數最小值



1. 微分找斜率
2. 往反方向走


x_0
x_1
x_2
x_3
x_4


1
0.5
y
-1
-0.5
0.5
1
x
-0.5
-1

Gradient Descent

f( ,w) = 1

f( ,w) = 1

f( ,w) = 1

f( ,w) = 2

f( ,w) = 2

f( ,w) = 2

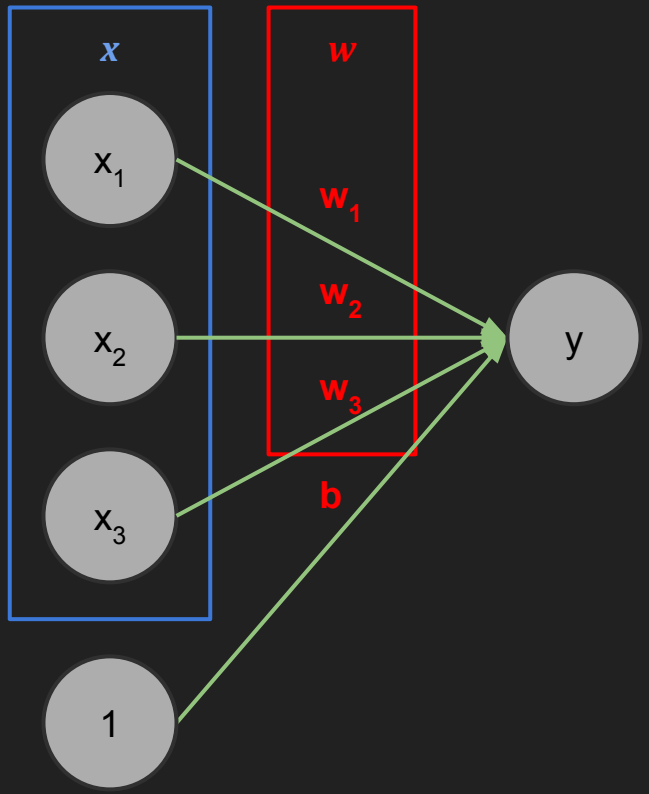
$$|f(\text{  }, w) - 1|$$

$$(f(\text{  }, w) - 1)^2$$

$$E(\text{  }, w) = (f(\text{  }, w) - 1)^2$$

透過調整W
最小化Error

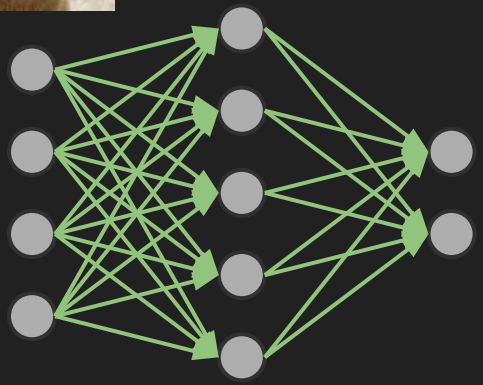
Perceptron



$$y = x_1 w_1 + x_2 w_2 + x_3 w_3 + b$$

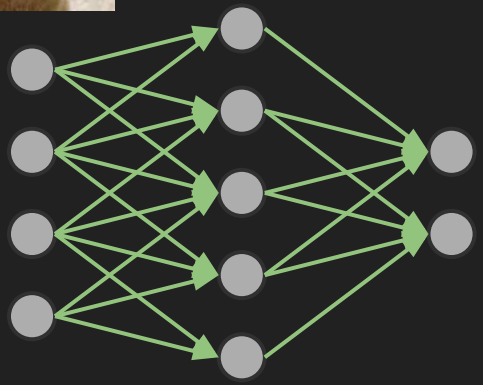
$$y = x * w + b$$

結構



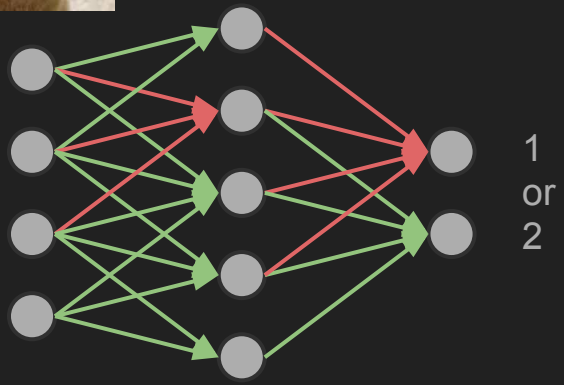
1
or
2

結構:寬度

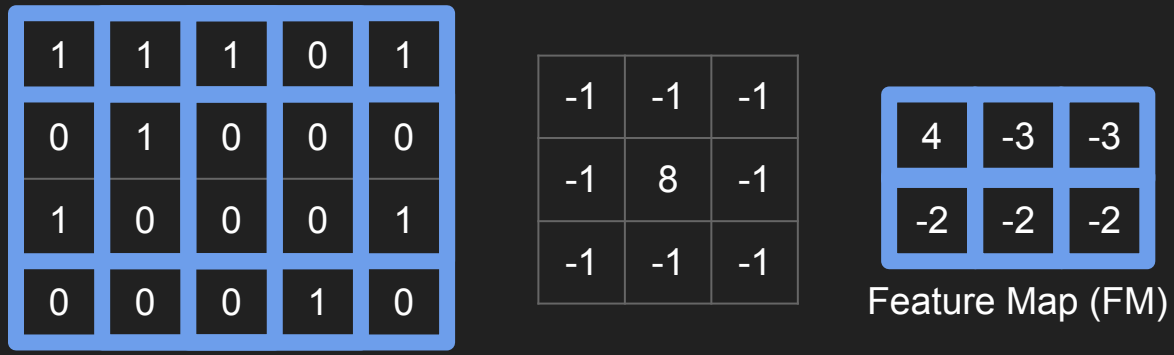


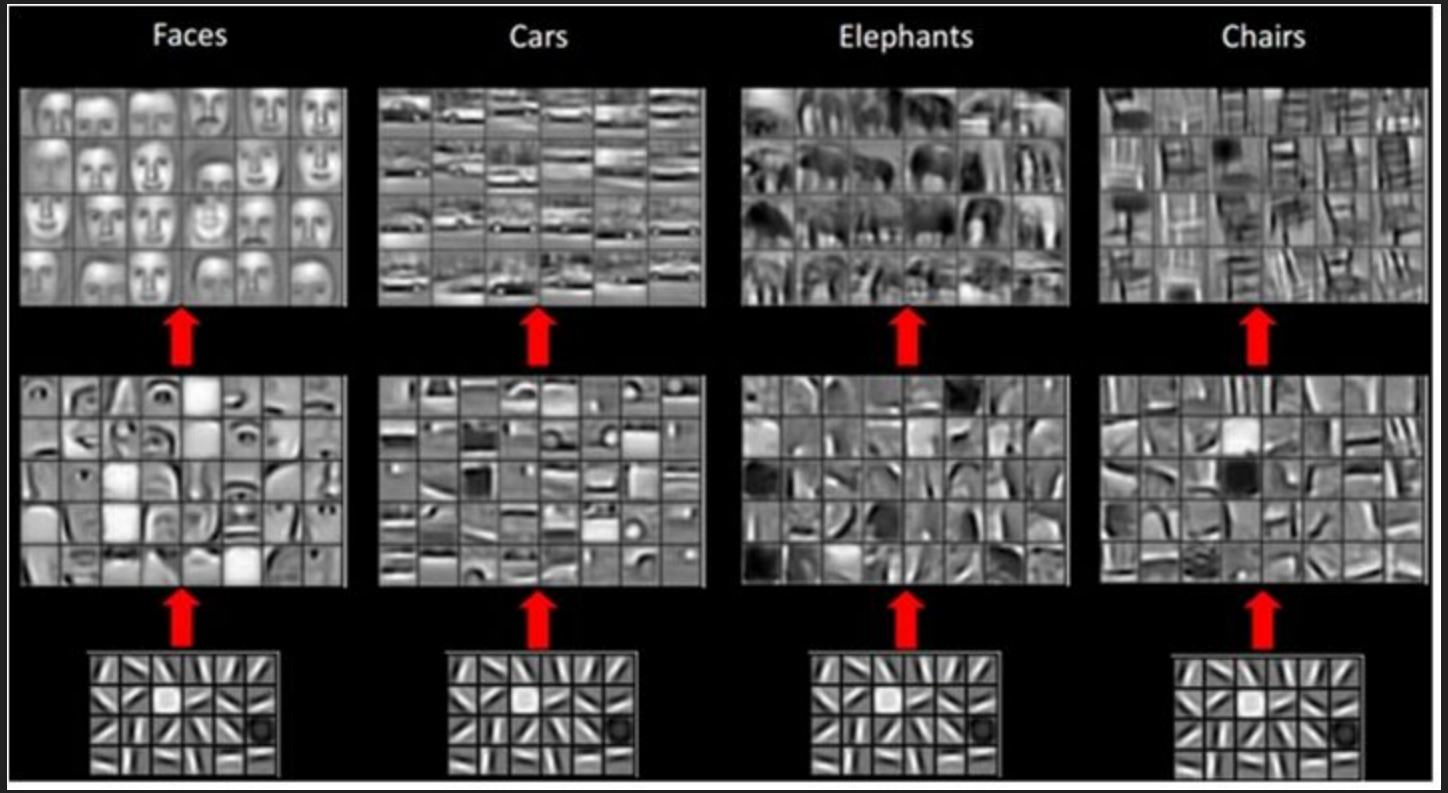
1
or
2

結構：每一層只跟前一層「附近」相連



Convolution




Faces
Cars
Elephants
Chairs

深度越深

抽象度越高

可是以前只能兩層