# 深度學習模型的比較研究 - 以 MNIST 為例

開放原始碼論文

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# 摘要

本論文的開放原始碼專案網址為:https://github.com/cccresearch/nnModelCompare

不同的神經網路模型,經訓練之後的正確率可能差異很大。本文針對手寫數字辨識的 MNIST 資料庫進行測試,以便觀察模型的表現,並分析其背後的原因。

關鍵字 神經網路·深度學習·MNIST

# 1 簡介

近幾年深度學習技術讓人工智慧領域有了很大的進展,也吸引到了學術界與產業界共同投入研究,相繼開發出更好,但也相對更複雜的模型。

為何有些模型表現好,有些模型表現差,各個網路層的效用是甚麼,為何需要加入某些層,若拿掉的話會有甚麼不良反應嗎?這就是本研究所想要探討的問題!

## 2 背景

手寫數字辨識的 MNIST 是影像辨識領域中最常被拿來測試的資料集,而 CNN 卷積神經網路架構的 LeNet 則是 Yann Le Cun 1989 年在研究手寫辨識問題時,提出來的辨識模型,實驗發現 LeNet 在手寫辨識上有相當高的正確率。

不過,其他的模型,像是使用多層感知器,也可以達到90%以上的正確率,

# 3 方法

簡易的『爬山演算法』如下圖所示 1 所示。

Algorithm Hill-Climbing(pi)
p = pi // 設定粒子 p 為起始粒子 pi
while not isEnd()
pn = p.neighbor(step) //選擇粒子 p 的鄰居 pn
if pn.fitness()>=p.fitness() //如果更好,就接受
p = pn;
End Algorithm

 $<sup>^*</sup>$ Use footnote for providing further information about author (webpage, alternative address)—not for acknowledging funding agencies.

Table 1: 不同模型的 MNIST 正確率

模型	正確率	說明
fc1 fc1s fc2 fc2s fc2net fc2signet LeNet	74% 92% 10% 92% 95% 91% 97%	損失負無限大

#### 3.1 高度函數如何設計

Measure Measur

$$\xi_{ij}(t) = P(x_t = i, x_{t+1} = j | y, v, w; \theta) = \frac{\alpha_i(t) a_{ij}^{w_t} \beta_j(t+1) b_j^{v_{t+1}}(y_{t+1})}{\sum_{i=1}^N \sum_{j=1}^N \alpha_i(t) a_{ij}^{w_t} \beta_j(t+1) b_j^{v_{t+1}}(y_{t+1})}$$
(1)

## 3.1.1 如何選取好的鄰居?

任何的參數變動,都可以創造出新的鄰居模型,因此、鄰居的選擇性是無限多的,我們面臨的問題是,該 如何從無限多的鄰居當中,選擇一個有可能更好的適當鄰居呢?

在此、我們用了一些啟發式法則如下

- 1. 加一個新層
- 2. 將一層換成另一層
- 3. 調整某層的參數

**Paragraph** Paragraph Para

# 4 Experiments

[1, 2] and see [3].

The documentation for natbib may be found at

http://mirrors.ctan.org/macros/latex/contrib/natbib/natnotes.pdf

Of note is the command \citet, which produces citations appropriate for use in inline text. For example,

\citet{hasselmo} investigated\dots

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Hasselmo, et al. (1995) investigated...

https://www.ctan.org/pkg/booktabs

## 4.1 Figures

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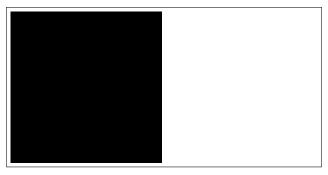


Figure 1: Sample figure caption.

Table 2: Sample table title

	Part	
Name	Description	Size $(\mu m)$
Dendrite Axon Soma	Input terminal Output terminal Cell body	

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#### 4.2 Tables

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### 4.3 Lists

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- consectetur adipiscing elit.
- Aliquam dignissim blandit est, in dictum tortor gravida eget. In ac rutrum magna.

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<sup>&</sup>lt;sup>2</sup>Sample of the first footnote.