內容

[FNN（Feedforward Neural Network） 1](#_Toc166076973)

[RNN（Recurrent Neural Network） 1](#_Toc166076974)

[CNN（Convolutional Neural Network） 2](#_Toc166076975)

[FNN RNN CNN三者之間的差別 2](#_Toc166076976)

[激活函數（Activation Function） 3](#_Toc166076977)

[Entropy 與 Cross Entropy 的差別 5](#_Toc166076978)

[Entropy（熵） 5](#_Toc166076979)

[Cross Entropy（交叉熵） 5](#_Toc166076980)

## FNN（Feedforward Neural Network）

- 中文描述：FNN（前饋神經網路）是一種**最基本的神經網路模型**，其中**訊息只會向前流動，不會形成循環或回饋。**它由多個層組成，每一層包含多個神經元（節點），**相鄰層之間的神經元之間存在權重**。每個神經元的輸出是前一層神經元的加權和，**經過激活函數處理後得到**。

- 英文描述：A Feedforward Neural Network (FNN) is a basic neural network model where information flows only in one direction, without cycles or feedback loops. It consists of multiple layers, each containing multiple neurons (nodes), with weighted connections between adjacent layers. The output of each neuron is the weighted sum of inputs from the previous layer, followed by an activation function.

## RNN（Recurrent Neural Network）

- 中文描述：RNN（循環神經網路）是一種**具有循環結構的神經網路**，能夠處理序列數據或時間序列數據。**RNN的特點是在每個時間步都會將當前的輸入與上一個時間步的隱藏狀態進行計算**，**產生當前時間步的輸出**。RNN**具有記憶功能**，可以**捕捉序列數據中的時間依賴性**。

- 英文描述：A Recurrent Neural Network (RNN) is a type of neural network with a loop structure that allows it to handle sequential or time-series data. In RNN, the current input at each time step is processed along with the hidden state from the previous time step to produce the output at the current time step. RNNs have the ability to capture temporal dependencies in sequential data.

## CNN（Convolutional Neural Network）

- 中文描述：CNN（卷積神經網路）是一種**專門用於處理圖像數據的神經網路模型**。它主要**包含卷積層（Convolutional Layer）、池化層（Pooling Layer）和全連接層（Fully Connected Layer）**。CNN通過使用卷積操作來提取圖像的特徵，並通過池化操作進行特徵降維，最終通過全連接層進行分類或回歸。

- 英文描述：A Convolutional Neural Network (CNN) is a type of neural network designed specifically for processing image data. It typically consists of convolutional layers, pooling layers, and fully connected layers. CNNs use convolution operations to extract features from images and pooling operations to reduce the dimensionality of the features, ultimately performing classification or regression tasks using fully connected layers.

## FNN RNN CNN三者之間的差別

**結構差異：**

FNN：訊息只向前傳播，沒有循環結構。

RNN：具有循環結構，能夠處理序列或時間序列數據。

CNN：主要用於處理圖像數據，包含卷積、池化和全連接層。

**Structural Differences:**

**Structural Differences:**

* **FNN (Feedforward Neural Network):** Information flows only forward without any cyclic structure.
* **RNN (Recurrent Neural Network):** Contains cyclic structure and is capable of handling sequential or time-series data.
* **CNN (Convolutional Neural Network):** Primarily used for processing image data and includes convolutional layers, pooling layers, and fully connected layers.

**應用領域差異：**

FNN：適用於一般的分類或回歸任務。

RNN：適用於序列建模，如自然語言處理（NLP）、時間序列預測等。

CNN：主要用於計算機視覺任務，如圖像分類、物體檢測等。

**Application Domain Differences:**

* **FNN:** Suitable for general classification or regression tasks.
* **RNN:** Suitable for sequence modeling tasks such as natural language processing (NLP) and time-series prediction.
* **CNN:** Mainly used for computer vision tasks like image classification and object detection.

**特點差異：**

FNN：較簡單，無法處理序列數據的時間依賴性。

RNN：具有記憶能力，能夠捕捉序列數據中的時間依賴性。

CNN：專門用於處理圖像數據，具有平移不變性（Translation Invariance）。

**Characteristic Differences:**

* **FNN:** Relatively simple and unable to handle time dependencies in sequential data.
* **RNN:** Possesses memory capabilities and can capture temporal dependencies in sequential data.
* **CNN:** Specifically designed for processing image data with translation invariance properties.

## 激活函數（Activation Function）

神經網路中的一種重要組件，它通常**被應用於神經元的輸出，用於引入非線性特性**，並決定神經元是否應該被激活（fired）。

在神經網路中，**每個神經元接收來自前一層的加權輸入（包括偏差項），然後通過激活函數計算出神經元的輸出**。激活函數**將線性組合的輸入轉換成非線性輸出**，這對於神經網路的學習和表示能力至關重要。

An activation function is a critical component in neural networks applied to determine the output of a neuron based on its input. It introduces non-linearity into the network, allowing it to model complex relationships and make decisions about whether a neuron should be activated (fired).

In neural networks, each neuron receives weighted inputs from the previous layer, including a bias term, and computes its output using an activation function. The activation function transforms the linear combination of inputs into a non-linear output, which is essential for the learning and representational capabilities of neural networks.

一張含有 文字, 螢幕擷取畫面, 字型, 數字 的圖片

自動產生的描述**Sigmoid Function** (Logistic Function): It compresses the input into the range of (0,1)(0,1) and is often used in the final layer of binary classification tasks.

**Tanh Function** (Hyperbolic Tangent Function): It compresses the input into the range of (−1,1)(−1,1) with a centering property.

**ReLU Function** (Rectified Linear Unit Function): It outputs the input if it's positive, otherwise outputs zero, commonly used in hidden layers.

**Softmax Function**:It converts a vector into a probability distribution, often used in the final layer of multi-class classification tasks

## Entropy 與 Cross Entropy 的差別

中文描述：

### Entropy（熵）

是訊息理論中衡量**隨機變量不確定度或混亂程度的度量**。在機器學習中，熵用於**衡量一個概率分佈的不確定性**，計算方式為將每個事件的概率乘以其自然對數，然後**求和取負值。熵越高，概率分佈的不確定性越大**。

1. Entropy:

- Definition: Entropy is a measure of uncertainty or disorder of a random variable in information theory. In machine learning, entropy is used to quantify the uncertainty of a probability distribution. It is calculated by multiplying each event's probability by its natural logarithm, then summing the results and taking the negative value. Higher entropy indicates greater uncertainty in the probability distribution.

### Cross Entropy（交叉熵）

是一種**衡量兩個概率分佈之間的差異或不匹配程度的指標**。在機器學習中，交叉熵**常用於衡量模型預測的概率分佈與真實概率分佈之間的距離**。交叉熵的計算方式是**將真實概率分佈的每個事件的概率乘以其自然對數，然後與模型預測的概率分佈相乘，最後求和取負值**。

英文描述：

2. Cross Entropy:

- Definition: Cross Entropy is a metric that measures the difference or mismatch between two probability distributions. In machine learning, cross entropy is commonly used to quantify the distance between the predicted probability distribution of a model and the true probability distribution. Cross entropy is calculated by multiplying each event's probability from the true distribution by its natural logarithm, then multiplying it with the corresponding probability from the model's predicted distribution, and finally summing the results and taking the negative value.

總之，熵衡量機率分佈內的不確定性，而交叉熵衡量兩個機率分佈之間的差異。交叉熵通常用作機器學習任務中的損失函數，例如分類，以根據預測分佈和真實分佈之間的差異來優化模型參數

In summary, entropy measures uncertainty within a probability distribution, while cross entropy measures the divergence between two probability distributions. Cross entropy is often used as a loss function in machine learning tasks such as classification to optimize model parameters based on the difference between predicted and true distributions.

formula