CNN - MNIST手寫辨識

About CNN

LeNet

①CNN的前身

②用於字以及符號的辨識（Ex. 郵政編碼、數字）

- 影像的特徵提取➜卷積(Convolution)+最大池化(Max Pooling)
- 完全連接前饋式網路➜平緩層 + 隱藏層 + 輸出層

  Fully Connected FeedForward Network➜ Flatten Layer + Hidden Layer + Output Layer

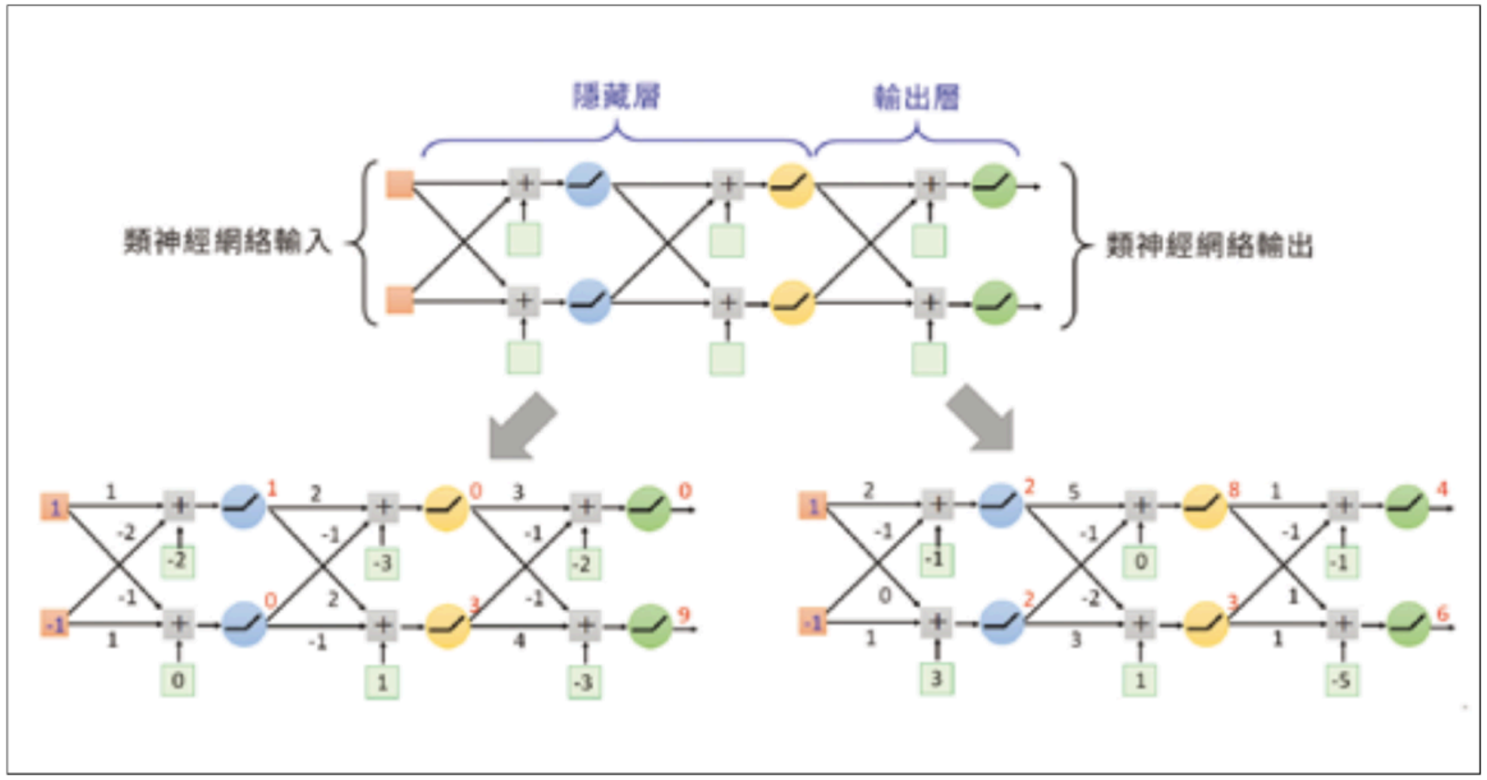
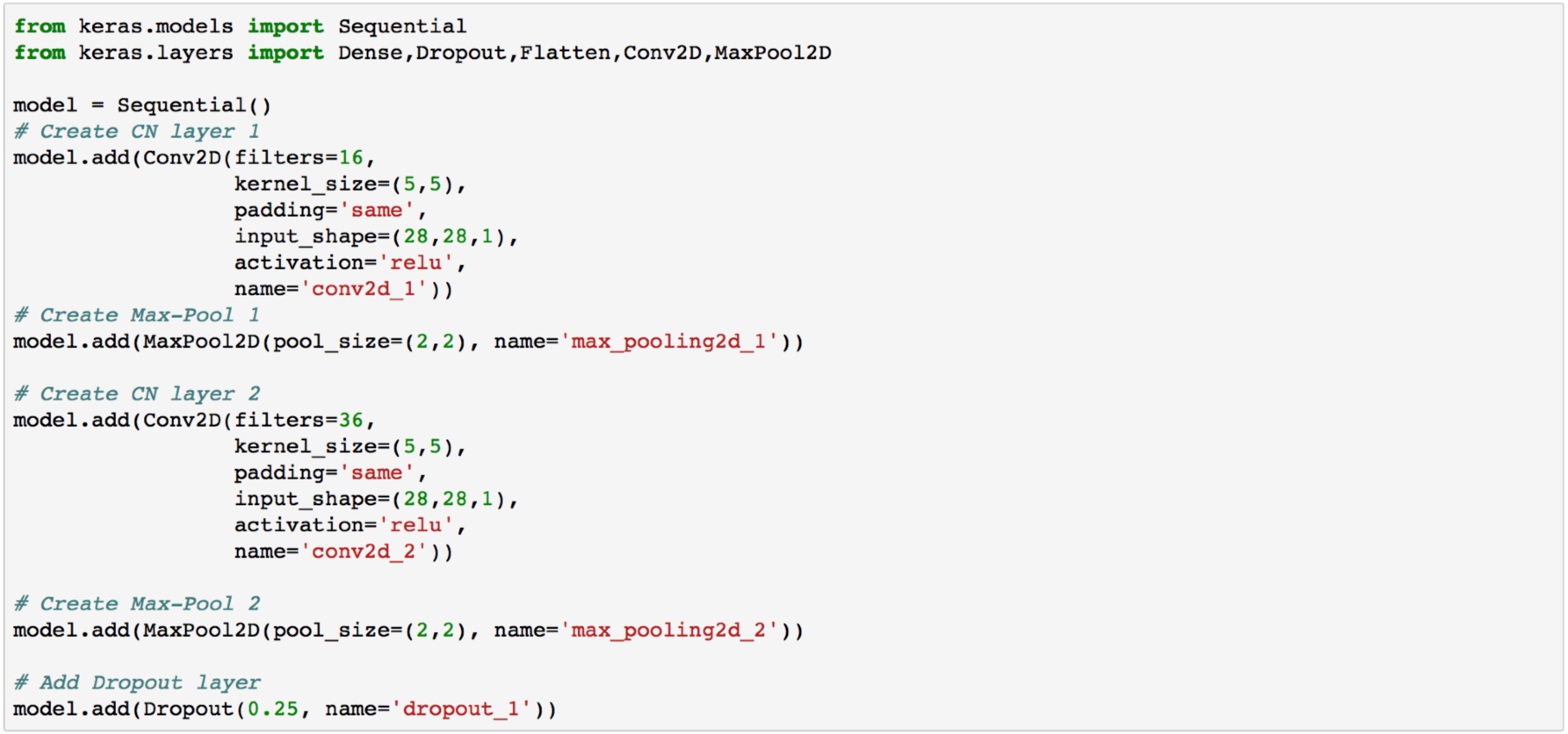


圖 2 圖上方為一完全連接前饋式網絡結構，下方為兩組不同的參數示例，分別代表兩個不同的函數。輸入同樣的數值，左下和右下的神經網絡會有不同的輸出。

特徵提取

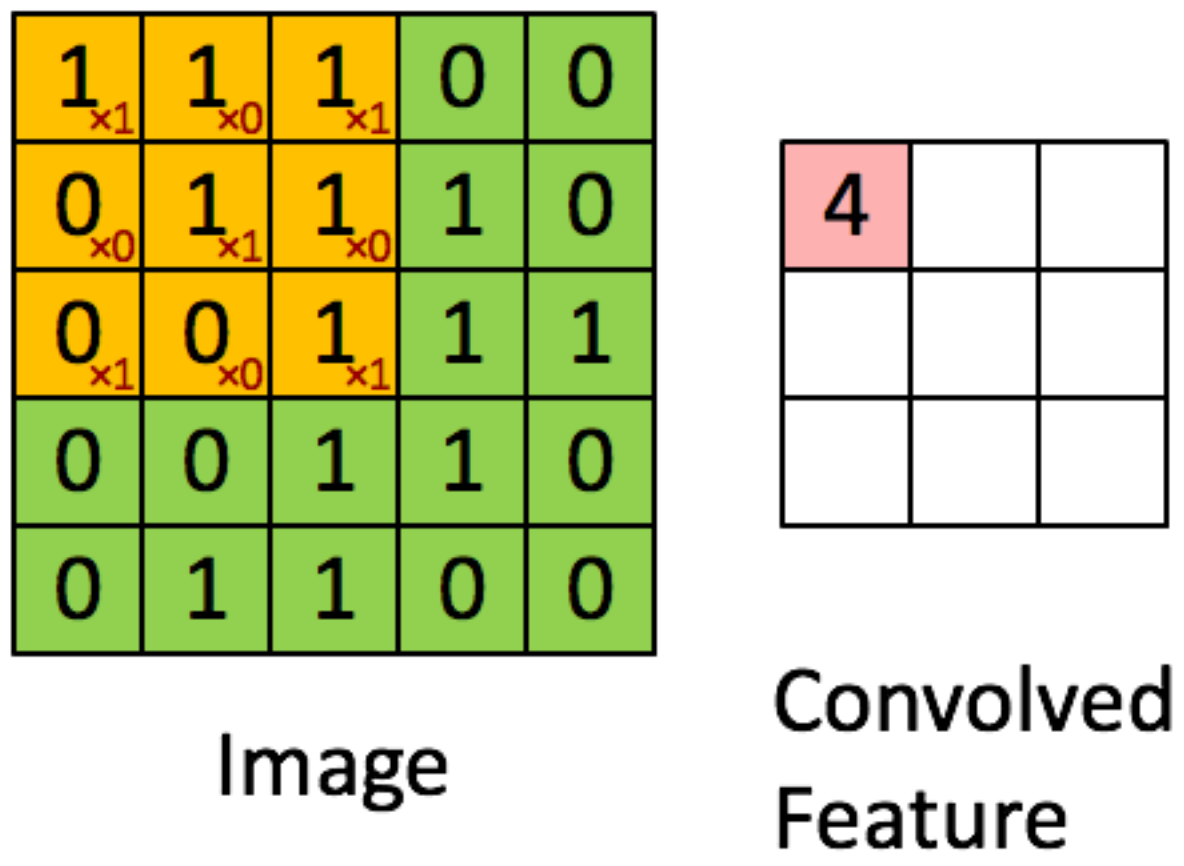
建立Convolution Layers & Max Pooling



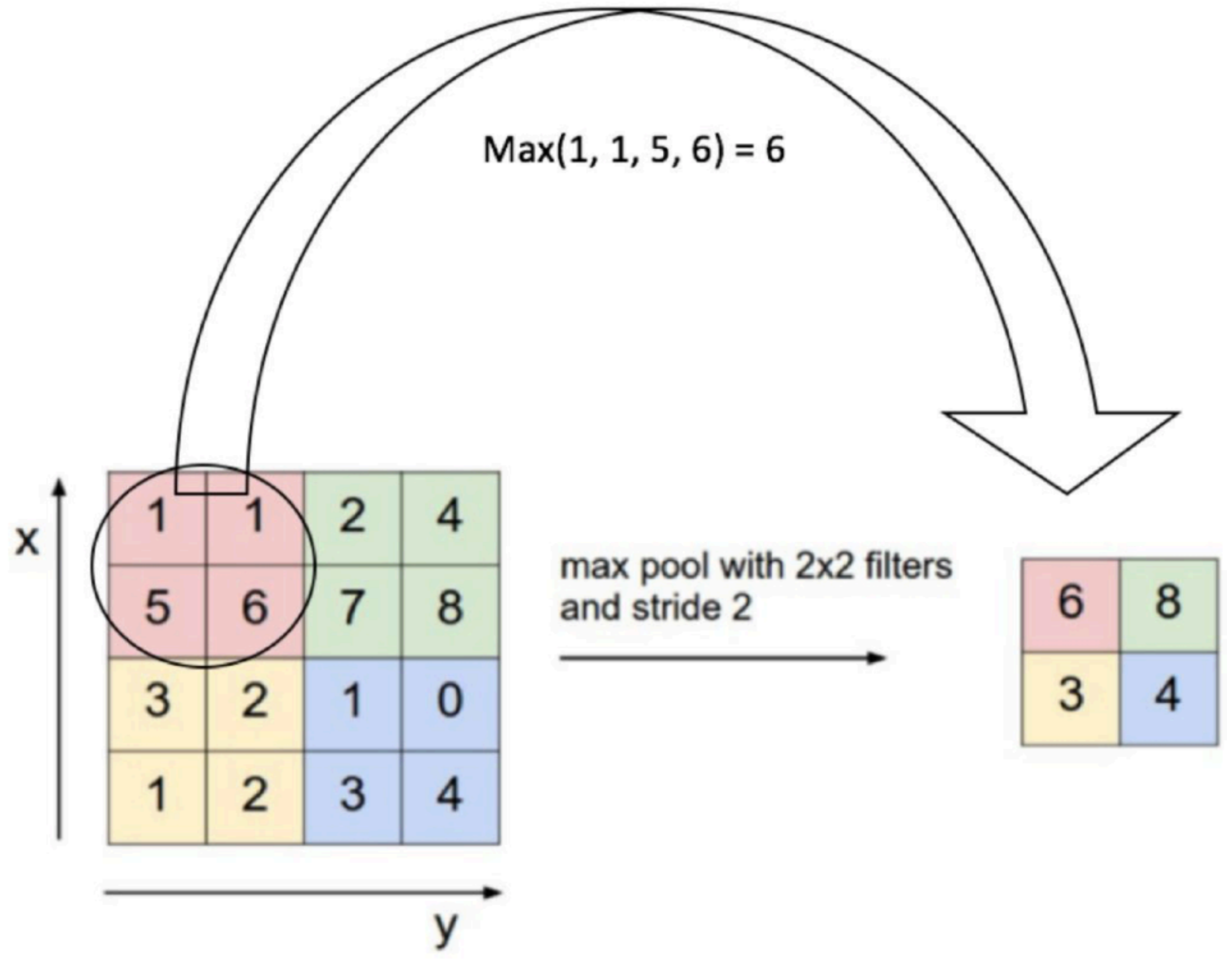
```python
from keras.models import Sequential
from keras.layers import Dense,Dropout,Flatten,Conv2D,MaxPool2D

model = Sequential()
# Create CN layer 1
model.add(Conv2D(filters=16,
                 kernel_size=(5,5),
                 padding='same',
                 input_shape=(28,28,1),
                 activation='relu',
                 name='conv2d_1'))
# Create Max-Pool 1
model.add(MaxPool2D(pool_size=(2,2), name='max_pooling2d_1'))

# Create CN layer 2
model.add(Conv2D(filters=36,
                 kernel_size=(5,5),
                 padding='same',
                 input_shape=(28,28,1),
                 activation='relu',
                 name='conv2d_2'))

# Create Max-Pool 2
model.add(MaxPool2D(pool_size=(2,2), name='max_pooling2d_2'))

# Add Dropout layer
model.add(Dropout(0.25, name='dropout_1'))
```

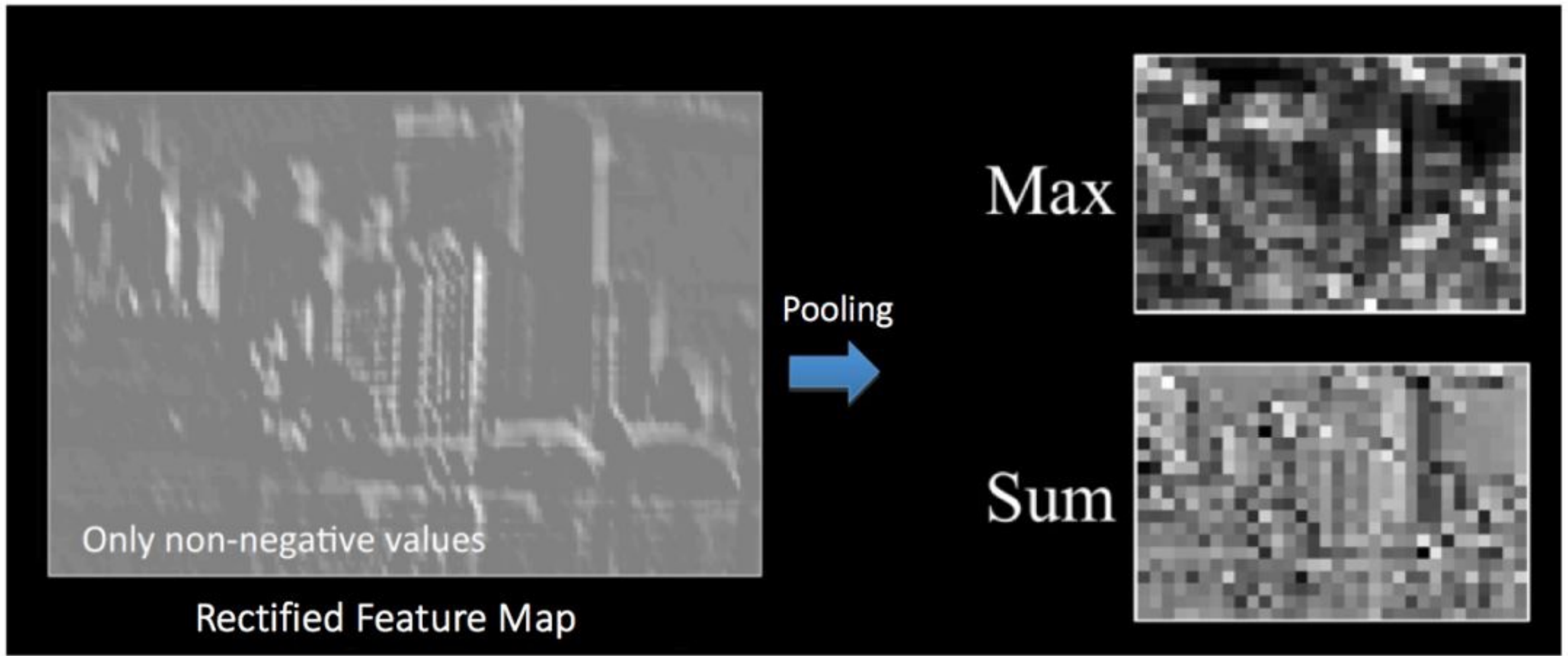
⚠️ Dropout：隨機扔掉權重降低複雜度

How Convolution Layers work?

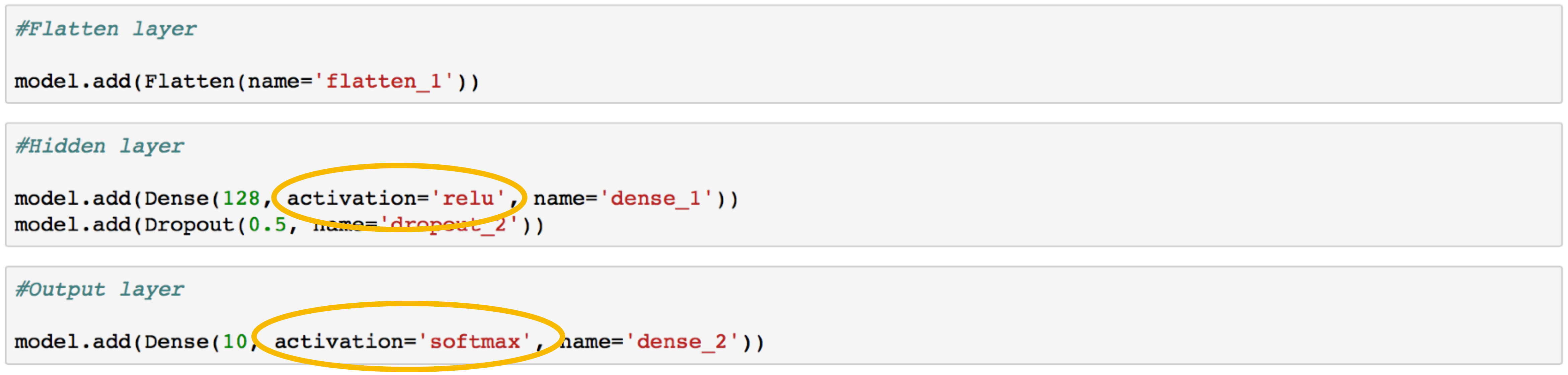


What is Max-Pooling?





Fully Connected FeedForward Network



```
#Flatten layer

model.add(Flatten(name='flatten_1'))
```

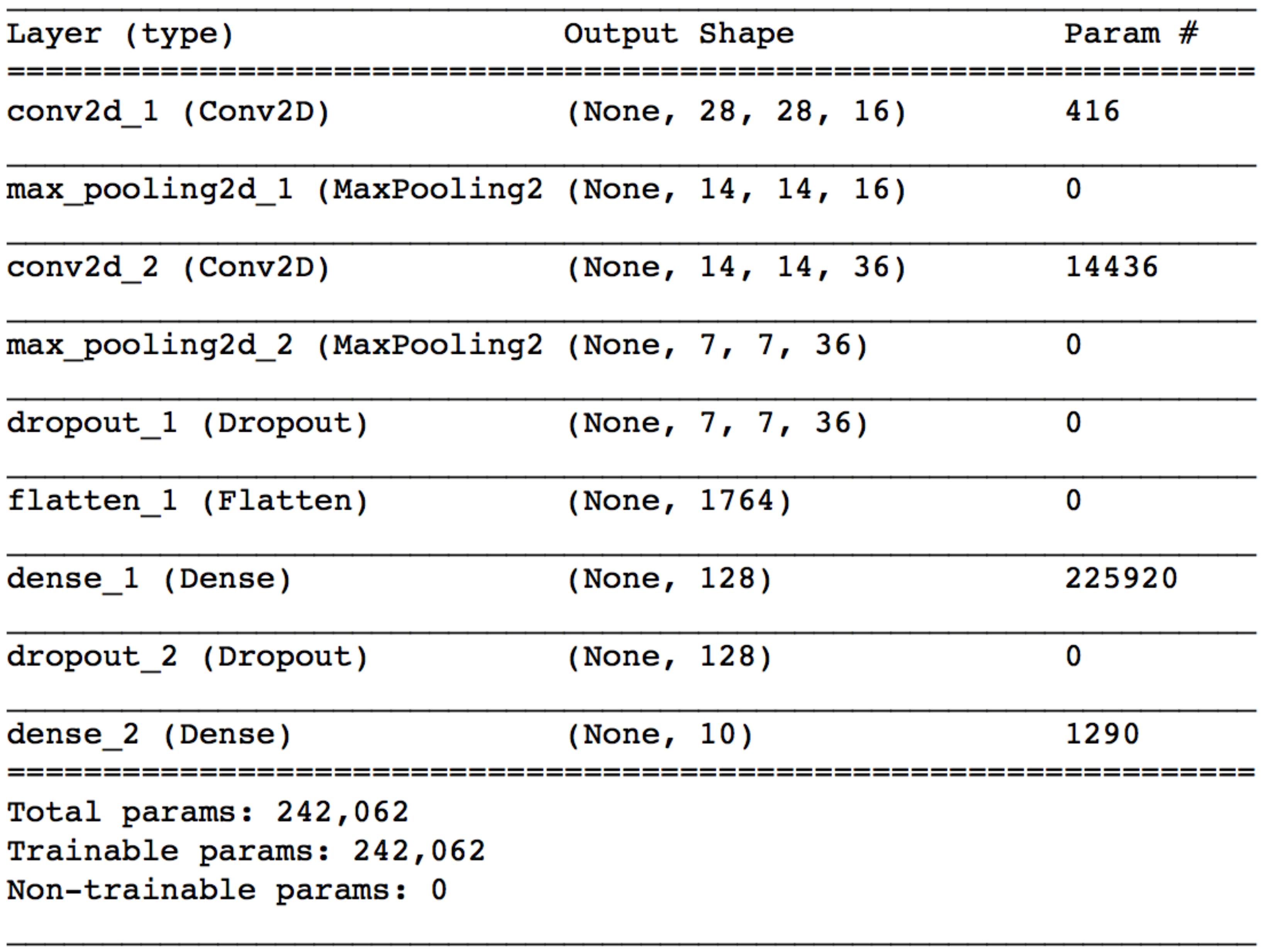
```
#Hidden layer

model.add(Dense(128, activation='relu', name='dense_1'))
model.add(Dropout(0.5, name='dropout_2'))
```

```
#Output layer

model.add(Dense(10, activation='softmax', name='dense_2'))
```

- ⚠️ Flatten Layer：將多維的資料壓縮成一維
- ⚠️ Relu : Output = Max(0, input)
- ⚠️ Softmax：輸出為機率，找出最大可能性

查看看

網路的架構如下👇👇



```
_________________________________________________________________
Layer (type)                 Output Shape              Param #
=================================================================
conv2d_1 (Conv2D)            (None, 28, 28, 16)        416
_________________________________________________________________
max_pooling2d_1 (MaxPooling2 (None, 14, 14, 16)        0
_________________________________________________________________
conv2d_2 (Conv2D)            (None, 14, 14, 36)        14436
_________________________________________________________________
max_pooling2d_2 (MaxPooling2 (None, 7, 7, 36)          0
_________________________________________________________________
dropout_1 (Dropout)          (None, 7, 7, 36)          0
_________________________________________________________________
flatten_1 (Flatten)          (None, 1764)              0
_________________________________________________________________
dense_1 (Dense)              (None, 128)               225920
_________________________________________________________________
dropout_2 (Dropout)          (None, 128)               0
_________________________________________________________________
dense_2 (Dense)              (None, 10)                1290
=================================================================
Total params: 242,062
Trainable params: 242,062
Non-trainable params: 0
_________________________________________________________________
```