CONVOLUTIONAL NEURAL NETWORKS WITH IMPLEMENTATION

SUBMITTED BY

SURAJ BHATTARAI
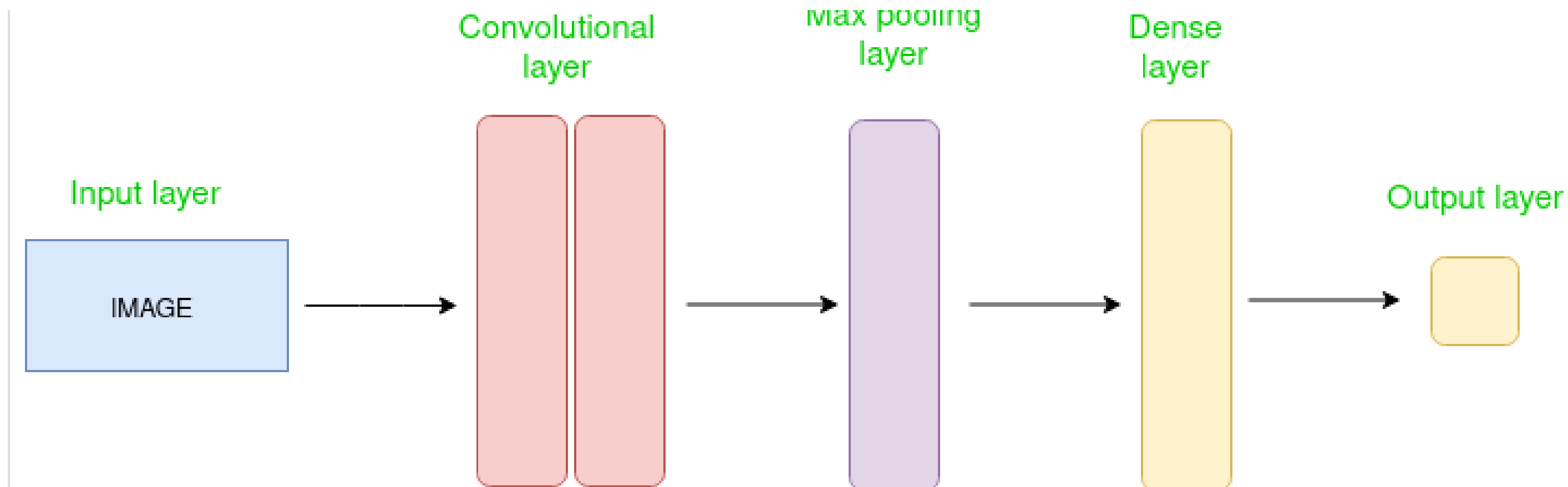
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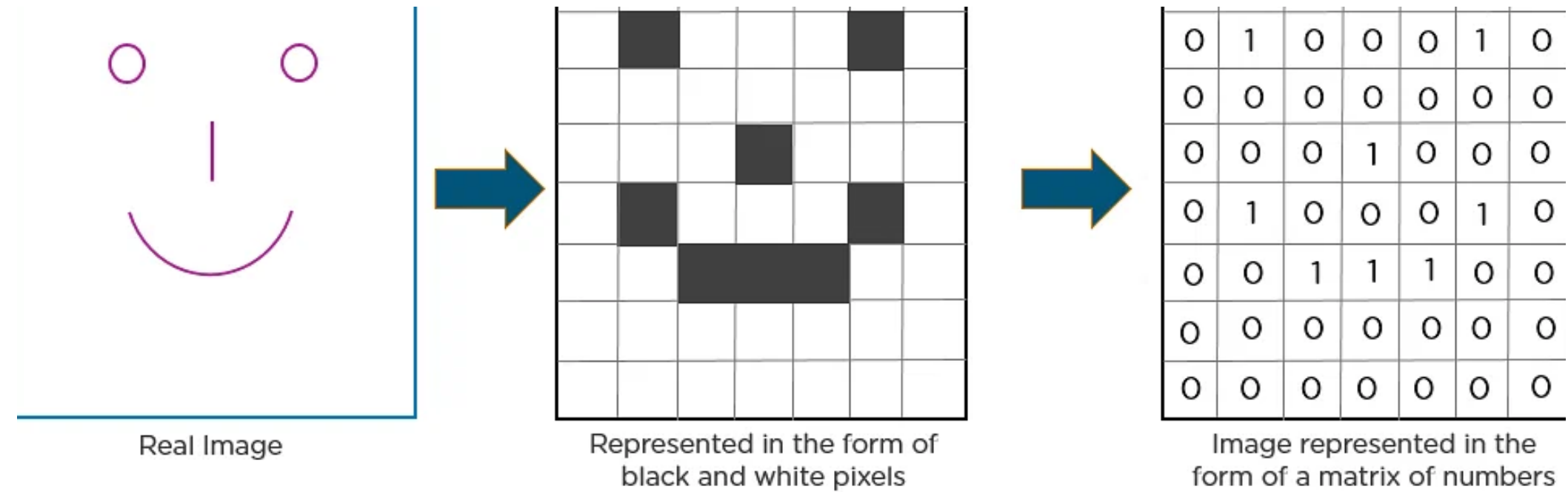
Introduction to CNN

- **convolutional neural network (CNN/ConvNet) is a class of deep neural networks, most commonly applied to analyze visual imagery.**
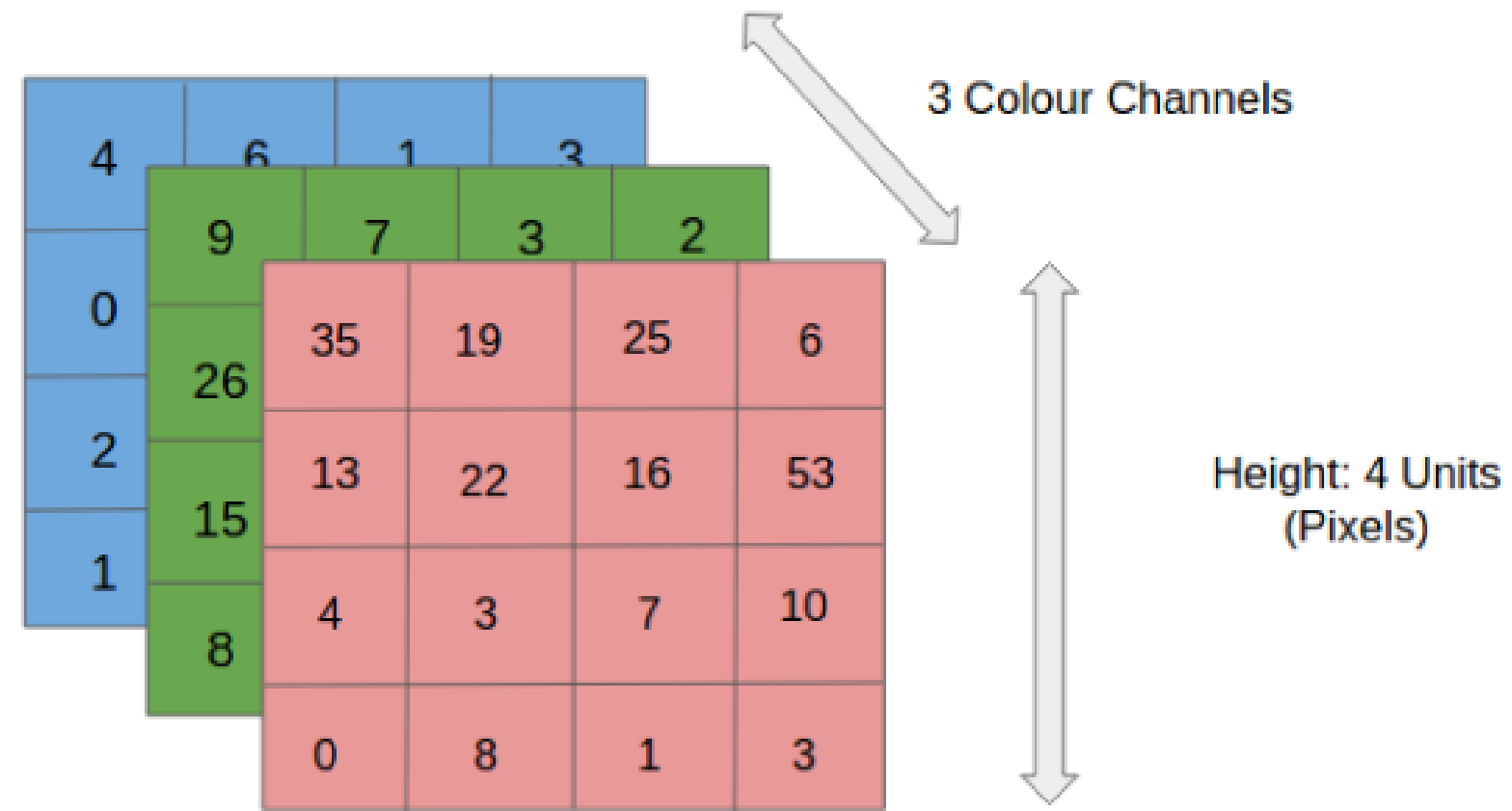

- **CONVOLUTIONAL NEURAL NETWORK IS USED TO DETECT AND CLASSIFY OBJECTS IN AN IMAGE.**

CNN continue...
How CNN recognizes image

Real Image

Represented in the form of black and white pixels

Image represented in the form of a matrix of numbers
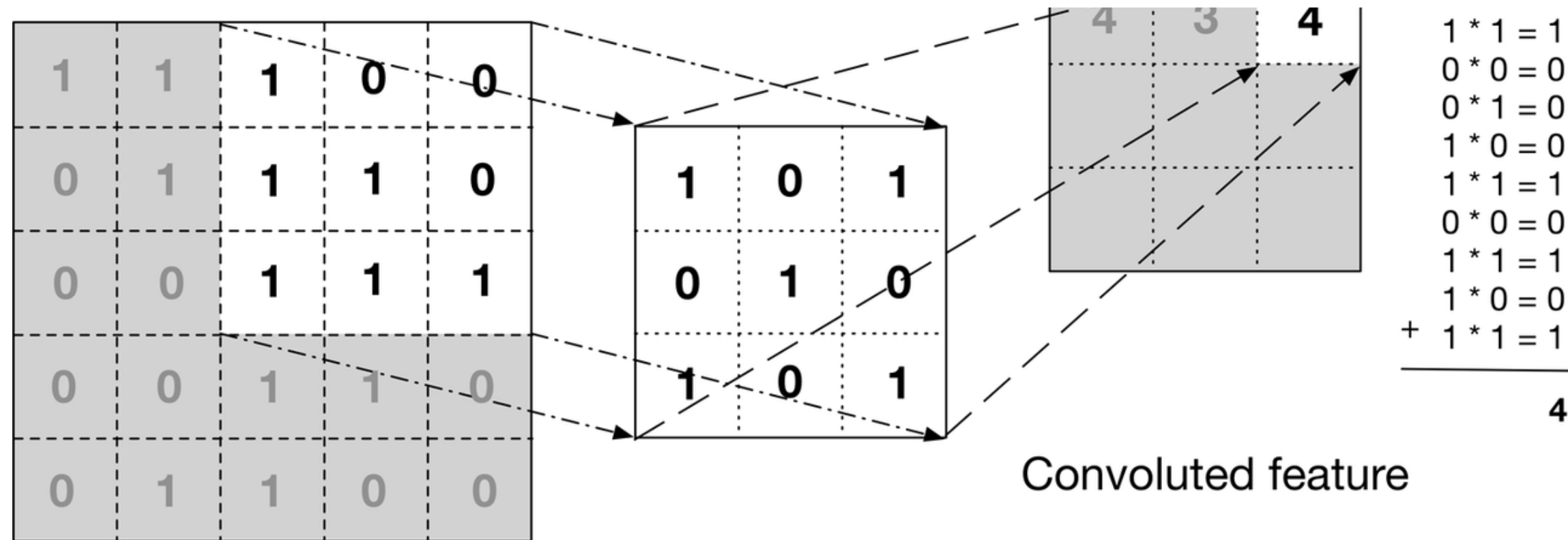
RGB CHANNEL

3 Colour Channels

Height: 4 Units (Pixels)

Layers in a Convolutional Neural Network

- **CONVOLUTION LAYER**
- **RELU LAYER**
- **POOLING LAYER**
- **FULLY CONNECTED LAYER**

CONVOLUTION LAYER

Convoluted feature

1	1	1	0	0
0	1×1	1×0	1×1	0
0	0×0	1×1	1×0	1
0	0×1	1×0	1×1	0
0	1	1	0	0

Image

4	3	4
2	4	

Convolved
Feature

image dimension : nxn
filter dimension: fxf
 then new convoluted dimension
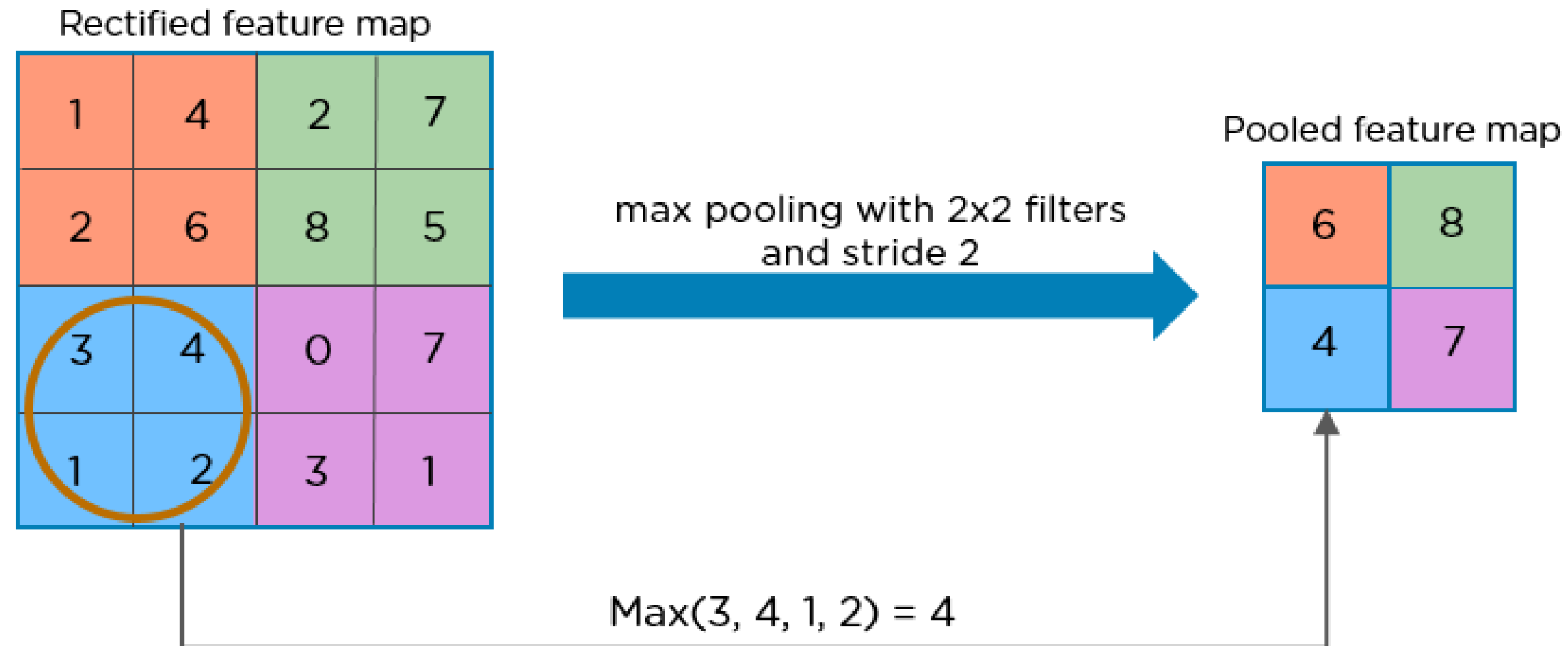$Hnew = (n-f+2p)/s + 1$

Relu layer

- ReLU performs an element-wise operation and sets all the negative pixels to 0

- It outputs the input value itself if it's positive, otherwise outputs zero.

- **Benefits of ReLU in CNN:**
    - Faster training convergence
    - Better generalization performance
    - Less prone to vanishing gradients
   - Computationally efficient
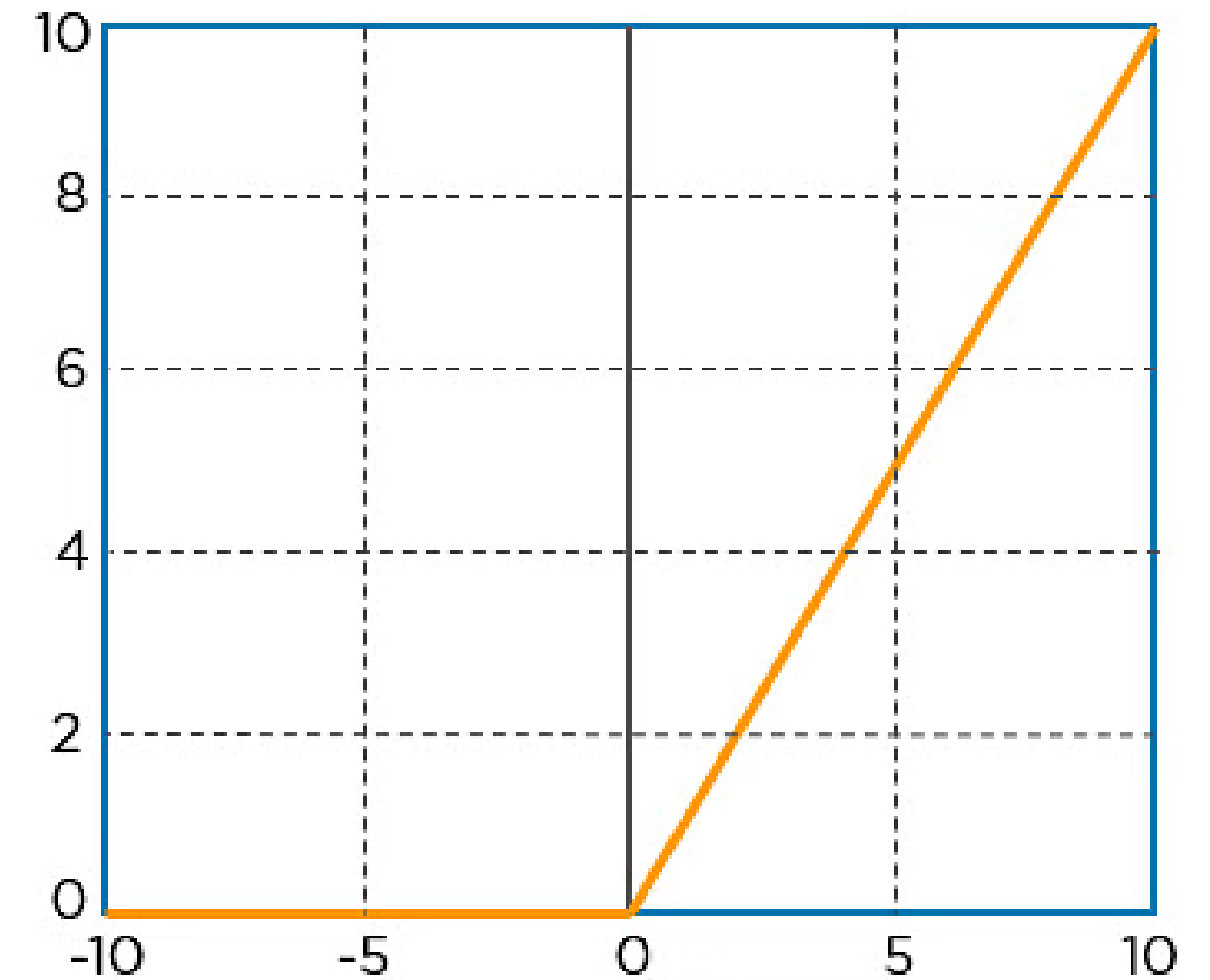
$$R(z) = max(0, z)$$

POOLING LAYER

- Pooling layer is responsible for reducing the spatial size of the Convolved Feature
- decrease the computational power required to process the data by reducing the dimensions.
- two types of poling are max pooling and average pooling

Rectified feature map

1	4	2	7
2	6	8	5
3	4	0	7
1	2	3	1

max pooling with 2x2 filters and stride 2

Pooled feature map

6	8
4	7

Max(3, 4, 1, 2) = 4

THE POOLING LAYER USES VARIOUS FILTERS TO IDENTIFY DIFFERENT PARTS OF THE IMAGE LIKE EDGES, CORNERS, BODY, FEATHERS, EYES ETC.
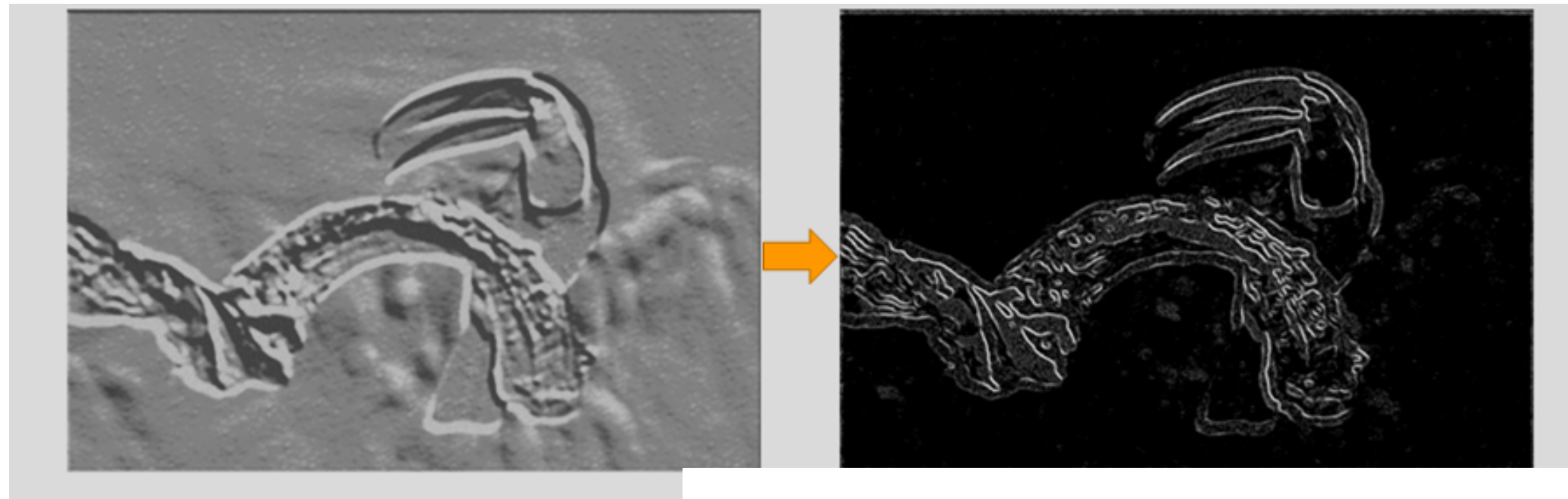
- once the pool featured map is obtained , next step is to faltten it

Pooled feature map

Flattening

| 6 |
| 8 |
| 4 |
| 7 |
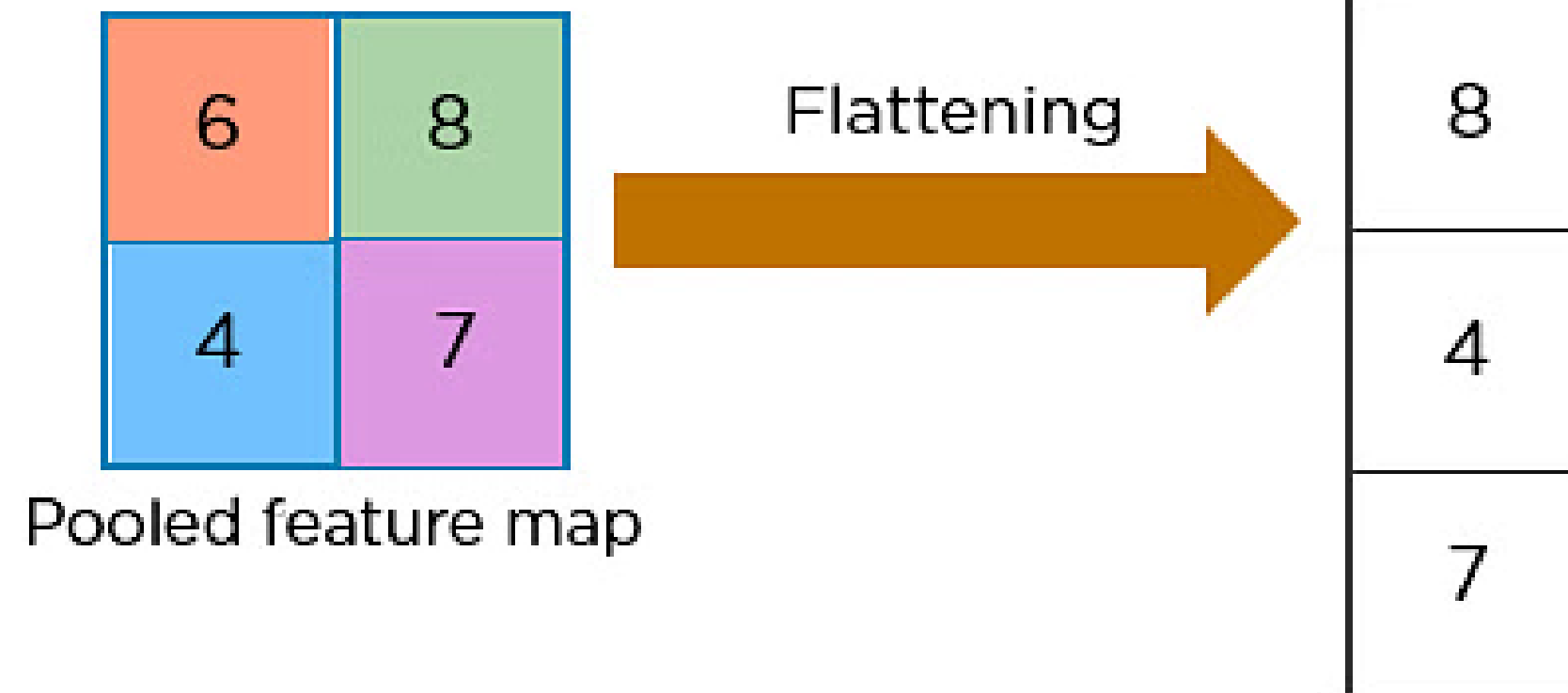
operation of CNN in Summary
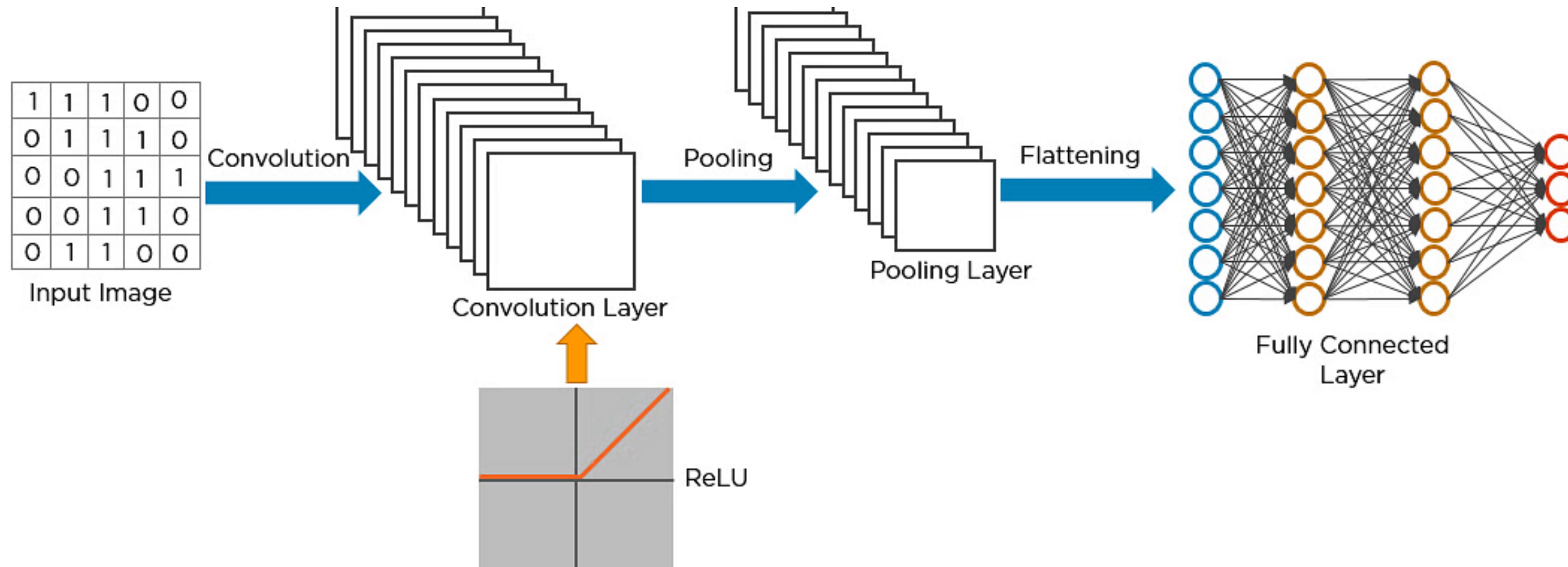
Implementation of CNN

Credit card fraud detection using kaggle dataset