

GLOW 2024

DEEP LEARNING

Convolutional Neural Network



Nur Laila Ab Ghani
Department of informatics
College of Computing and Informatics
Universiti Tenaga Nasional
Laila@uniten.edu.my

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Outline

- Introduction to Deep Learning
- Basic CNN

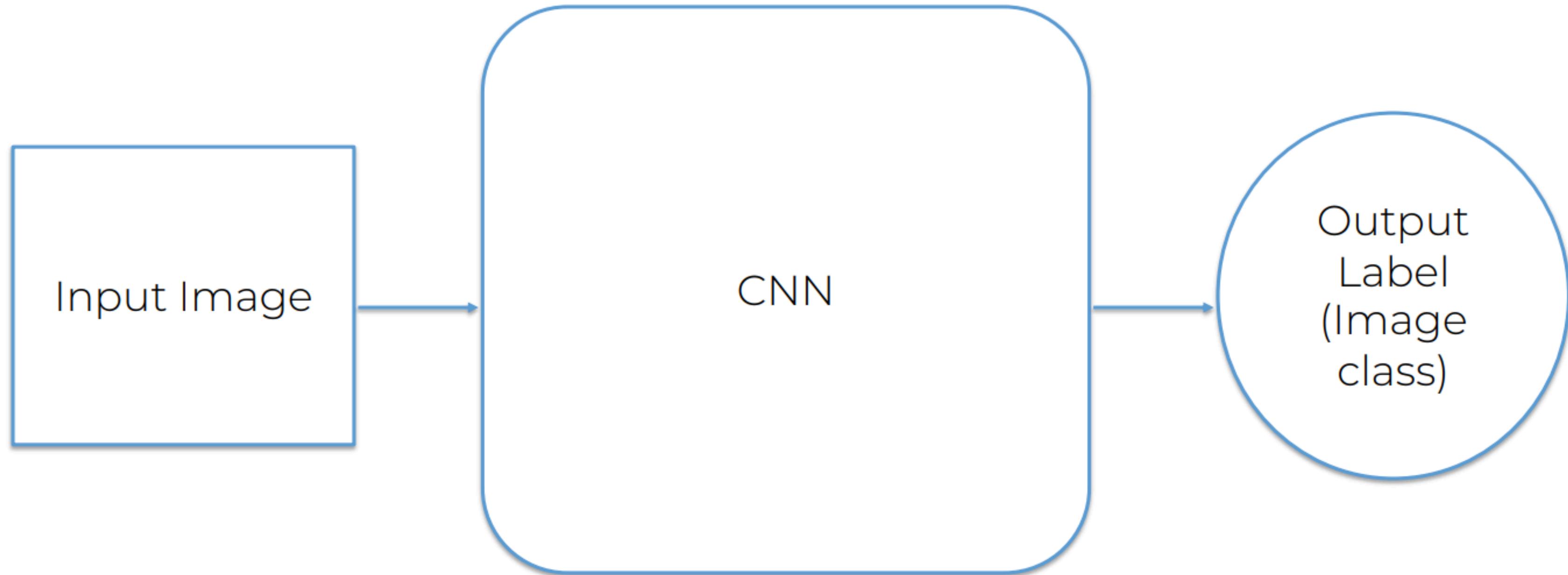


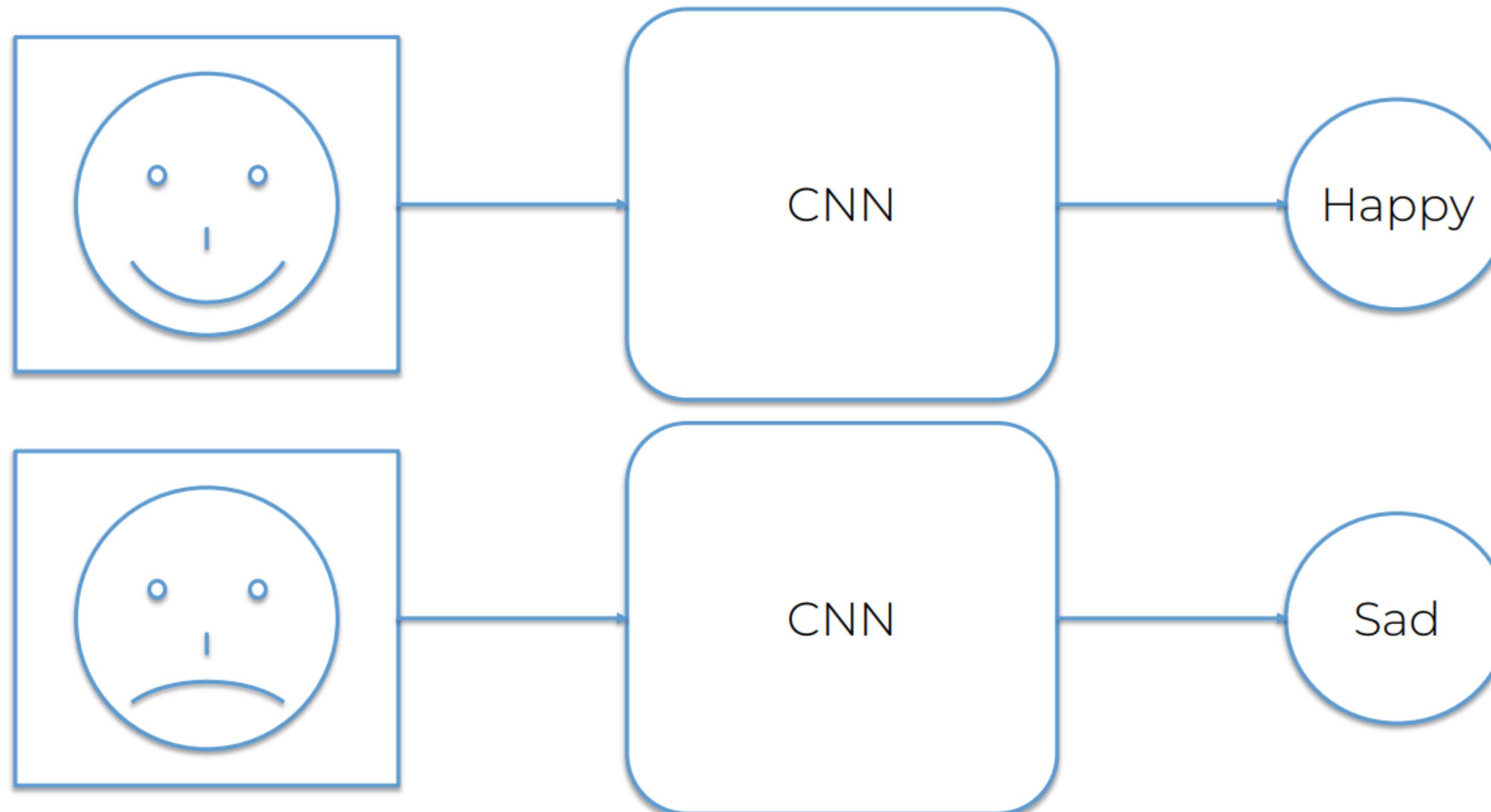
Artificial Intelligence has been witnessing a monumental growth in bridging the gap between the capabilities of humans and machines. Researchers work on numerous aspects of the field to make amazing things happen. One of many such areas is the domain of **Computer Vision**.

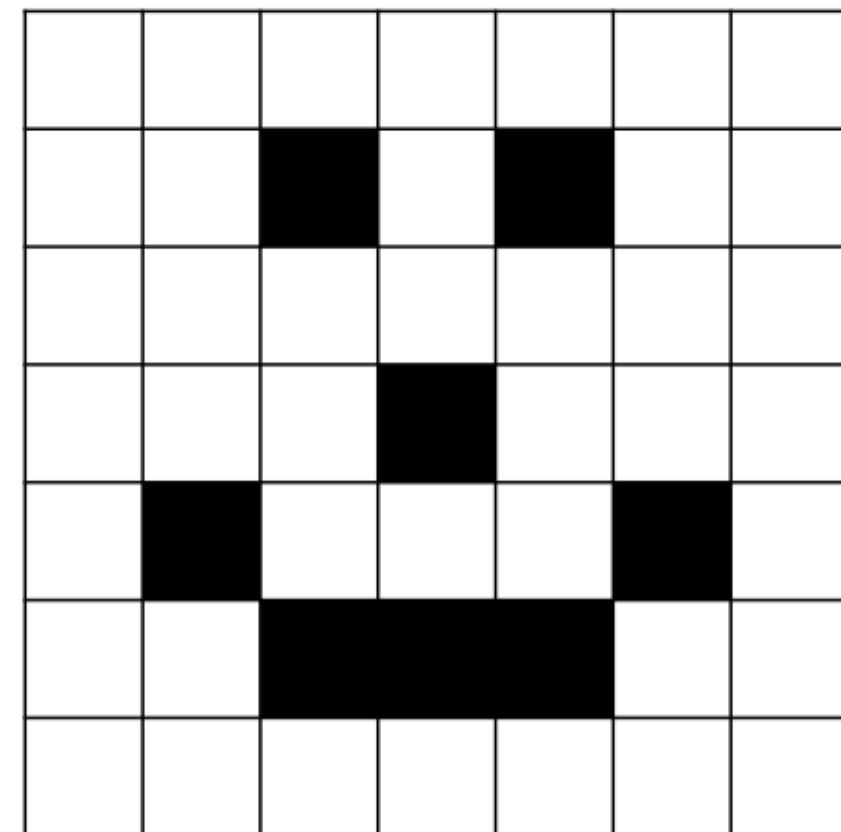
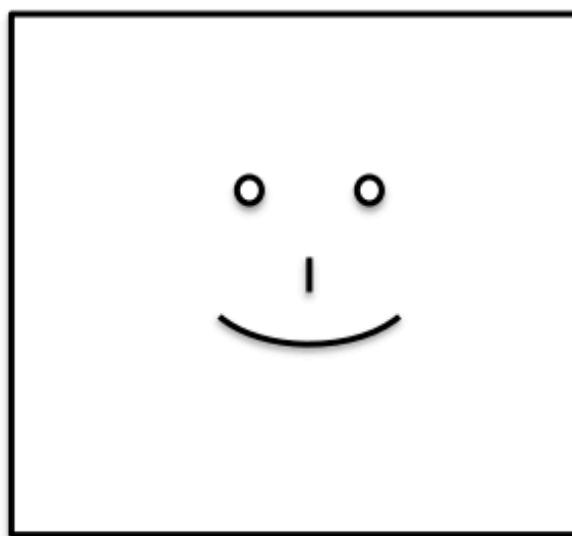
Computer vision is a field of computer science that works on enabling computers to see, identify and process images in the same way that human vision does, and then provide appropriate output.

- A **Convolutional Neural Network (CNN)** is a Deep Learning algorithm which can take in an input image, assign importance (learnable weights) to various objects in the image and be able to differentiate one from the other.
- The pre-processing required in a CNN is much lower as compared to other classification algorithms.

- A **Convolutional Neural Network (CNN)** is a Deep Learning algorithm which can take in an input image, assign importance (learnable weights) to various objects in the image and be able to differentiate one from the other.
- The pre-processing required in a CNN is much lower as compared to other classification algorithms.







0	0	0	0	0	0	0
0	1	0	0	0	1	0
0	0	0	0	0	0	0
0	0	0	1	0	0	0
0	1	0	0	0	1	0
0	0	1	1	1	0	0
0	0	0	0	0	0	0

STEP 1: Convolution



STEP 2: Max Pooling



STEP 3: Flattening



STEP 4: Full Connection

1. Convolutional (Smiling Face)

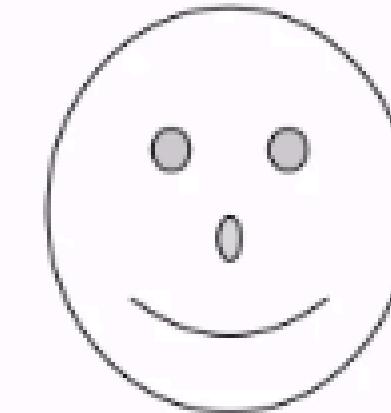


0	0	0	0	0	0	0
0	1	0	0	0	1	0
0	0	0	0	0	0	0
0	0	0	1	0	0	0
0	1	0	0	0	1	0
0	0	1	1	1	0	0
0	0	0	0	0	0	0

Input Image

0	0	1
1	0	0
0	1	1

Feature Detector



Feature Detector/Filter/Kernel:

It extracts some features from our image, stores in separate 2D array and compress the image.

HOW?

We are going to match Feature detector with original image to compress it.

0	0	0	0	0	0	0
0	1	0	0	0	1	0
0	0	0	0	0	0	0
0	0	0	1	0	0	0
0	1	0	0	0	1	0
0	0	1	1	1	0	0
0	0	0	0	0	0	0

Input
Image



0	0	1
1	0	0
0	1	1

Feature
Detector

0				

=

Feature Map

0	0	0	0	0	0	0
0	1	0	0	0	1	0
0	0	0	0	0	0	0
0	0	0	1	0	0	0
0	1	0	0	0	1	0
0	0	1	1	1	0	0
0	0	0	0	0	0	0



0	0	1
1	0	0
0	1	1



0	1			

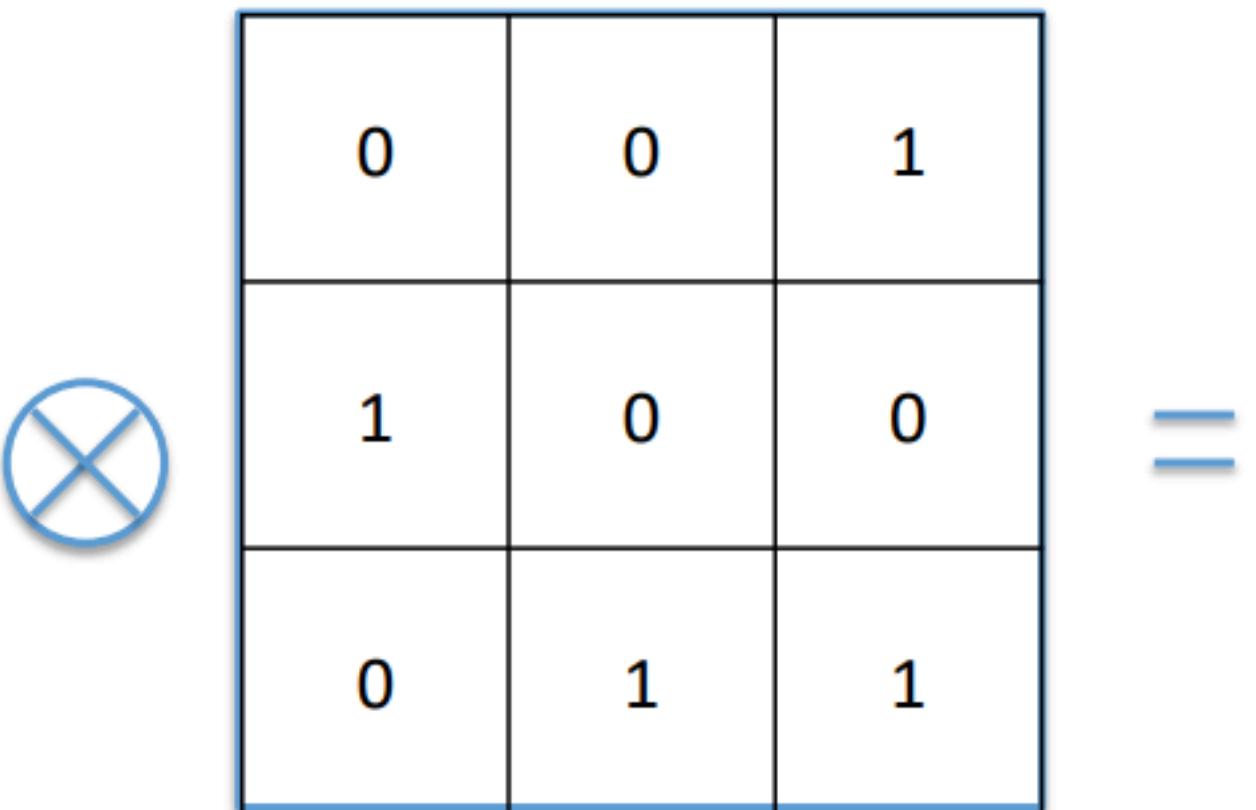
Input
Image

Feature
Detector

Feature Map

0	0	0	0	0	0	0	0
0	1	0	0	0	1	0	
0	0	0	0	0	0	0	
0	0	0	1	0	0	0	
0	1	0	0	0	1	0	
0	0	1	1	1	0	0	
0	0	0	0	0	0	0	

Input
Image



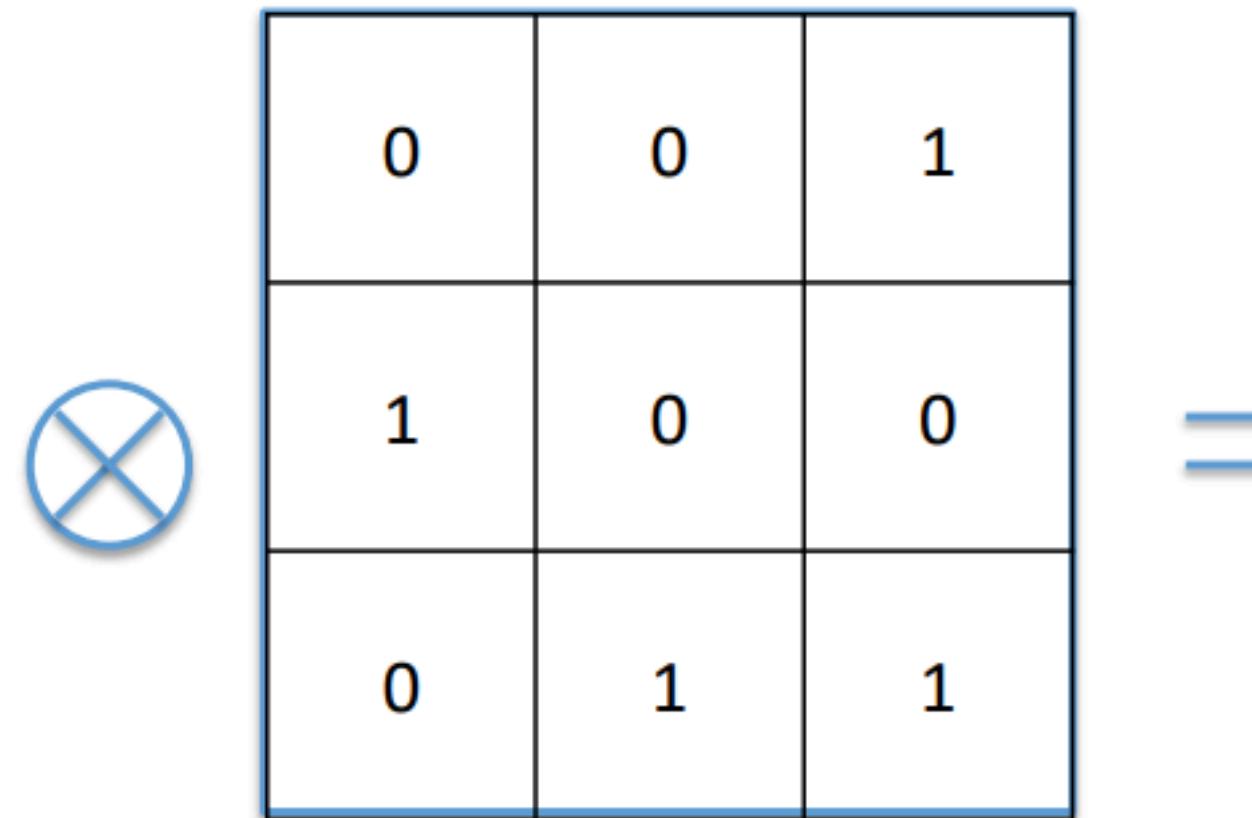
Feature
Detector

0	1	0					

Feature Map

0	0	0	0	0	0	0
0	1	0	0	0	1	0
0	0	0	0	0	0	0
0	0	0	1	0	0	0
0	1	0	0	0	1	0
0	0	1	1	1	0	0
0	0	0	0	0	0	0

Input
Image



Feature
Detector

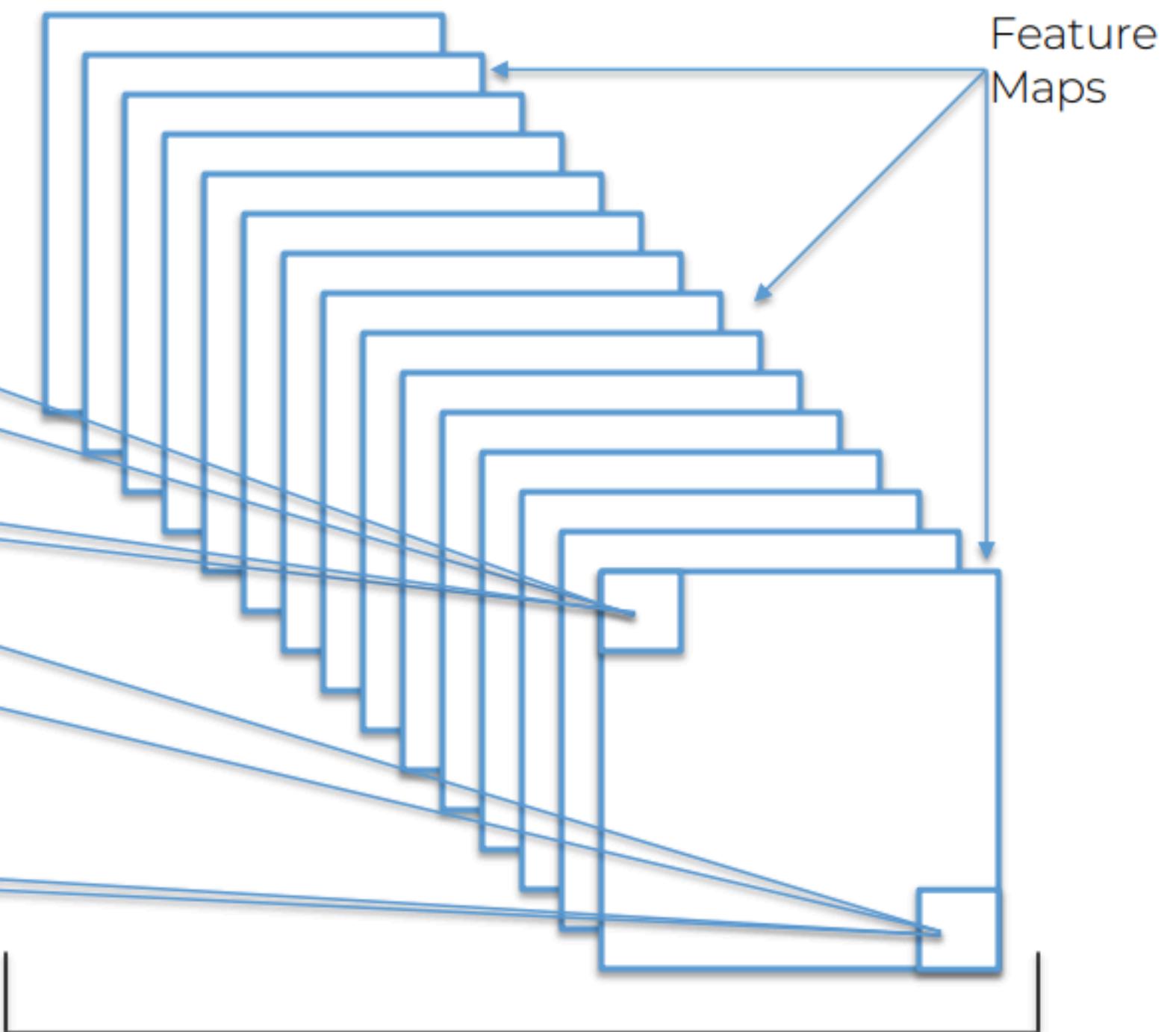
0	1	0	0	0
0	1	1	1	0
1	0	1	2	1
1	4	2	1	0
0	0	1	2	1

Feature Map

0	0	0	0	0	0	0	0
0	1	0	0	0	1	0	0
0	0	0	0	0	0	0	0
0	0	0	1	0	0	0	0
0	1	0	0	0	1	0	0
0	0	1	1	1	0	0	0
0	0	0	0	0	0	0	0

Input Image

We create many feature maps to obtain our first convolution layer

Convolutional
Layer

2. Pooling

A pooling layer is another building block of a CNN.

This is basically a function which reduces the pixels of “Feature Map” and change in Pooled Feature Map, Common technique is **Max Pooling**.

0	1	0	0	0
0	1	1	1	0
1	0	1	2	1
1	4	2	1	0
0	0	1	2	1

Feature Map

Max Pooling

Pooled Feature Map



0	1	0	0	0
0	1	1	1	0
1	0	1	2	1
1	4	2	1	0
0	0	1	2	1

Feature Map

Max Pooling



1		

Pooled Feature Map

0	1	0	0	0
0	1	1	1	0
1	0	1	2	1
1	4	2	1	0
0	0	1	2	1

Feature Map

Max Pooling



1	1	

Pooled Feature Map

0	1	0	0	0
0	1	1	1	0
1	0	1	2	1
1	4	2	1	0
0	0	1	2	1

Feature Map

Max Pooling

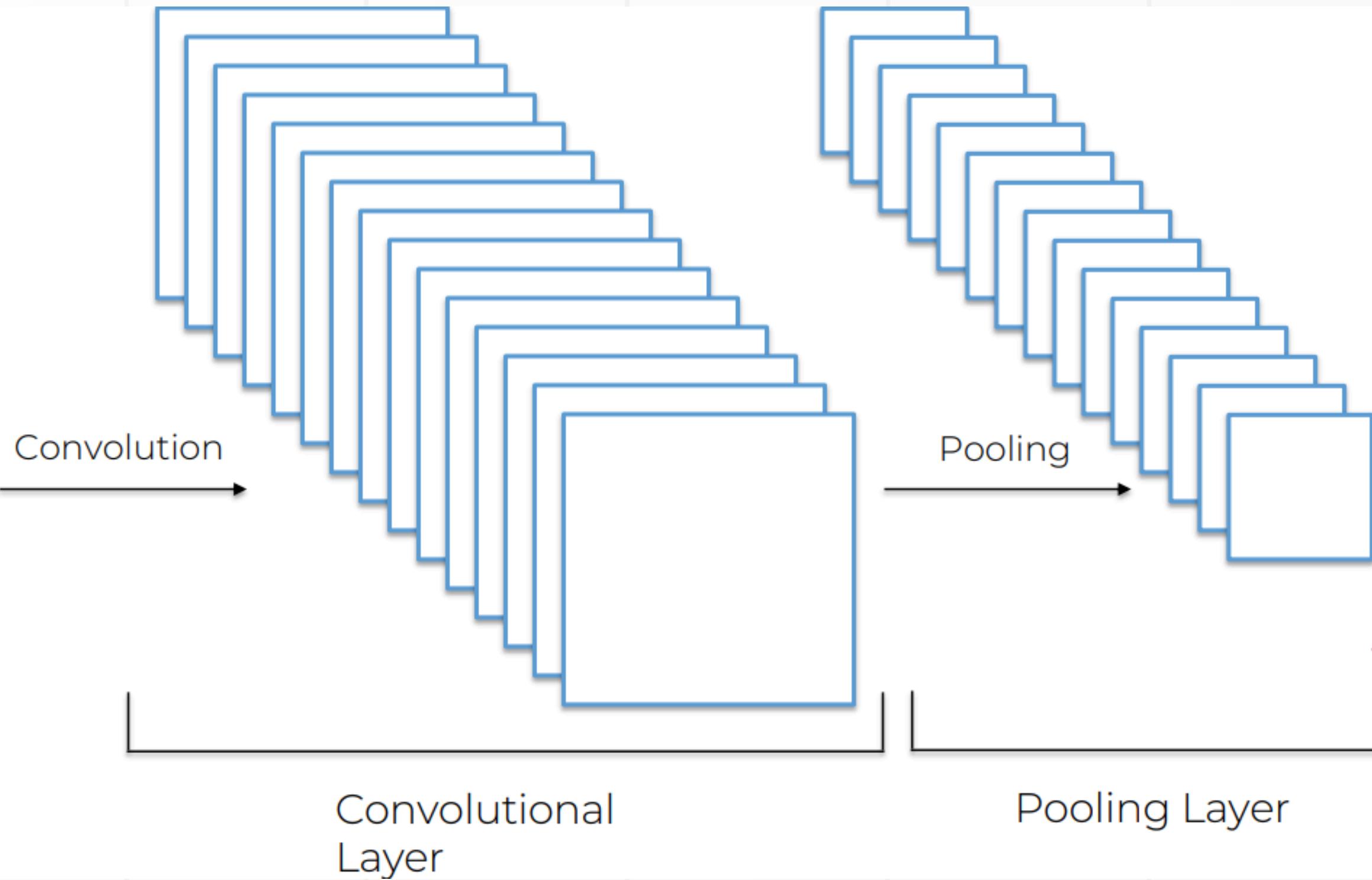


1	1	0
4	2	1
0	2	1

Pooled Feature Map

0	0	0	0	0	0	0
0	1	0	0	0	1	0
0	0	0	0	0	0	0
0	0	0	1	0	0	0
0	1	0	0	0	1	0
0	0	1	1	1	0	0
0	0	0	0	0	0	0

Input Image



3. Flattening

Flattening is converting the data into a 1-dimensional array for inputting it to the next layer. We flatten the output of the convolutional layers to create a single long feature vector. And it is connected to the final classification model, which is called a fully-connected layer

1	1	0
4	2	1
0	2	1

Pooled Feature Map

1	1	0
4	2	1
0	2	1

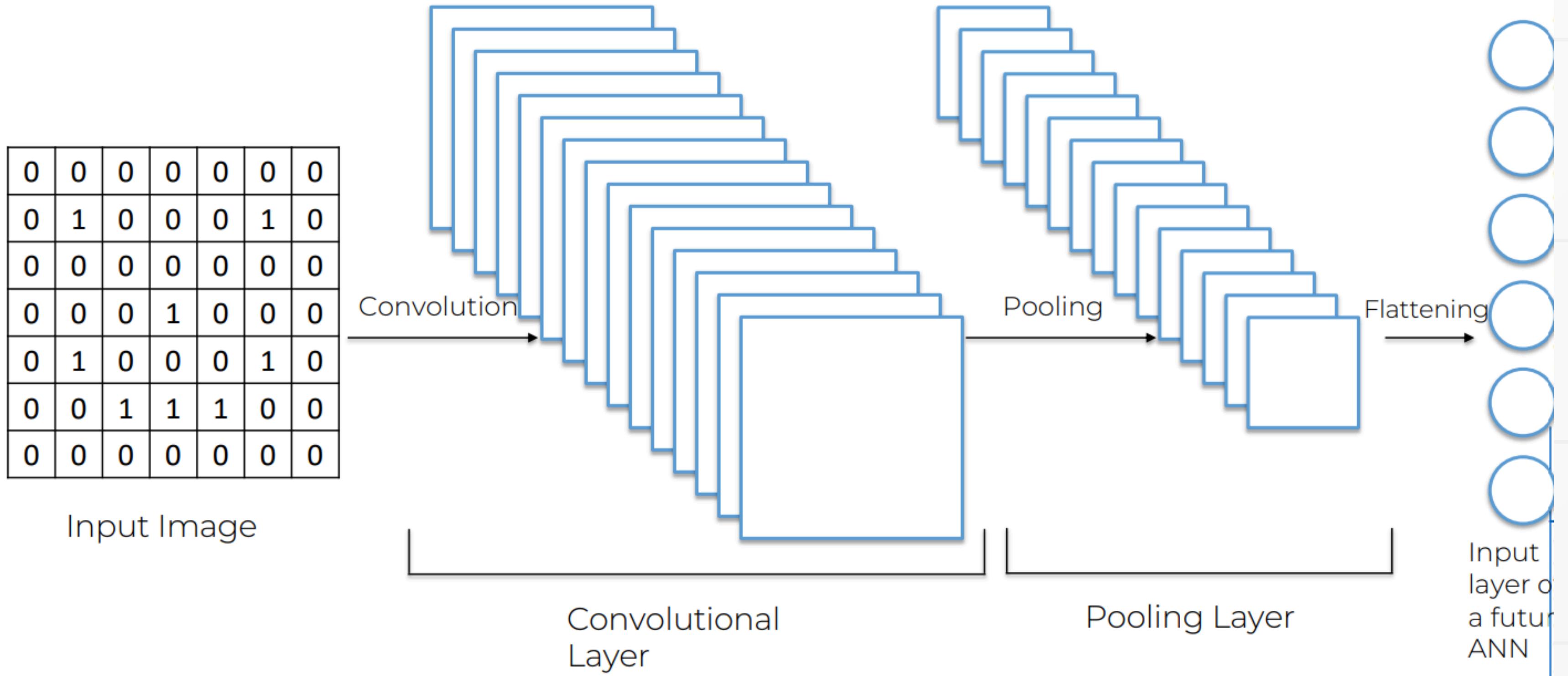
Pooled Feature
Map

Flattening

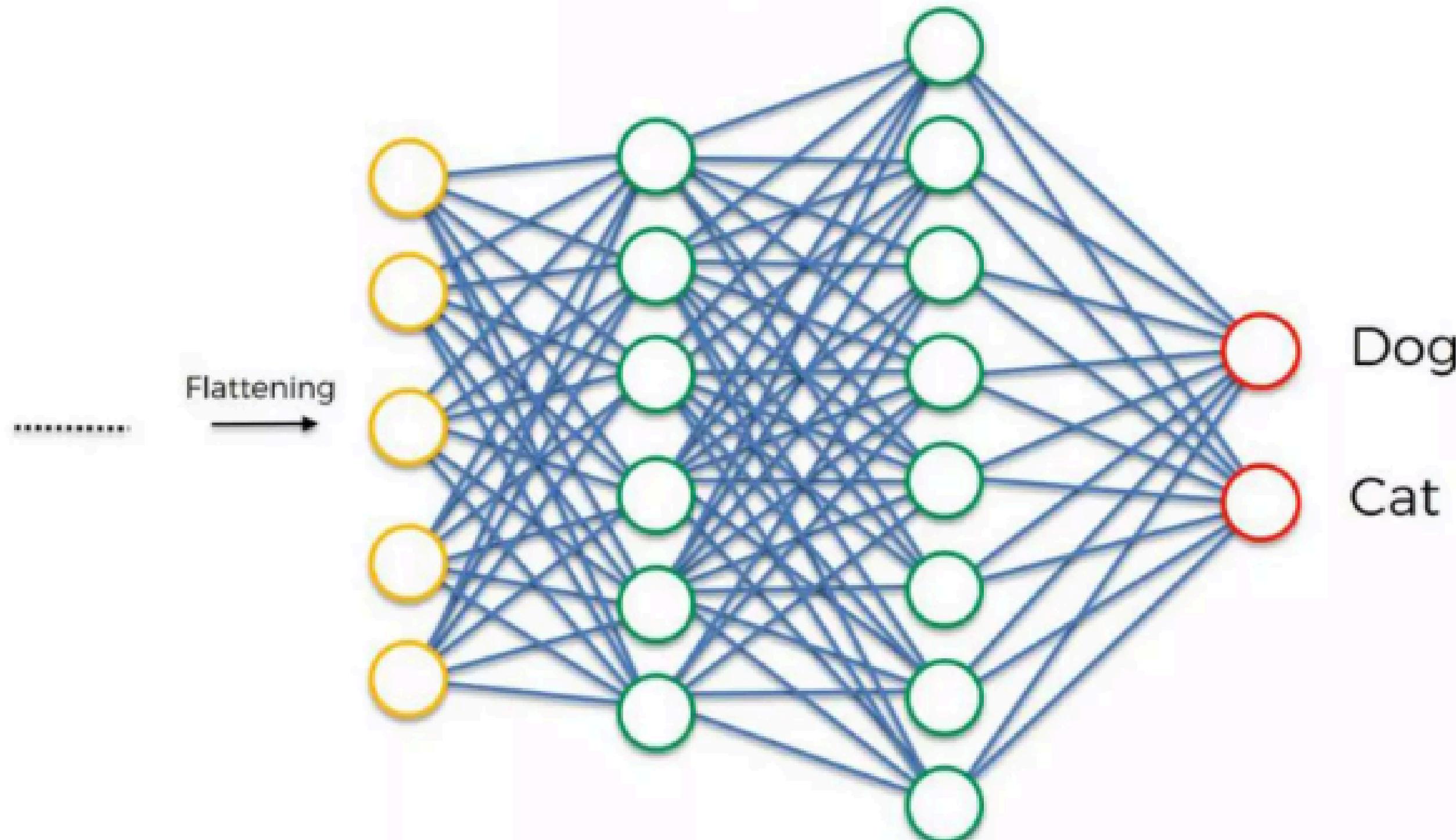


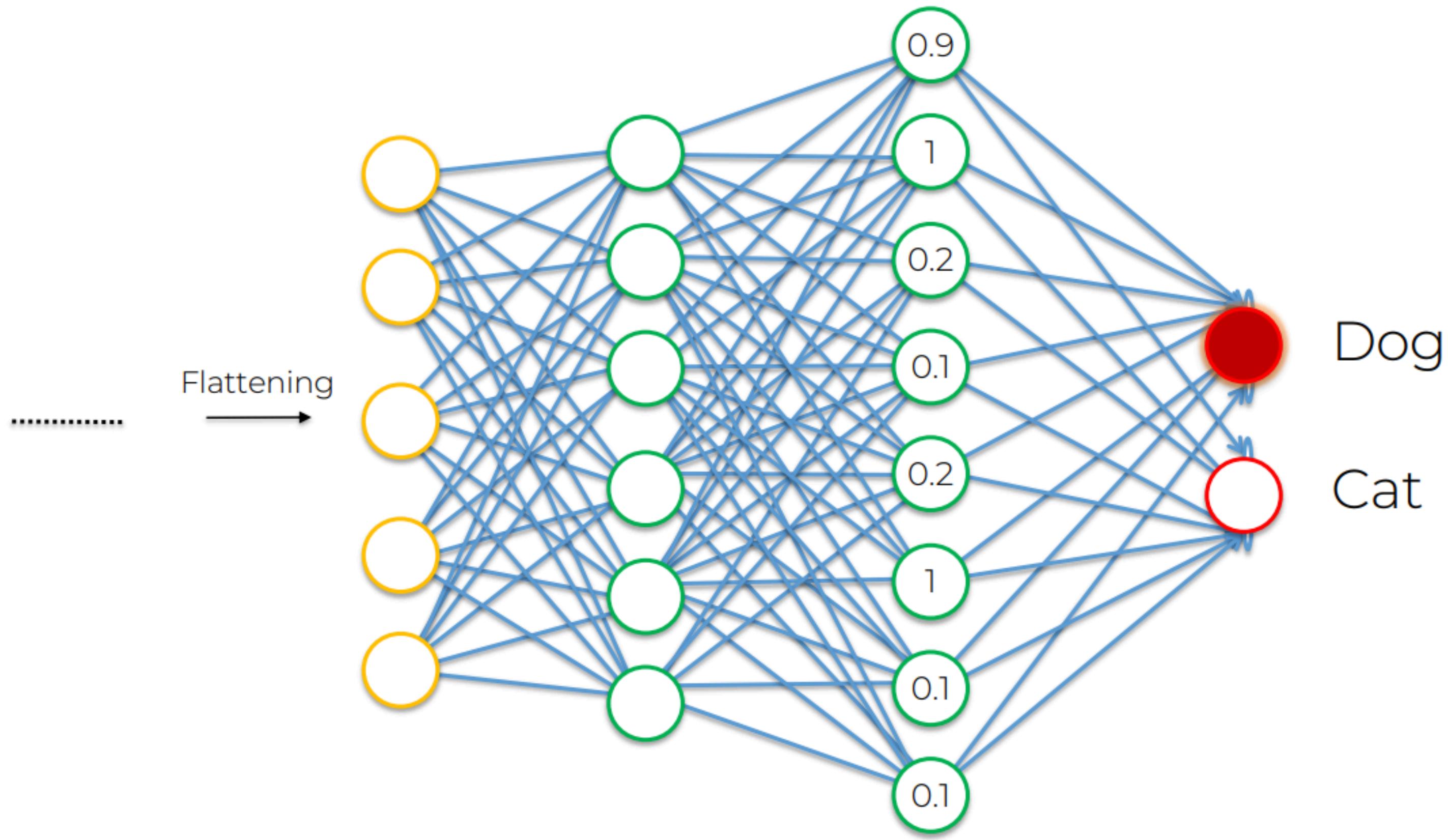
1
1
0
4
2
1
0
2
1

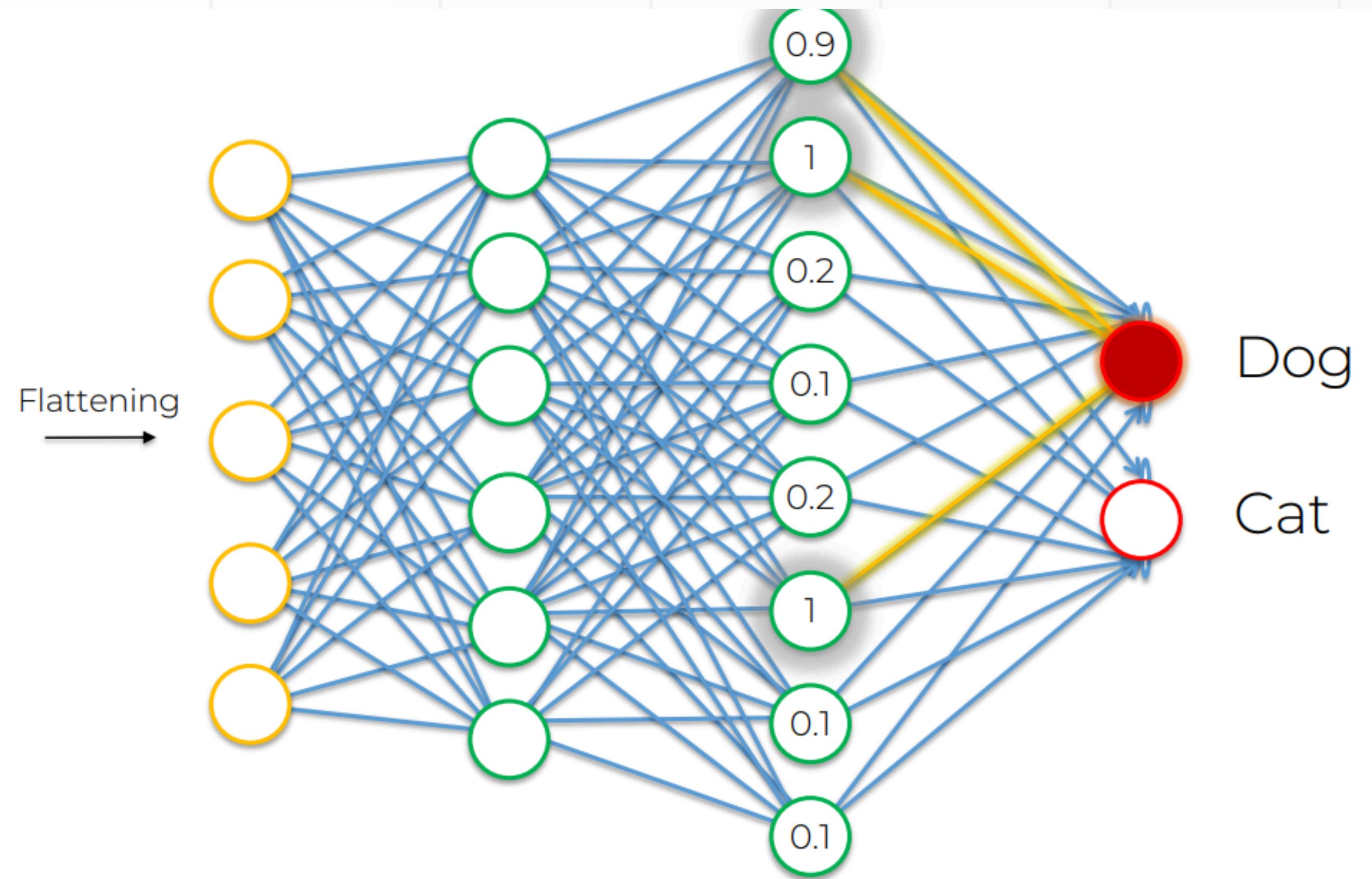


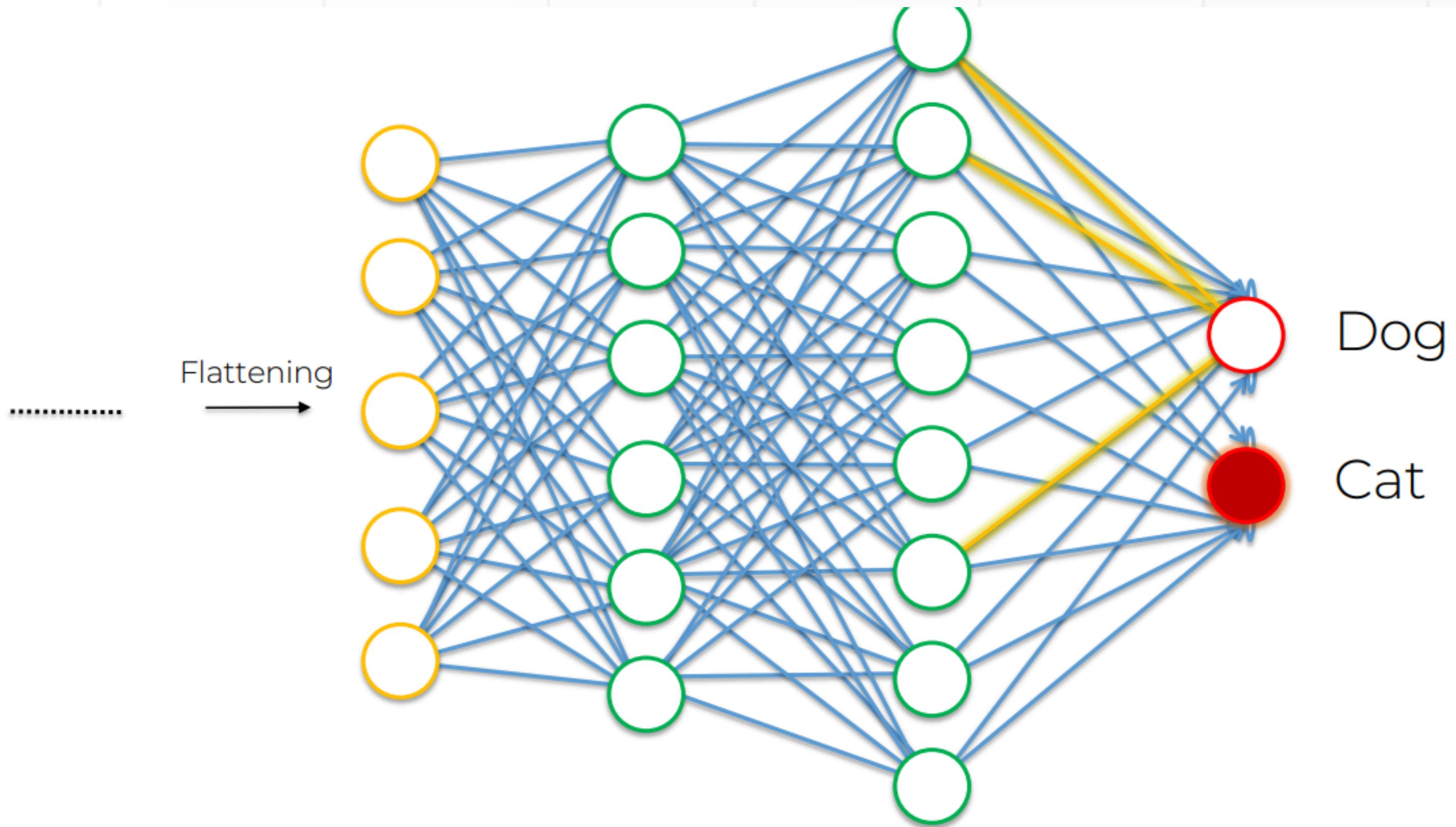


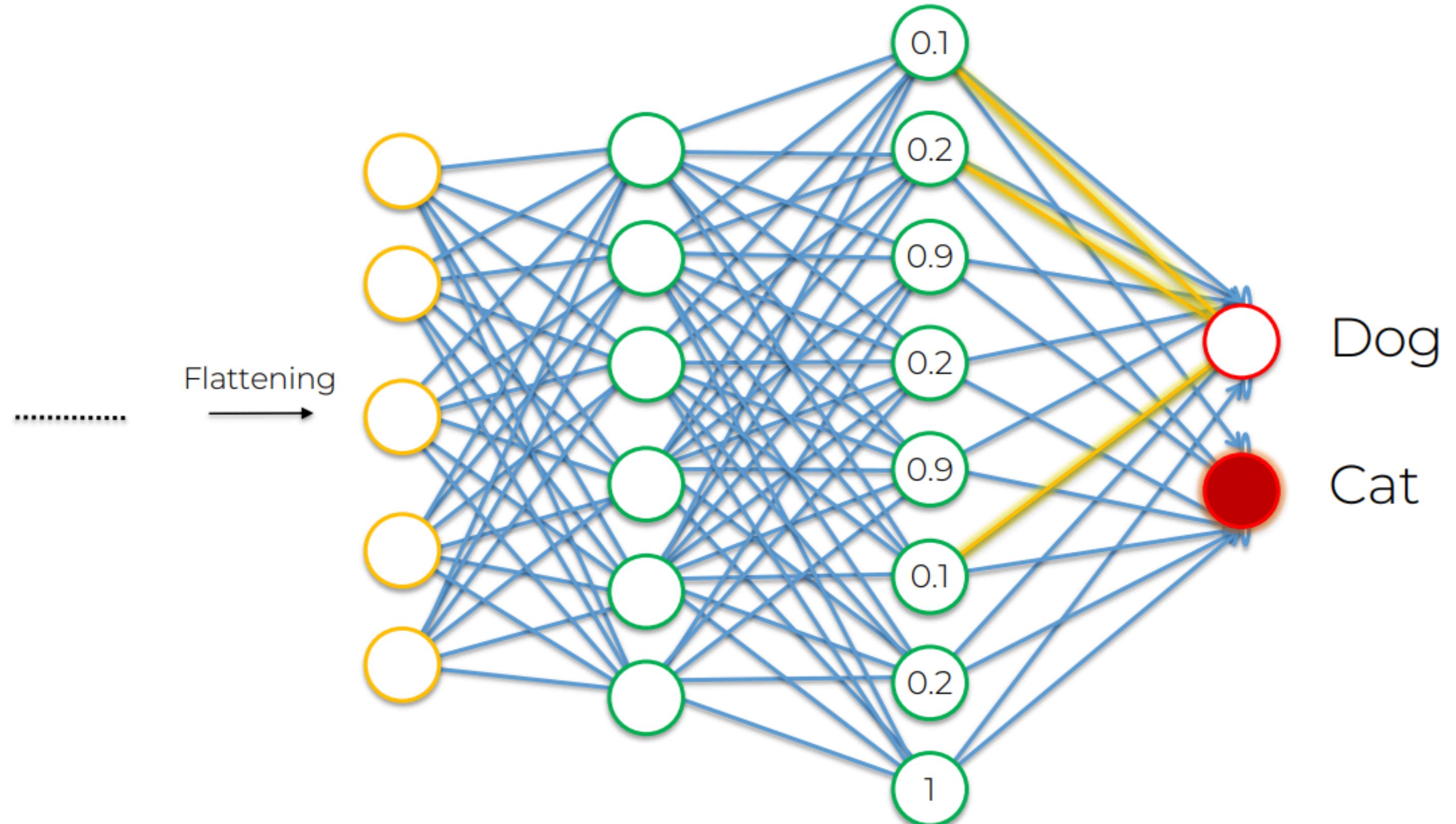
4. Fulling Connection

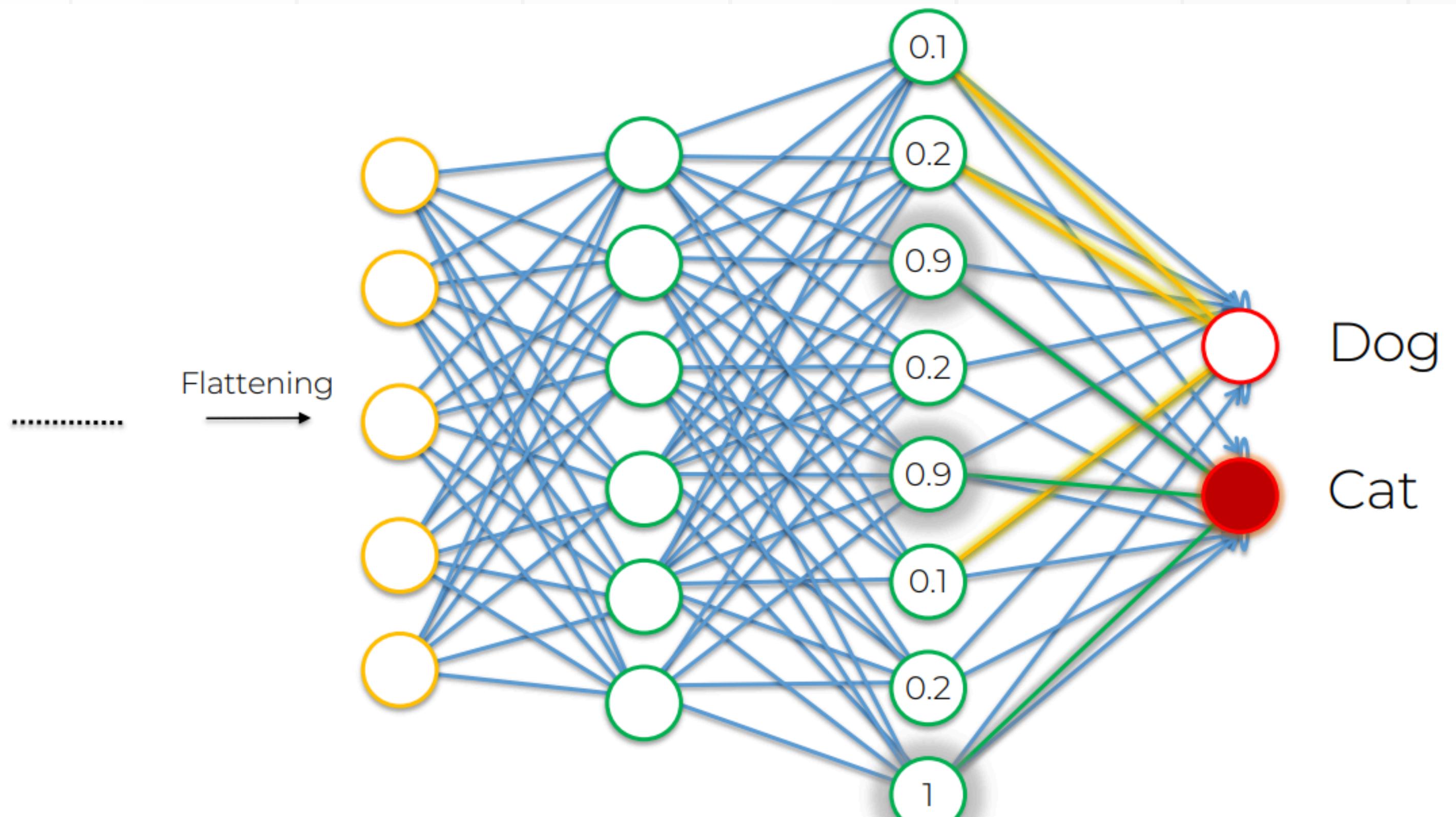














Flattening

