Neural Network and Its Applications

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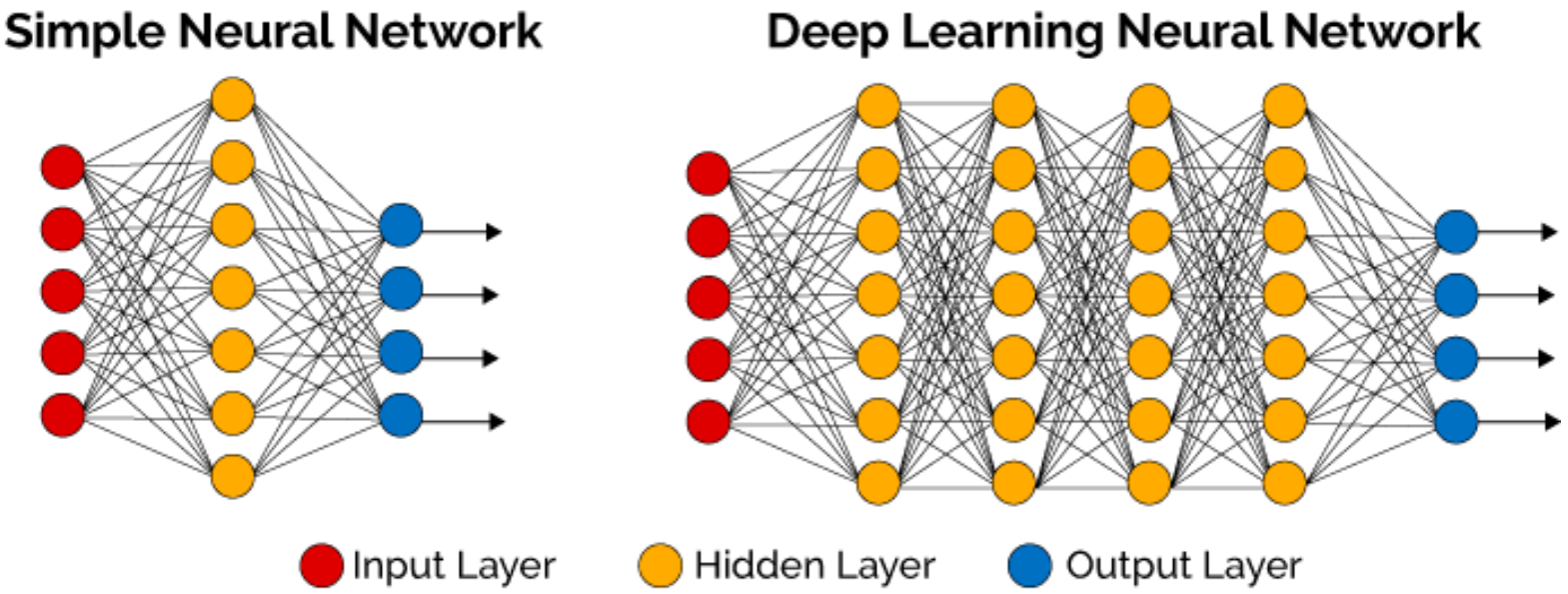
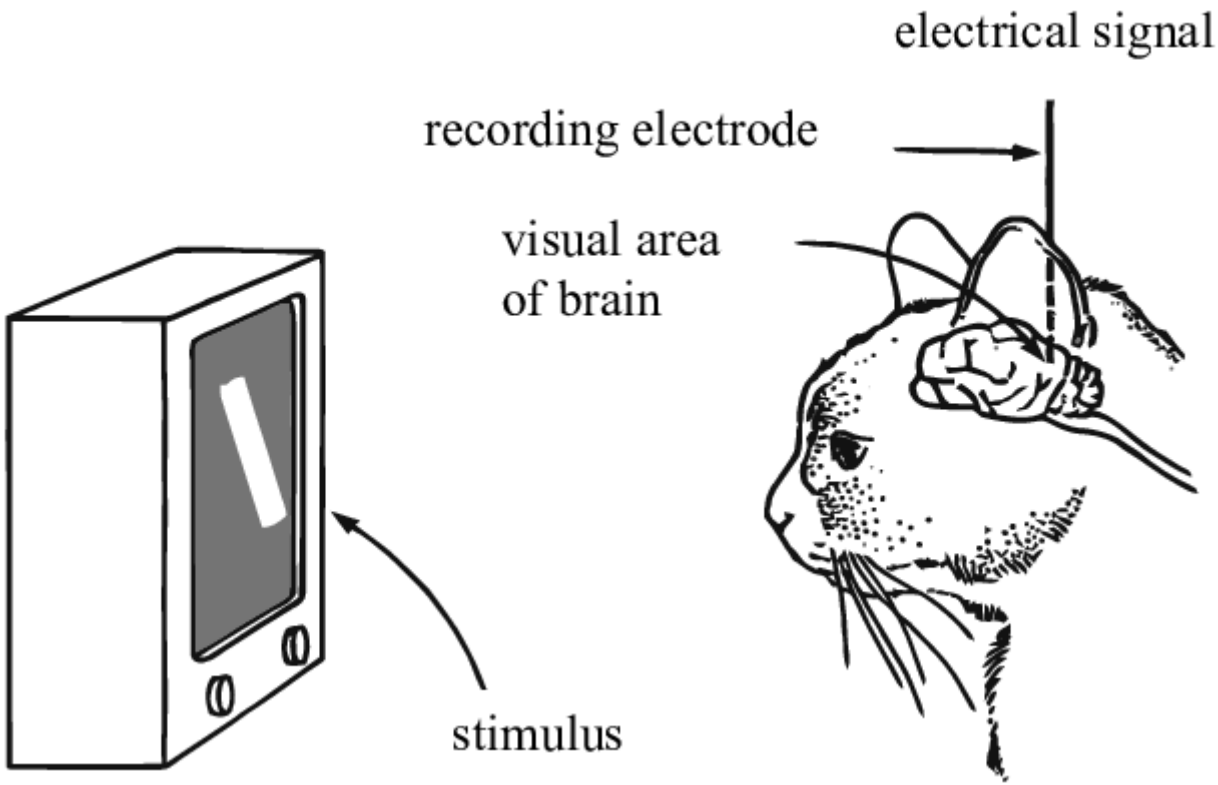
Simple vs. Deep Neural Network

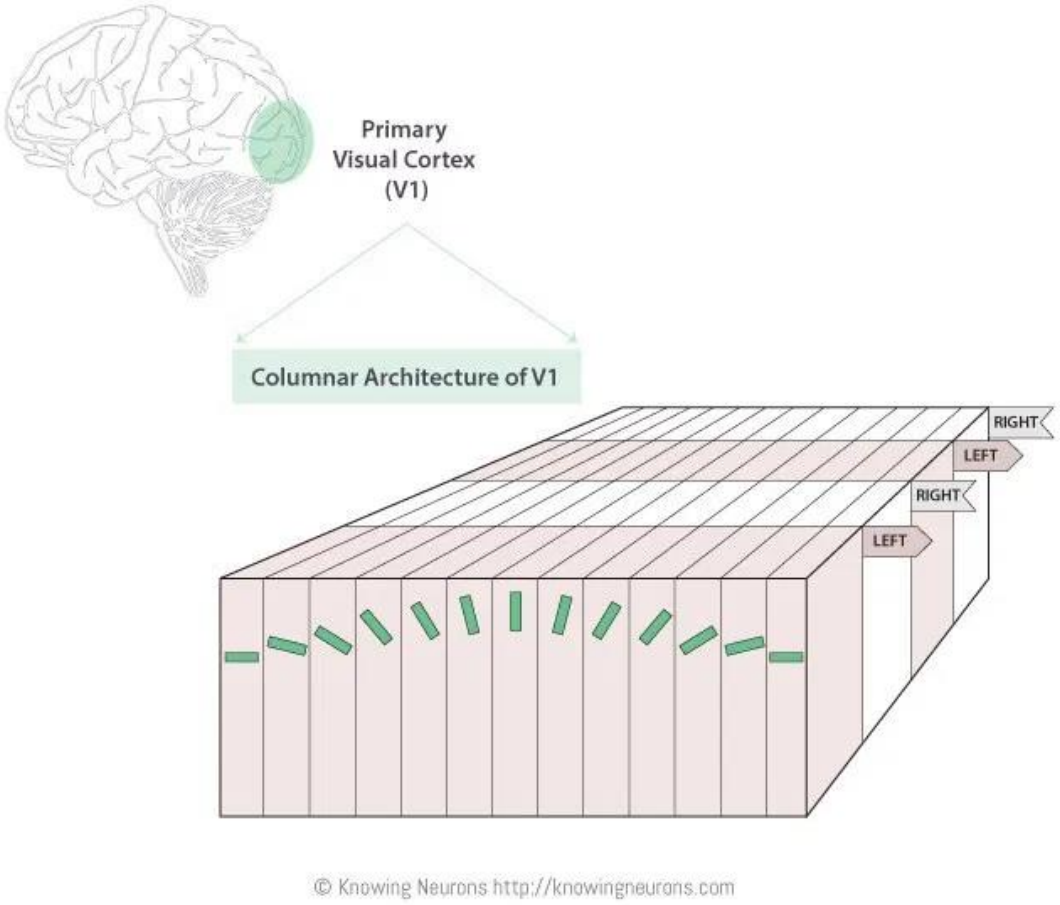


Visual Cortex



https://knowingneurons.com/2014/10/29/hubel-and-wiesel-the-neural-basis-of-visual-perception/

Visual Cortex



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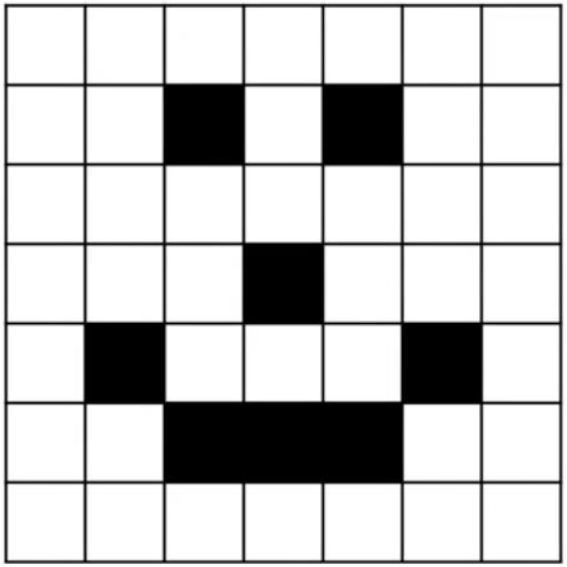
How to Digitize an Image?



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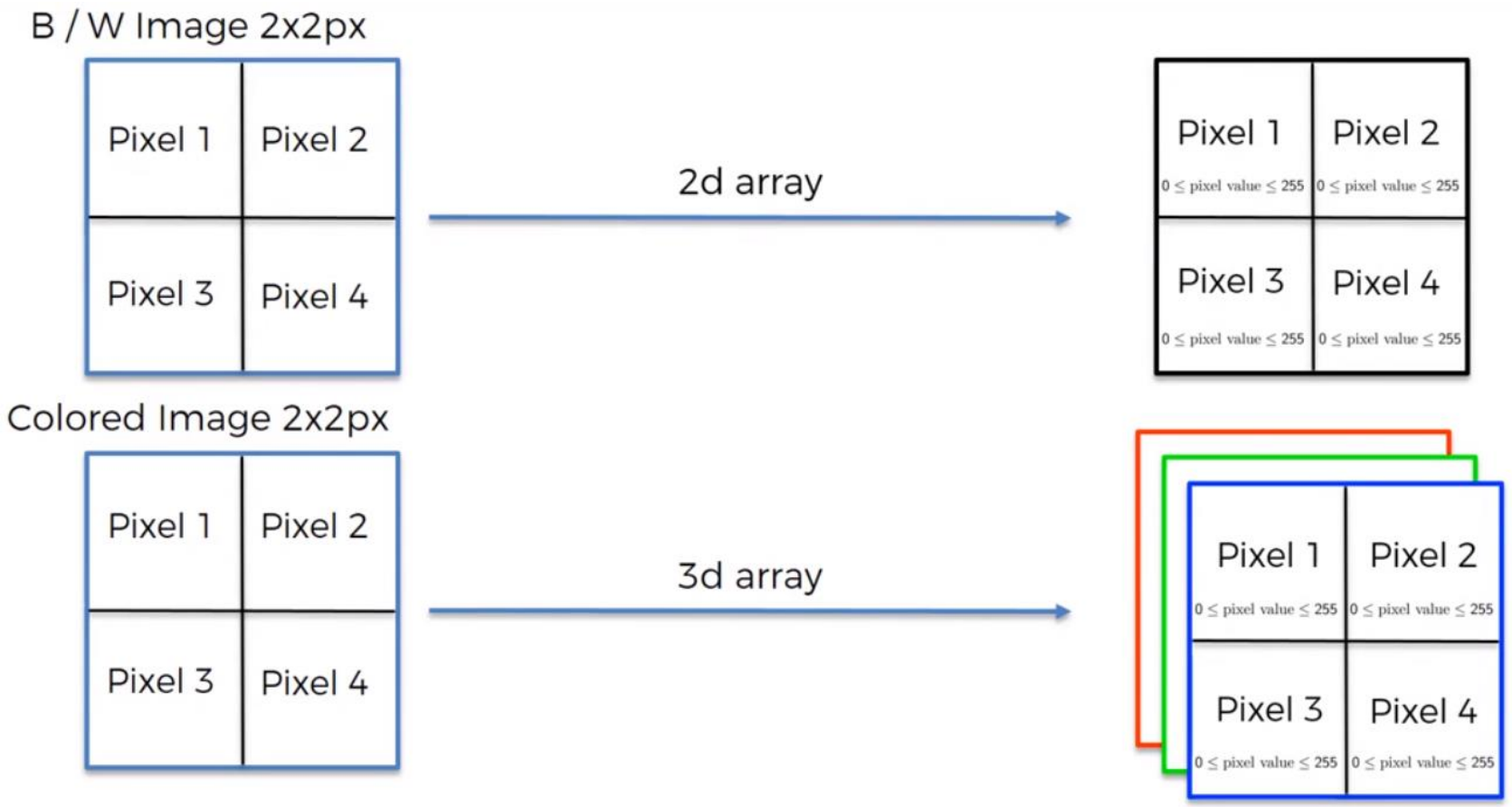
0	0	0	0	0	0	0

https://www.superdatascience.com

How to Digitize an Image?



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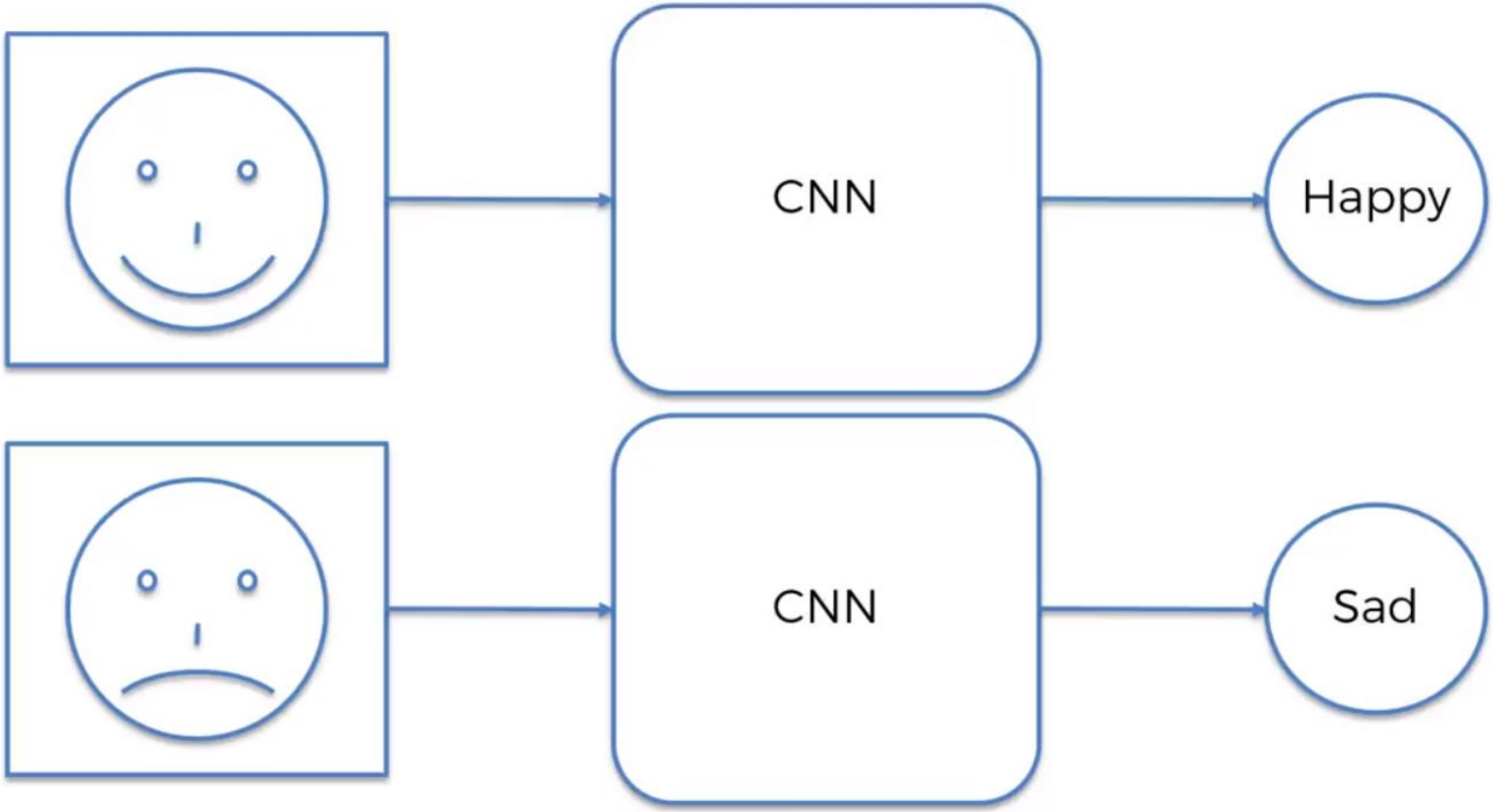
Neural Network for Image Classification



https://www.superdatascience.com

IMAGENET

14,197,122 images, 21841 synsets indexed

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ImageNet is an image database organized according to the WordNet hierarchy (currently only the nouns), in which each node of the hierarchy is depicted by hundreds and thousands of images. Currently we have an average of over five hundred images per node. We hope ImageNet will become a useful resource for researchers, educators, students and all of you who share our passion for pictures.

Click here to learn more about ImageNet, Click here to join the ImageNet mailing list.

What do these images have in common? *Find out!*

Research updates on improving ImageNet data

Examples from the test set
(with the network's guesses)

cheetah

cheetah
leopard
snow leopard
Egyptian cat

bullet train

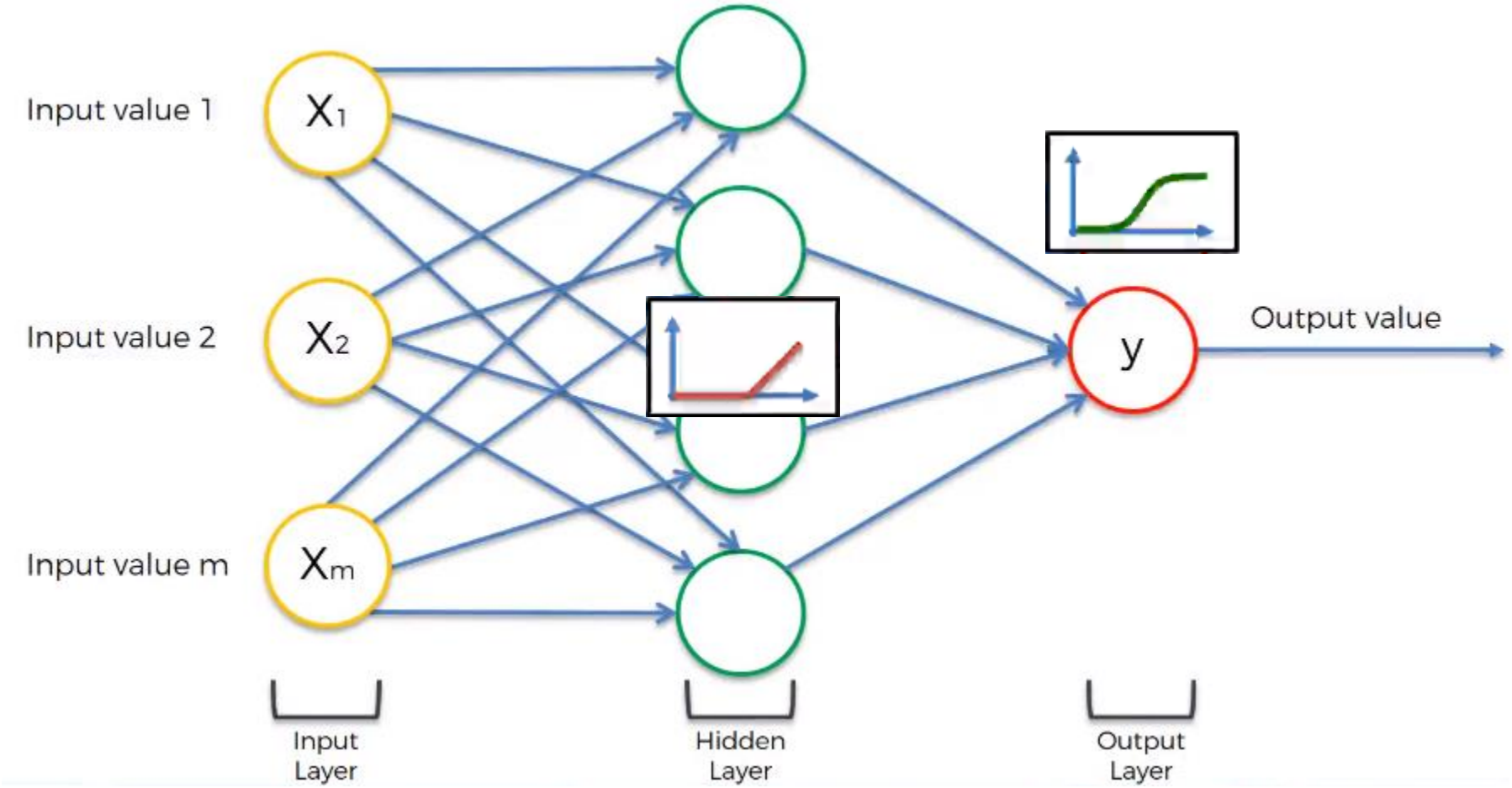
bullet train
passenger car
subway train
electric locomotive

hand glass

scissors
hand glass
frying pan
stethoscope

Slide from Geoffrey Hinton

Simple Neural Network

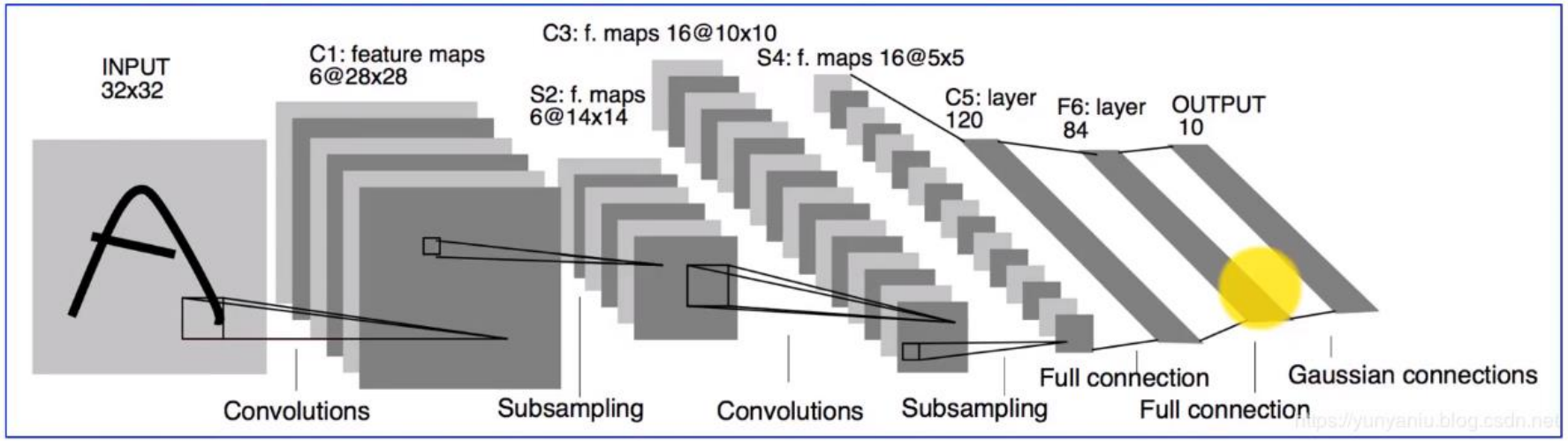


https://www.superdatascience.com/blogs/artificial-neural-networks-how-do-neural-networks-work/

LeNet

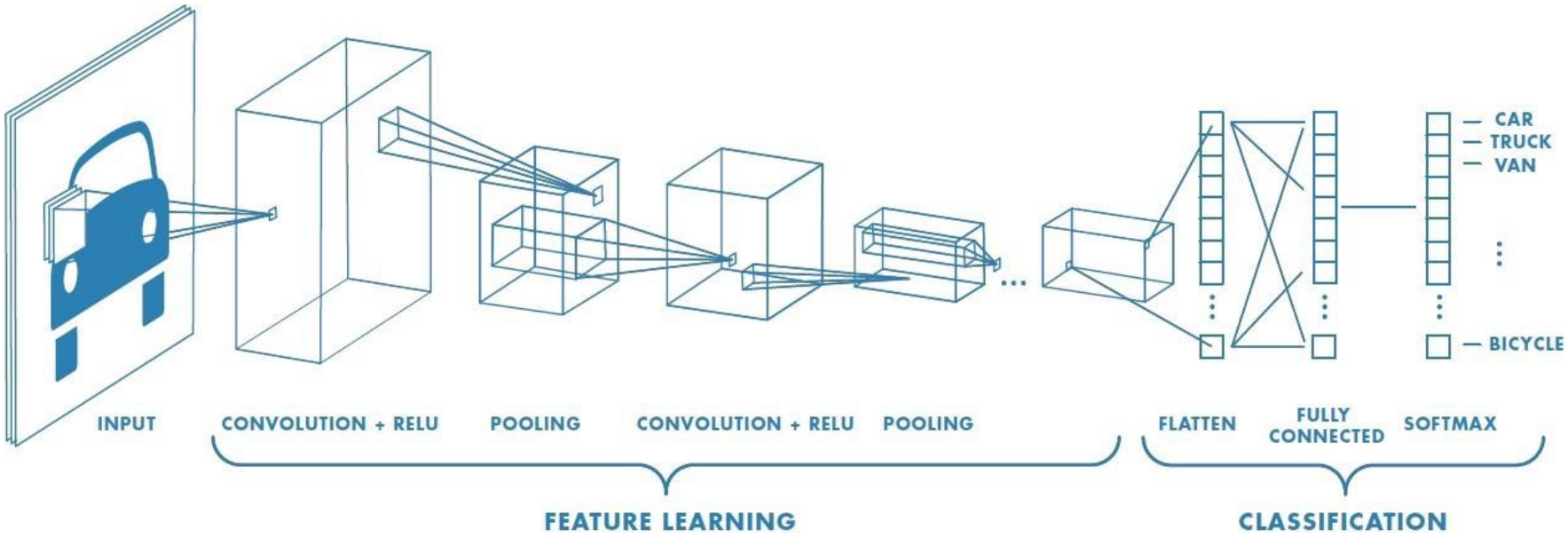
Yann LeCun

LeNet-5

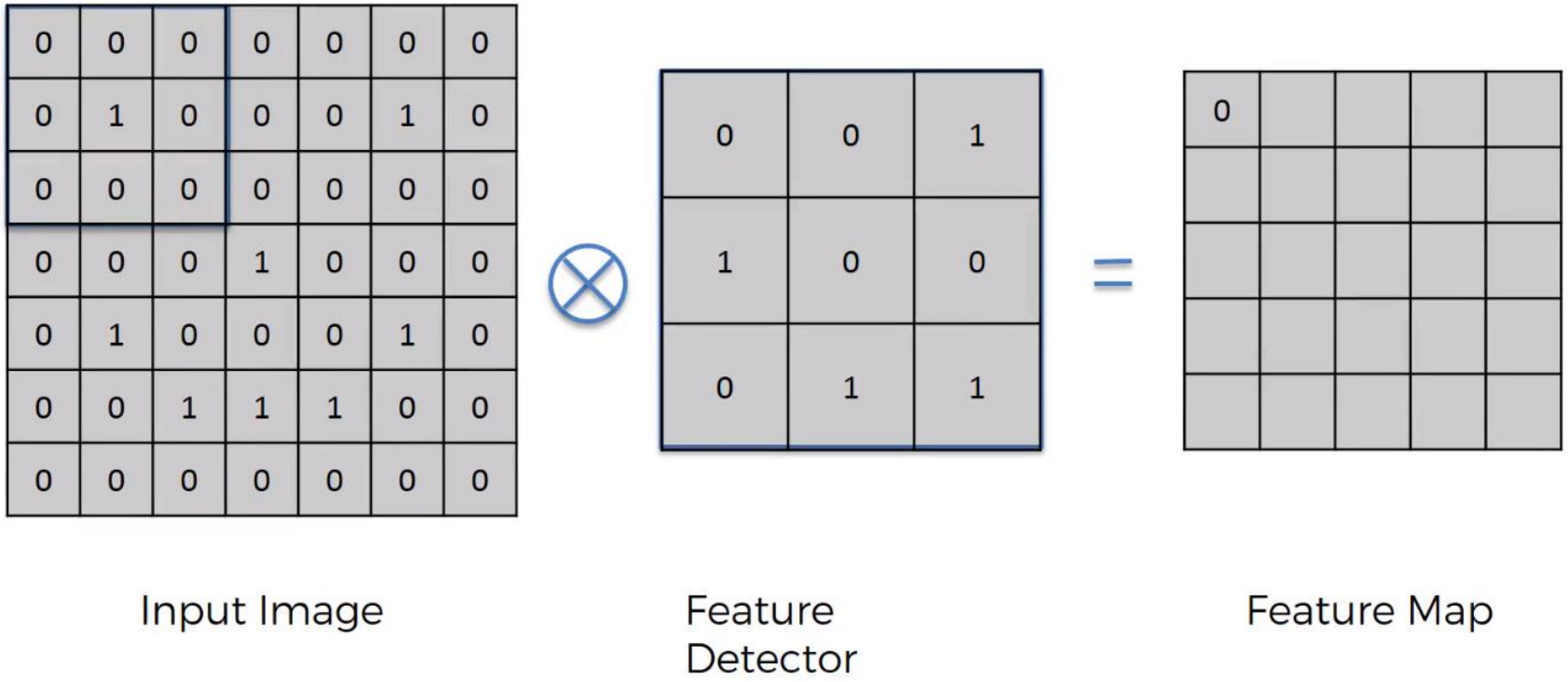


Neural Computation. 1989;1(4): 541–551.

Convolutional Neural Network



What is Convolution?



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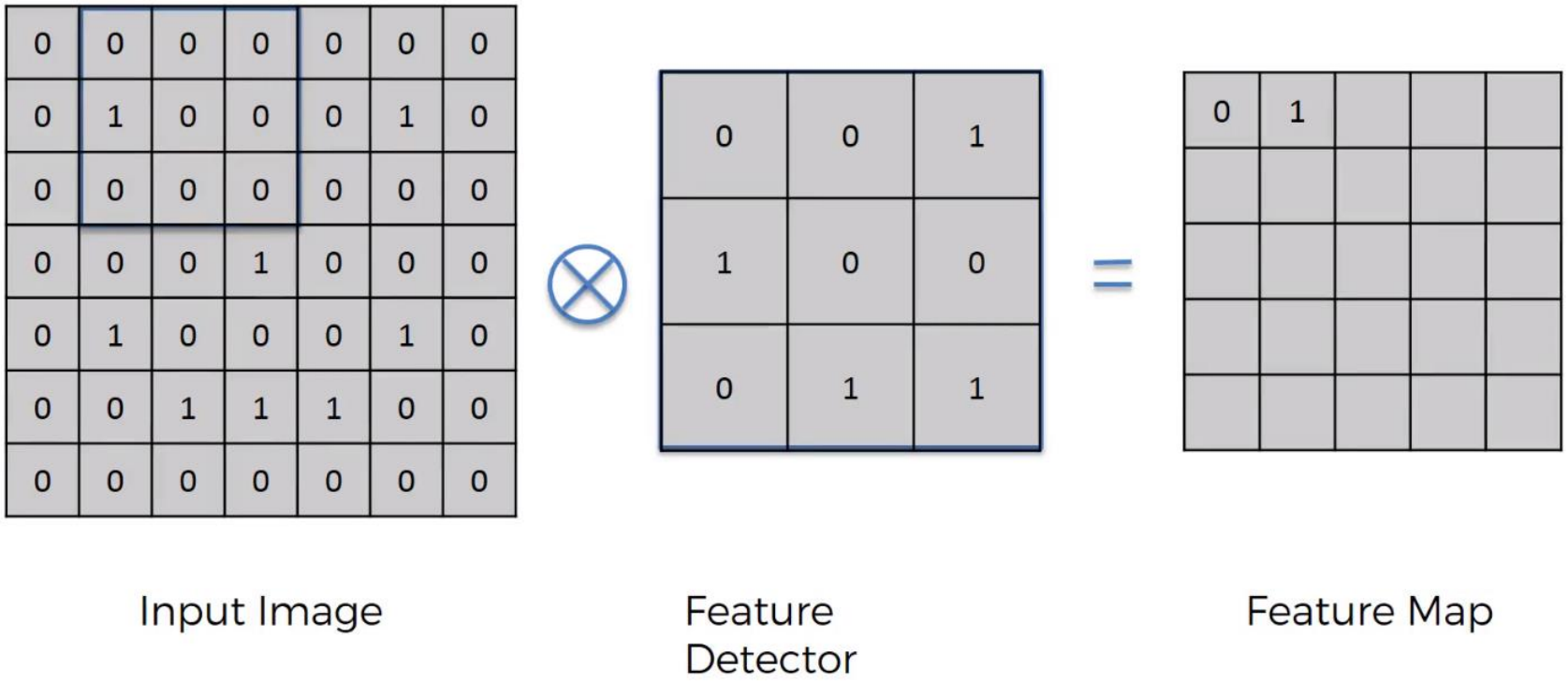
What is Convolution?



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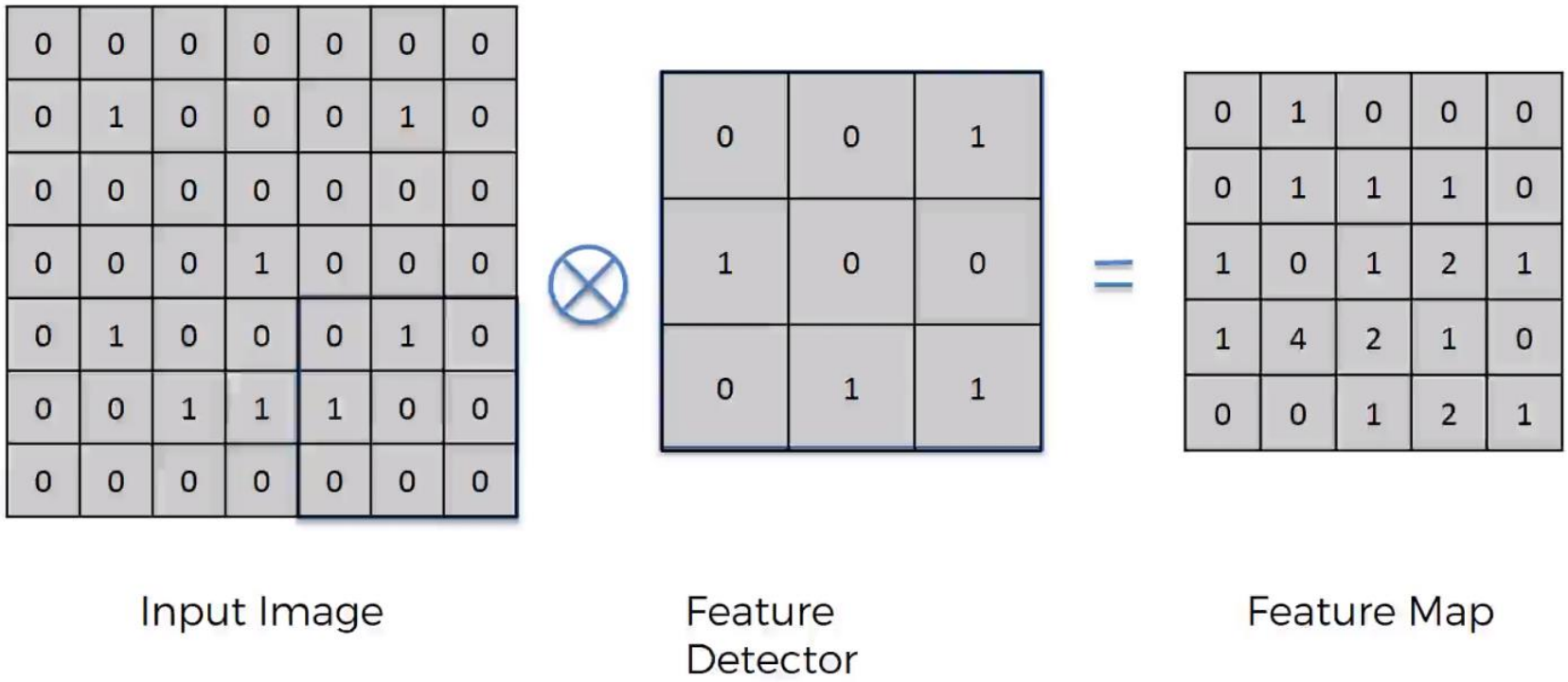
What is Convolution?



https://www.superdatascience.com

Image Processing - Sharpen

0	0	0	0	0
0	0	-1	0	0
0	-1	5	-1	0
0	0	-1	0	0
0	0	0	0	0

https://www.superdatascience.com

Image Processing – Edge Detection

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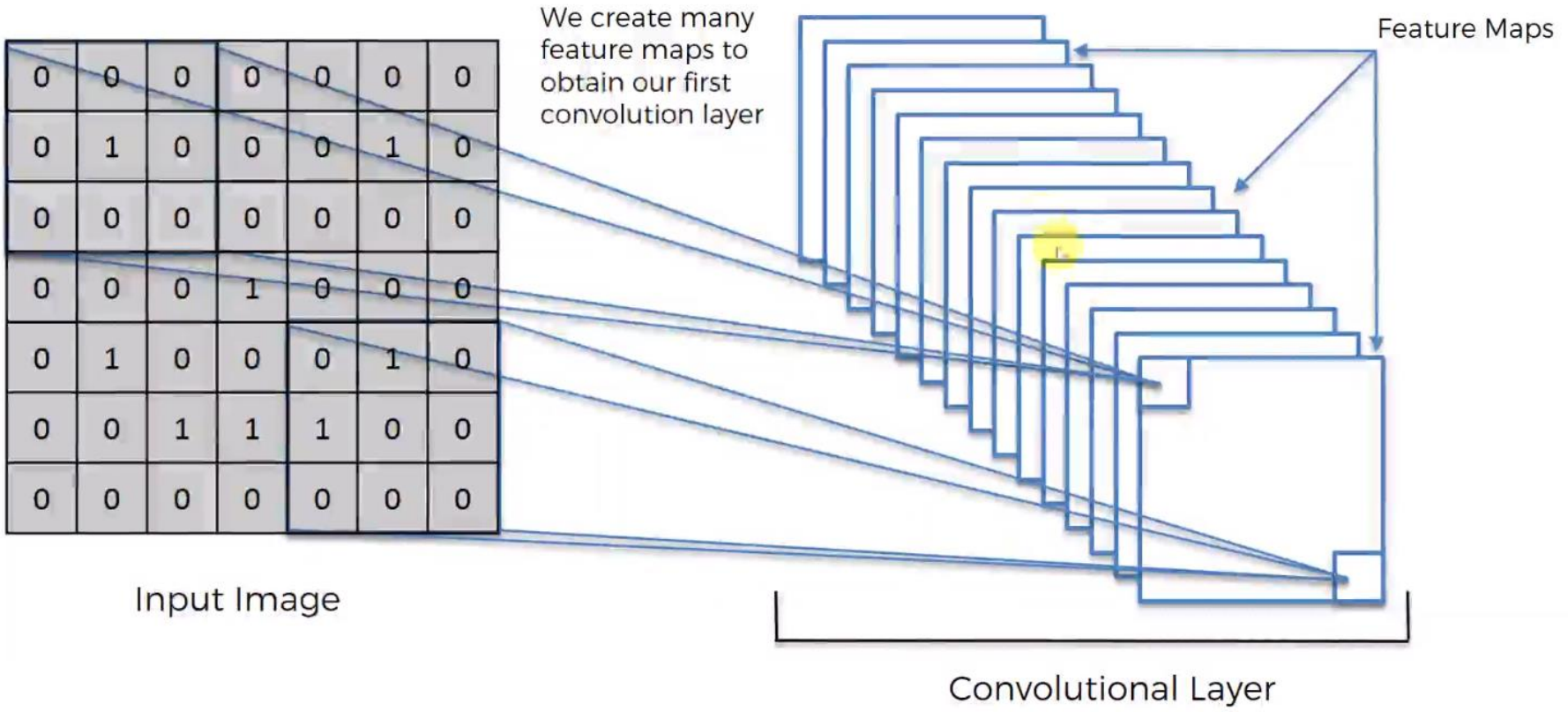
	1	-4	1	
	0	1	0	

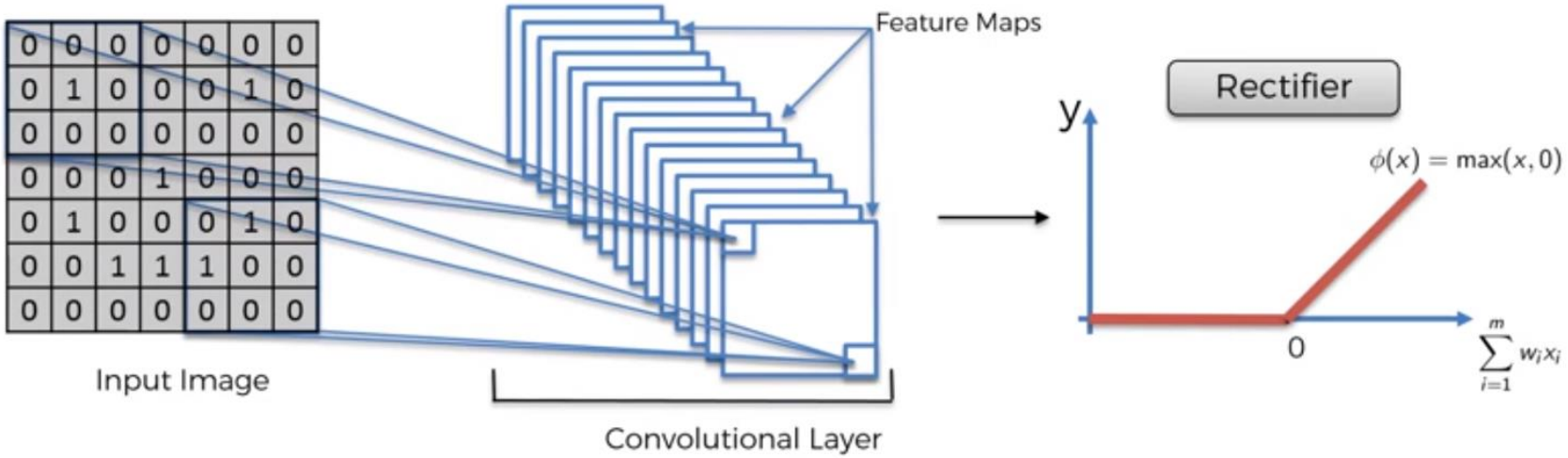
https://www.superdatascience.com

Feature Detection Using Convolution



https://www.superdatascience.com

Rectified Linear Unit (ReLu)



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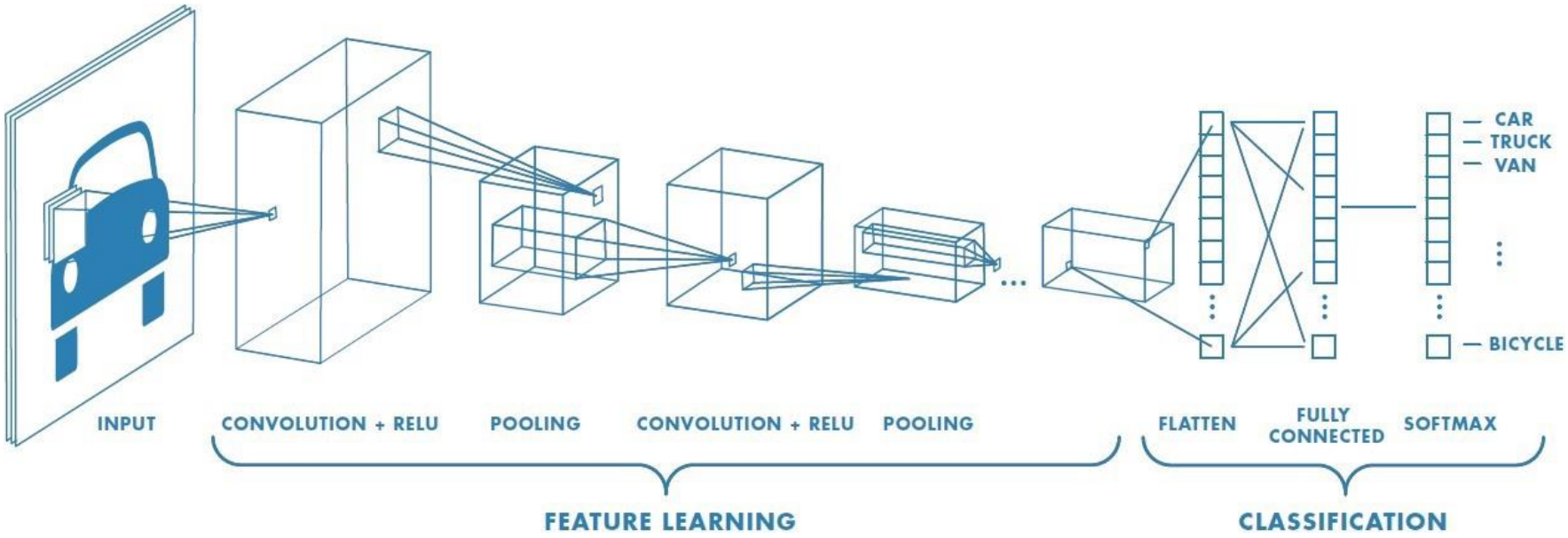
What does ReLu Do?

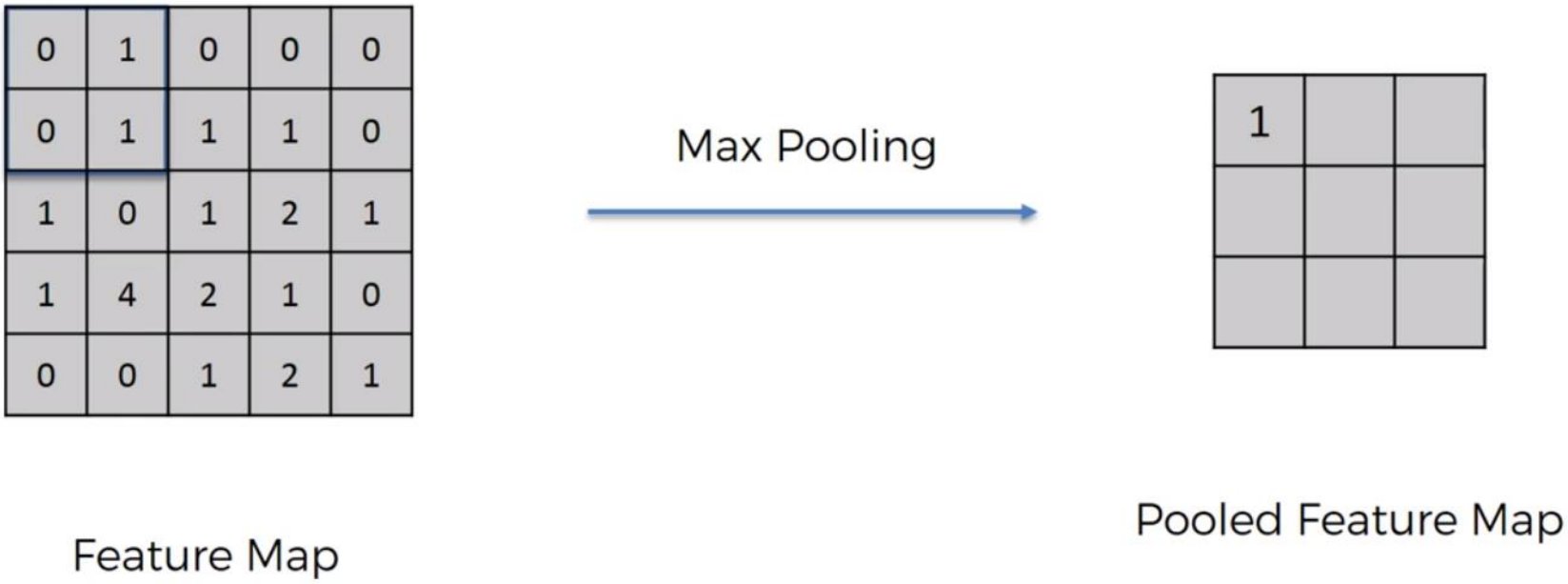
What does ReLu Do?

Convolutional Neural Network



How to Find Common Features in Images?

Max Pooling



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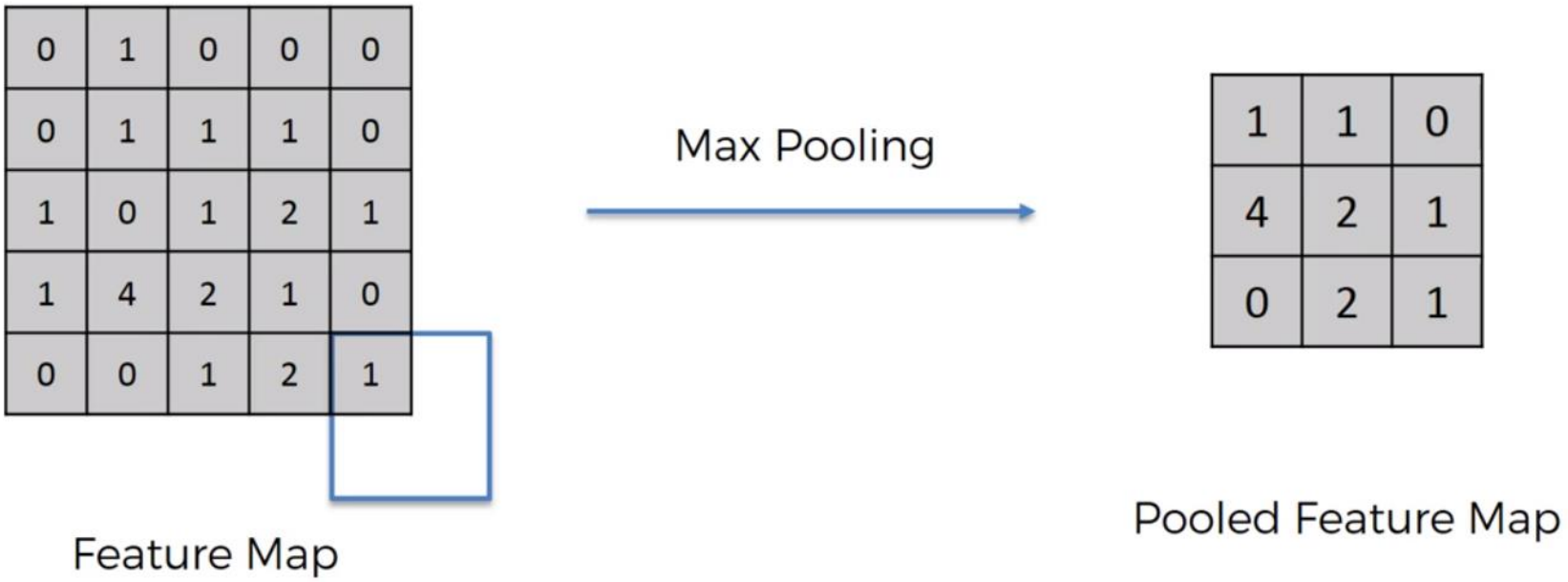
Max Pooling



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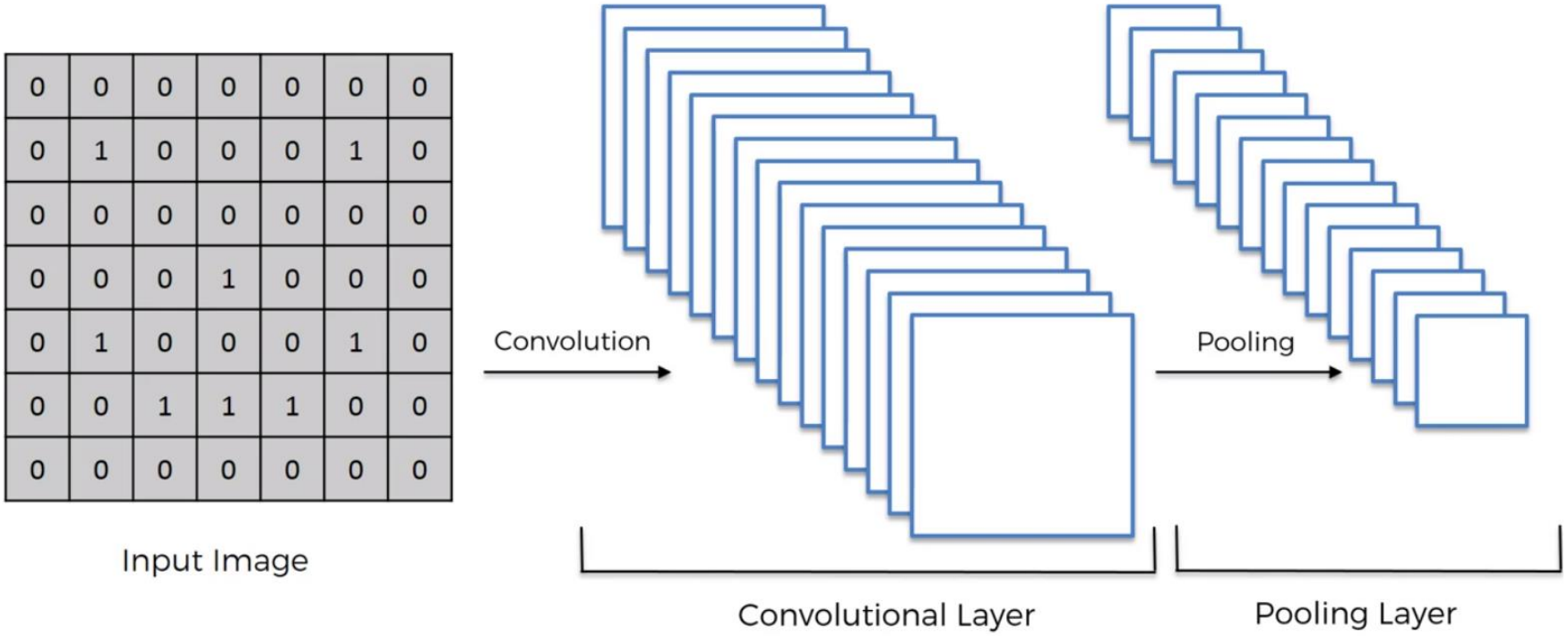
Convolution-Pooling



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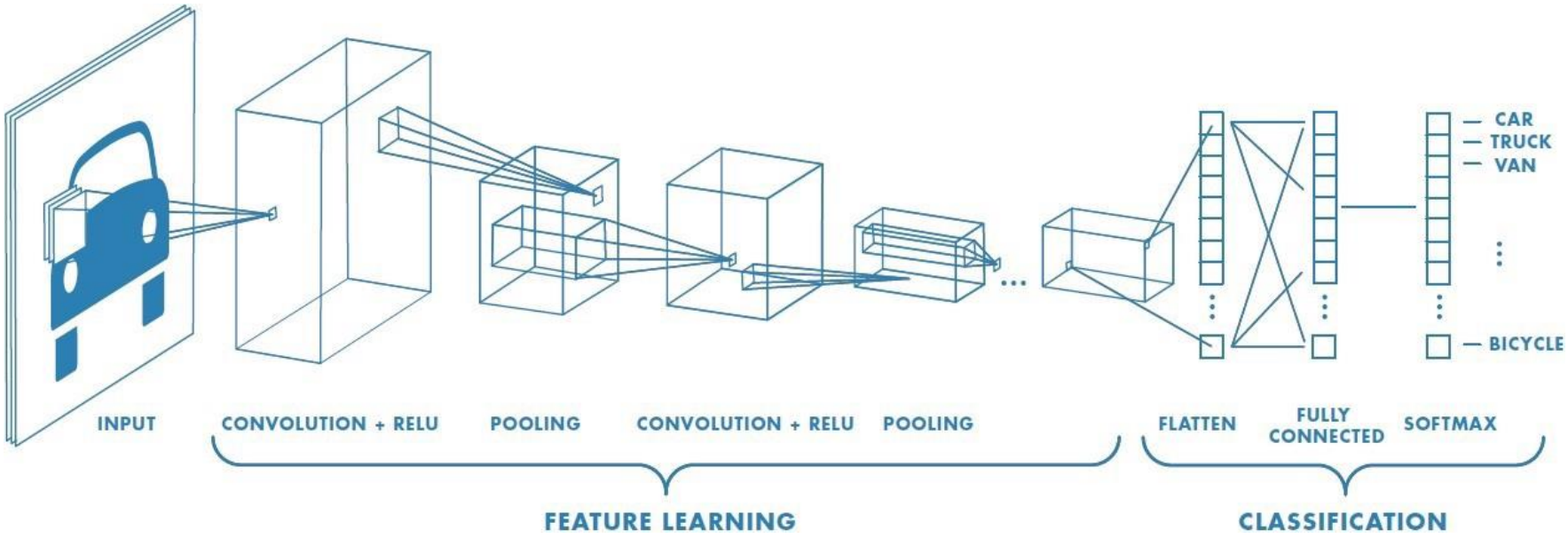
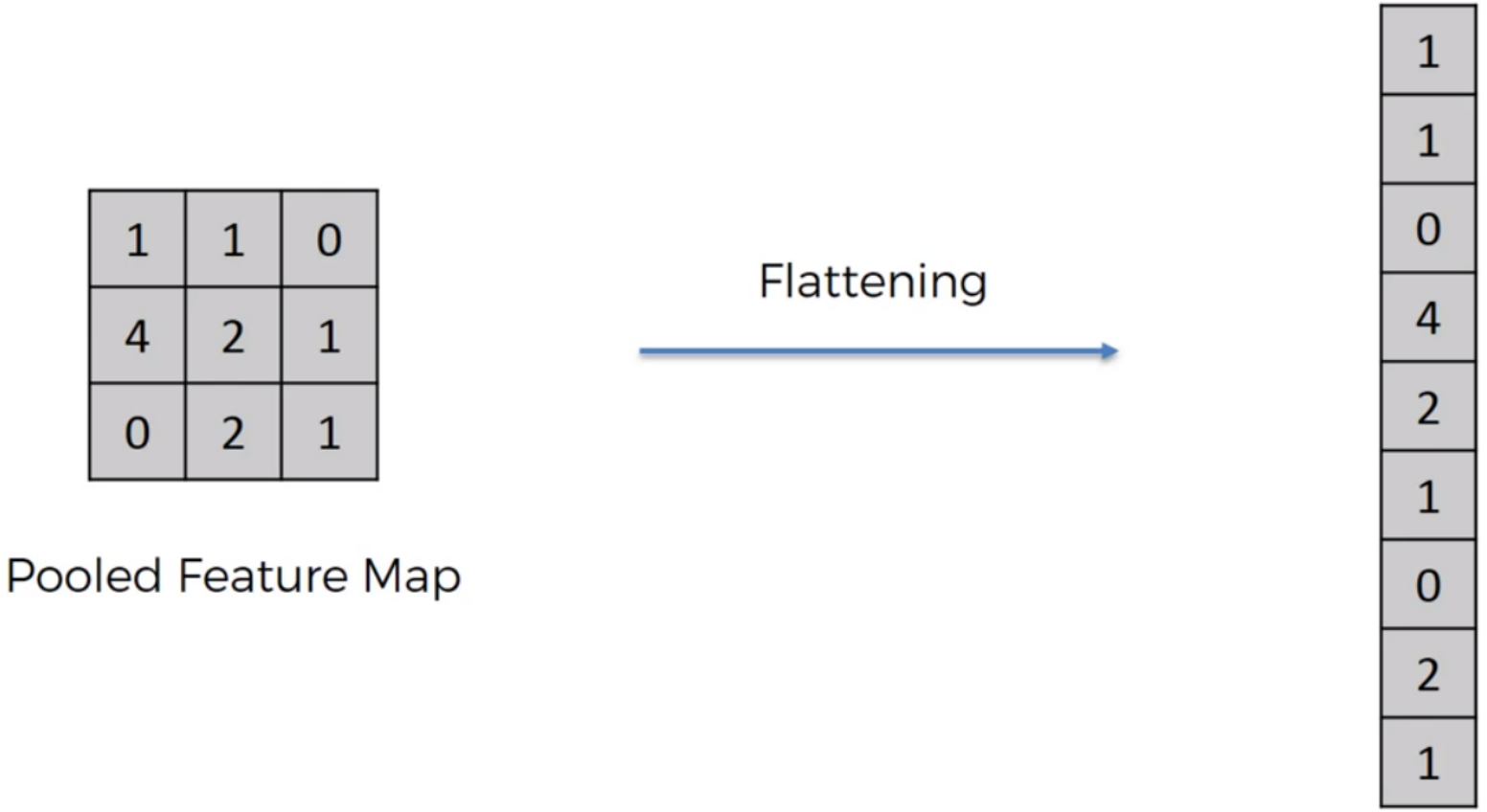
Convolutional Neural Network



Flattening



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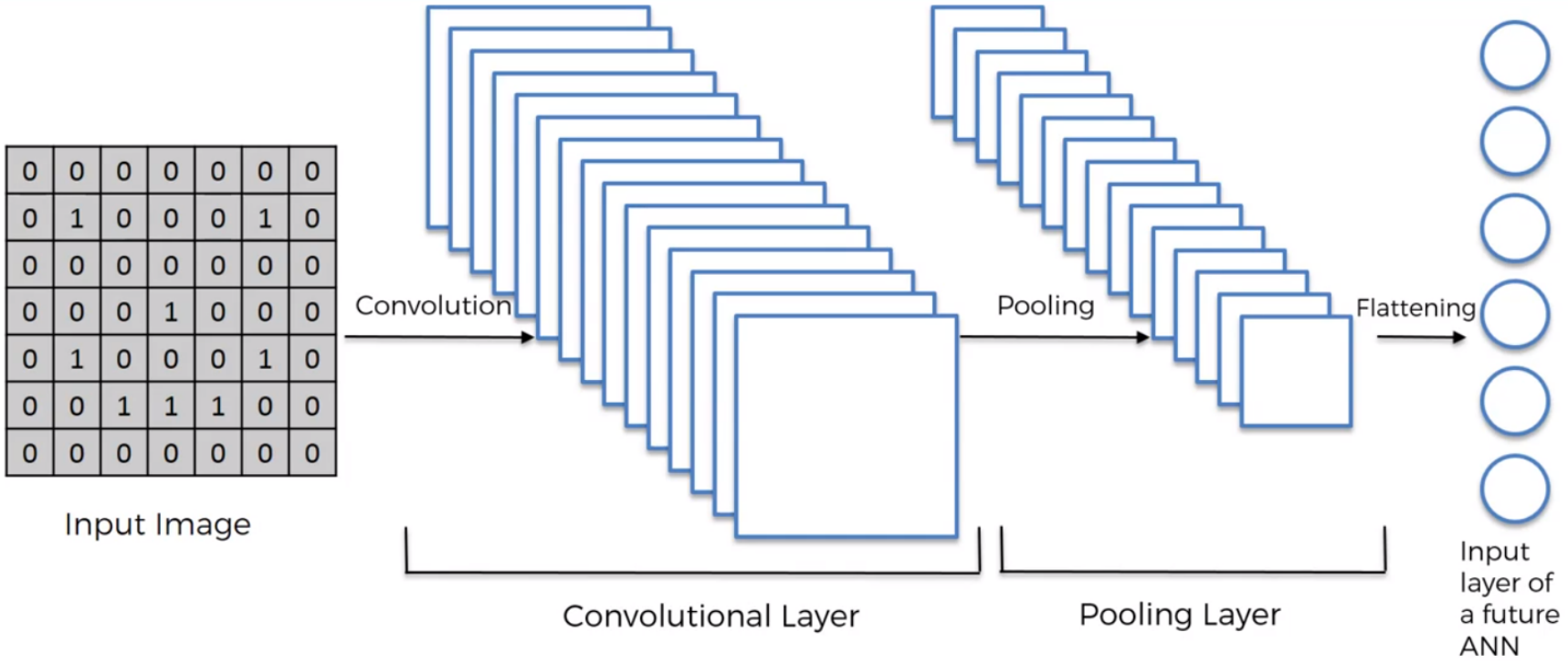
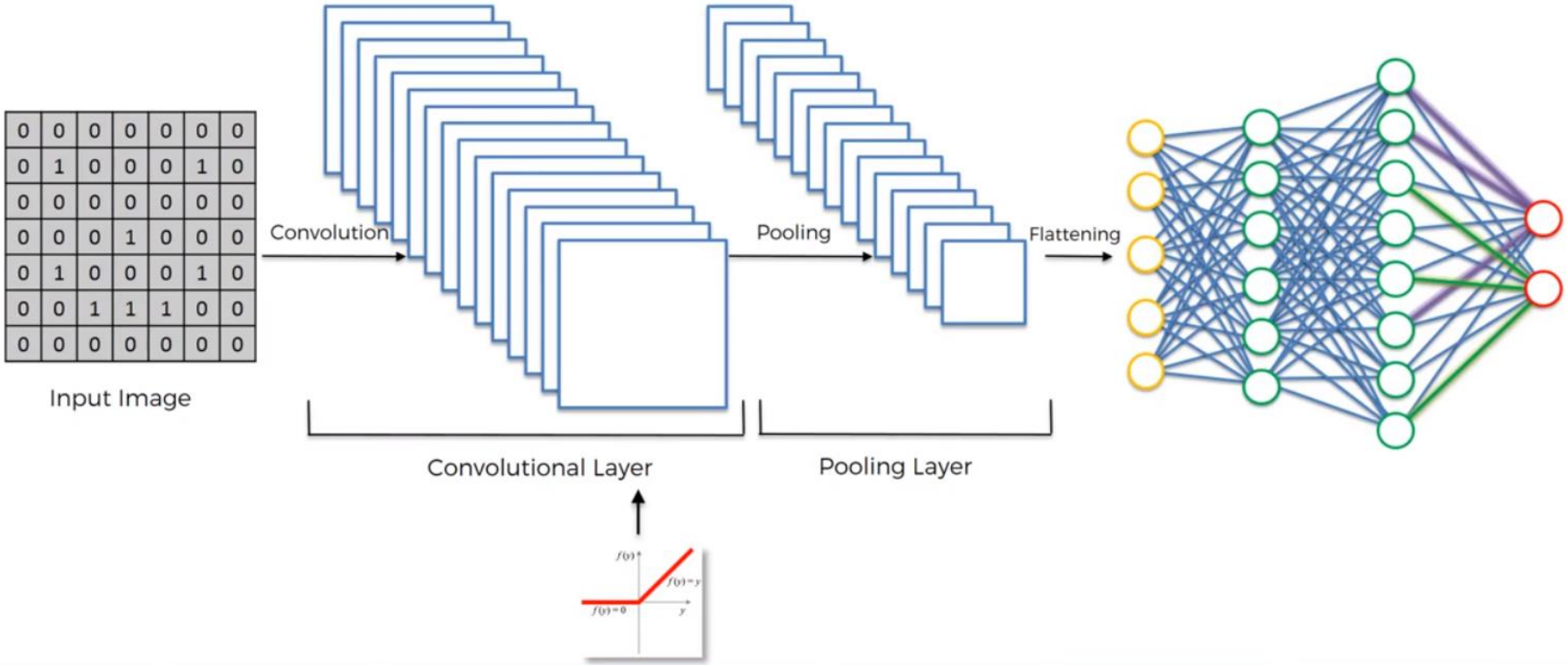
Convolutional Neural Network



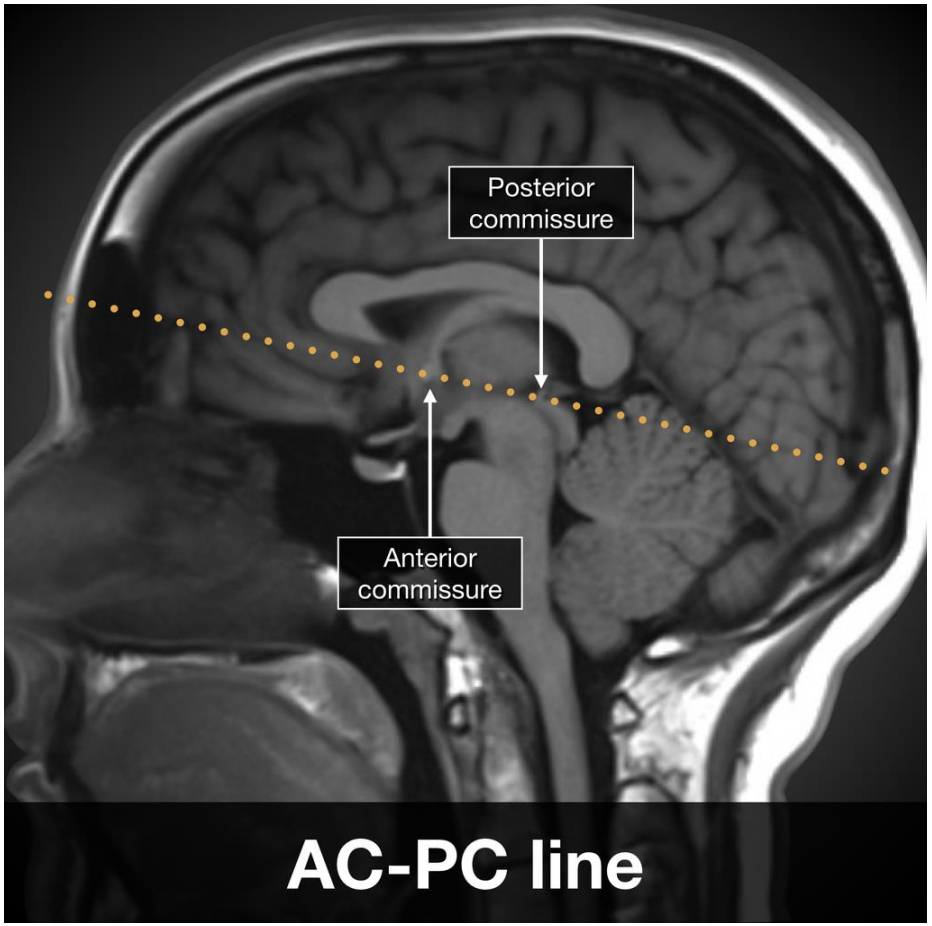
https://www.superdatascience.com

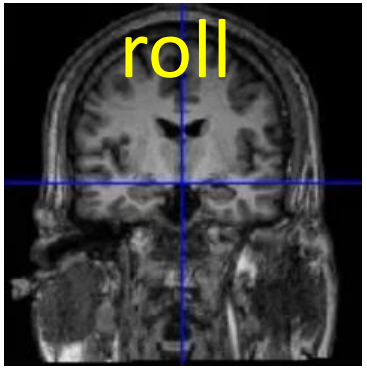
CNN = Feature Detection + ANN

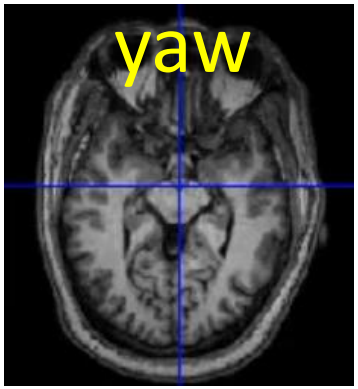


https://www.superdatascience.com

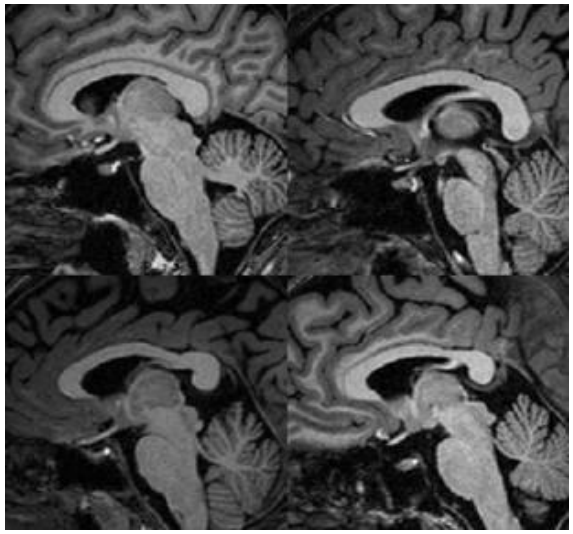
Head Motion Correction

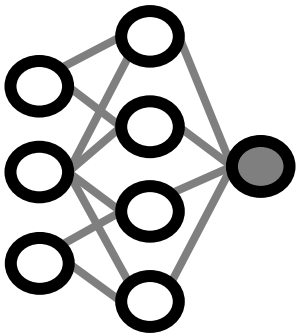


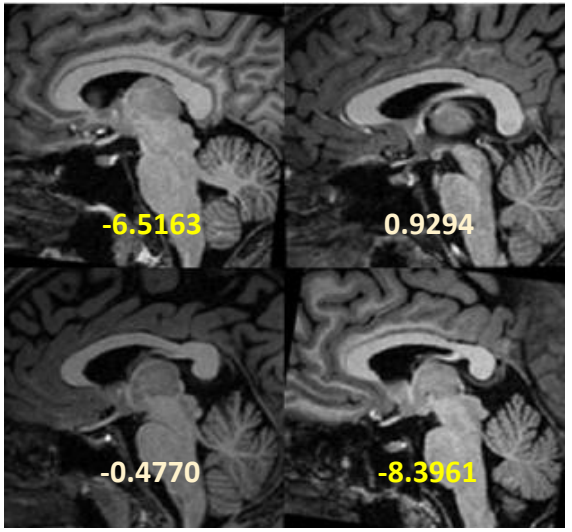




Head Motion Correction Using CNN





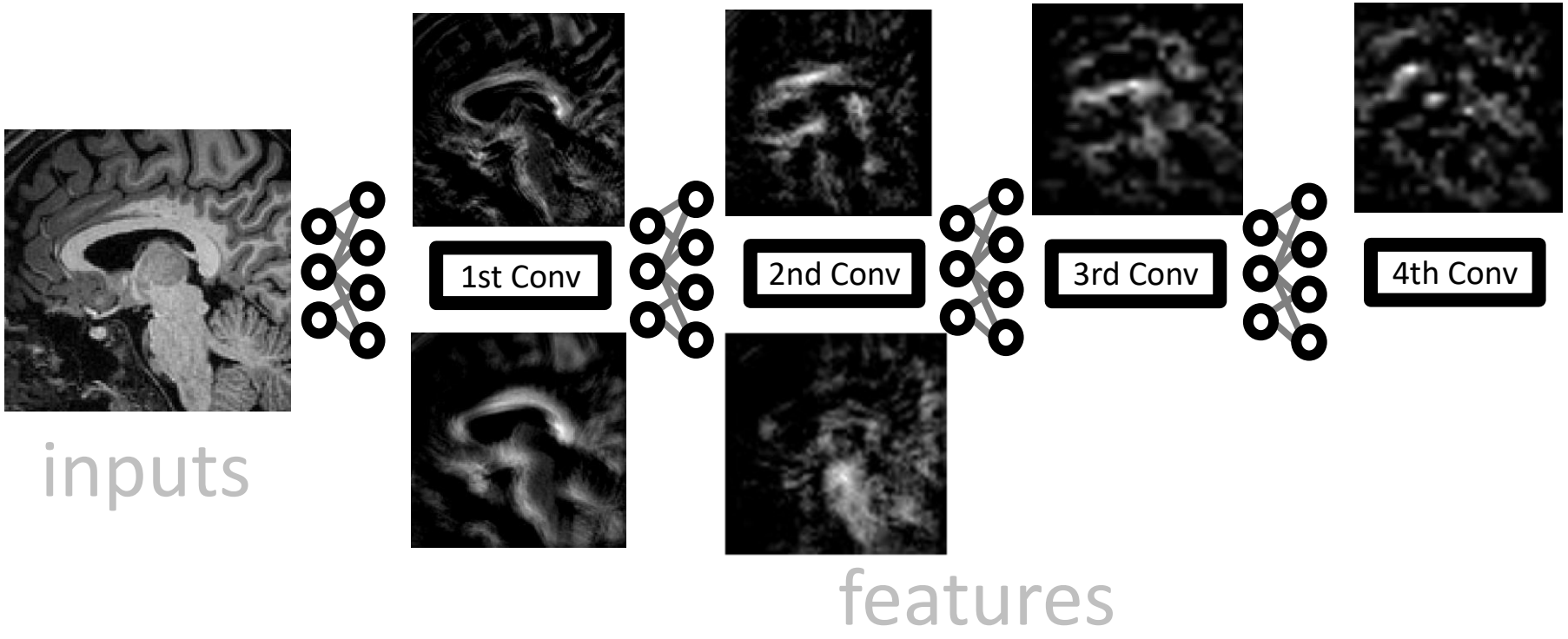


Original Image

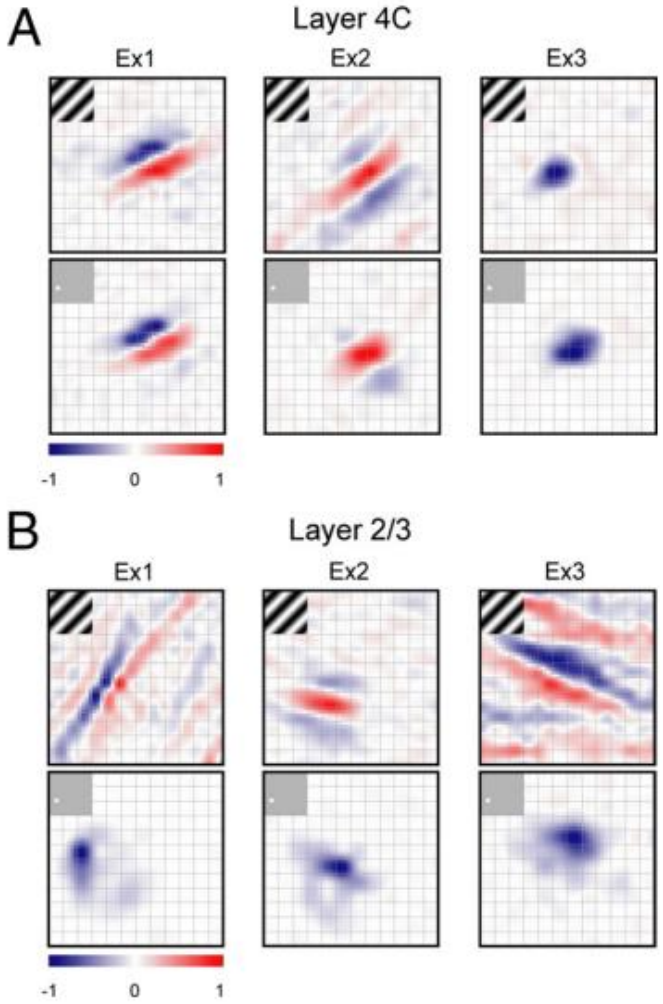
CNN Model

Corrected Image

What Does CNN See?



What does Visual Neurons See?



Yeh CY et al. PNAS 2009

CNN in Matlab

Create Simple Deep Learning Network for Classification

R2020a

This example shows how to create and train a simple convolutional neural network for deep learning classification. Convolutional neural networks are essential tools for deep learning, and are especially suited for image recognition.

View MATLAB Command

The example demonstrates how to:

- Load and explore image data.
- Define the network architecture.
- Specify training options.
- Train the network.
- Predict the labels of new data and calculate the classification accuracy.

https://www.mathworks.com/help/deeplearning/ug/create-simple-deep-learning-network-for-classification.html