

Deep Learning

Applied to oil spills detection
on satellite radar images



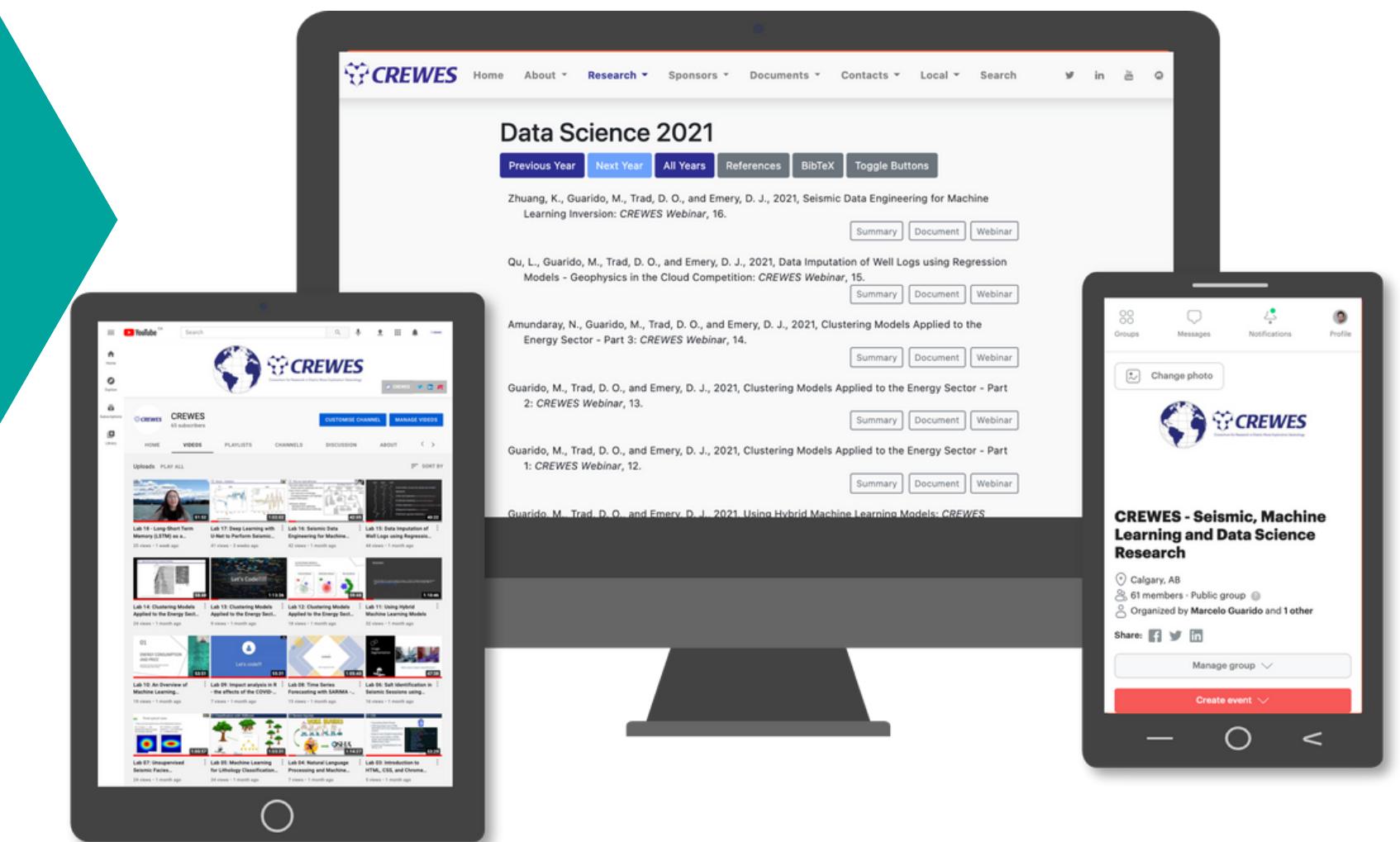


About me

Senior Data Scientist at **CREWES** and head of the **CREWES Data Science Initiative**.

Go to www.crewes.org to learn more and to have access to a large selection of data science material.

CREWES Data Science Initiative



CREWES DATA SCIENCE TRAINING

ContED course with the University of
Calgary focused on the practical side
of data science:

How to solve a business problem?

To learn more, click [here](#).

PROGRAMMING

Learning from Python foundations to the latest
data science application for EDA, machine
learning, and deep learning

PROJECT FOCUSED

Using real data in examples and final projects
motivating learners to solve problems and
build their portfolios on GitHub

MANY APPLICATIONS

Learn how to work on data from different
areas, such as energy, digital marketing,
finances, petrophysics, and others

Agenda

Bootcamp agenda

ML

An introduction to machine learning

Neural Networks

What is deep learning and its applications?

CNN

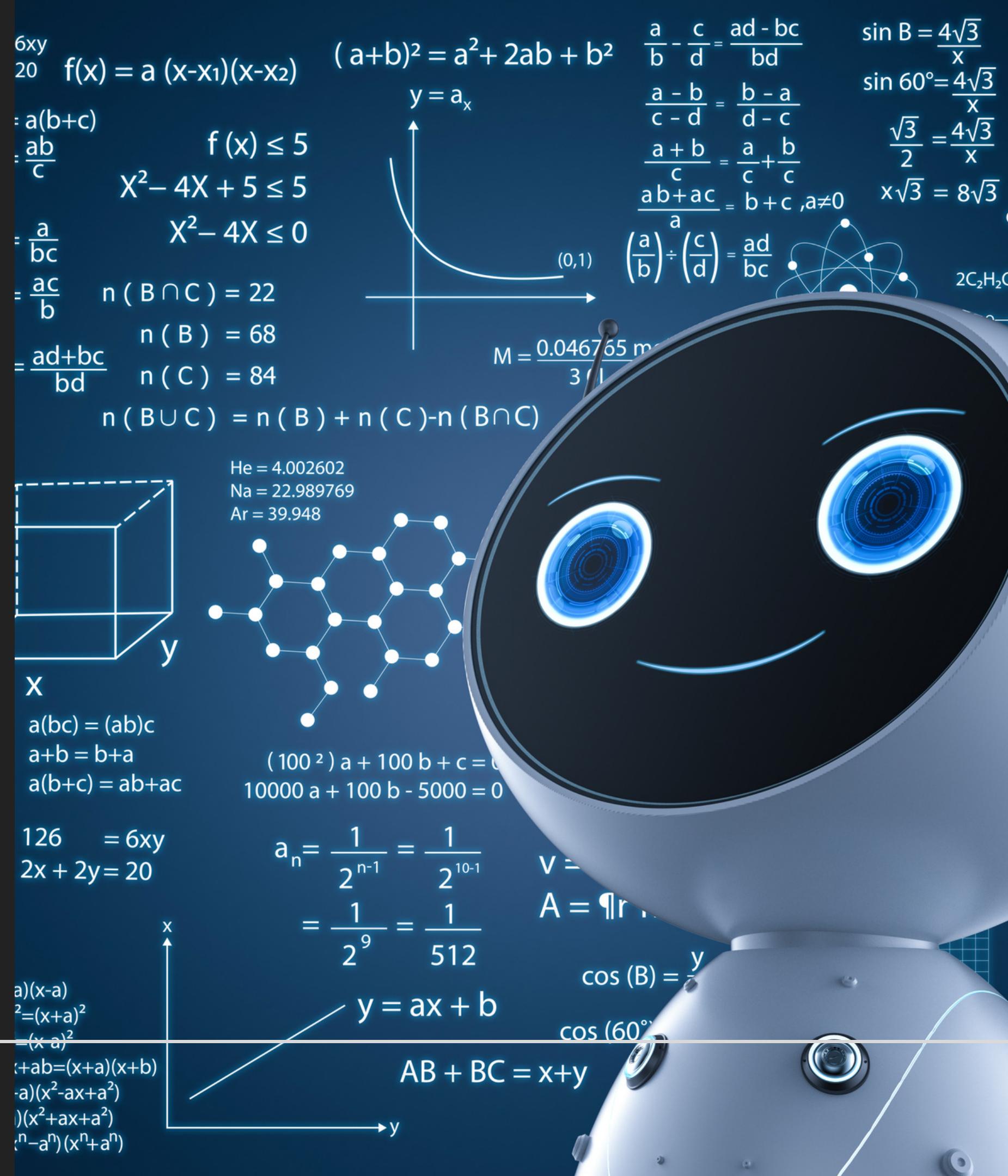
Computer vision and convolutional neural networks

Live Coding

Application of CNN to oil spill detection on satellite radar images

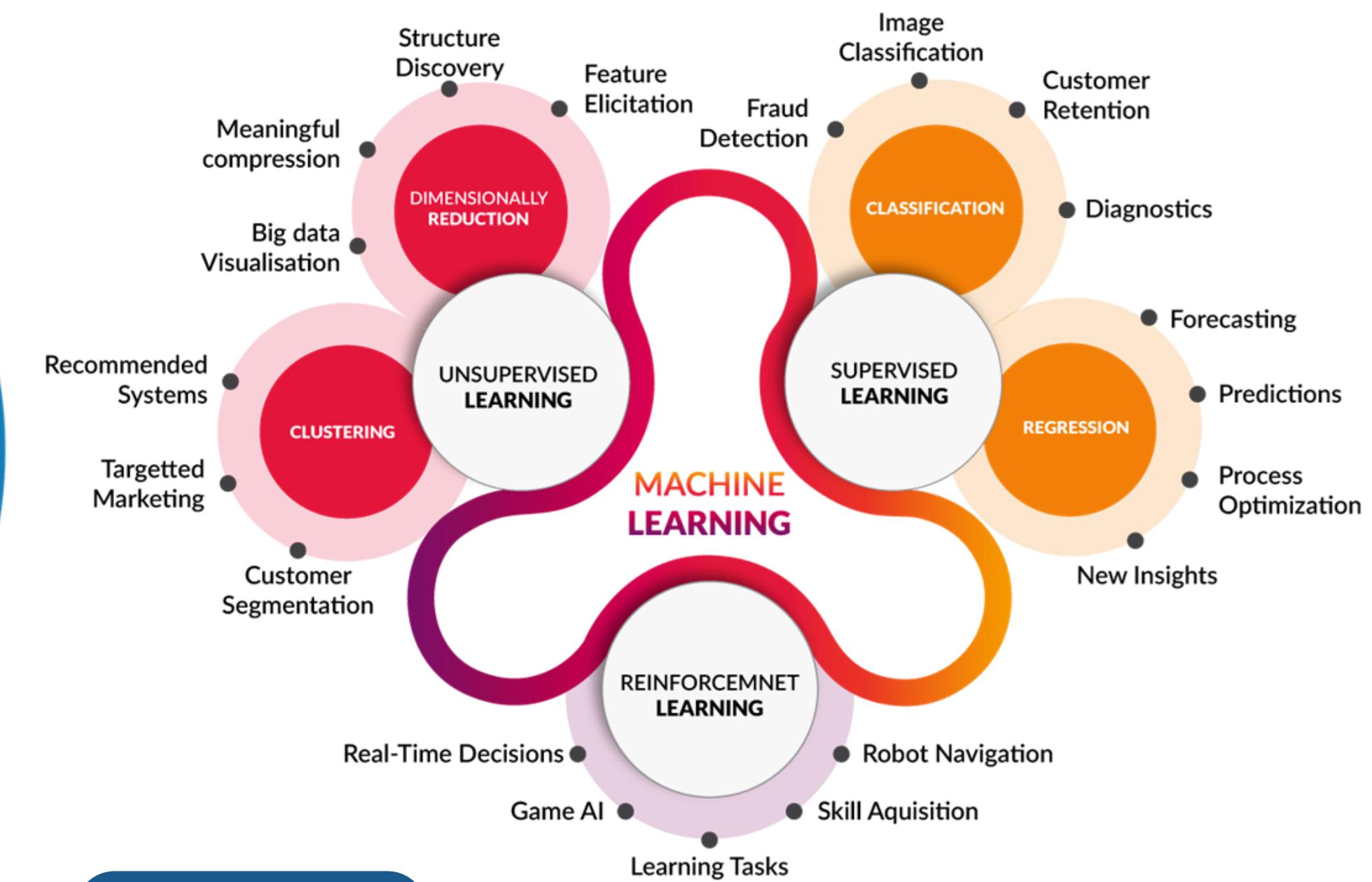
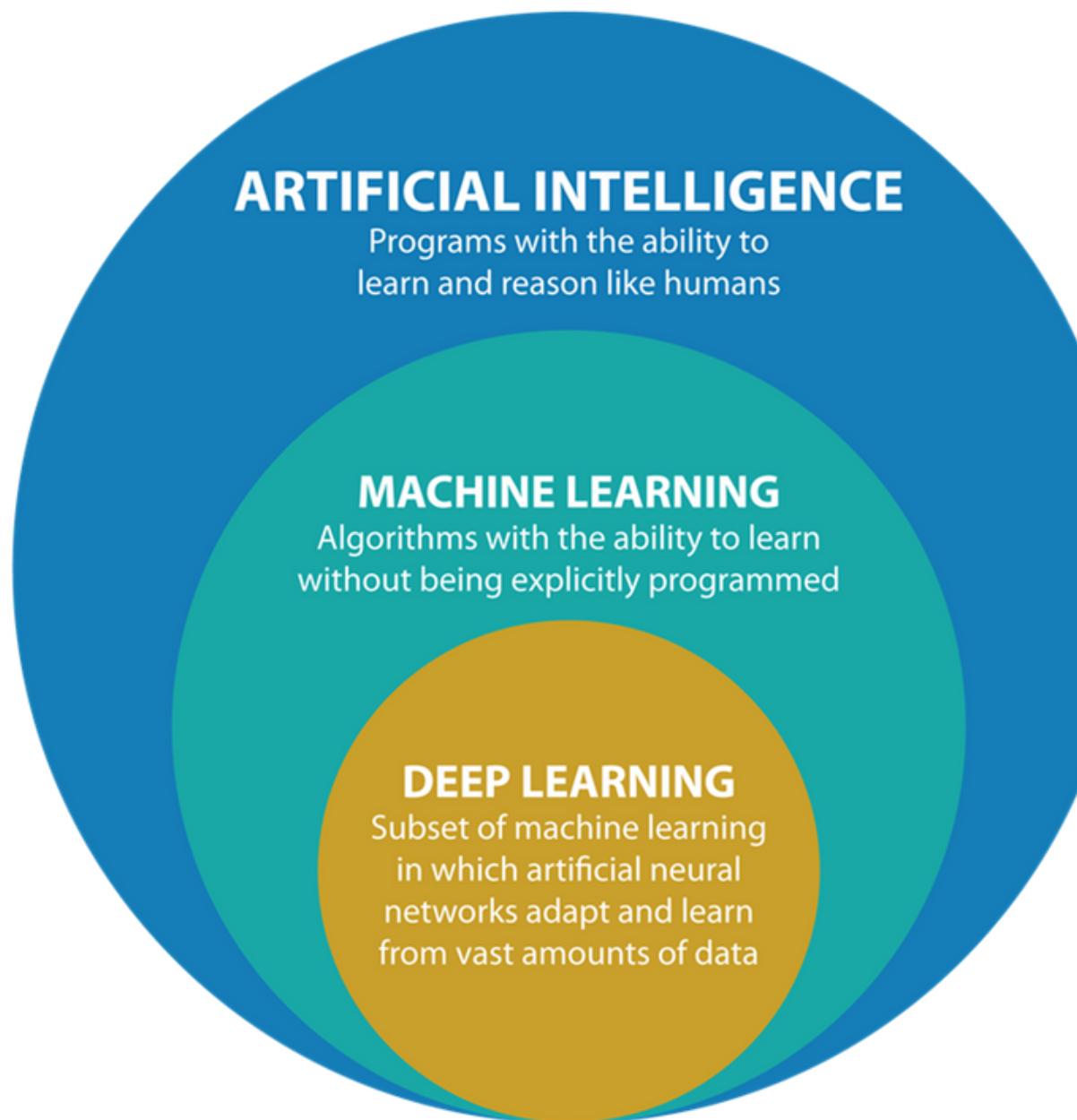
Machine Learning

An introduction to Machine Learning

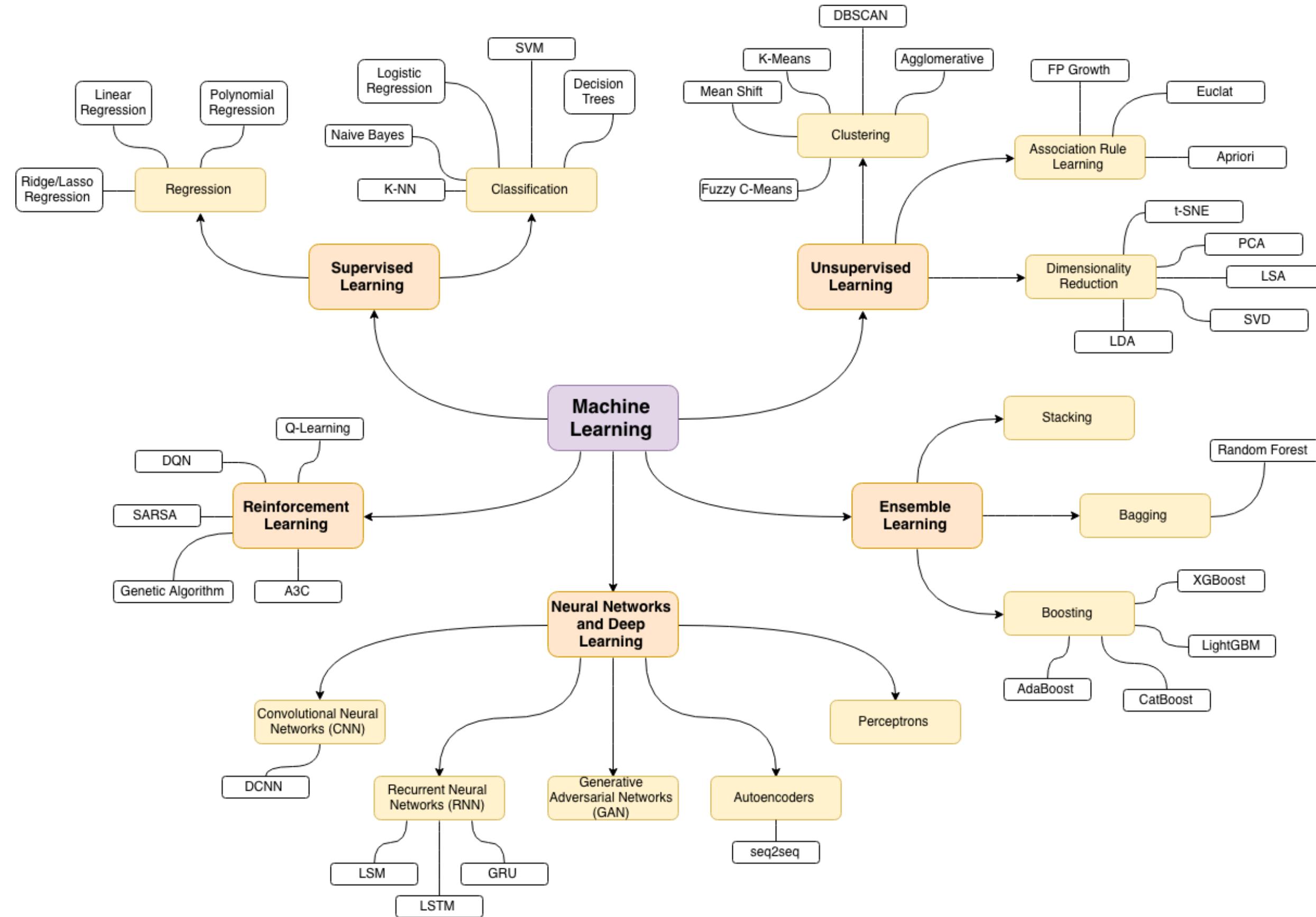


“ **Machine learning** is a field of computer science that gives computer systems the ability to "learn" (i.e. progressively improve performance on a specific task) with data, without being explicitly programmed. ”

Machine Learning

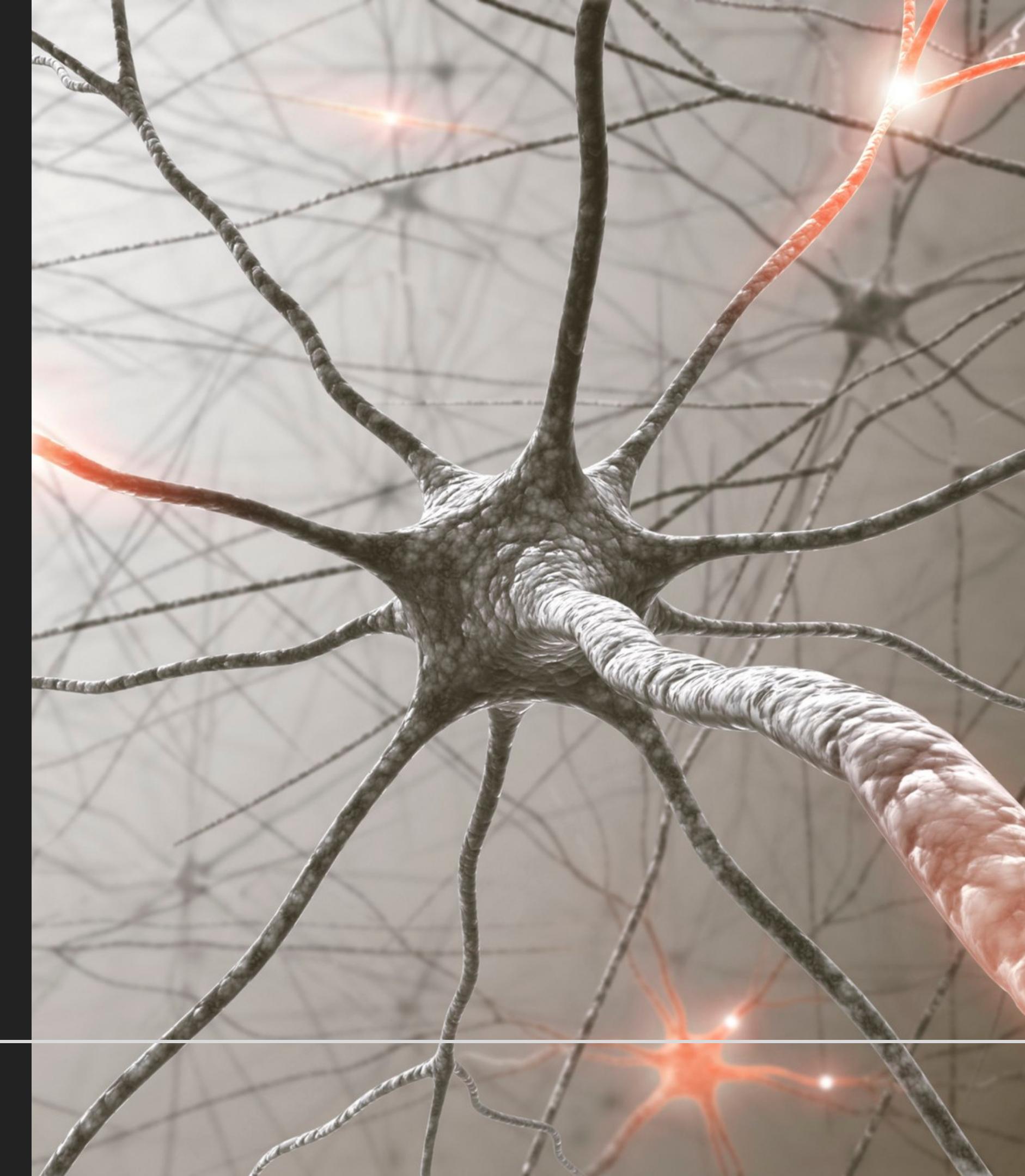


Source



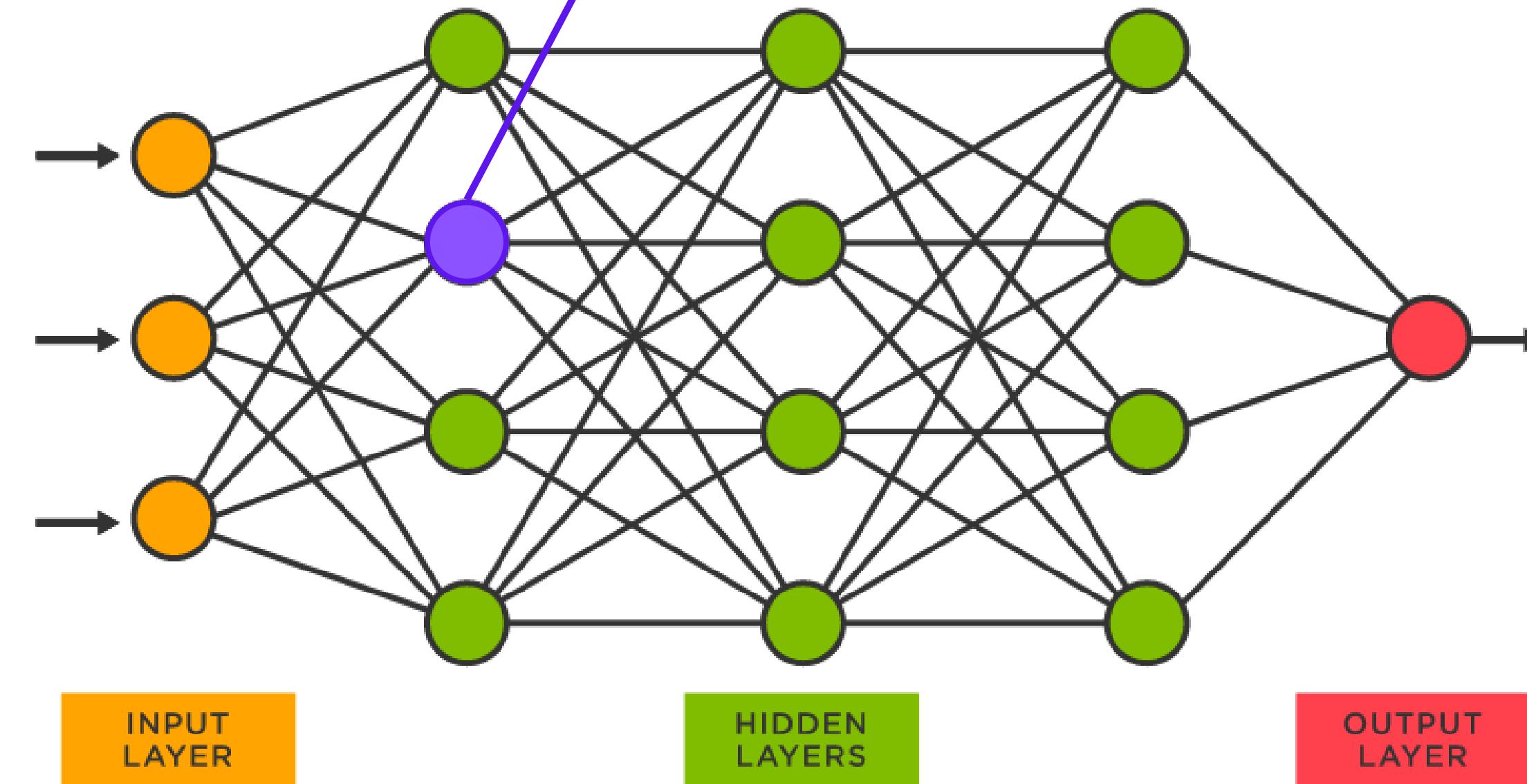
Neural Networks

An introduction to Neural Networks



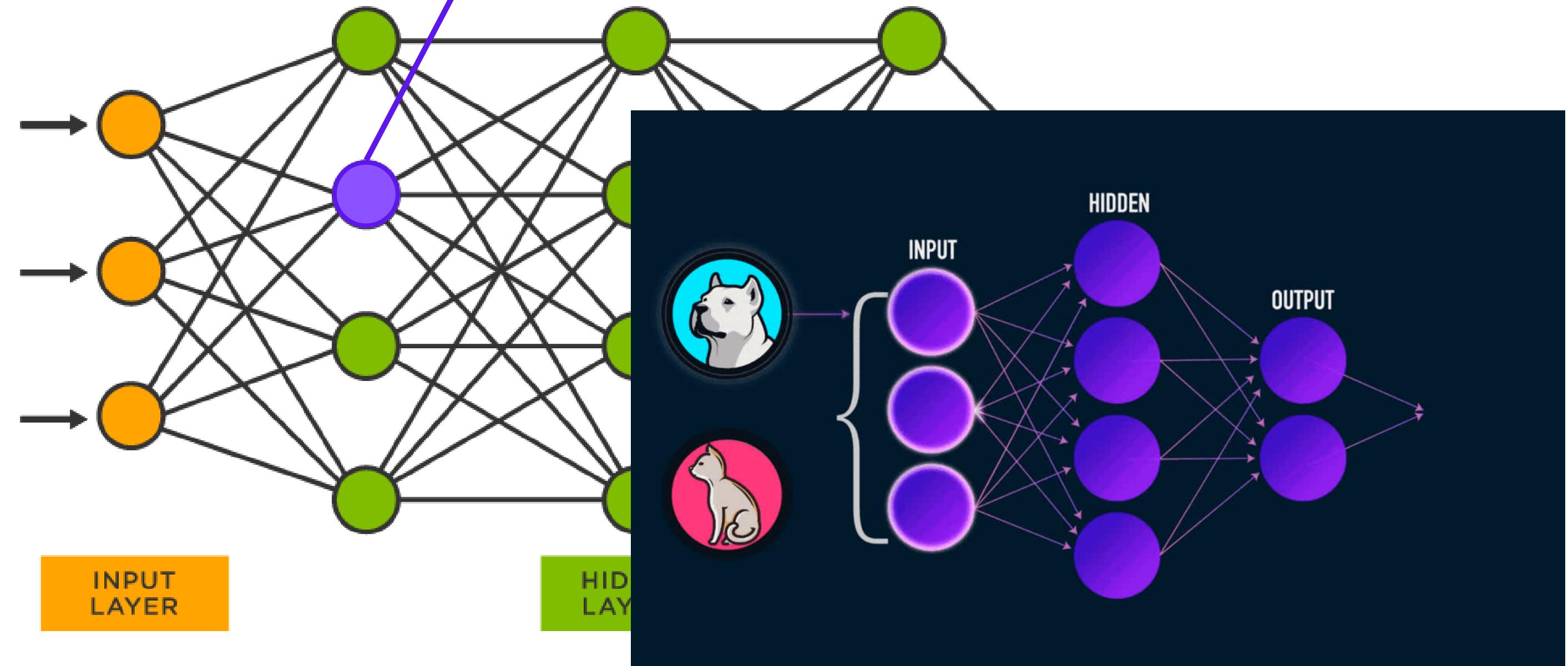
Neural Networks

Based on brain's neurons



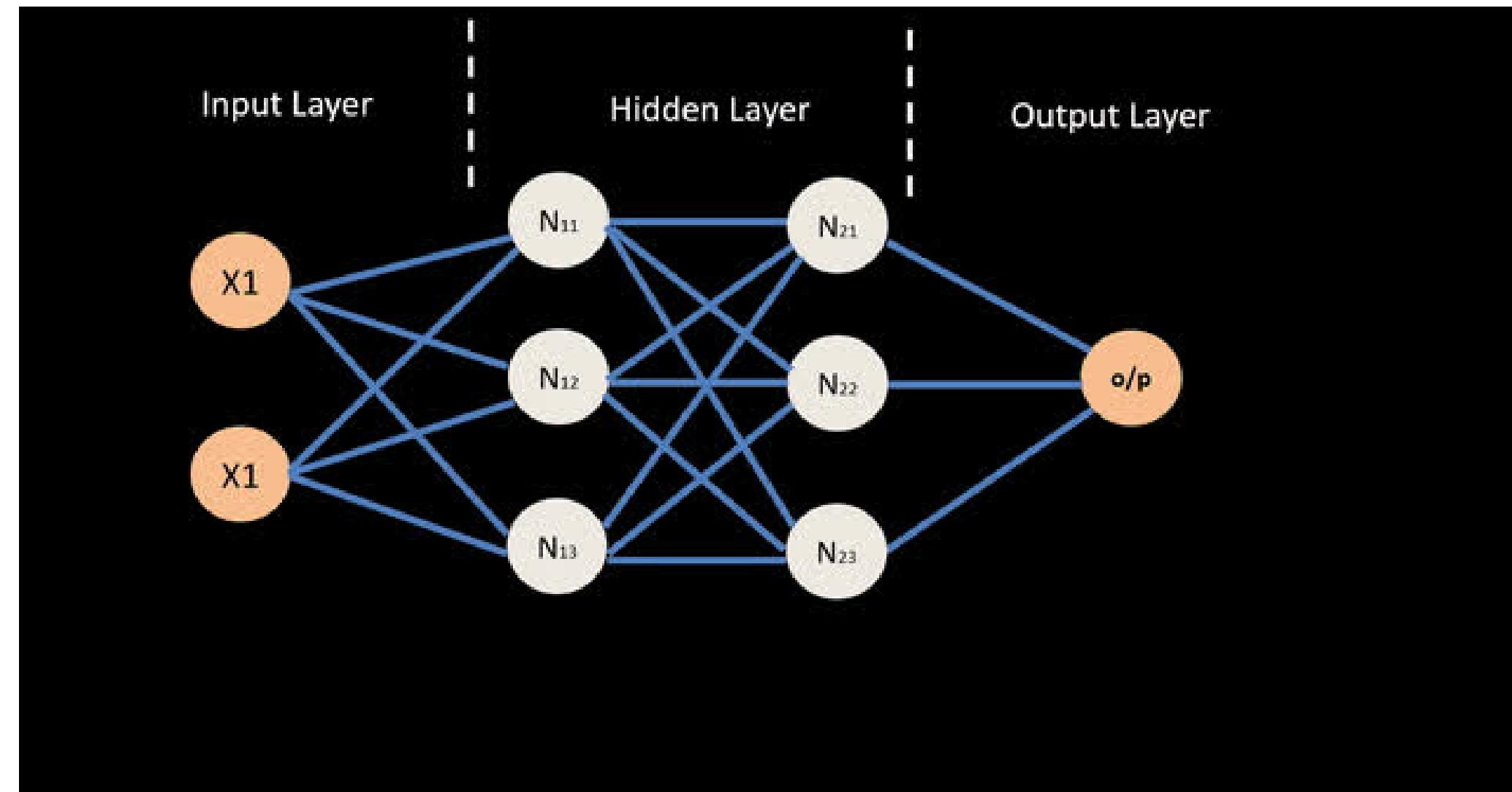
Neural Networks

Based on brain's neurons



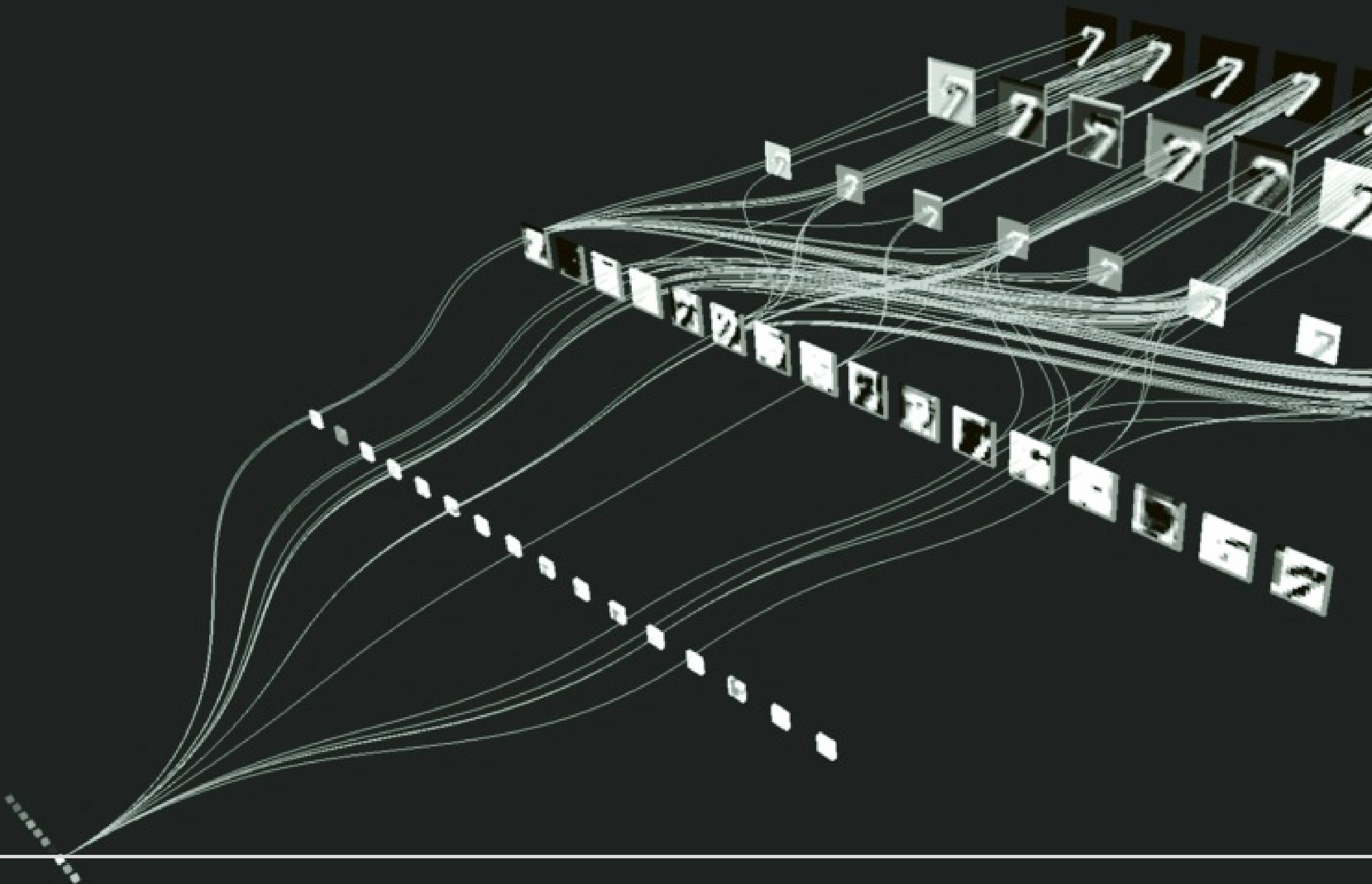
Neural Networks

Based on brain's neurons



CNN

An introduction to Convolutional
Neural Networks

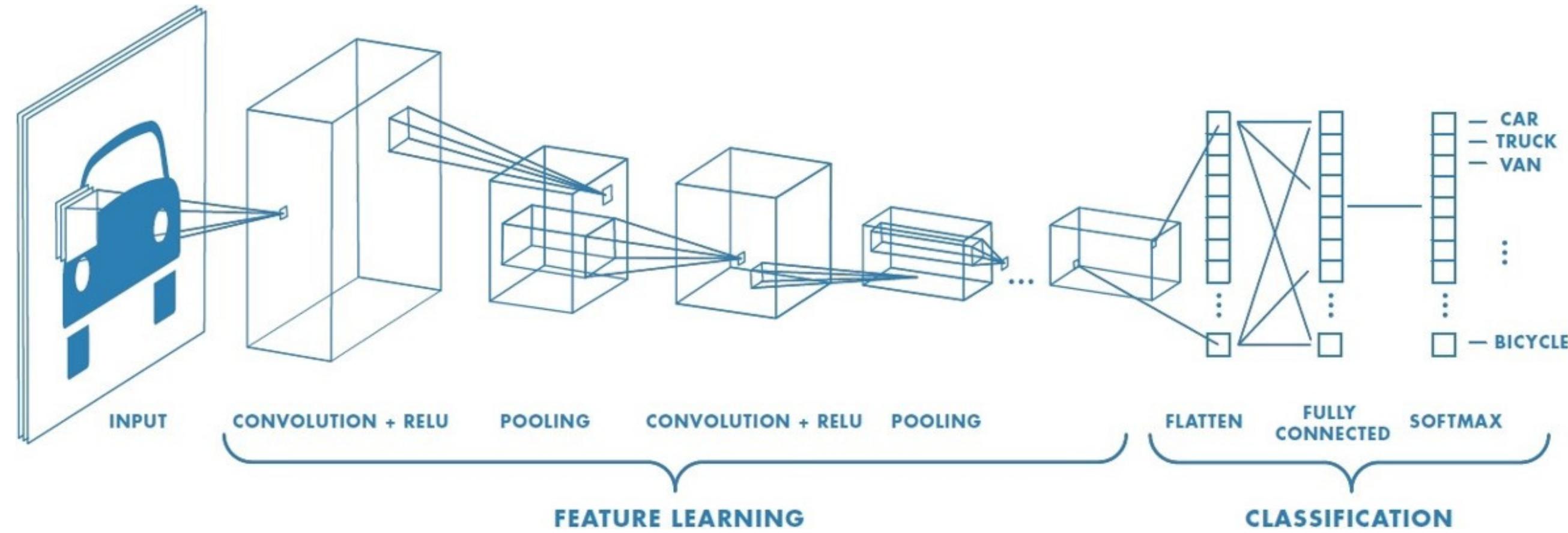


CNN

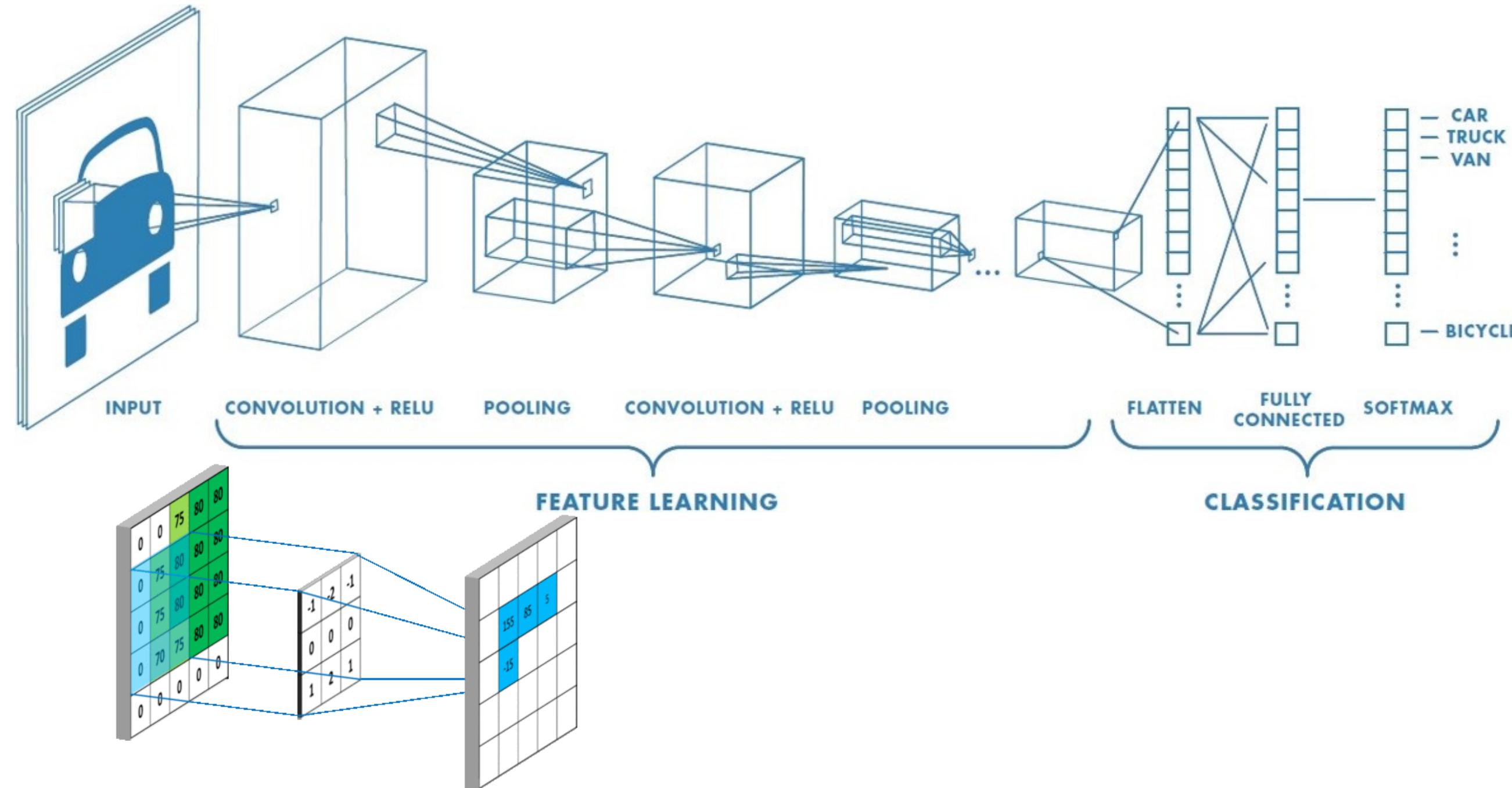
Convolution Neural Networks, or CNN, are deep learning methods that can be applied to images by using filters to extract features from an image and classify it.



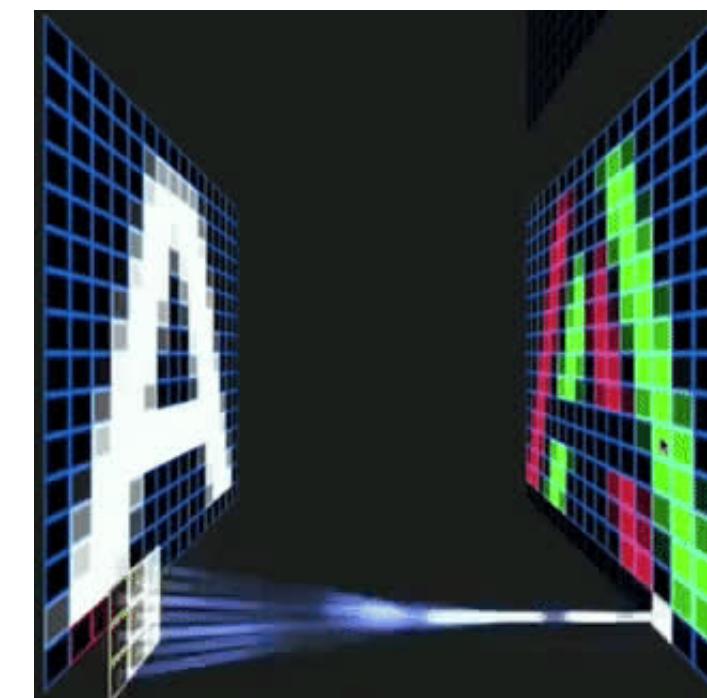
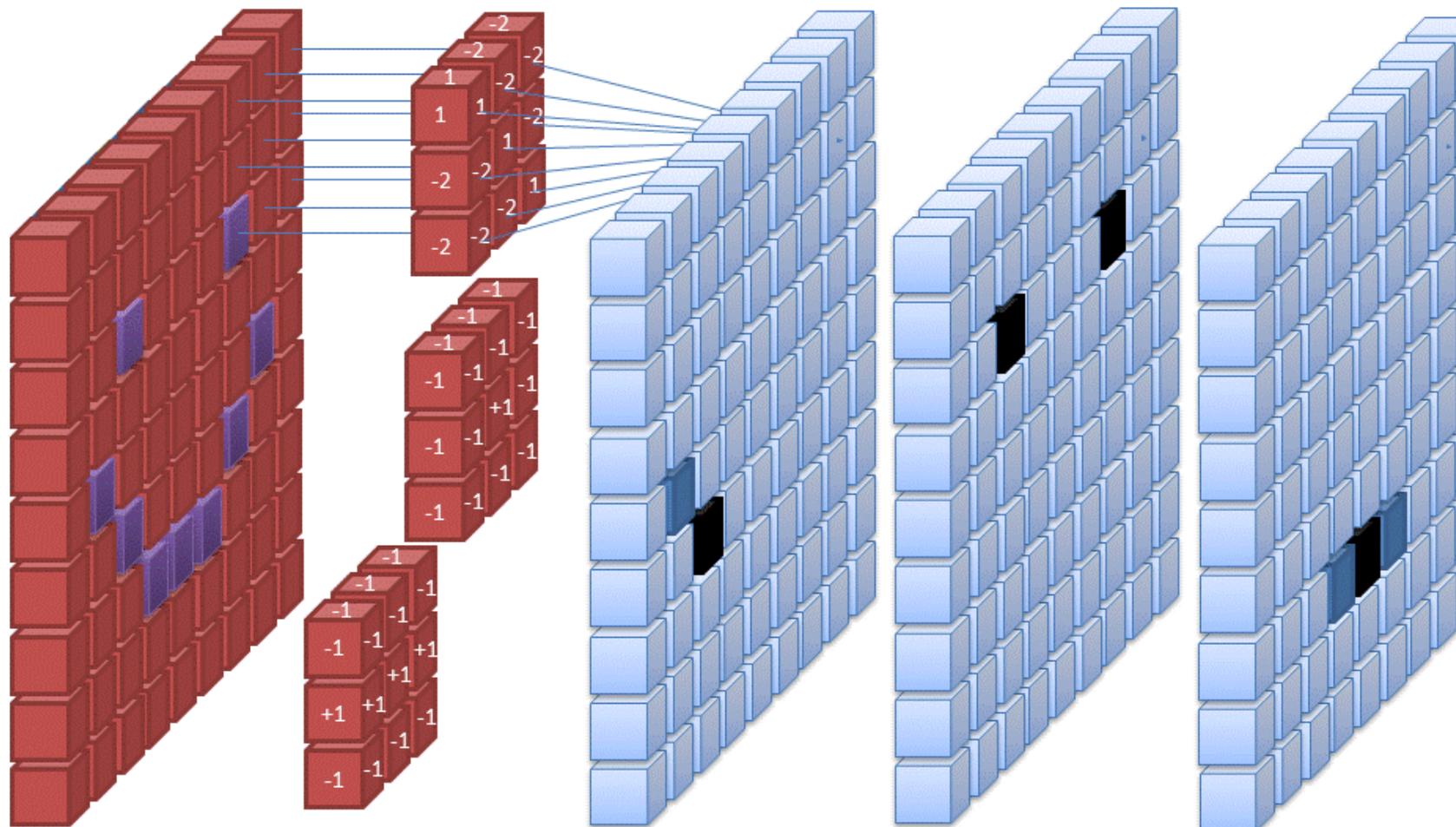
CNN



CNN



CNN



Each filter extract a part of the original image, like everything that is horizontal, all the borders, etc.

CNN

0	0	0	0	0	0	...
0	156	155	156	158	158	...
0	153	154	157	159	159	...
0	149	151	155	158	159	...
0	146	146	149	153	158	...
0	145	143	143	148	158	...
...

Input Channel #1 (Red)

0	0	0	0	0	0	...
0	167	166	167	169	169	...
0	164	165	168	170	170	...
0	160	162	166	169	170	...
0	156	156	159	163	168	...
0	155	153	153	158	168	...
...

Input Channel #2 (Green)

0	0	0	0	0	0	...
0	163	162	163	165	165	...
0	160	161	164	166	166	...
0	156	158	162	165	166	...
0	155	155	158	162	167	...
0	154	152	152	157	167	...
...

Input Channel #3 (Blue)

-1	-1	1
0	1	-1
0	1	1

Kernel Channel #1



308

1	0	0
1	-1	-1
1	0	-1

Kernel Channel #2



-498

0	1	1
0	1	0
1	-1	1

Kernel Channel #3



164

$$+ 1 = -25$$

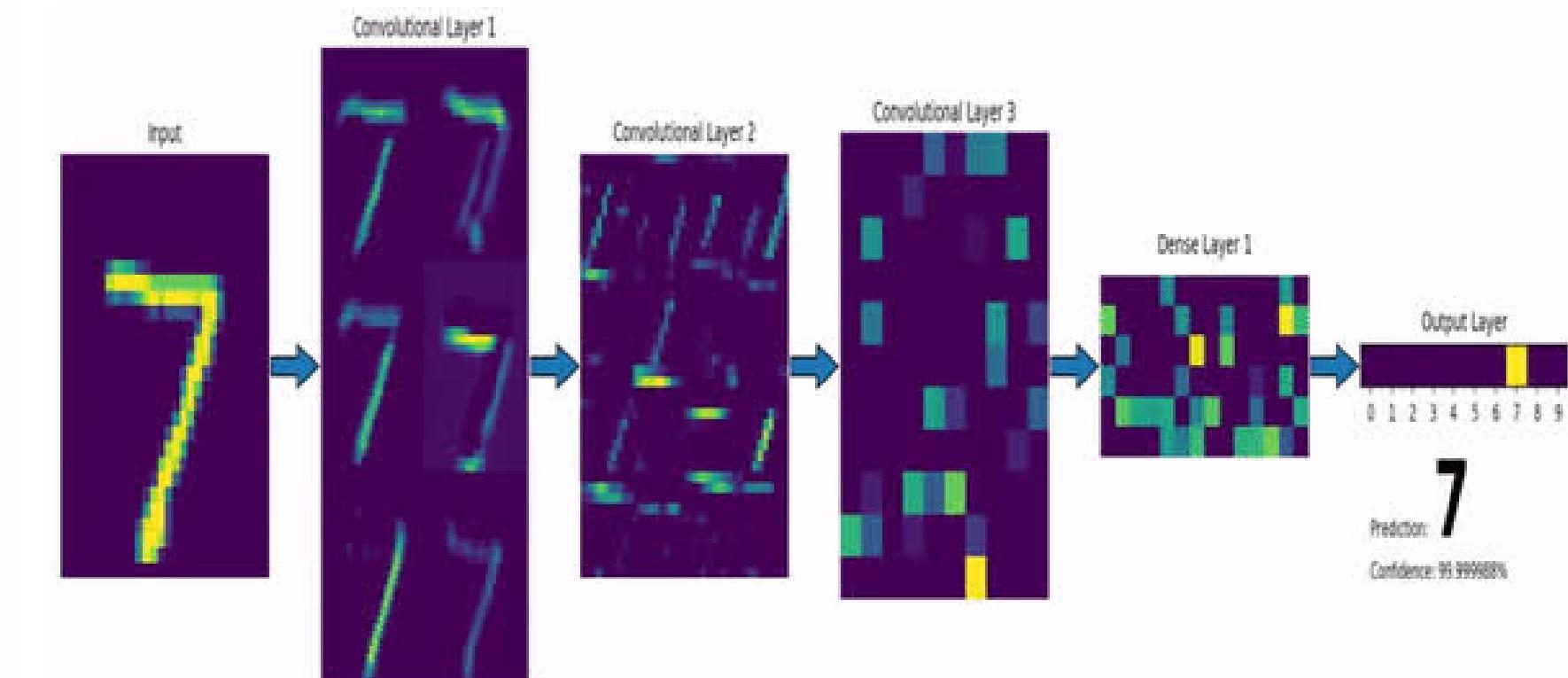
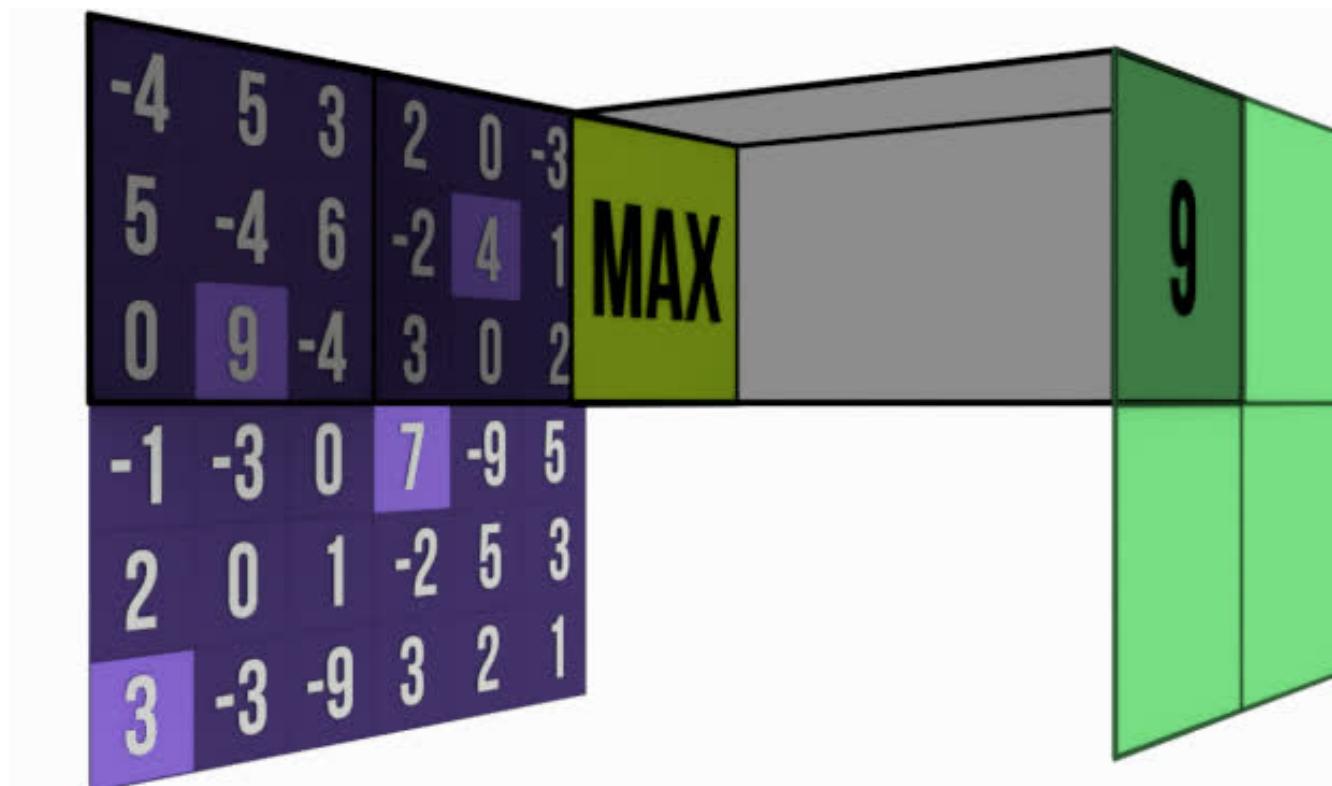
$$\begin{array}{c} \uparrow \\ \text{Bias} = 1 \end{array}$$

-25				...
				...
				...
				...
...

Output

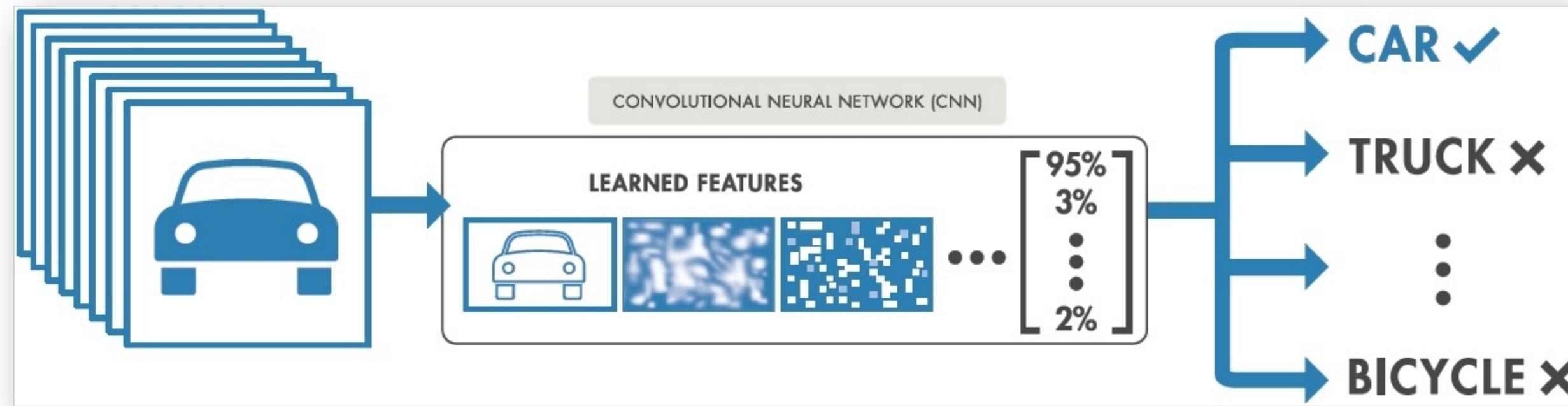
Images can contain only one matrix representation in grayscale, three matrices in RGB, or four in RGBA.

CNN



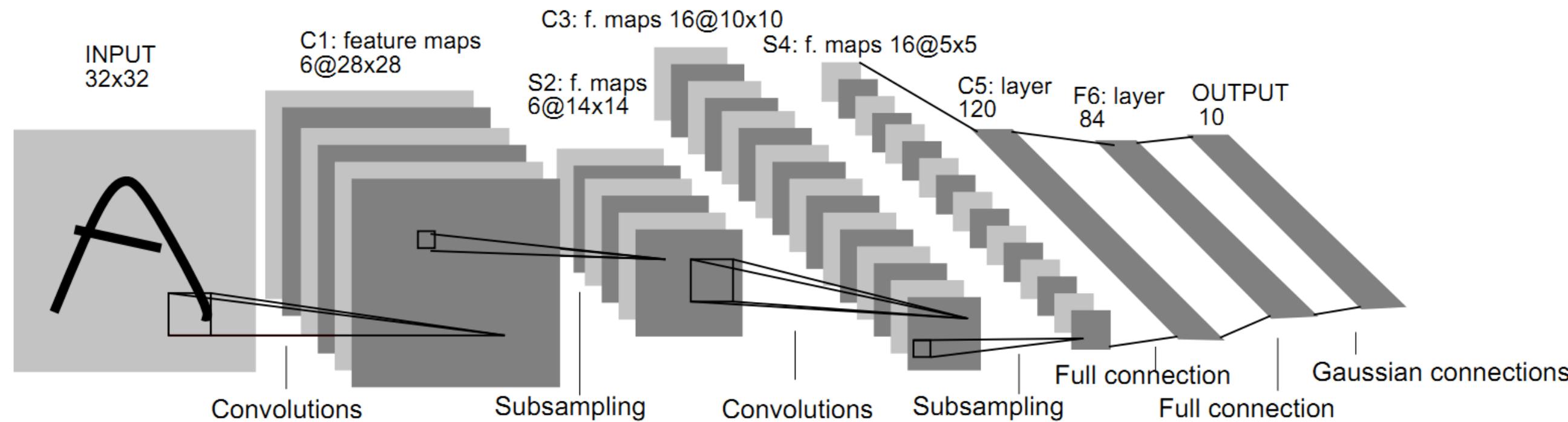
After convolution layers, pooling layers are used to decrease the size of the filtered images to create small features elements from the original image.

CNN



After several convolution layers, small features of the images are then used to classify the image.

CNN



With the feature maps created, a regular fully-connected neural network is used to classify the image.

Good News!!!

All this is already programmed and made available for us!!!



theano



TensorFlow

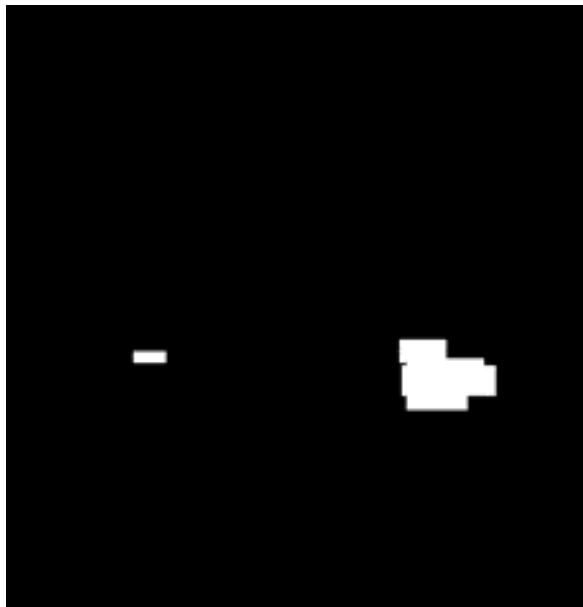
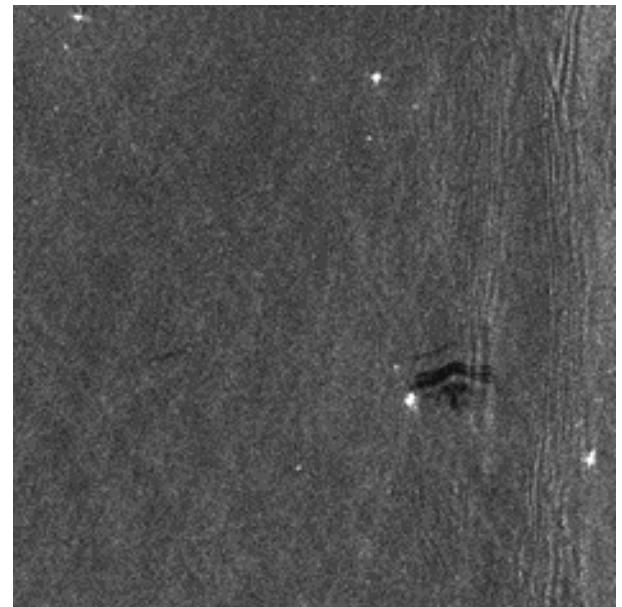
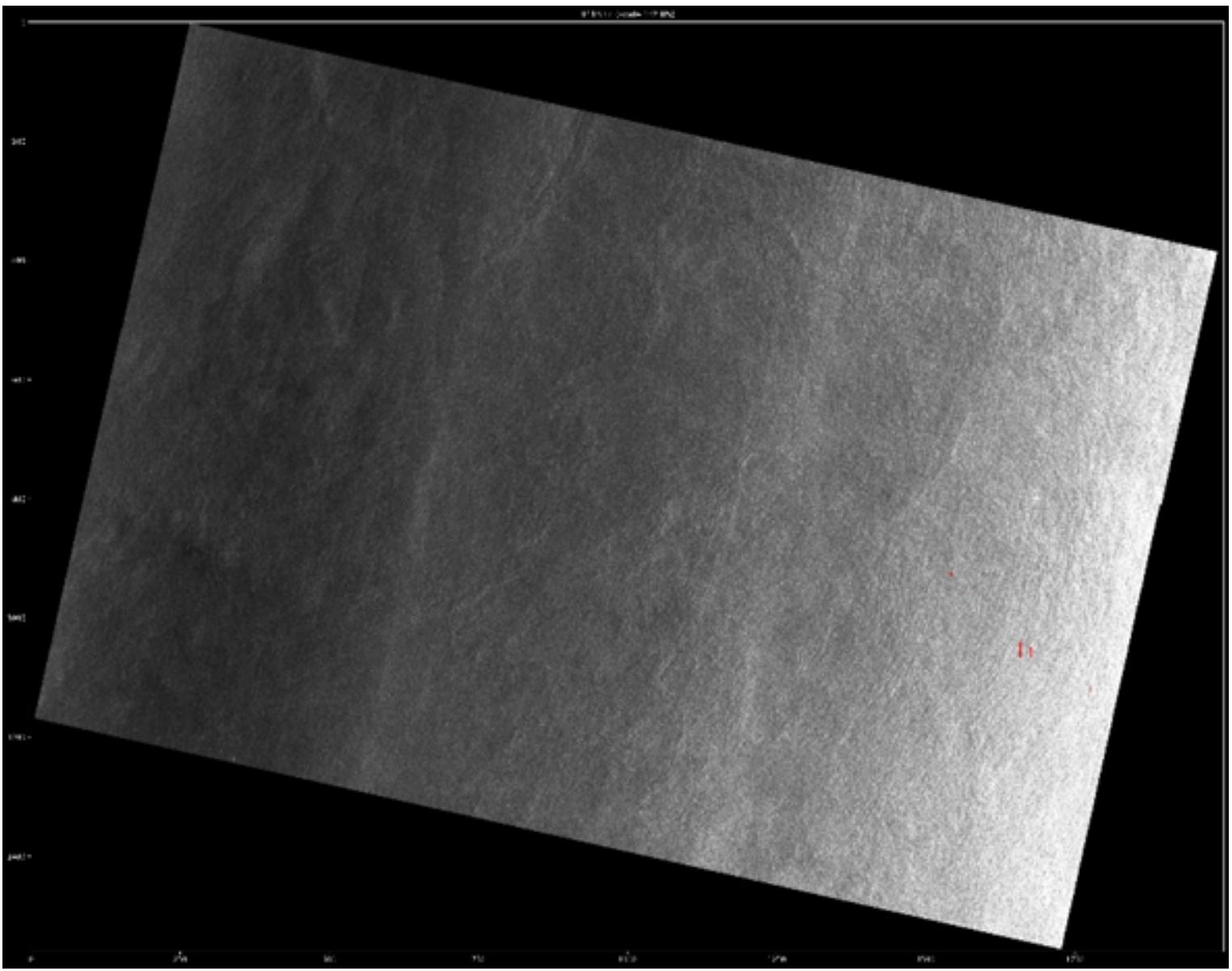


Today's Application

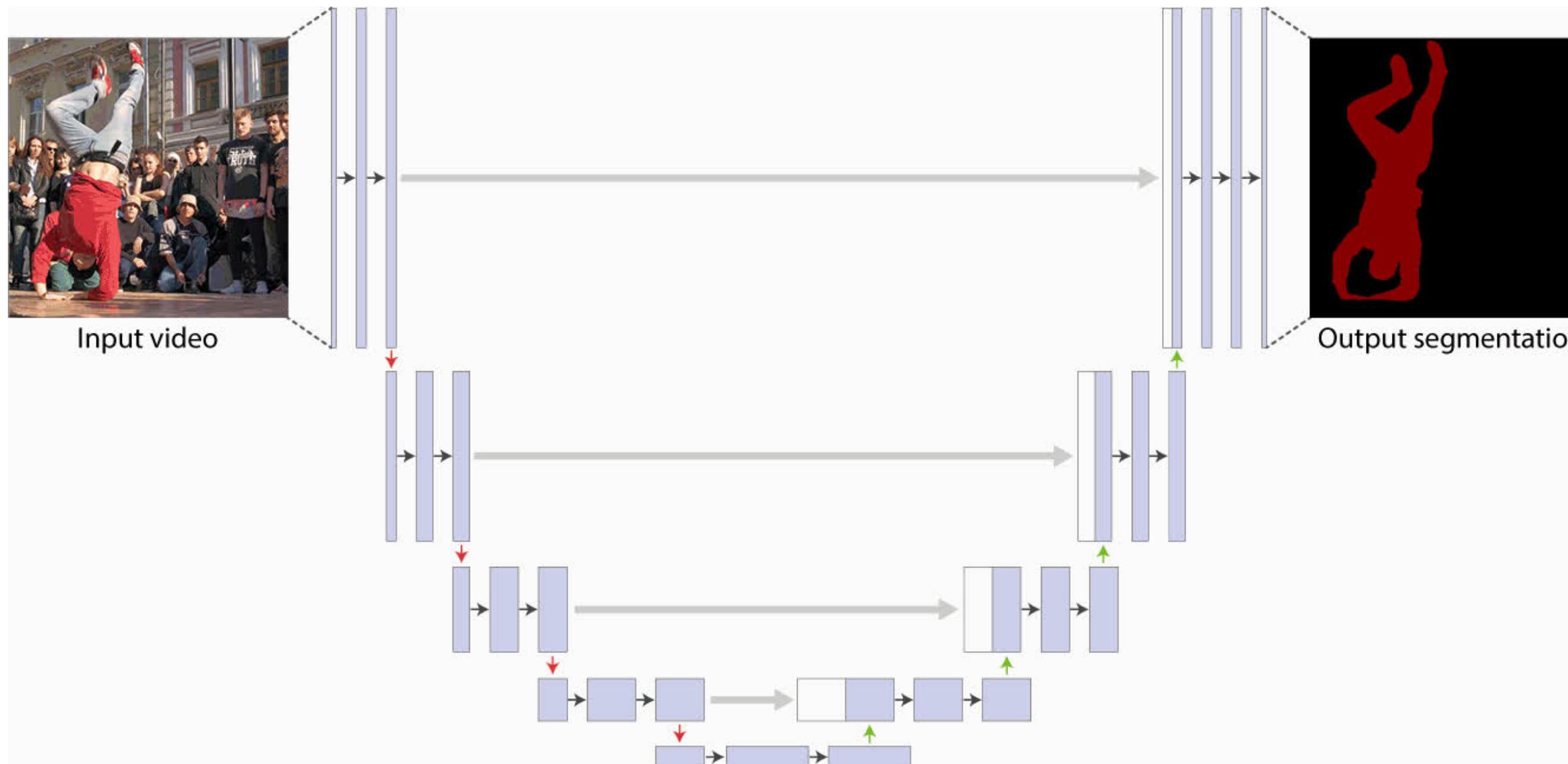
Oil Spill Detection on Satellite Radar
Images



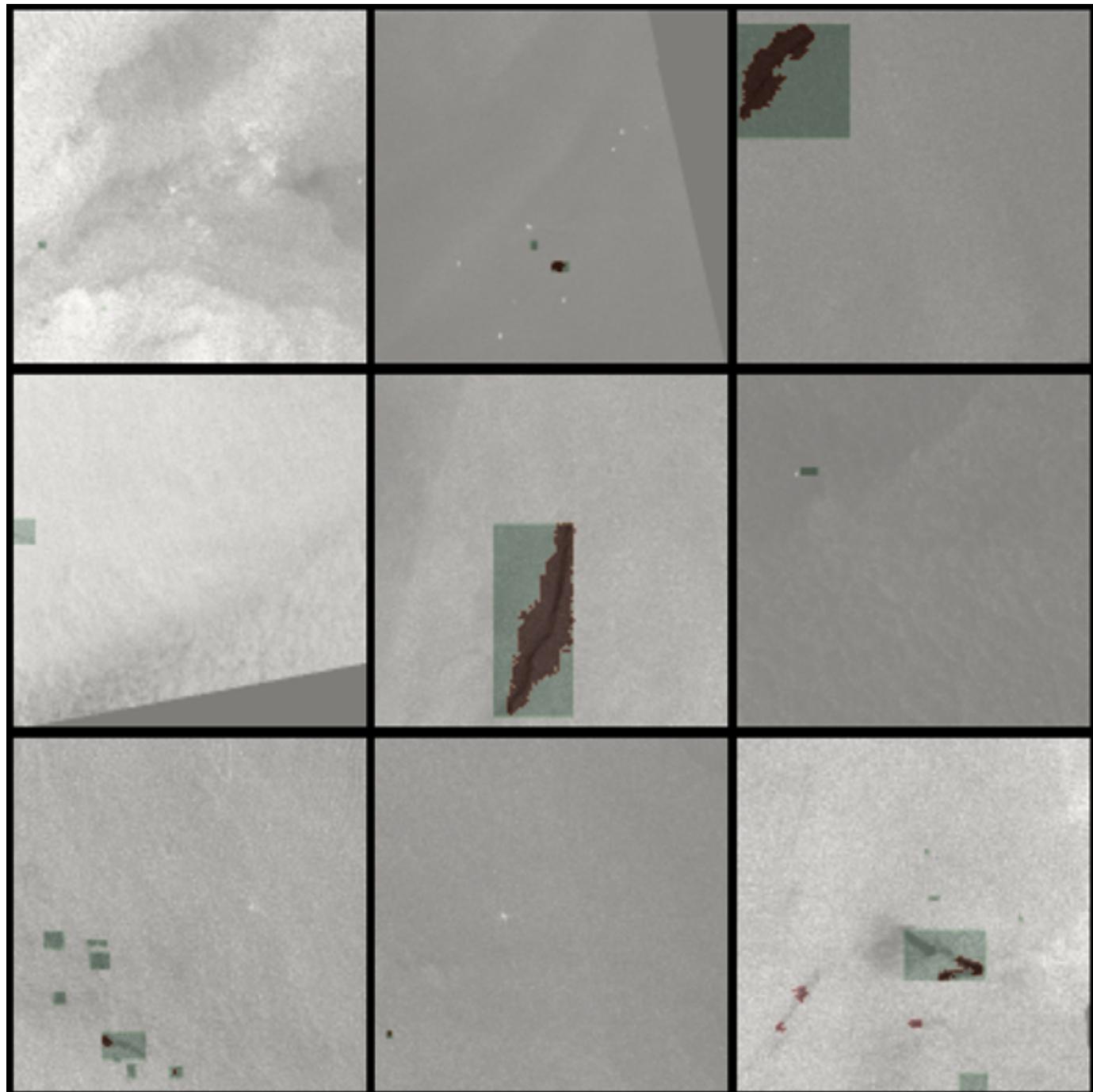
Oil Spill Detection



Oil Spill Detection



Oil Spill Detection



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OPENING



Get in Touch



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University of Calgary



www.crewes.org