Hardware Specifications

Board Specifications

- Quad Core 1.2GHz Broadcom BCM2837 64bit CPU
- 1GB/4GB RAM
- BCM43438 wireless LAN and Bluetooth Low Energy (BLE) on board
- LoRaWAN (Optional)
- 100 Base Ethernet
- 4 USB 2 ports
- 4 Pole stereo output and composite video port
- Full size HDMI
- CSI camera port
- DSI display port
- Upgraded switched Micro USB power source up to 2.5A

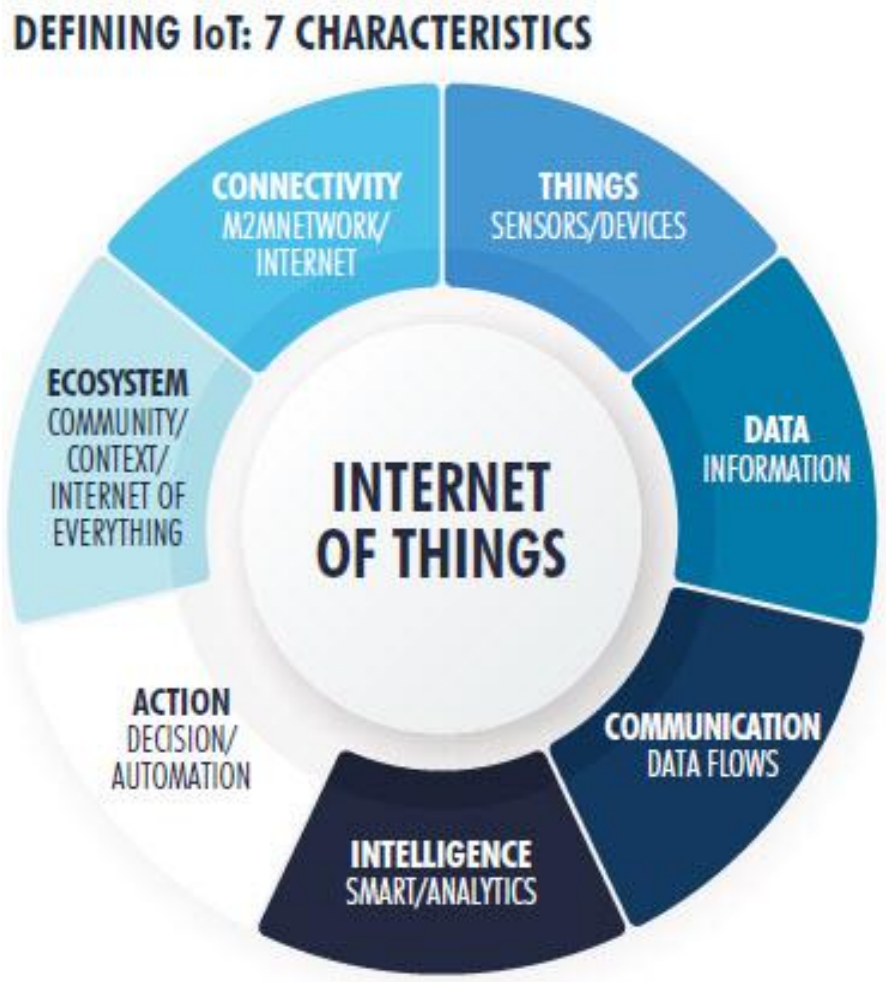
Camera Specifications

Still resolution	8 Megapixels
Video modes	1080p30, 720p60 and 640 × 480p60/90
Linux integration	V4L2 driver available
C programming API	OpenMAX IL and others available
Sensor	Sony IMX219
Sensor resolution	3280 × 2464 pixels
Sensor image area	3.68 x 2.76 mm (4.6 mm diagonal)
Pixel size	1.12 µm x 1.12 µm
Optical size	1/4"
Focal length	3.04 mm
Horizontal field of view	62.2 degrees
Vertical field of view	48.8 degrees
Focal ratio (F-Stop)	2.0

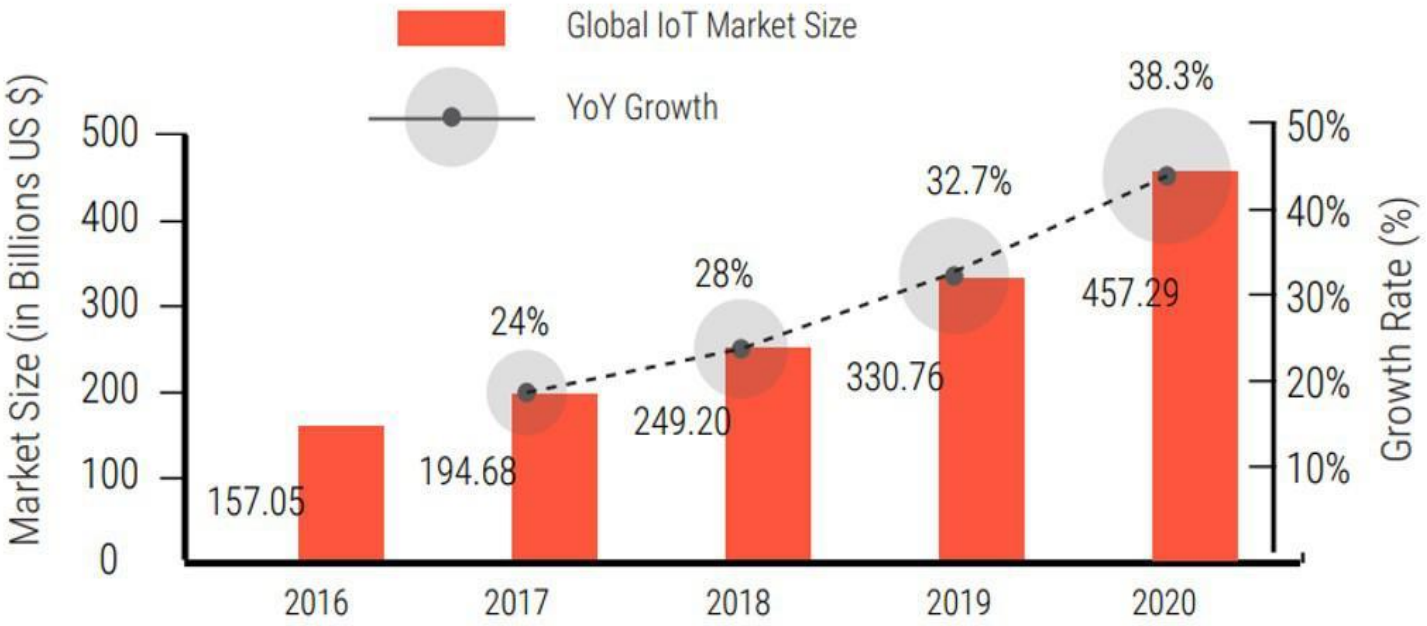
Technology:

Internet of Things

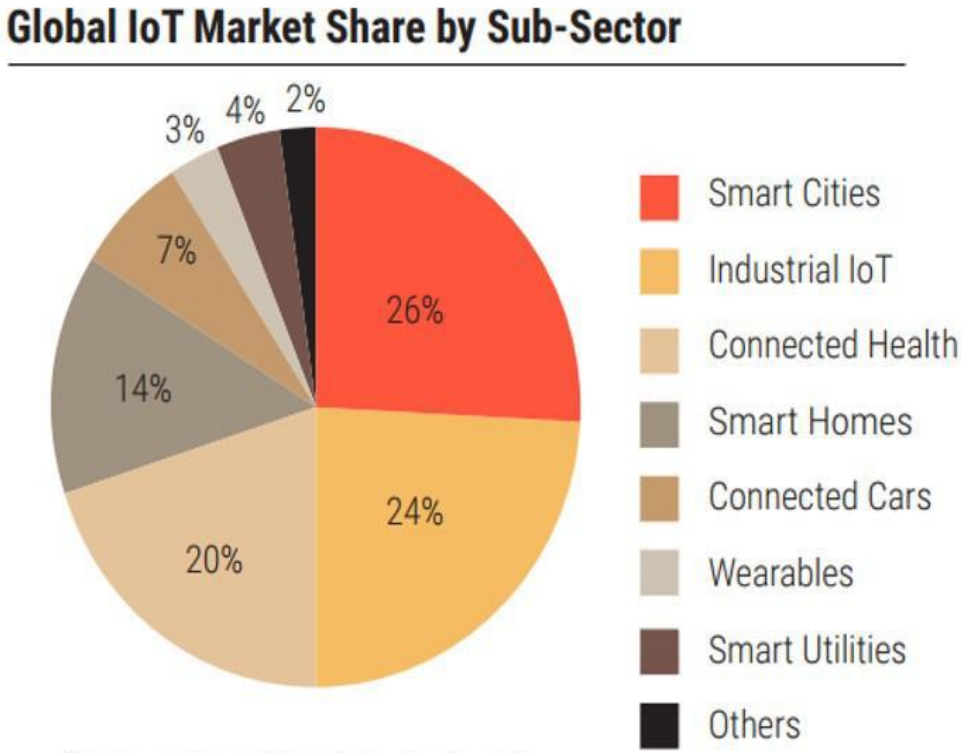
- The IoT is a giant network of connected things and people – all of which collect and share data about the way they are used and about the environment around them.



Growth of IoT



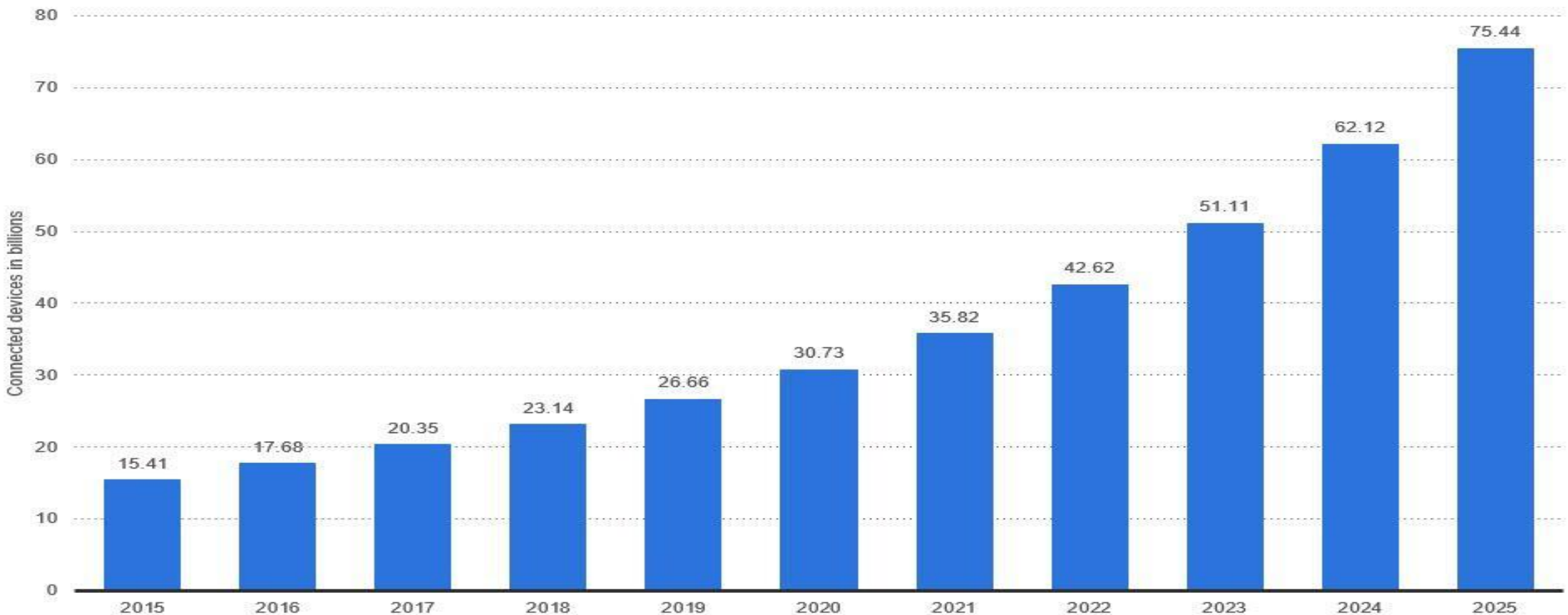
[Sources: GrowthEnabler Analysis/MarketsandMarkets]



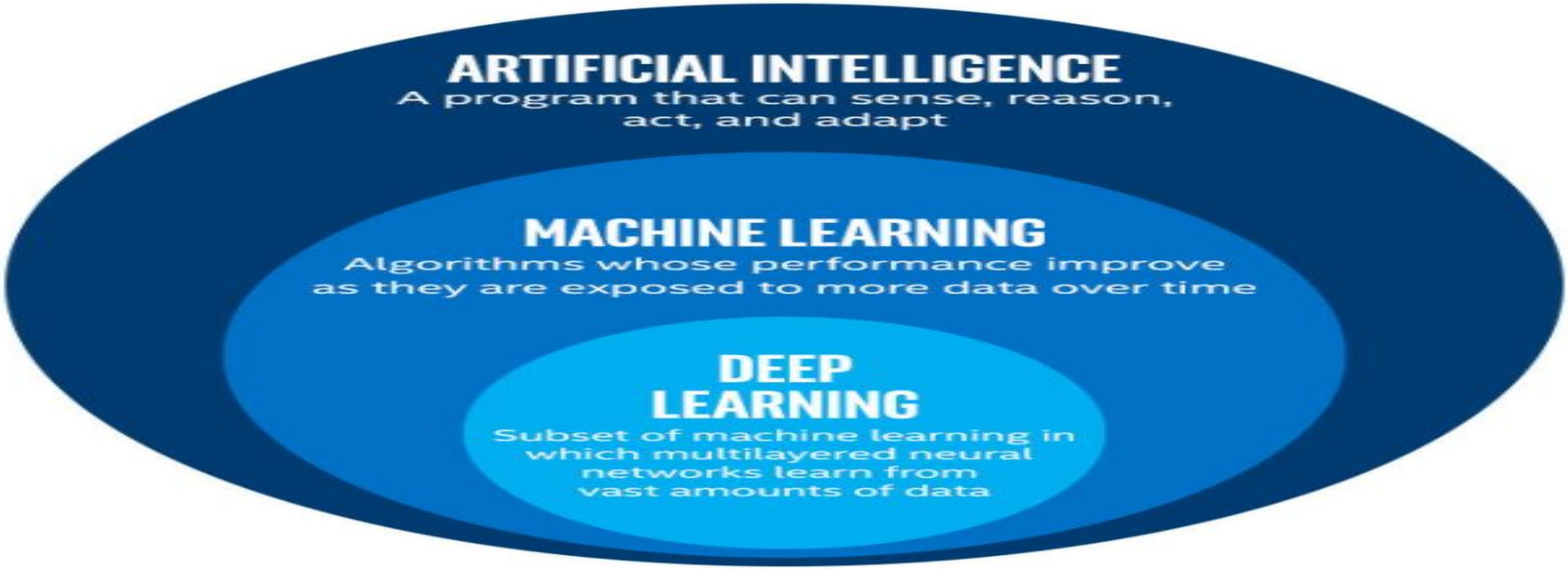
[Source: GrowthEnabler Analysis]

Internet of Things - number of connected devices worldwide 2015-2025

Internet of Things (IoT) connected devices installed base worldwide from 2015 to 2025 (in billions)



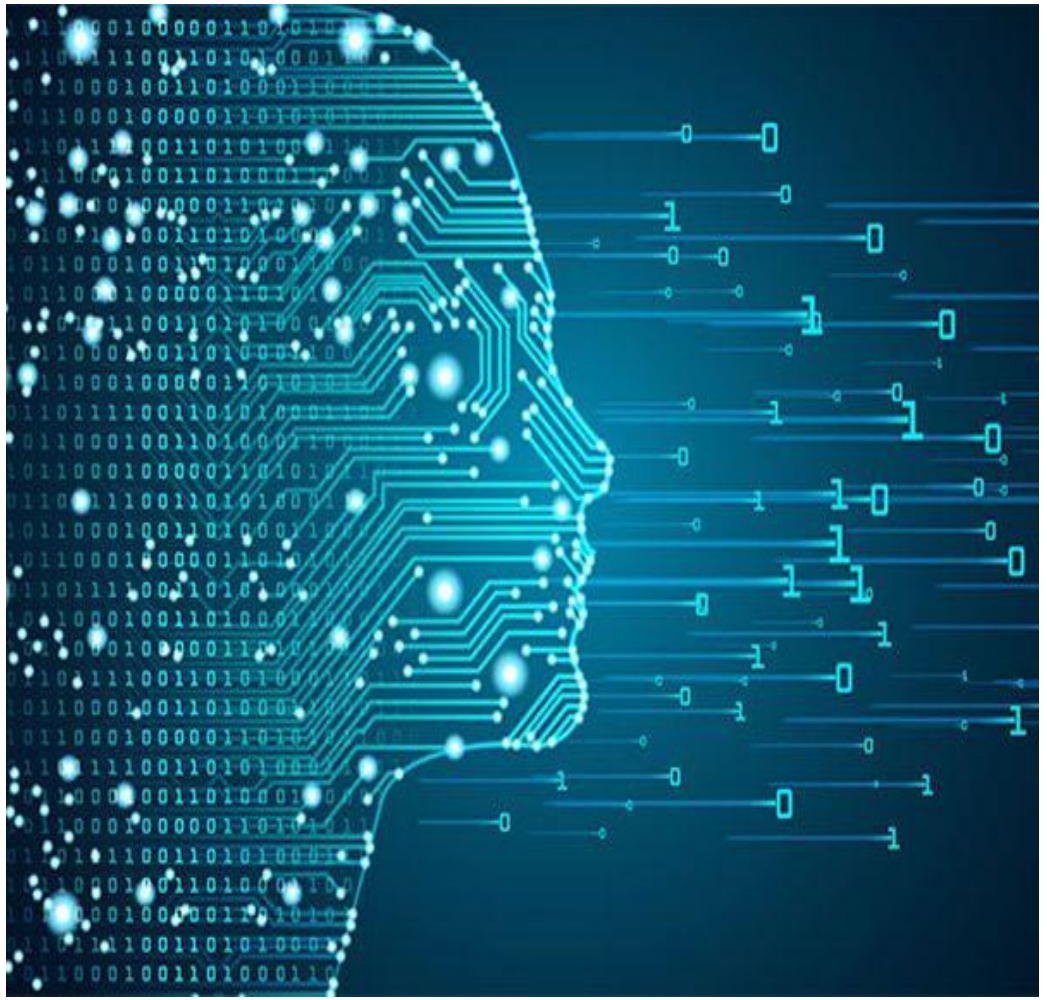
What is AI, ML & DL?



Technology:

Deep Neural Networks

- A form of machine learning that uses multiple layers of a selected algorithm to model highly abstract data.



Types of Machine Learning – At a Glance

Supervised Learning

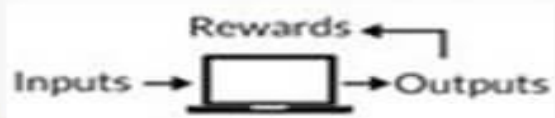
- Makes machine Learn explicitly
- Data with clearly defined output is given
- Direct feedback is given
- Predicts outcome/future
- Resolves classification and regression problems

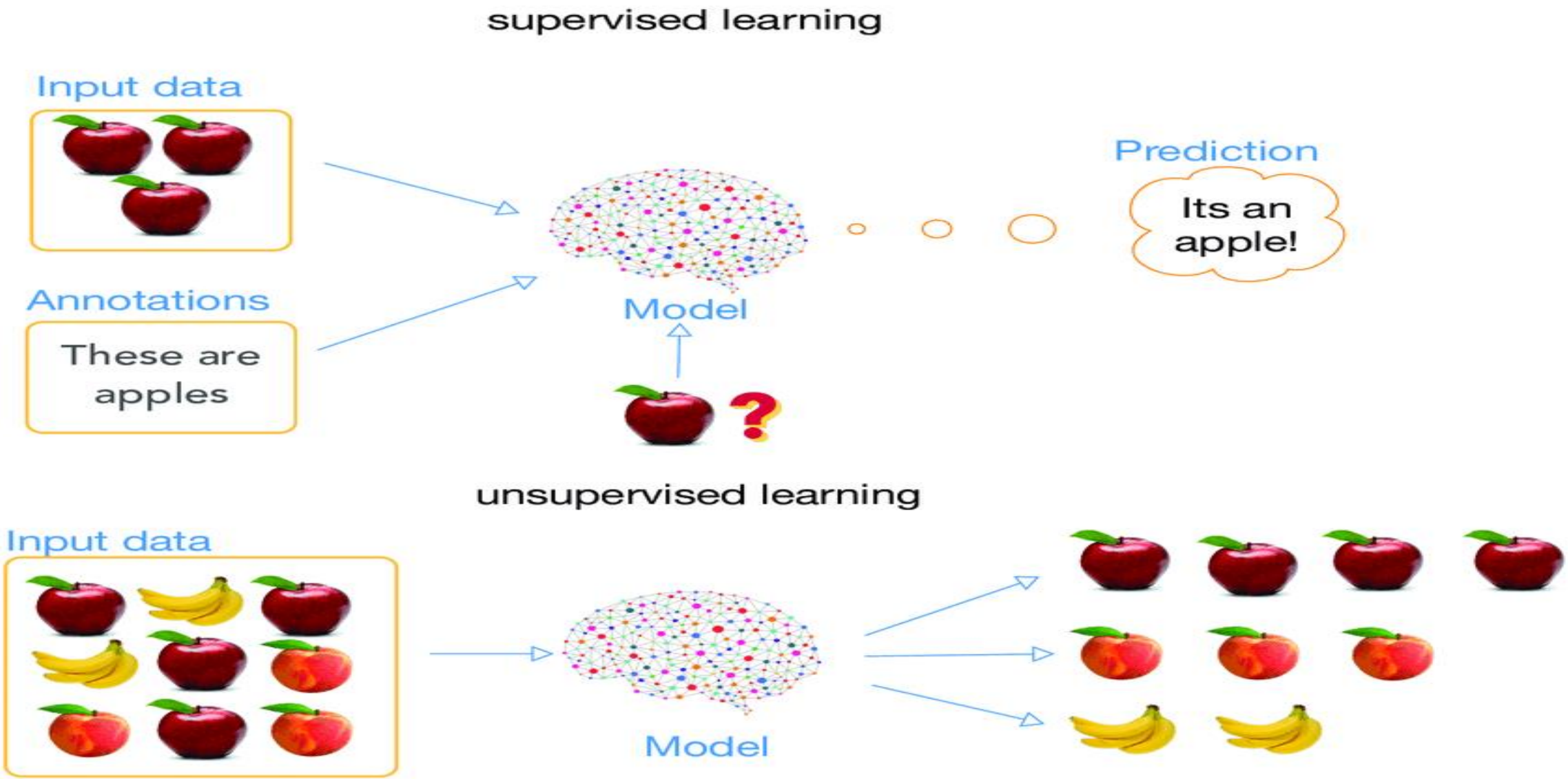
Unsupervised Learning

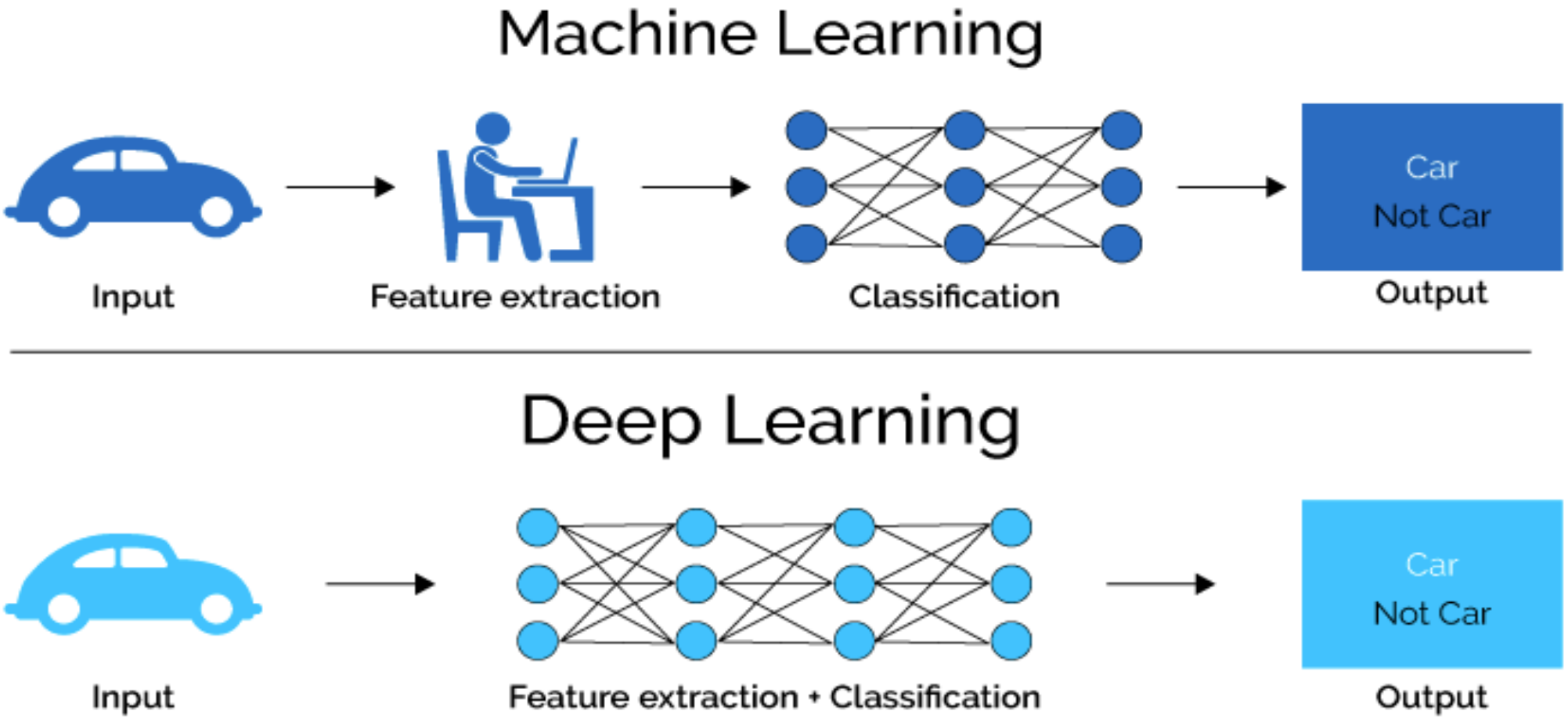
- Machine understands the data (Identifies patterns/structures)
- Evaluation is qualitative or indirect
- Does not predict/find anything specific

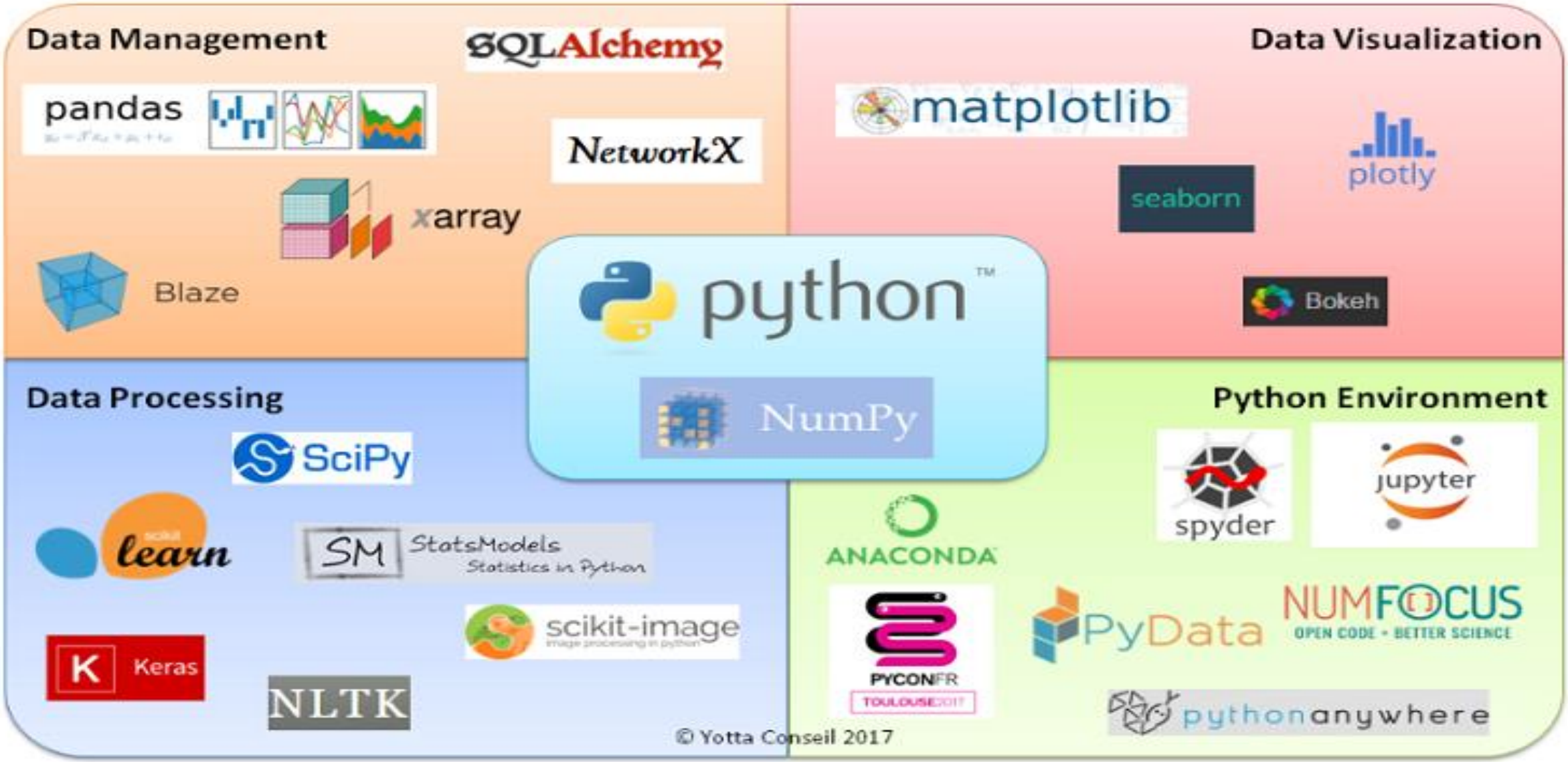
Reinforcement Learning

- An approach to AI
- Reward based learning
- Learning form +ve & +ve reinforcement
- Machine Learns how to act in a certain environment
- To maximize rewards



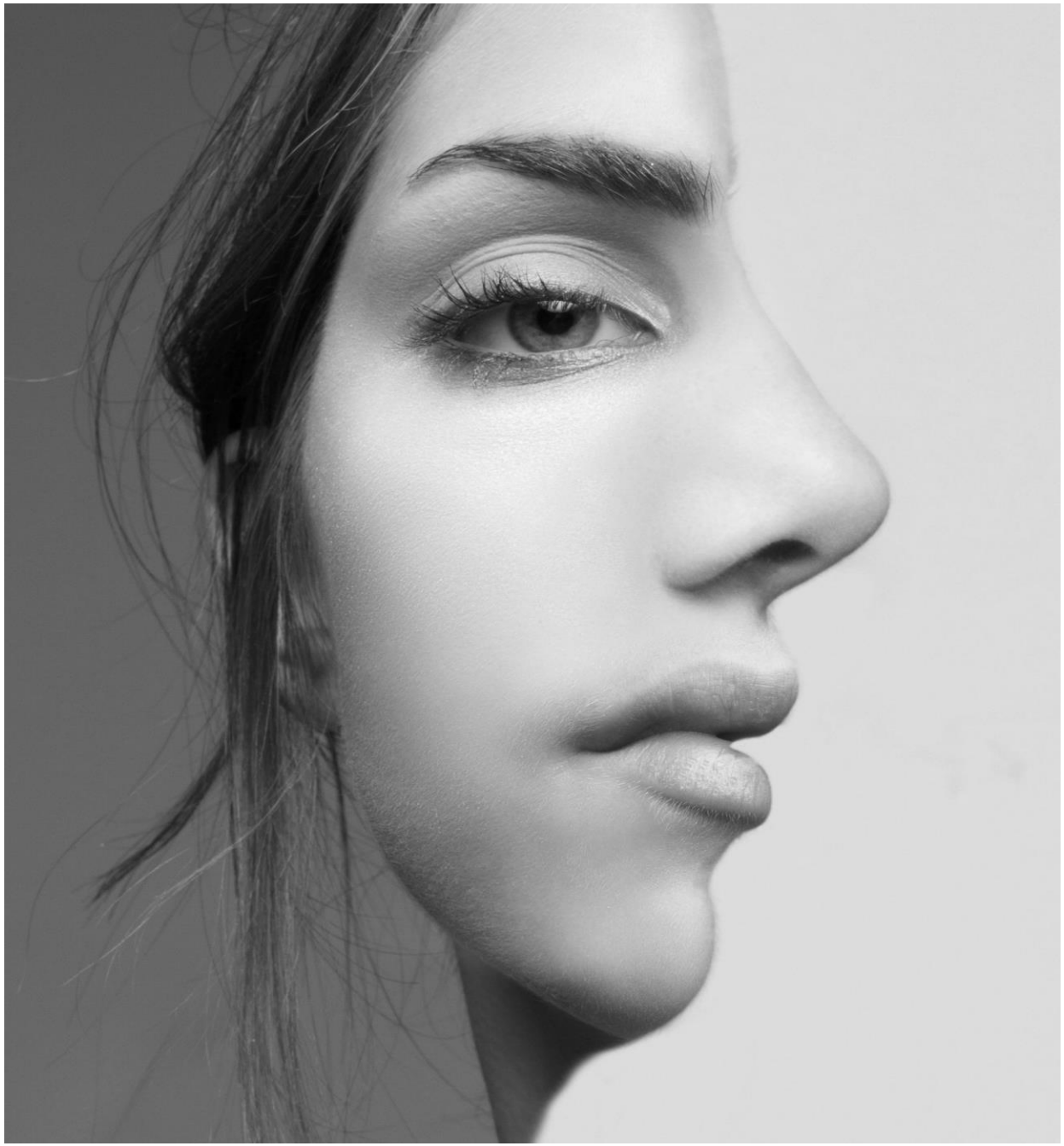

supervised learning
Input data
Annotations
These are apples
Model
Prediction
Its an apple!
unsupervised learning
Input data
Model


Machine Learning
Input
Feature extraction
Classification
Car
Not Car
Output
Deep Learning
Input
Feature extraction + Classification
Car
Not Car
Output


Data Management
SQLAlchemy
pandas
NetworkX
xarray
Blaze
Data Visualization
matplotlib
plotly
seaborn
Bokeh
python
NumPy
Data Processing
SciPy
learn
SM
StatsModels
Statistics in Python
scikit-image
Keras
NLTK
Python Environment
spyder
jupyter
ANACONDA
PYCONFR
TOULOUSE2017
PyData
NUMFOCUS
OPEN CODE + BETTER SCIENCE
pythonanywhere
© Yotta Conseil 2017

AI and IoT :

The convergence of AI (Artificial Intelligence) and IoT can redefine the way industries, business, and economies functions. AI enabled IoT creates intelligent machines that simulate smart behavior and supports in decision making with little or no human interference.



STEP 1: Convolution

STEP 2: Max Pooling

STEP 3: Flattening

STEP 4: Full Connection

Convolutional Neural Network (CNN) — Deep Learning:

- In neural networks, Convolutional neural network (ConvNets or CNNs) is one of the main categories to do

a) images recognition
b) images classifications
c) Objects detections

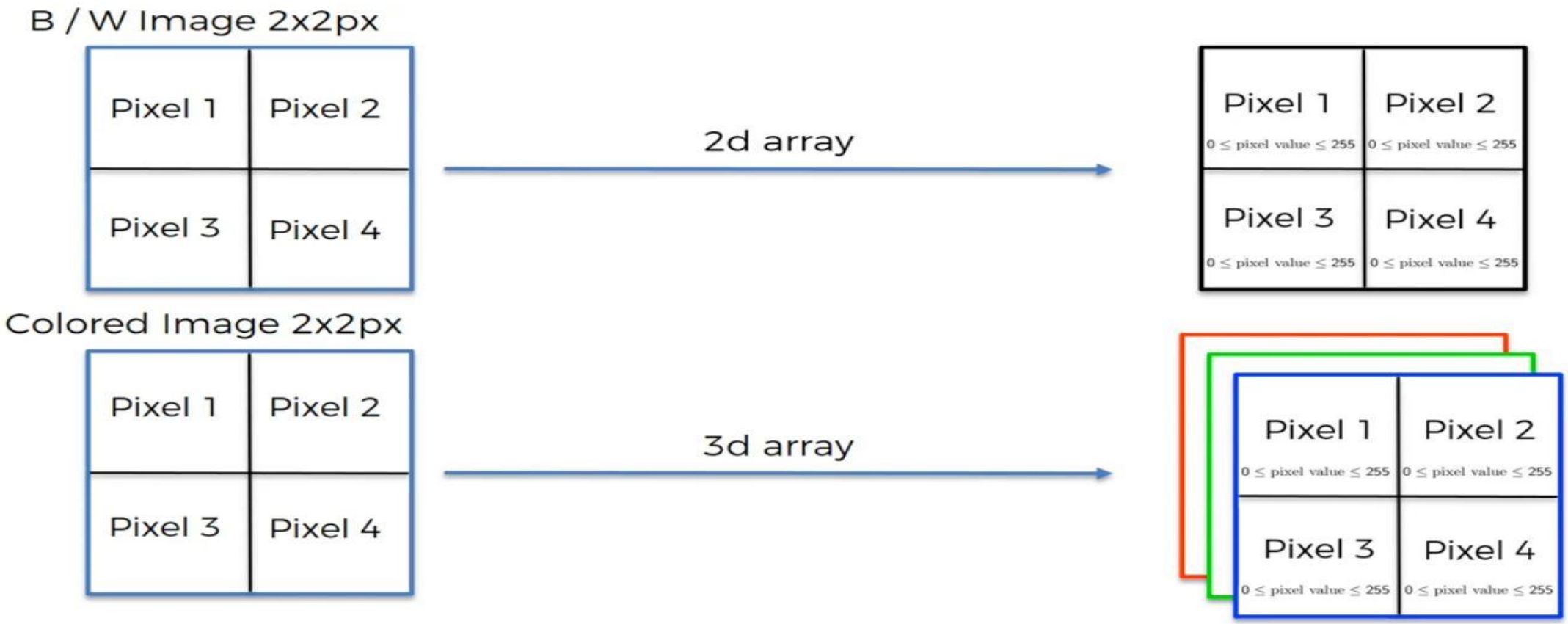
- CNN image classifications takes an input image, process it and classify it under certain categories (Eg., Dog, Cat, Tiger, Lion)

- Computers sees an input image as array of pixels and it depends on the image resolution.

- Based on the image resolution, it will see h x w x d(h = Height, w = Width, d = Dimension).

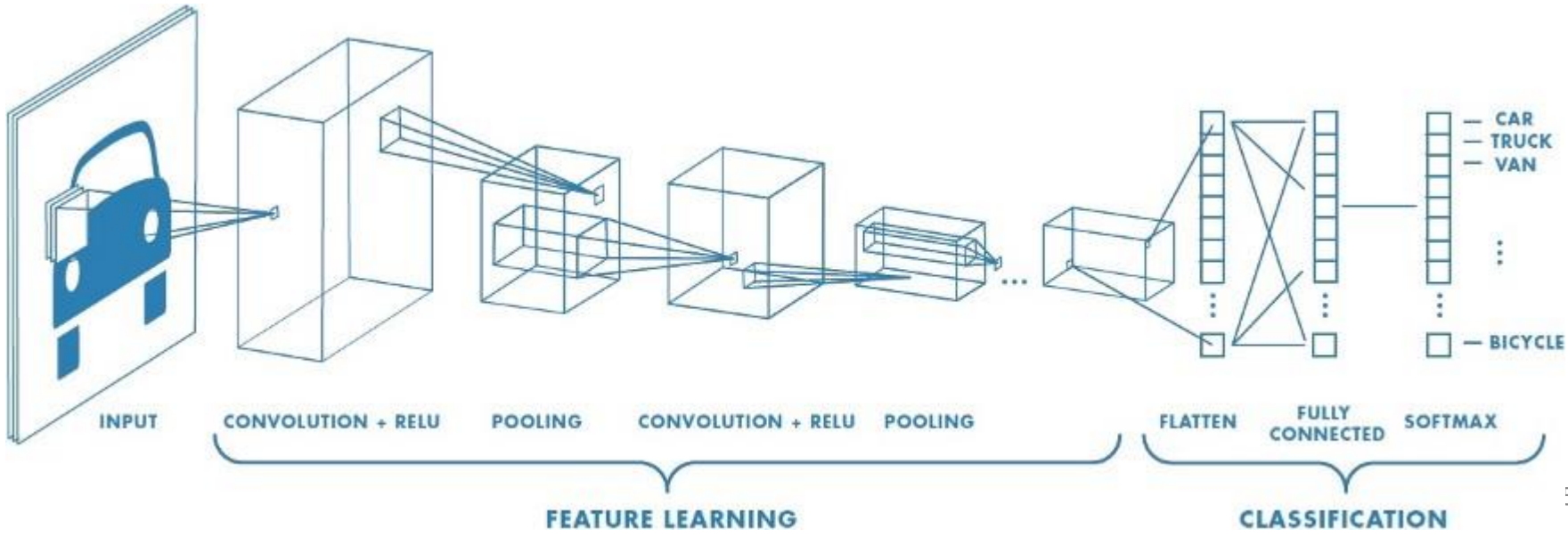
- An image of 6 x 6 x 3 array of matrix of RGB (3 refers to RGB values) and an image of 4 x 4 x 1 array of matrix of grayscale image.

Image Representation



Convolutional Neural Network (CNN) — Deep Learning:

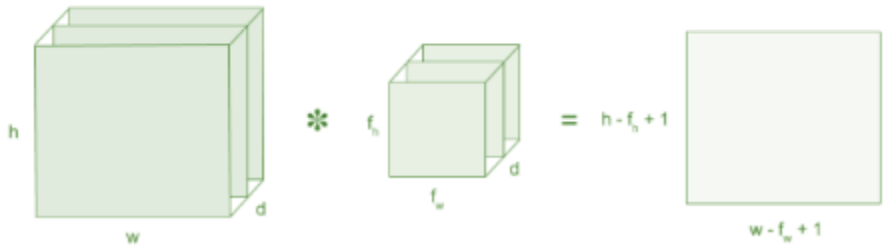
- Deep learning CNN models to train and test.
- Each input image will pass it through a series of convolution layers with filters (Kernals), Pooling, fully connected layers (FC) and apply Softmax function to classify an object with probabilistic values between 0 and 1.
- The below figure is a complete flow of CNN to process an input image and classifies the objects based on values.



Convolution Layer:

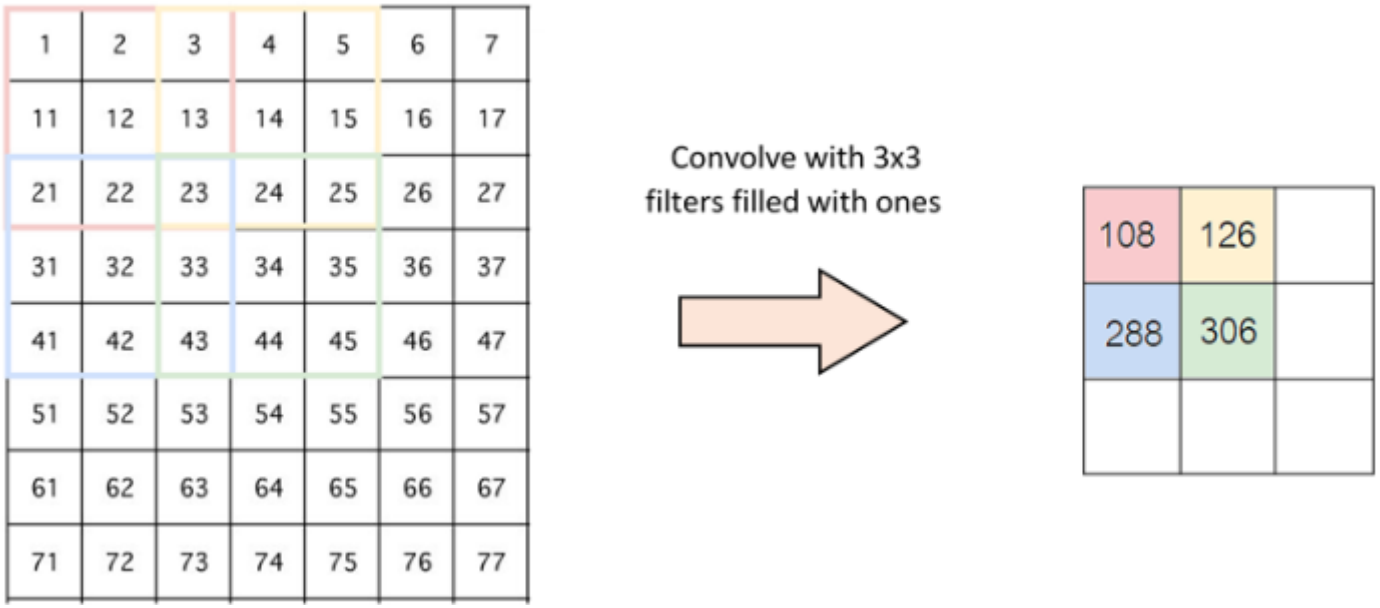
- Convolution is the first layer to extract features from an input image.
- Convolution preserves the relationship between pixels by learning image features using small squares of input data.
- It is a mathematical operation that takes two inputs such as image matrix and a filter or kernel.

- An image matrix (volume) of dimension **(h x w x d)**
- A filter **(f_h x f_w x d)**
- Outputs a volume dimension **(h - f_h + 1) x (w - f_w + 1) x 1**



Strides:

- ❖ Stride is the number of pixels shifts over the input matrix.
- ❖ When the stride is 1 then we move the filters to 1 pixel at a time.
- ❖ When the stride is 2 then we move the filters to 2 pixels at a time and so on.

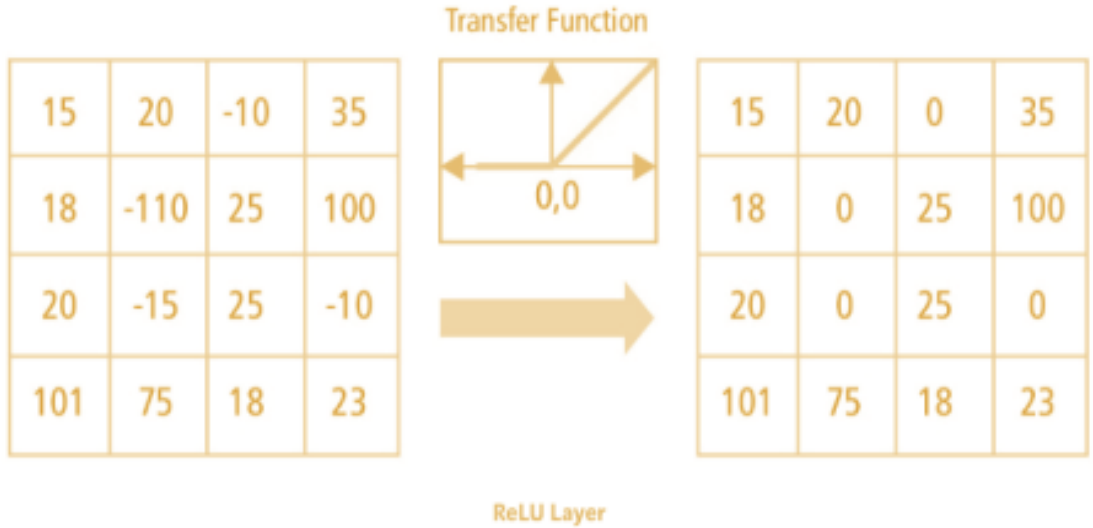


Non Linearity (ReLU):

- ReLU stands for Rectified Linear Unit for a non-linear operation. The output is ***f(x) = max(0,x).***

- Why ReLU is important : ReLU's purpose is to introduce non-linearity in our ConvNet.

- There are other non linear functions such as tanh or sigmoid that can also be used instead of ReLU.

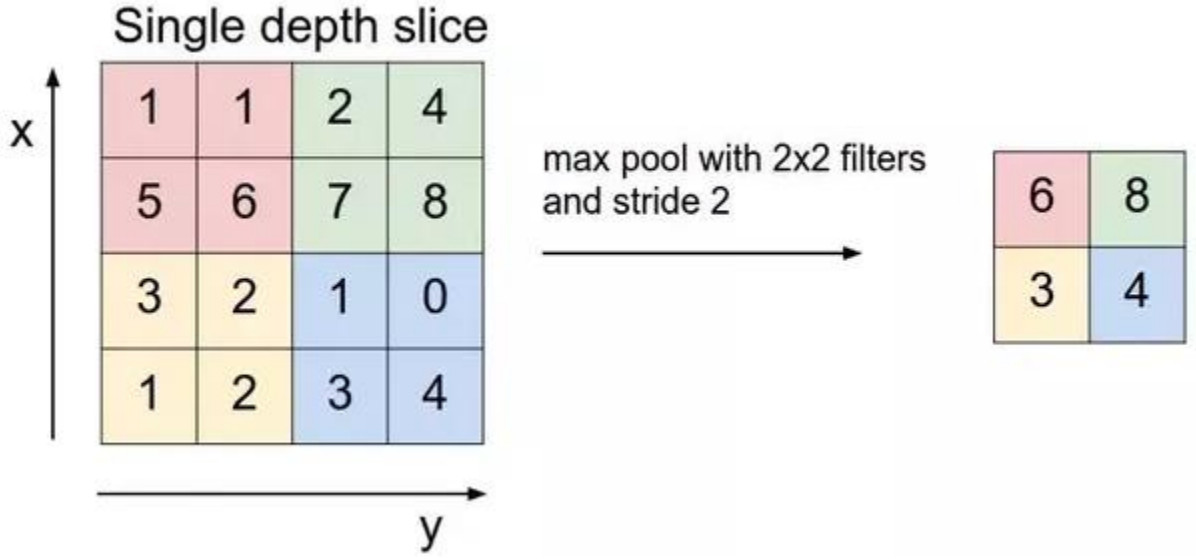


Pooling Layer:

- Pooling layers section would reduce the number of parameters when the images are too large.

- Spatial pooling also called subsampling or downsampling which reduces the dimensionality of each map but retains important information.

- Spatial pooling can be of different types:
  - Max Pooling
  - Average Pooling
  - Sum Pooling

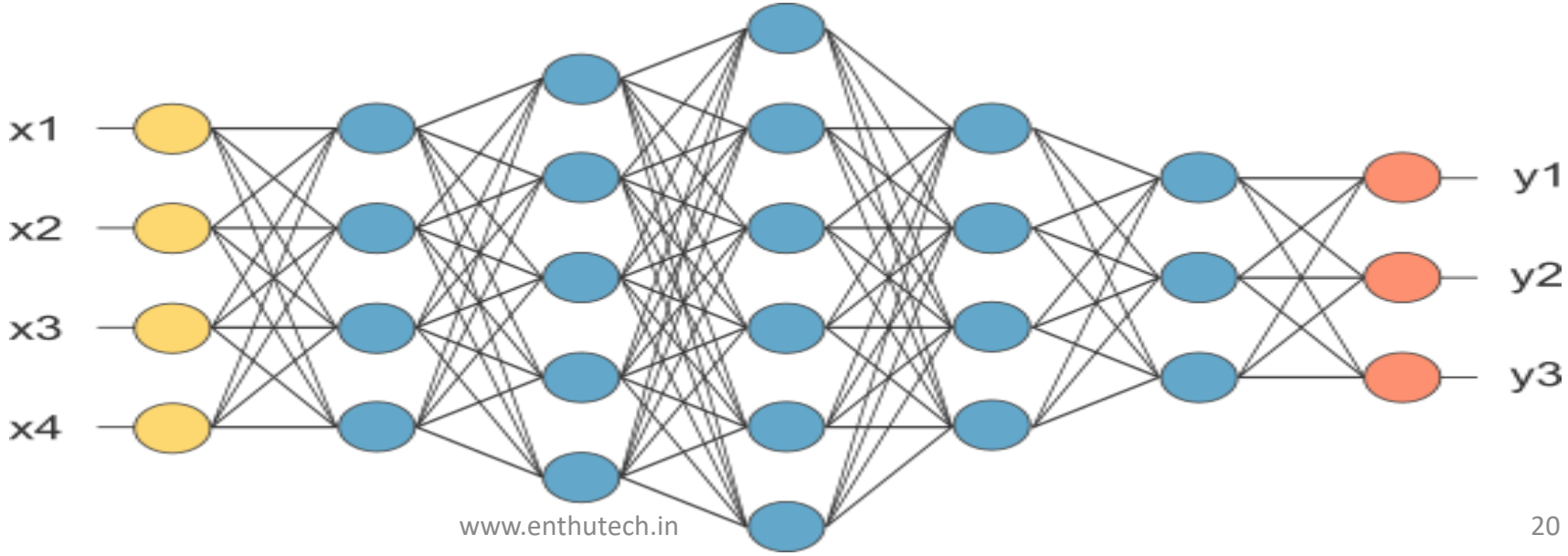


Fully Connected Layer:

- The layer we call as FC layer, we flattened our matrix into vector and feed it into a fully connected layer like a neural network.

- In the above diagram, the feature map matrix will be converted as vector (x1, x2, x3, …).

- With the fully connected layers, we combined these features together to create a model.



Places to be Installed:

Receptions

Stores

Factories

Ticket Counters

Offices