Track 7


Inteligencia Artificial Aplicada

# 1. About the Track & Syllabus

Prof. Marcelo José Rovai
rovai@unifei.edu.br

UNIFEI - Universidade Federal de Itajubá, Brazil

**Marcelo Rovai** was born in São Paulo and held a Master's degree in Data Science from the Universidad del Desarrollo (UDD) in Chile and an MBA from IBMEC (INSPER) in Brazil. He graduated in 1982 as an Engineer from UNIFEI, Federal University of Itajuba, with a specialization from Escola Politécnica de Engenharia of São Paulo University (USP); both institutions are located in Brazil.

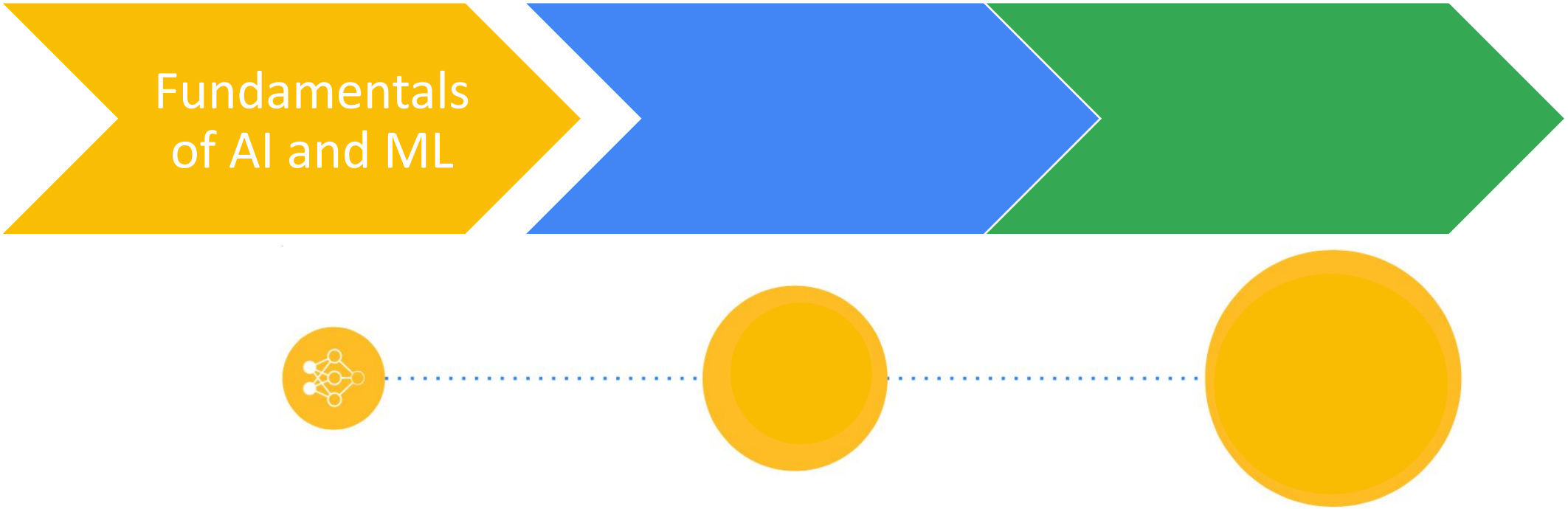
Mr. Rovai has experience as a teacher, engineer, and executive in several technology companies such as CDT/ETEP, AVIBRAS Aeroespacial, SID Informática, ATT-GIS, NCR, DELL, COMPAQ (HP), and more recently at IGT as a VP. He now works at IGT as a Senior Advisor for Latin America.

Marcelo Rovai publishes articles about electronics on websites such as MJRoBot.org, Hackster.io, Instructables.com, and Medium.com. Furthermore, he is a volunteer Professor at the UNIFEI Engineering Institute in Brazil and a lecturer at several Congresses and Universities on the topics of IoT and TinyML. He is an active member and a Co-Chair of the TinyML4D group, an initiative to bring TinyML education to developing countries.

# What will We learn?

# What will We learn?

Part 1 (2 days)

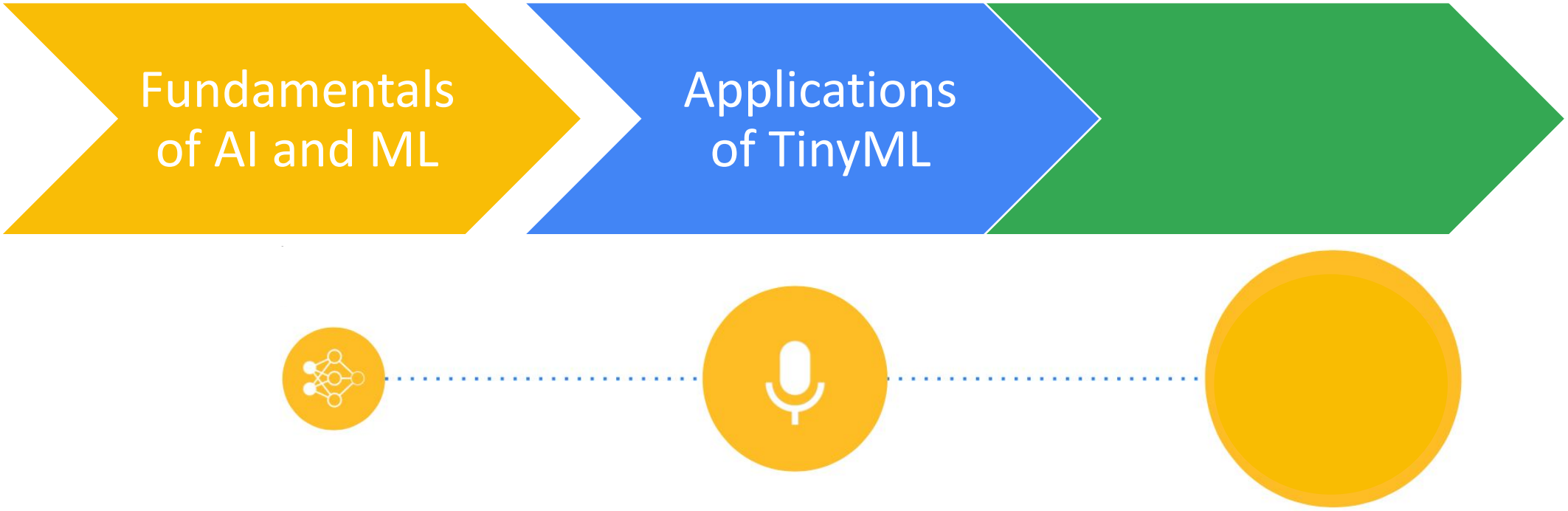



Part 1 is all about talking about what is the language of **Artificial Intelligence (AI)** and **Machine Learning (ML)**

# What will We learn?

Part 1

Part 2

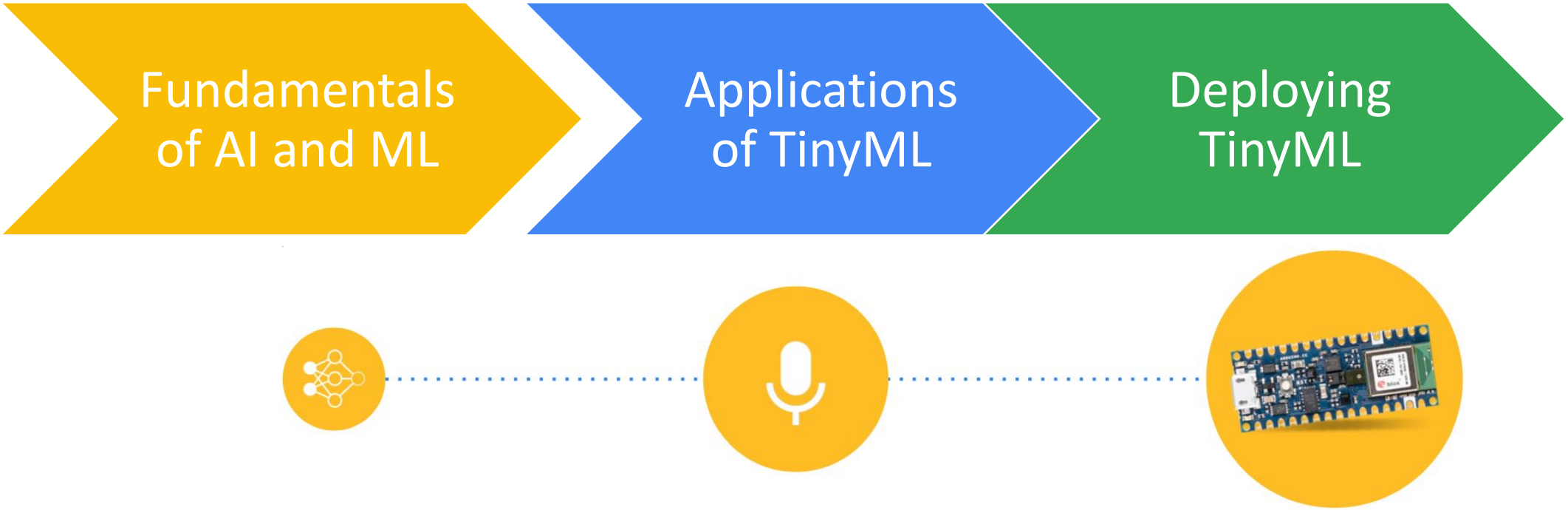



In Part 2, we will get a sneak peek into the variety of different **TinyML (Embedded Machine Learning)** applications, as keyword spotting (“Alexa”), gesture recognition, understand how to leverage the sensors, and so forth.

# What will We learn?

Part 1 (2 days)

Part 2 (3 days)




In Part 2, we will **also** learn how to deploy models on real devices such **as smartphones or microcontrollers**. Along the way, we will explore the challenges unique to and amplified by TinyML (e.g., preprocessing, post-processing, and dealing with resource constraints).

# How are we going to get there?

# Hands-on Learning

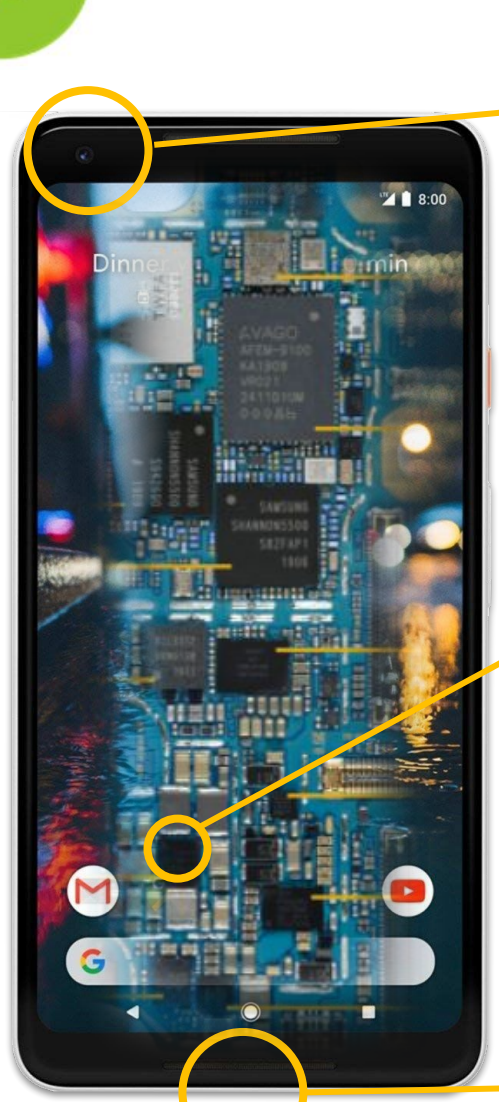
- **Software**
  - Machine Learning (TensorFlow)
  - Programming environments (Google Colab)
  - Edge Impulse Studio

- **Hardware**
  - SmartPhone
  - Arduino Nano 33 BLE Sense (Optional)

# Hardware

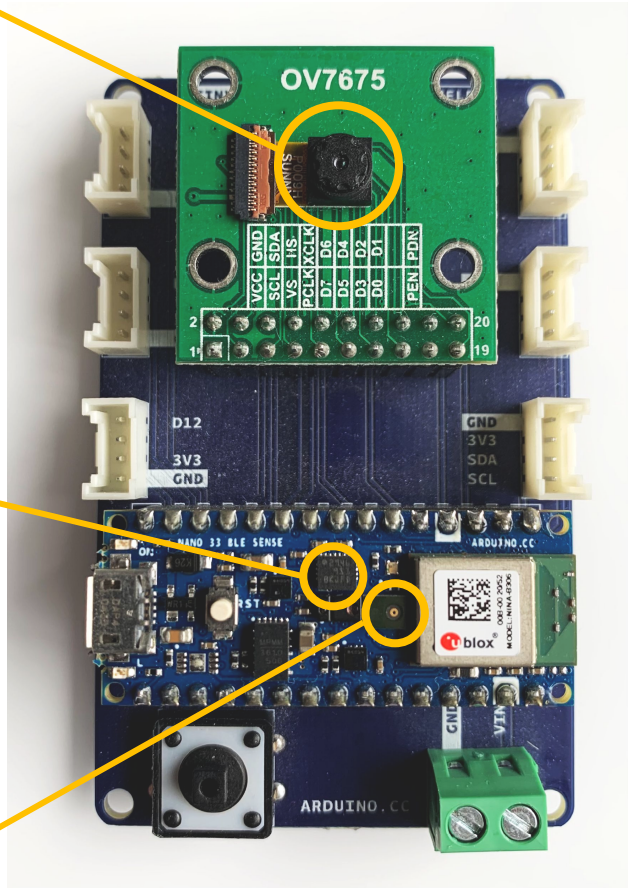

ARDUINO
TINY MACHINE
LEARNING KIT
In partnership with:
edX
TensorFlow
OV7675
cingular
9:41 AM
Text
Calendar
Photos
Camera
YouTube
Stocks
Maps
Weather
Clock
Calculator
Notes
Settings
Phone
Mail
Web
iPod

# Edge Device & Sensors



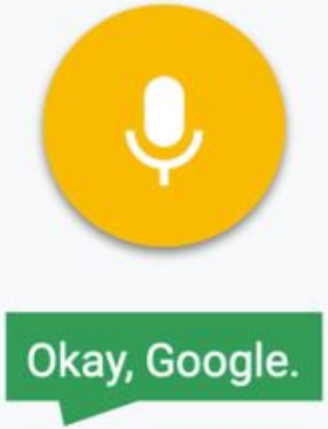




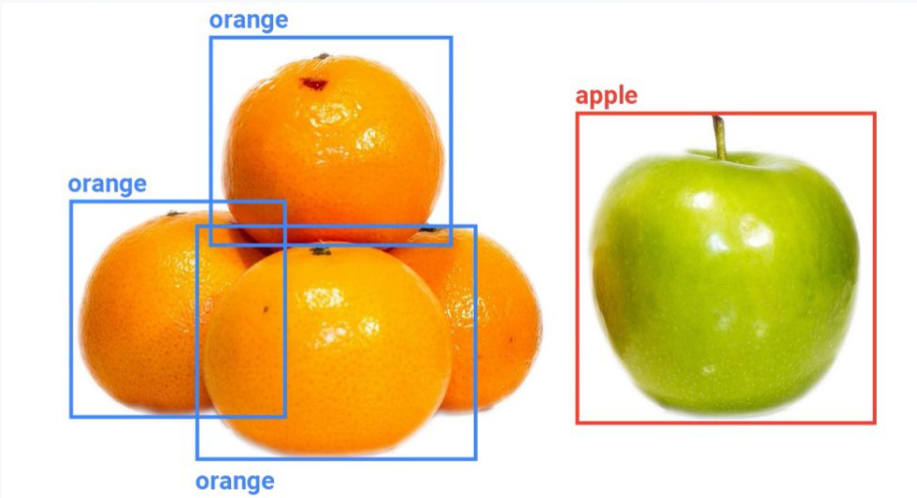


# Hands-on Activities

## Speech

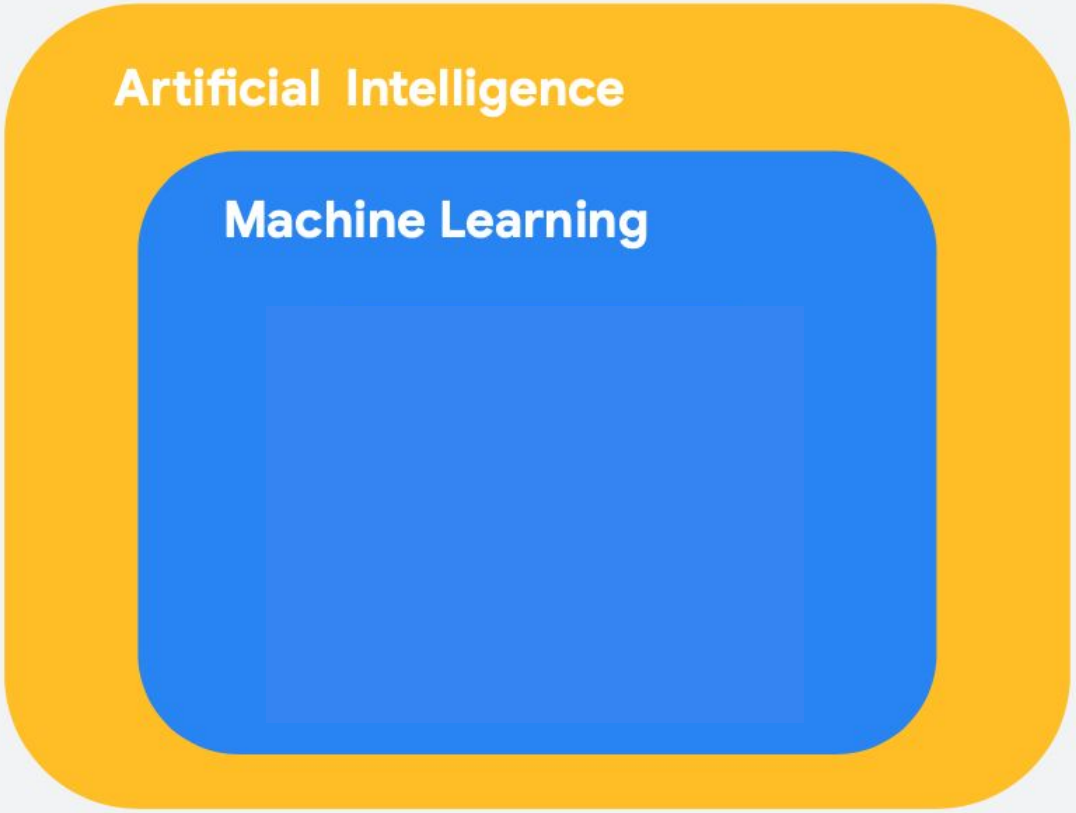



## Vision




## IMU


# What is Artificial Intelligence (AI)? And Machine Learning (ML)?



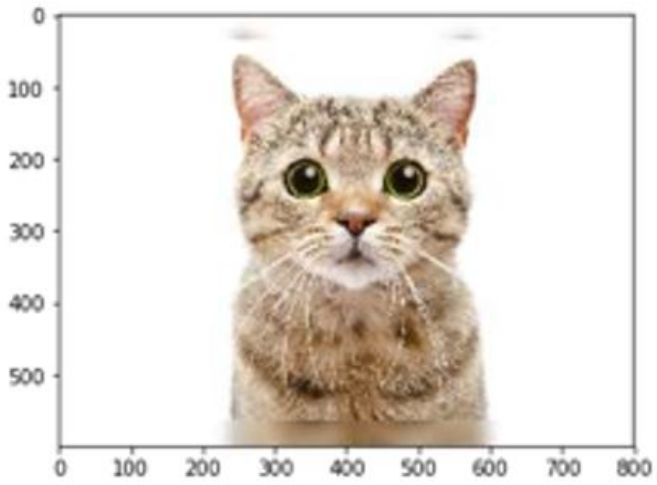

AI: Any technique that enables computers to mimic human behavior

ML: Ability to learn without explicitly being programed

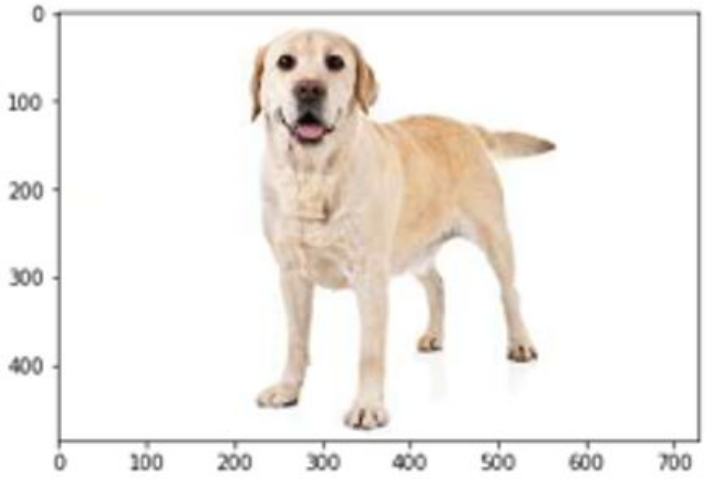
# Applications of Machine Learning


# Image Classification

| [PREDICTION] | [Prob] |
| --- | --- |
| Egyptian cat | : 64% |
| tabby | : 14% |
| bucket | : 3% |

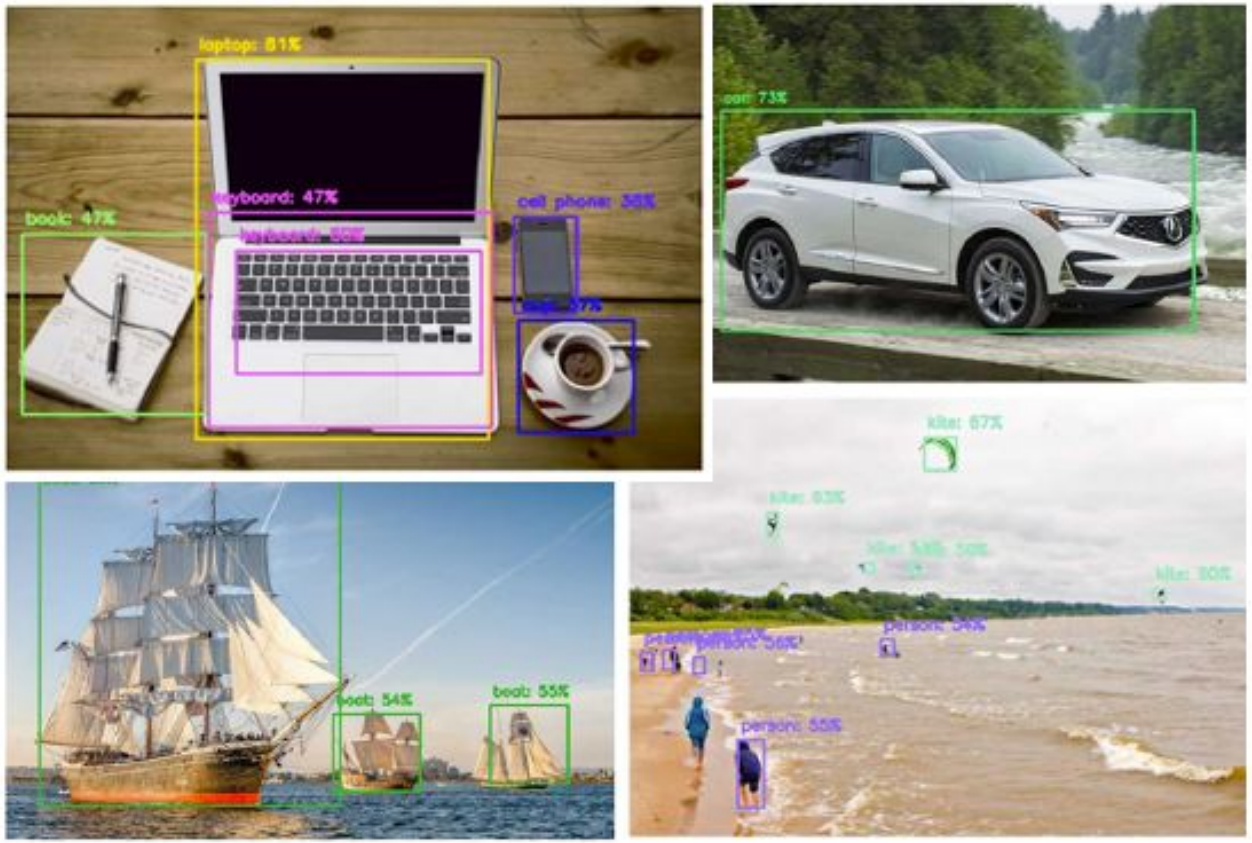


| [PREDICTION] | [Prob] |
| --- | --- |
| Labrador retriever | : 83% |
| golden retriever | : 13% |
| bloodhound | : 0% |

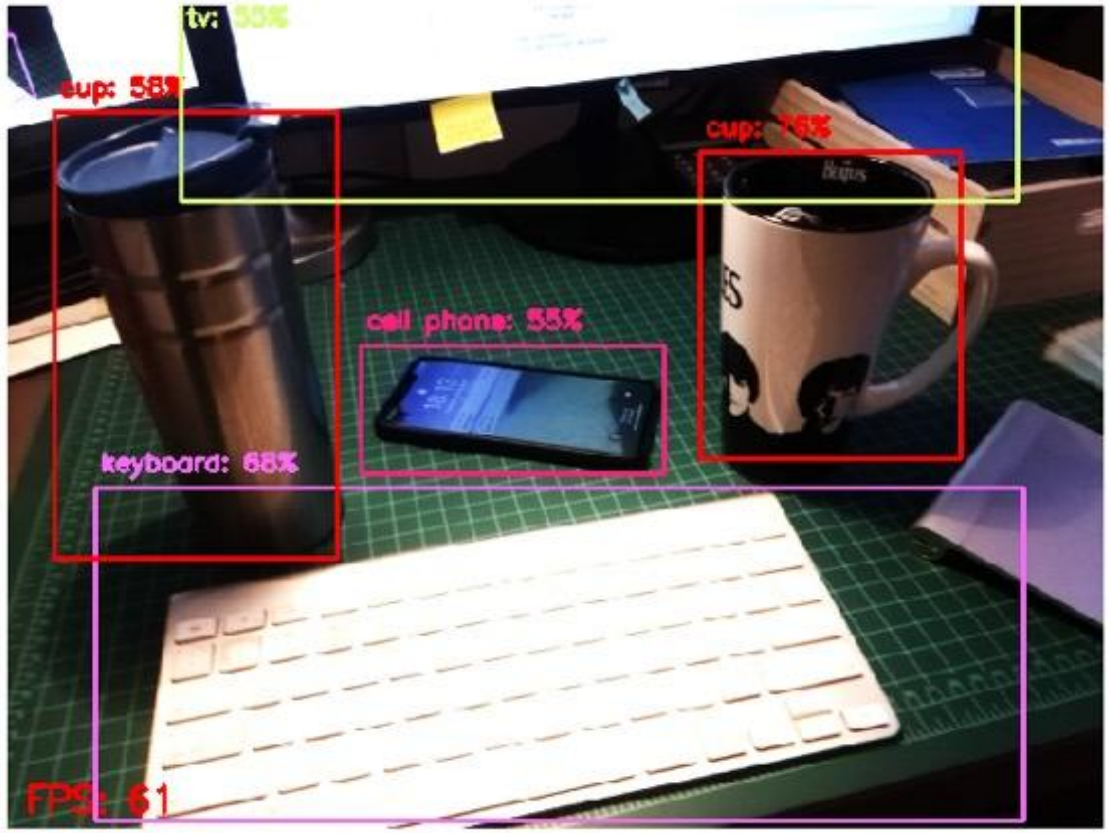


| [PREDICTION] | [Prob] |
| --- | --- |
| German shepherd | : 60% |
| dhole | : 16% |
| malinois | : 7% |

# Object Detection

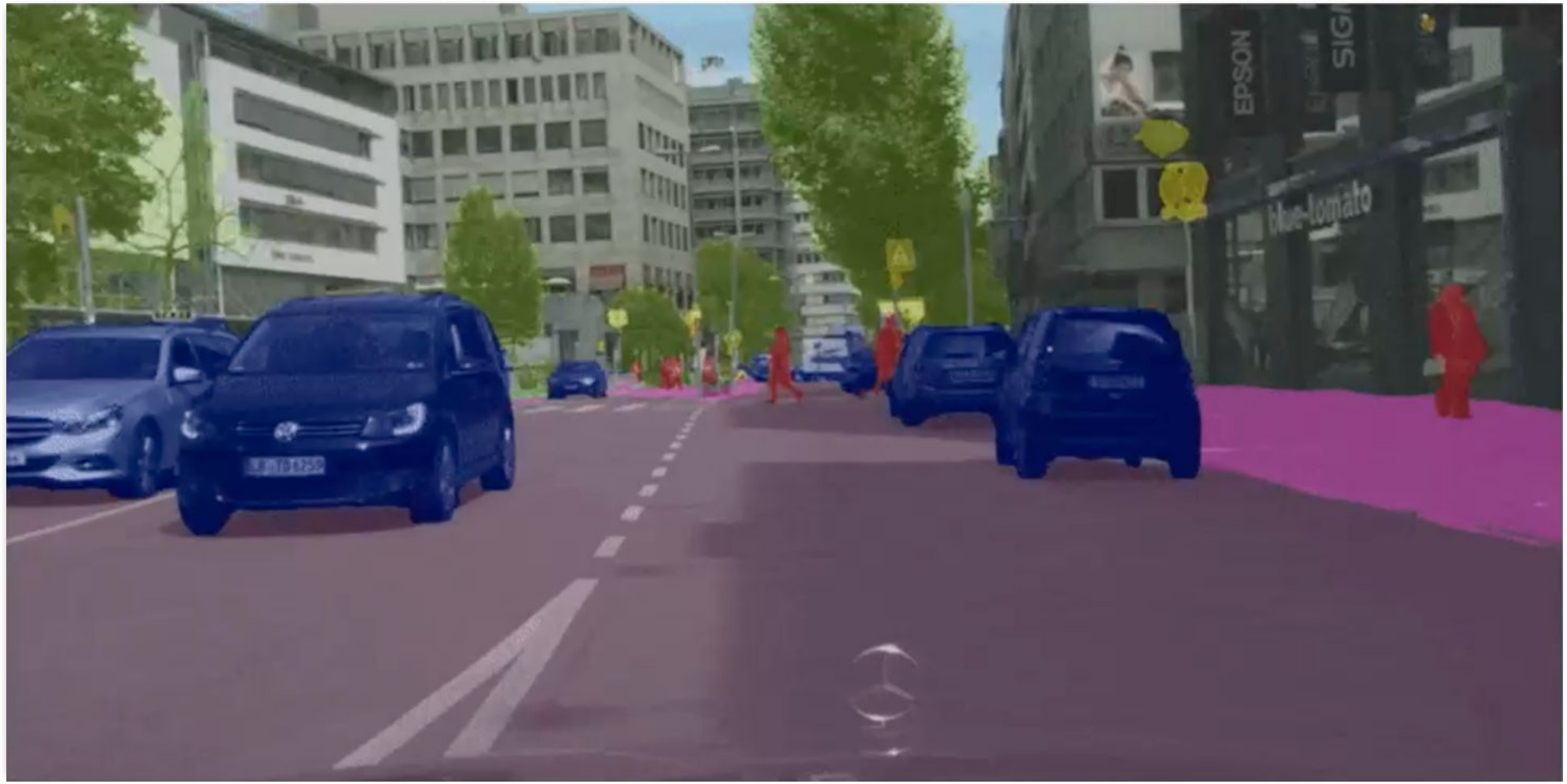



Photos



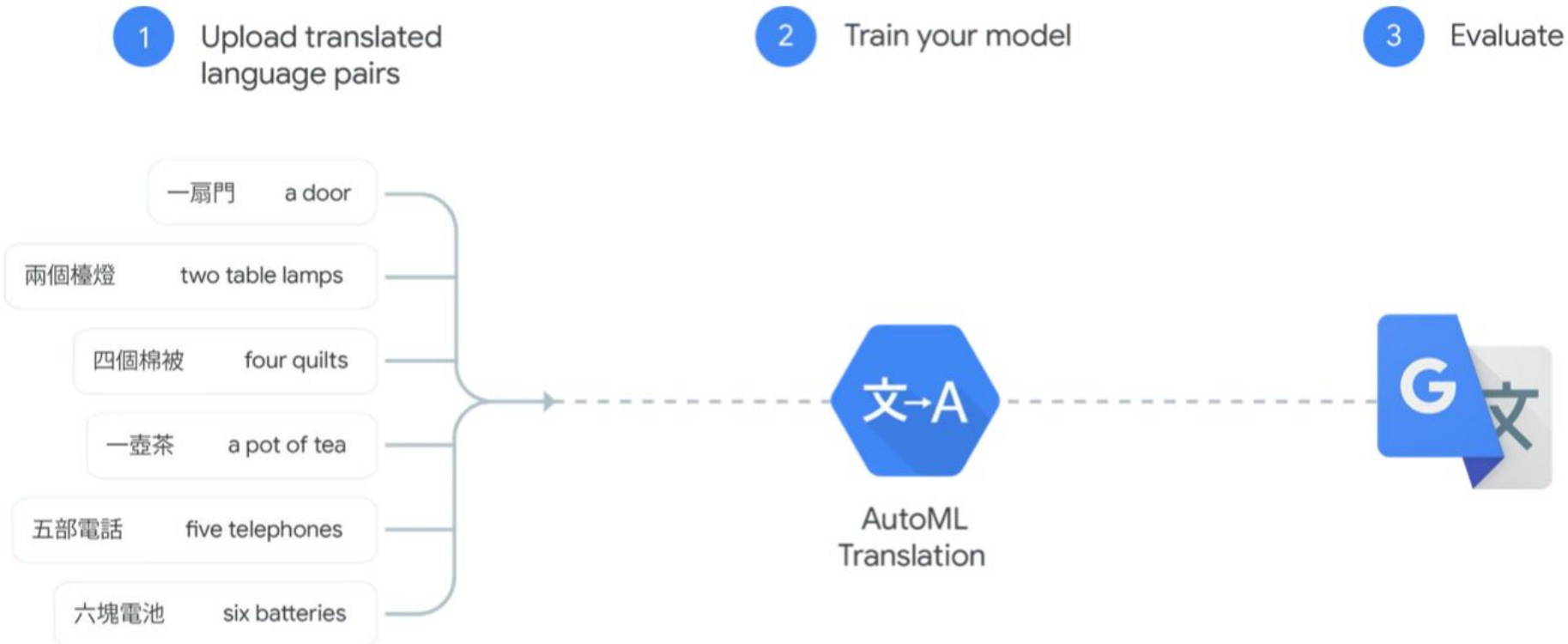

Live Video

# Segmentation

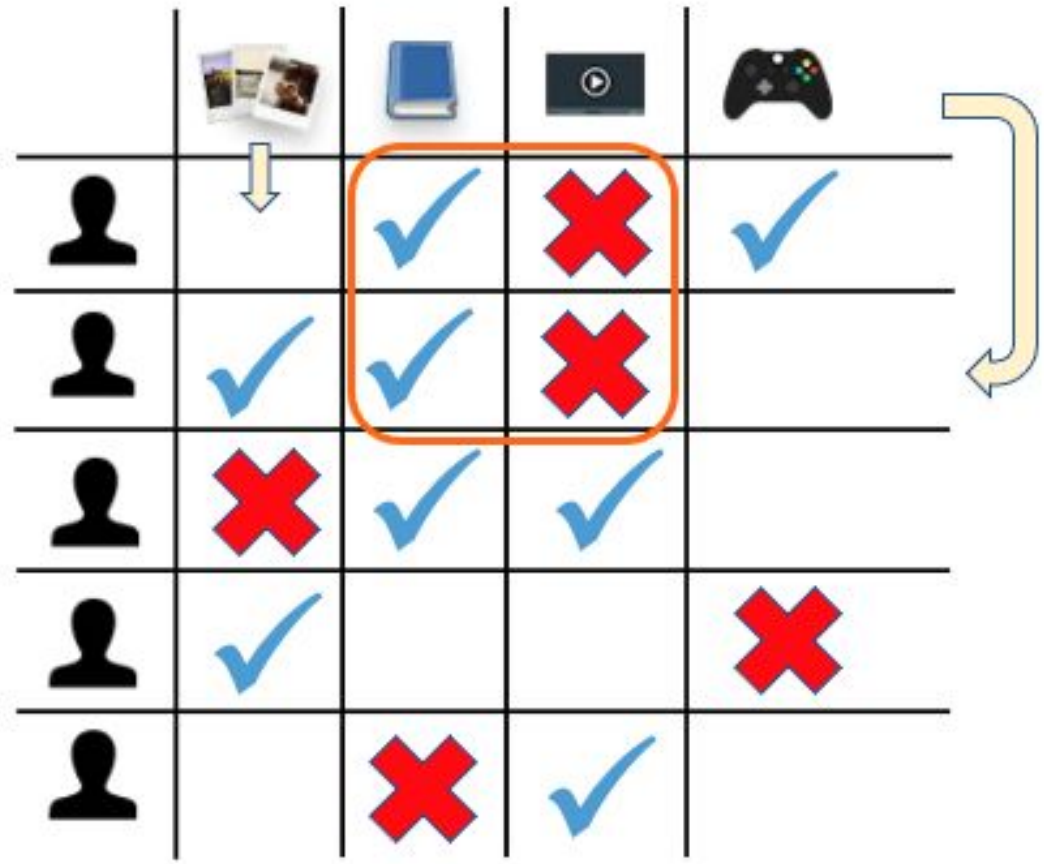


# Pose Estimation

# Machine Translation



# Recommendations

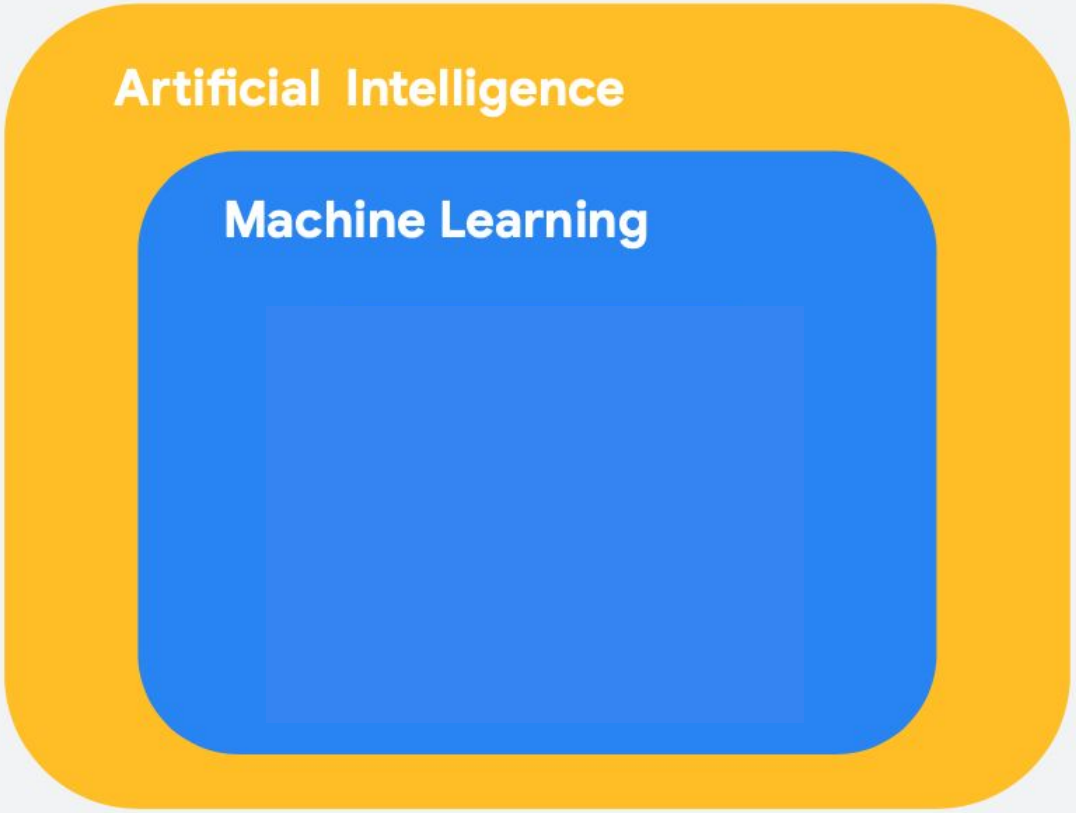


# General AI does not exist (yet)

# Dedicated ML Application examples

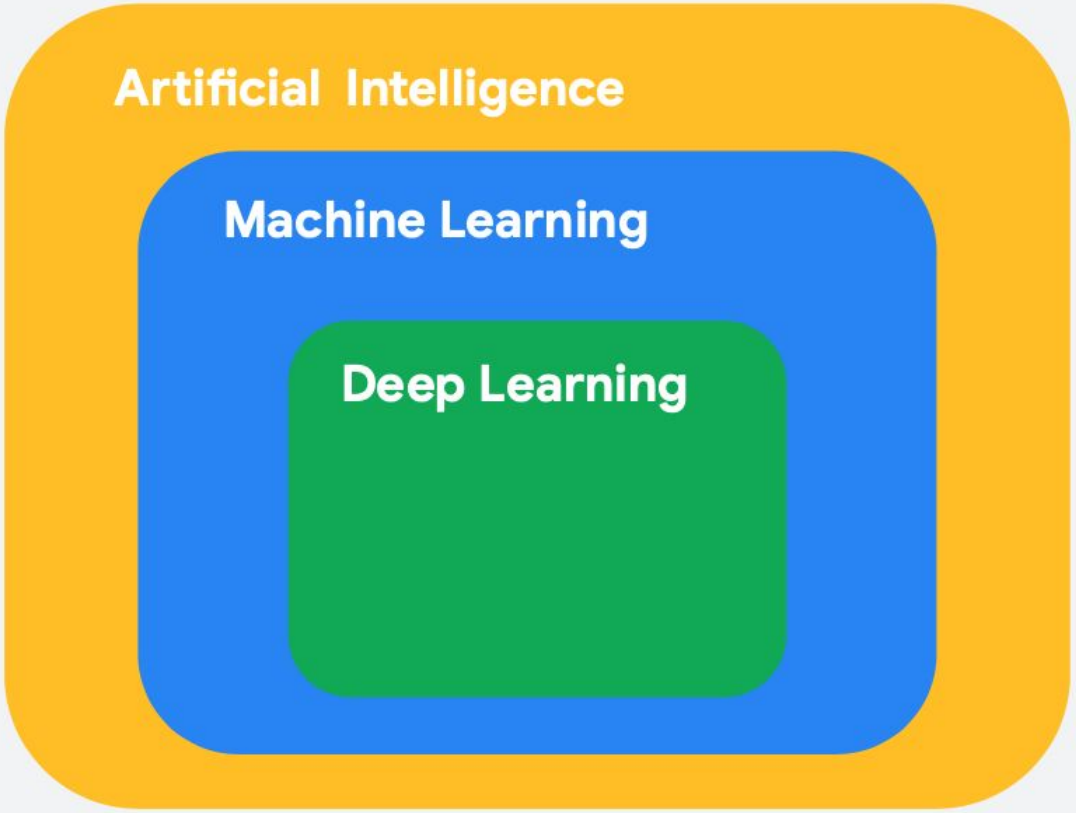
- Image Classification
- Object Detection
- Pose Estimation
- Voice Recognition
- Gesture Recognition
- Anomaly Detection
- Natural Language Processing (NLP)

# What is Deep Learning (DL)?




AI: Any technique that enables computers to mimic human behavior

ML: Ability to learn without explicitly being programed



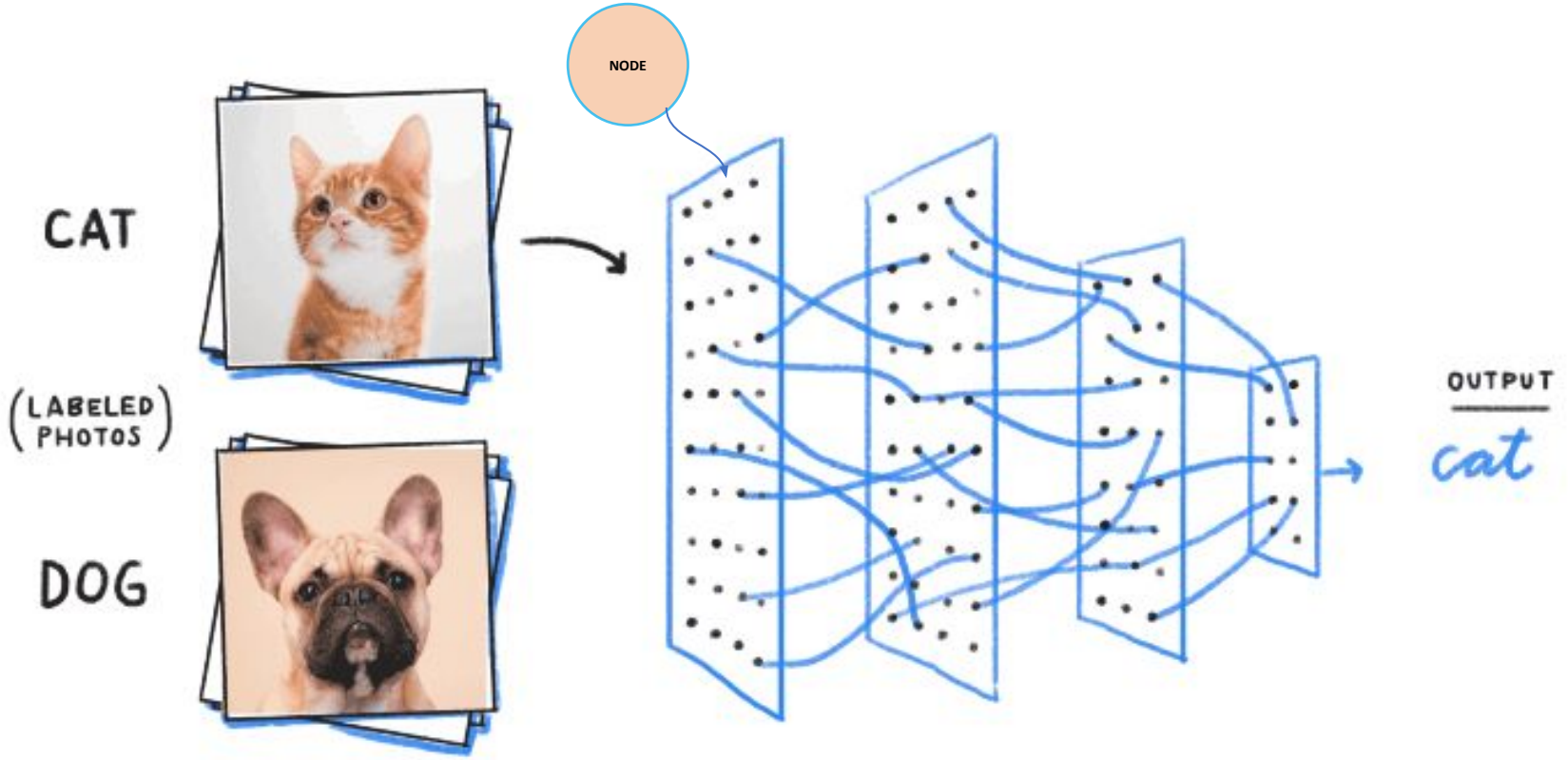

AI: Any technique that enables computers to mimic human behavior

ML: Ability to learn without explicitly being programed

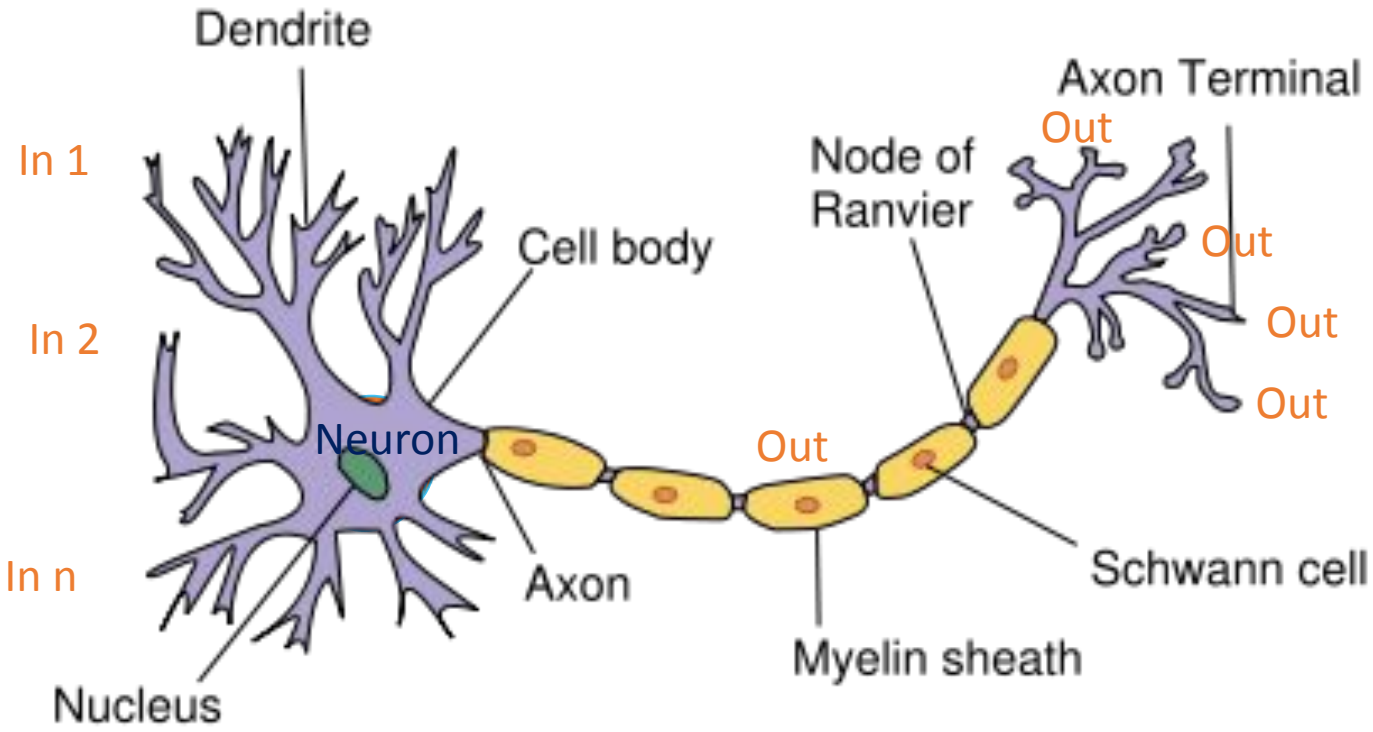
DL: Extract patterns from data using neural networks

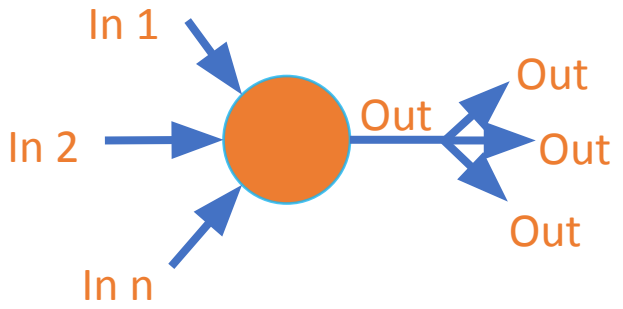
# (Deep) Machine Learning

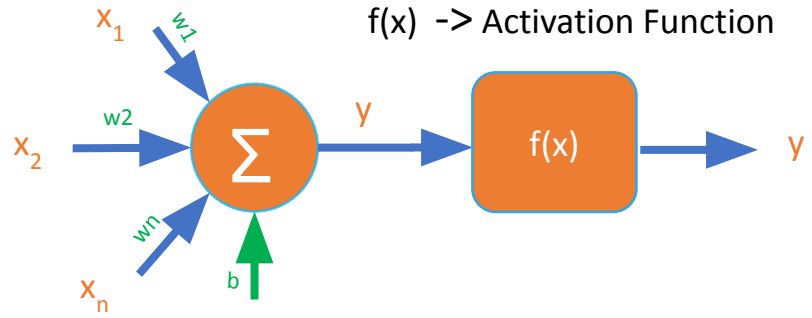
Deep Learning: Subset of Machine Learning in which multilayered neural networks learn from vast amounts of data



# Neuron (Perceptron)



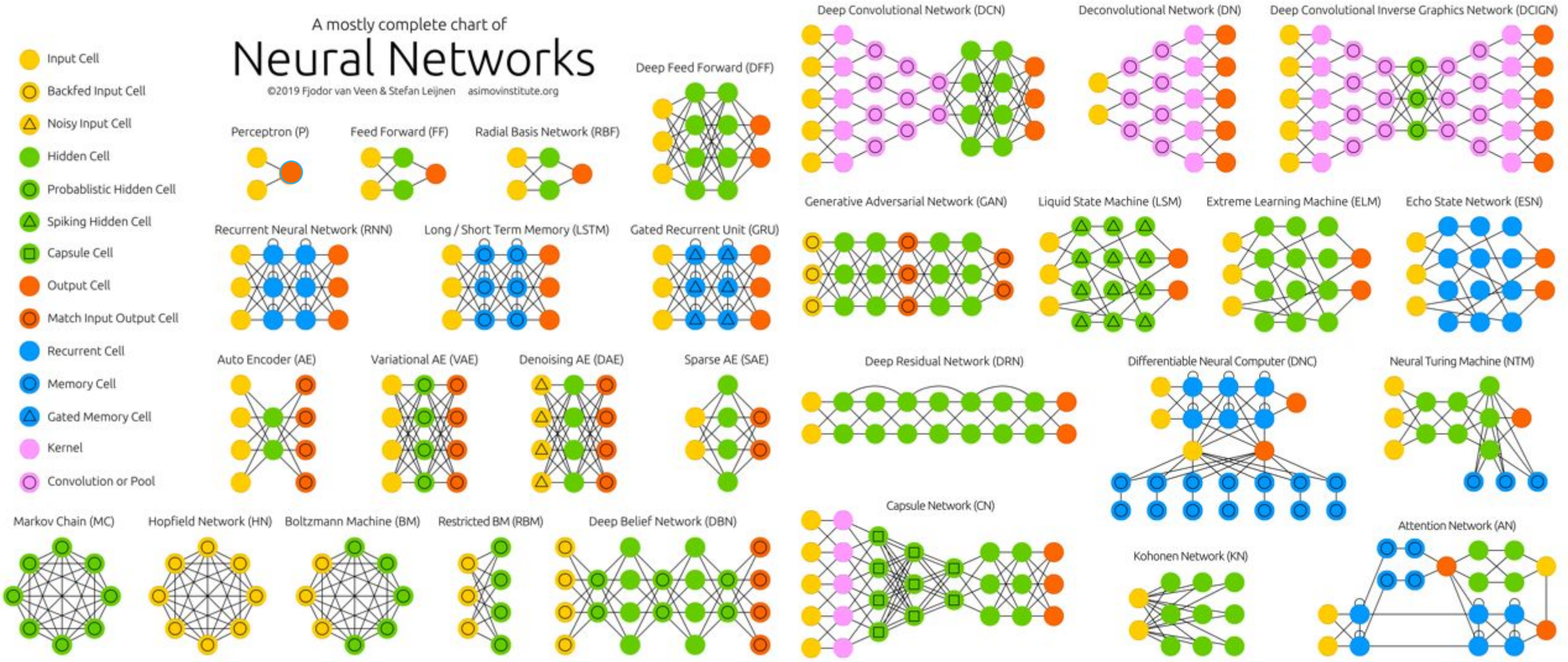




Parameters

$$y = f(\sum_{i=1}^{n} x_i w_i + b)$$

# The Neural Network Model Architecture

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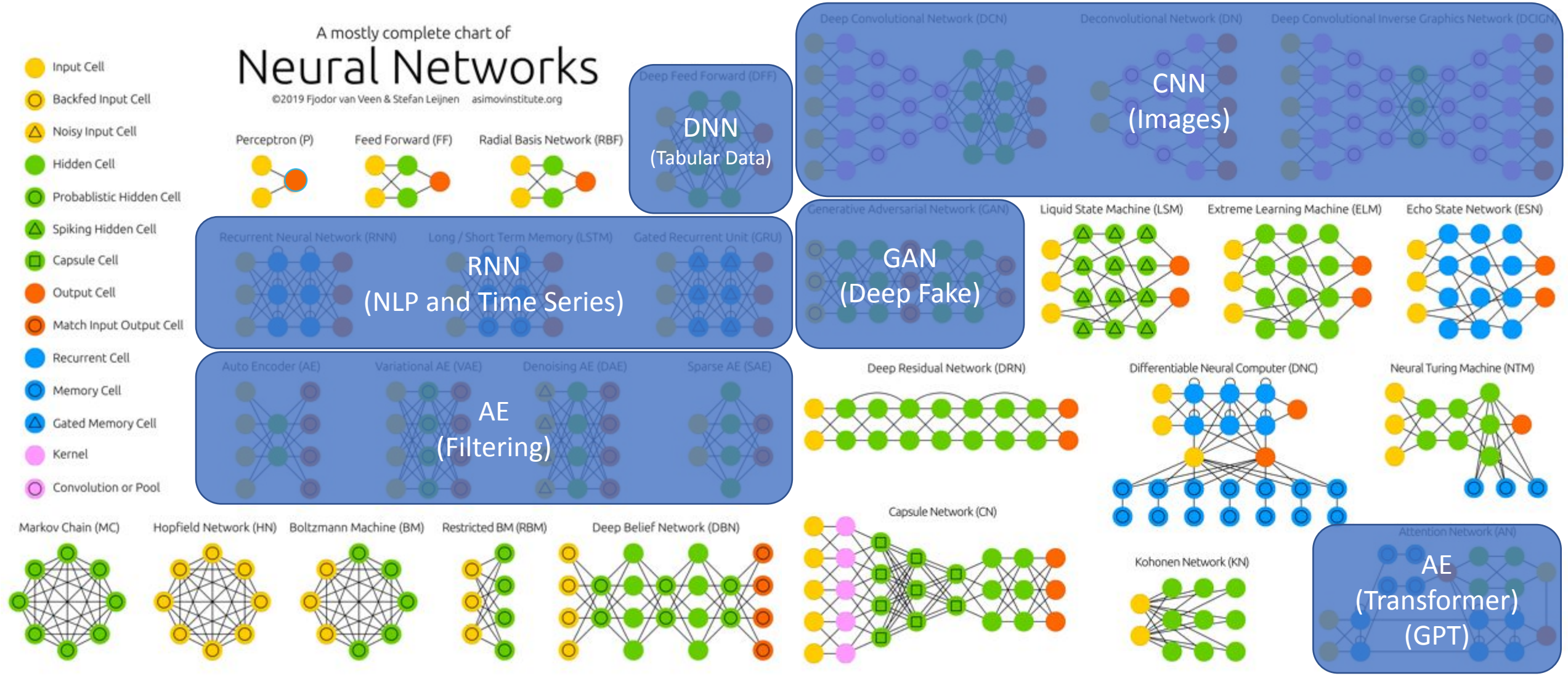


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# Thanks

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