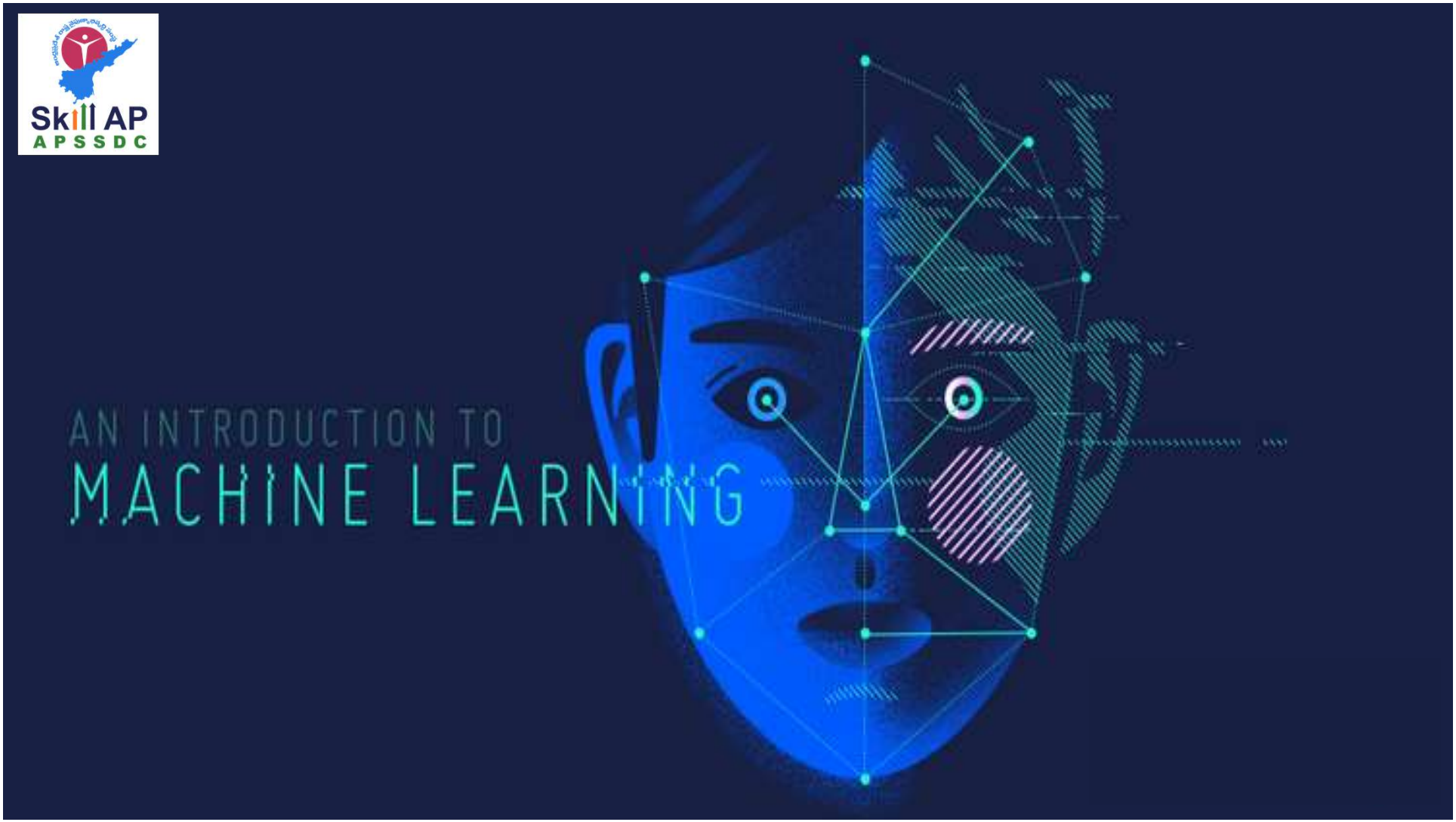

Skill AP
APSSDC
AN INTRODUCTION TO
MACHINE LEARNING

"A computer program is said to learn from experience E with respect to some class of tasks T and performance measure P, if its performance at tasks in T, as measured by P, improves with experience E."

— Tom Mitchell, Professor at Carnegie Mellon University

WHAT IS **ARTIFICIAL INTELLIGENCE, MACHINE LEARNING** AND **DEEP LEARNING**

ARTIFICIAL INTELLIGENCE

Artificial Intelligence (**AI)** is the science of making things smart. Can be defined as:

"Human intelligence exhibited by machines"

A broad term for getting computers to perform human tasks. The scope of AI is disputed and constantly changing over time.

AI: COMMON USE CASES

- Object recognition
- Speech recognition / Sound detection
- Natural Language Processing / Sentiment analysis
- Creative (e.g. Style Transfer – Learning to draw an image in the style of an artist)
- Prediction – given some inputs, what is the expected output for unseen examples
- Translation between languages
- Restoration / Transformation – e.g. taking an image and using ML to figure out what should be there, or generating faces based on what it knows face to be.
- Some AI Examples

MACHINE LEARNING

- Machine Learning (**ML**) can be defined generally as:

"An approach to achieve AI through systems that can learn from experience to find patterns in a set of data"

ML involves **teaching a computer to recognize patterns by example, rather than programming it with specific rules.** These patterns can be found within data. In other words, ML is about creating algorithms (or a set of rules) that learn complex functions (or patterns) from data and make predictions on it –a form of "narrow AI"

A DIFFERENT WAYS OF DOING THINGS

Write a computer program with **explicit rules** to follow

```
if email contains V!agrå
  then mark is-spam;
if email contains …
if email contains …
```

Traditional Programming

Write a computer program to **learn from examples**

```
try to classify some emails;
change self to reduce errors;
repeat;
```

Machine Learning Programs

DEEP LEARNING

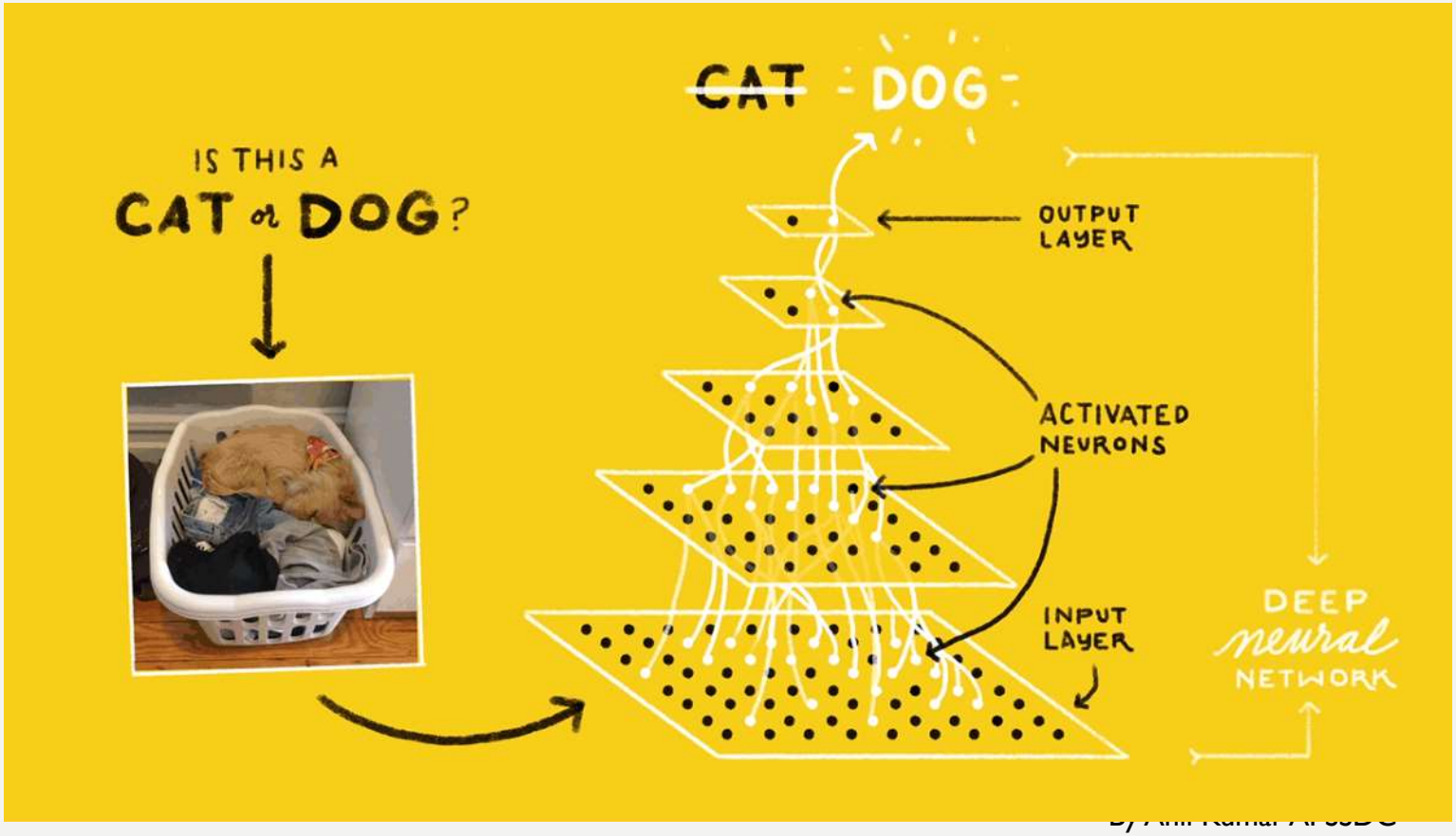
- Deep Learning (**DL** from here on) can be defined generally as:

"A technique for implementing Machine Learning"

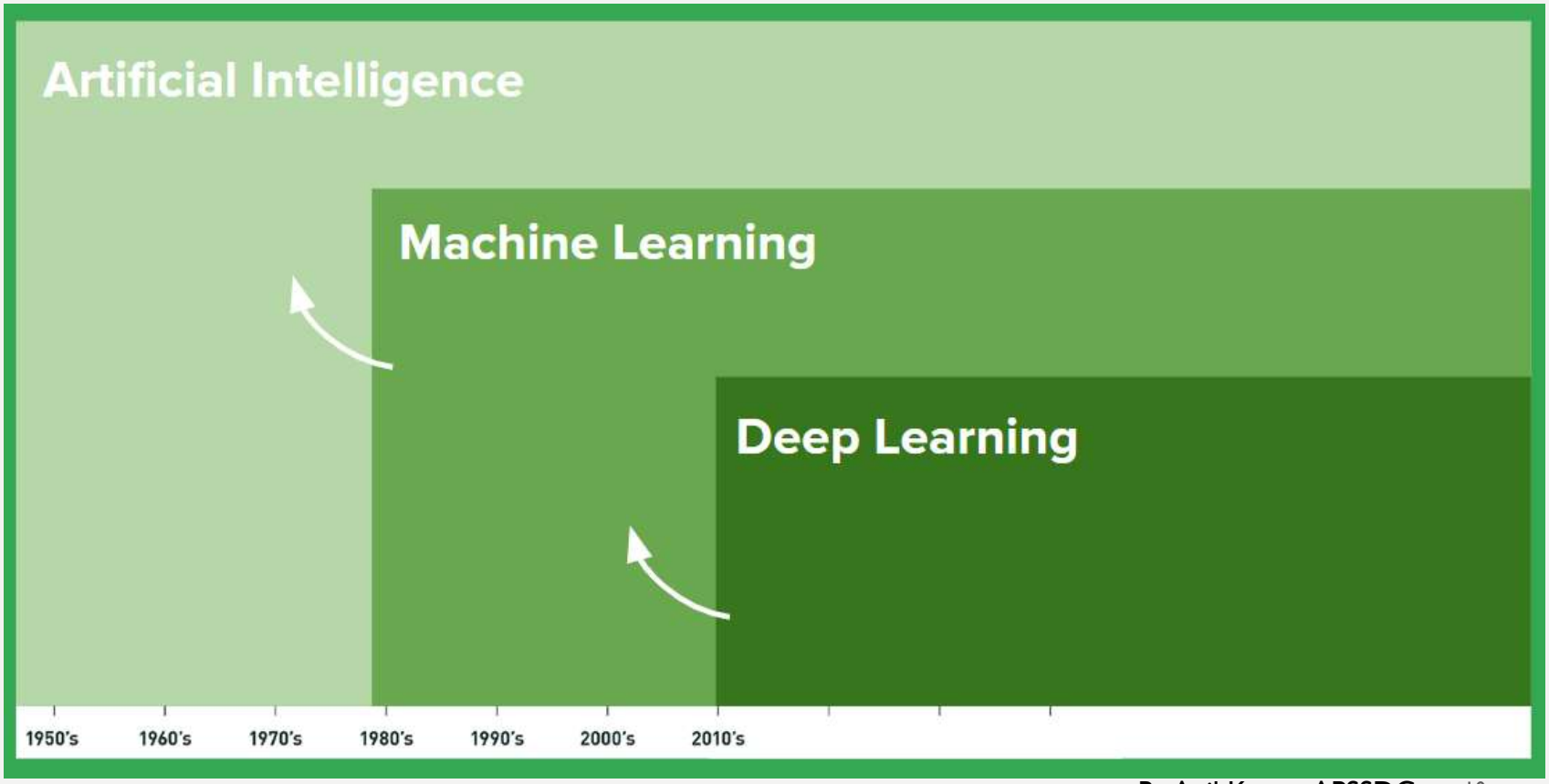
One such DL technique is a concept known as **deep learning Neural networks (DNNs)** which you may have heard of.

Essentially DL in the context of DNNs is where the code structures you write **are arranged in the layers that loosely mimic the human brain, learning patterns of patterns.**

SIMPLE NEURAL NETWORK



SUMMARY


Artificial Intelligence
Machine Learning
Deep Learning
1950's
1960's
1970's
1980's
1990's
2000's
2010's

FEW QUOTES

- "Machine learning is the hot new thing"

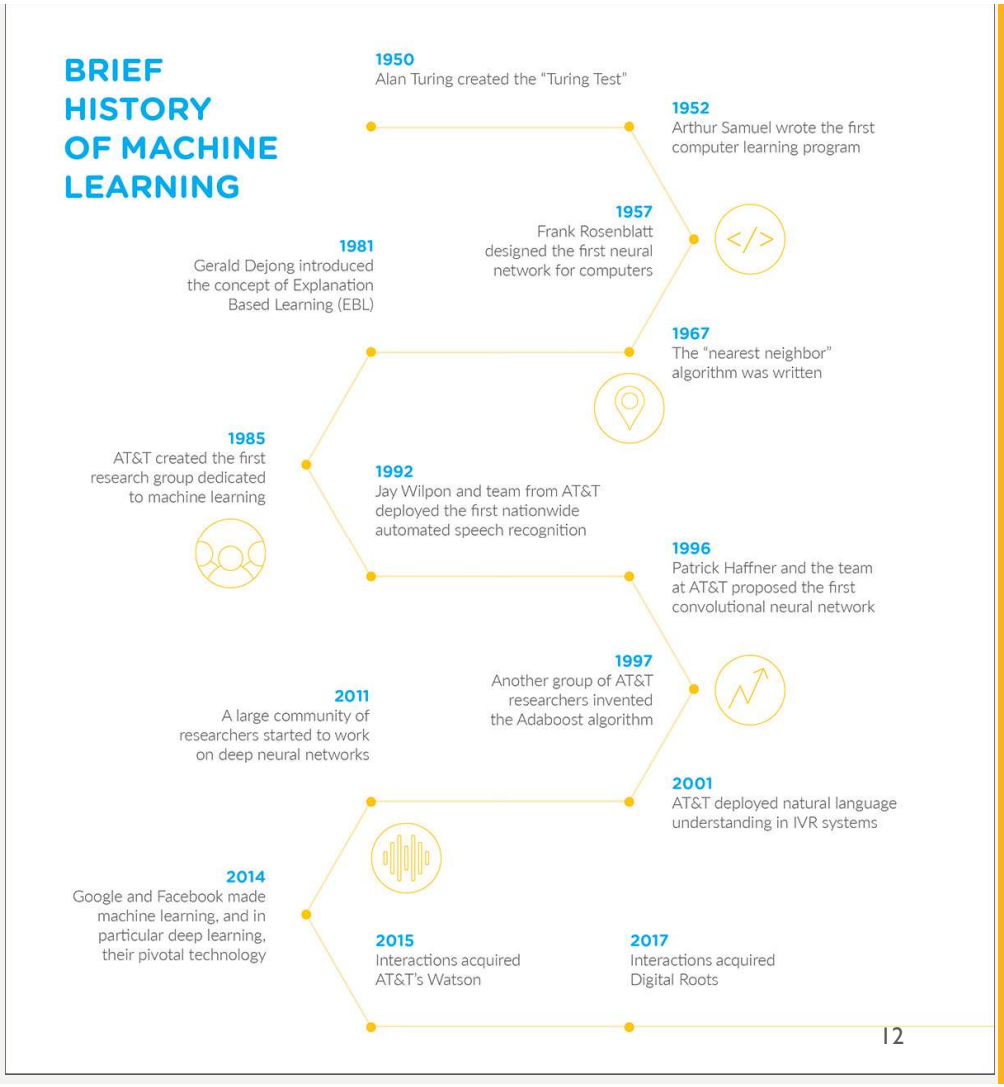
— John L. Hennessy, President of Stanford (2000–2016)

"A breakthrough in machine learning would be worth ten Microsoft"

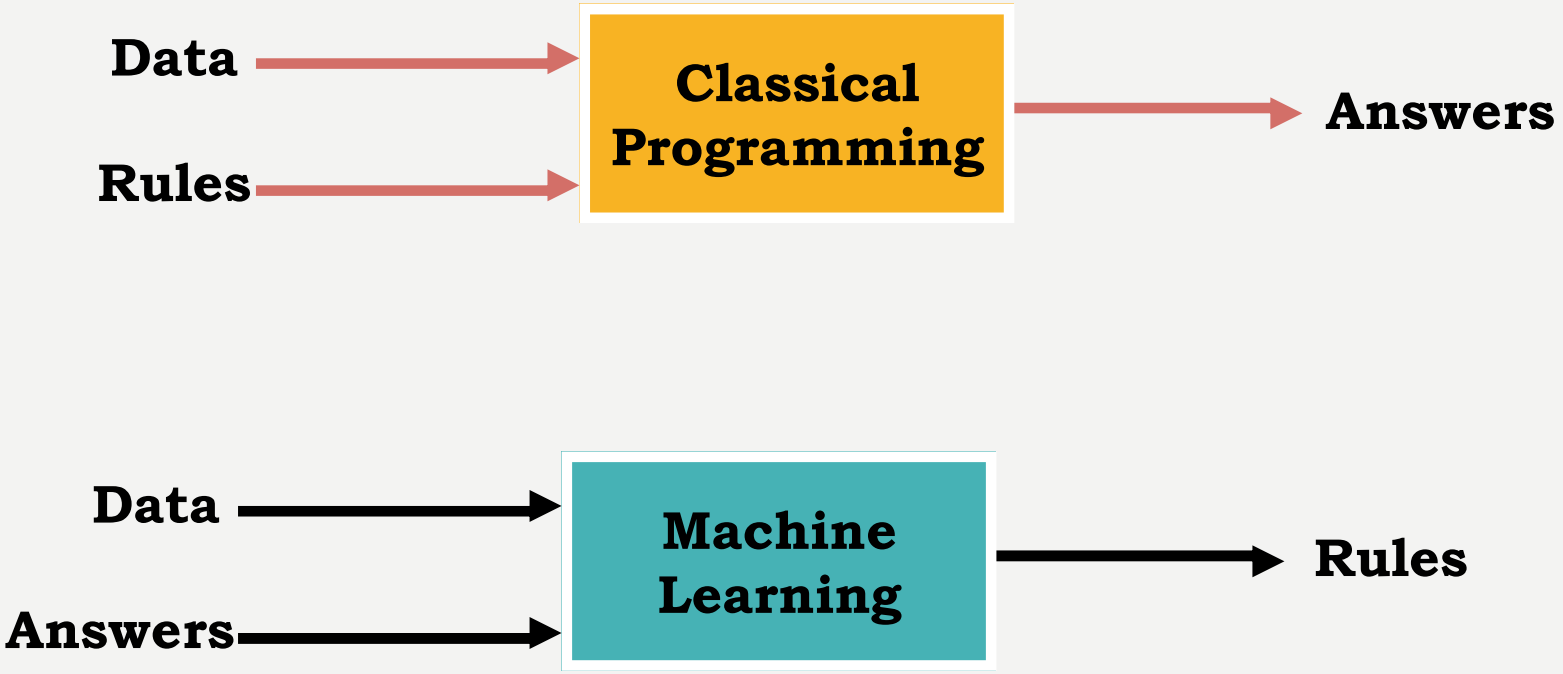
— Bill Gates, Microsoft Co-Founder

"Machine learning is the field of study that gives computers the ability to learn without being explicitly programmed"

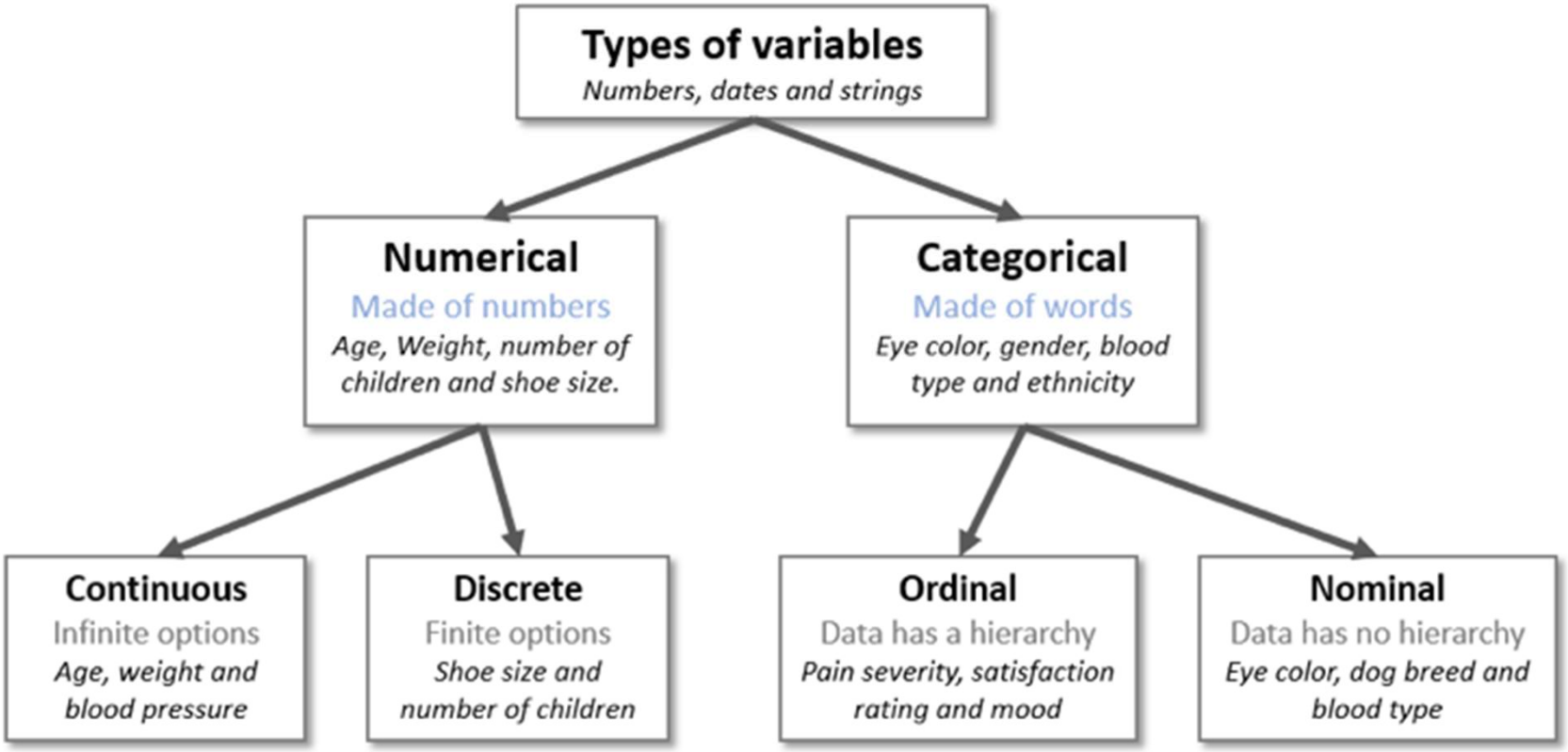
HISTORY


BRIEF HISTORY OF MACHINE LEARNING
1950
Alan Turing created the "Turing Test"
1952
Arthur Samuel wrote the first computer learning program
1957
Frank Rosenblatt designed the first neural network for computers
1967
The "nearest neighbor" algorithm was written
1981
Gerald Dejong introduced the concept of Explanation Based Learning (EBL)
1985
AT&T created the first research group dedicated to machine learning
1992
Jay Wilpon and team from AT&T deployed the first nationwide automated speech recognition
1996
Patrick Haffner and the team at AT&T proposed the first convolutional neural network
1997
Another group of AT&T researchers invented the Adaboost algorithm
2001
AT&T deployed natural language understanding in IVR systems
2011
A large community of researchers started to work on deep neural networks
2014
Google and Facebook made machine learning, and in particular deep learning, their pivotal technology
2015
Interactions acquired AT&T's Watson
2017
Interactions acquired Digital Roots

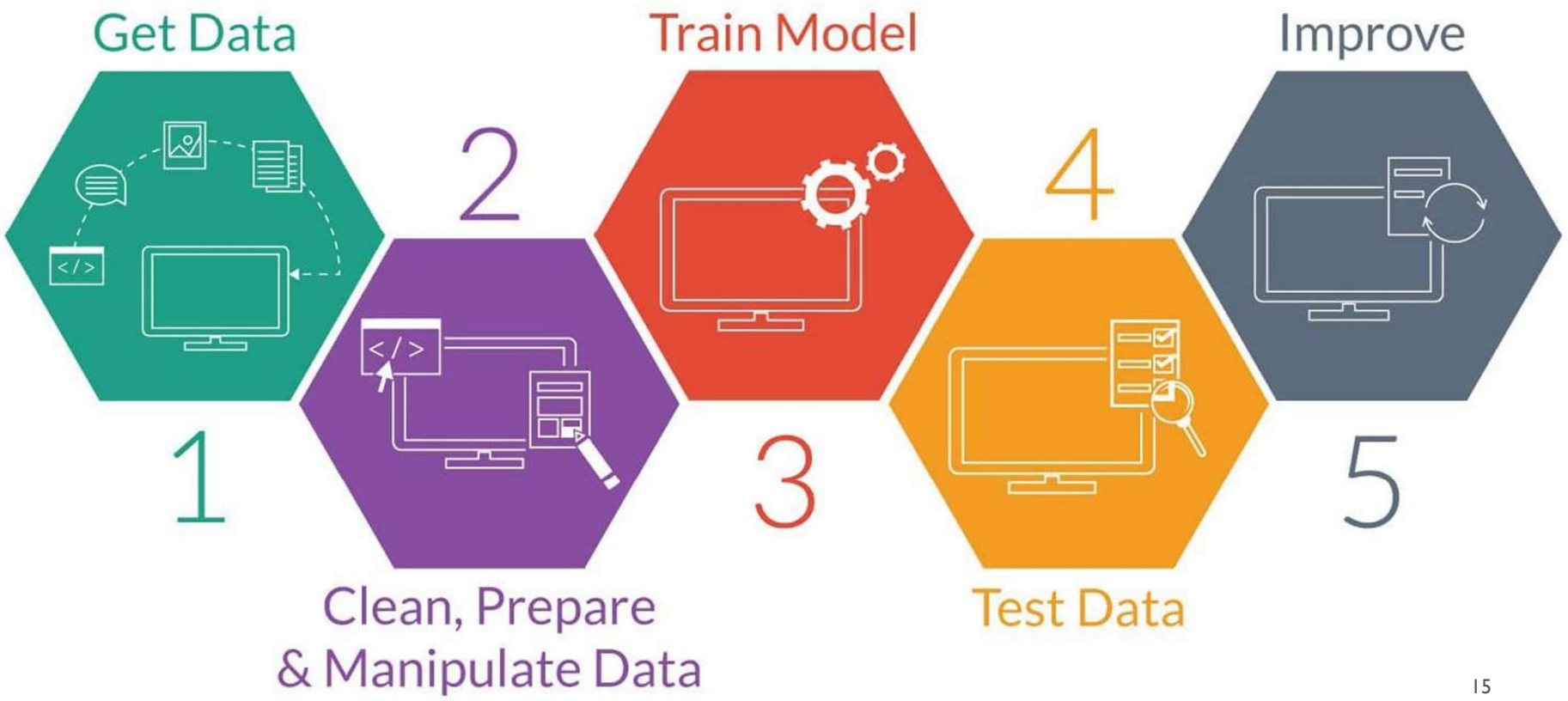
CLASSICAL PROGRAMMING VS MACHINE LEARNING



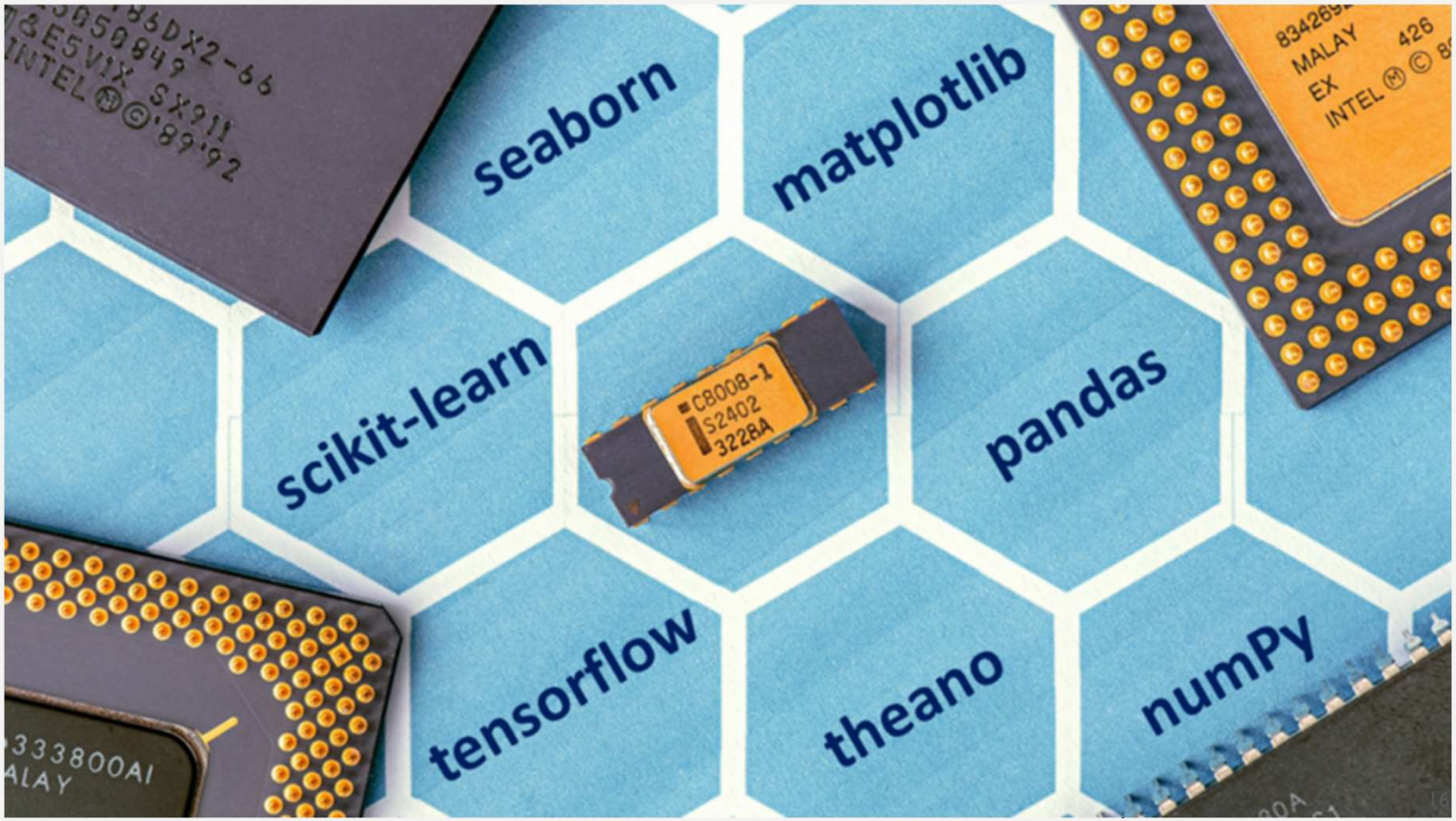
TYPES OF VARIABLES



MACHINE LEARNING PROCESS



PACKAGES FOR ML IN PYTHON



HOW TO CHOOSE DATA TO TRAIN THE MODEL

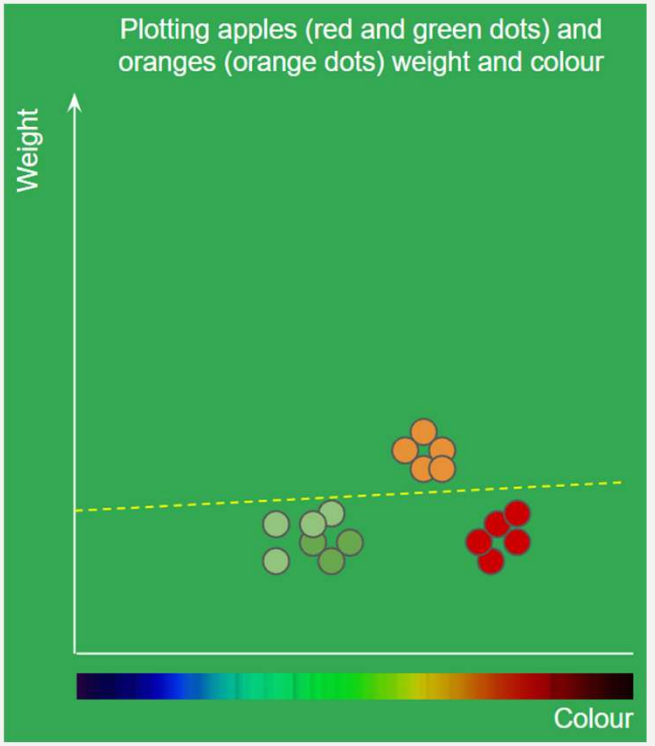
FEATURES / ATTRIBUTES

- **Features (aka attributes) are used to train an ML system.** They are the properties of the things you are trying to learn about.

FEATURES / ATTRIBUTES

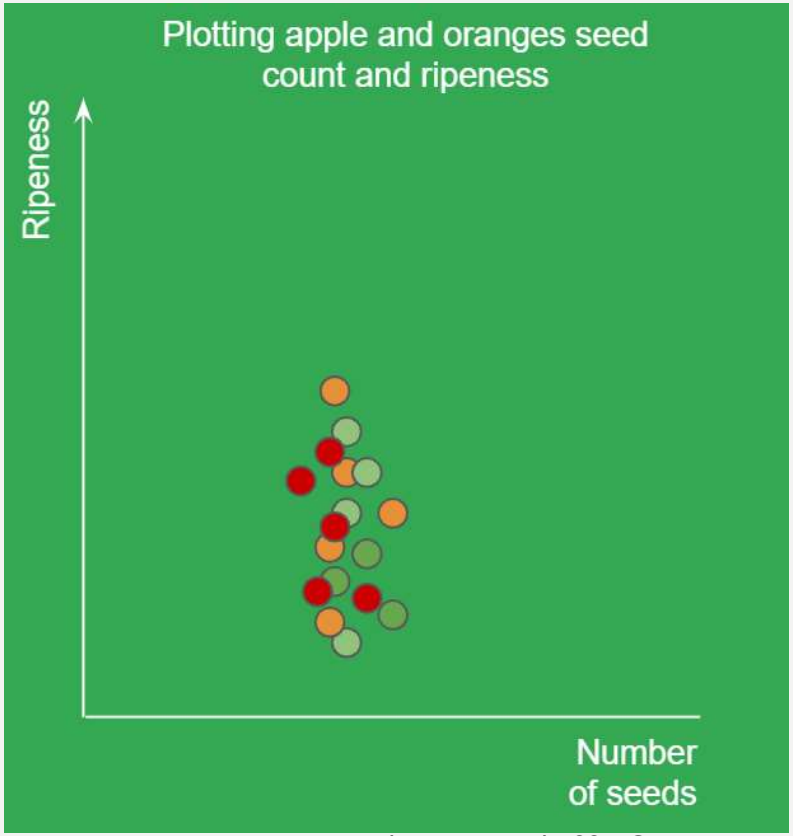
Taking fruit as an example. Features of a fruit might be weight and color. 2 features, would mean there are 2 dimensions. A 2D system may be plotted on a graph if features are represented in a numerical way.

In the plot on the right, the ML system can learn to split the data up with a line to separate apples from oranges. This **can now be used to make future classifications when we plot new points the system has not seen (anything above is orange, below is apple)**



FEATURES / ATTRIBUTES

- **Choosing useful features can have a big impact on the quality of the ML system.** Some features may not be useful enough to separate the data points.
- In this example we take bad features of fruits(ripeness and seed count) that do not allow us to learn any distinguishing factors for the fruit.



WHAT ML CANNOT PREDICT STUFF IT DOESN'T KNOW ABOUT

Lets say you teach an ML system about animals like this:

Number of Legs, Color, Weight, Animal:

- 4, Black, 10KG, Dog
- 2, Orange, 5KG, Chicken

If you now present it with a Cow: 4 legs, black, 200KG it would predict "Dog". This is because it only knows about dogs and chickens and this was the closest match.

HOW ML SYSTEMS ARE TRAINED (LEARNING STYLE)

MACHINE LEARNING TYPES

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

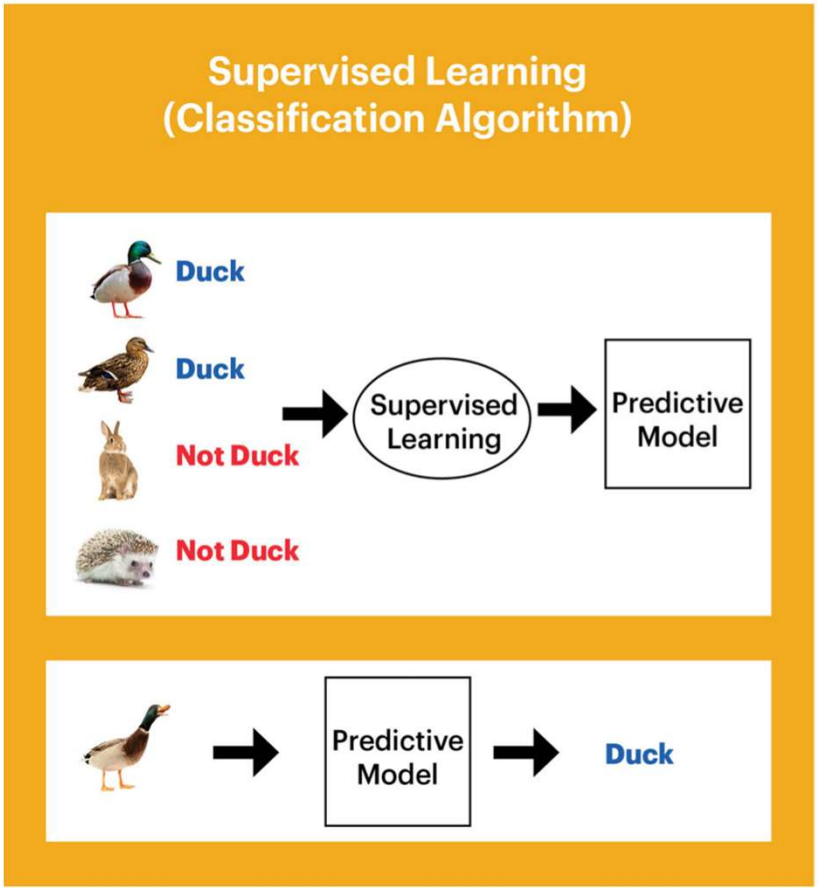
Unsupervised Learning

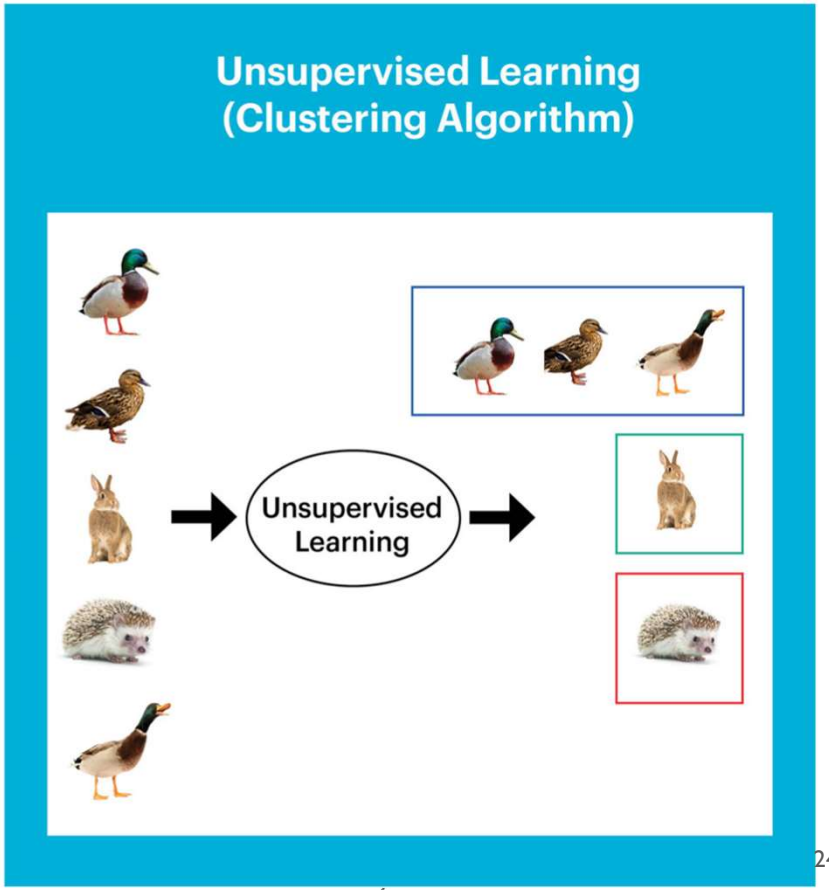
- Machine understands the data (Identifies patterns/structures)
- Evaluation is qualitative or indirect
- Does not predict/find anything specific

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 VS UNSUPERVISED





MACHINE LEARNING ALGORITHMS SUPERVISED

Regression

- Linear Regression
- Logistic Regression
- Polynomial Regression

Classification

- Linear Classifiers
  - Logistic Regression
  - Naive Bayes Classifier
- Nearest Neighbor
- Support Vector Machines
- Decision Trees
- Random Forest

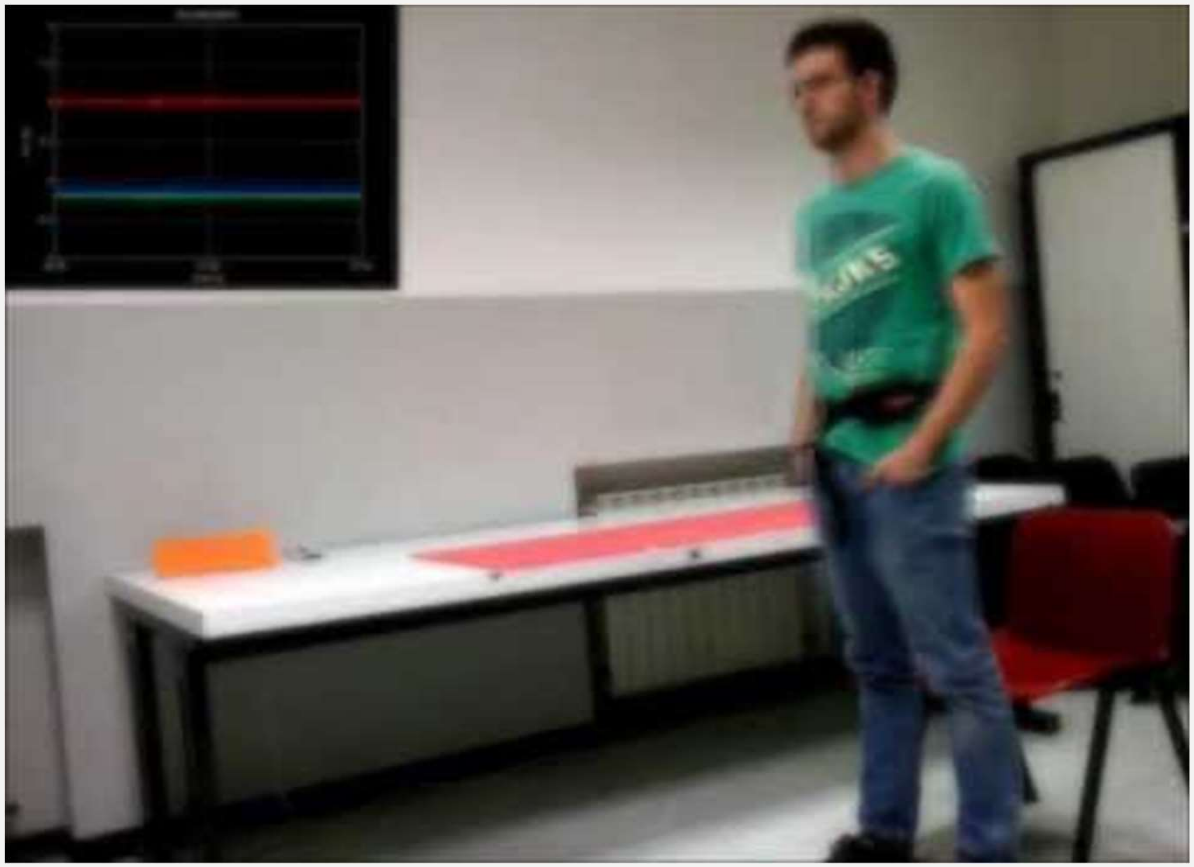
CLASSIFICATION VS REGRESSION

UNSUPERVISED

Clustering Types

- Hierarchical clustering
- K-means clustering
- K-NN (k nearest neighbors)
- Principal Component Analysis
- Singular Value Decomposition
- Independent Component Analysis

CLASSIFICATION



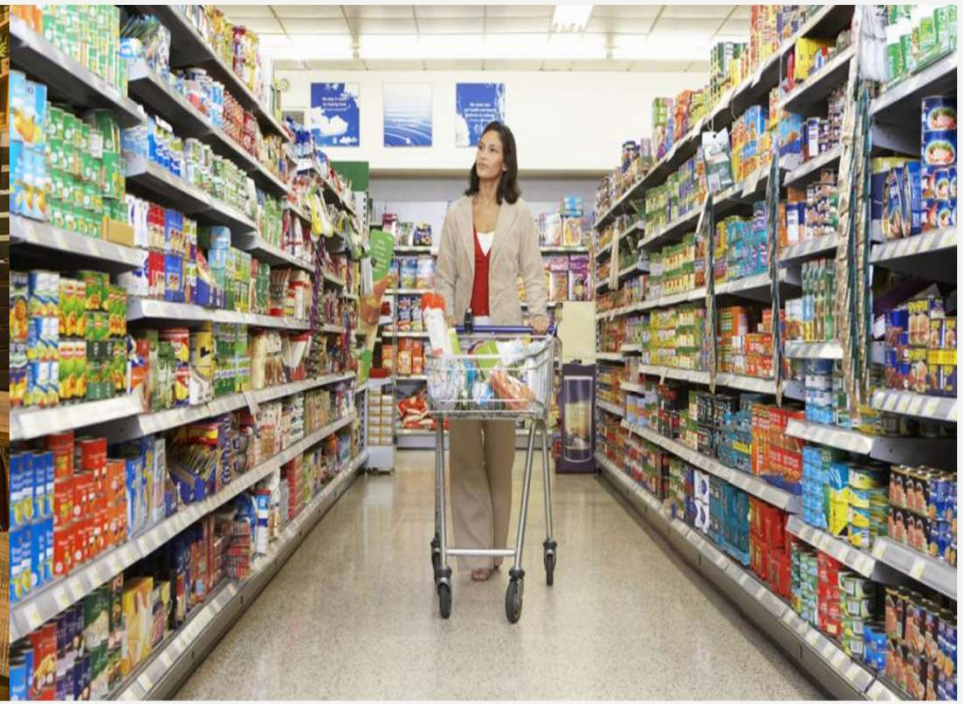
https://www.youtube.com/watch?v=XOEN9W05_4A

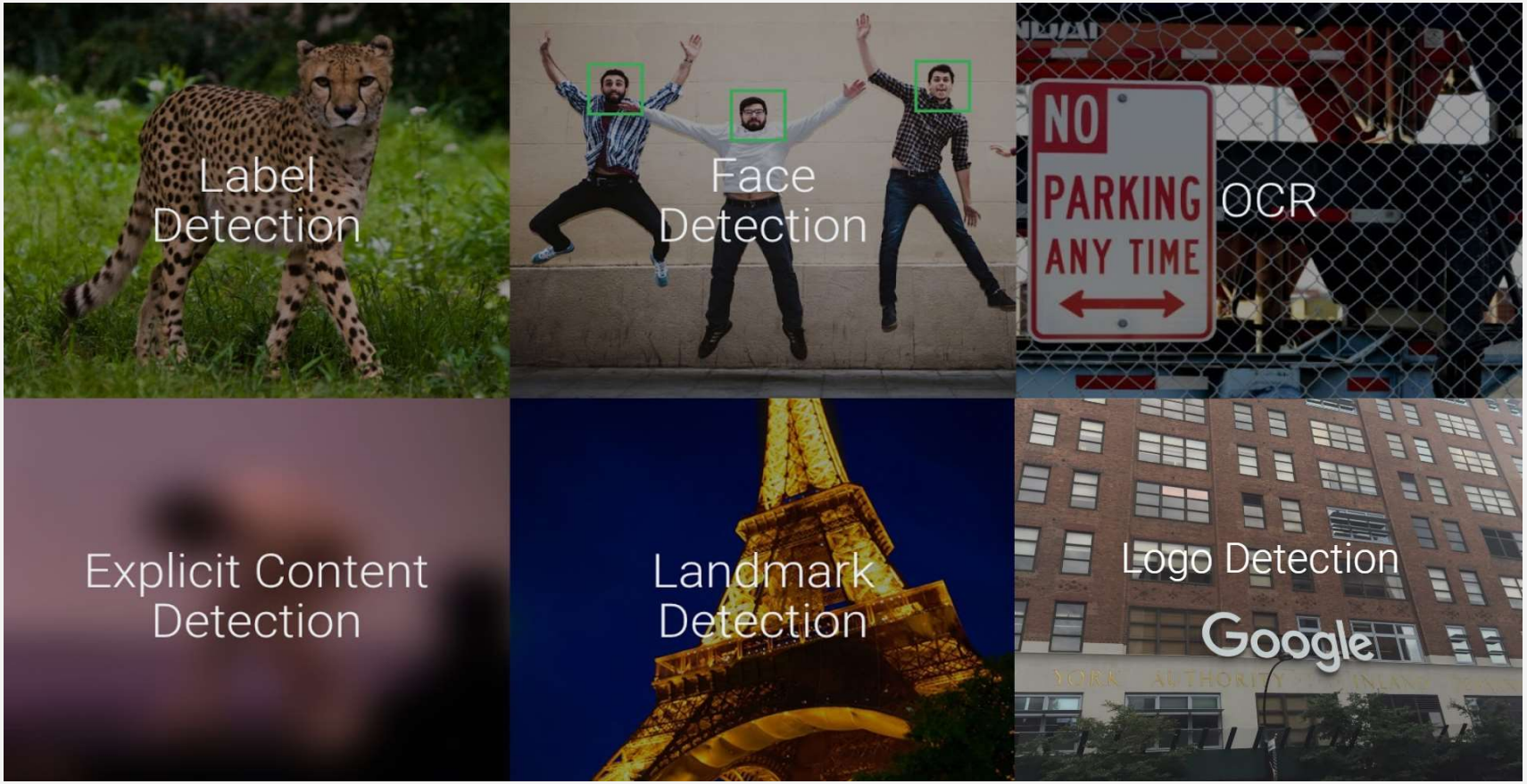
FRAUD DETECTION

HOUSE PRICE PREDICTION

STOCK PREDICTION

CUSTOMER PREDICTION

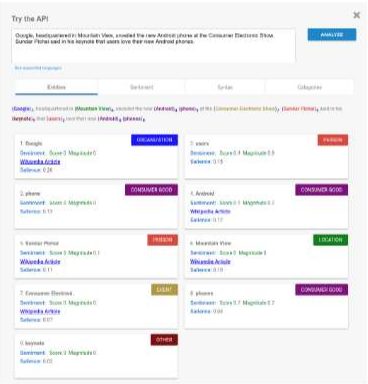



Label Detection
Face Detection
NO PARKING ANY TIME
OCR
Explicit Content Detection
Landmark Detection
Logo Detection
Google

Natural Language

TRY THE API

Derive insights from unstructured text using Google machine learning.



Entity Recognition

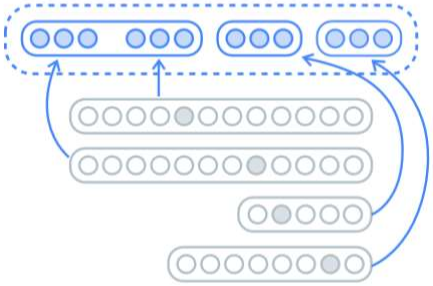
Identify entities and label by types such as person, organization, location, events, products and media.

Sentiment Analysis

Understand the overall sentiment expressed in a block of text.

Multi-Language Support

Enables you to easily analyze text in multiple languages including English, Spanish and Japanese.



Syntax analysis

Extract tokens and sentences, identify parts of speech (PoS) and create dependency parse trees for each sentence.