

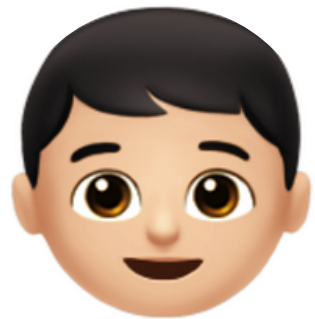
# Machine Learning in Autonomous Cars



A Machine Learning project presented by □"END"□ Group to Sir  
Usman Ali

# Group Members

Group "END"



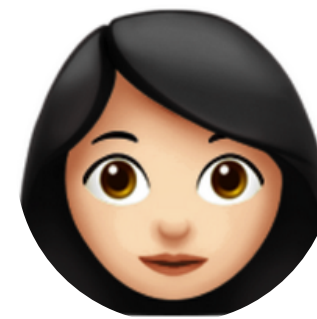
Abdullah Asad



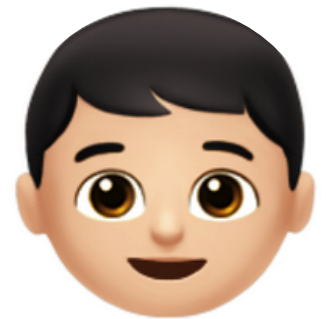
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# Objectives

What we want  
to achieve

What is Machine Learning?

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What are autonomous cars?

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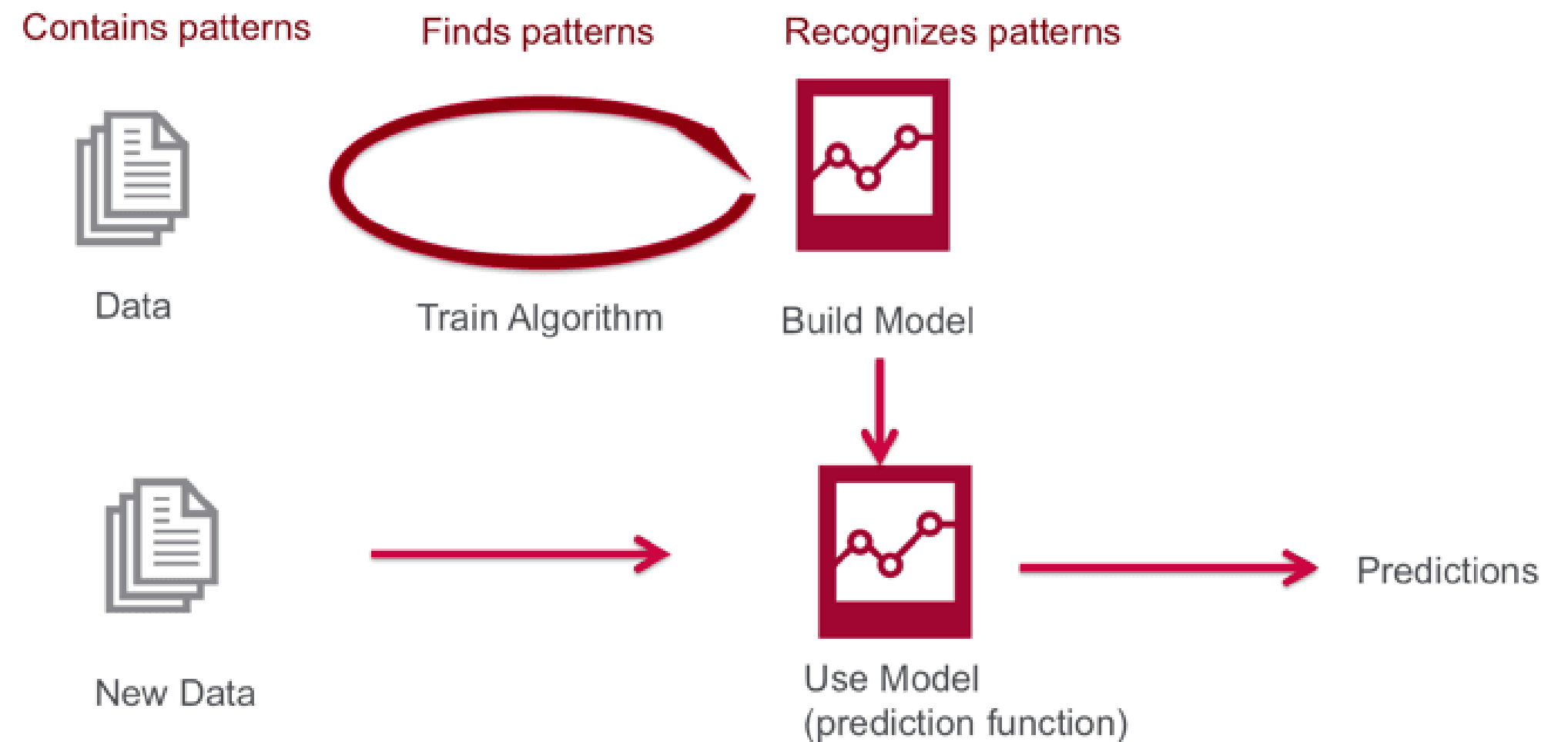
What is the role of machine learning in Autonomous Cars?



Introduction  
to

Machine Learning

- Machine Learning uses algorithms to find patterns in massive amounts of data.
- It uses a model that recognizes those patterns to make predictions on new data.



# Machine Learning can be broken into two types.

## Supervised Learning

These algorithms use  
labeled data

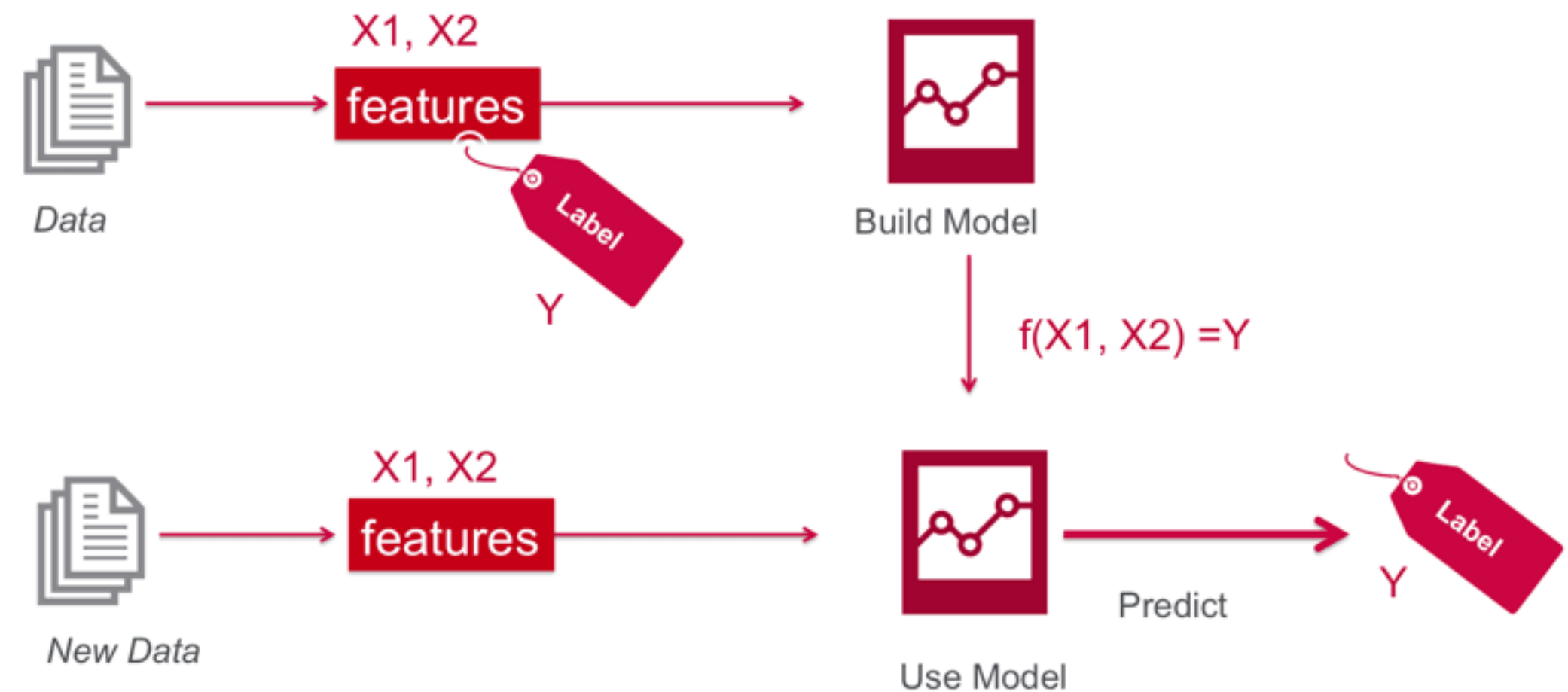
## Unsupervised Learning

These algorithms find patterns  
in unlabeled data

- Between Supervised and Unsupervised Learning
  - Semi-supervised Learning uses a mixture of labeled and unlabeled data.
  - Reinforcement Learning trains algorithms to maximize rewards based on feedback.

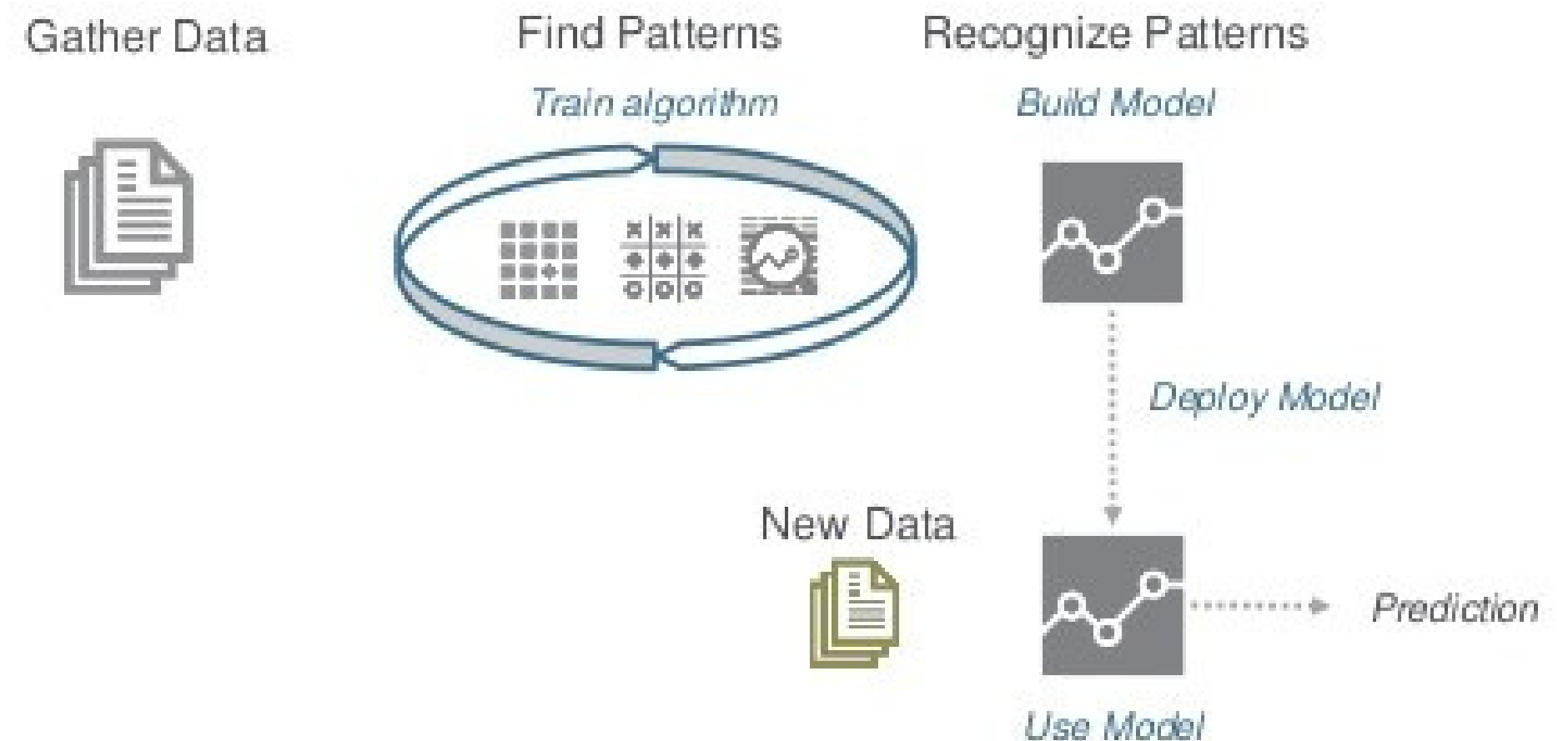
# Supervised Learning

- Also called predictive modeling or predictive analysis.
- These algorithms use labeled data in which both the input and target outcome, or label, are provided to the algorithm.



# Unsupervised Learning

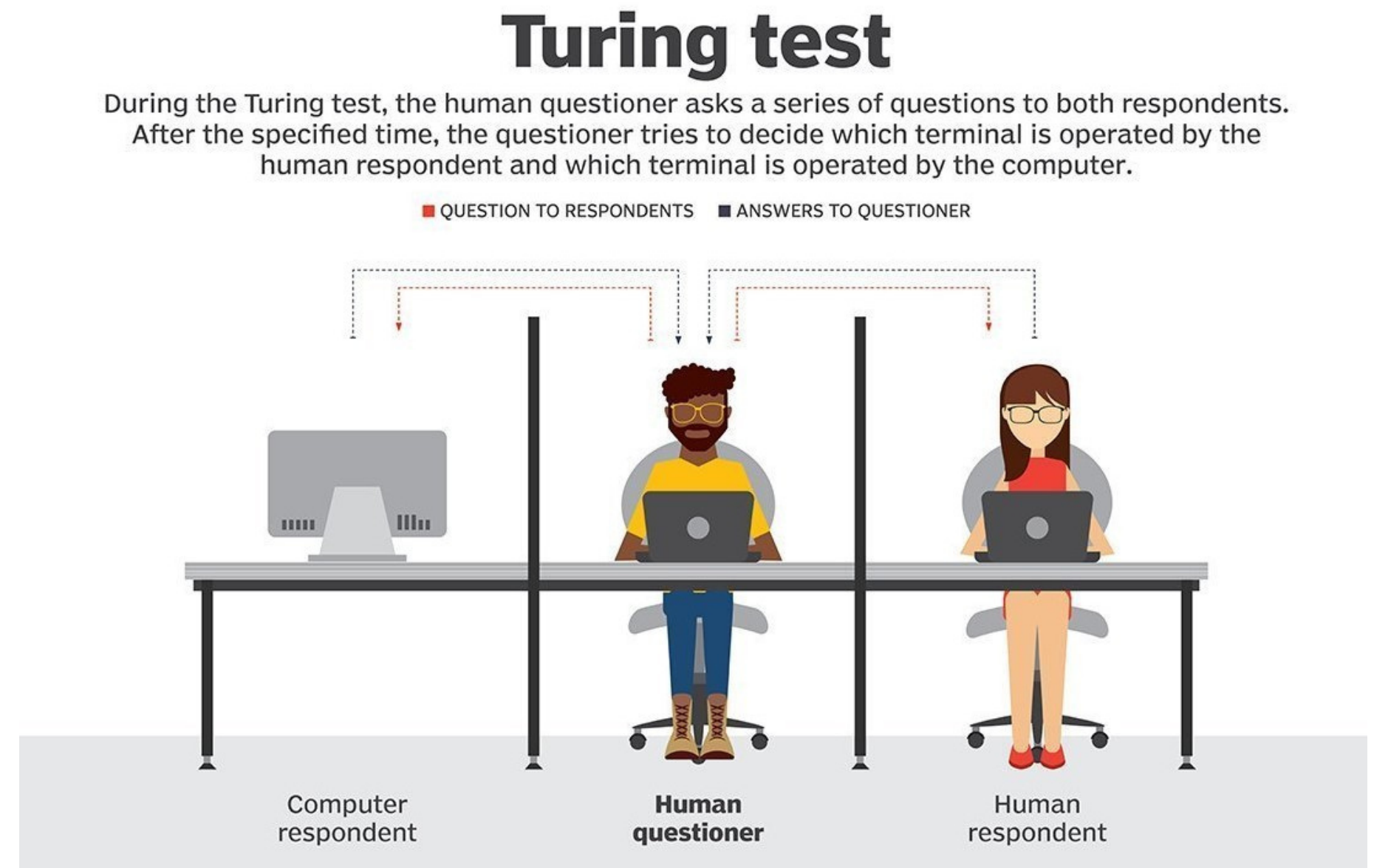
- Also sometimes called descriptive analytics, does not have labeled data provided in advance.
- These algorithms discover similarities or regularities in the input data.



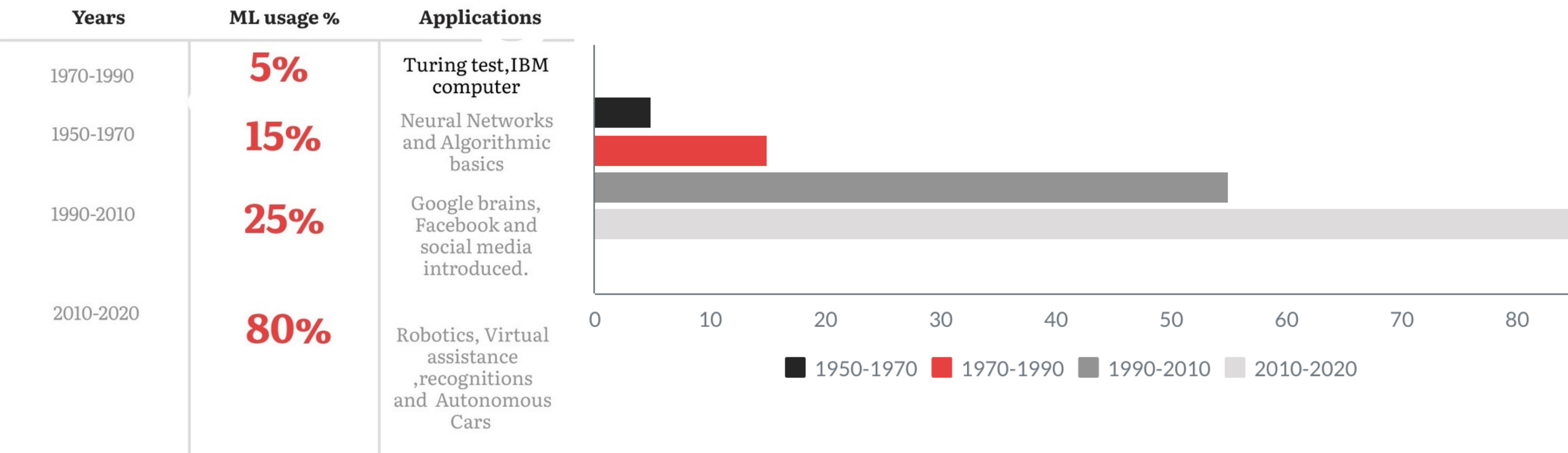


# How It Started?

- Alan Turing created the basic concept of machine learning also known as "The First Application of Machine Learning".
- In 1950, he created a test called "Imitation Game".
- It determined whether a computer can think like a human.



# Quick Overview on the History of Machine Learning



# Moving towards Autonomous Cars

Leading Company in manufacturing autonomous cars is Tesla

- Autonomous Driving which they call as Auto-Pilot.
- They are currently offering two autonomous packages.
  - Auto-Pilot is an advanced driver assistance system (ADAS) that enhances safety and convenience behind the wheel.
  - Full Self-Driving Capability where the car is capable of driving itself anywhere.

# These Packages Include

## Auto-Pilot

- Traffic-Aware Cruise Control matches the speed of your car to that of the surrounding traffic.
- Autosteer assists in steering within a clearly marked lane and uses traffic-aware cruise control.

# Full Self-Driving Capability

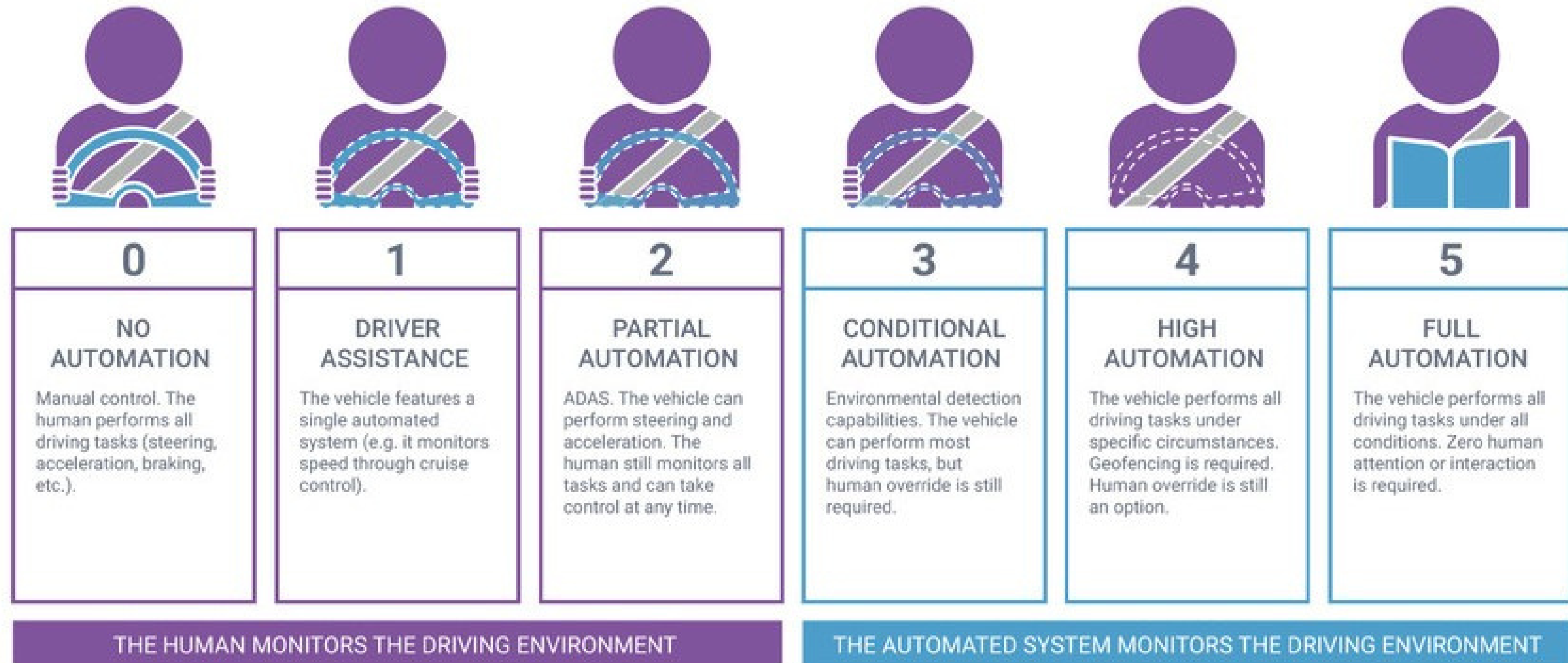
- Navigate on Auto-Pilot actively guides the car from a highway's on-ramp to off-ramp, including suggesting lane changes, automatically engaging the turn signal, and taking the correct exit.
- Auto Lane Change assists in moving to an adjacent lane on the highway when Autosteer is engaged.
- Autopark helps automatically parallel or perpendicular park the car.

- Summon moves the car in and out of a tight space.
- Smart Summon the car will navigate more complex environments and parking spaces, maneuvering around objects as necessary to come to find the driver in a parking lot.
- Traffic and Stop Sign Control identifies stop signs and traffic lights and automatically slows the car to a stop on approach, with the driver's active supervision.

# What are autonomous cars?

- A vehicle that gets from one point to another without human interaction through the ability to sense its surrounding.
- It utilizes a fully automated driving system in order to allow the car to respond to external conditions that a human driver would manage.

# There are six levels of automation.







MOTION FLOW

LANE LINES

LANE LINES

ROAD FLOW

IN-PATH OBJECTS

ROAD LIGHTS

OBJECTS

ROAD SIGNS

**Rearward Looking Side Cameras**

Max distance 100m

**Wide Forward Camera**

Max distance 60m

**Main Forward Camera**

Max distance 150m

**Narrow Forward Camera**

Max distance 250m

**Rear View Camera**

Max distance 50m

**Ultrasonics**

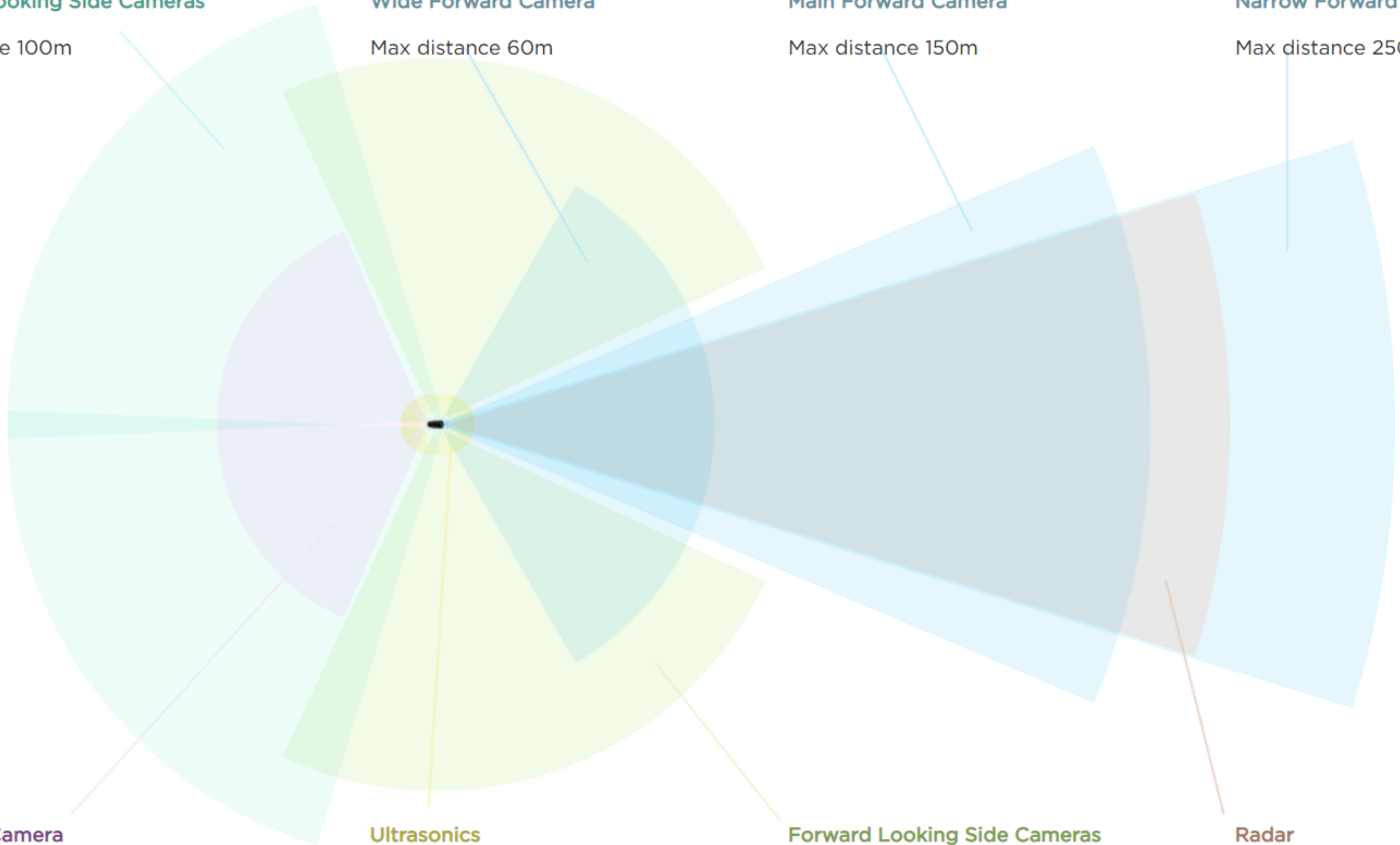
Max distance 8m

**Forward Looking Side Cameras**

Max distance 80m

**Radar**

Max distance 160m



# Autonomous Car Machine Learning Algorithms

- One of the main tasks of any machine learning algorithm in the autonomous car is:
  - Continuous rendering of the surrounding environment.
  - The prediction of possible changes to those surroundings.
- These tasks are mainly divided into four sub-tasks:
  - Object Detection.
  - Object Identification or Recognition.
  - Object Classification.
  - Object Localization and Prediction of Movement.

# Machine Learning Algorithms

They can be divided into four parts

## 1 - Regression Algorithms

- These are used explicitly for predicting events.
- There are three main types of regression algorithms used in autonomous cars.
  - Bayesian Regression.
  - Neural Network Regression.
  - Decision Forest Regression.

## 2- Pattern Recognition Algorithms (Classification)

- In ADAS, the images obtained through sensors possess all types of environmental data, filtering is required.
- These algorithms are good at unusual data points.
- They are also defined as data reduction algorithms.
- Recognition of patterns in a data set is an important step before classifying the objects.
- The most commonly used pattern recognition algorithms are SVM, HOG, PCA, Bayes decision rule, and KNN.

# 3- Clustering Algorithms

- Sometimes the images obtained by ADAS are not clear and it is difficult to detect and locate objects.
  - Low-Resolution Images
  - Few Data Points
  - Discontinuous Data
- These algorithms are good at discovering structure from data points.
- K-Meas and Multi-Class neural networks are the two most widely used clustering algorithms for autonomous cars.

## 4- Decision Matrix Algorithms

- As the name suggests these types of algorithms are essentially used for decision making.
- They are designed for systematically identifying, analyzing, and rating the performance relationships between sets of values and information in them.
- They determine the moves of the autonomous cars.
- The most common decision matrix algorithms used in autonomous cars are Gradient Boosting GDM and AdaBoosting.

# Conclusion

- At present these cars can perform basic human tasks of a human driver with certain limitations.
  - Controlling
  - Navigating
  - Driving
- With further advancement of Machine Learning and improvement of self-driving car algorithms we have a lot to look forward to from these autonomous cars



# References

- <https://www.upgrad.com/blog/how-machine-learning-algorithms-made-self-driving-cars-possible/>
- <https://iiot-world.com/artificial-intelligence-ml/machine-learning/machine-learning-algorithms-in-autonomous-driving/>
- <https://www.visteon.com/machine-learning-algorithms-in-autonomous-cars/>
- <https://developer.hpe.com/blog/ool8lOg74Vtwrj46qznY/demystifying-ai-machine-learning-and-deep-learning/>
- <https://www.expert.ai/blog/machine-learning-definition/>
- <https://www.tesla.com/>

# **Thank You**

If You Have Any Questions Please Ask