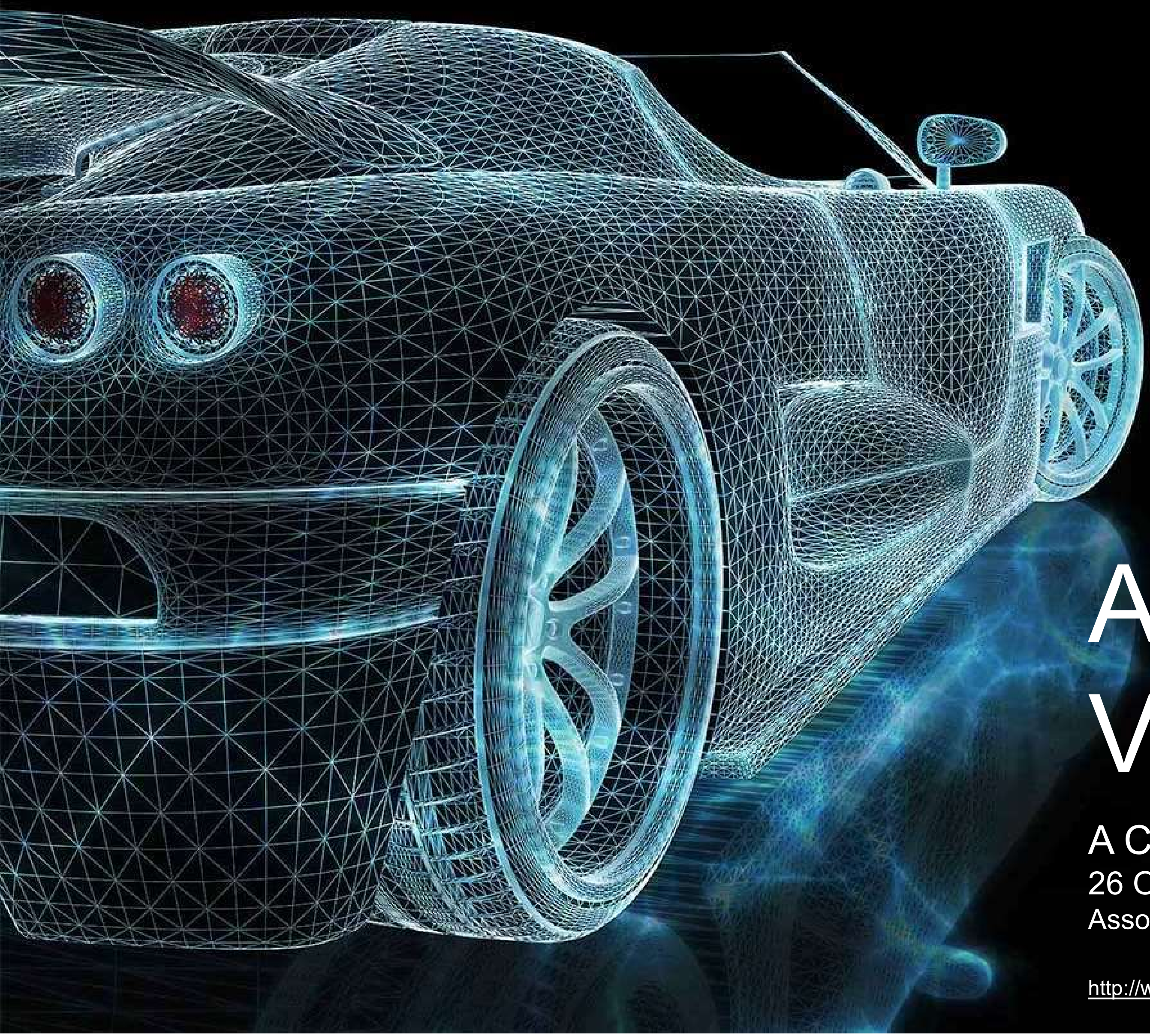

Autonomous Vehicle

A Case Study by Keith Teo See Koy

26 Oct 2020

Associate Data Analyst Cohort 5

http://www.free-powerpoint-templates-design.com

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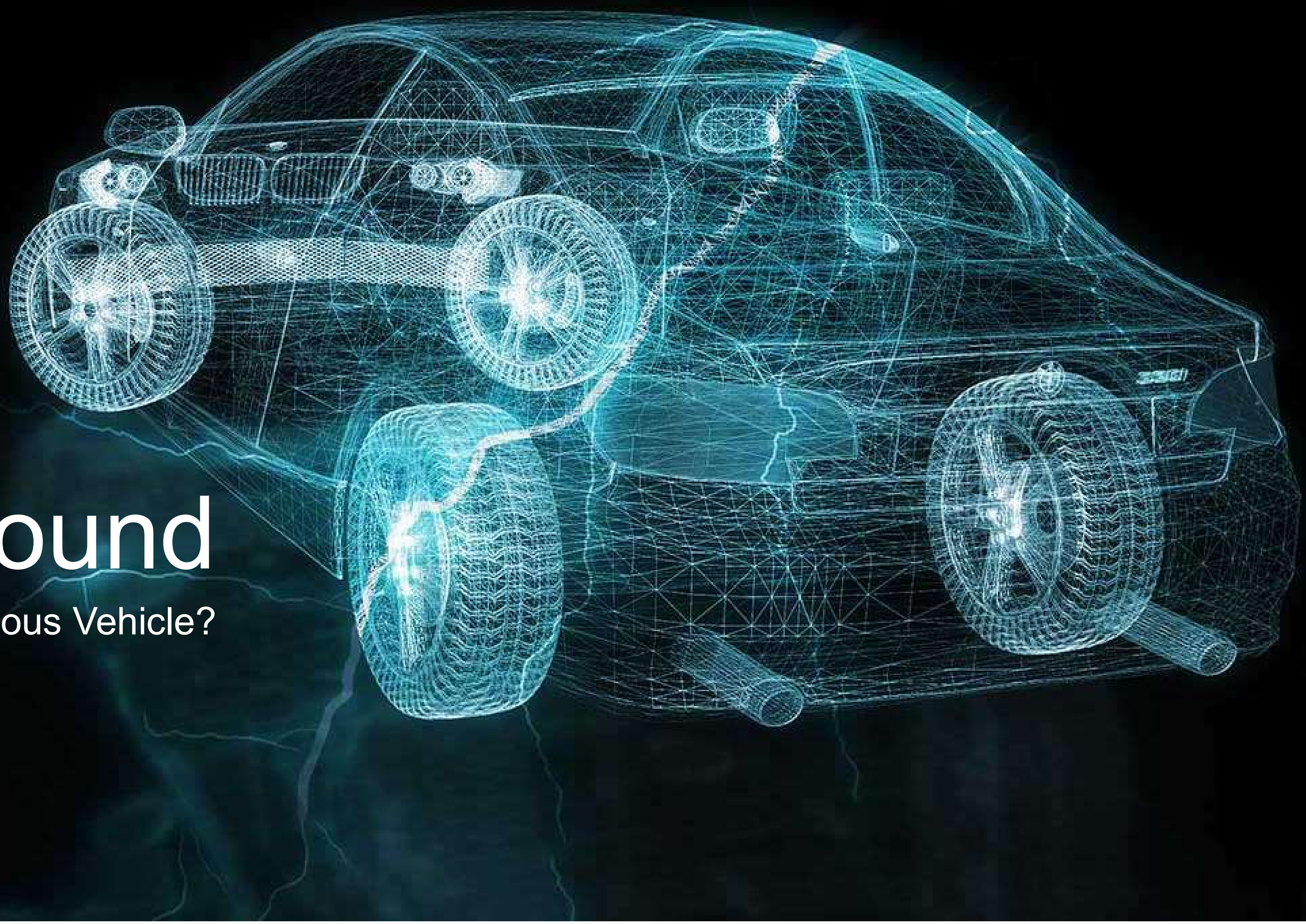
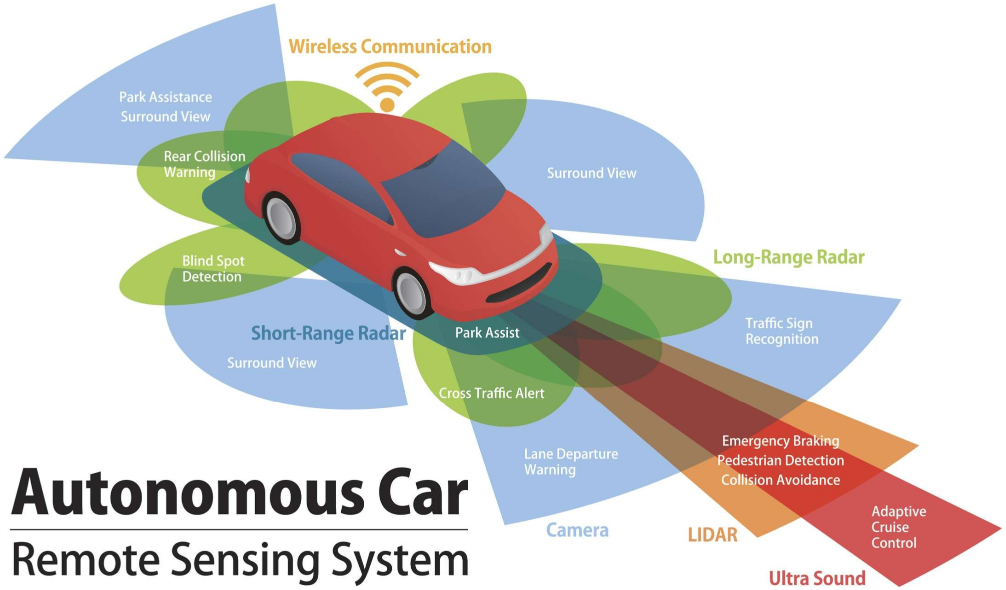
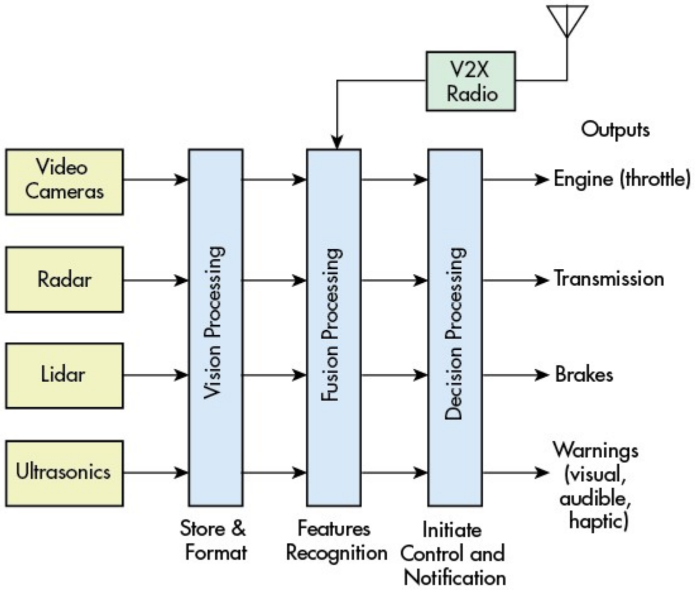


Background

What is an Autonomous Vehicle?

Background





The vehicle sensors provide a 360-deg. view that approximates a human's visual sensual ability.

Source : https://innovation-destination.com/2018/02/16/7-factors-critical-success-self-driving-cars/

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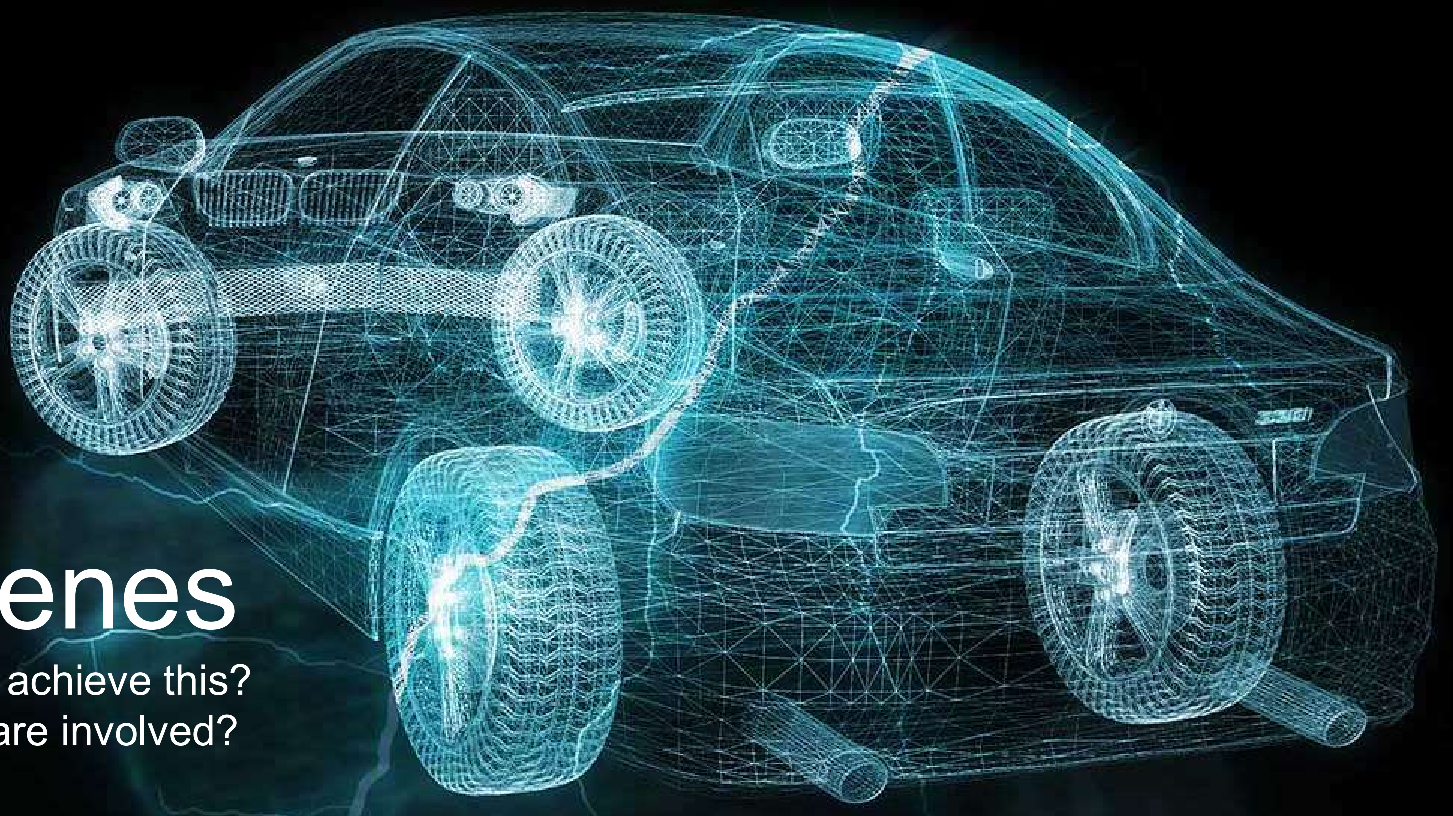


Behind the Scenes

How are we employing Data Science to achieve this?

Who are involved?

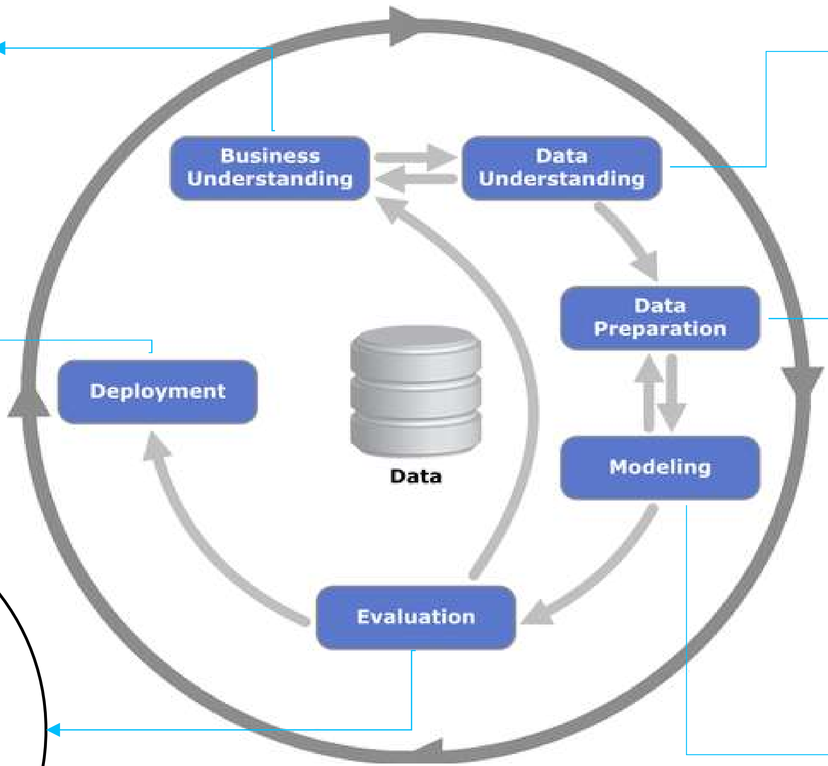
Autonomous Vehicle

Behind the Scenes

- Set goals for the project

- Depending on the results, strategic decisions are taken

- Perform statistical and visual analysis
- Discover and handle outliers/errors
- Shortlist predictive modeling techniques
- The results are presented, analyzed and disseminated.

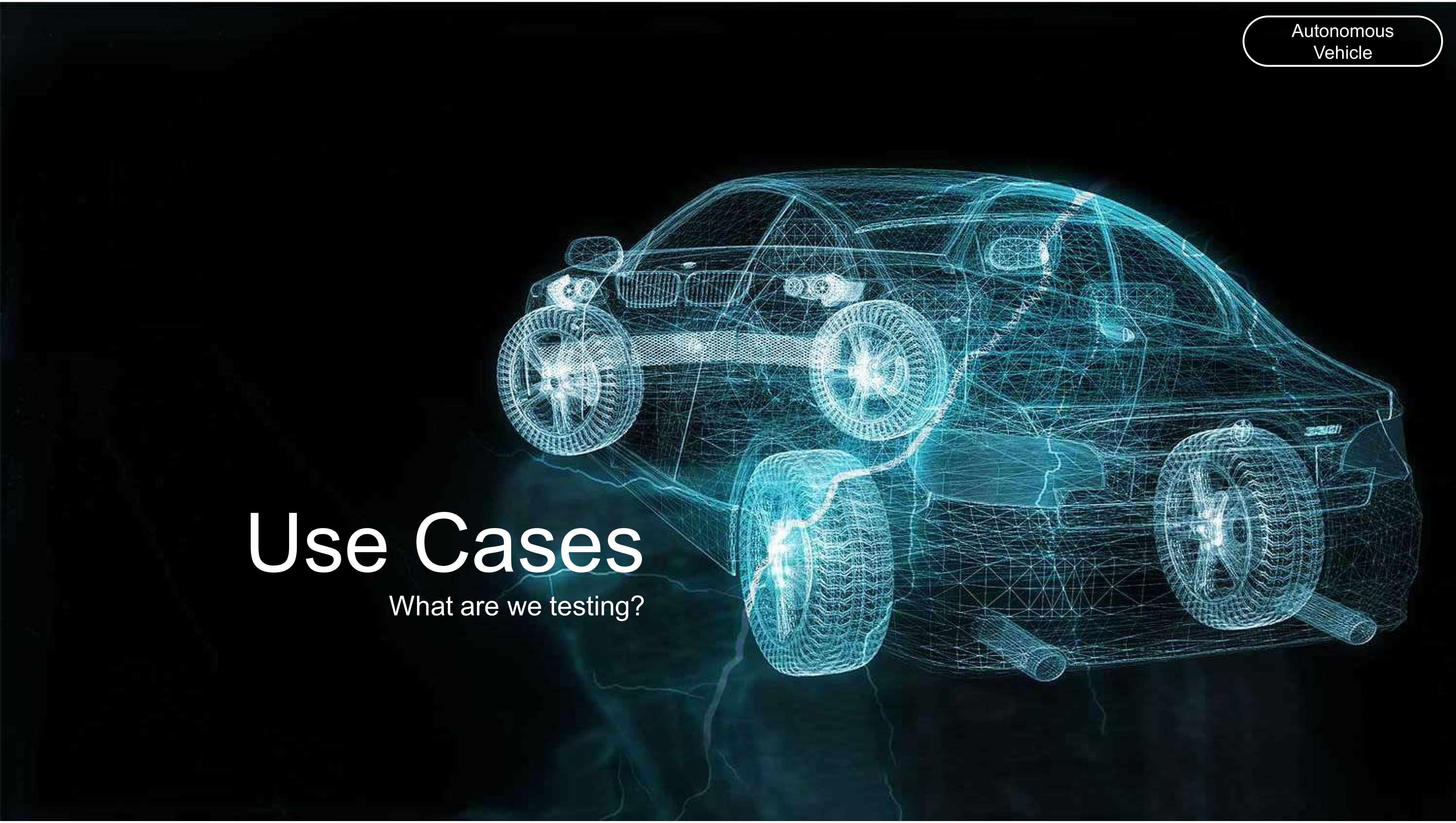


- Set the data and data sources
- Check if the available data can meet the objectives of the project and establish how you will meet the objectives

- Data cleaning and data transformation

- Experiment with multiple models
- Choose the most optimal model

Source :https://www.datasciencecentral.com/profiles/blogs/data-science-simplified-principles-and-process


Autonomous
Vehicle
Use Cases
What are we testing?

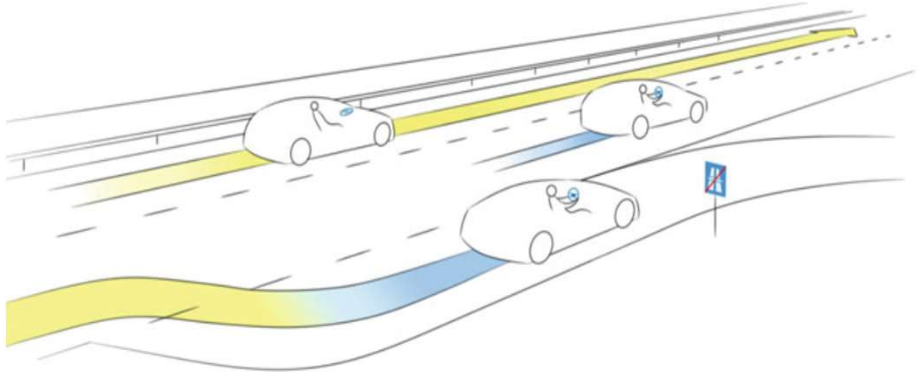
Use Cases – 5 Levels of Autonomous Driving

Level 1	Level 2	Level 3	Level 4	Level 5
Driver Assistance. Driver performs all functions but automated driving systems provide alerts and partial control or braking, steering and throttle.	**Partial Automation.** Driver must still monitor actions but automated systems control braking, steering and throttle.	**Conditional Automation.** Automated driving systems perform all driving activities but driver must still be available to take control in special circumstances.	**High Automation.** Automated driving systems perform all driving activities. Driver may still control the vehicle if needed.	**Full Automation.** No driver is needed, but a driver may intervene if necessary.
Driver handles most of the car's functions but with a little autonomous help. For example, vehicle might provide a brake boost if edge too close to another vehicle, or it might have an adaptive cruise control function to control distance and speed.	Partial automation enables drivers to disengage from some driving functions. Vehicles are able to assist with functions like steering, acceleration, braking, and maintaining speed, although drivers still need to have both hands on the wheel and be ready to take control if necessary.	Conditional automation allows driver to sit back and let the car do all the driving. Also referred to as 'eyes-off' vehicles, drivers are able to focus their attention on other activities like using mobile phones, for example.	Vehicles are capable of steering, accelerating, and braking on their own. They are also able to monitor road conditions and respond to obstacles, determining when to turn and when to change lanes.	Vehicles are able to steer, accelerate, brake and monitor road conditions like traffic jams. Essentially, Level 5 automation enables the driver to sit back and relax without having to pay any attention to the car's functions whatsoever.
E.g. 2018 Nissan Sentra, with its Intelligent Cruise Control feature	E.g. 2019 Volvo 560, with its auto-braking feature and pilot assist capabilities	E.g. Honda (Acura brand) announced it would have self-driving cars ready for freeway use around 2020, with even more autonomy coming around 2025.	E.g. Google's Waymo project (US)	Vehicles will be driven using AI and will respond to real-world data points, generated from sensors. This data can be as much as 4TB per hour. Only a powerful computing system like AI can process such large volumes of data quick enough to achieve real-time responses.

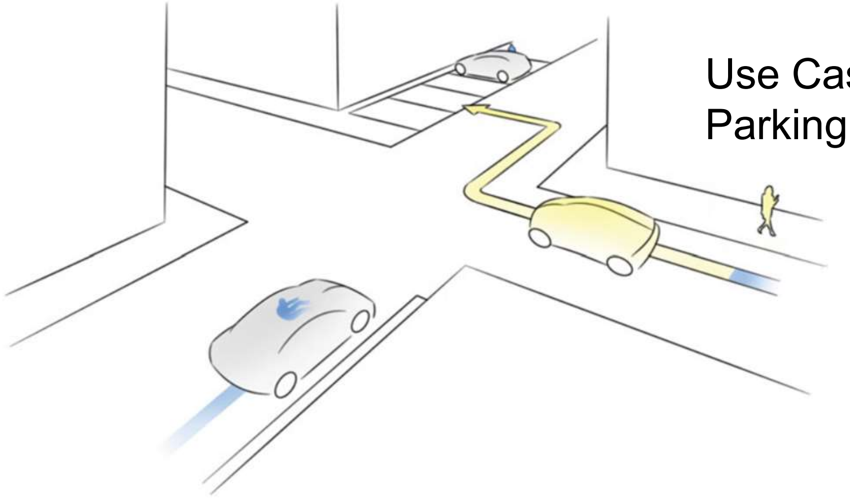
Source : https://www.mes-insights.com/amp/the-5-levels-of-autonomous-driving-explained-a-912868/

Use Cases

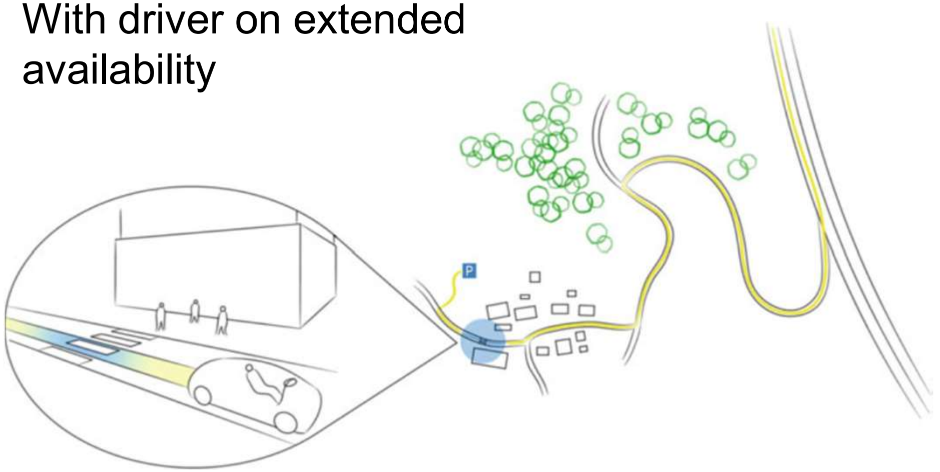
Use Case 1 - Highway Driving



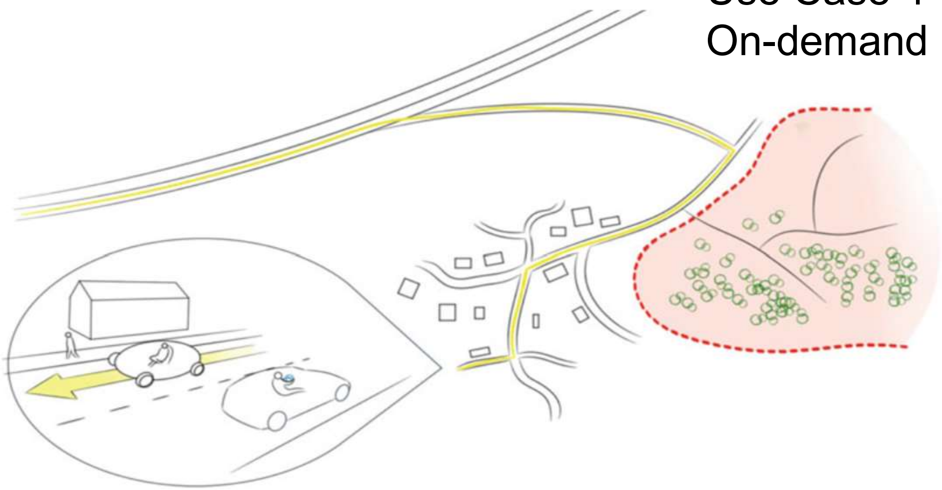
Use Case 3 – Valet Parking



Use Case 2 – Full Automation With driver on extended availability



Use Case 4 – Vehicle On-demand



Source : https://www.researchgate.net/publication/303480945_Use_Cases_for_Autonomous_Driving

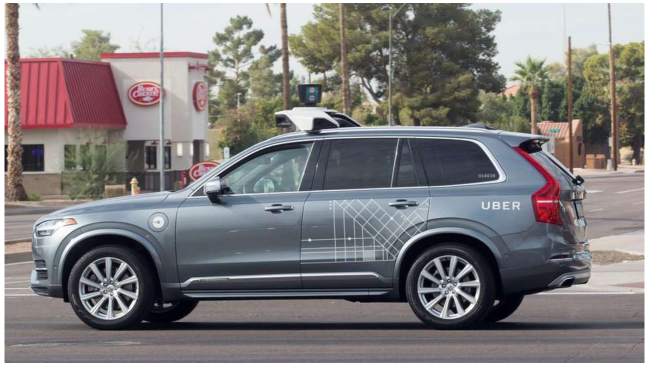

Autonomous Vehicle
Pit Falls
What to watch out for?

Autonomous Vehicle

Pitfalls

Low Tolerance of AV Accidents

- US - The outcry following the tragic death of a pedestrian in Phoenix, Arizona who was killed by an AV in 2019 shows that society has a very low tolerance for accidents caused by technology, and governments will set policy accordingly.
- **SG - The self-driving car was changing lanes in Biopolis Drive at one-north (Oct 2016) when it knocked into the lorry. The car belongs to nuTonomy, which is conducting trials of its autonomous vehicles in the one-north area. The start-up said the car was travelling at a "low speed" at the time of the accident.**
- In February, a Google self-driving car collided with a bus in California. In May, the driver of a Tesla Model S sedan, with the autopilot mode engaged, was killed when it crashed into a tractor trailer in Florida.



Autonomous Vehicle

Pitfalls

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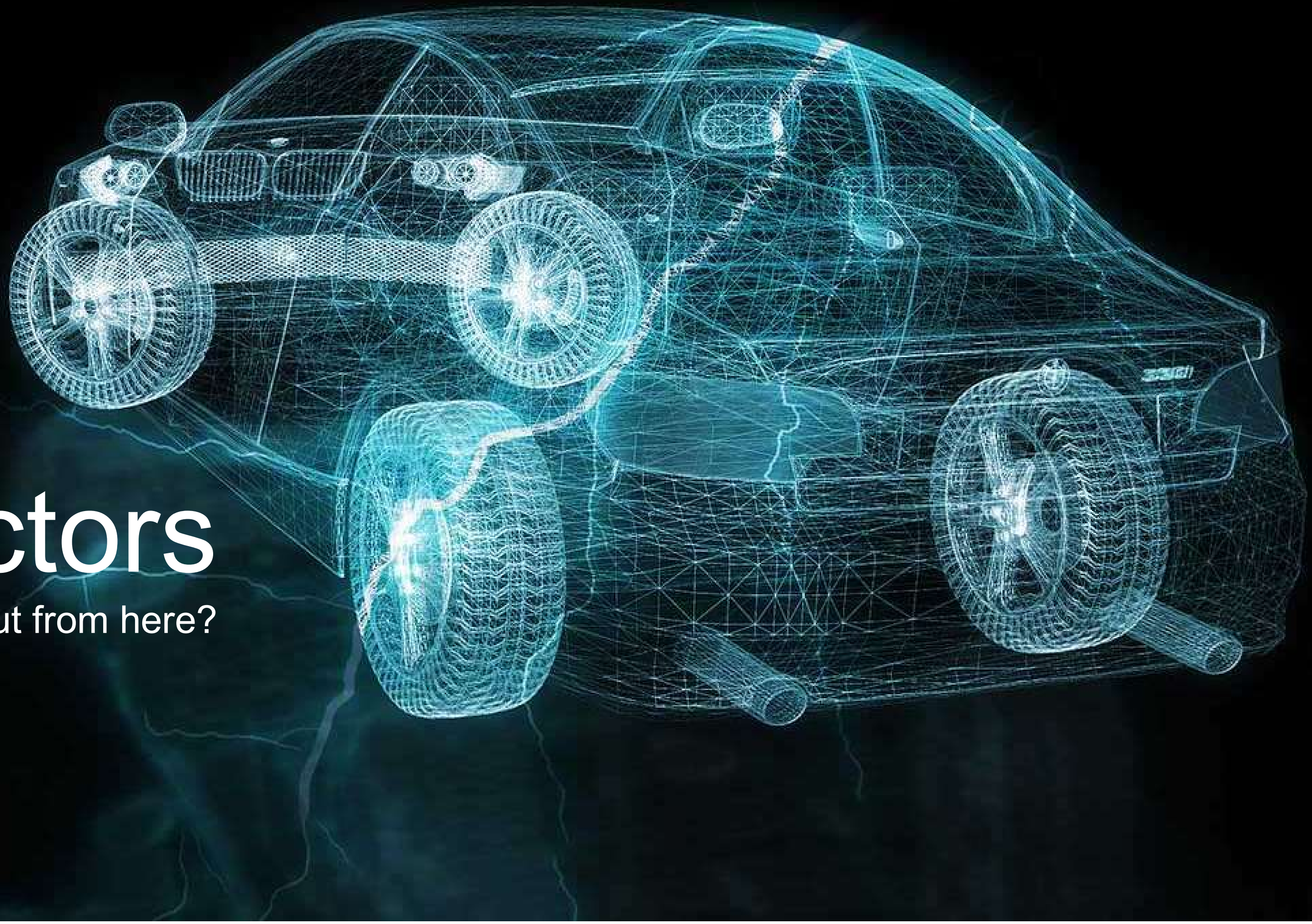
Black Swan Scenario

- Failure of system will tend to occur when the system is least expected to perform.

Pandemic Effect

- Due to lock-down, various road trials has been halted. This will impact the progress of the AV.
- With lesser pedestrians and vehicles on the road, the richness of the data will also be impacted

Autonomous Vehicle



Success Factors

What benefits can we get out from here?

Success Factors

01
Safety
The World Health Organization estimates that there are 1.35 million road deaths and 50 million injuries annually. With human error responsible in around 95 percent of cases, AVs have the potential to reduce these casualties dramatically.

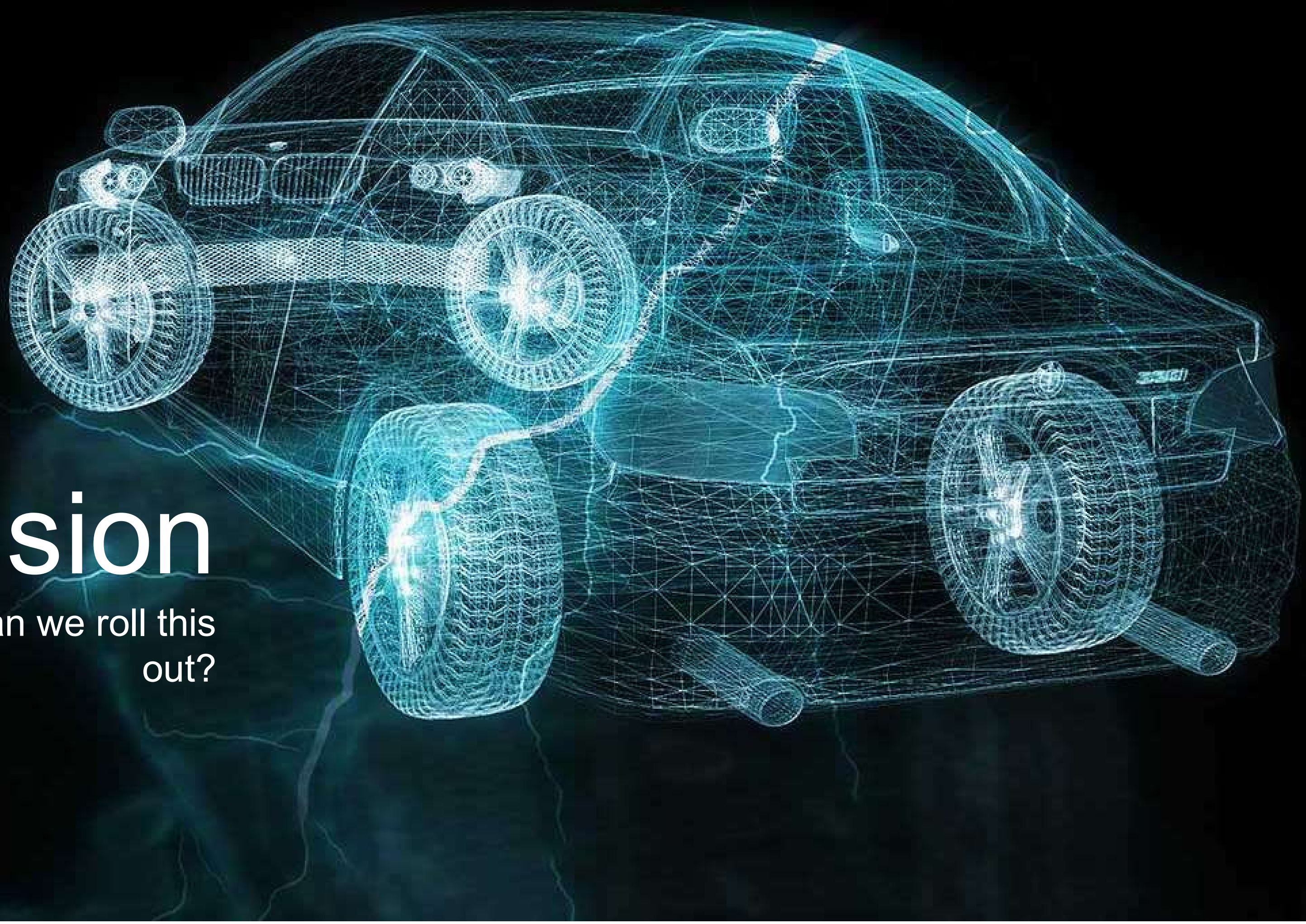
02
Privacy
For public authorities, one of the great opportunities of connected vehicles is the optimization of road capacity. If they know the position and destination of all vehicles in a particular area, an intelligent traffic management system can set the speeds and routes of all these vehicles in order to minimize journey times and congestion levels.

03
Digital Infrastructure
There is debate over how much effort countries and jurisdictions should put into digital infrastructure for AVs, including sensor networks, roadside equipment such as smart traffic lights that can tell AVs when to stop or go, and high-quality digital mapping.

04
Impact on Transport Systems
The highest-profile work on AV development, led by technology companies based in the US, has focused on driverless private cars and taxi services. If these predominate, the result is likely to be more vehicles on roads.

Source : https://home.kpmg/avri

Autonomous
Vehicle



Conclusion

Where do we go from here? When can we roll this out?

Autonomous Vehicle

Milestones

Feb 2019 (Taiwan)

Car Lab Opens

President Tsai Ing-wen opens Car Lab in Tainan, its first closed testing ground for AVs.

Mar 2019 (Austria)

Autonomous Driving

Austria allows users to take their hands off the steering wheels when driving within one lane on a highway and operate self-parking systems when outside the vehicle.

Jul 2019 (Australia)

On-demand AV Service

Residents of a retirement village in Coffs Harbour, New South Wales, get access to an on-demand AV minibus service called BusBot, summoned using a smartphone app.

Mar 2020 (USA)

Testing Resumes

US ride-hailing company Uber resumes testing of AVs in its home city San Francisco, two years after one of its vehicles was involved in a fatal accident in Arizona.

Jan 2020 (USA)

Self-driving Car

General Motors' Cruise AV division unveils the Origin, a purpose-built self-driving car designed for ride-sharing with no physical driving controls and room for six passengers.

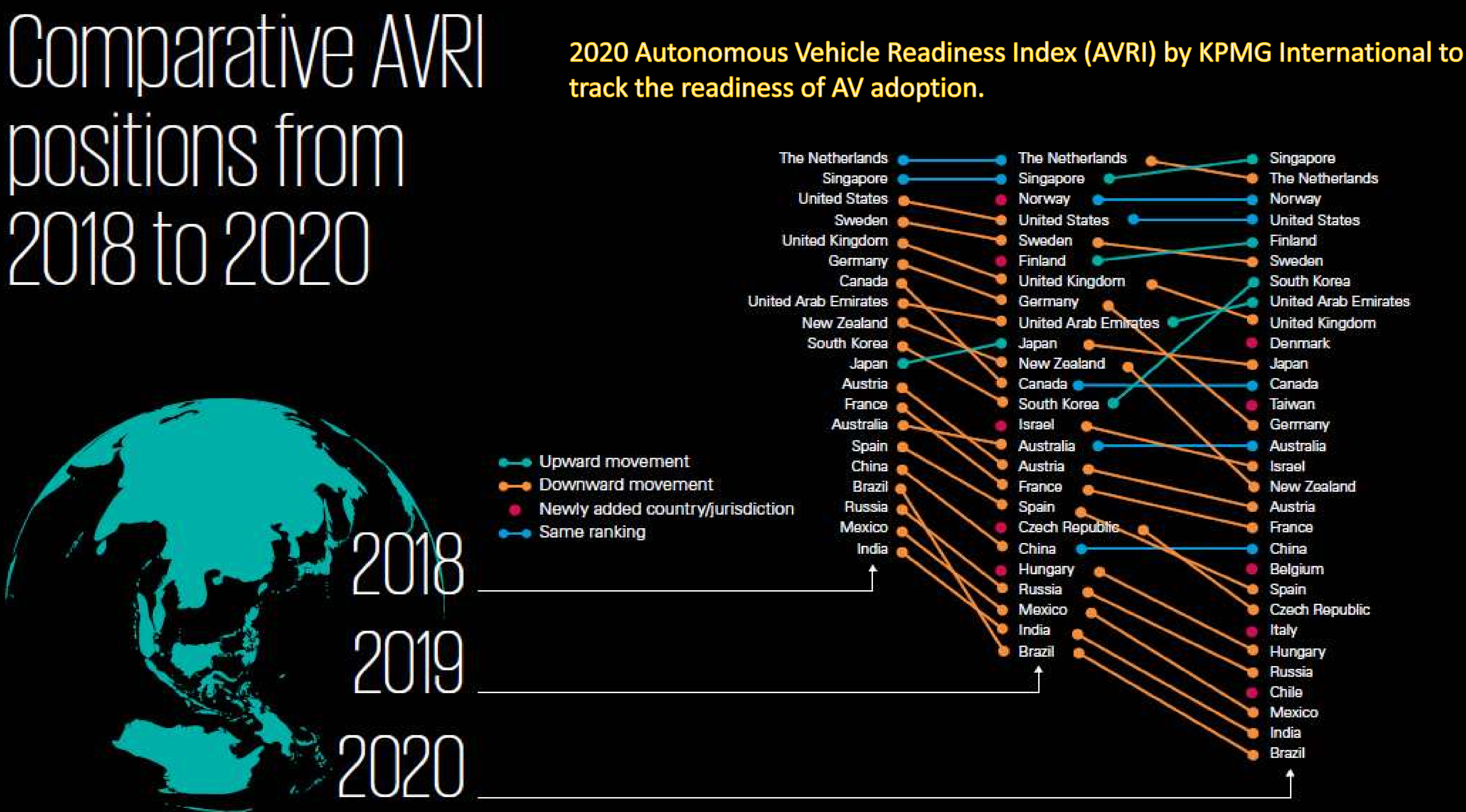
Oct 2019 (Singapore)

AV Testing

Singapore's government opens one-tenth of its total road network for AV testing and starts re-training 100 bus drivers as safety operators.

Source : https://home.kpmg/avri

2020 Autonomous Vehicle Readiness Index (AVRI) by KPMG International to track the readiness of AV adoption.



Source : https://home.kpmg/avri

Autonomous Vehicle

AVRI Achievements - Singapore

Singapore Overall Ranking : 1st (2020)

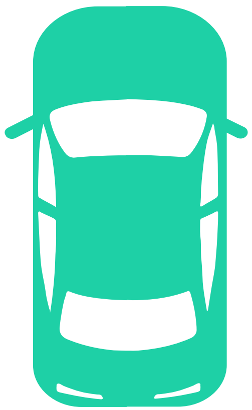
Pillar 1 Scores: Policy and Legislation	Pillar 2 Scores: Technology and Innovation	Pillar 3 Scores: Infrastructure	Pillar 4 Scores: Consumer Acceptance
1. Singapore	1. Israel	1. The Netherlands	**1. Singapore**
2. United Kingdom	2. United States	2. South Korea	2. Finland
3. The Netherlands	3. Japan	3. United Arab Emirates	3. Sweden
…	…	…	…
…	**11. Singapore**	**5. Singapore**	

Pillar 1 breakdown by variable

AV Regulations, Government-funded AV Pilots, AV-focused agency, Future orientation of government, Efficiency of legal system in challenging regulations, Government readiness for change, Data-sharing environment

Pillar 2 breakdown by variable

Industry partnerships, AV technology firm headquarters, AV-related patents, Industry investments in AV, Availability of the latest technologies, Innovation capability, Cybersecurity, Assessment of cloud computing, AI and IoT, Market share of electric cars



Pillar 3 breakdown by variable

EV charging stations, 4G coverage, Quality of roads, Technology infrastructure change readiness, Mobile connection, Broadband

Pillar 4 breakdown by variable

Population living near test areas, Civil society technology use, consumer ICT adoption, Digital skills, Individual readiness, Online ride-hailing market penetration

Source : https://home.kpmg/avri

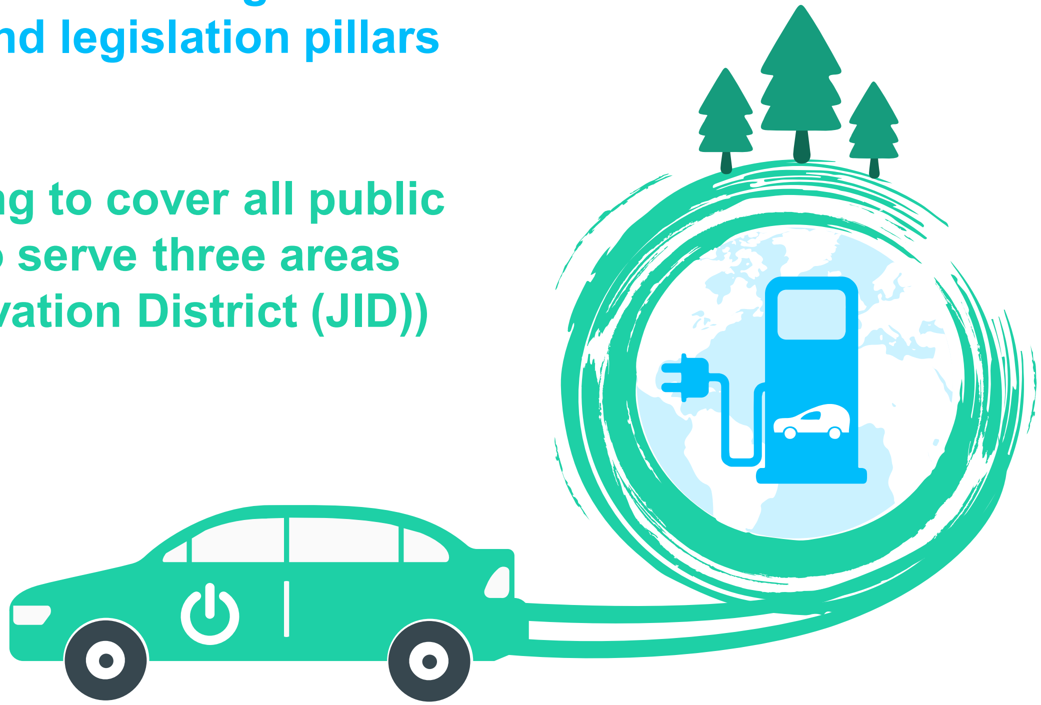
Autonomous Vehicle

Milestones - Singapore

1. For the first time Singapore leads the AVRI, overtaking the Netherlands for the top-ranked position and leading on both the consumer acceptance, and policy and legislation pillars

2. The city-state has expanded AV testing to cover all public roads in western Singapore and aims to serve three areas (Punggol, Tengah, and the Jurong Innovation District (JID)) with driverless buses from 2022

3. The number of charging points for electric vehicles will increase from 1,600 to 28,000 by 2030



Source : https://home.kpmg/avri
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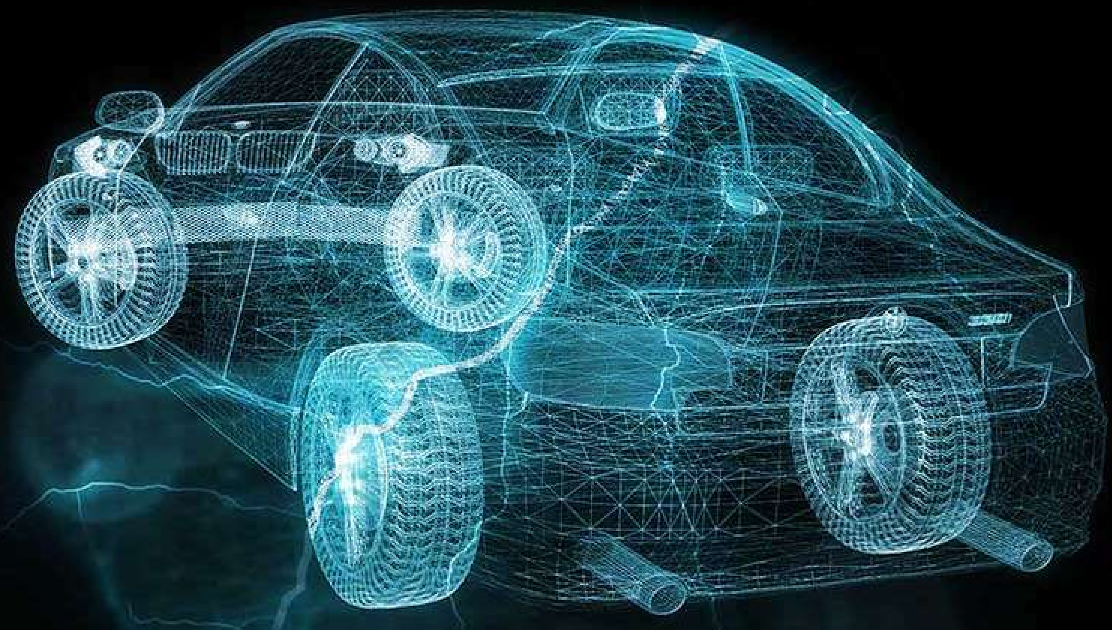

Q&A


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THANK YOU