

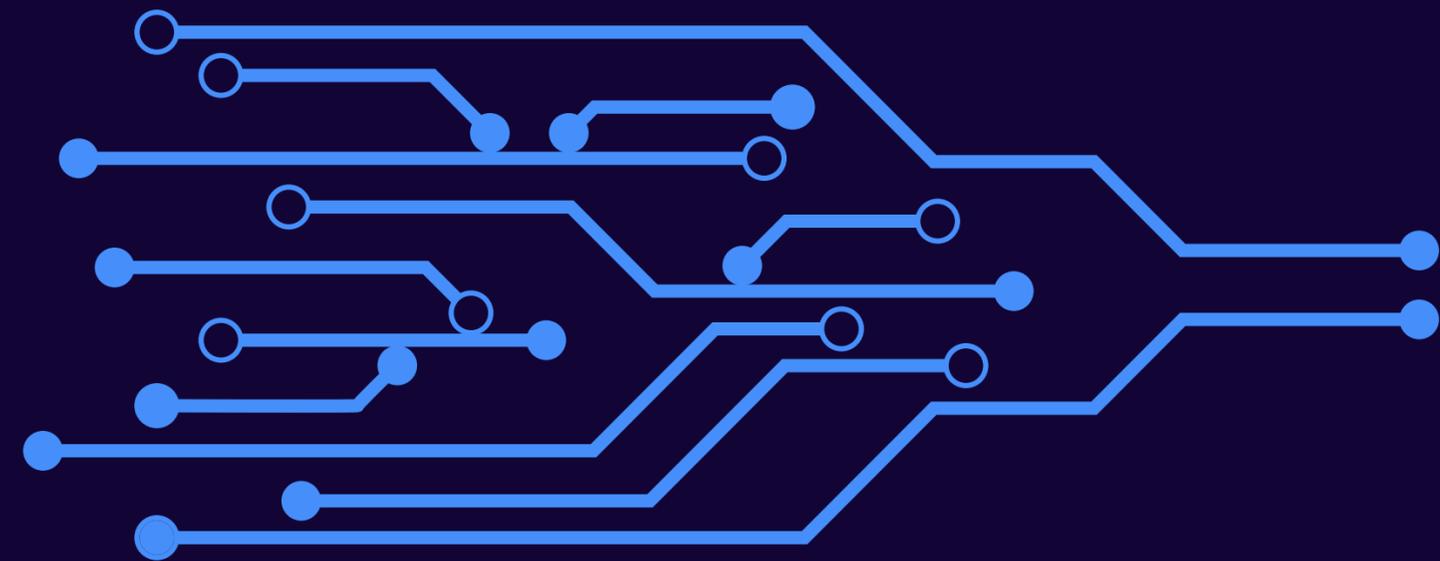


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DIGITAL LIFE

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INTELLIGENT TECHNOLOGY

Intelligent technology has replaced basic tasks used to be done manually and required a lot of human workforce.

Intelligent technology automates processes, has decision-making capabilities, and needs little human involvement.



Don't just think of the robots in sci-fi movies. Intelligent technology is closer than you think and you might be using it.





THE THREE DIGITAL PILLARS



Internet of Things (IoT)

Allows equipment to be managed over the internet, typically via mobile applications.



Big Data

The bigger data, the more accurate the prediction.



Artificial Intelligence (AI)

Allow machines to make decisions like humans and increase accuracy as it receives additional input data.

Internet of Things (IoT)



This is an electric kettle. Its sole purpose is to boil water.



You connect a Wi-Fi relay switch, so you can turn it on and off remotely.



You attach a probe to measure temperatures and feedback data to your phone.



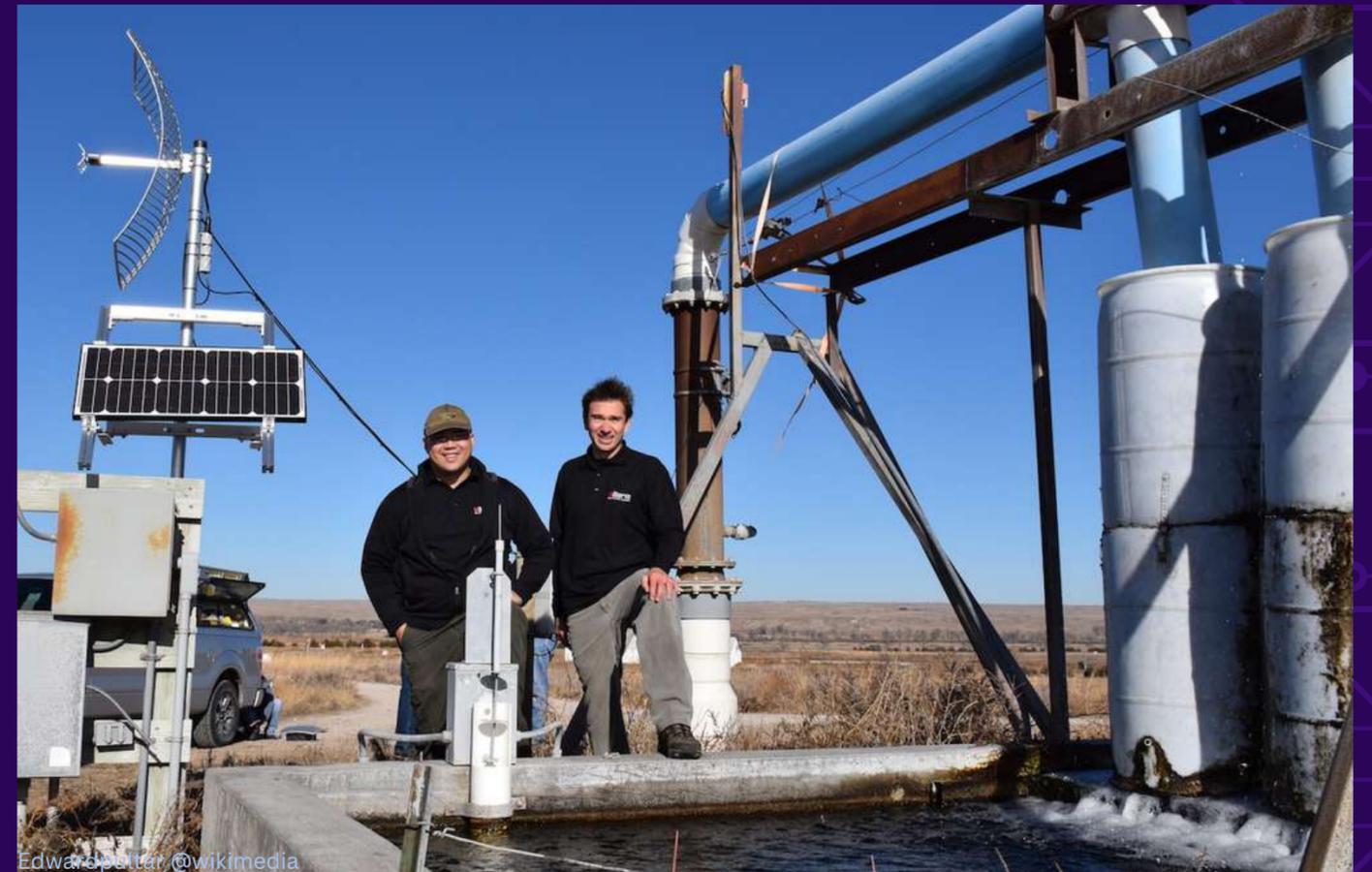
You install a liquid level sensor and have it alert you if the kettle is empty.

Now it has become a smart kettle.

IoT as part of the Industry 4.0



Indeed, industrial sectors have been adopting IoT long before it reaches the consumer sector.



IoT allows industries to measure water quality and flow rates remotely without frequent travel.

Consumer IoT devices



Wi-Fi outlet



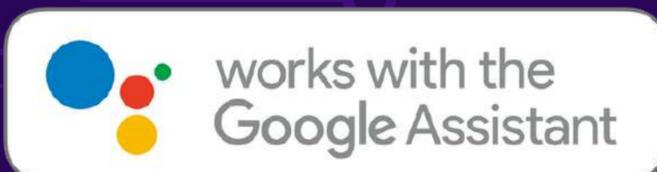
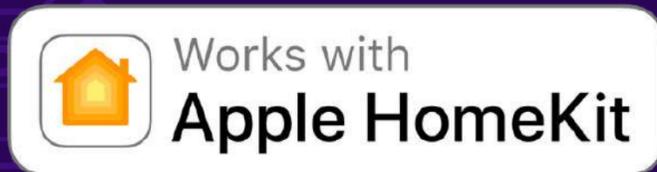
Smart lighting



IP camera



Smart speaker

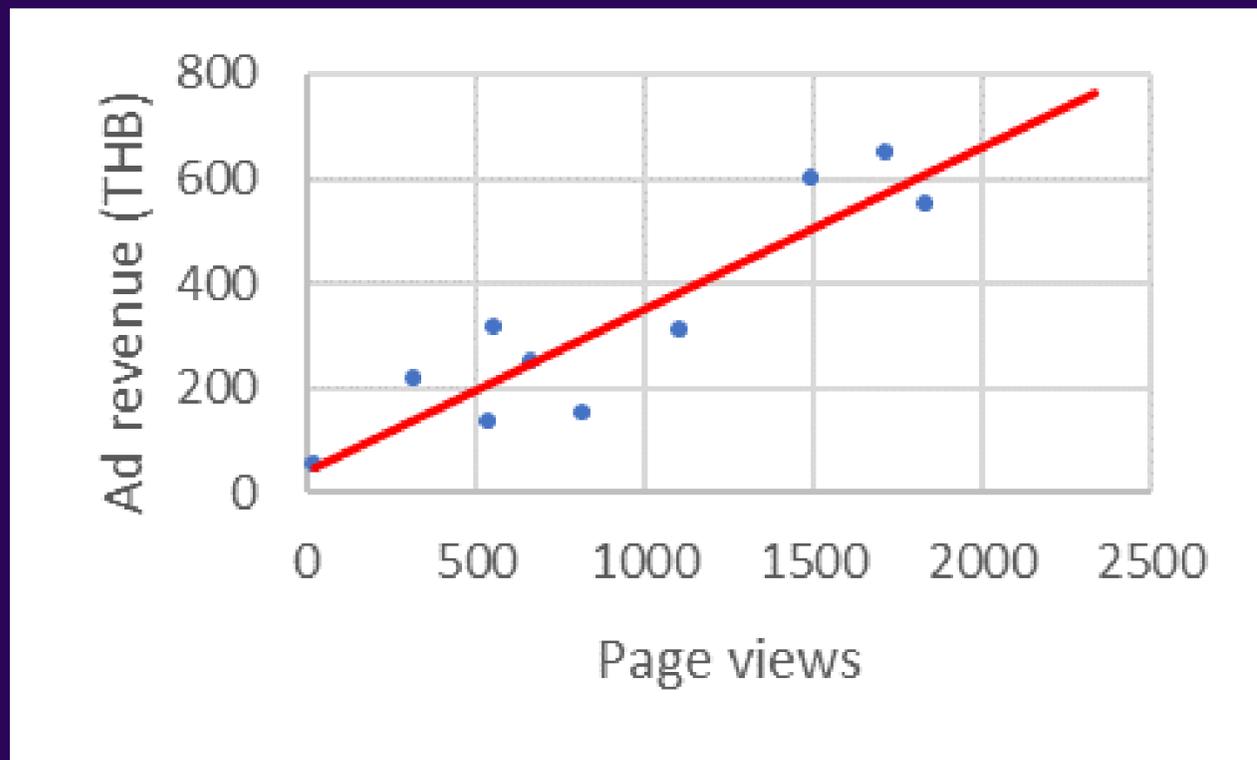


Check if it is compatible with your:

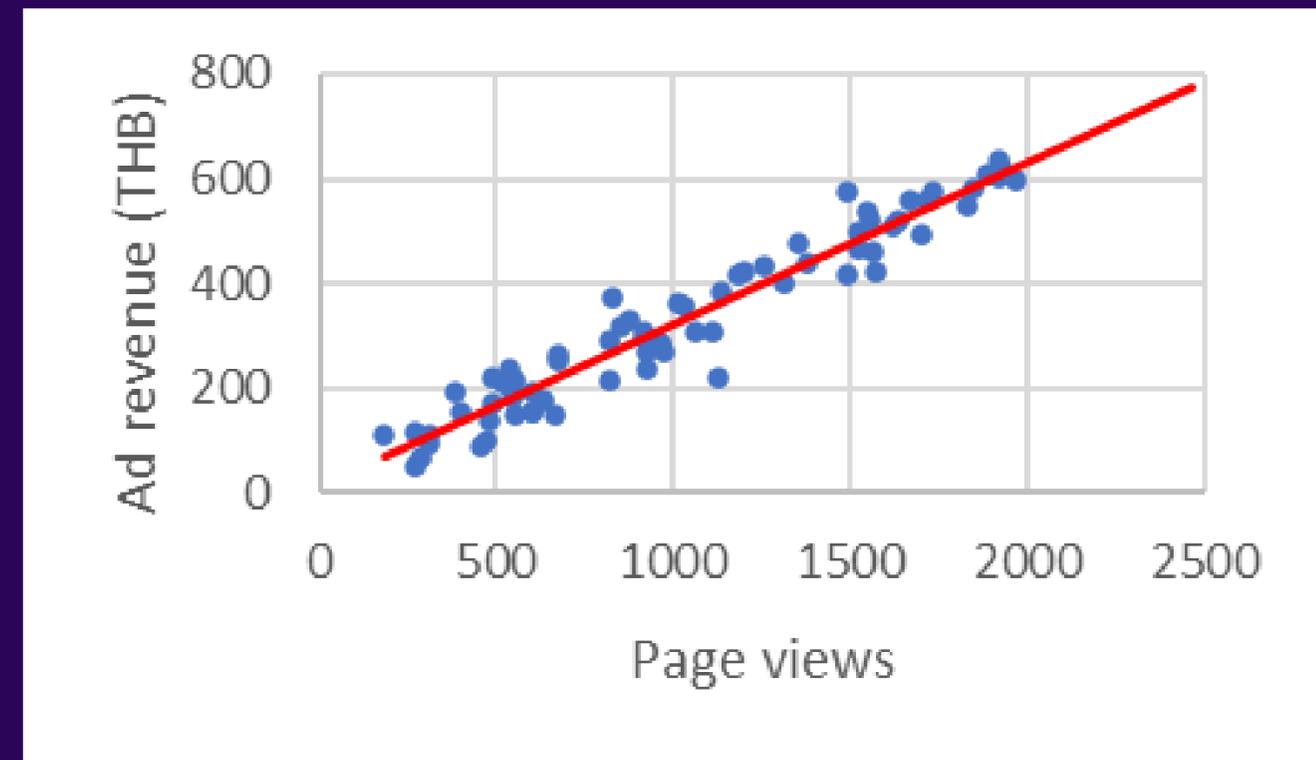
- Mobile OS
- Voltage and frequency
- Socket type
- Existing devices

Big data

Basic principle: The bigger data, the more accurate the prediction.



The prediction line (red) is made from **10** inputs.



The prediction line (red) is made from **100** inputs.

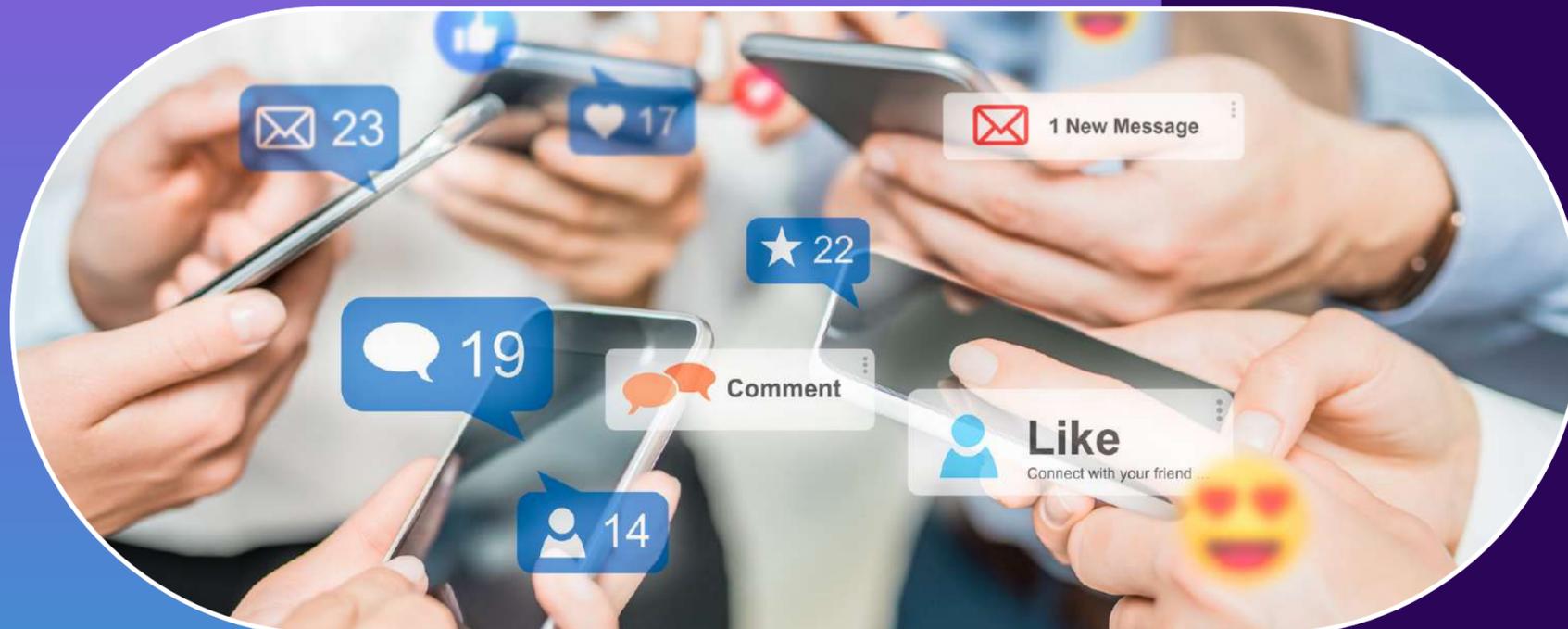
Which one makes more accurate predictions?

| | | |
|-------------|-------------|-------------|
| $\pm 0,005$ | $\pm 0,005$ | $\pm 0,005$ |
| $\pm 0,013$ | $\pm 0,013$ | $\pm 0,013$ |
| $\pm 0,025$ | $\pm 0,025$ | $\pm 0,025$ |
| $\pm 0,08$ | $\pm 0,08$ | $\pm 0,08$ |

PROBLEM 1

DATA TYPE

There won't be an issue if data is highly structured (e.g., in a tabular format) as shown on the left.



In reality, data appears in various formats (e.g., formatted text, image, video clips, ...). Data processing becomes a challenge.



PROBLEM 2

DATA PROCESSING

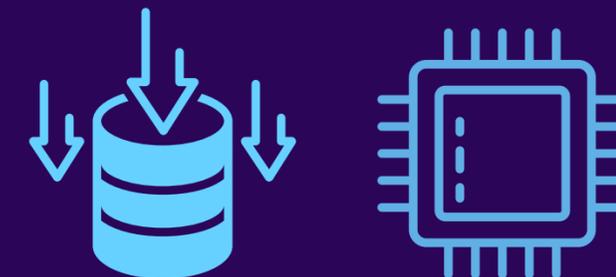
Humans create approx. 2.5 quintillion (10^{18}) bytes of data each day in 2018.

These massive data are mostly complicated and unstructured.

They take a huge storage space.

They require intensive computing power.

Not all of the data are useful.



Big data requires specialized software, infrastructure, and algorithm.



Cloud computing is key to dealing with big data as it allows individuals to utilize remote resources.

THE 5 V'S OF BIG DATA

Volume - the amount of data available

Velocity - the speed data is created and moved

Variety - diversity of data types

Veracity - quality and accuracy of the initial dataset

Value - usefulness of the data

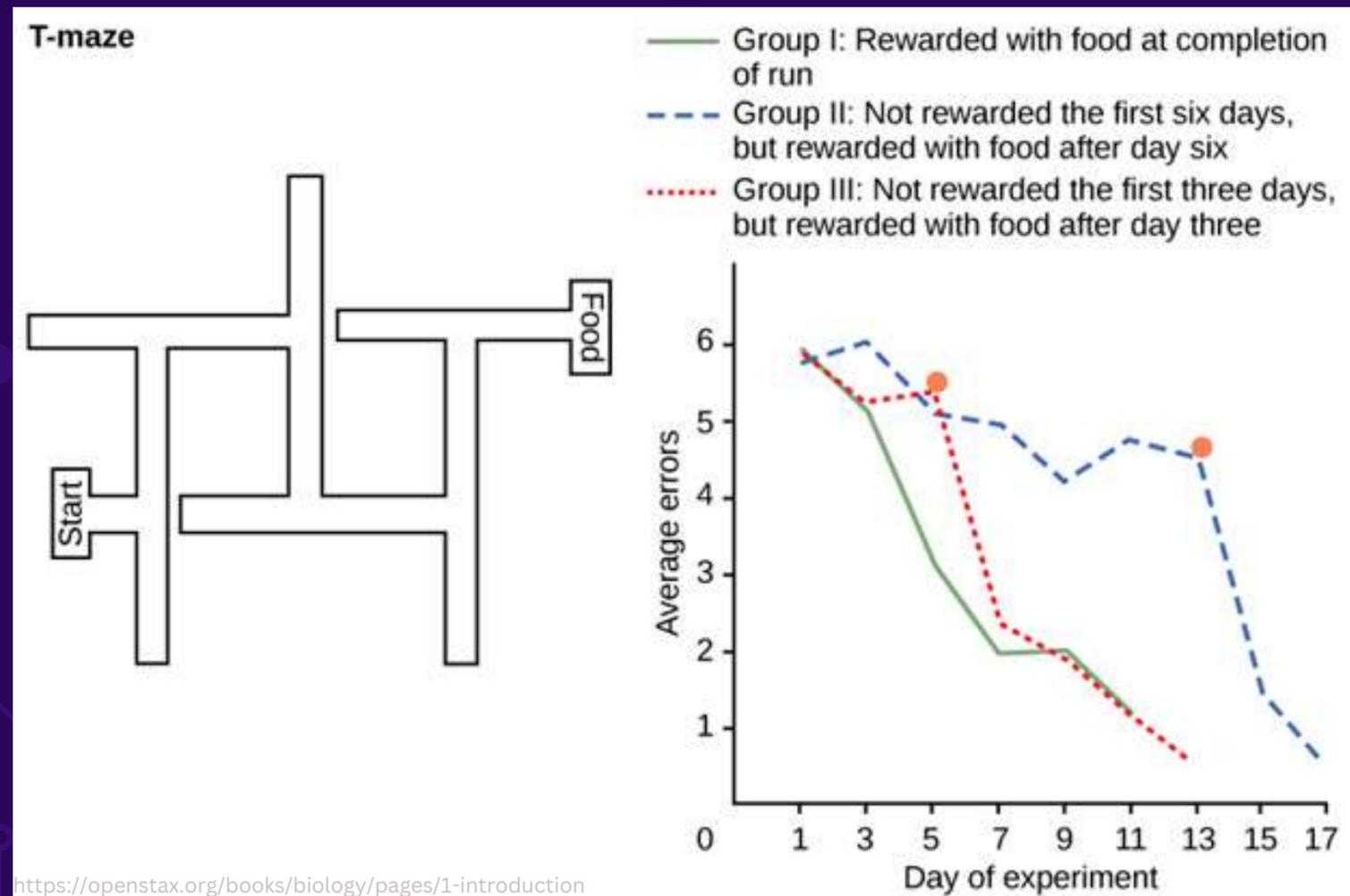
5V helps businesses determine whether they can make the most of their data and which systems they should adopt.



Artificial Intelligence (AI)



AI allow machines to make decisions like humans and increase accuracy as it receives additional input data.



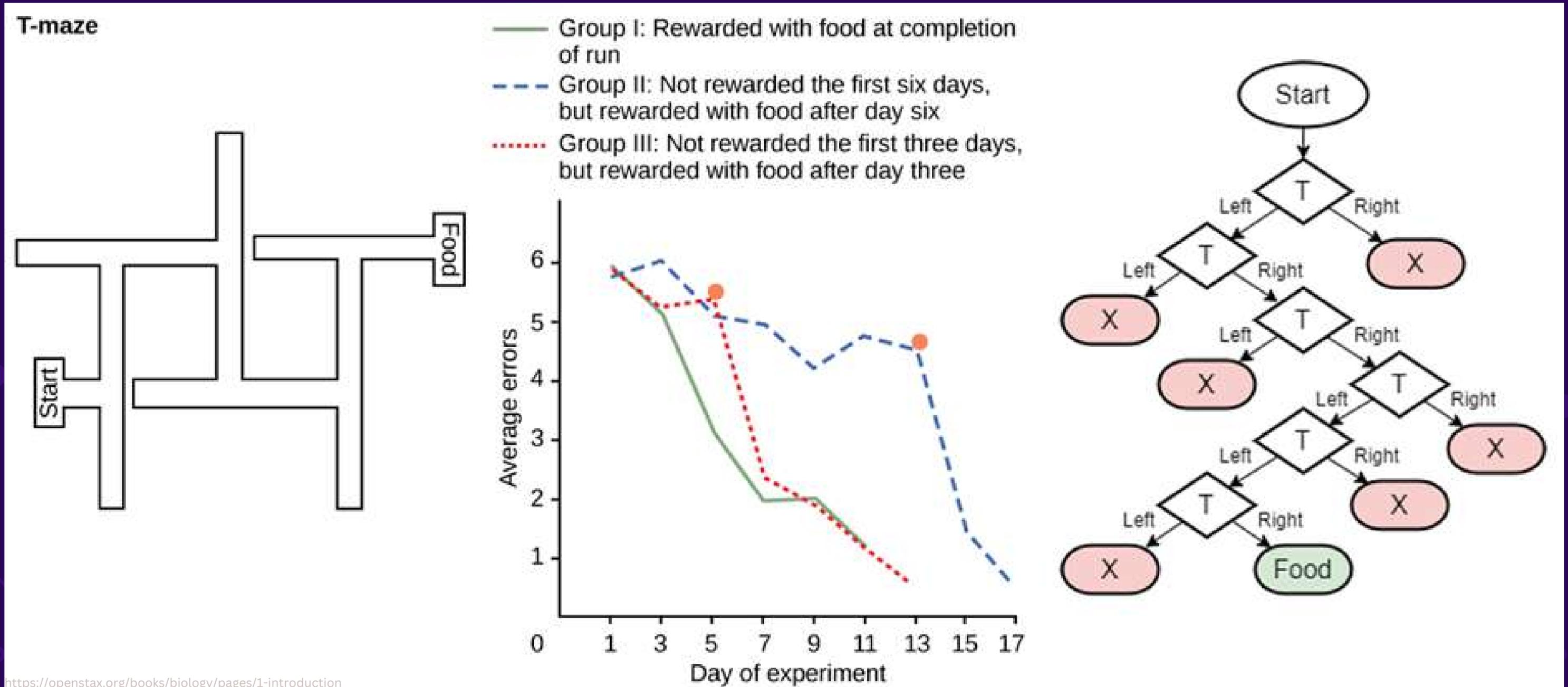
Rat maze experiment

When facing a junction, a rat can choose to turn left or right.

There can be a max. of 6 wrong turns.

After making several mistakes, rats start to build a logic that helps improving the decision-making.

Such logic is like a flowchart on the right. When they have logic (also known as programs or algorithms), they can make instant decisions with high accuracy.



Similar concepts are used in autonomous vehicles. They simulate traffic with routes, collisions, congestion, and real-time data from GPS, speed, and proximity sensors. The algorithm can calculate the optimal vehicle's direction and speed.



Position



Route



Speed



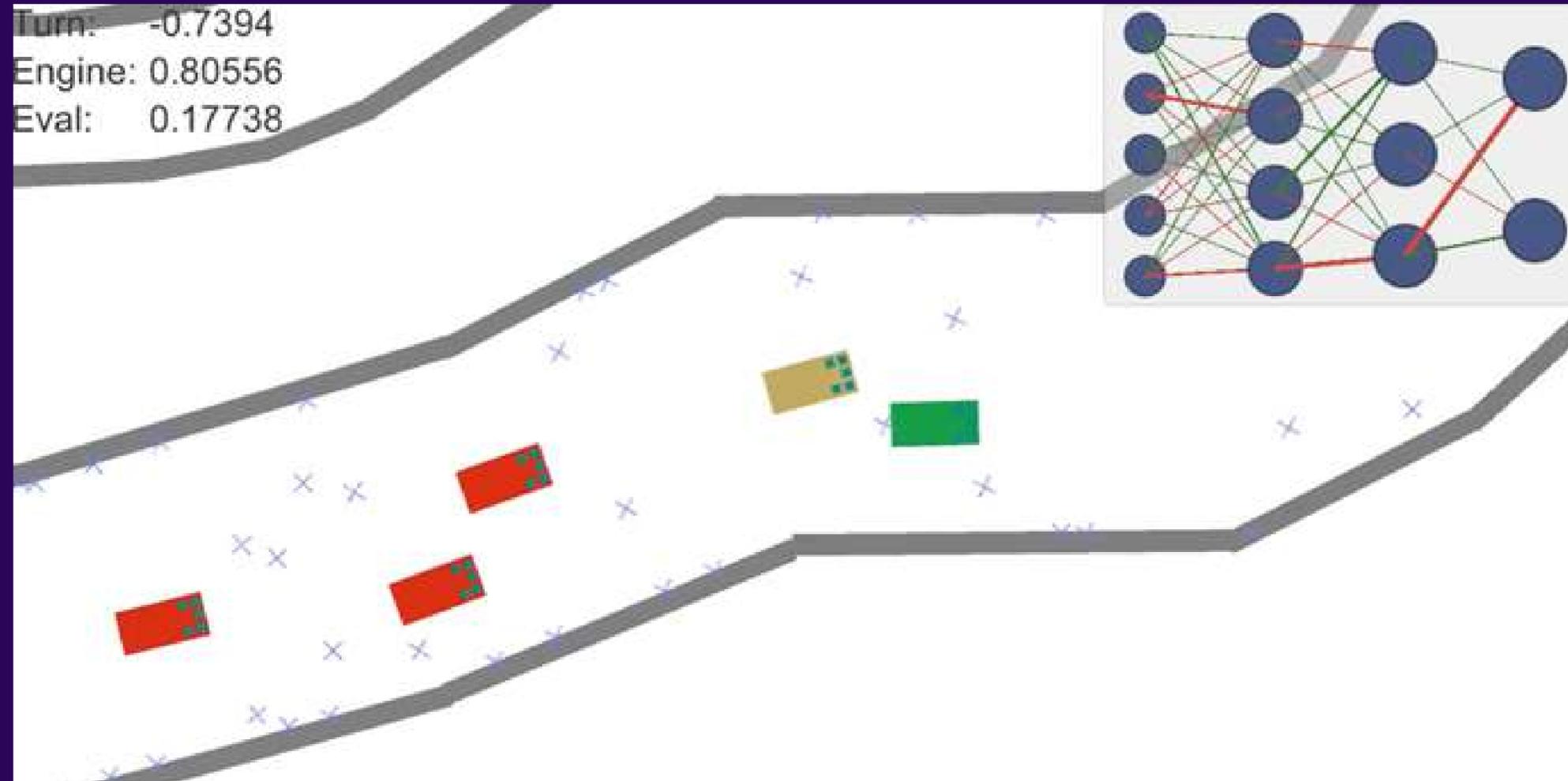
Proxiimity



Congestion

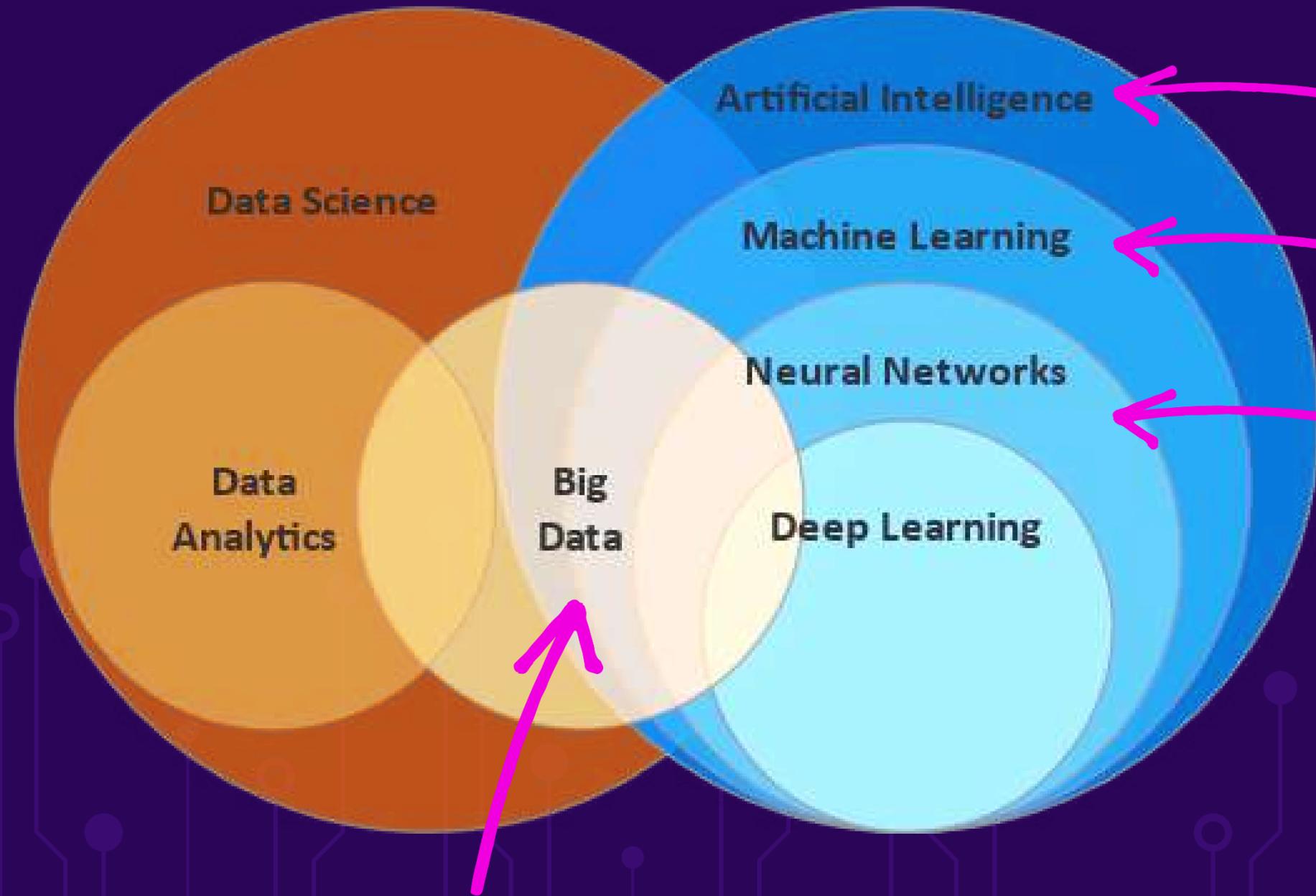


Collision



[Watch this video on YouTube](#)

AI shares some concepts and resources with data science and big data.



Gives the machine the ability to make decisions based on inputs and conditions.

Allows the machine to learn from mistakes and improve accuracy over time.

Allows the machine to create conditions or relationships based on learning.

AI handles big data very well.

MACHINE LEARNING



E.g., distinguishing cats and dogs

Supervised learning

Have a "training dataset" filled with labelled data.

Upon receiving new unknown input, the algorithm will try to match its attributes with existing known data.

Once the data become known, it will be added to the training dataset.



E.g., finding the purchasing pattern

Unsupervised learning

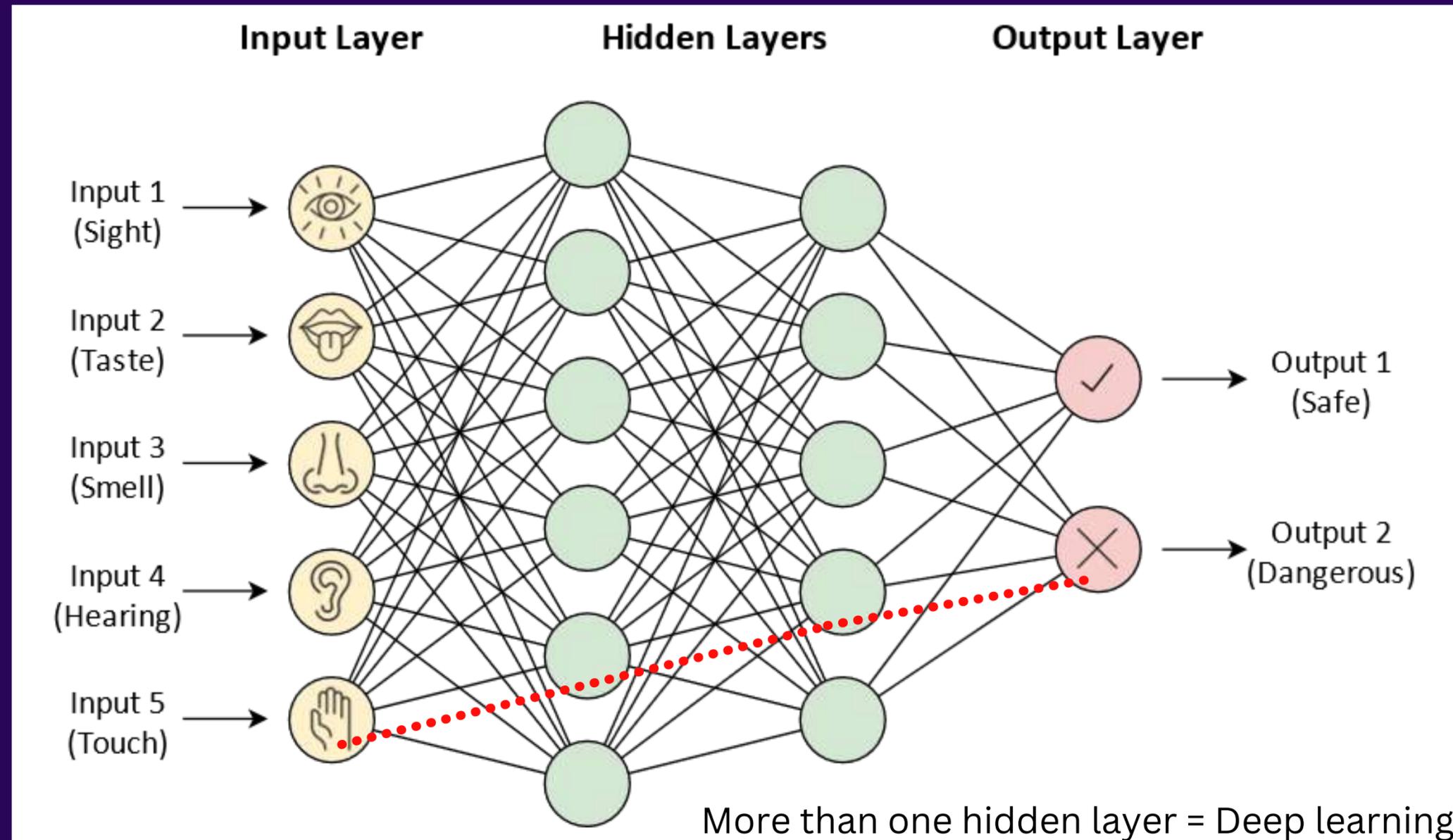
Have a number of unlabelled input data.

The algorithm creates groups based on common attributes found.

NEURAL NETWORKS AND DEEP LEARNING



Simulate the operation of the human neural network.



When you touch a hot surface, your brain marks it as "danger" and sends a command to your muscle to retract your hand.

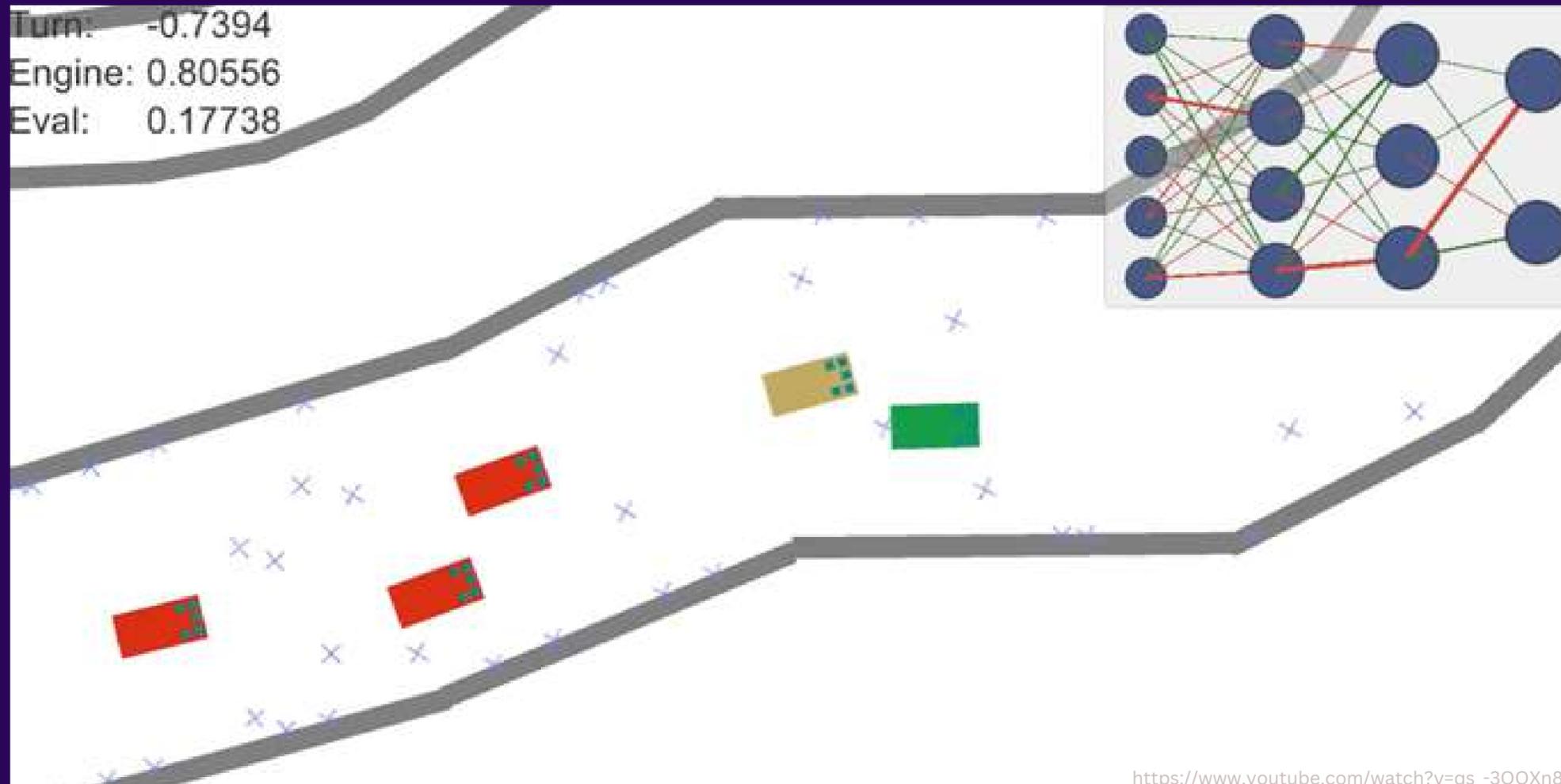
At the same time, your eyes, nose, and ears will retrieve information regarding its look, smell, and sound.

The next time you see, smell, or hear that object, you will notice that it is dangerous without any need to touch it.

NEURAL NETWORKS AND DEEP LEARNING



Simulate the operation of the human neural network.



From the autonomous vehicle example discussed earlier, when the car crashes, it keeps record of every condition.

From that point, you don't need to crash your car every time to know that it is danger.

When it receives some input signals related to a car crash, it tells your vehicle to slow down.



EXTENDED REALITY (XR)



Virtual Reality (VR)

Users interact with a virtual environment simulated from real places or created purely by the creator's imagination.



Augmented Reality (AR)

Users simultaneously see the real environment through the device's camera with overlaid graphics or other digital elements.



Mixed Reality (MR)

Allow real and virtual objects to interact in real-time, similar to that we are viewing AR content while wearing VR headsets.

VIRTUAL REALITY (VR)



E.g., Minecraft

3D VR

Create a virtual environment using graphic design software, similar to 3D game development.

Players can look around in 360 degrees and move freely in three dimensions.



E.g., Google Street View

360° VR

Capture an environment using a 360° camera.

Viewers can pan a camera view around, but movement and navigation are limited.



HEADSETS AND CONTROLLERS

Typical VR content is compatible with general computers and mobiles and can be played using mouse, keyboard, and touchscreen. Using special devices will enhance the user experience.



SMARTPHONE VR HEADSETS

Affordable,
Need smartphone
attachment



TETHERED VR HEADSETS

Connect to a PC
or console,
better graphics



STANDALONE VR HEADSETS

Need no
attachment,
limited features

HEADSETS AND CONTROLLERS

Typical VR content is compatible with general computers and mobiles and can be played using mouse, keyboard, and touchscreen. Using special devices will enhance the user experience.



AUGMENTED REALITY (AR)

Users simultaneously see the real environment through the device's camera with overlaid graphics or other digital elements (video, audio, hyperlink, action button, etc.).

Pokémon GO, one of the most downloaded mobile apps, is a good example.



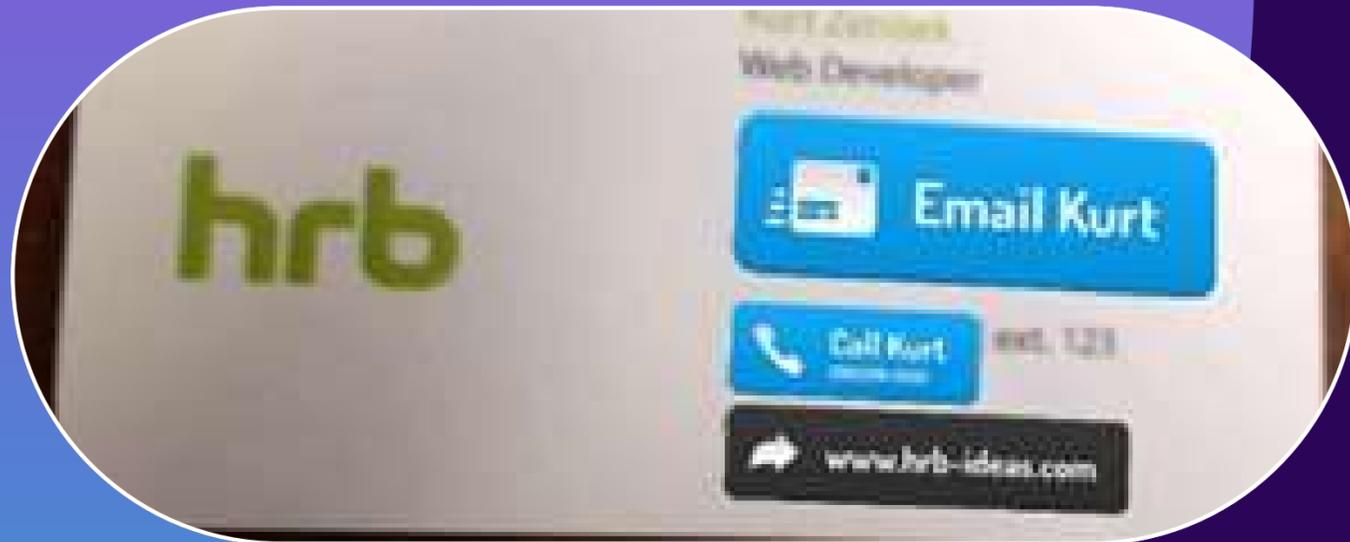
Instagram and snapchat filters are other good examples of AR.

OTHER USES



Interactive book

Interactive objects (e.g., sound, animation, or video) will pop up when the page is being scanned using a specific mobile app.



Interactive business card

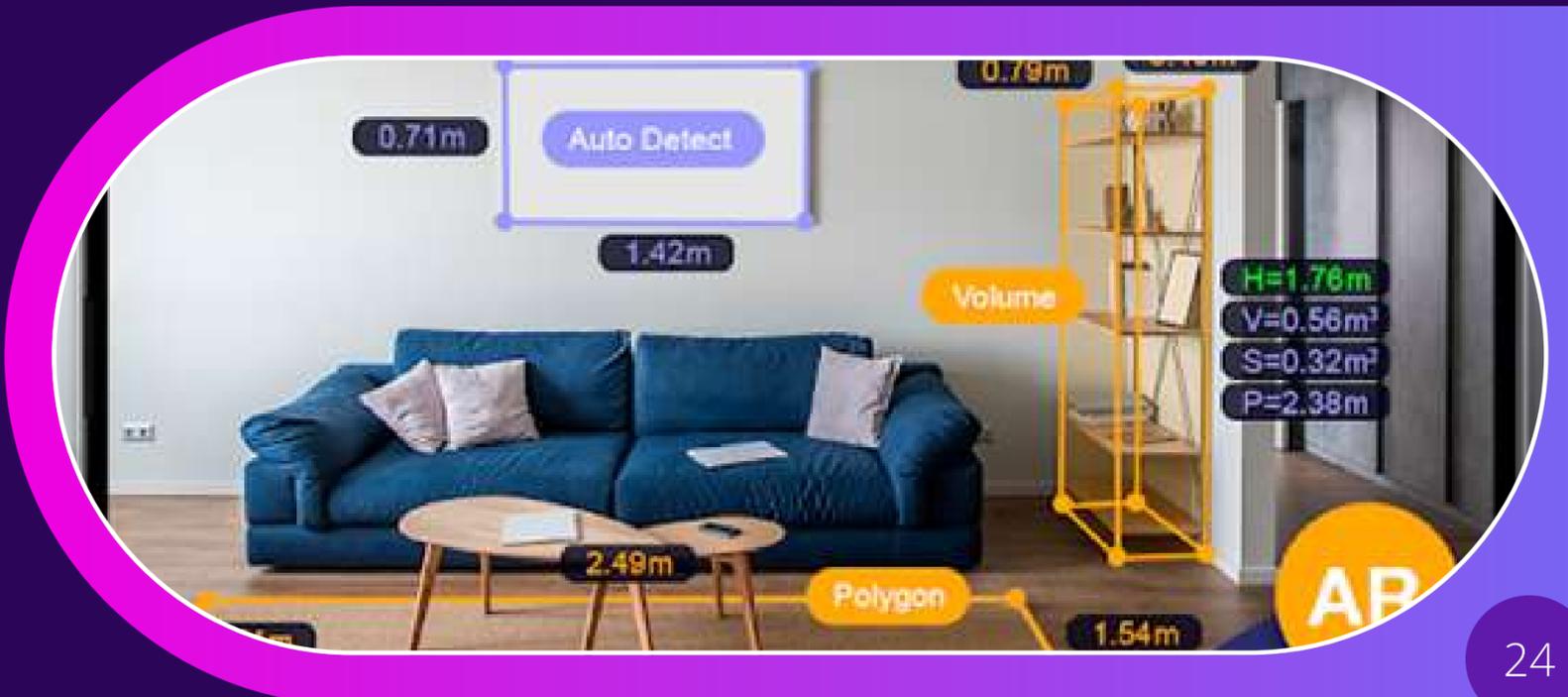
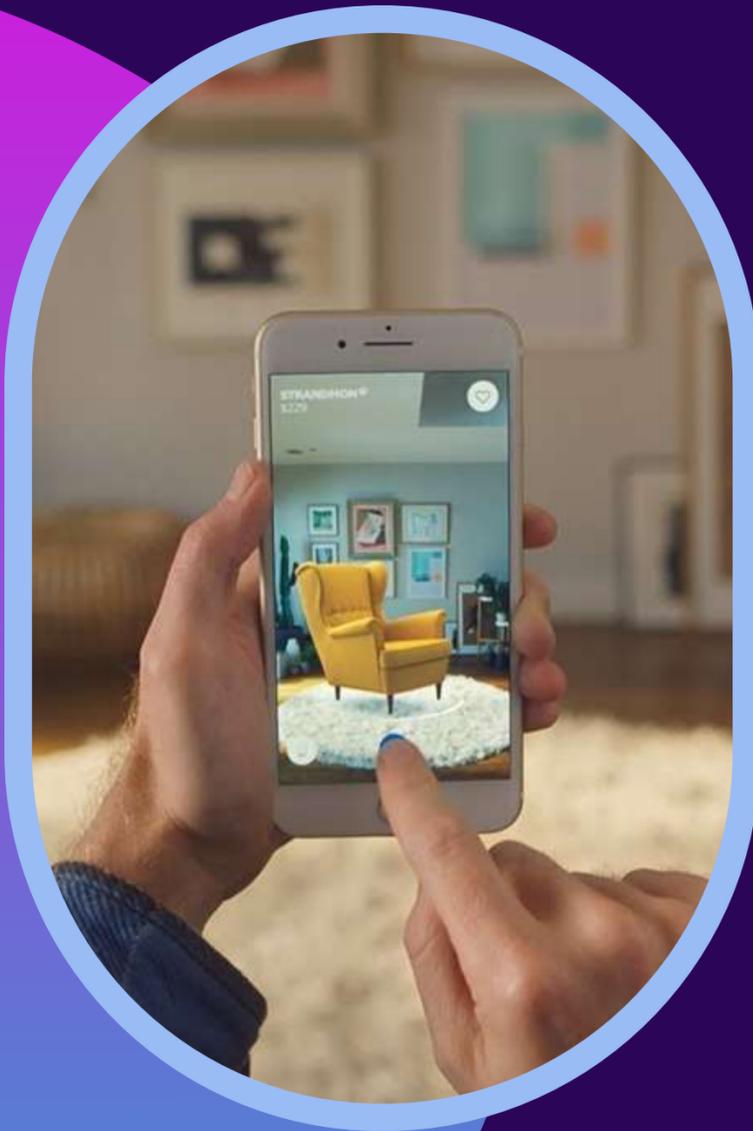
When scanned, can be instantly tapped to email, call, or open a website without having to type in an address or number.

OTHER USES

Furniture & interior design industries

IKEA Place app allows IKEA customers to pick an item and see if it fits the space before purchasing.

AR Ruler app can measure room dimensions and object sizes using a smartphone camera.



MIXED REALITY (MR)



MR creates a smooth transition between VR and AR, allowing real and virtual objects to interact in real-time.

The concept is similar to that we are viewing AR content while wearing VR headsets.



Extending VR to MR, manufacturers simply install additional cameras or sensors into typical VR headsets.



Example 1



Virtual plant pot (3D model)

Real computer devices viewed through a camera mounted on the VR headsets

Player interacts with a 3D objects using hands. The MR detects positions and movement of fingers.



[Watch this video on YouTube](#)



INTELLIGENT TECHNOLOGY APPLICATIONS

Smart home

Smart home gadgets are available globally, from Wi-Fi-enabled light switches and outlets to thermostats and sensors like smoke and flood detectors.

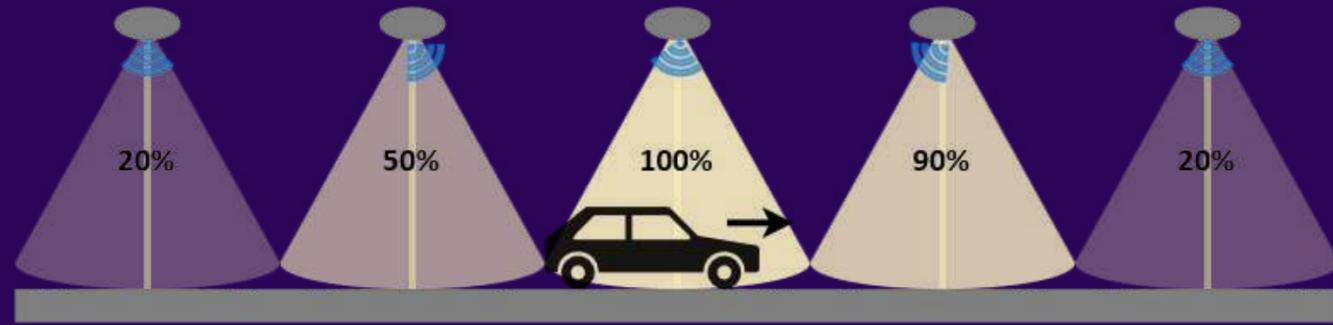
Users simply connect the purchased devices to their smartphones or home hub devices to remotely control and monitor equipment.

- Turn the equipment on and off
- Lock and unlock doors
- Set the temperature (thermostat)
- Set timer or automation
- Monitor the status (e.g., power consumption)
- Activate or deactivate the alarm
- View real-time video (IP camera)
- ...



Smart city

Smart city provide the following features:



Standby Light - Dims to save power but turns back on when motion is detected.



Smart CCTV

- Control traffic
- Detect and report violation
- Detect and report accident



Ride share

- Bicycle rental
- Scooter rental
- ...

Others

- Parking reservation
- EV charging station reservation
- Toll adjustment based on real-time traffic and pollution data



Smart industry

Smart manufacturing seamlessly connects orders, design workshops, inventory, production lines, warehouses, and customer support.

- Customers can track their orders.
- Operators can control machines remotely.
- Inventory is updated in real-time.
- Operators can calculate realistic costs.



Smart manufacturing



Smart retail (Amazon Go)

Amazon Go is a semi-automated convenience store.

- Registered customers scan the QR code to enter.
- Cameras detect which items customers pick up and add them to the virtual shopping cart.
- When customers exit the store, the purchased items will be charged to the credit card.

Smart industry

Smart farming uses smart technologies, particularly the IoT, to overcome challenges in food production.

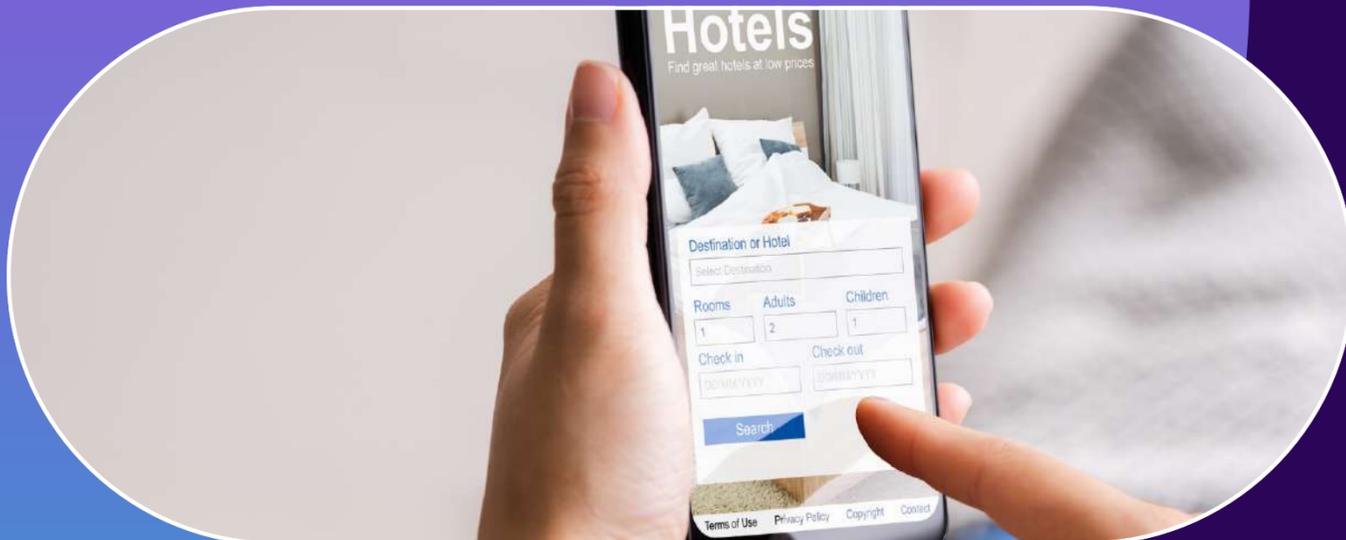
- Geocode the crop fields to control equipment.
- Use sensors to provide feedback data, such as air temperature, soil pH, humidity, and water.
- Automatically operates sunshades and irrigation systems based on feedback data.
- Tag farm animals for easy tracking.

Smart hospitality is found in many self-service hotels.

- Guests make reservations using mobile app.
- Use a self-check-in kiosk upon arrival.
- Use a mobile app to control door locks and in-room equipment.
- Room service delivered by robots.



Smart farming



Smart hospitality

CONCLUSION

iOT - Allows us to control devices remotely.

Big Data - The bigger data, the more accurate the prediction.

AI - Enables machines to make decision and improve accuracy upon receiving new data.

VR - Players view an immersive environment, completely isolate from the real world.

AR - Players view a real environment through a smartphone camera with overlay digital media.

MR - Players view a real environment through a camera mounted on VR headsets and interact with overlay digital media.

Intelligent technology can be applied anywhere in the home, in the city, and in industries such as manufacturing, retail, agriculture and hospitality.

The concept is to provide real-time data for the algorithm to process and automate tasks.

