

# ARTIFICIAL INTELLIGENCE EVERYWHERE

Past, Present & Future

AI systems/machines which display intelligent behaviour

Reason & act autonomously

Learn by example

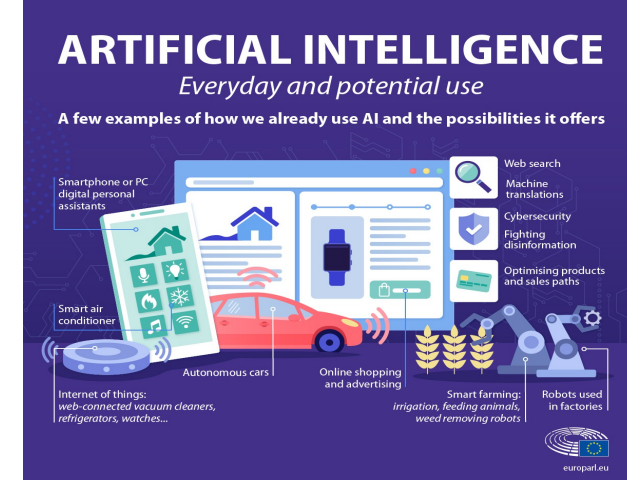
Improve with experience

Work well in complex situations (healthcare, fraud...)

Global investment in AI ~\$100 billion per year

Generative AI creates new content (Chat GPT...)

None Generative AI improves efficiency (energy, transport...)



# AI TECHNOLOGY

AI is an umbrella term including Machine Learning & Deep Learning

Machine learning

Algorithms

Adapt & improve over time

Deep learning

Simulated neural networks

Improves by creating new virtual connections

AI systems are trained using DATA

Internet and other information sources

Protected by data selection & filtering

Training methods

Supervised learning for specific tasks

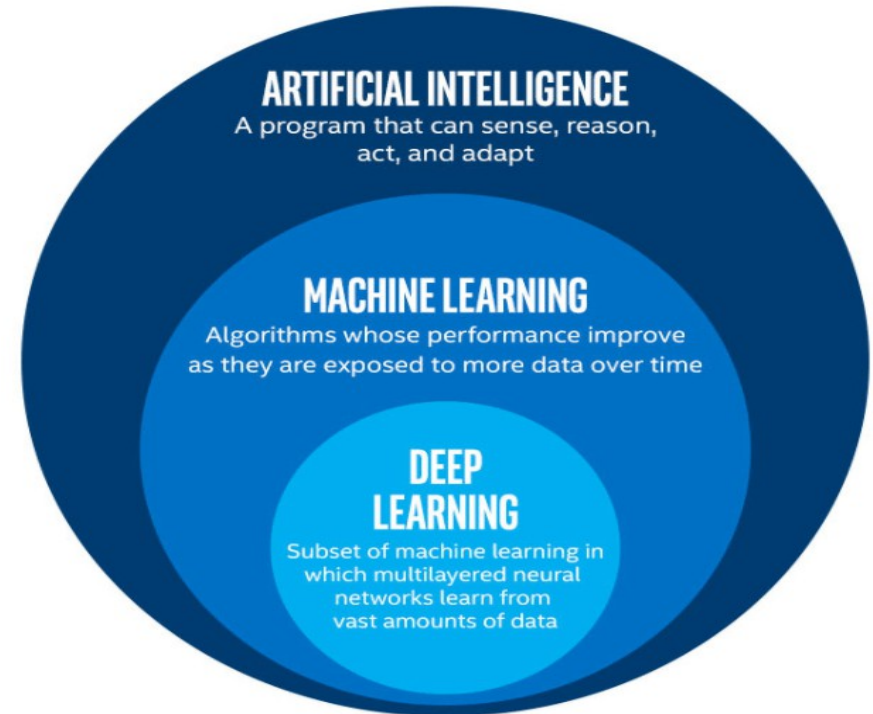
Unsupervised learning

AI technology is getting faster

In 10 years expected speed/capability >10 times

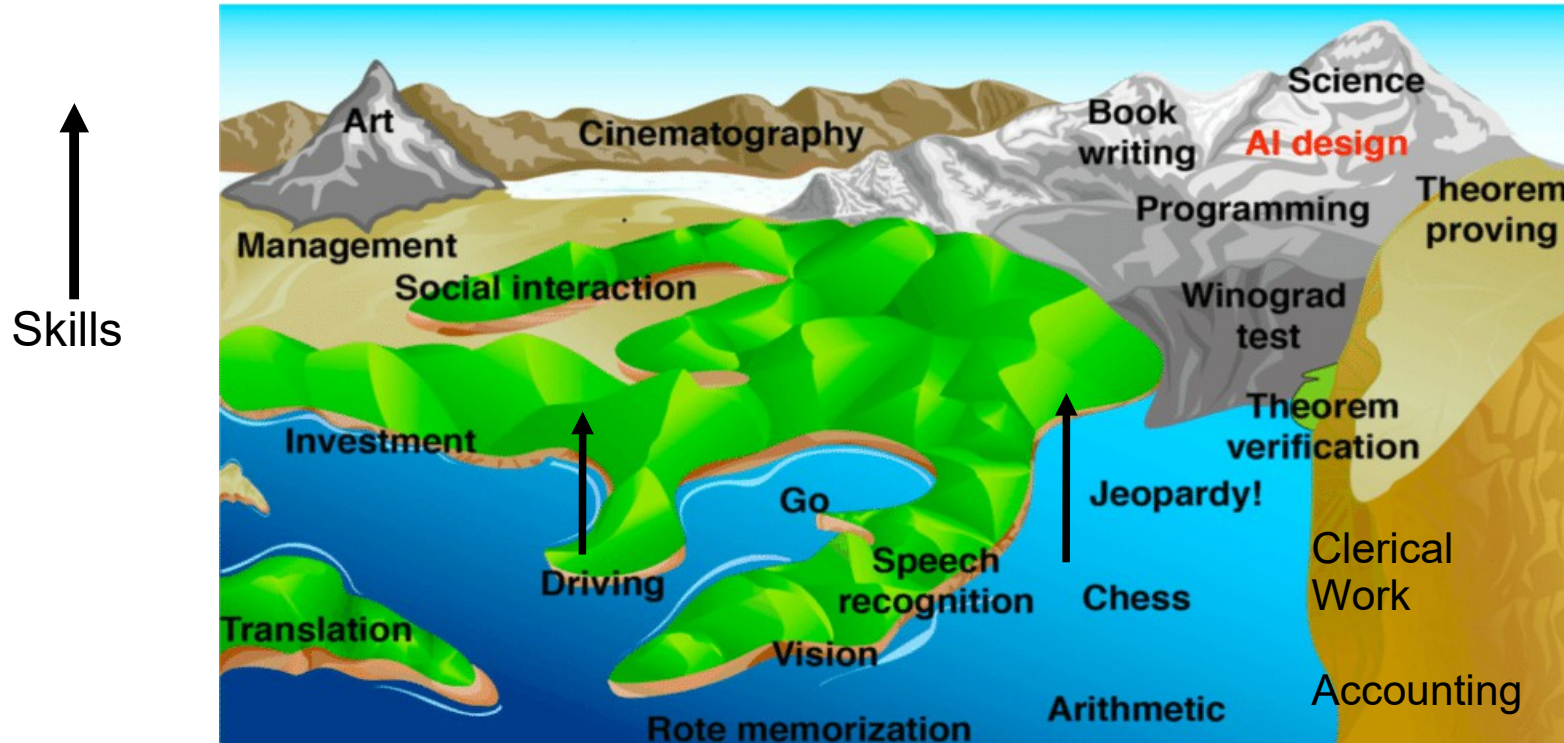
Power consumption of AI increasing

2% to >15% of national supply within 10 years



# SKILL LANDSCAPE

Land = Human Skills, Sea = AI Skills



The AI Sea Is Rising

Routine jobs absorbed by AI machines

# AI & HUMAN INTELLIGENCE ARE NOT THE SAME

|                      | HUMAN            | AI                   |
|----------------------|------------------|----------------------|
| Skills               | Wide             | Specific             |
| Training method      | Learn & question | Show examples        |
| Understanding        | Yes              | No                   |
| Manage unexpected    | Yes              | Within its skill set |
| Operational cost     | High             | Low                  |
| Speed                | Slow             | Fast                 |
| Evolution            | Slow             | Fast                 |
| Conscious/Self Aware | Yes              | No                   |

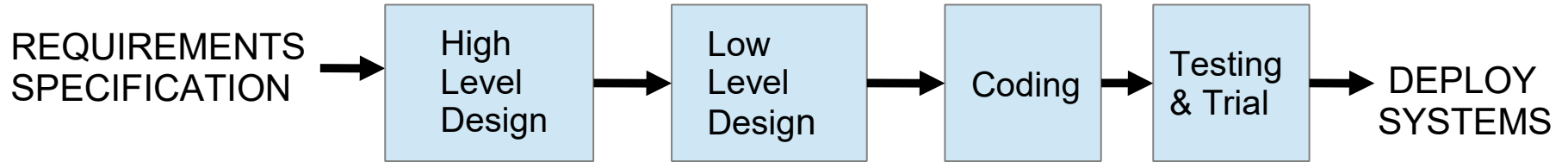
We do not know exactly how AI works

AI does not behave like humans

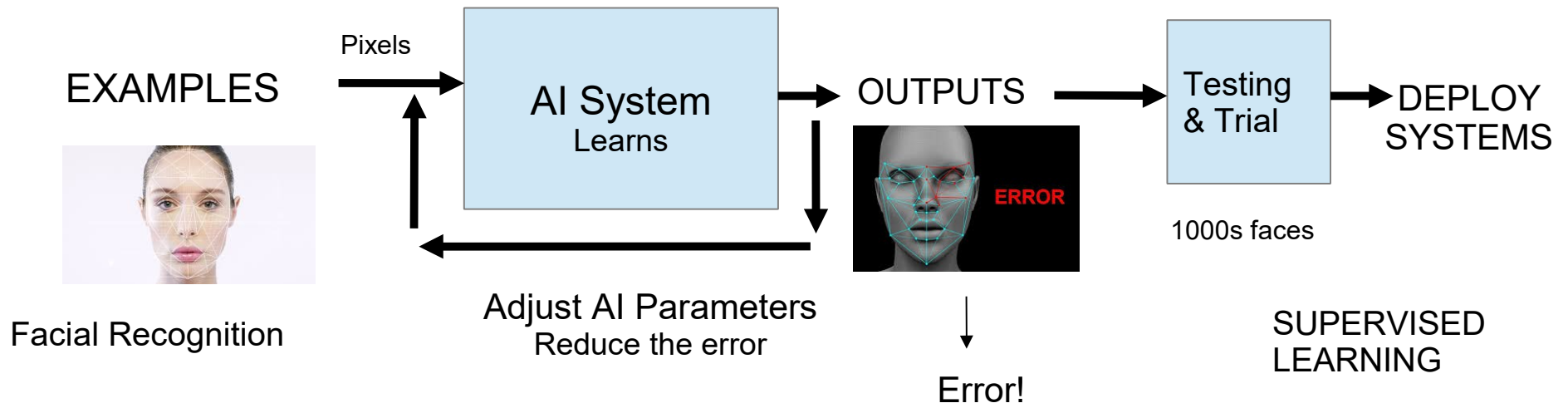
Add constraints to restrain AI to the real world

# AI TRAINING

Traditional Rule Based Programming  
Meet a requirements specification

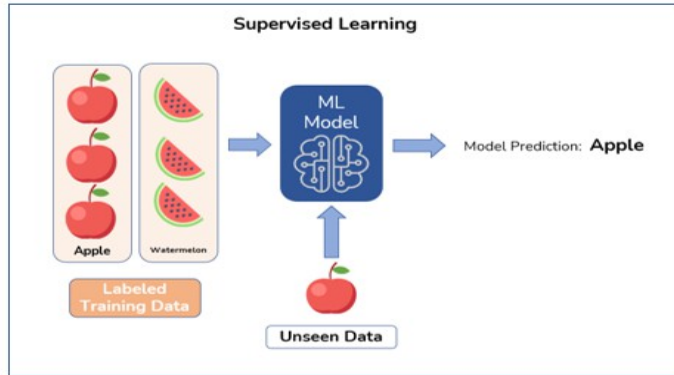


AI Training  
Learns by example



# AI LEARNING METHODS

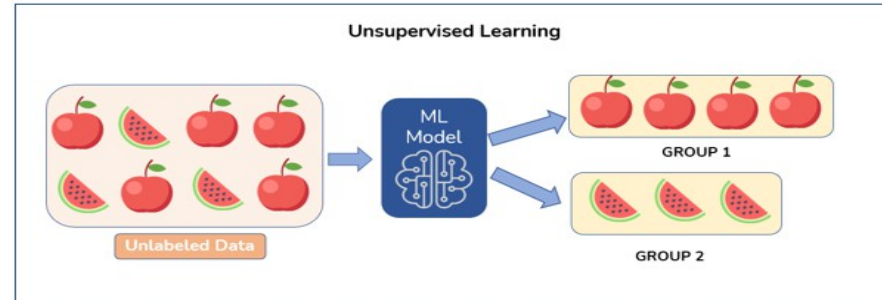
## SUPERVISED LEARNING



### Supervised Learning

Trained to recognize data patterns  
Accurate  
Expensive  
Medical Diagnosis  
Image/Speech Recognition

## UNSUPERVISED LEARNING



### Unsupervised Learning

AI discovers patterns within the data  
Less Accurate  
Cheaper  
Large Language Models (Chat GPT)  
Market Research

Quality of AI depends on the quality of the input data

# AI USE ACROSS MARKET SECTORS

What, where & how AI is being used

Large Language Models

Chatbots

Digital Friends

Content Creation

Entertainment

Fake News

Sales & Marketing

Medicine

Social Care

Transport

Education

Banking

Science

Climate Change

Power Distribution

Military

War

# LARGE LANGUAGE MODELS

## Generative AI

Provide direct human interaction with a machine  
Responds to any customer request  
May provide idea generation  
Interact using text, speech or vision  
More intuitive than web browsing

Write essays, poems, plan trips, translate text, write code, generate pictures...

Access data from filtered internet & global public sources

Uses statistical methods

Chat GPT was the first marketed general purpose language model 2023  
Google Gemini, LaMDA, CoPilot, Claude...

Subject specific language models are also being developed (medical, law...)  
Doctor virtual assistant  
Legal assistant



# AI CHATBOTS

Subject specific LLM

Digital assistant for online business services

Simulate conversation with humans through text or voice

AI chatbots have the ability to learn and adapt

## **Benefits:**

24/7 Availability

Self improve & learn with use

Frees up human staff for more complex questions

## **Risks:**

Privacy as chatbots collect user data during interactions



# DIGITAL FRIENDS

## Generative AI

Big demand for digital friends

Human-like virtual avatar

Choose the digital friend that suits you

Provide conversation & empathy

Dependency on the fictional world

Privacy

Man marries digital friend



# FAKE NEWS

## Generative AI

AI can create cloned human voices, images & videos in seconds

Waves of fake photos and videos flood social media after major news events



### To identify Fake News:

Be wary of sensational headlines

Does the story cite credible sources?

Check the facts

Is the story biased?

Does it seem likely?

# AI CONTENT CREATION

Generative AI



ASK A LARGE LANGUAGE MODEL TO:

Design a modern room layout

Improve an existing layout

Fast

Iterate for personal satisfaction

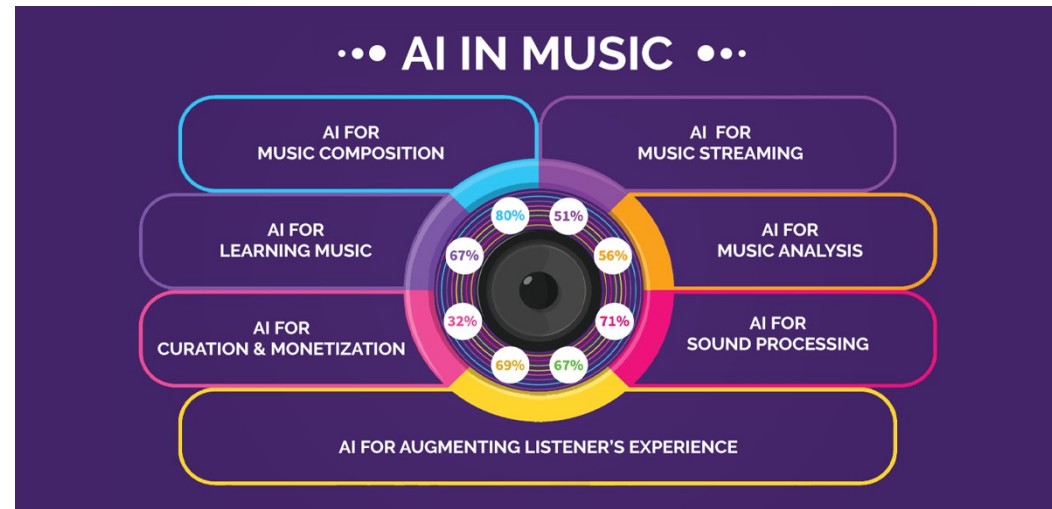
Compose a new piece of music:

Concerto, modern pop hits

Any combination of styles

Does the music have human creativity?

Emotional connection with listener?



# AI IN EDUCATION

AI trials in UK schools & colleges

Teacher + AI screen learning

AI adjusts content to pupil ability

Measure & report pupil progress



## VR Headsets

Students walk around the pyramid's in a virtual world generated by AI

Engineering students meet in a virtual room and work together to build a plane engine

'Hands on' experience prior to live work

# USE OF AI IN MEDICINE

## Health benefits

Enhanced Diagnosis

Health screening

Drug Discovery:

Personalized Treatment:

Neurological Health:

AI Implants



# FASTER MEDICAL DIAGNOSIS

In development

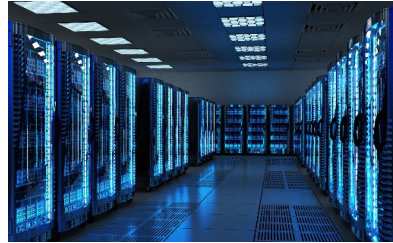
## Human Diagnosis

Using scans &  
sample analysis  
SLOW, EXPENSIVE,  
EXPERTS NEEDED



## AI Diagnosis

(1) Train the AI machine  
using diagnoses of  
10,000s patients



(2) AI machine becomes  
an expert



(3) Replicate expertise  
over 1000's machines



AI DIAGNOSIS IS  
CHEAP, FAST &  
ACCURATE

(5) Human Specialists focus on  
none routine cases



(4) AI local doctor fast diagnosis  
of routine cases to 99% accuracy

# AI STROKE TREATMENT

100,000 people have strokes each year in UK  
Early treatment reduces stroke damage clots/swelling

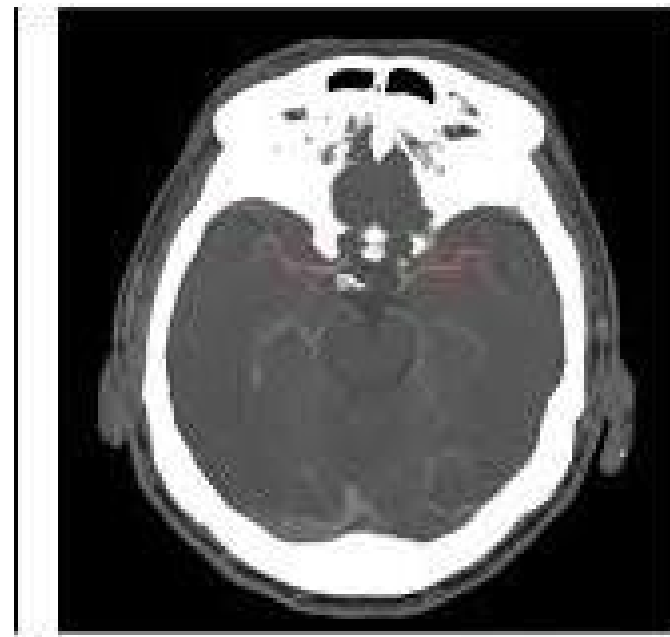
## Early Detection and Diagnosis of Strokes

Fast diagnosis of home test results using AI device

Movement, Blood pressure...

Fast diagnosis of hospital CT & MRI scans

Determine stroke severity & begin treatment



## Treatment

Time between stroke symptoms & treatment reduced by >60 minutes

x3 number of stroke patients recovering with no/slight disability

AI flag the likelihood of complications/recurrence

## Rehabilitation and Recovery

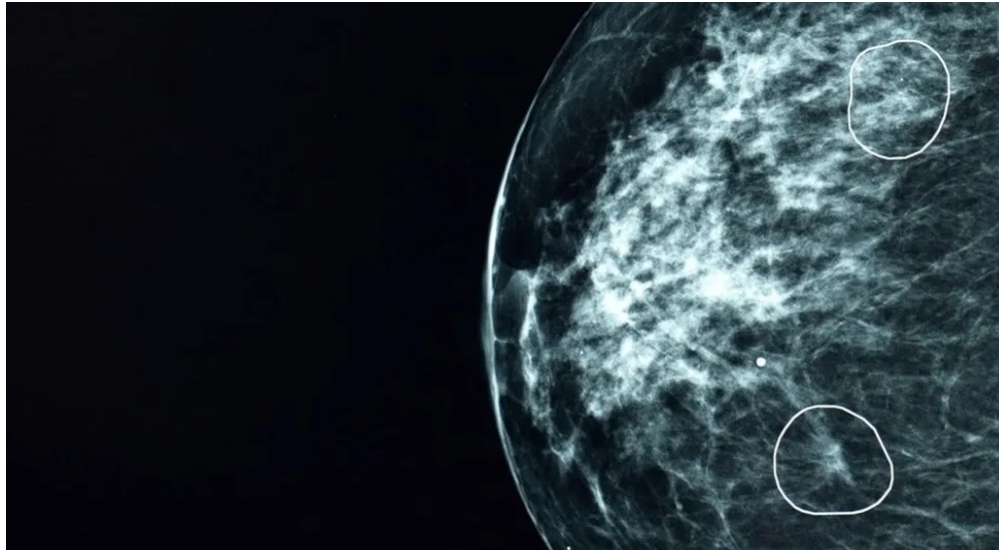
AI-powered VR platforms aid recovery

AI-controlled exoskeletons can assist in physical rehabilitation



# CANCER DIAGNOSIS

AI Tool was piloted by NHS clinicians to analyse the mammograms of over 10,000 women



AI identified all known cancer cases + 12 additional cases missed by medics

Early stages cancers can be hard to spot

# AI HEALTH SCREENING

## Trials

Healthcare costs reduced by early interventions

Collect people's remote home testing medical data

Data processed by AI which recognizes symptoms

Flag warnings to a GP who makes a health assessment

GP calls the patient to discuss symptoms

A healthcare system that creates health rather than  
a medicine dispenser for the sick people



# DRUG DEVELOPMENT & CUSTOMISATION

AI is accelerating the discovery of new drugs

AI analysis of vast clinical data records

Helps researchers to identify new drug candidates

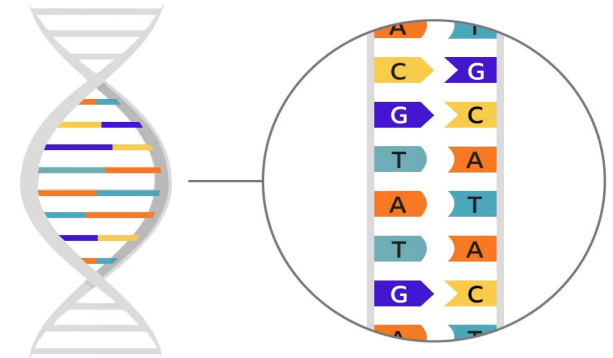
Customise drugs to individuals

Challenge for pharmaceutical companies

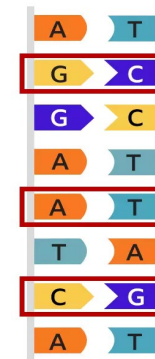
## How AI is helping scientists spot disease genes

All living organisms  
are built from  
**DNA**

**DNA** is made up of  
blocks of repeating  
chemicals, **A, C, G, T**



**AI** can spot if the  
letters are in the  
wrong order



This can lead to disease  
because the body's cells  
and tissues aren't  
made properly

# AI & NEUROLOGICAL HEALTH

## Trials

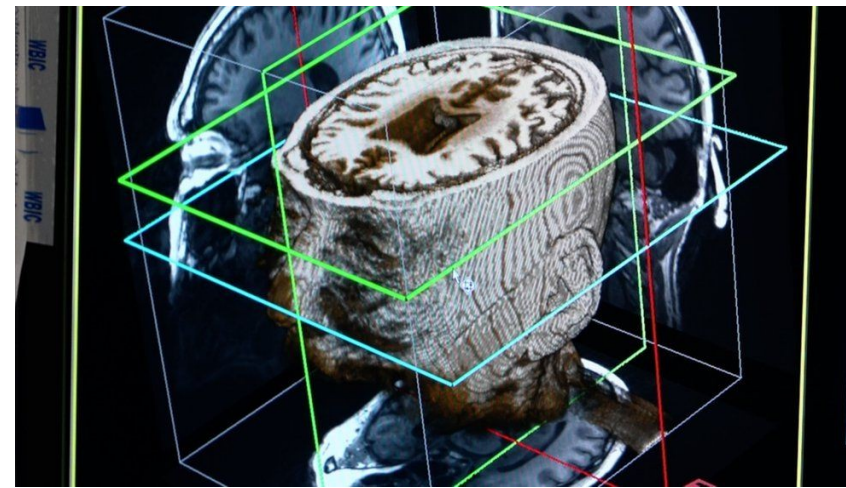
AI trained on brain scans of 1000s patients with common conditions

AI detects Parkinson's, MS, Dementia...

Up to 8 years before physical symptoms appear

AI can also diagnose dementia from measurements of memory, speech, movement

AI machines enable fast screening



# AI MIND READING

## Research

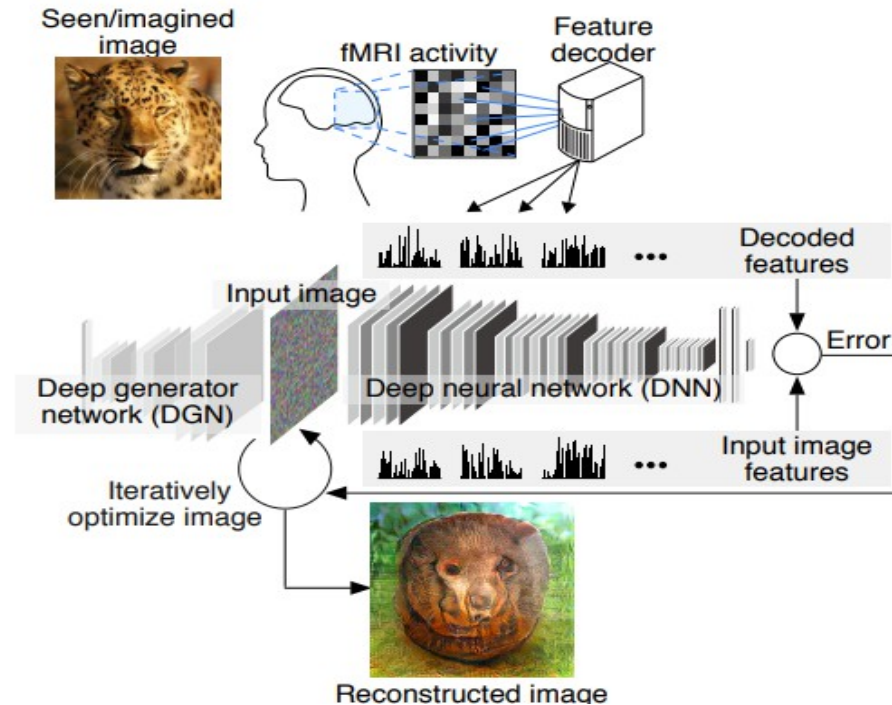
Communicate with people who have lost the ability to move or speak

Show the human subject many images/sounds

Functional MRI records brain signals specific to each image/sound

Train AI system to associate signals with images

AI system can then interpret what the subject is thinking



# AI BRAIN IMPLANTS

## Development

Brain implants enable direct communication between brain & external devices

Treatment for major spinal injury

Brain signals transmitted to limb implants over WiFi

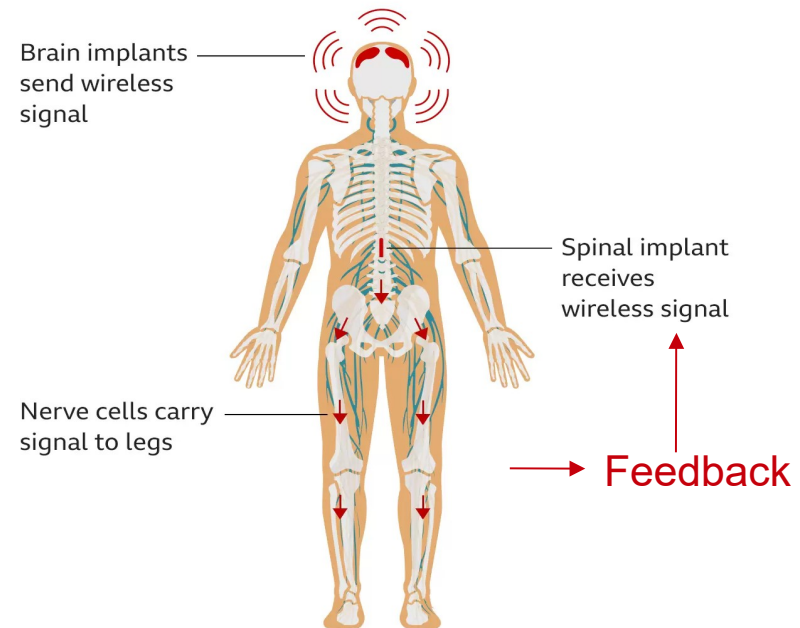
Legs respond to the patients thoughts

Feedback improves walking over time



*Neuralink patient*

## Implants boost brain signals to legs



# AI FOR THE VISUALLY IMPAIRED

## Development

AI application in phone provides a voice description of a visual image

Users point their phone's camera at an object or scene & the AI will describe it

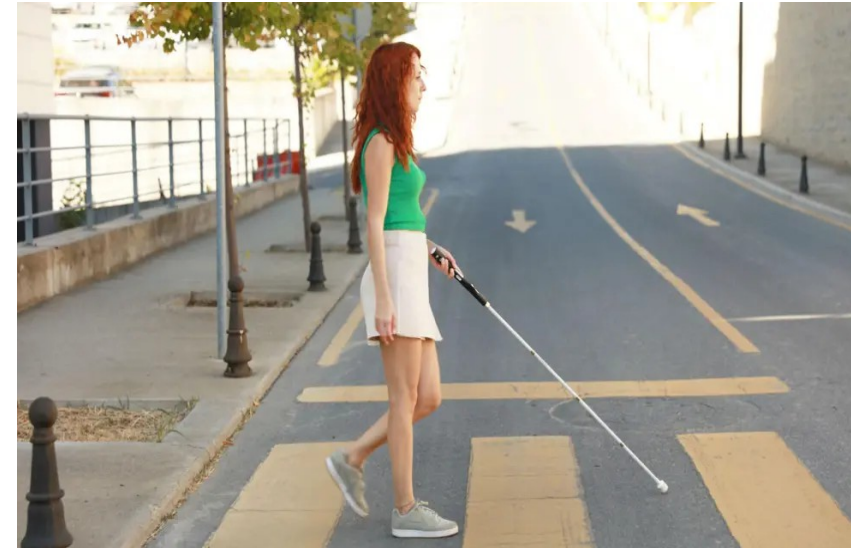
The AI can be trained to recognize people's faces



AI-powered cane trained to detect obstacles

Voice interface warns the user

AI navigates the user to their destination



# AI HEARING ENHANCEMENT

AI automatically adjusts the hearing aid settings to suit the patient

Reduces the background noise for each environment

Individuals hearing profile is stored in the device

AI optimises the received signal to the hearing profile

Allows for a more natural and personalized listening experience



# AI ROBOTS IN ELDER CARE

Development & trial

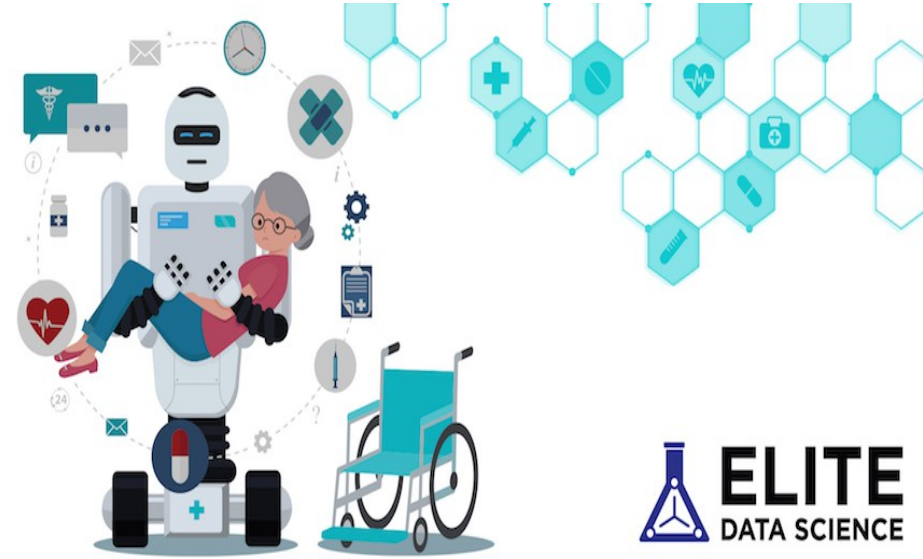
Help seniors with every day tasks

Keep them independent

Monitor health 24/7

Become a digital friend

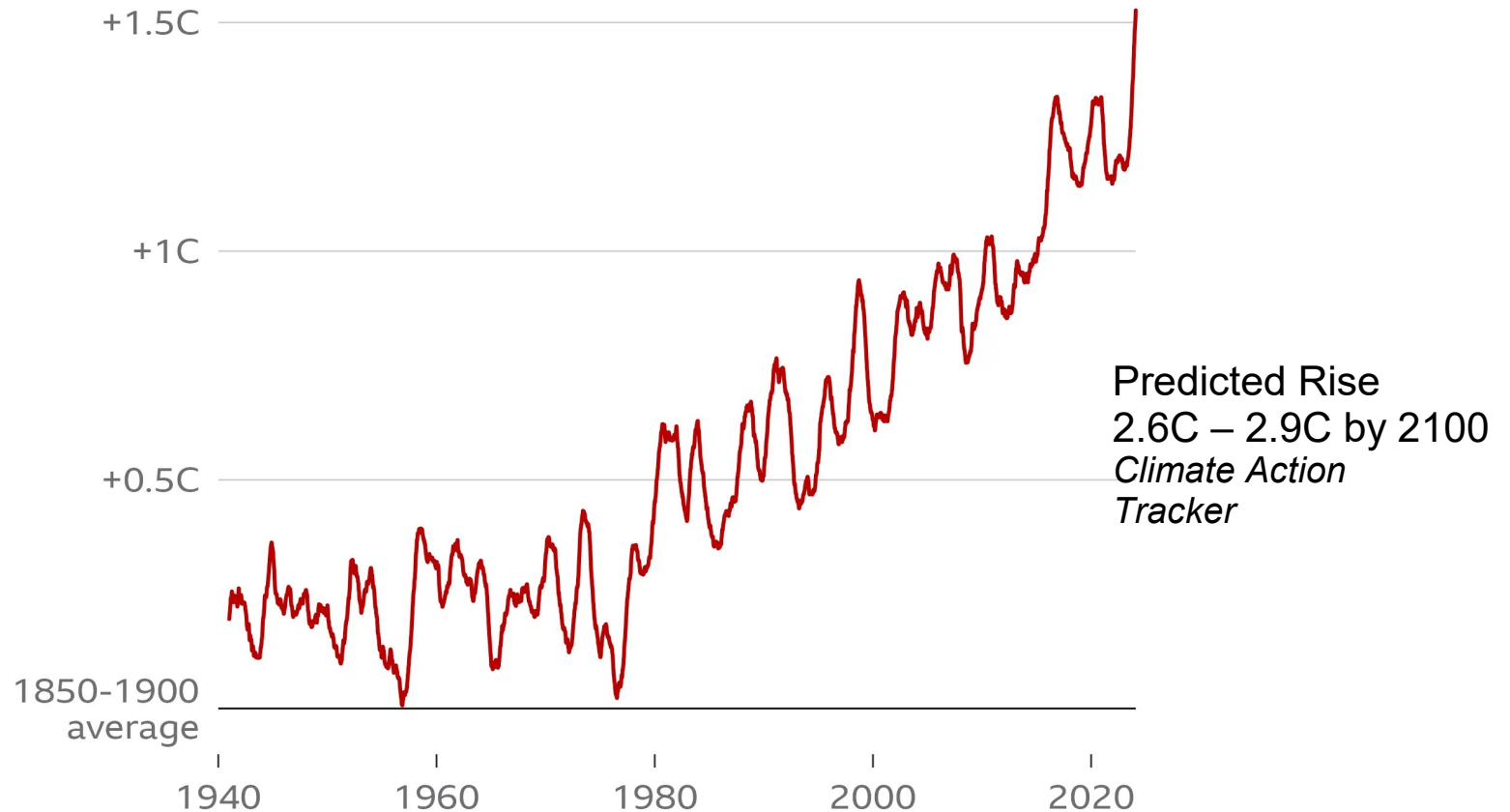
Robot adapts to the individual



# AI & CLIMATE CHANGE

## Temperature rises pass 1.5C for full year

Average global air temperature compared with pre-industrial levels, running average of 365 days

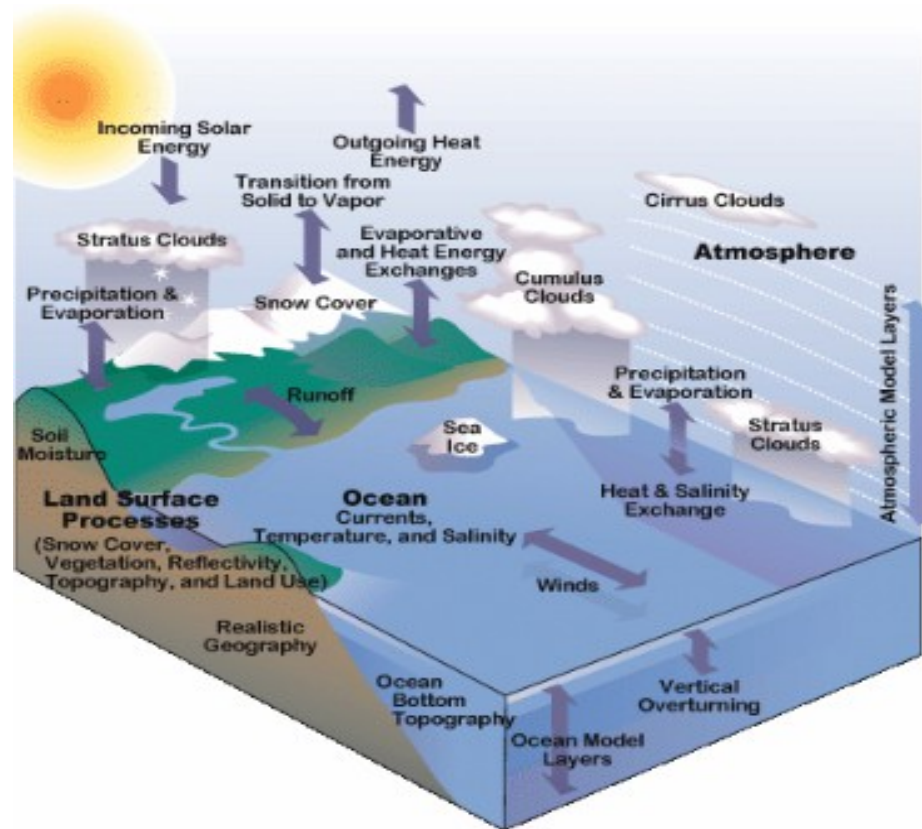


Source: ERA5, C3S/ECMWF

**B B C**

# CLIMATE MODELLING

Complex problem



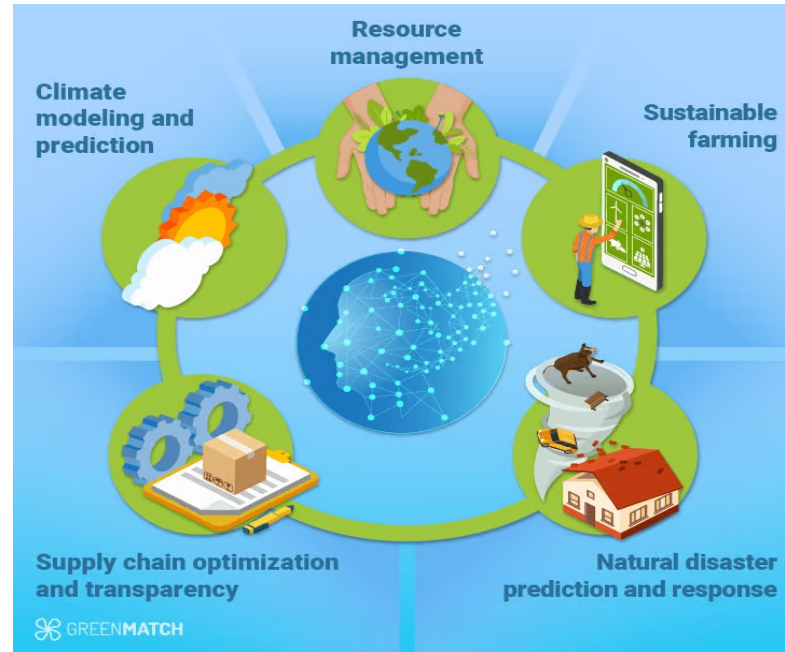
Solve mathematical equations which describe how energy and matter interact in different parts of the ocean, atmosphere & land

Predict weather & climate change for various scenarios

# AI IMPROVES WEATHER & CLIMATE PREDICTIONS

AI is trained on historical data to recognise weather & climate patterns

Analyse satellite & sensor data

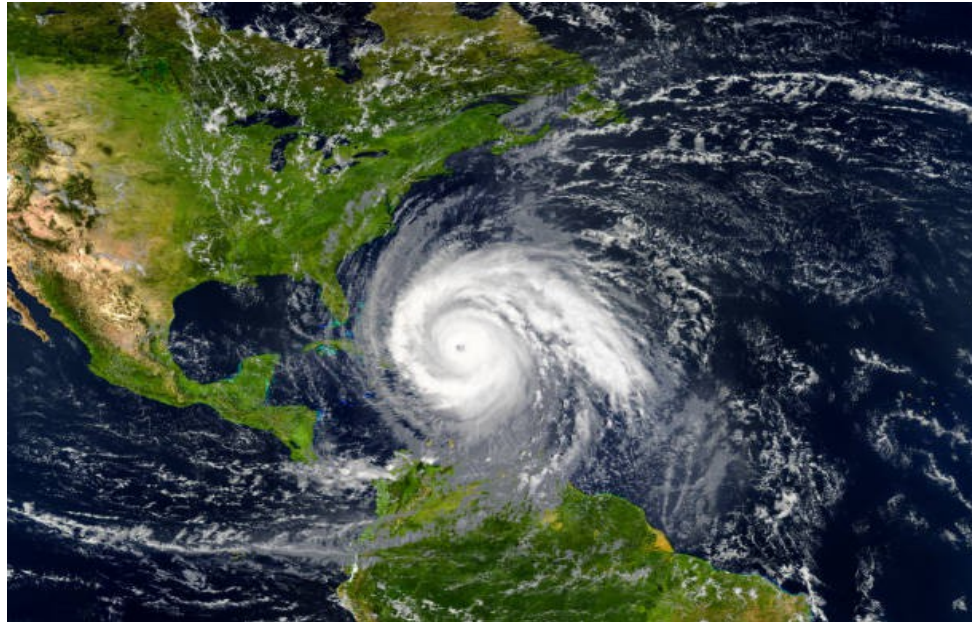


Predict weather & climate fast using pattern recognition

Run many scenarios to improve weather & climate predictions

# AI HURRICANE PREDICTION

Google DeepMind predicted hurricane Lee landfall three days ahead of existing methods



GraphCast uses AI to learn how weather patterns evolve.

AI tools help predict how climate is likely to change in the future

# HOLISTIC CLIMATE MODELLING

Modelling systems which incorporate natural & human systems

Explore interactions between climate change, societal change & ecosystem response



How will Climate Change Mitigation affect the environment?

Impact of Climate Adaptation Scenarios on agriculture, water supply?

Impact on natural resources?

# FIRE FIGHTING DRONES

AI drones working together in swarms to put out fires

Spot & extinguish fires early preventing spread

Drones trained using real fires & computer simulations



The drones are large twin-engined aircraft  
Wingspan of 9.5metres  
Large water-carrying capacity

# AI IN ASTRONOMY

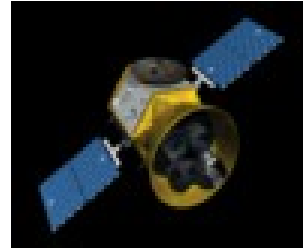
New telescopes produce masses of data



HUBBLE



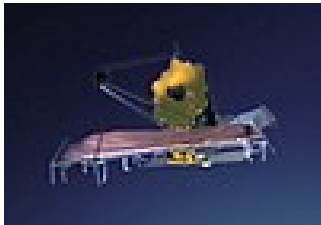
KEPLER



TESS



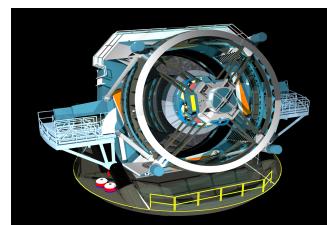
SPITZER



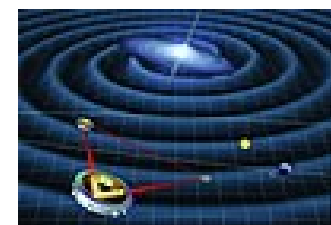
JAMES  
WEBB



EUCLID



LARGE  
SYNOPTIC  
SURVEY



LISA

Train AI systems to search for exoplanets, quasars...

AI can identify new patterns in the information (make new discoveries)

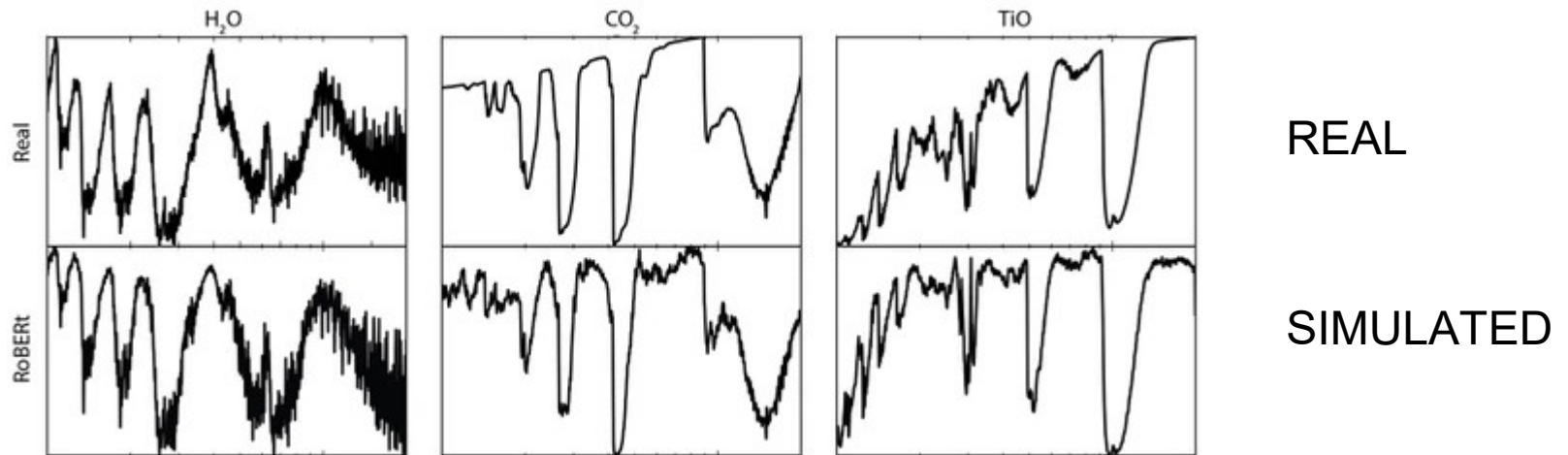
# AI SEARCH FOR EXTRATERRESTRIAL LIFE

RobERt (Robotic Exoplanet Recognition) is an AI system created by UCL

Identify life signatures in exoplanet atmospheres

Find water, carbon dioxide & ammonia with 99.7% accuracy

Works 24/7



**HOW MIGHT AI IMPACT OUR SOCIETY?**

# **JOBS WILL CHANGE**

Many jobs will be replaced by AI systems & new jobs created

## **Jobs which can be automated:**

- Drivers
- Retail
- Manufacturing
- White collar jobs
- Agriculture

## **Jobs requiring creativity & people skills:**

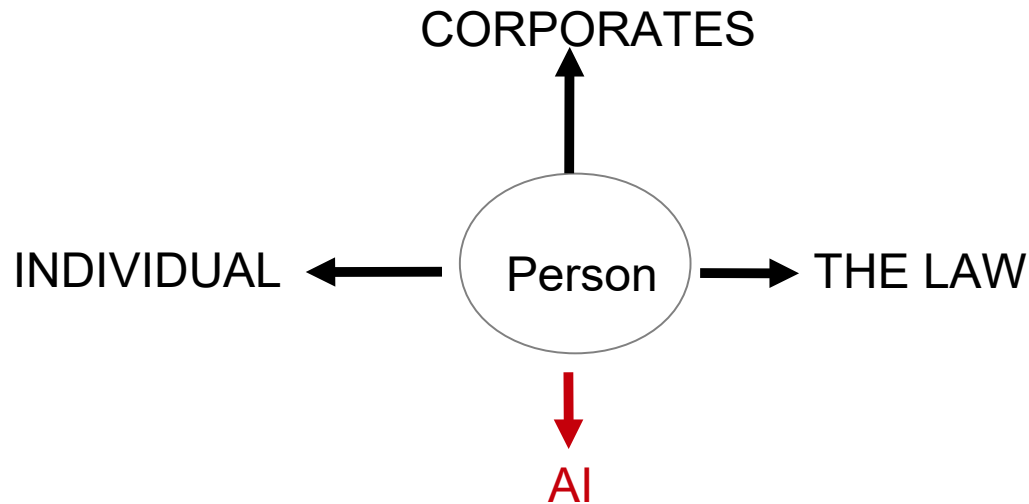
- Arts
- Science
- Social work
- Sales & marketing
- Manual work

## **New jobs will appear:**

- AI Robotics
- AI Health
- AI Education
- Start a new business assisted by AI



# AI & THE BALANCE OF POWER



90% of human data is processed by IT systems run by corporates

More decision making made by AI systems (employment, legal...)

AI can enhance government efficiency analysing large datasets to inform policy decisions

AI regulation needed

# AI REGULATION

Balance between regulation & innovation

Regulate when things go wrong?

Regulation of AI Developers, AI Businesses, AI Users

Safety, Security, Fairness, Transparency, Privacy

AI Regulation is years behind the IT developers

European Union lawmakers approved a landmark law 13 Mar 24

Parts of the AI market will always remain unregulated

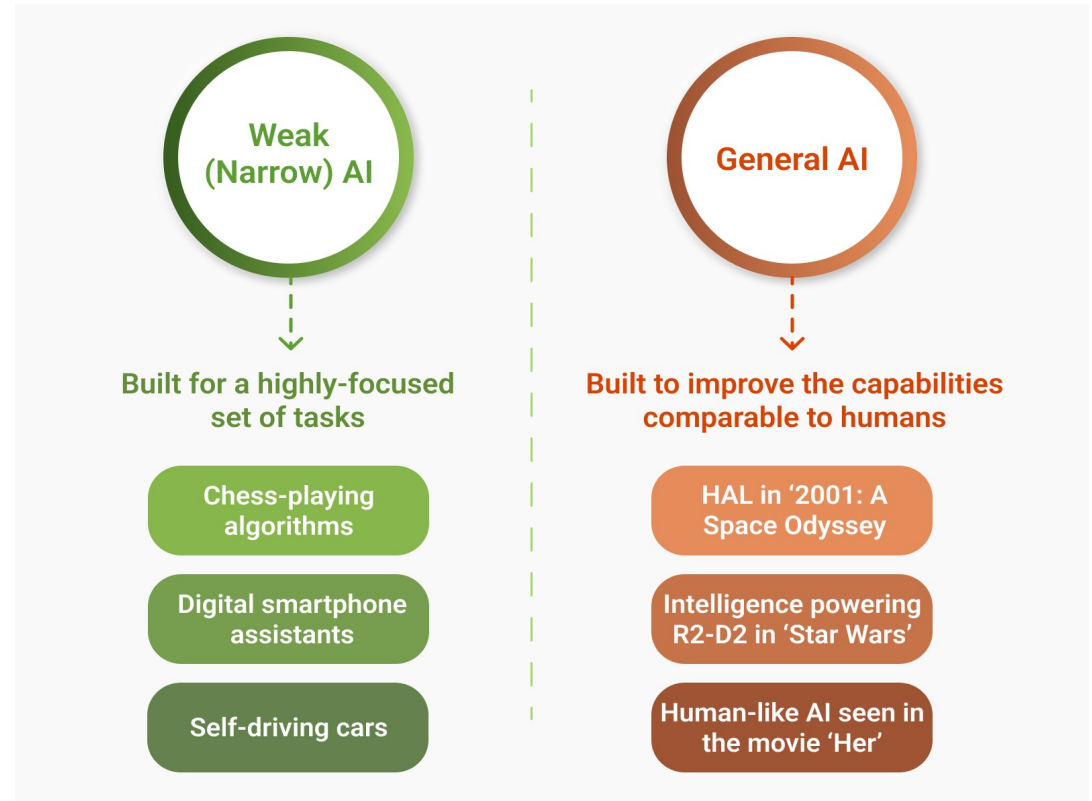


# FUTURE GENERAL AI

Machines that can do anything  
a human can do but even better  
NOT CLOSE

Machines that can do any cognitive  
task a human can do  
CLOSER

Machines that can do any language  
based task a human can do  
CLOSE



# ALTERNATE FUTURES

Humans



Biological  
Evolves Slowly

1. Humans stay in control
2. Humans partner with AI
3. AI takes control

AI



Artificial  
Evolves Rapidly

# SUMMARY

## AI is benefiting human society

Personalised education

Efficiency improvements across industry

New medical advances (physical & neurological)

## Issues

Energy consumption is significant (small nuclear)

Data Centres to increase from 2-3% to 10-15% national power

## Society Adaptation

Jobs will change

New skills needed

## AI Regulation Required

Privacy & Security

## Future of AI

Clear benefits to humanity in short/medium term

Generalised AI

Humans & AI must work together

### TOP 10 Advantages of Artificial Intelligence



1. Impact on the Job Market
2. Healthcare and Medicine
3. Banking and Finance Industry
4. Transportation Industry
5. Improved Efficiency and Productivity
6. Better Decision-Making Capabilities
7. Enhancing Customer Experience
8. Manufacturing Industry
9. Customer Service Industry
10. Entertainment Industry

**ADDITIONAL SLIDES**

# HOW LESS DEVELOPED COUNTRIES BENEFIT FROM AI



## **Disease Diagnosis**

AI-powered tools can help diagnose diseases accurately especially in remote areas with limited medical expertise

## **Smart Irrigation**

AI-powered systems can efficiently manage water resources, reducing waste and improving crop productivity.

## **Pest and Disease Control**

AI can identify and predict outbreaks early, allowing for timely interventions

## **Disaster Management**

AI can predict and help respond to natural disasters, minimizing damage and loss of life

## **Job Creation**

AI can create new jobs in technology and data science sectors

## **Financial Inclusion**

AI-powered financial services can expand access to banking and credit for underserved populations by looking at new opportunities

# AI SALES & MARKETING

## Deeper Customer Insights

AI used to identify trends and patterns  
AI captures customer likes/dislikes

## Enhanced Decision-Making

AI continually analyses data  
AI aids data-driven decisions

## Improved Sales

AI delivers targeted content and promotions  
AI respond quickly to customer feedback

## AI Prediction

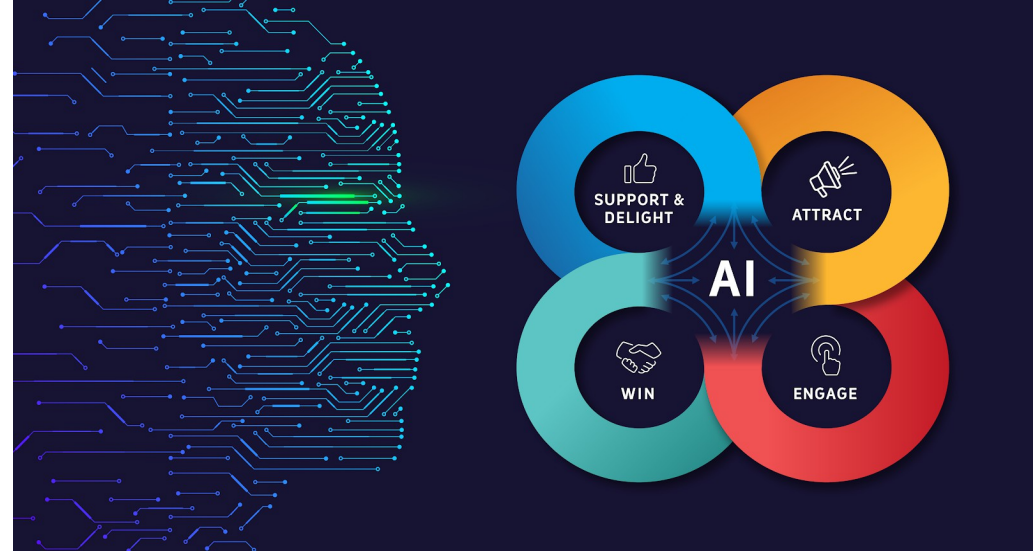
AI predicts customer response to product launch

## Benefits To Individual

Products tailored to specific interests  
Fast automatic response to customer request 24/7

## Risks To Individual

Access to personal information



# ANIMAL HEALTH

## Trial

Some veterinary practices use AI to diagnose of illnesses in animals

Staff prepare a slide with a sample from the pet.

Sample is analysed by an AI microscope

Works by optical pattern recognition

AI trained to detect all common conditions  
Worms, infections, cancers...

Diagnosis locally within an hour

Email results to a world expert if needed



# CONVERSING WITH ANIMALS

## Research

AI translate animal sounds into human speech

AI analyses animal sounds in different circumstances

Associates animal sounds with meaning

Generate synthetic speech

Bi-directional conversation?

Allows conversation with many species?



# SELF DRIVE CARS

Phased introduction over the next 30 years

The cars are driven by AI systems

AI systems are trained in the factory by simulation & road testing

AI learns & improves with use

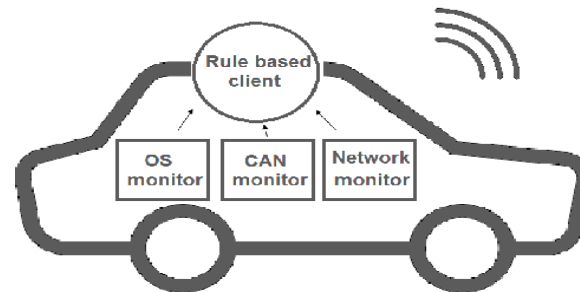
AI decides on the best route to reach destination

AI monitors detects obstacles using laser/radar

AI adapts driving to different road conditions

Reduced accident rates

Self driving cars  
legal in UK from 2026



Icons made by Iconnice, Smashicons and Freepik from Flaticon

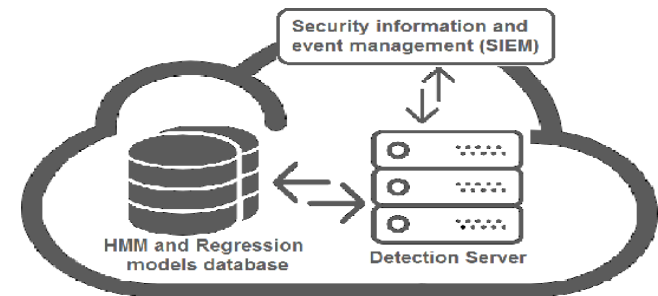


Fig. 11: High Level System Architecture

# AI IN THE AIRCRAFT INDUSTRY

Used in airline support systems

Responds well to changing situations

AI models predict & manage air traffic flow

Reduce congestion, minimise delays

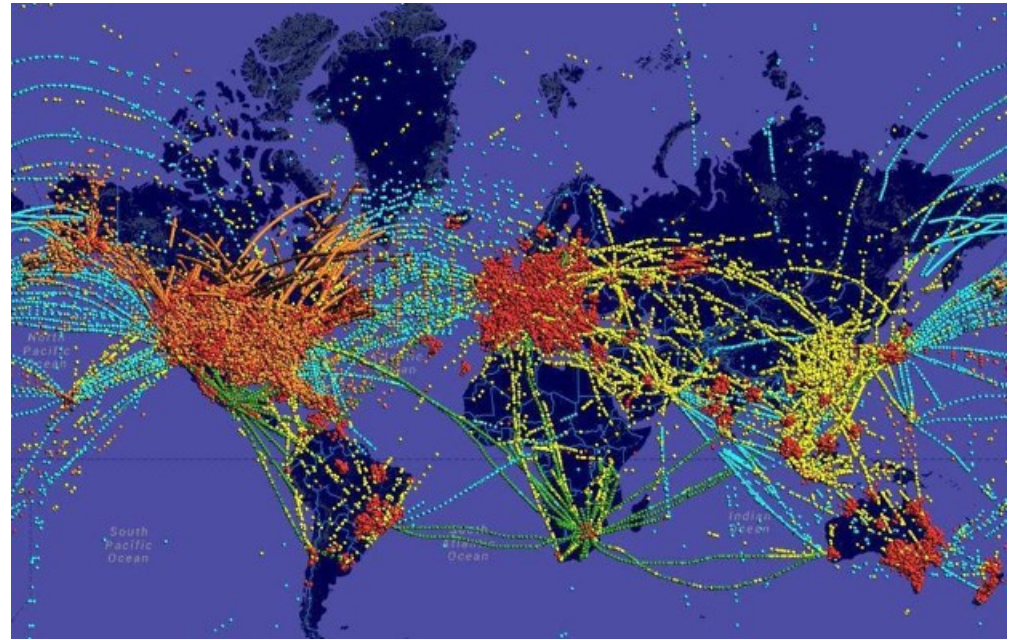
Sequence arrivals & departures

Analyse weather patterns, air traffic & other variables

Optimise flight paths & reduce travel time,

Reduce fuel costs & minimise environmental impacts

*Thanks to Donald Mobley*



# AI IN RETAIL SECURITY

Shoplifting in UK is a big problem

Facial recognition is improving store security using biometrics



Large supermarkets have surveillance cameras for theft monitoring

Upgrade to camera surveillance with AI systems

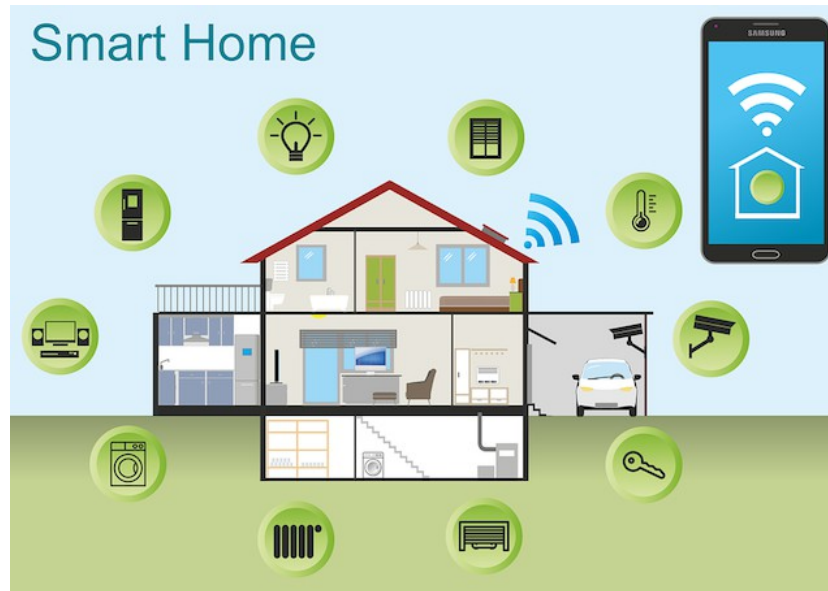
Alerts of the serial shoplifter using facial recognition

Shoplifters behaviour also recognized by the AI monitors

Is it legal in the UK?

# AI IN HOME SECURITY

AI integrated cameras & alarm systems using facial recognition software



Automation in the Home

AI system adapts itself to each household

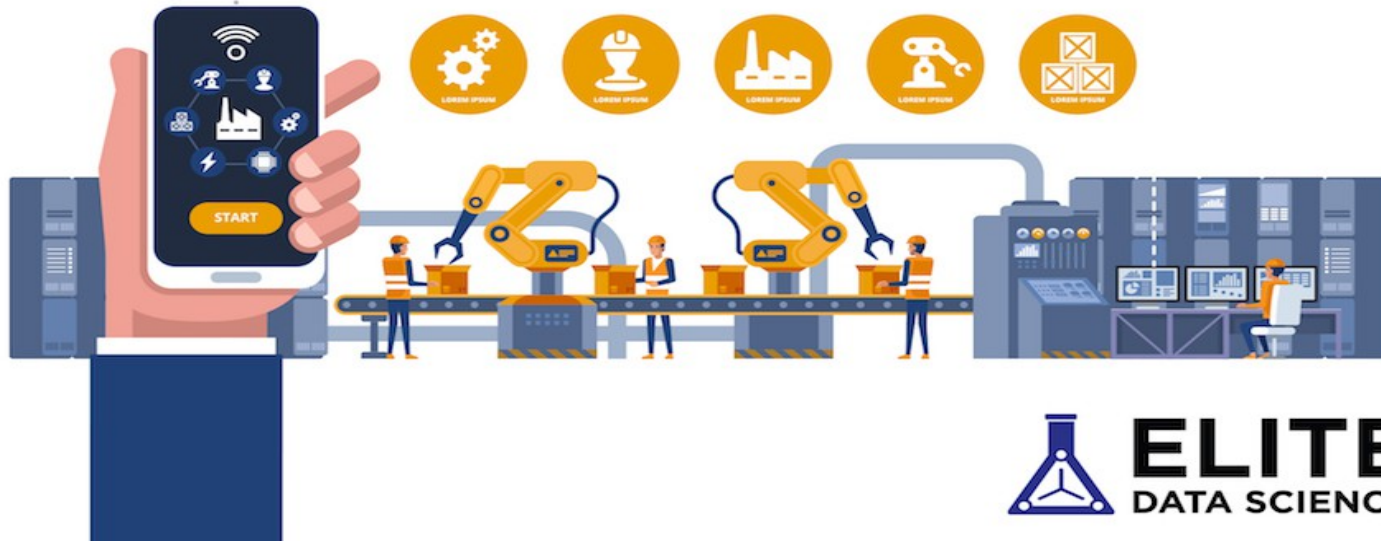
# AI IN MANUFACTURING

Optimise end-to-end manufacturing processes

Speed up product delivery & reduce costs

Adapt autonomously to changing circumstances

Adjust product mix as supplies fluctuate



Supply chain management beyond the factory

Improved product distribution (self drive vehicles, drones)

# AI IN MILITARY: LETHAL AUTONOMOUS WEAPONS



Modern wars are increasingly fought using AI

AI collates conflict information & predicts possible attacks

Analyses effectiveness of military tactics in real time

Autonomous weapons can locate, select & engage targets without supervision

A shipping container can contain 1 million autonomous weapons

Give a platoon the power of a regiment

AI arms race

Human is better at strategic decisions

Keep a human in the loop!

# AI SURVEILLANCE

Use of artificial intelligence to analyse video & audio feeds from surveillance cameras



## **AI-powered facial recognition systems**

Used in airports, train stations & public spaces to identify individuals, track their movements, and flag potential threats

## **Object Detection**

Identify and track objects like abandoned bags, weapons, or suspicious packages in public areas

## **Workplace Monitoring**

Detect unsafe behaviours like not wearing safety gear or improper lifting techniques to prevent accidents.

## **Access Control**

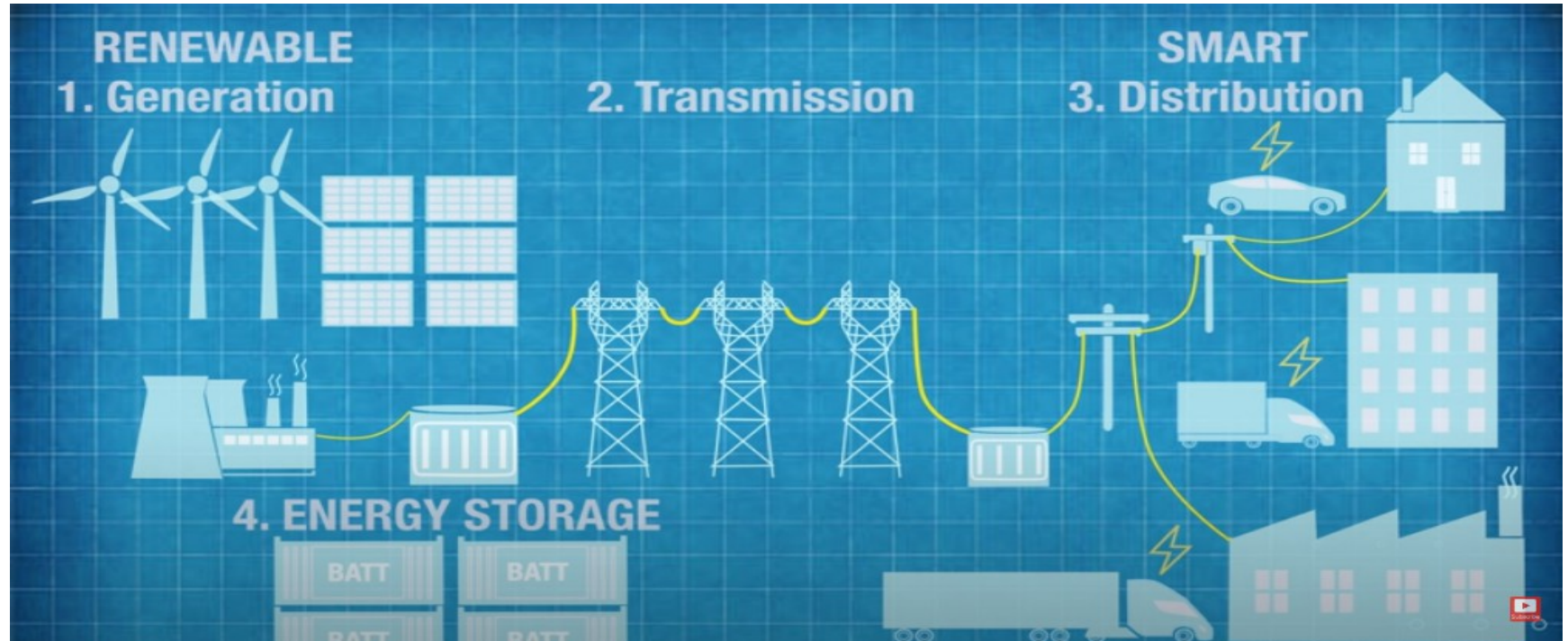
Verify employee identities and grant access to secure areas

## **Social media monitoring**

Analyse social media posts to identify potential threats and censor critical voices

# POWER NETWORKS

Real time control of complex power networks



AI improves energy efficiency

Maintain the resilience of the network (reconfigure network autonomously)

# AI & LARGE HADRON COLLIDER (LHC)

Protons crash into each other at near light speed

Artificial intelligence analyses the complex images of particle tracks produced by the collisions

AI identify what particles are produced

Real-time processing using AI reduces the amount of data that needs to be stored

Increased efficiency, improved accuracy, more scientific discovery

Discover new particles beyond The Standard Model?



# LEGAL SYSTEM

Makes each activity much faster

Document Review

Research legal cases

Assist Courts and Tribunals

AI provides a level playing field

Reduce legal backlogs

Passing Sentence?

