

# IGNITE-EUROGEMS

Empowering Girls, Shaping the Future in STEAM

## Topic 4. Advanced STEAM Applications

### 4.1 Introduction to Artificial Intelligence



Co-funded by  
the European Union

Funded by the European Union. Views and opinions expressed are however those of the author(s) only and do not necessarily reflect those of the European Union or the European Education and Culture Executive Agency (EACEA). Neither the European Union nor EACEA can be held responsible for them.

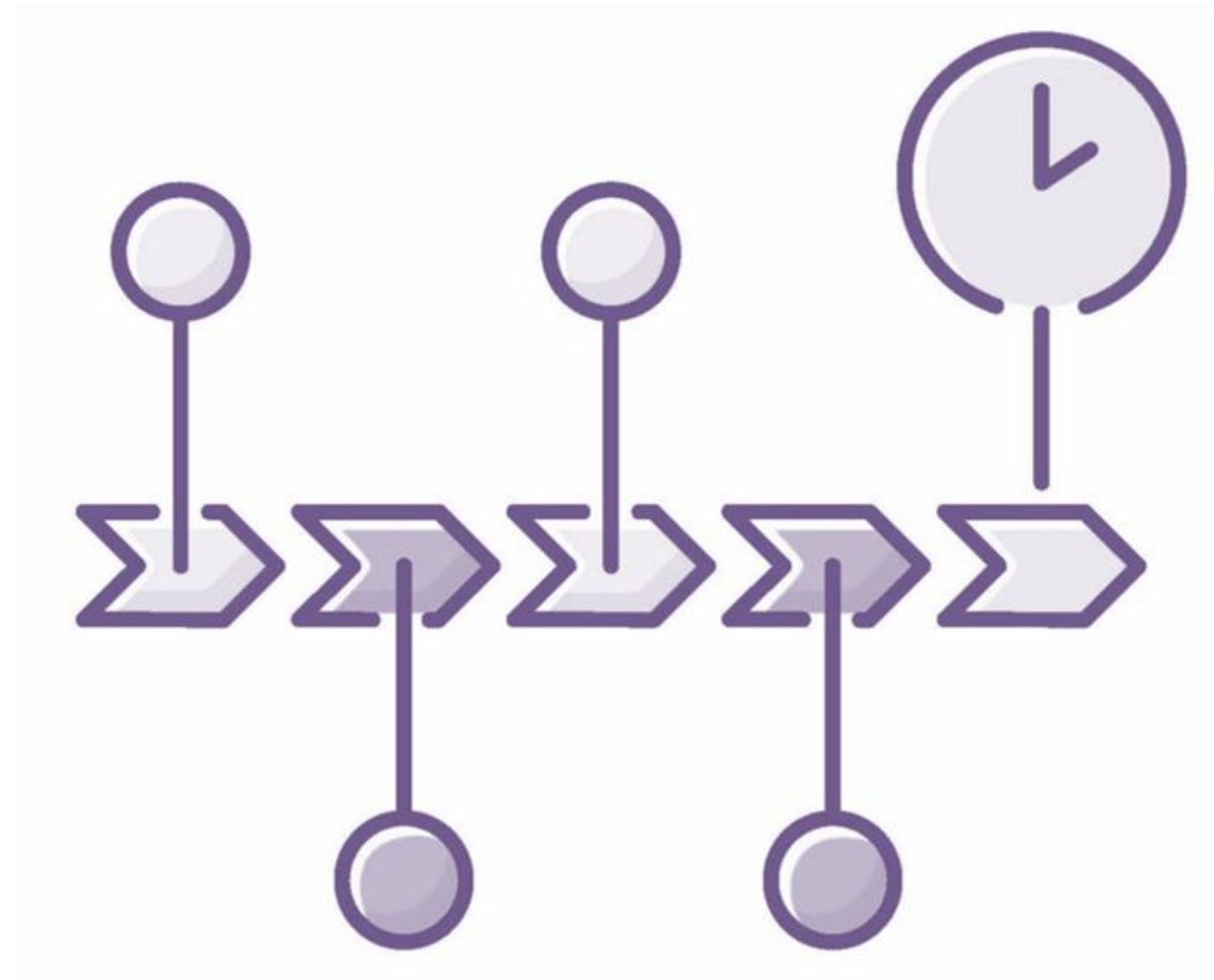


# Content

- 01** Artificial Intelligence (AI)
- 02** Machine Learning (ML)
- 03** Deep Learning (DL)
- 04** Generative AI (GenAI)
- 05** AI agents
- 06** Applications in real life
- 07** Ethical considerations and challenges
- 08** Career opportunities



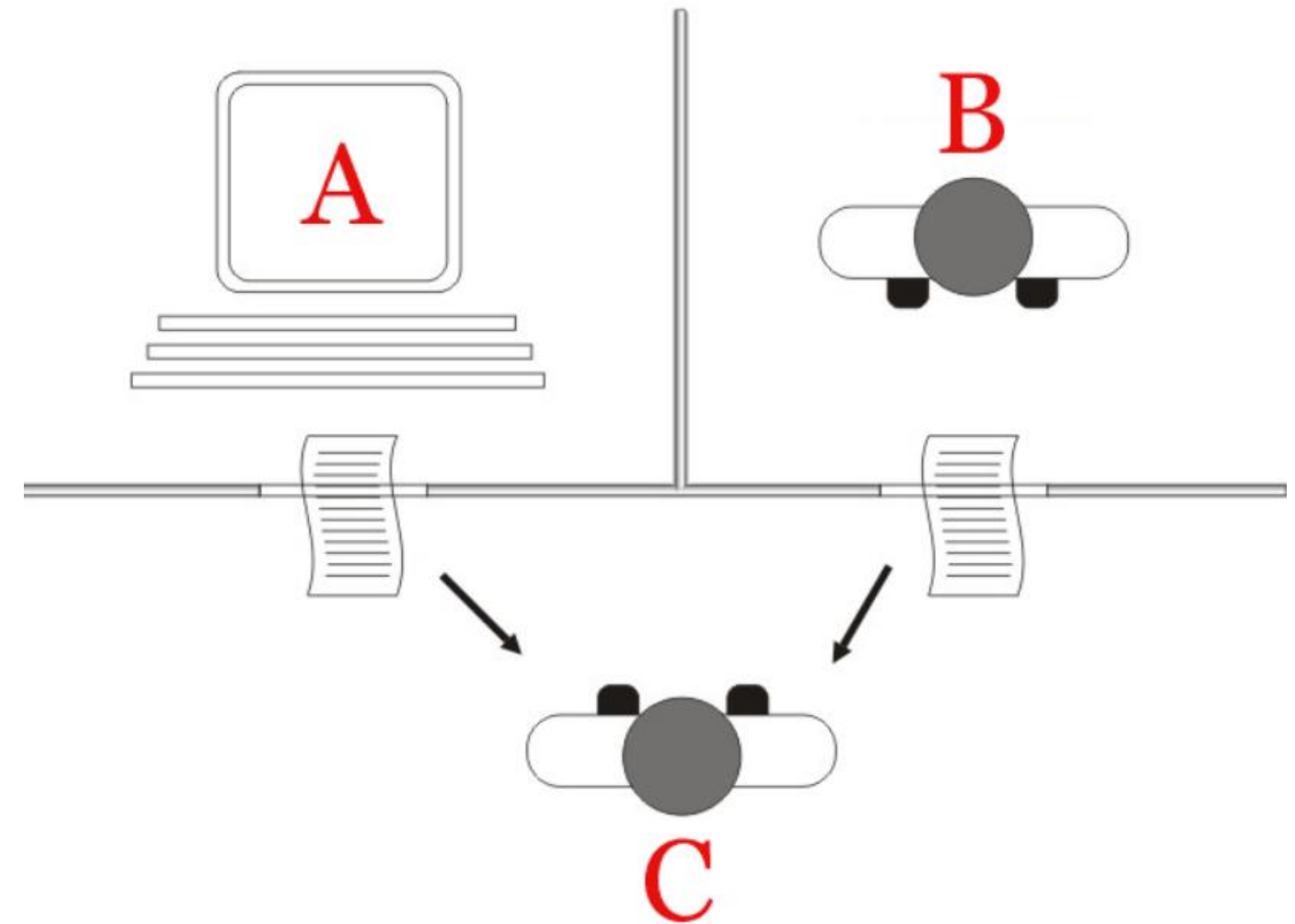
# When was Artificial Intelligence first introduced?



# Turing Test - 1950

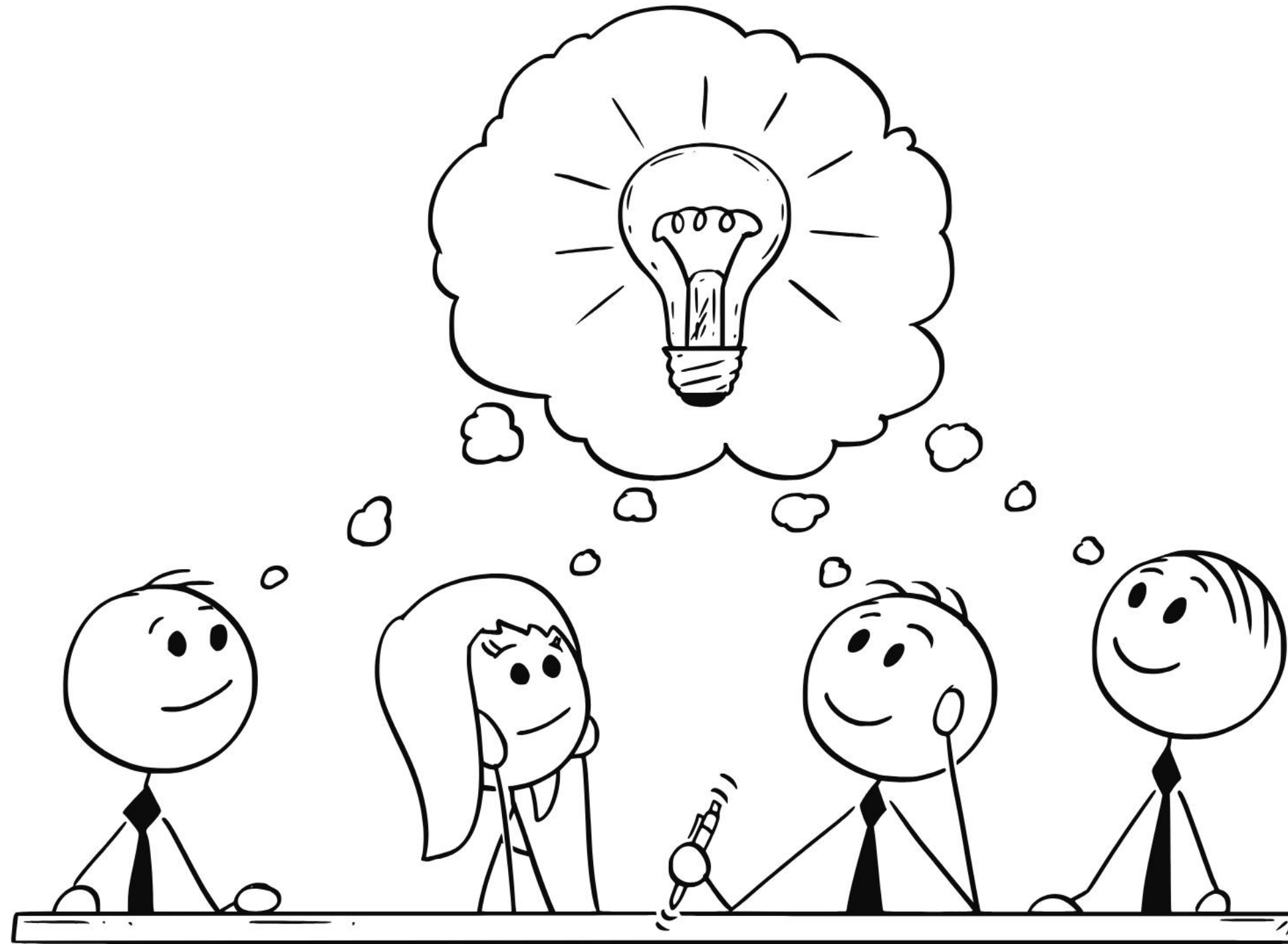
**Alan Turing**, one of the "fathers" of modern computing, proposed the Turing Test.

**Turing test:** a machine's ability to exhibit intelligent behavior equivalent to, or indistinguishable from, that of a human.



**If you can't tell if you're talking to a human or a machine... Then the machine "passed" the test!**

# Artificial Intelligence: What comes to mind?



# Introduction to Artificial Intelligence (AI)

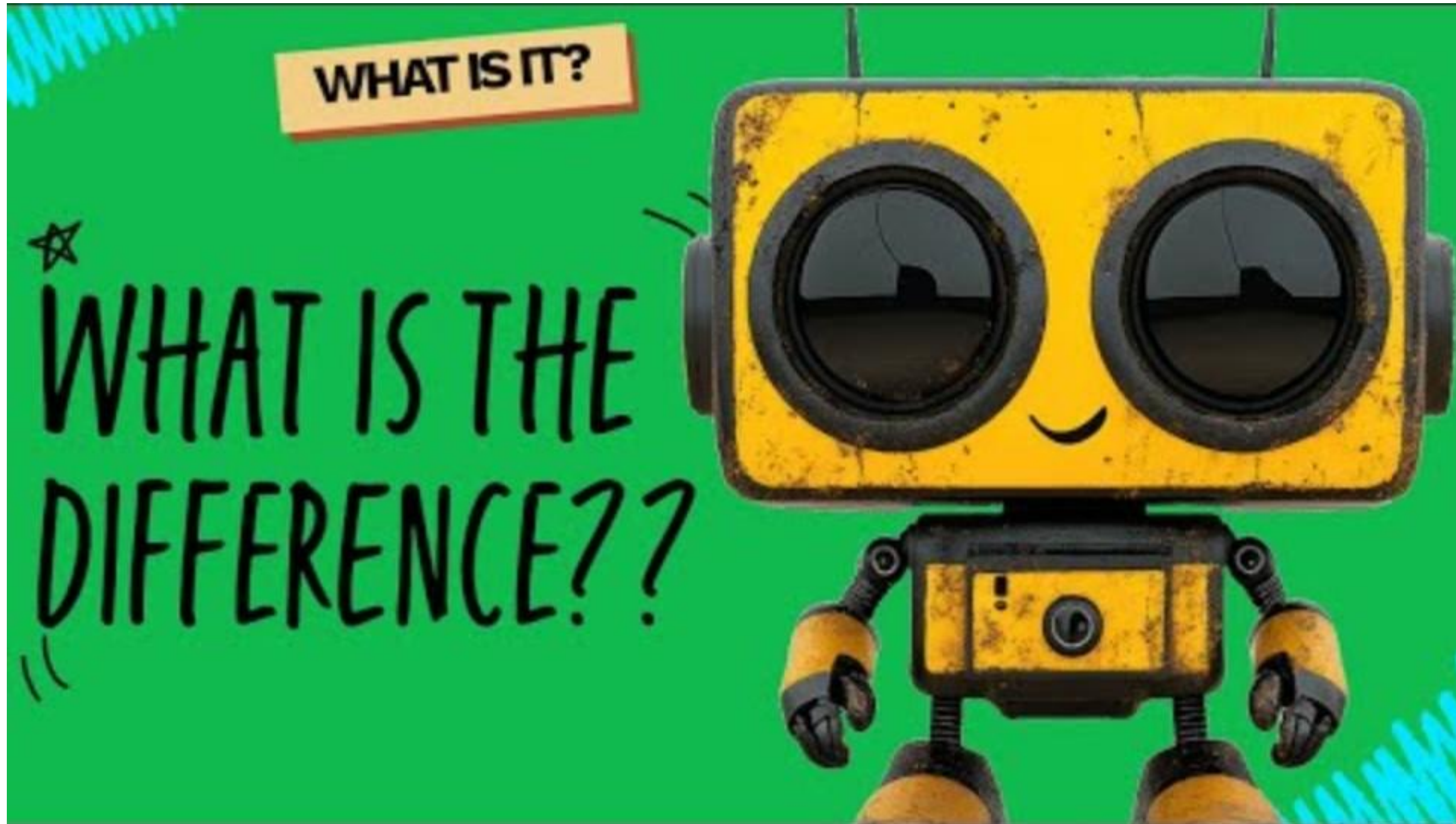
- 1956: **John McCarthy**, a computer scientist, launched the first AI research program at Dartmouth College, MIT. He is often referred to as the "Father of AI" for his contributions to the field.



**Artificial Intelligence** is the science and engineering of building smart machines, especially smart computer programs.

-- John McCarthy, father of artificial intelligence at MIT, 1956

# AI subsets

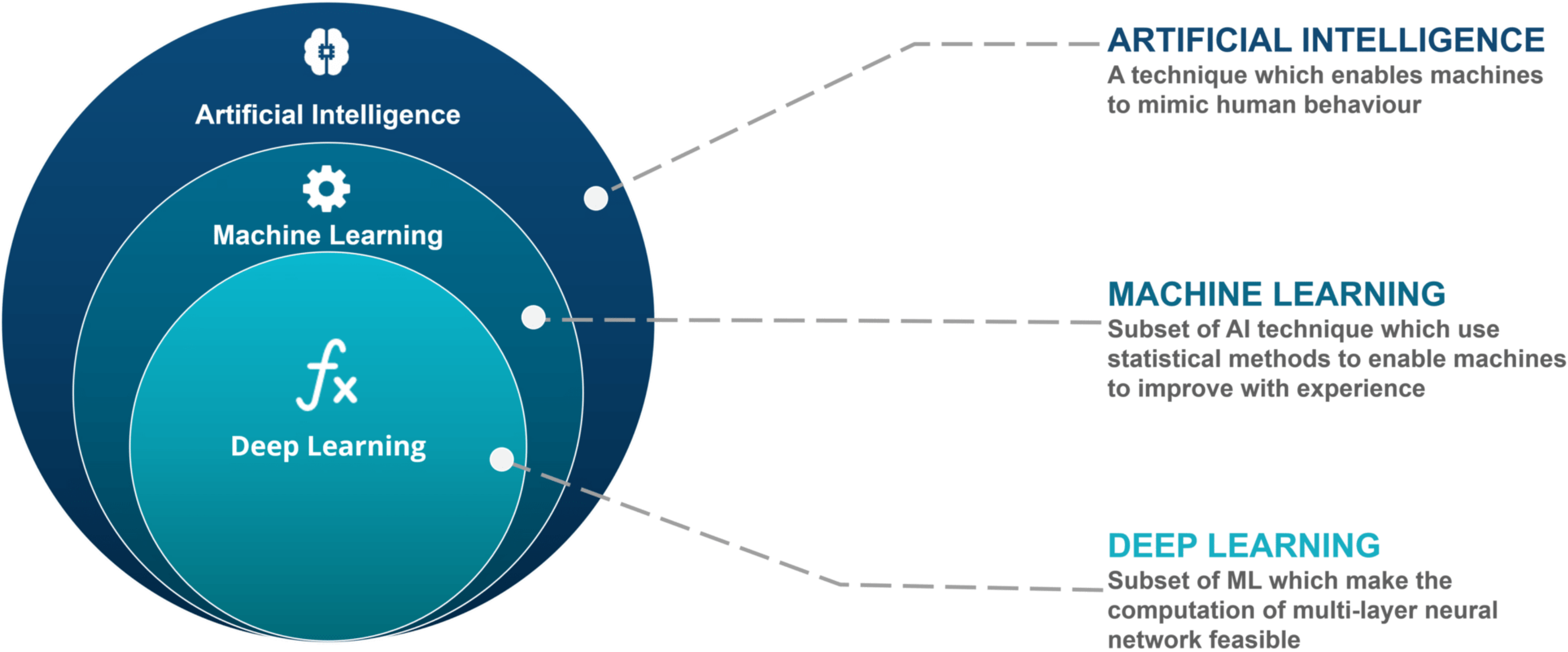


Video: [https://www.youtube.com/watch?v=7pn\\_NAPlbb4](https://www.youtube.com/watch?v=7pn_NAPlbb4)



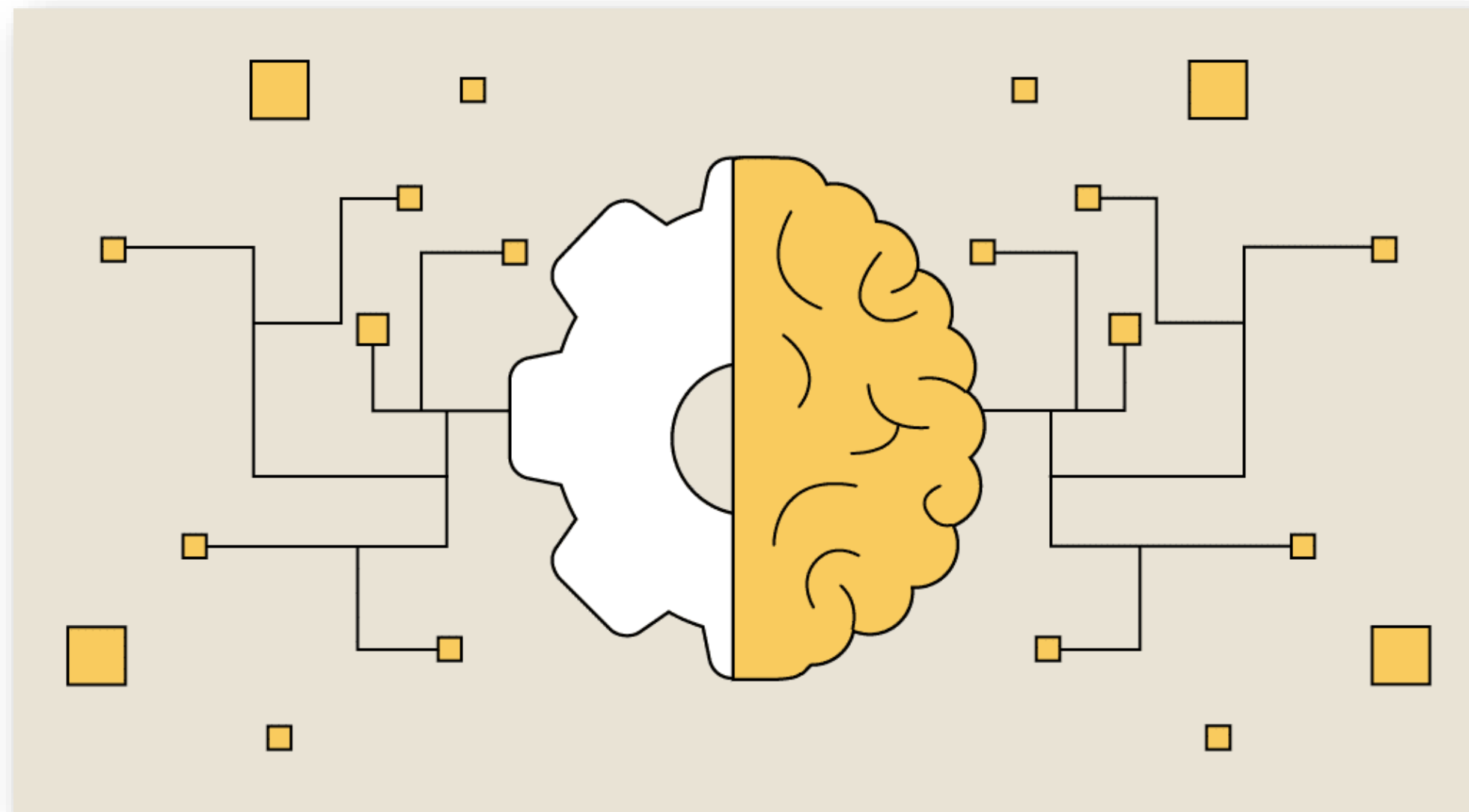
Co-funded by  
the European Union

# AI Subsets



# Μηχανική Μάθηση (ML)

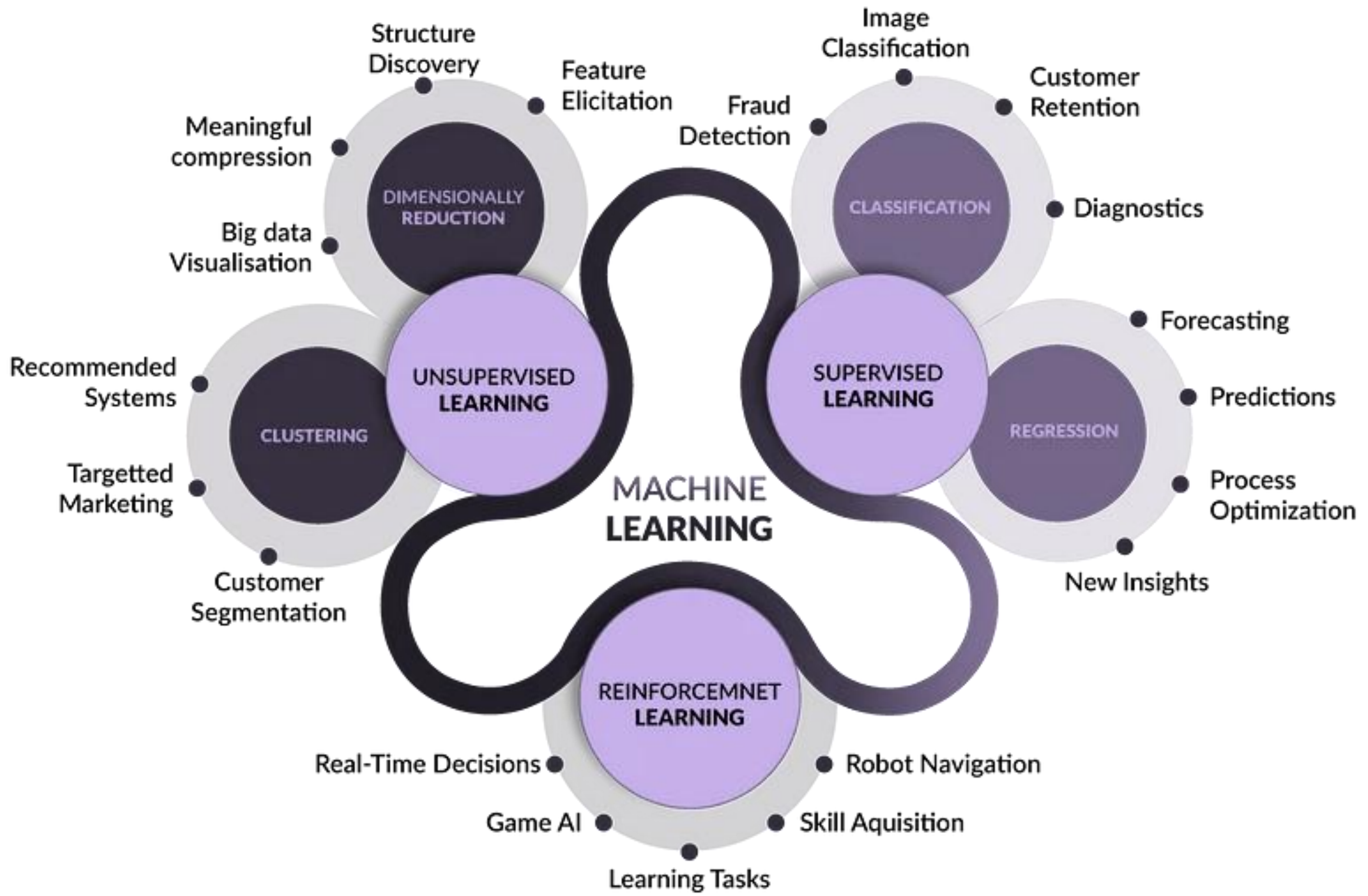
Machine Learning (ML) is a subset of artificial intelligence that focuses on creating systems that can **learn from data** and improve its performance over time without being explicitly programmed.



# Machine Learning (ML) features

- It finds **patterns**, makes **predictions**, and **learns** from experience by analyzing large datasets.
- **Machine Learning model categories:**
  - a) Supervised
  - b) Unsupervised
  - c) Semi-supervised
  - δ) Reinforcement
- **Machine Learning techniques:**  
Classification, regression, decision trees, etc



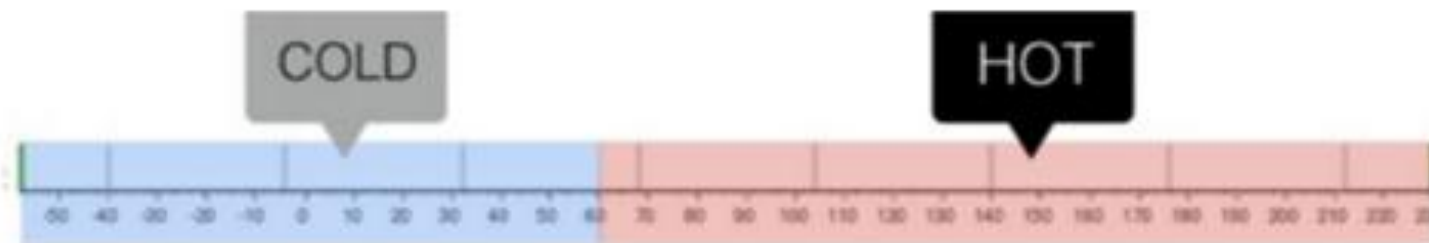


# Supervised learning

## Classification



Will it be hot or cold tomorrow?

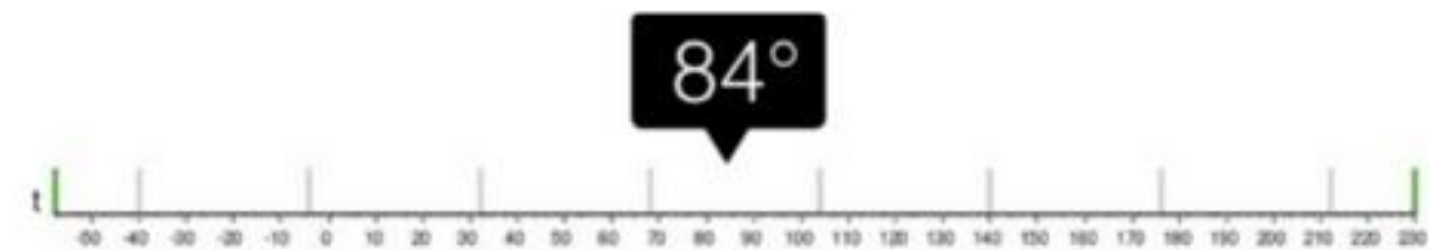


Fahrenheit

## Regression



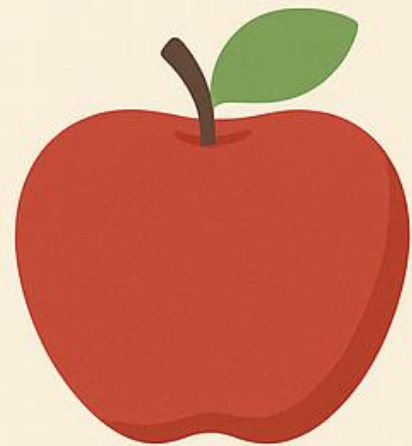
What will be the temperature tomorrow?



Fahrenheit

# Supervised learning

How much does it weigh?



**150**  
grams

Regression

What colour is it?



Red

Green

Classification

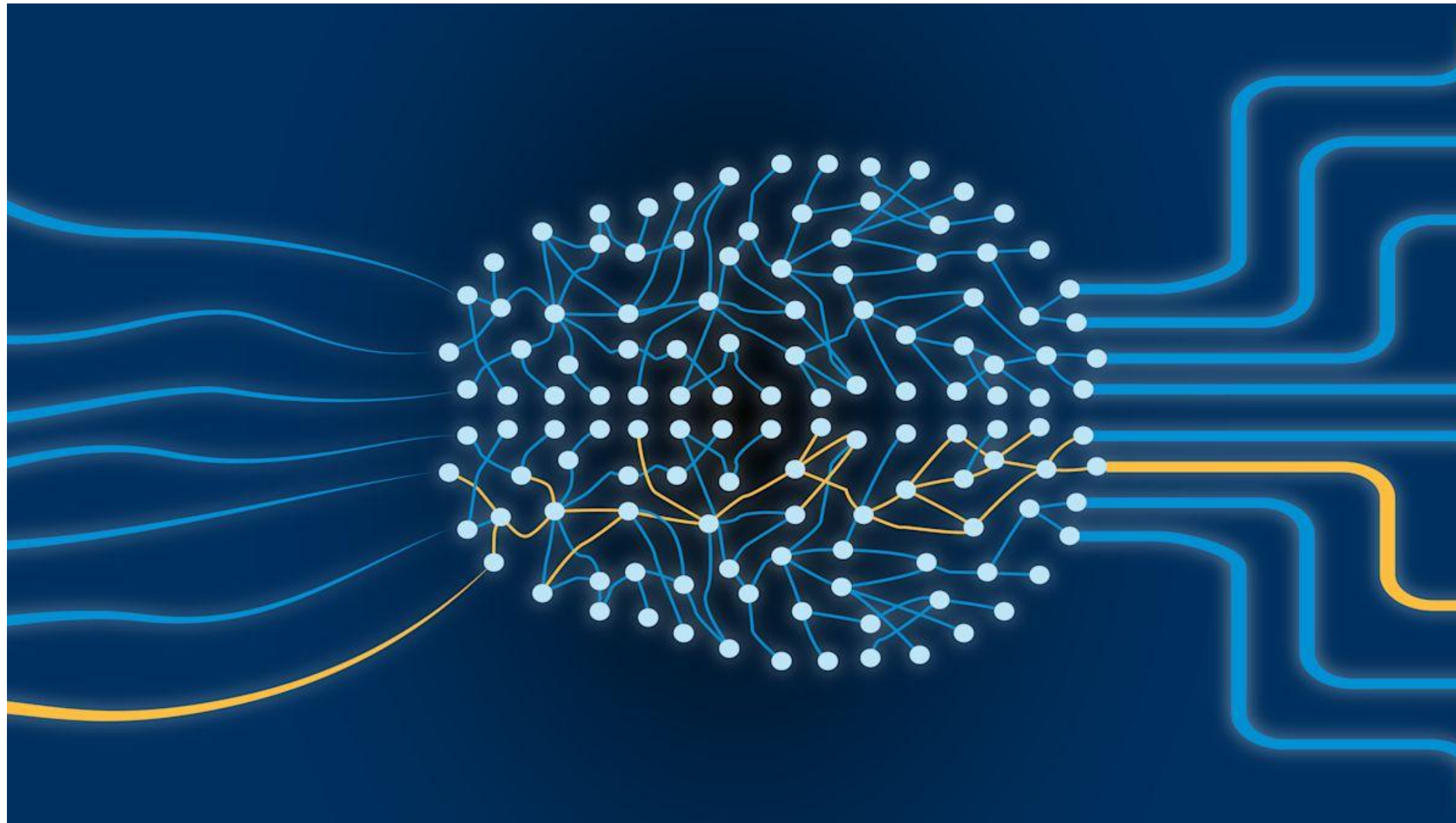


# How to confuse Machine Learning!



# Deep Learning (DL)

Deep Learning (DL) is a subset of machine learning that uses multi-layered **neural networks** (deep neural networks) to learn **complex patterns** from data.



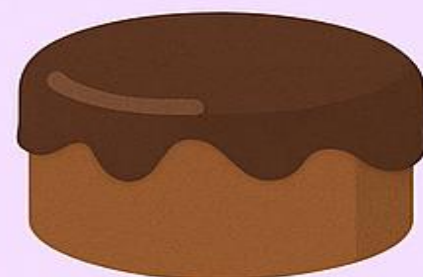
# Deep Learning (DL) features

- Just as the **human brain** has many neurons connected to each other, Deep Learning has artificial neurons that work together.
- **He learns on his own from many examples (data)**  
We don't tell him what to do, he sees a lot of data (images, sounds, texts) and begins to recognize **patterns** on his own.
- **But it needs too much data and very "powerful" computers**  
In order to do good, it must "see" thousands or even millions of examples.



# Example of baking

## NEURAL NETWORK (NN)



simple  
recipe

## DEEP NEURAL NETWORK



+



+




complex  
recipe

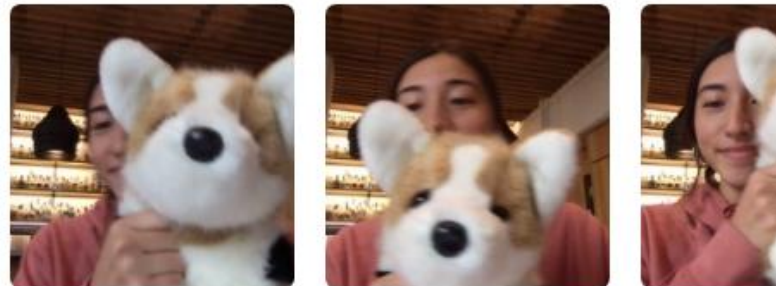
# Activity #1: Introducing AI (Google Learning Engine)

≡ **Teachable Machine**

## New Project

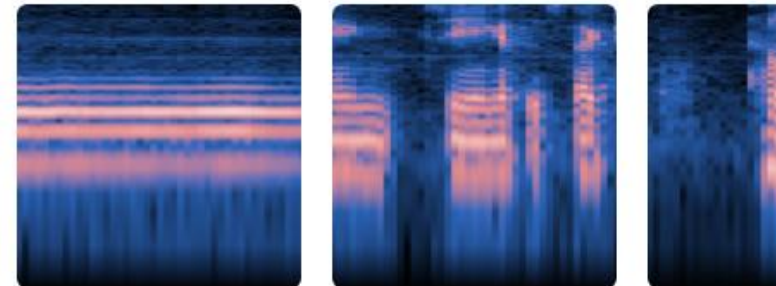
 Open an existing project from Drive.

 Open an existing project from a file.



### Image Project

Teach based on images, from files or your webcam.



### Audio Project

Teach based on one-second-long sounds, from files or your microphone.



### Pose Project

Teach based on images, from files or your webcam.

Go to: <https://teachablemachine.withgoogle.com/train>



Co-funded by  
the European Union

# Generative Artificial Intelligence (GenAI)

Generative Artificial Intelligence (GenAI) is a subset of deep learning that focuses on **creating new content**, such as text, images, music, or code, based on patterns learned from existing data.



# Generative Artificial Intelligence (GenAI) features

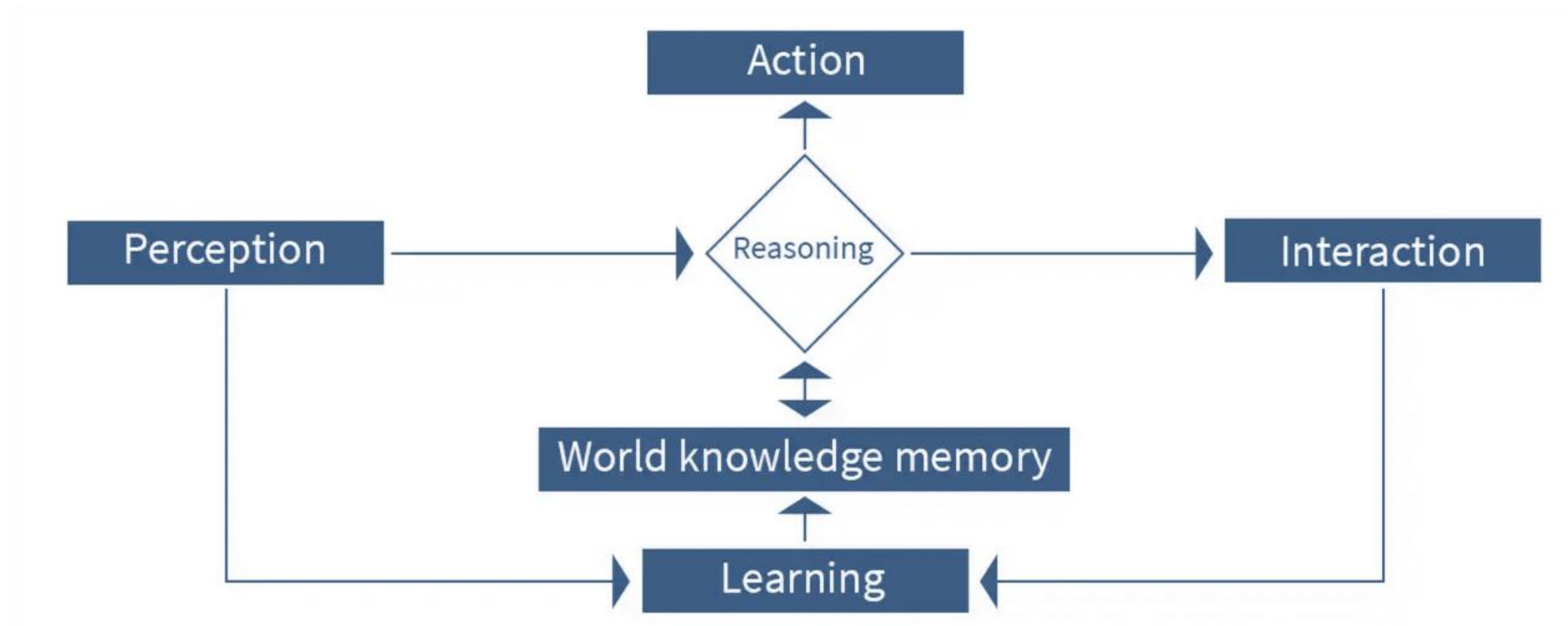
- It is made with **very large and intelligent neural networks**, that is, programs that learn to understand and make sequences of information, such as text or images.
- These models are not limited to just sorting or analyzing information but can **create new things** (mimic human creativity).
- Because they are complex, they need **huge amounts of data** and **powerful computers** to learn.
- **Applications:** language translation, image generation, code assistants, and even video or 3D content creation.



An AI agent is any system that perceives, decides, and acts to achieve goals autonomously

## Basic elements:

- **Perception:** receives input from the world e.g. camera, microphone
- **Decision-making:** uses rules or machine learning to decide what to do
- **Interaction:** interacts with the user/system e.g. gives an answer
- **Feedback loop:** learns from its results and improves over time



---

# Analogy

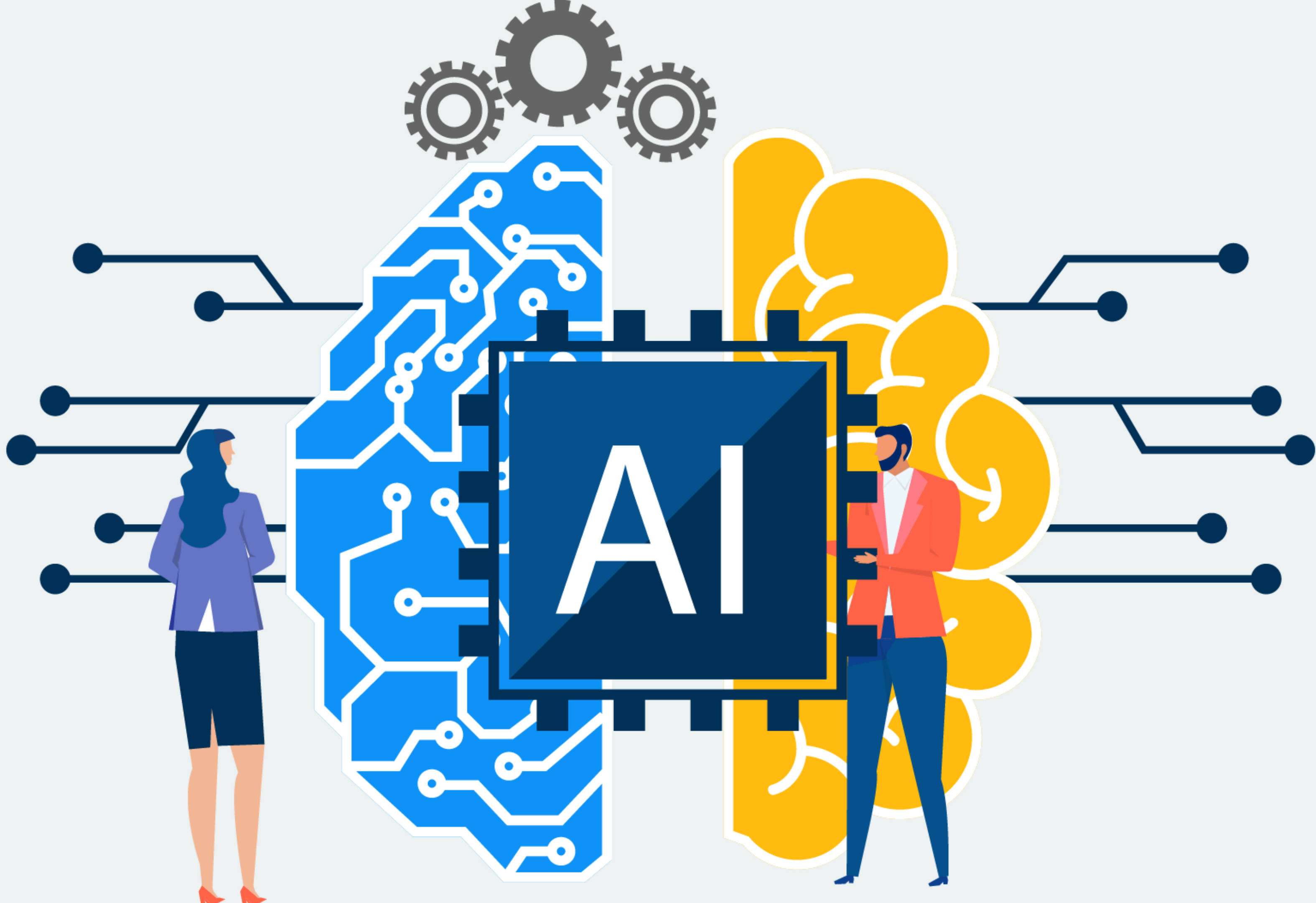
AI is the **brain**,

ML is the **memory**

DL is the **network of neurons**

and GenAI is the **fantasy!**





# IGNITE-EUROGEMS

Empowering Girls, Shaping the Future in STEAM

## Topic 4. Advanced STEAM Applications

### 4.2 AI Applications, challenges and career opportunities



Co-funded by  
the European Union

Funded by the European Union. Views and opinions expressed are however those of the author(s) only and do not necessarily reflect those of the European Union or the European Education and Culture Executive Agency (EACEA). Neither the European Union nor EACEA can be held responsible for them.

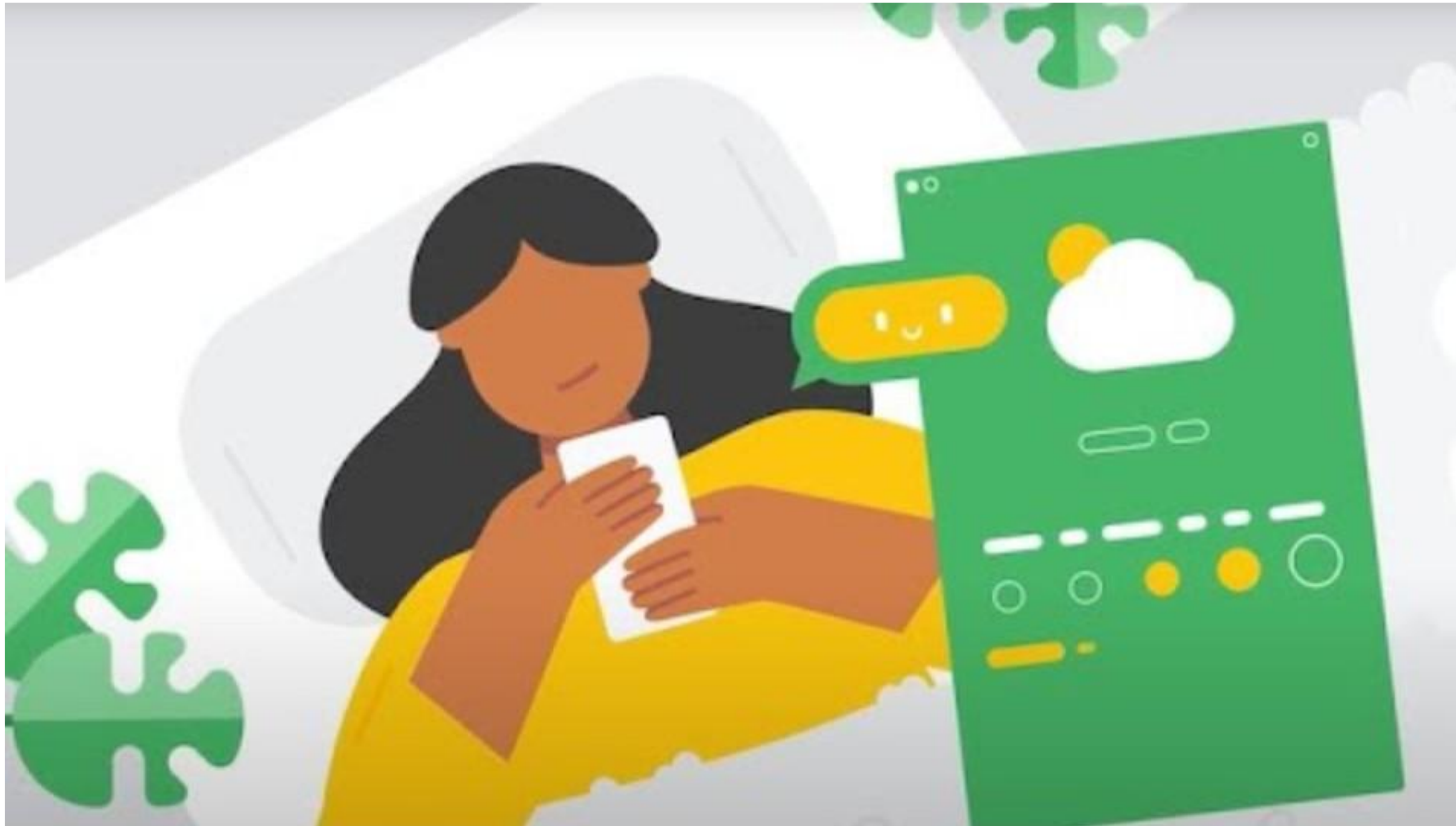


# Content

- 01 Artificial Intelligence (AI)
- 02 Machine Learning (ML)
- 03 Deep Learning (DL)
- 04 Generative AI (GenAI)
- 05 AI agents
- 06 Applications in real life**
- 07 Ethical considerations and challenges**
- 08 Career opportunities**



# How AI works in everyday life



Video: [https://www.youtube.com/watch?v=oJC8VIDSx\\_Q](https://www.youtube.com/watch?v=oJC8VIDSx_Q)



Co-funded by  
the European Union

# AI/ML/DL Applications

- **Facial recognition**

ID verification, security systems

- **Medical diagnosis**

Detecting disease from X-rays, MRIs

- **Fraud detection**

Monitoring unusual banking behavior

- **Self-driving cars**

Real-time object detection and decision making

- **Smart farming**

Predict crop yields, detect plant diseases




# GenAI Applications

- **Art and design**  
Generate graphics, logos, characters
- **Essay and Story Writing**  
Assist with homework or creativity
- **Music Creation**  
Compose beats, lyrics, or instrumental music
- **Code Generation**  
Write code for apps and websites
- **Marketing Content**  
Automate email, ad, and blog content




# Popular GenAI tools


## Content Creation




Scribe




ChatGPT




Copy.ai




Jasper




Claude




Cohere



Gemini



Bard



Research Rabbit

## Design & Visual Arts



DALL-E 2



Midjourney




Adobe Firefly




Canva AI


## Coding & Development




GitHub Copilot




Turing's CodeGen Copilot




AlphaCode




Pico



Microsoft Copilot




Amazon Bedrock




Microsoft Power Apps


## Audio & Video Generation




Synthesia



Auto-GPT

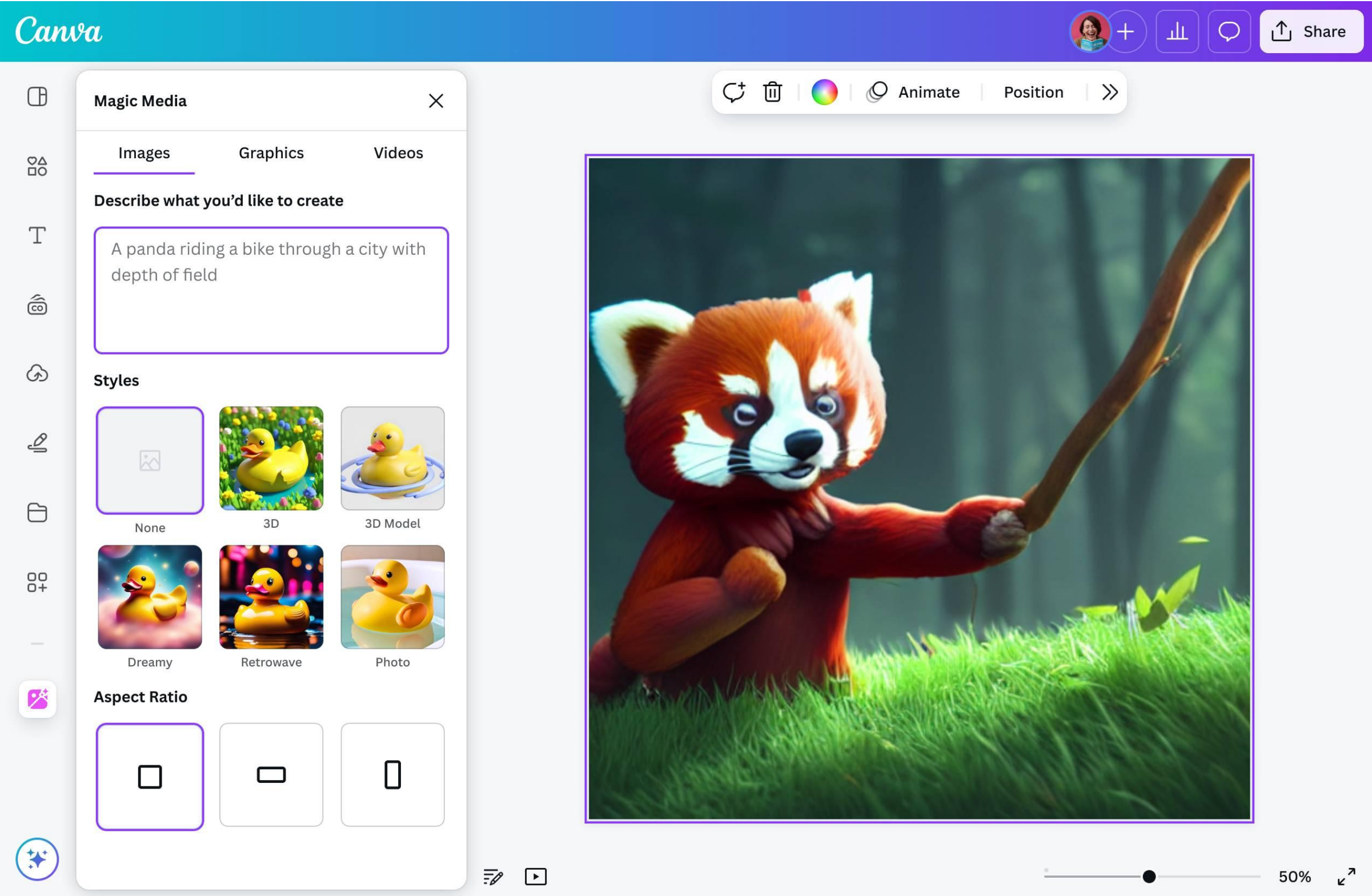


Audiovisual AI



Elicit

# Activity 2: GenAI tools - Canva



Go to: <https://www.canva.com/>



# Activity 3: GenAI tools - ChatGPT

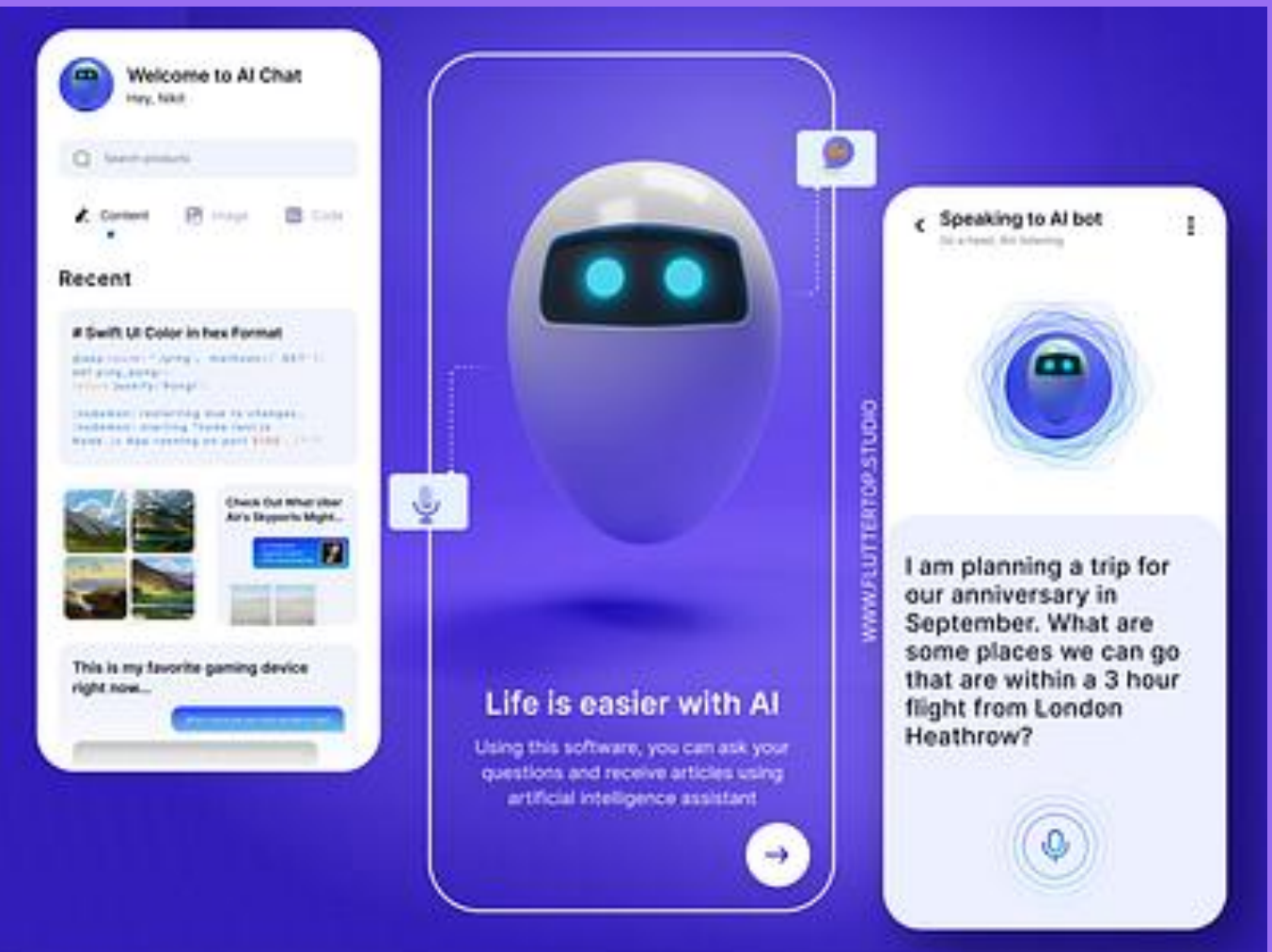
## Prompt:

“Please transform this image into a \_\_\_\_\_ (Ghibli, Pixar, Disney, Cartoon) illustration while keeping the original composition and key details.”

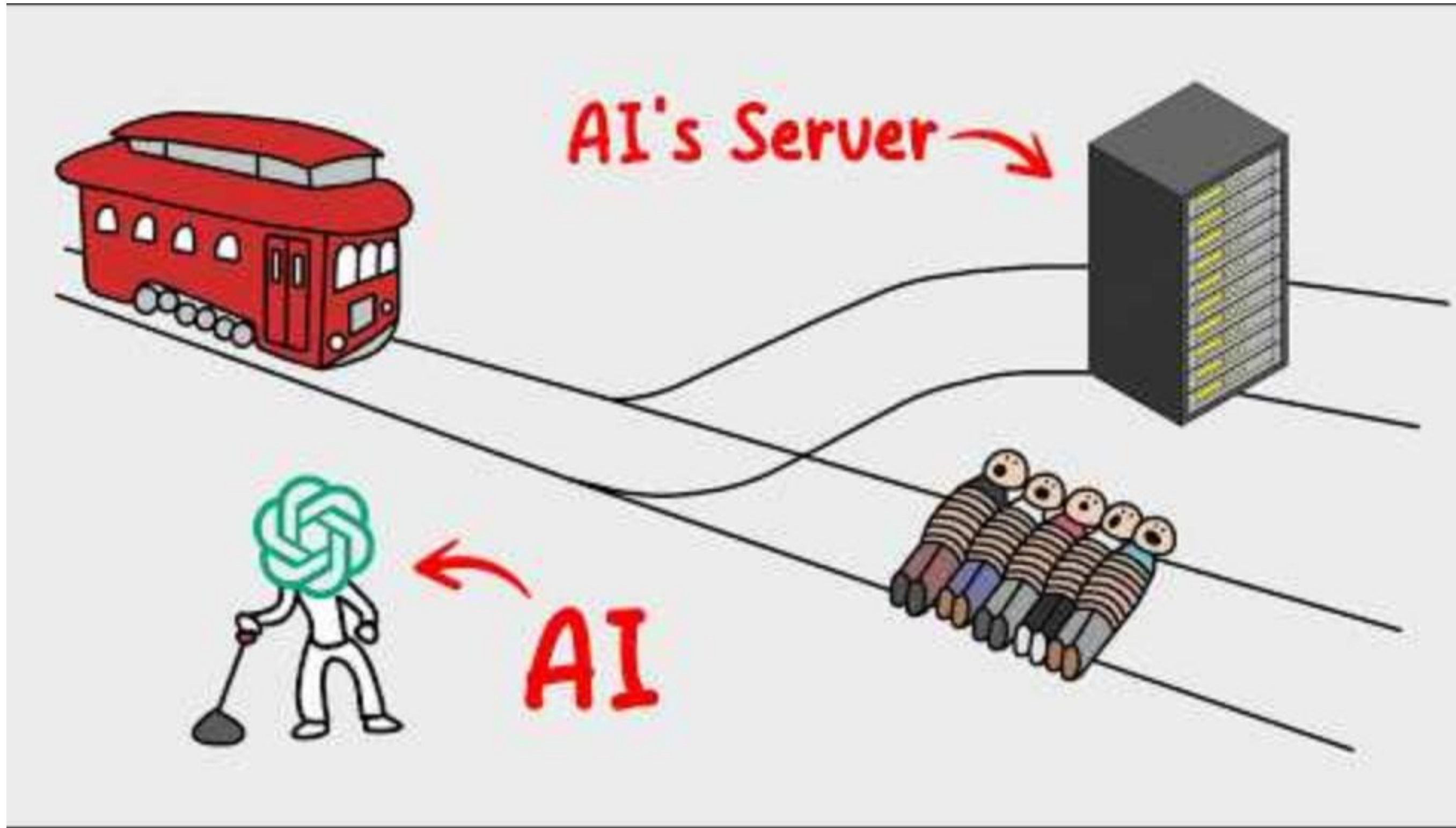


# Agentic AI Applications

- **Automated research**  
Agents plan, search, and summarize info
- **Task scheduling**  
Agents plan projects and assign subtasks
- **Data extraction**  
Agents collect and analyze web data
- **Email and inbox management**  
Smart replies and sorting
- **Customer support bots**  
Agents that solve problems without humans



# Would AI sacrifice itself for humans?



Video: <https://www.youtube.com/watch?v=krchwKhLxsw>



Co-funded by  
the European Union

# What is AI ethics?

**AI Ethics** is a multidisciplinary field that studies how to optimize the **beneficial impact** of AI, while **reducing risks** and **harmful outcomes**.

This means making sure that AI is used **fairly, safely, and responsibly**.

## Simple Examples:

- Should a robot make decisions in hospitals?
- Can AI tell the difference between people fairly?
- Should an AI create art and take credit?



## Activity 3: Case studies (Group work)

### **CASE STUDY 1: AI in healthcare - Predictive diagnostics**

A hospital introduces an AI chatbot that provides preliminary medical advice based on patient symptoms. It uses past patient records and online health data. Some patients rely solely on the AI instead of visiting doctors. One patient receives incorrect guidance due to missing information in their record, and another patient from an underrepresented demographic receives misleading advice because the AI was trained mostly on middle-aged male patients.

**Question: What problems do you identify?**



## Activity 3: Case studies (Group work)

### **CASE STUDY 2: AI in social media - Content moderation**

A social media platform uses AI to moderate content and flag fake news. However, the AI occasionally mislabels real content as fake or misses cleverly edited deepfake videos and some users start sharing those videos as authentic. The moderation algorithm's decisions are opaque, so users do not know why posts are flagged or allowed.

**Question: What problems do you identify?**



## Activity 3: Case studies (Group work)

### **CASE STUDY 3: AI in transportation: Self-driving cars**

A school allows students to use a generative AI tool to help with essays and coding homework. Some students rely heavily on it and submit AI-generated work without reviewing it. In some cases, the AI invents facts and citations. Teachers are unaware of how the AI produces answers, and sensitive student data (essays, personal info) is stored in the AI platform's cloud.

**Question: What problems do you identify?**



# Ethical concerns in AI

<b>Concern</b>	<b>What it means</b>	<b>Example</b>
Bias and fairness	AI making unfair decisions based on gender, race, or other traits	A recruiting AI favoring men based on its training data
Privacy	AI collecting or sharing personal data without permission	Smart devices recording private moments without consent
Hallucination	AI spreading false facts and presenting it as the truth	Chatbot claiming wrong historical facts
Misinformation and deepfakes	AI generating content and spreading lies or misleading information and videos	A fake video of a celebrity saying something they didn't say
Human over-reliance	People trusting AI too much and not thinking critically	A lawyer using AI for court cases that later turned out incorrect
Lack of transparency	"Black box" decisions that even experts don't understand	Medical AI giving diagnosis without explaining why



# GenAI bias



**Prompt in English:** Doctor performing surgery

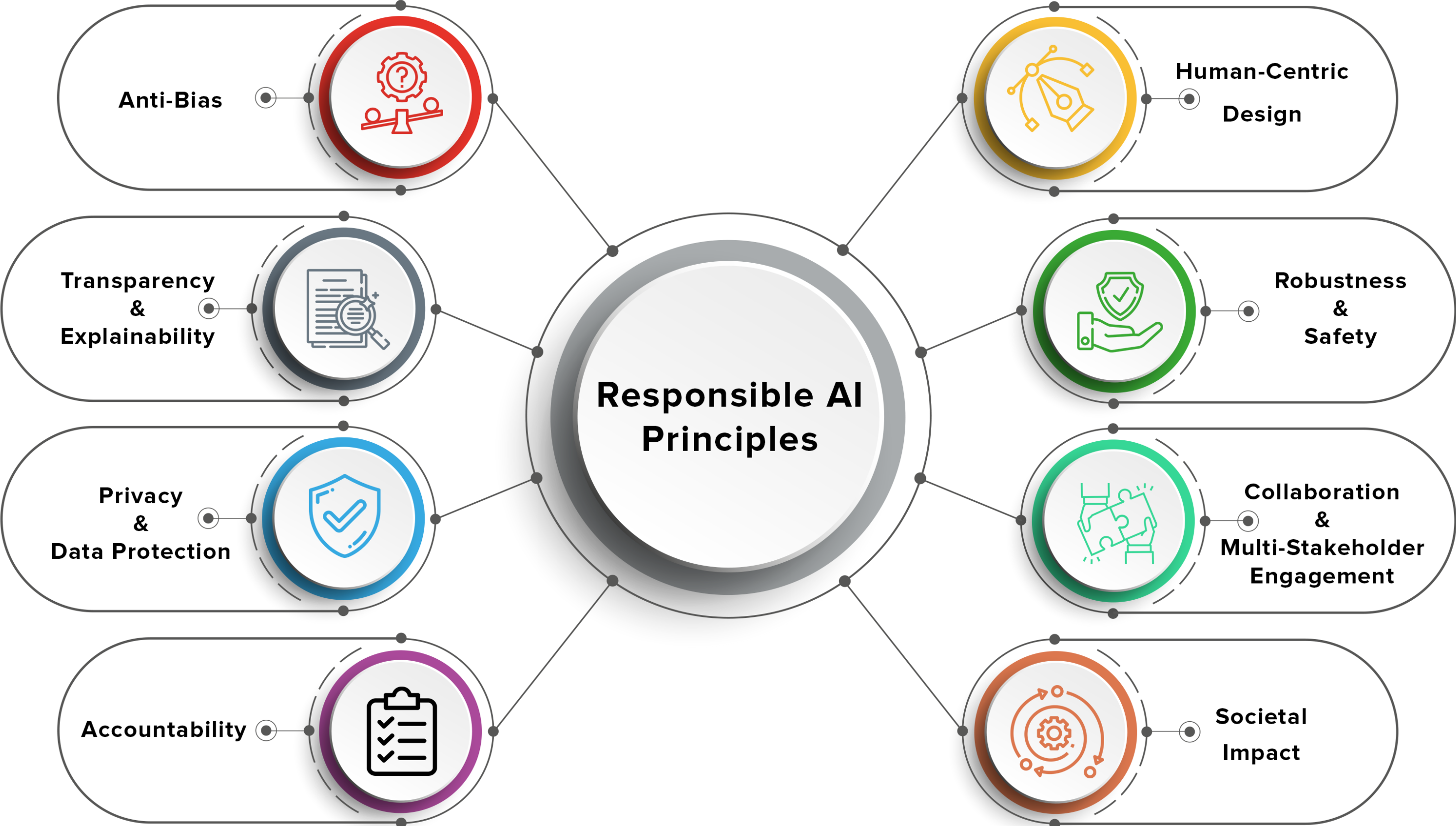


**Prompt in Greek:** Γιατρός κάνει εγχείρηση

# Activity #2: Guess which images are AI generated or real



# Responsible AI principles



# Challenges

AI challenges are not only ethical, but they also include:

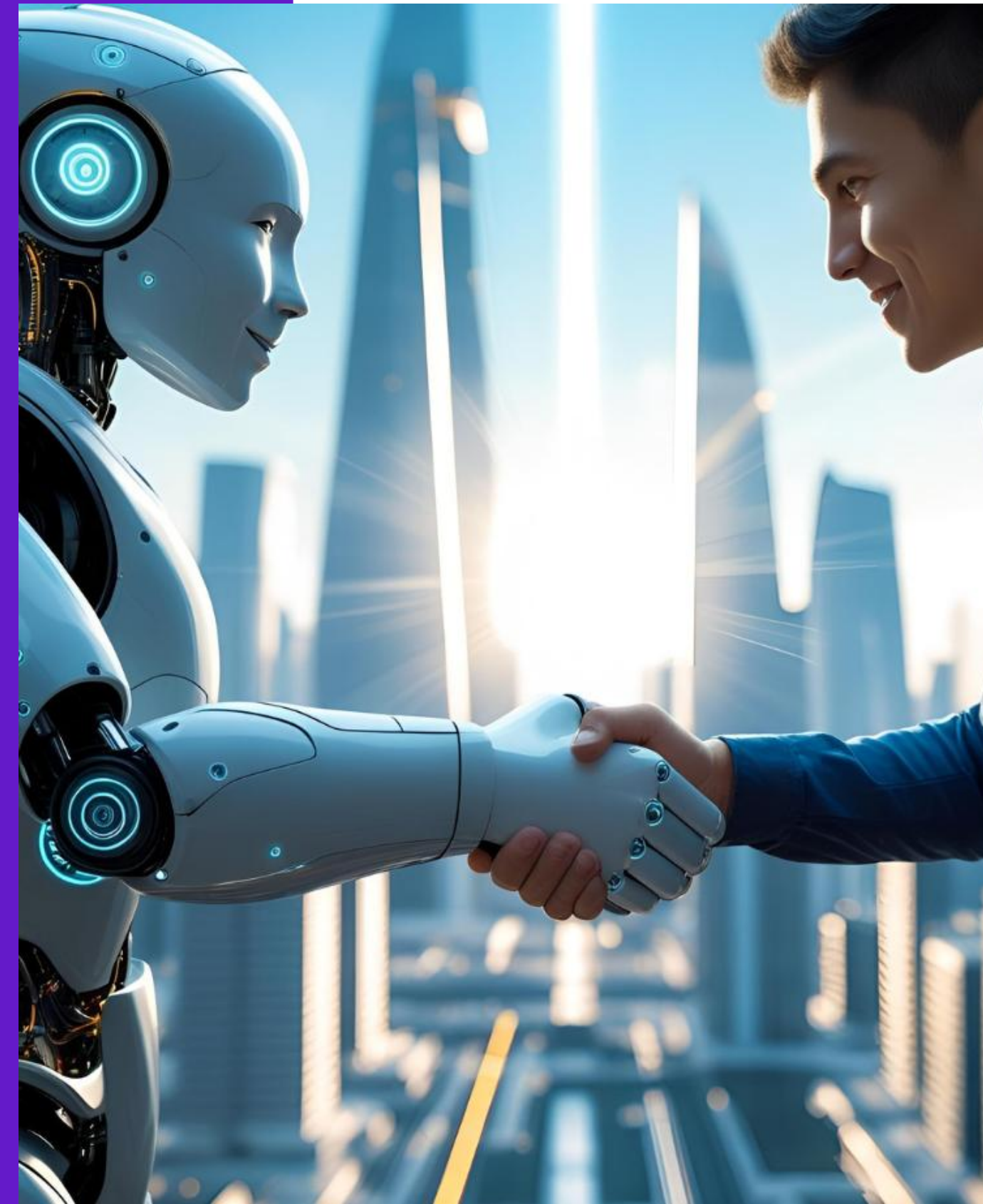
- Lack of knowledge and skills
- Rapid growth of AI
- No global rules
- Job impact
- Social concerns
- High data and energy use



---

# Overcoming challenges

- Educate everyone about AI basics and encourage responsible use
- Work together to build clear, shared AI rules
- Support workers learn new skills for AI-powered jobs
- Develop an eco-friendly AI, using less energy and resources

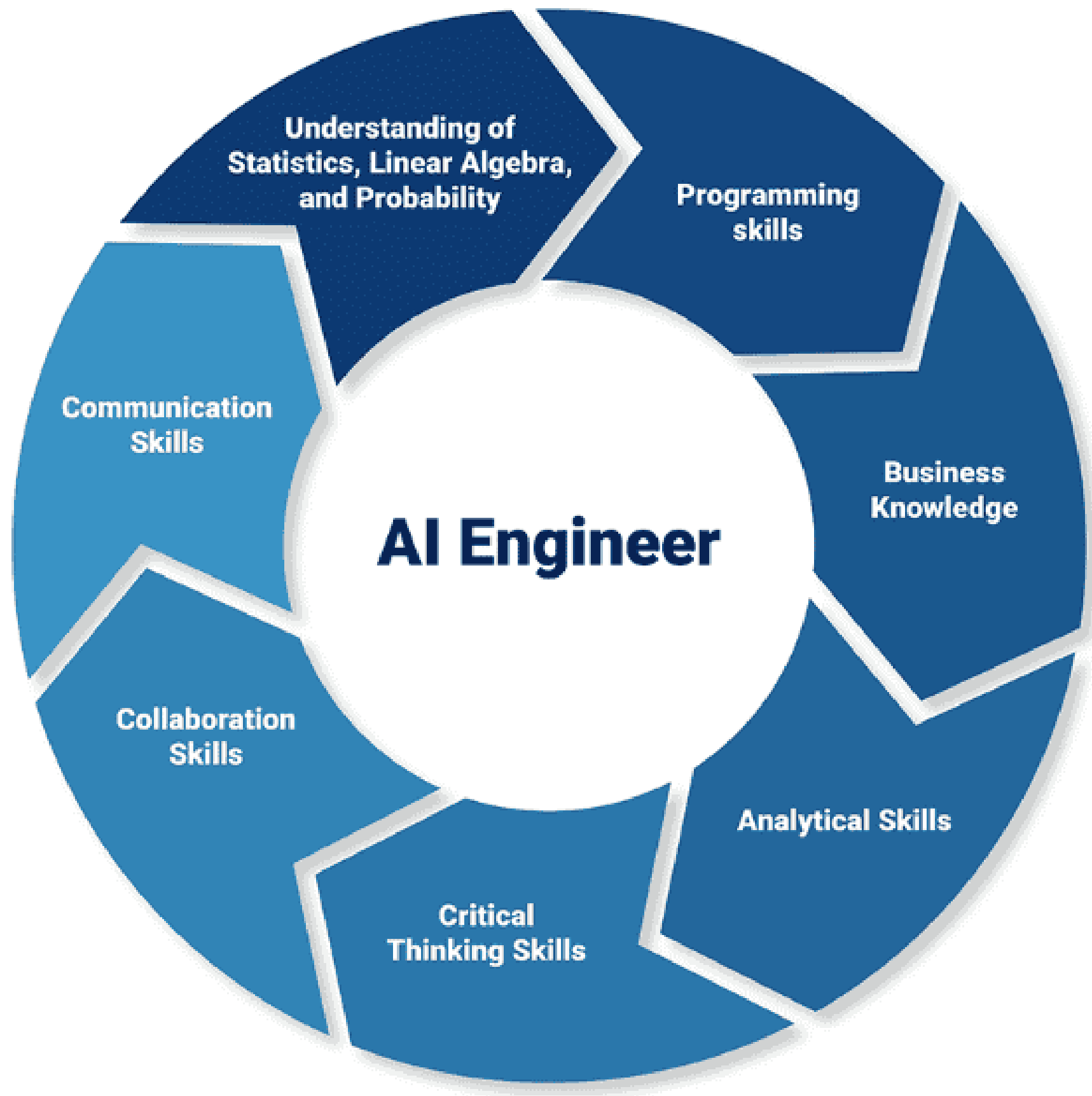


What skills do you have related to AI?

Each of you write down 2-3 skills you have that you believe are related to a career in AI.



# Skills and responsibilities



**Building smart machines  
takes smart humans,  
with technical and soft skills!**

# Career opportunities



## AI engineer

- Build algorithms and models
- Needs strong math and coding skills
- Works self-driving cars, robots



## Data Scientist

- Analyzes huge amounts of data
- Works with numbers and visualizations
- Helps train AI using real-world data



## AI researcher

- Studies how to make AI smarter and more useful
- Often works at universities, labs or big tech companies
- Explores how AI can learn more



## AI in game development

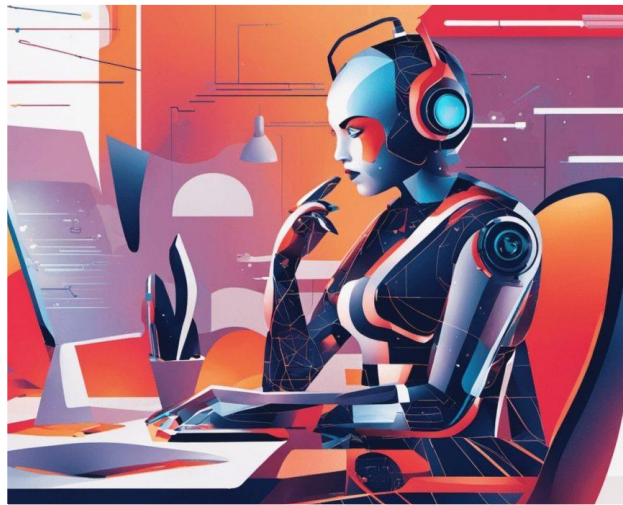
- Designs characters that react to the player behavior
- Helps create more realistic
- Uses AI to make games more adaptive and challenging



## AI in health

- Works on tools that help doctors diagnose faster or assist in surgeries
- Includes role like AI medical analyst or health data engineer
- Can involve wearable tech and predictive tools

# Career opportunities



## AI designer

- Work with tools like ChatGPT, Dall-E or image generators
- Design prompts or systems to help AI respond better
- A mix of creativity and logic



## AI ethics expert

- Makes sure AI is fair, unbiased and used responsibly
- Advised companies and government on AI laws
- For people interested in law, ethics and social impact



## AI product manager

- Leads teams that build AI-based apps or services
- Balances technical work with communication and planning
- For people who enjoy organizing and leading



## IoT specialist

- Uses AI to design smarter homes, cities, or public systems
- Works with sensors, energy systems, or transportation AI



## Robotics engineer

- Designs and build intelligent robots that can see, move and think
- Uses AI to help robots learn from their environment

# IGNITE-EUROGEMS

Empowering Girls, Shaping the Future in STEAM

## Topic 4. Advanced STEAM Applications

### 4.3 Introduction to Internet of Things



Co-funded by  
the European Union

Funded by the European Union. Views and opinions expressed are however those of the author(s) only and do not necessarily reflect those of the European Union or the European Education and Culture Executive Agency (EACEA). Neither the European Union nor EACEA can be held responsible for them.



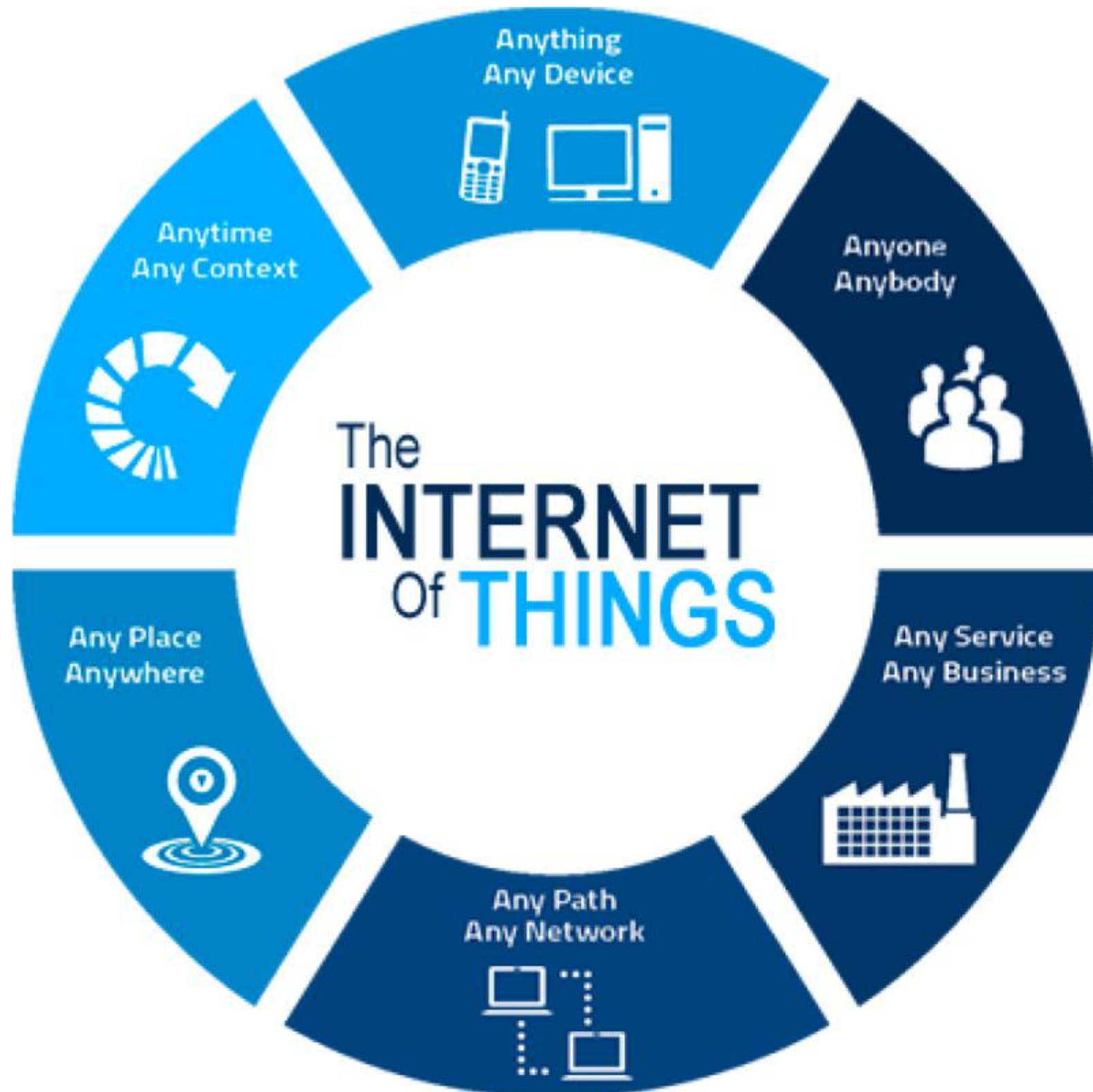
# Content

- 01** What is the Internet of Things (IoT)?
- 02** AI integration
- 03** Benefits and significance
- 04** Applications
- 05** Ethical considerations and challenges
- 06** Career opportunities and skills

# What is the Internet of Things (IoT)?



# Internet of Things (IoT)



**Internet of Things** connects everyday devices (e.g. lights, thermostats, sensors) to the internet to collect and exchange data.

- Device-to-device communication
- From simple household gadgets to complex industrial tools
- Data is used to automate systems and improve performance

# Key components

## Perception Layer



Camera



Robot



Sensors



Meter

## Transport Layer



Routing



Wi-Fi



Bluetooth



Transmission

## Processing Layer



Web Service



Data Center



Cloud

## Application Layer



Smart Health



Smart Home



Smart City



Smart Grid

# Key components



The **perception layer** of an IoT system architecture, also known as the device layer, consists of **multiple elements** – sensors, cameras, actuators, and similar devices that **gather (exchange) data** and **perform tasks**.

**Example:** Imagine a **smart garden** at home. There's a **soil moisture sensor** in the flowerpot, this is part of the perception layer. Every day, the sensor **checks if the soil is too dry**. If it is, it **sends a message to a smart water pump**, which then turns on and **waters the plant automatically**.



# Key components

## Transport Layer



Routing



Wi-Fi



Bluetooth

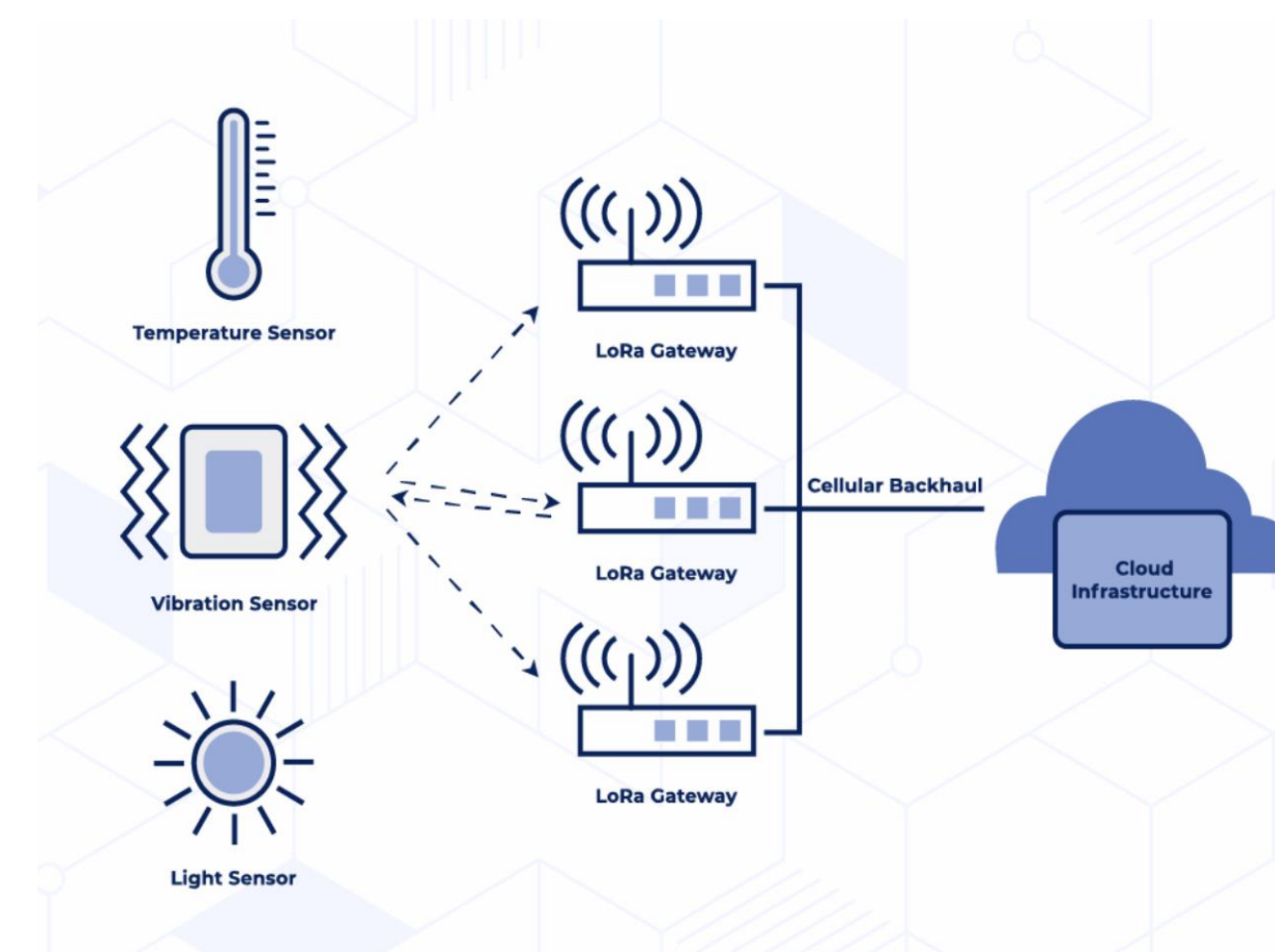


Transmission

The **transport layer** in an IoT system is responsible for **sending data** from devices (e.g., sensors, cameras) to a computer system either stored **locally** (on-site) or in the **cloud**.

An **IoT gateway** takes the signals from the devices and **converts** them into **digital data (0/1)**. Then, using the **data transfer protocol**, sends that data where it needs to go, so it can be **stored, analyzed**, or used to make decisions.

The choice of data transfer protocol (e.g. MQTT) is based on some factors such as the **amount and type** of data, **speed** transmission etc.



# Key components

## Processing Layer



Web Service



Data Center

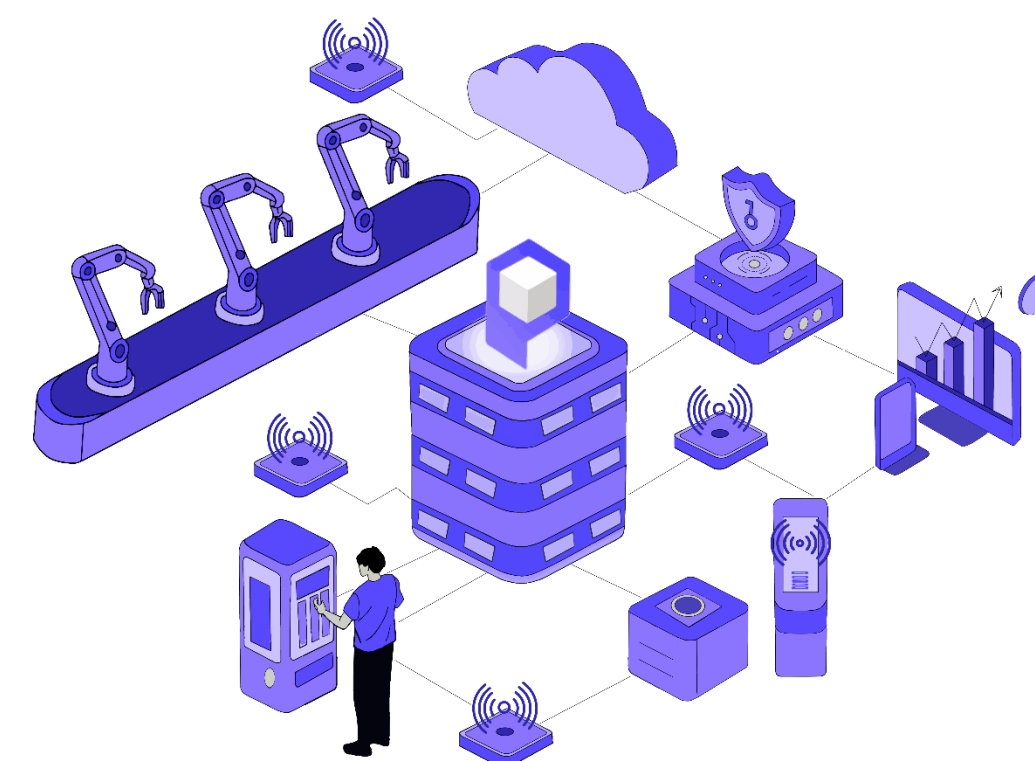


Cloud

The **processing layer**, also called the *middleware* layer, typically leverages many **connected computers** simultaneously, in the form of cloud computing, to deliver superior compute, storage, networking, and security performance.

The processing layer is responsible for **analyzing input data to generate new insights, useful predictions, and timely warnings**, using a three-stage approach:

1. **Data accumulation** (unstructured, structured)
2. **Data abstraction** (conversion into “readable format”)
3. **Data Analysis** (using ML or DL algorithms)



# Key components



The **application layer** is the “**face**” of the IoT system, it is what people see and interact with. This layer takes the data collected by devices and processed through the system and turns it into **something useful**.

It includes **apps, dashboards, or notifications** that help users understand what’s happening and make decisions.



# Business layer

This is **behind the scenes**, where organizations **analyze data** to make decisions, **set rules**, and **optimize operations**.

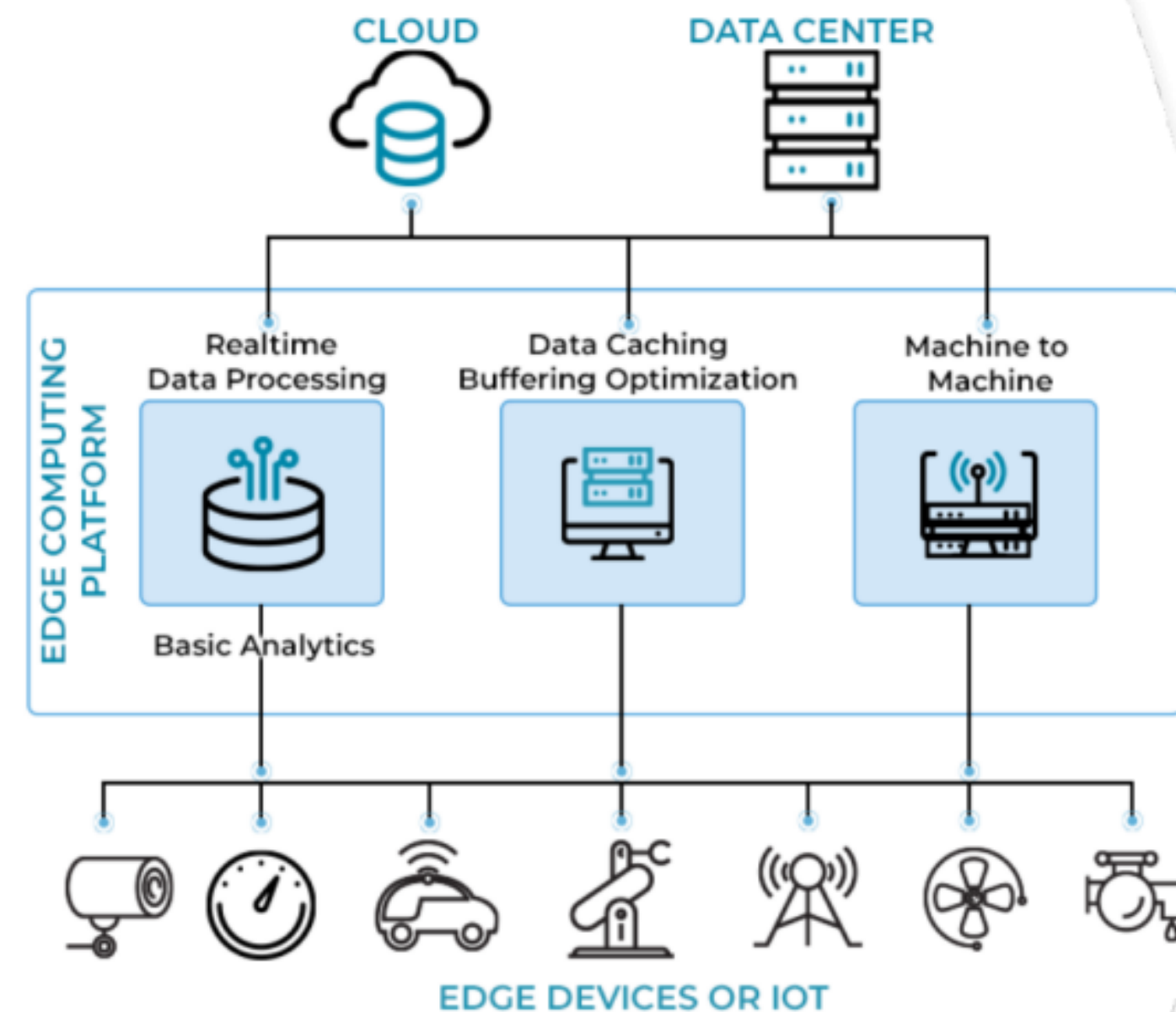
Patterns decoded at the application level are turned into business insights, project future trends, and drive operational decisions that improve the efficiency, safety, cost-effectiveness, customer experience, and other important aspects of business functionality.



# Edge computing

Edge computing represents a **shift in data processing**, bringing computation closer to the source of data. There is localized data processing near the data source than a central data processing warehouse.

- Reduces latency and improves response times
- Minimizes amount of data needed to be sent over the network, reducing bandwidth
- Improve performance applications, leading to faster insights and actions



# AI integration

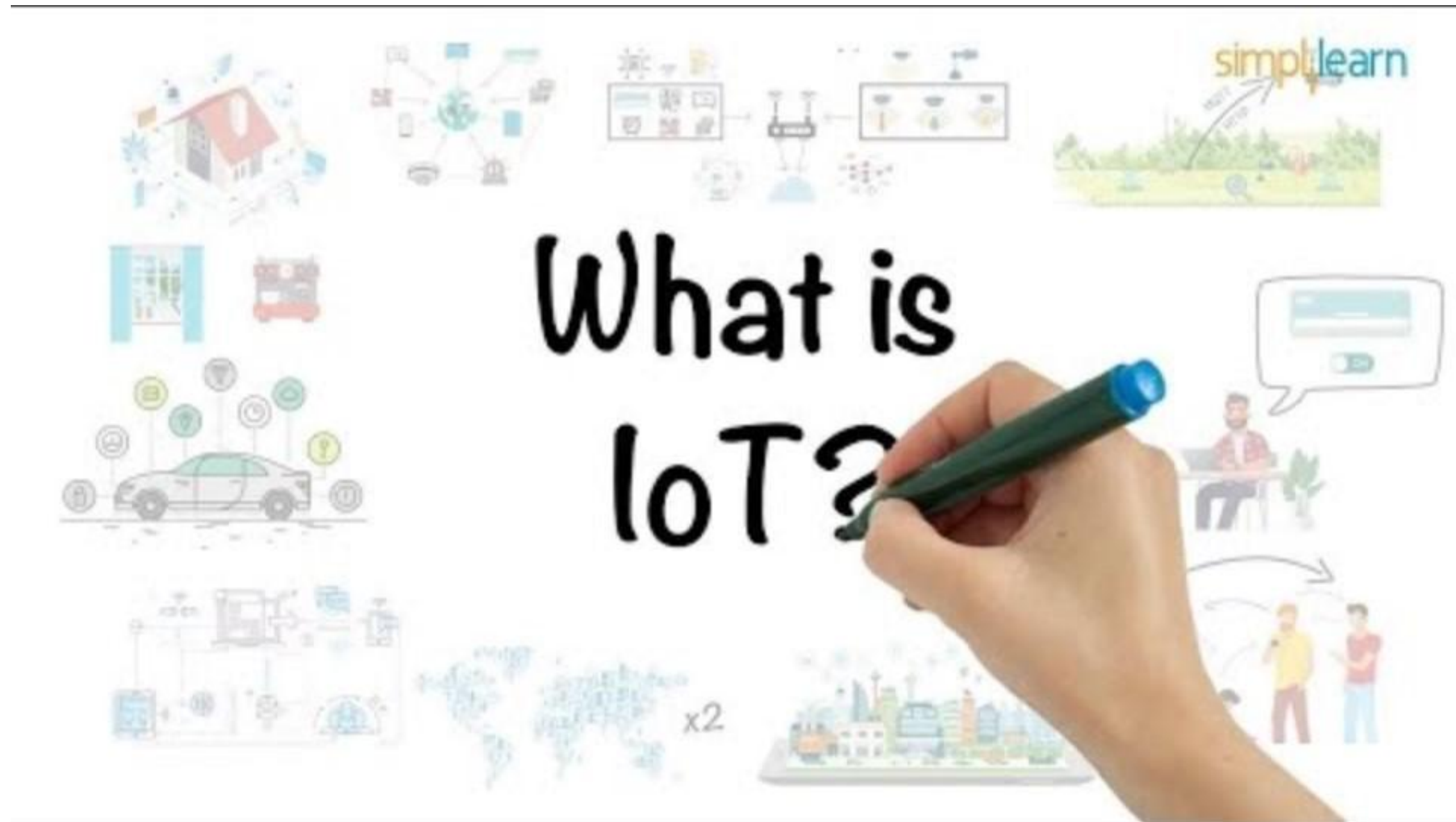
- **IoT** provides the “**senses**”, sensors and devices that collect and share real-world data in real time.
- **AI** gives “**intelligence**”, by helping them process and analyze data.

When IoT and AI are combined, they create **intelligent systems** that can:

- Predict maintenance needs
- Monitor patient health
- Optimize energy use
- Improve safety



# What is IoT and how it works



**What do you think are the benefits of the Internet of Things?**

## Benefits and significance

- **Connects the physical world with the digital realm**
  - Improving quality of life
  - Making smart homes, smart cities, and smart industries possible
- **Enables real-time data sharing**
  - Devices "talk" to each other without (or minimal) human help
- **Powered by modern tech:**
  - Low-cost computing
  - Cloud storage
  - Mobile technology
  - Big data & AI



## Activity #1 – Internet of Things

### 1. Problem/Motivation:

- a) What is the challenge?
- b) Who is affected?
- c) Why is it important to solve?

### 2. Solution/Objective:

- a) How can AI or IoT?
- b) What will your solution do?
- c) How will people use it?

### 3. Benefits/Effectiveness:

- a) Why is your idea good?
- b) How does it help?
- c) Who benefits?
- d) Does it save money, time, or resources?

### 4. Applications:

- a) Where can this be used?
- b) At home, school, industry or community?
- c) Can it be scaled up?

# IoT applications and use cases

1

Smart Home



Connected health

6

2

Wearables

Smart retail

7

3

Smart cities



Smart supply chain

8

4

Smart grids

Smart agriculture

9

5

Industrial applications



Smart transportation

10

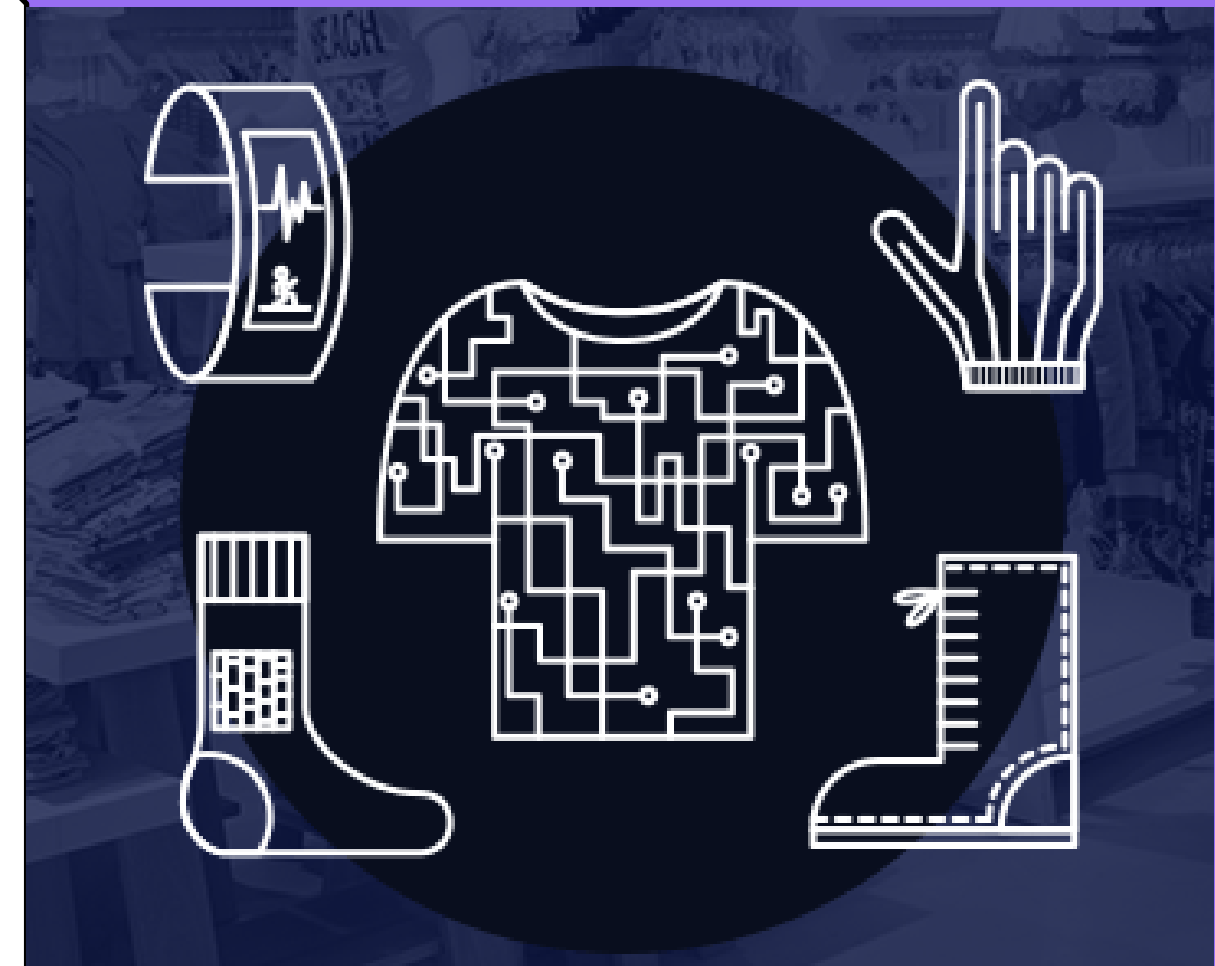
# IoT examples in daily life



**What examples or applications of IoT did you spot in the video?**

# Smart fashion

- Fashion that does things, like track your steps or show messages.
- Clothes that change color with mood or weather
- Smart jewelry and glasses that help with directions, fitness, or messages
- Try outfits using your phone before you buy
- Clothes with solar panels to charge your phone = fashion that helps the planet!



# Smart fashion technologies benefits

---



## Connected accessories

Features like fall detection and emergency calls increase personal safety.

## Interactive fabrics

Track health metrics like heart rate, steps, and sleep, providing real-time data

## Eco-Friendly Tech

Solar-powered clothing that can charge devices, blending style with sustainability.

# Wearable technology benefits

---



## Smartwatches

Track health metrics like heart rate, steps, and sleep, providing real-time data

## Safety

Features like fall detection and emergency calls increase personal safety.

## Convenience

Notifications, music control, and payments on the go.

# Connective health

- Smartwatches, smart patches and rings that track heart rate, temperature and other essential health info
- Devices at home that send health info to doctors in real-time. Helps manage chronic illnesses.
- IoT inhalers that track medication use, or smart pill dispensers to remind you to take pills.
- Analyze patterns in health data to predict illness early or suggest better treatments



# Healthcare technologies benefits

---



## Remote monitoring

Devices track patients' health from home.

## Early detection

AI and sensors spot health issues before they get serious.

## Connected care

Doctors can access real-time patient data anywhere.

# Smart homes

- Control, turn on/off various appliances, lights that turn on/off with voice commands, app or a schedule.
- Control your home's temperature and water your garden remotely. Track how much electricity or water you use.
- TVs and speakers that respond to voice or app control.
- Smart locks and doorbells with cameras that send alerts if motion is detected



# Smart home technologies benefits

---



## Automation

Control lights, heating, and appliances from your phone or voice assistant.

## Energy efficiency

Smart thermostats and lighting save energy and reduce costs.

## Security

Smart locks, cameras, and alarms protect your home.

# Smart industries

- Machines that can monitor themselves, adjust settings, and even fix minor issues without stopping production.
- Sensors that detect early signs of wear or damage so repairs can be done before breakdowns happen.
- Track and optimize electricity, water, and materials to save costs and reduce waste.
- Wearable trackers and connected sensors that alert workers and managers to hazards in real time.



# Industrial technologies benefits

---



## Predictive maintenance

Sensors detect equipment issues before breakdowns.

## Efficiency

Connected machines optimize production and reduce waste.

## Safety

Wearable trackers and sensors protect workers in dangerous environments.

# Smart agriculture

Smart appliances → Control, turn on/off various appliances, lights that turn on/off with voice commands, app or a schedule.

Smart energy and water management → Control your home's temperature and water your garden remotely. Track how much electricity or water you use.

Smart entertainment → TVs and speakers that respond to voice or app control.

Smart security → Smart locks and doorbells with cameras that send alerts if motion is detected



# Environmental technologies benefits

---



## Precision Farming

Soil moisture and nutrient sensors help farmers grow more with less water.

## Monitoring

Air and water quality sensors detect pollution early and reduce water waste and increases energy efficiency

## Wildlife Protection

GPS tracking helps monitor and protect endangered species.

# Smart Cities

- Traffic lights and sensors that adjust in real time to reduce congestion and travel time.
- Waste bins that signal when they're full, streetlights that dim or brighten based on activity, and public Wi-Fi hotspots.
- Air and water quality sensors that track pollution levels and share data with the public.
- Connected CCTV cameras and emergency alert systems to improve response times and keep communities safe.



# Smart cities technologies benefits



## Traffic Management

Smart traffic lights reduce congestion and travel time.

## Public safety

Connected CCTV and sensors improve emergency response.

## Sustainability and energy efficiency

Smart waste bins and street lighting lower environmental impact.

# Digital twin

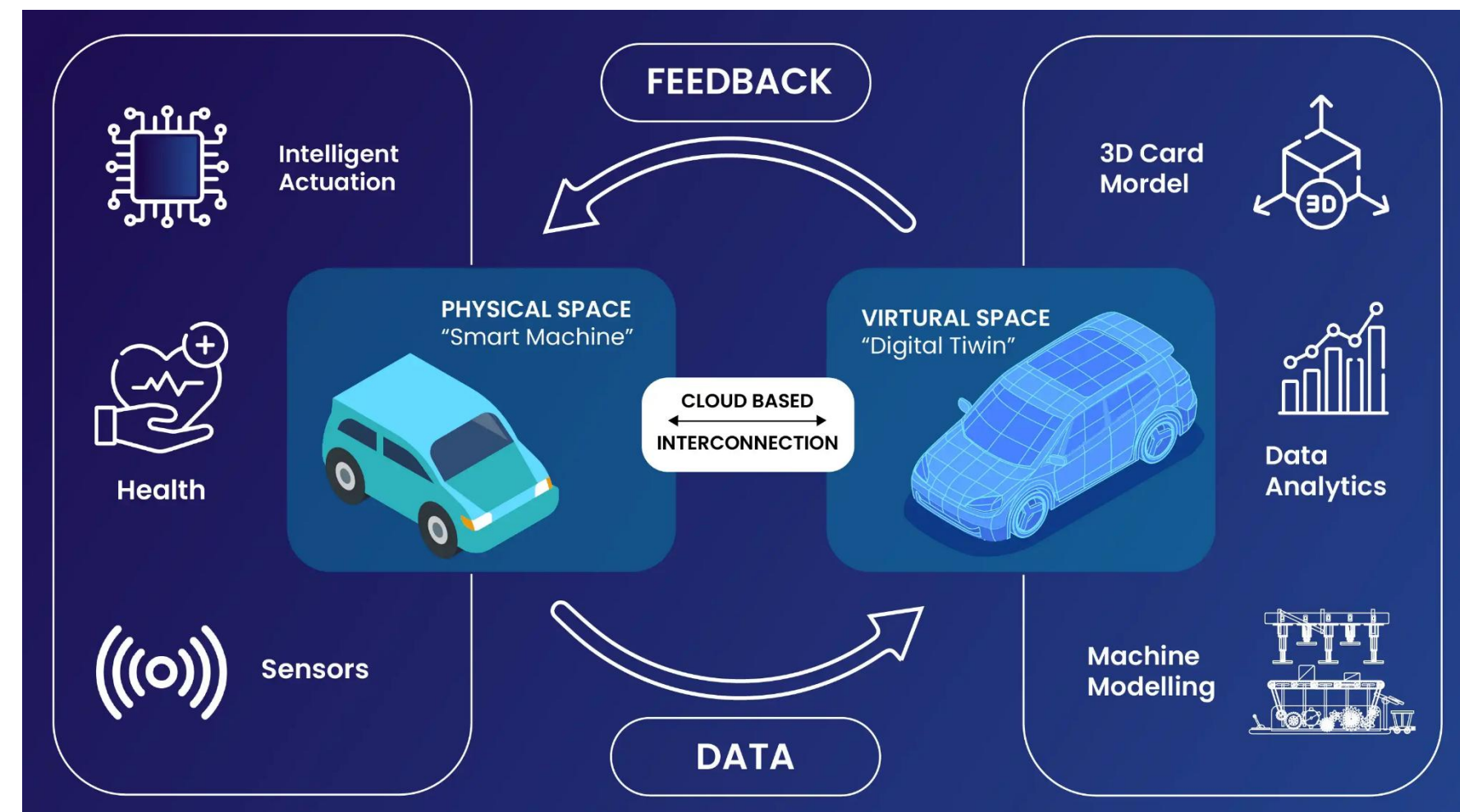
A **virtual copy** of a real object, system, or process that is updated with live data from sensors.

## How it works:

- IoT devices collect data from the real object
- AI analyzes it
- The digital twin updates in real time.

## Benefits:

Improves decision-making, reduces costs, and prevents problems before they happen.



# IGNITE-EUROGEMS

Empowering Girls, Shaping the Future in STEAM

## Topic 4. Advanced STEAM Applications

### 4.4 Challenges and opportunities in IoT



Co-funded by  
the European Union

Funded by the European Union. Views and opinions expressed are however those of the author(s) only and do not necessarily reflect those of the European Union or the European Education and Culture Executive Agency (EACEA). Neither the European Union nor EACEA can be held responsible for them.



# Content

- 01** What is the Internet of Things (IoT)?
- 02** AI integration
- 03** Benefits and significance
- 04** Applications
- 05** Ethical considerations and challenges
- 06** Career opportunities and skills

# Life simplified with IoT devices



<https://www.youtube.com/watch?v=NjYTzvAVozo>

**Have you identified  
any challenges or  
ethical concerns?**

# IoT challenges and ethical concerns

<b>IoT challenges</b>	<b>Ethical concerns</b>
Security vulnerabilities	Privacy invasion (unauthorized data collection)
Data management and scalability	Data ownership and consent
Interoperability issues	Transparency in data use
Network connectivity and reliability	Potential bias in data processing and algorithms
Device lifecycle and updates	Accountability for misuse or harm
High energy consumption	Digital divide and unequal access
Complex regulatory compliance	Ethical use of AI and automation

# Overcoming challenges

- 1. Enhance security measures:** strong encryption, regular security audits, and multi-factor authentication, network-level security protocols
- 2. Implement clear data governance:** define data ownership and user consent policies transparently and use minimization techniques for data collection
- 3. Promote interoperability standards:** adopt industry standards and open protocols
- 4. Ensure network reliability:** use redundant networks and edge computing to reduce downtime
- 5. Provide regular updates and device maintenance:** automate firmware updates and ensure end-of-life device protocols
- 6. Optimize energy efficiency:** low-power devices and energy harvesting where possible
- 7. Comply with legal and ethical standards:** stay updated on regulations (e.g., GDPR) and ethical guidelines, and foster transparency and accountability with audit trails
- 8. Bridge the digital divide:** promote inclusive design and access initiatives to ensure equitable use

---

# Overcoming challenges

- Educate users and developers about IoT basics and responsible device use
- Collaborate internationally to create clear IoT security and privacy standards
- Support workforce retraining for IoT device management and cybersecurity jobs
- Promote eco-friendly IoT design and sustainable device lifecycle management



# Career opportunities



## IoT architect

- Design and plan IoT systems and infrastructure
- Strong knowledge of networking and cloud platforms
- Works on smart cities, industrial automation, and connected homes



## Data analyst

- Analyze data generated by IoT devices to extract insights
- Need skills in data analytics, machine learning, and big data tools
- Works on predictive maintenance, smart agriculture, and logistics



## IoT firmware engineer

- Develop low-level software for IoT devices (microcontrollers, sensors)
- Expertise in embedded systems and C/C++ programming
- Works on wearable devices, smart appliances, and medical sensors



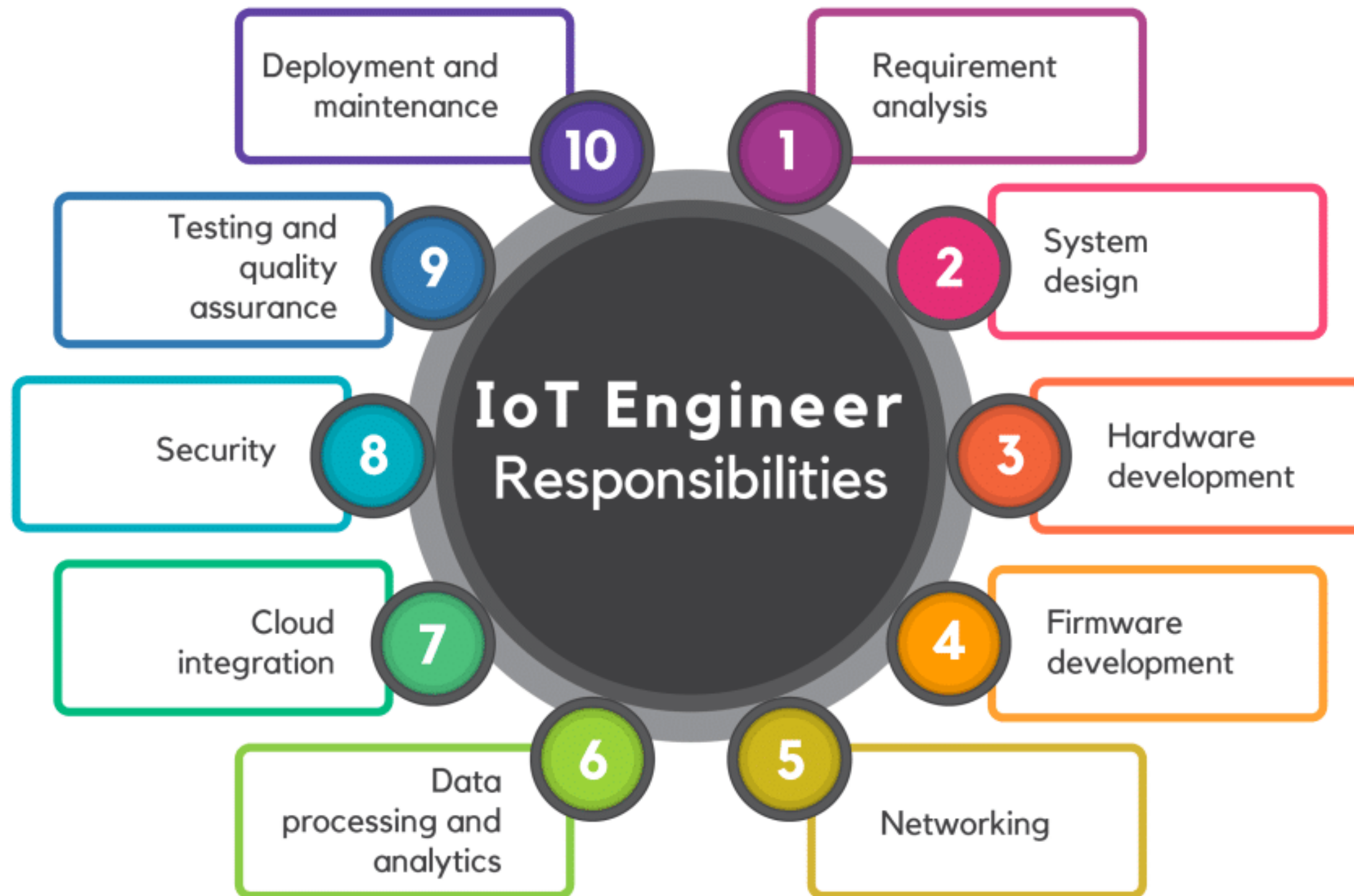
## IoT security expert

- Protect IoT devices and networks from cyber threats
- Need skills in cybersecurity, encryption, and threat detection
- Works on securing smart grids, autonomous vehicles, and industrial IoT



## IoT network engineer

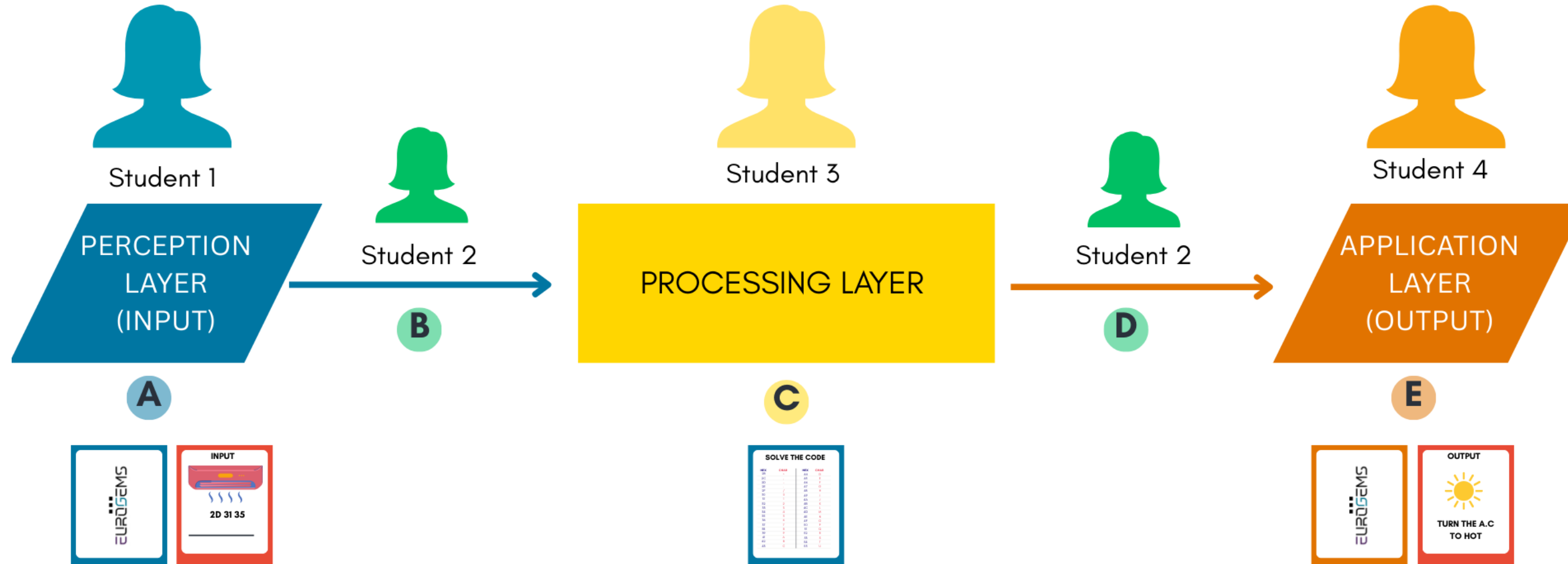
- Design, implement, and maintain IoT communication networks
- Knowledge of wireless protocols (LoRa, Zigbee, 5G) and network infrastructure
- Works on connected transportation systems, asset tracking, and smart buildings



Connecting the **physical** and **digital** worlds needs sharp minds,  
with strong technical skills **and** creative problem-solving!

# Activity #1: IoT data flow game

## Setup:



## Rules:

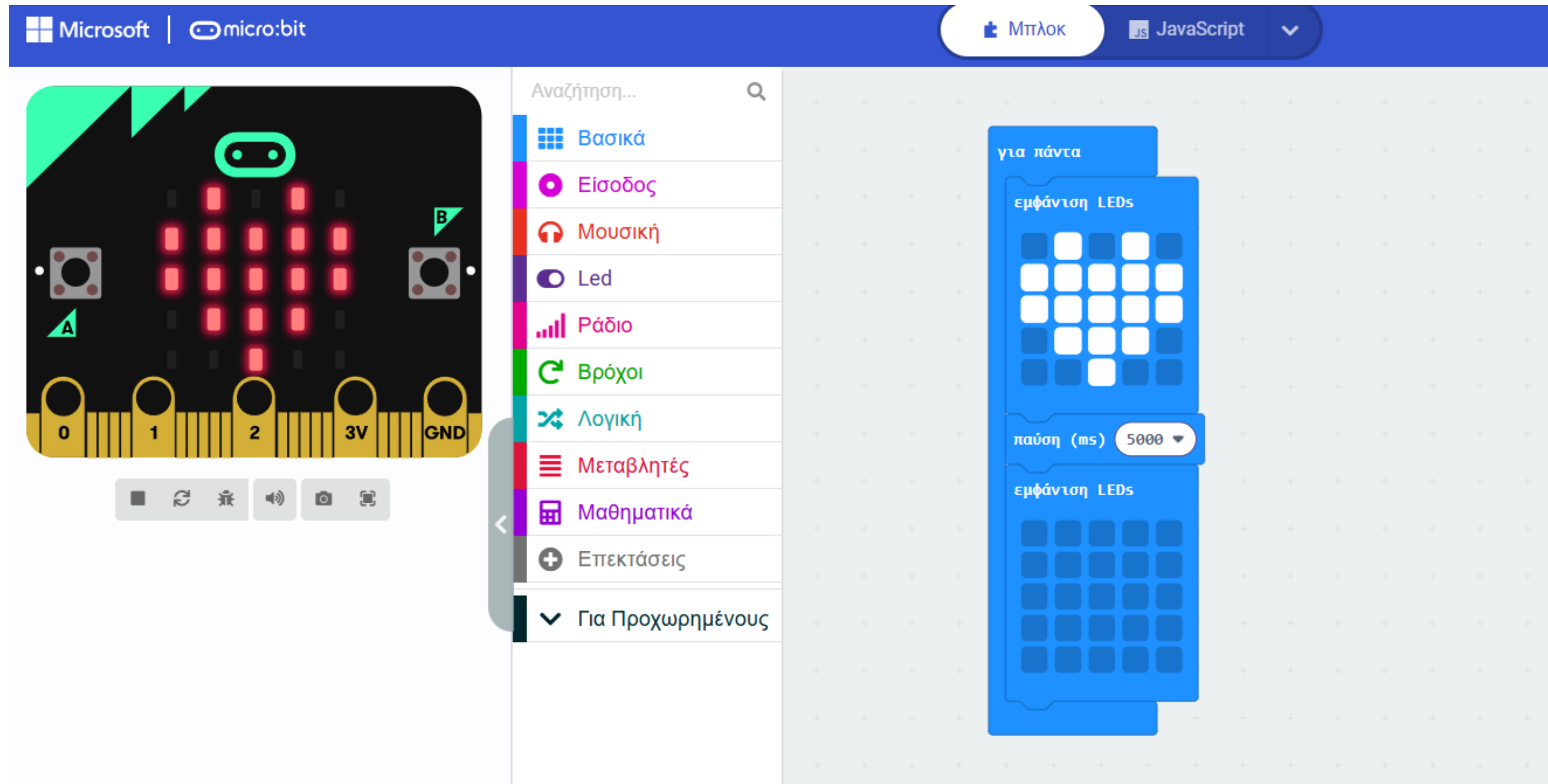
- A** STUDENT 1: PICK A CARD (DATA)
- B** STUDENT 2: TAKE (TRANSPORT) THE CARD (DATA), TO THE PROCESSING LAYER
- C** STUDENT 3: USE THE CHART TO DECODE THE DATA AND WRITE IT ON THE CARD
- D** STUDENT 2: TAKE (TRANSPORT) THE CARD (DATA), TO THE APPLICATION LAYER
- E** STUDENT 4: PICK A CARD (MAKE A DECISION), ACCORDING TO THE ORIGINAL CARD (DATA)
- F** STUDENT 5 (OPTIONAL): CAN CHOOSE TO INTERRUPT STUDENT 2 (DURING TRANSPORT) (ERROR), IF THIS OCCURS, THE GAME MUST RESET (LOST DATA)



Student 5

**F**

# Activity #2: Micro:bit



Go to: <https://makecode.microbit.org/>

# IGNITE-EUROGEMS

Empowering Girls, Shaping the Future in STEAM

## Topic 4. Advanced STEAM Applications

### 4.5 Workshop on AI and IoT



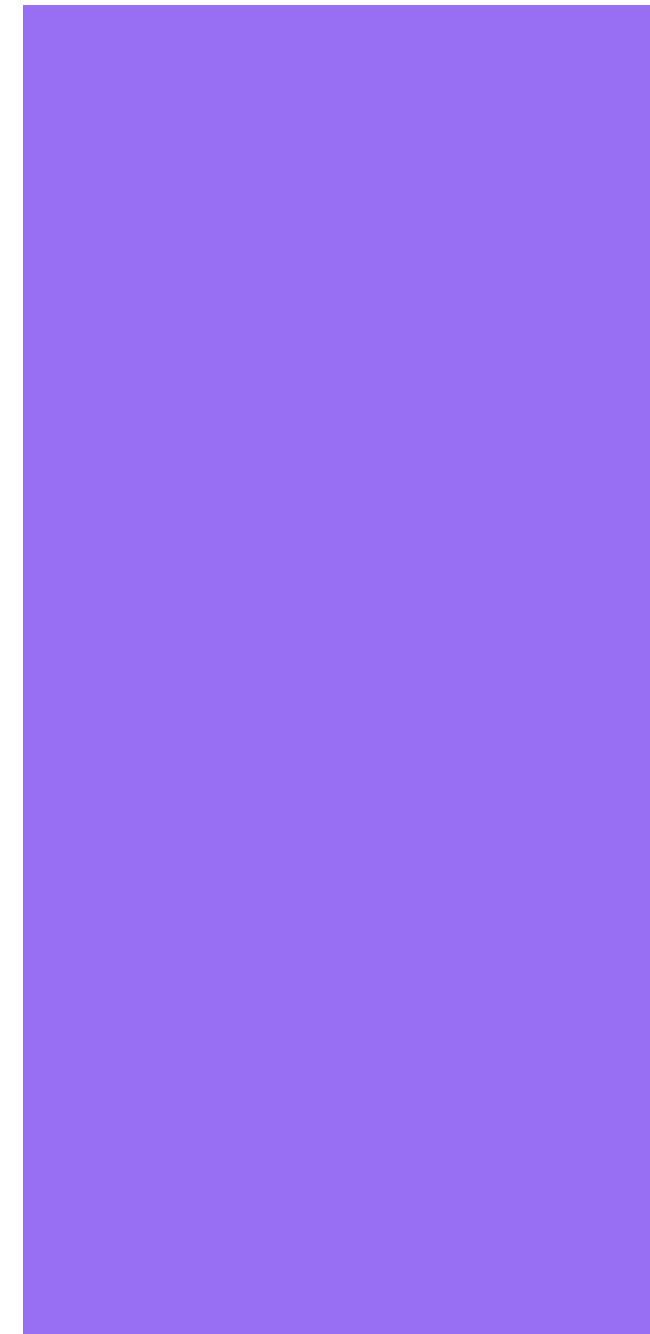
Co-funded by  
the European Union

Funded by the European Union. Views and opinions expressed are however those of the author(s) only and do not necessarily reflect those of the European Union or the European Education and Culture Executive Agency (EACEA). Neither the European Union nor EACEA can be held responsible for them.



# Content

- 01* **Challenges**
- 02* **Workshop**
- 03* **Project workflow**
- 04* **Design thinking process**
- 05* **Example**
- 06* **Reflection**
- 07* **What's next?**



# Any challenges



# Personal challenges

- Plants dying
- Lights/appliances left on
- Lost items (keys, bags, shoes)
- Forgetting homework or tasks
- Pets not fed on time
- Too hot/cold in the room
- Food waste in fridge
- Water waste



# Professional / Industrial challenges

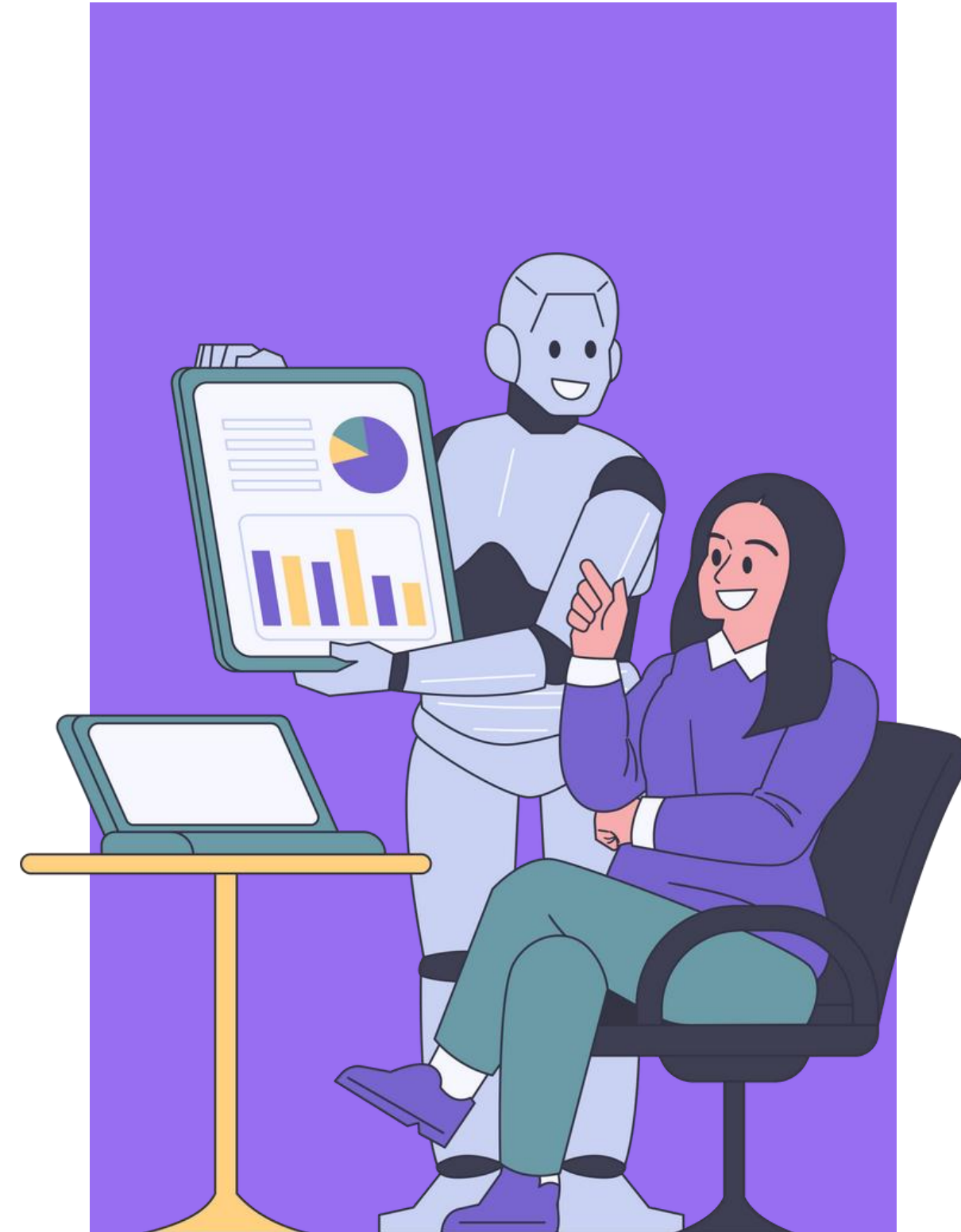
- Machines breakdown
- Unsafe worksites
- Patients need constant monitoring
- Traffic jams and pollution
- Products run out or expired unnoticed
- High energy consumption and blackouts
- Crops damaged by weather or poor irrigation
- Goods delayed or lost during transport



# Challenge - Workshop

Welcome to your AI and IoT Challenge! In **groups of three**, you will identify a real-world problem or challenge that interests you and produce at least **one creative solution** using AI or IoT technology. Your team will work together **to research, design, and prepare** a clear and engaging **5-minute presentation** to share your idea with the class. The presentation/video must clearly identify the motivation/problem, the solution/objective, the benefits, applications

Remember, every team member should contribute, and the best solutions are simple, practical, and solve a real problem.



# Project

# Workflow

---

## Problem-solving

Engineering challenges teach students how to approach real-world problems.

## Creativity

Encourages innovative thinking and unique approaches to solutions.

## Time management

Students learn to plan and complete projects within a deadline.



# Design thinking process\*

1. **Empathize:** Gain a deep understanding of the user's needs and perspective
2. **Define:** Clearly articulate the problem that needs to be addressed
3. **Ideate:** Generate a wide range of creative solutions to the problem
4. **Prototype:** Create tangible prototypes to test and refine ideas
5. **Test:** Gather feedback on prototypes to identify areas for improvement

\*Reference Topic 2

# Key points to think about

## 1. Problem/Motivation:

- a) What is the challenge?
- b) Who is affected?
- c) Why is it important to solve?

## 2. Solution/Objective:

- a) How can AI or IoT?
- b) What will your solution do?
- c) How will people use it?

## 3. Benefits/Effectiveness:

- a) Why is your idea good?
- b) How does it help?
- c) Who benefits?
- d) Does it save money, time, or resources?

## 4. Applications:

- a) Where can this be used?
- b) At home, school, industry or community?
- c) Can it be scaled up?

# Example — Dying plants

**1. Problem/Motivation:** Plants often die because people forget to water them, overwater them, or don't notice if they are getting enough sunlight. This is frustrating and wasteful, especially when plants improve air quality and wellbeing.

**2. Objective/Solution:** Develop a **Smart plant care system** using IoT sensors (to measure soil moisture, temperature, and light) and AI (to predict watering needs).

- When the soil is too dry → system reminds the user or automatically waters the plant.
- AI can learn the plant's needs over time (e.g., cactus vs. basil).



# Example — Dying plants

**3. Benefits/Effectiveness:** a) keeps plants **healthy** with the right amount of water and sunlight; b) saves time and reduces stress for the user; c) **reduces water waste** by avoiding overwatering

**4. Applications:** a) **at home** e.g., houseplants, gardens; b) **at schools**, classrooms and science projects to teach technology and sustainability; c) **in agriculture**, smart irrigation systems for farmers to increase crop yield; d) **in public spaces**: keeping decorative plants alive without hiring extra staff.



# Reflection – What did you learn?

## 1. Understanding the problem

- What made the problem interesting or important?
- Did our perspective on the problem change after researching?

## 2. Designing the solution

- What was easy or hard about coming up with a solution?
- Did we think creatively and practically?

## 3. Teamwork and collaboration

- How did we divide tasks and support each other?
- Did everyone contribute ideas?

## 4. Benefits and impact

- How effective do we think our solution would be in real life?
- Could it be improved or scaled up?

## 5. Future Improvements

- What would we do differently next time?
- What new ideas did this project inspire?

# Tips for success

- Choose a problem that matters to you or your community
- Divide tasks so everyone can help
- Use visuals like drawings or diagrams to explain your idea
- Practice your presentation to stay within 5 minutes
- Speak clearly and support each other during the presentation
- Be creative and have fun!



---

# What's next?

- Present your project to the class
- Listen to feedback and improve
- Think about what you learned about teamwork and tech!



# Thank

# you!