SCALE UP
community-driven
bioeconomy development

DIGITAL TECHNOLOGIES FOR UNLOCKING BIOMASS POTENTIAL: UNDERSTANDING THE INTEGRATION OF DIGITAL TECHNOLOGIES IN BIO-BASED PRODUCT DEVELOPMENT

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Digitalization

Digitalization in the context of bioeconomy involves the integration of digital tools and technologies to improve efficiency, monitor and control processes, and make data-driven decisions for bioeconomy development.

Digitalization

Digitalization in the bioeconomy contributes to increased efficiency, reduced environmental impact, and enhanced overall sustainability in biomass production.

Digitalization allows stakeholders to make informed decisions based on data insights, leading to better resource management and a more reliable and resilient biomass supply chain.

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10 digital tools
and technologies
for unlocking bioeconomy potential

Technologies

Space technologies

Space technologies are tools, systems, and applications developed for use in outer space or designed to explore and operate in the space environment.

Space technologies serve diverse purposes, including telecommunications, Earth observation, weather monitoring, navigation, scientific research, and space exploration.

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Technologies

Drones

Drones, also known as Unmanned Aerial Vehicles (UAVs) or Unmanned Aircraft Systems (UAS), are remotely piloted aircraft that can be operated without a human onboard.

These devices are typically controlled by a human operator using a remote control or, more commonly, by autonomous systems that follow pre-programmed flight paths or respond to real-time commands. Can be used for comercial, industrial and personal purposes.

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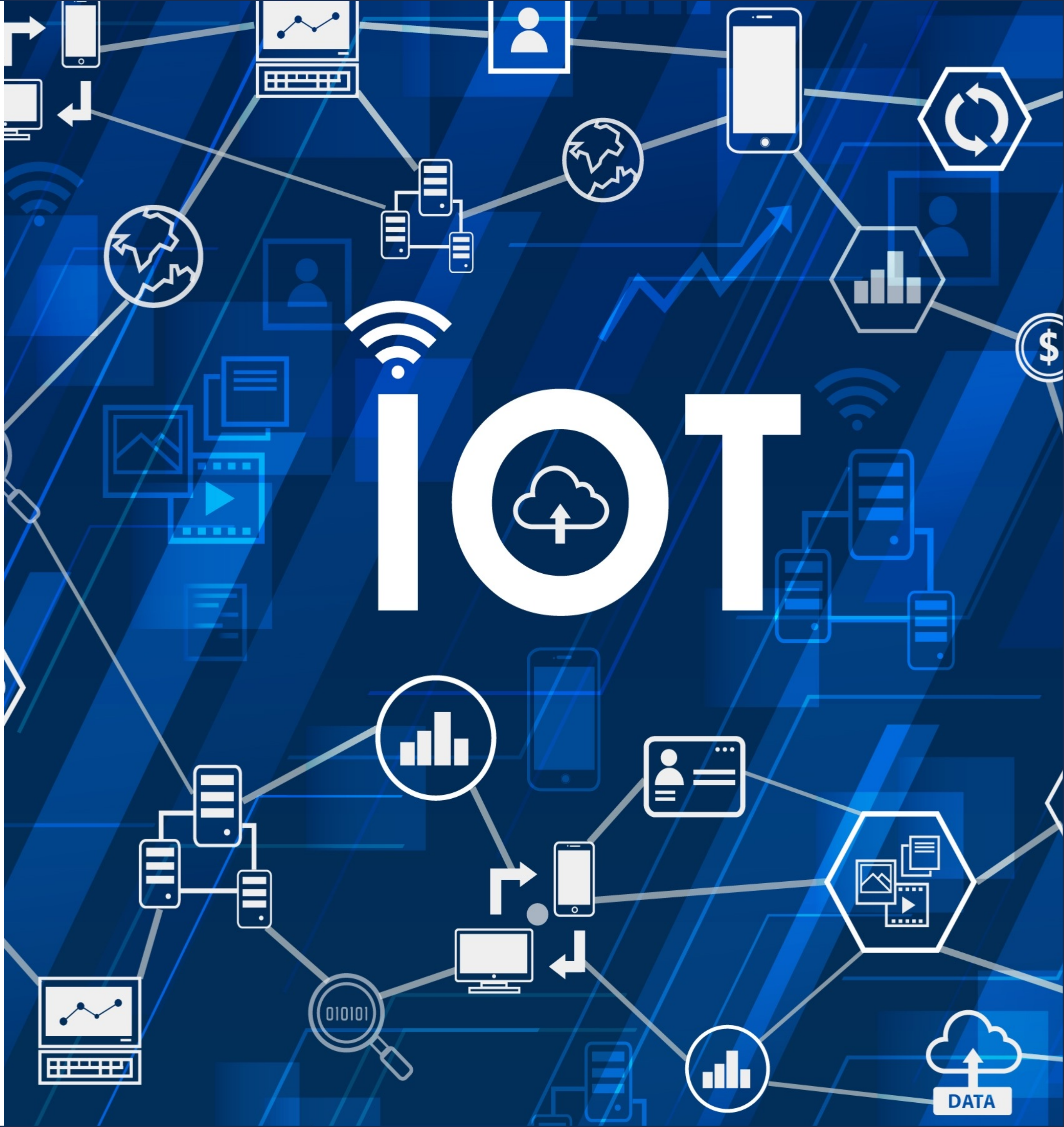
Technologies

Internet of Things (IoT)

IoT (Internet of Things) refers to a network of interconnected physical devices, vehicles, appliances, and other objects embedded with sensors, software, and network connectivity, allowing them to collect and exchange data.

They enable these devices to communicate with each other, analyze the data they gather, and make intelligent decisions, often without direct human intervention.



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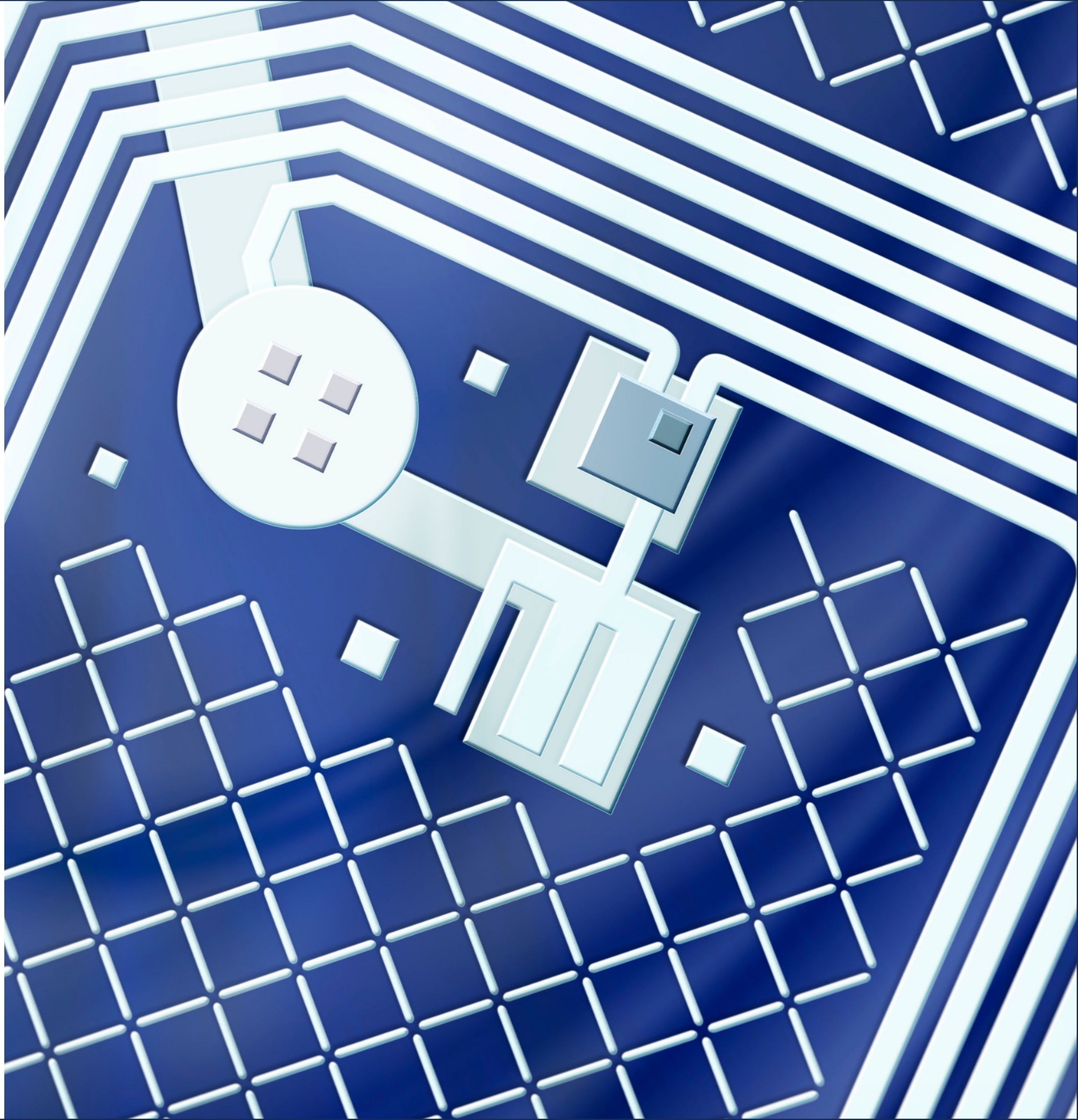
RFID

RFID

Radio-Frequency Identification (RFID) is a technology that uses radio waves to identify and track objects, people, or animals. RFID systems consist of tags containing electronically stored information and readers that communicate with the tags wirelessly.

RFID enables efficient and automated data capture, enhancing visibility, accuracy, and traceability throughout various processes

Applications of RFID technology include inventory management, supply chain tracking, access control systems, contactless payment cards, toll collection systems, and asset tracking in industries such as logistics, retail, healthcare, and transportation.



Technologies

NIRS

NIRS stands for Near-Infrared Spectroscopy and is a non-destructive analytical technique that uses the absorption of near-infrared light to analyze the composition of materials.

Near-infrared light has wavelengths ranging from about 700 to 2500 nanometers.

NIRS is widely used in various industries, including agriculture, food and beverage, pharmaceuticals, and environmental monitoring. It provides a rapid and non-destructive method for qualitative and quantitative analysis of a wide range of materials.

Screen: https://www.iris-eng.com/feed-analysis-nir-spectroscopy/

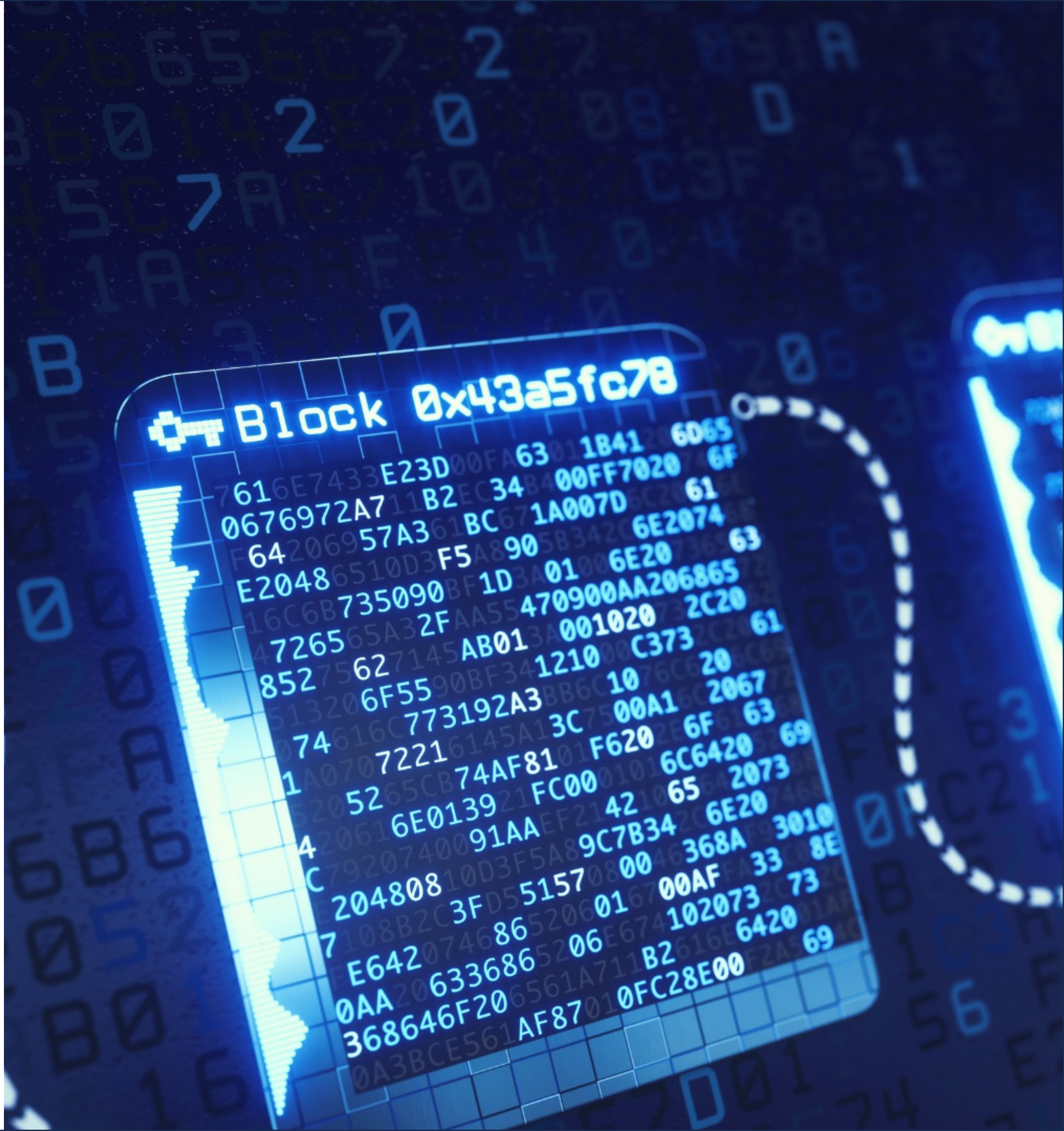
Technologies

Blockchain

Blockchain is a decentralized and distributed ledger technology that enables secure, transparent, and tamper-resistant record-keeping of transactions across a network of computers. In simpler terms, it is a chain of blocks, where each block contains a list of transactions.

Once a block is completed, it is linked to the previous block, forming a chronological chain. Each participant in the network has a copy of the entire blockchain, making it highly resistant to fraud or data manipulation.

Its adoption should be carefully considered based on the specific needs and requirements of a given application or industry.



Technologies

Robotics

Robots are autonomous or semi-autonomous machines capable of performing tasks in the physical world. They can be programmed to execute specific actions, often with the ability to sense and interact with their environment.

Robots represent interdisciplinary field of study and engineering that involves the design, construction, operation, and use of robots. They can be programmed to execute specific actions, often with the ability to sense and interact with their environment.

Technologies

Cloud

The term *"cloud"* refers to a network of remote servers connected over the internet, collectively providing computing resources and services. Cloud computing involves the delivery of on-demand computing services, including storage, processing power, and applications, without the need for direct management or physical proximity to the hardware.

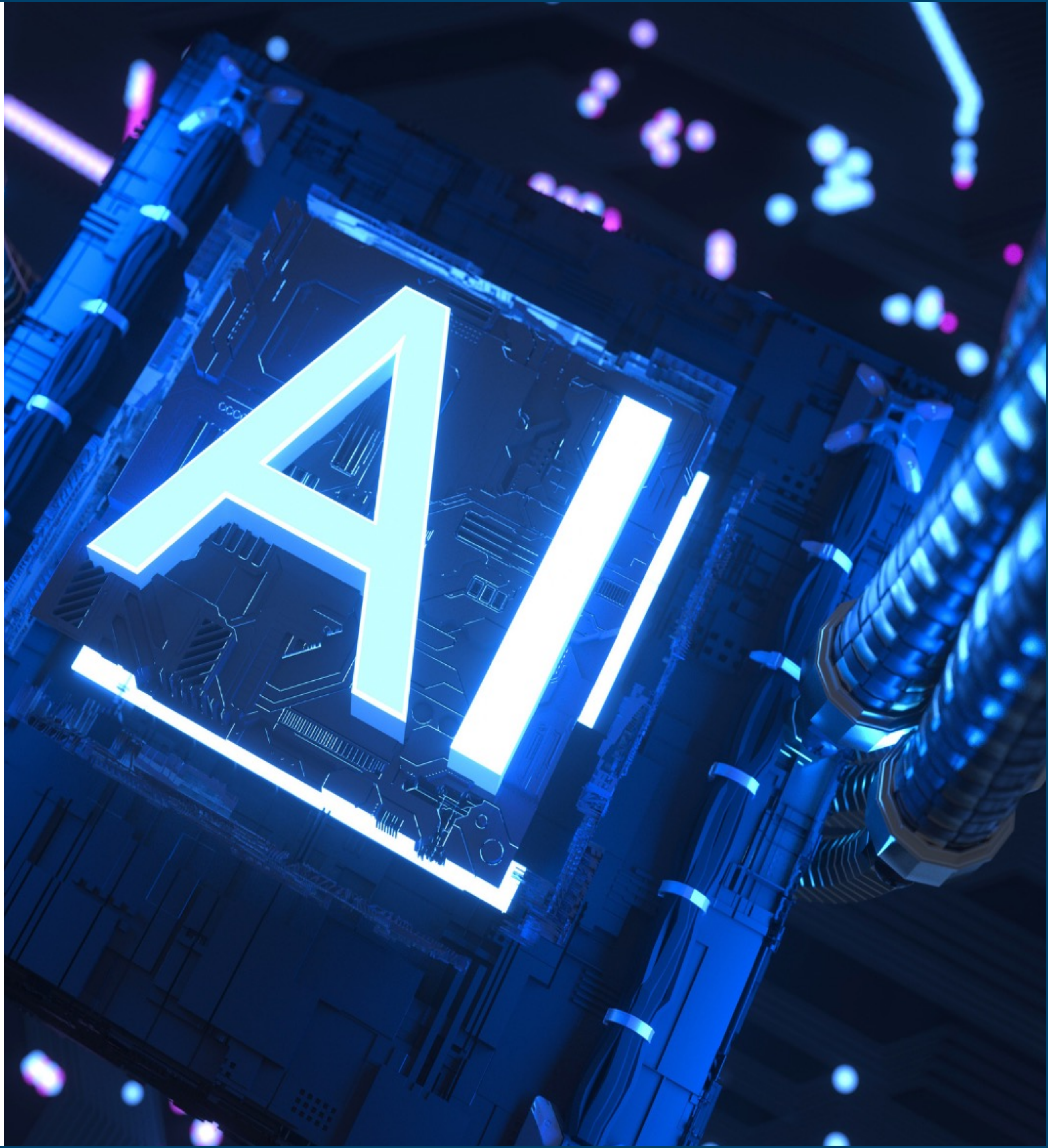
Applications encompass a wide range of services, such as data storage and backup, softwar and development platforms, virtual servers, streaming services, and scalable computing resources for businesses.

Technologies

Artificial Intelligence

Artificial Intelligence (AI) is a branch of computer science that involves the development of algorithms and systems capable of performing tasks that typically require human intelligence.

Can be applied to computer vision for image and video analysis, machine learning for data analysis and pattern recognition, and robotics for autonomous systems and automation, as well as natural language processing for voice recognition and language translation,.
Its diverse applications aim to replicate or augment human cognitive functions, leading to advancements in efficiency, decision-making, and problem-solving across multiple industries.

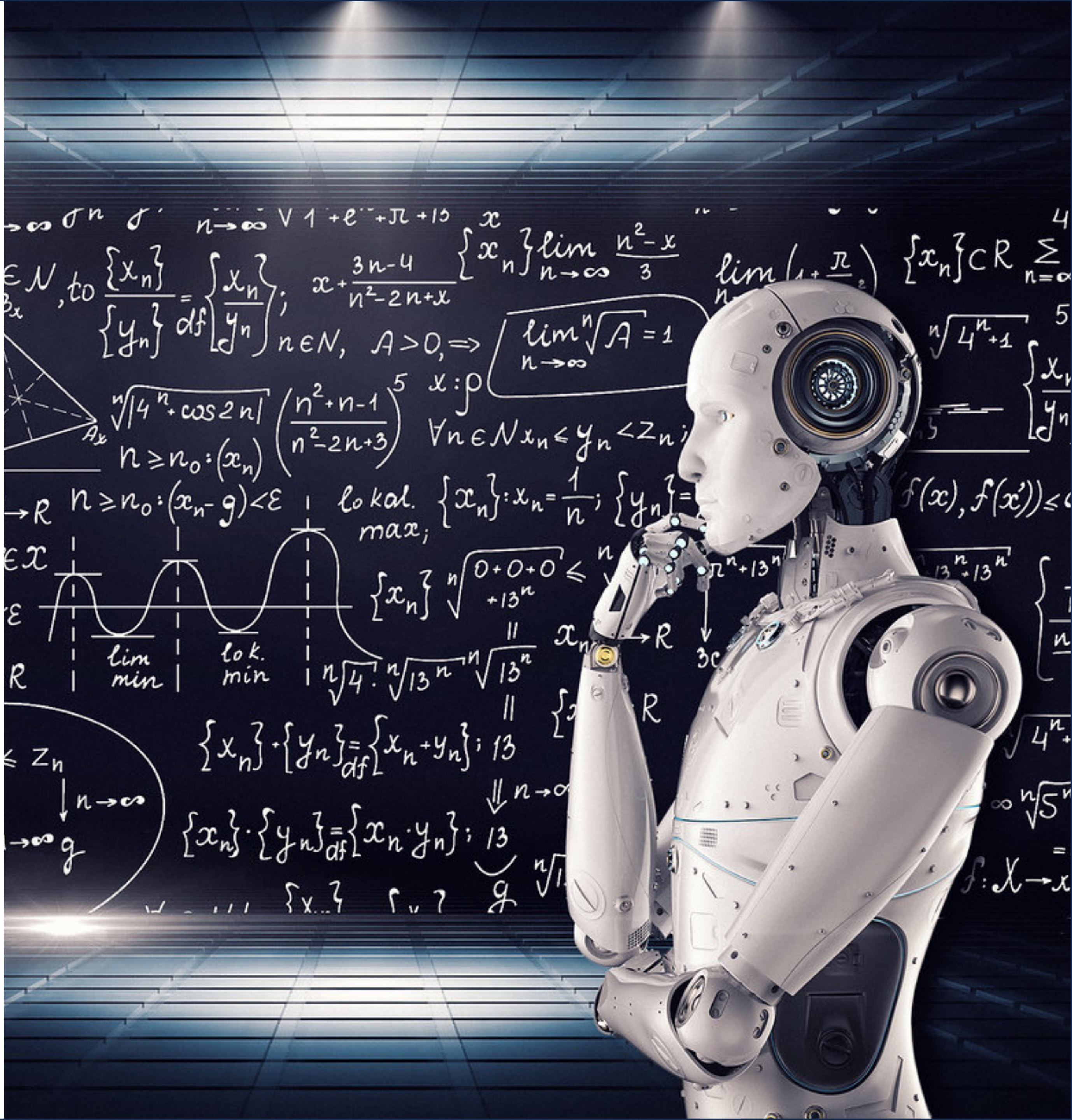


Technologies

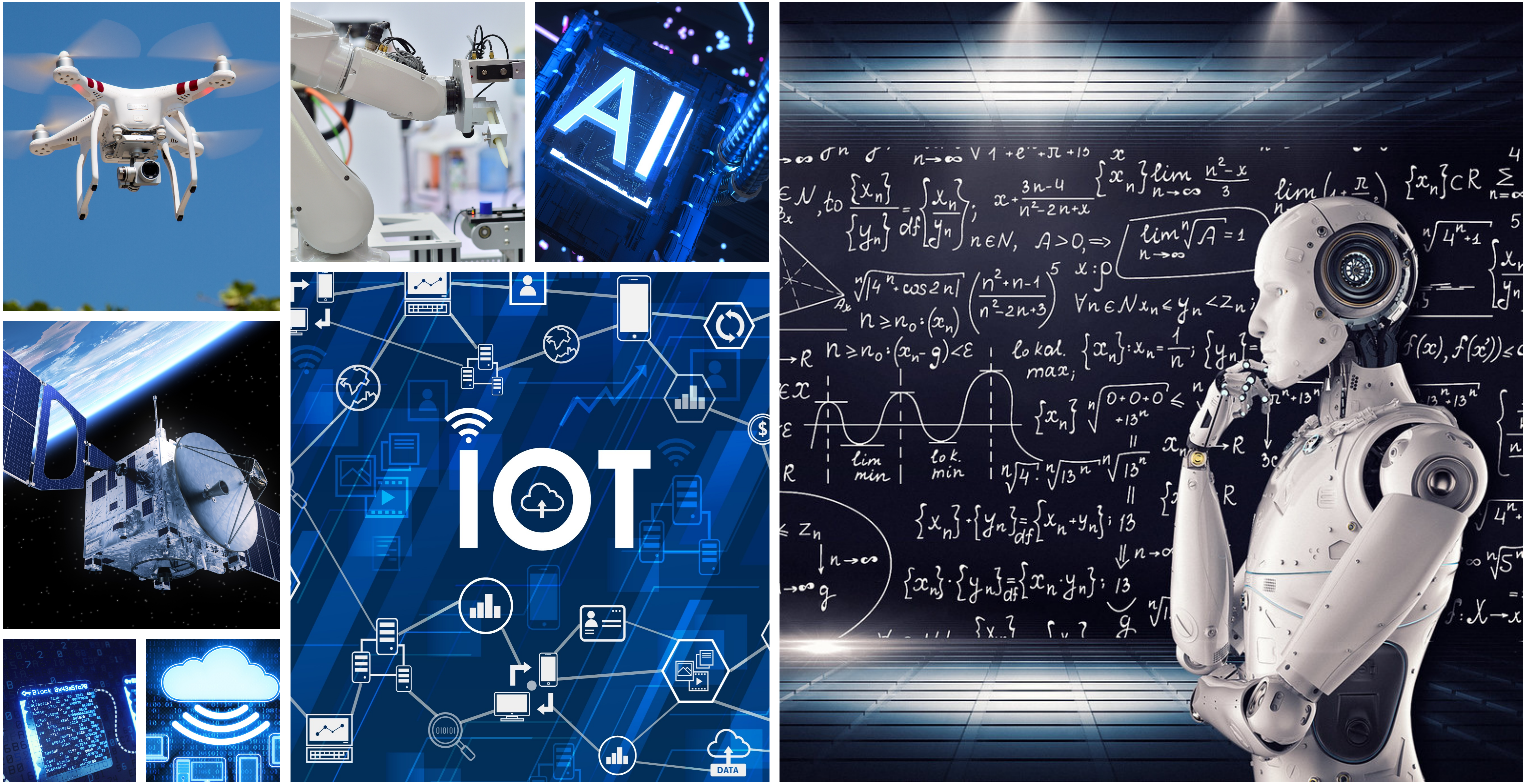
Machine learning

Machine Learning is a subset of artificial intelligence that involves the development of algorithms and models that enable computer systems to learn patterns and make predictions or decisions based on data, without being explicitly programmed.

Is utilized in fraud detection, email filtering, personalized marketing, and optimization of various processes across industries, contributing to advancements in automation, efficiency, and data-driven decision-making.




Combining
digital tools and technologies
to unlock bioeconomy potential


AI
IOT
DATA


Sweden


Poland


France


Austria


North-Macedonia


Spain

Examples of application

Forest

- **Geographic Information System (GIS)** helps in mapping and analyzing forest biomass resources, identifying suitable locations for biomass harvesting, and assessing the spatial distribution of biomass availability, while satellite and **drone-based** remote sensing technologies provide real-time data on forest cover, health, and biomass content, aiding in monitoring and planning activities.

- Utilizing **precision** forestry technologies, such as **GPS-enabled** equipment and sensors, for optimized and efficient harvesting of specific trees or areas with high biomass content.

- Deploying **Internet of Things (IoT)** devices and sensors in forests to monitor environmental conditions, soil moisture, and other parameters affecting biomass growth.

- Implementing **blockchain technology** to create transparent and traceable supply chains for biomass products. This can enhance the sustainability credentials of forest biomass by providing verifiable information on the origin and production practices.

Examples of application

Olive (oil) production

- **Sensors, drones, and satellite imagery** can be used to monitor soil conditions, crop health, and water usage, allowing for optimized resource management and increased yield.

- **Automated** harvesting **machinery equipped with sensors**, ensures timely and efficient picking of olives, thus reduces labor costs and minimizes waste.

- Real-time monitoring and control of the processing pase, as **data analytics** can optimize parameters like temperature and pressure during oil extraction, leading to improved product quality and consistency.

- Digital solutions provide transparency across the supply chain, as **blockchain technology** can be employed to trace the journey of olives from the orchard to the consumer, ensuring authenticity and quality control.

Examples of application

Apple production

- Deployment of **IoT sensors** to monitor temperature, humidity, and soil conditions in the orchard. This **data** helps farmers make informed decisions about irrigation, pest control, and overall orchard management.

- The use of **robotic systems equipped with computer vision** to identify and pick ripe apples. These robots can work efficiently, reducing the time and labor required for harvesting.

- Utilizing **blockchain technology** to create a secure and transparent supply chain. This allows consumers to trace the origin and journey of apples, ensuring food safety and authenticity.

- Implementing **automated packing and sorting** systems that use **machine learning algorithms** to categorize apples based on size, color, and quality. This streamlines the packing process and improves overall efficiency.

Examples of application

New crops

- **Remote sensing technologies**, including s**atellites and drones**, can provide high-resolution images of crops. This data helps farmers monitor crop health, identify potential issues, and optimize irrigation and fertilization practices for flax and hemp cultivation.

- **Internet of Things (IoT)** sensors can be deployed in the fields to monitor soil moisture, temperature, and nutrient levels. This real-time data helps farmers make informed decisions about irrigation, fertilization, and other agronomic practices.

- Implementing **blockchain** in the supply chain helps ensure transparency and traceability for crops like flax and hemp, which is particularly important for products with specific quality and certification requirements, allowing consumers to trace the origin and production practices of the crops.

Examples of application

Agricultural residues

- **Internet of Things (IoT)** devices can be integrated into compost bins to collect real-time data on temperature, moisture, and turning frequency for remote monitoring and adjustments to the composting process.

- Implementing **sensor networks** in composting piles can monitor crucial parameters such as temperature, humidity, and oxygen levels. This data helps in maintaining optimal conditions for microbial activity, ensuring efficient decomposition.

- **RFID tags or barcode** technology can be used to trace the source and composition of agricultural residues. This traceability helps in creating tailored composting recipes and ensures that only suitable materials are included in the composting process.

- **Machine learning algorithms** can analyze historical data from composting processes to predict optimal conditions and composting times. This can lead to more precise management and resource allocation for composting operations.

Examples of application

Food industry

- **RFID tags and barcodes** help in tracking and managing inventory more efficiently to ensure that perishable goods are used before their expiration date and minimizes the chances of food spoilage.

- **Machine learning algorithms** can analyze patterns and trends in data to identify areas of improvement in the production and distribution processes, leading to waste reduction.

- **Smart packaging with sensors** can monitor the freshness of food products. For example, temperature-sensitive labels can indicate whether a product has been exposed to unfavorable conditions during transportation or storage.


Integration of digital
technologies in
bio-based product
development

Digital products

WasteMaster...

WasteMaster is an **innovative system** with patented and certified technology that **treats and converts food waste and organic waste at the source (in situ)**. This is achieved by accelerating the decomposition through **reactive oxygen direct oxidation (RODO)** of the mentioned waste, without the use of bacteria, without generating harmful gases, leachate, or other residues..

The system operates entirely automatically and is easy to manipulate through a **self-loading system** and protective mechanisms. Only qualified personnel are authorized to handle the system. As a result, there is a **60-80% reduction and conversion of the waste from its original state**, depending on the organic waste.

The outcome is an **odorless, stabilized resource** with **high calorific value** that can be transformed into **compost, fuel, or animal feed within hours**. The product can be stored to optimize removal if necessary, avoiding the generation of leachates, all without the use of chemicals, bacteria, or water. Additionally, it **prevents the CO2 emissions** associated with the natural degradation of waste.

Source and screenshot: https://www.ewmsoluciones.com

WasteMaster...

Technologies

WasteMaster...

The WasteMaster MIRA system can degrade 400 kg of apples in less than 20 hours, compared to the several weeks required by conventional composting systems.

Products to be handled:

vegetables, cooked meat, fresh meat, cooked fish scraps, carbohydrates: bread, pasta, etc., fruits, lawn clippings, eggs, any human food scraps and residues from the food industry.

Products not handled:

- **Plastic:** Plastic contaminates organic waste with small pieces, degrading the quality of the final product.
- **Metals**: Metals are not treated by the WasteMaster machine. It expels them in the same way they were introduced without affecting the process.
- **Paper:** While WasteMaster can handle paper and cardboard in small quantities mixed with organic matter, it is not specifically designed for paper management. However, if restaurants use paper napkins, cutlery, or paper utensils, they can be introduced mixed with the food.

Source and screenshot: https://www.ewmsoluciones.com

Projects

Vertedero 4.0

Through the use of "WasteMaster" technology, the project has developed **software that integrates advanced sensing and massive data processing technologies**. Advancing towards zero waste is one of the objectives, achieved through the transformation of organic waste into a byproduct with high added value for the market.

The consortium that has worked on the initiative has focused on **digitizing data in the management of organic waste**. To this end, it has deployed **extensive sensor technology** to **monitor the most relevant phases of the treatment process**, as well as integrating information throughout the system. The massive processing of this data and its analysis enable informing each of the users involved in the operation of the machine throughout the process.

The project has involved the participation of the **University of Córdoba, Ciconia, Polux, and EWM,** coordinated by the **onTech Innovation Cluster in collaboration with Tecnara**. The initiative is funded by the Ministry of Industry, Commerce, and Tourism, as part of the latest call for grants for Innovative Business Groupings (AEIs).

Source and screenshot: https://https://www.ontechinnovation.com/el-proyecto-vertedero-4-0-lanza-un-software-que-reduce-y-transforma-los-desechos-organicos-en-compost/

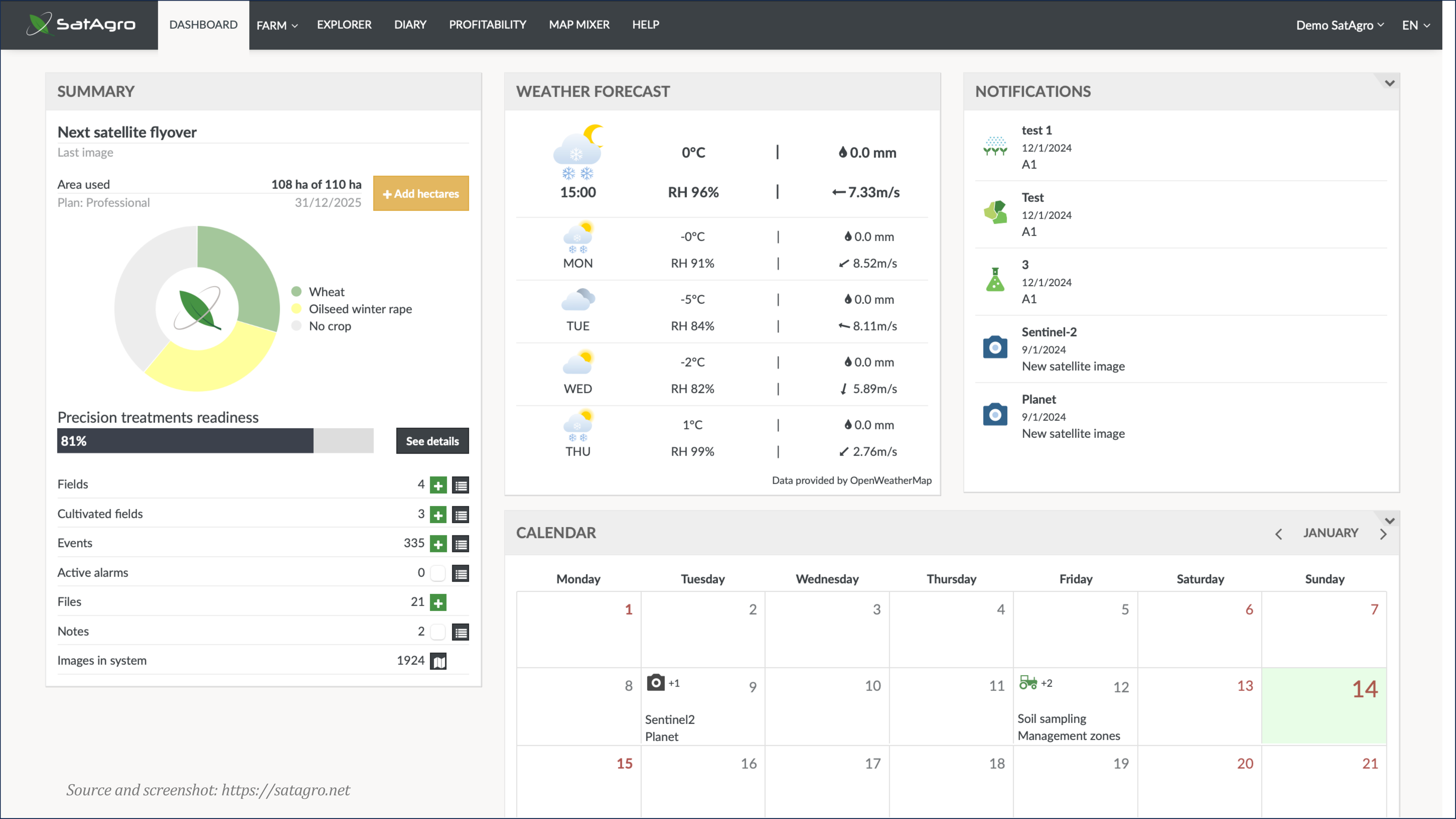
Digital products

The SatAgro is a world class product in **satellite monitoring, cloud computing, agronomy** and related sectors, and translate this progress into tools for its clients. The **platform** allows farms to save money while improving their **environmental footprint and climate resilience**.

It is accesible, as works with entities who manage land from < 10 ha to 100 000+ ha, and is constantly pushing the boundaries of who can use **space-based crop data.** Moreover, it is affordable, because believes that to achieve a wide-spread change, well-informed decisions should not be a luxury. Sat Agro is also connected to speed up the adoption of **digital agriculture**, so it is one seamlessly **interconnected solution** for the agronomist. Additionally, it is scalable, as the SatAgro platform, and associated monitoring, work in multiple scales and can be **deployed in any geography** in a matter of days .

Source and screenshot: https://satagro.net


A1
LAYER
Image
Vegetation
Absolute
DATE
9/1/2024
Source and screenshot: https://satagro.net



Source and screenshot: https://satagro.net

Possibilities

1. **Map area** – observe variations in crop development within the selected field, and gain insights into the long-term characteristics of the field, such as soil and moisture dynamics.
2. **Map value** – in the mobile app, this value corresponds to the user's location in the field, creating a powerful tool for the implementation of precision agriculture.
3. **Chart area** – information on crop state and weather timeseries (Growing Degree Days) back to 2002.
4. **Vertical lines on the timeline mark events** – either created within SatAgro, or added by the user – such as sowing, fertilization, harvest, available satellite images.
5. **Horizontal lines** mark alarms, e.g. temperature reaching frost-risk levels, crops reaching a specified level of development.

Source and screenshot: https://satagro.net

Possibilities

6. **Use the Precision Treatment Wizard** to create variable **rate application** files from individual satellite images. Specify zones, rates and other parameters for drilling, fertilizing and spraying

7. **Choose the data to be displayed** – specify the type of satellite (operated by NASA, ESA, or commercial companies), type of information or date of acquisition – to. As well as satellite imagery, the user can import their own data (yield maps, soil properties, etc.).

8. Compare mode – enable this option to easily compare information from different fields, data sources and dates, e.g. a prescription map and the satellite image from which it originated.

9. Use SatAgro on your phone or tablet also at work in the field. Mobile application available for free.

Source and screenshot: https://satagro.net

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