MINISTERIO DE CIENCIA, INNOVACIÓN Y UNIVERSIDADES

CSIC CONSEJO SUPERIOR DE INVESTIGACIONES CIENTÍFICAS

VNIVERSITAT DE VALÈNCIA

IFIC INSTITUT DE FÍSICA CORPUSCULAR

EXCELENCIA SEVERO OCHOA

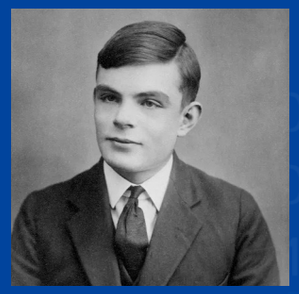
Artemisa

Artificial Environment For ML And Innovation In Scientific Advanced Computing

Jose.Enrique.Garcia@ific.uv.es

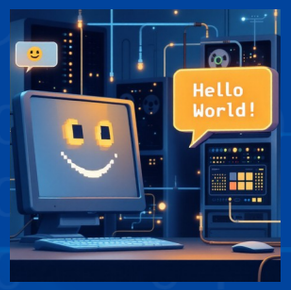
April 8th, 2026

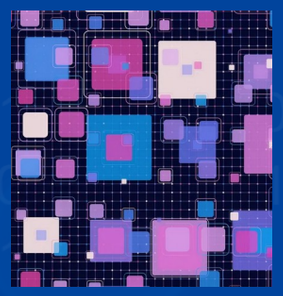
AI Timeline



1950 — Alan Turing's AI paper

1966 — First AI chatbot



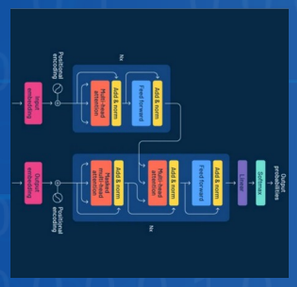


1980 — Flurry of expert systems

1987-1993 — Second AI winter

2012 — AlexNet begins deep learning era

2017 — Invention of transformer architecture



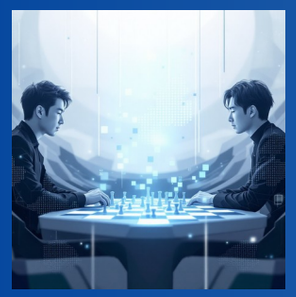
1950 | 1956 | 1966 | 1974 | 1980 | 1986 | 1987 | 1993 | 1997 | 2012 | 2016 | 2017 | 2022

1956 — The Dartmouth workshop

1974-1980 — First AI winter

1986 — Foundations of Deep Learning

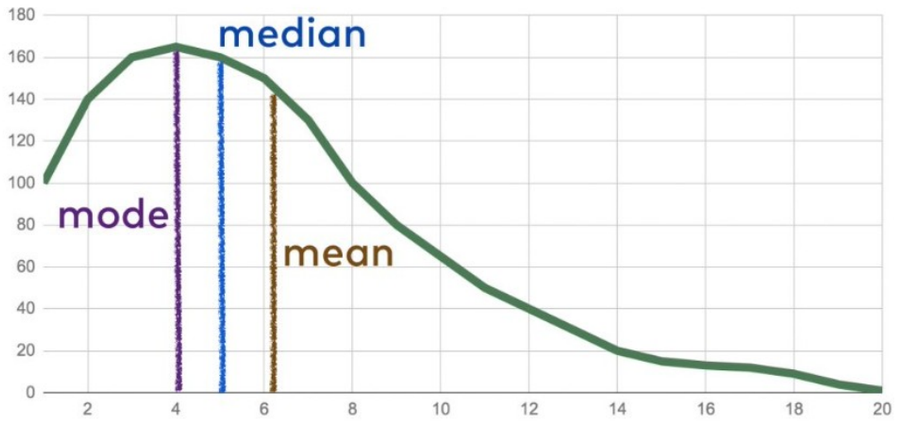
1997 — Deep Blue defeats Garry Kasparov

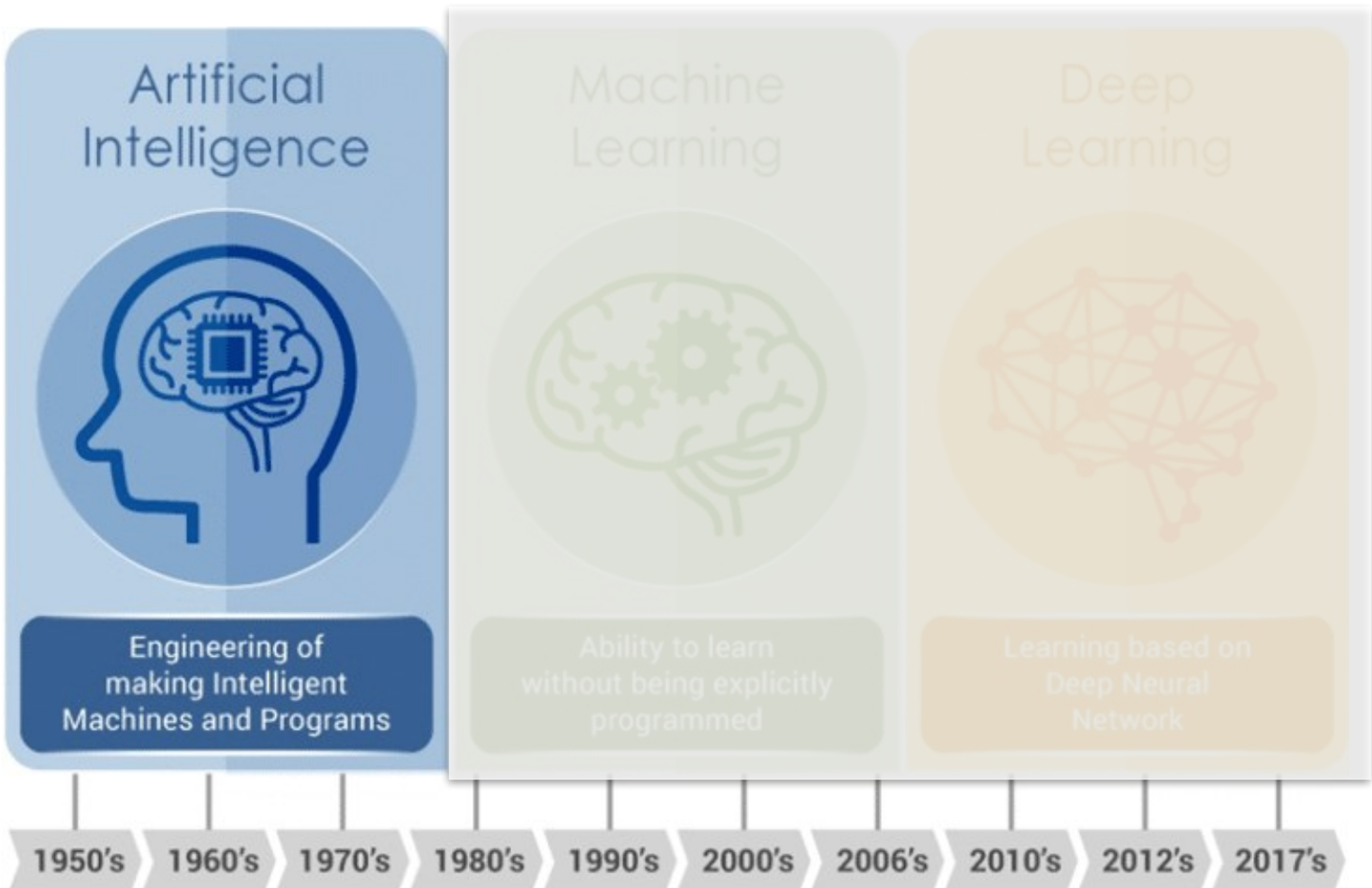


2016 — AlphaGo defeats Lee Sedol

2022 — Launch of ChatGPT

Artificial Intelligence



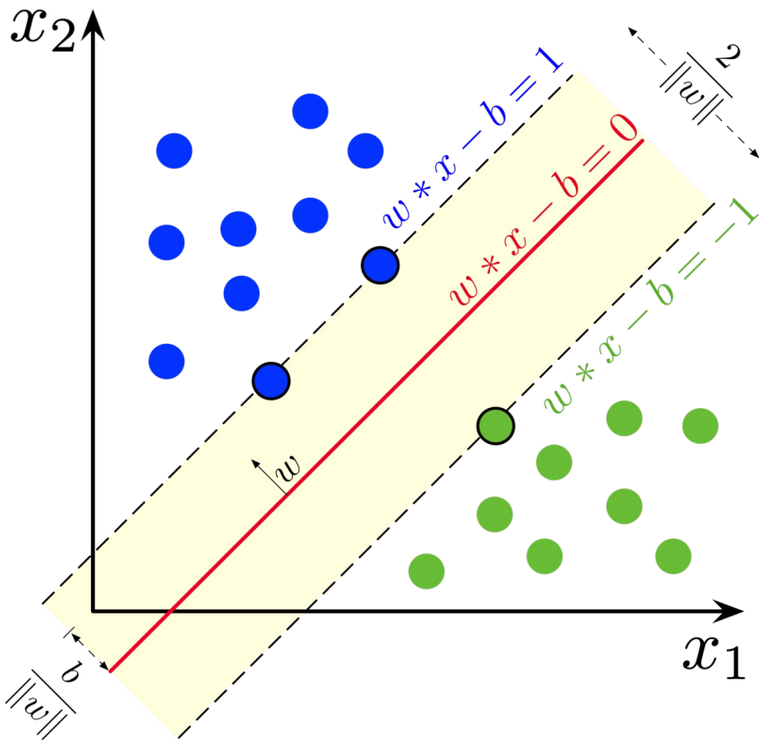


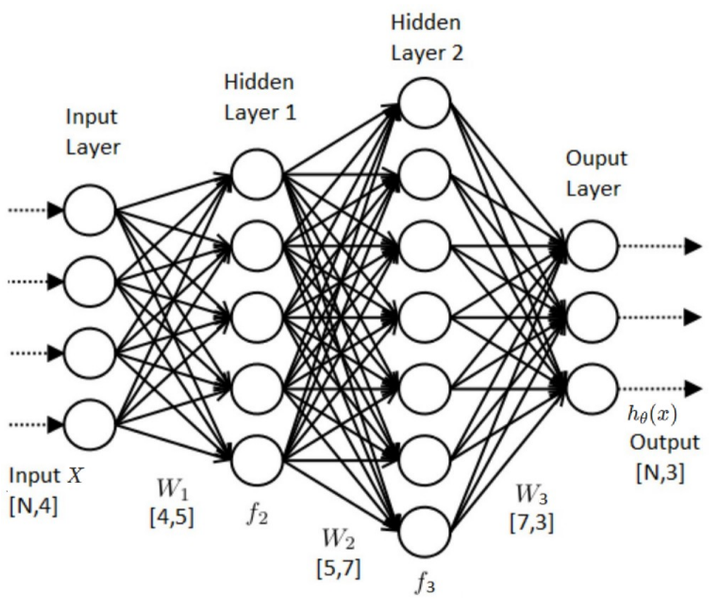
"In three to eight years, we will get a machine with average human intelligence."

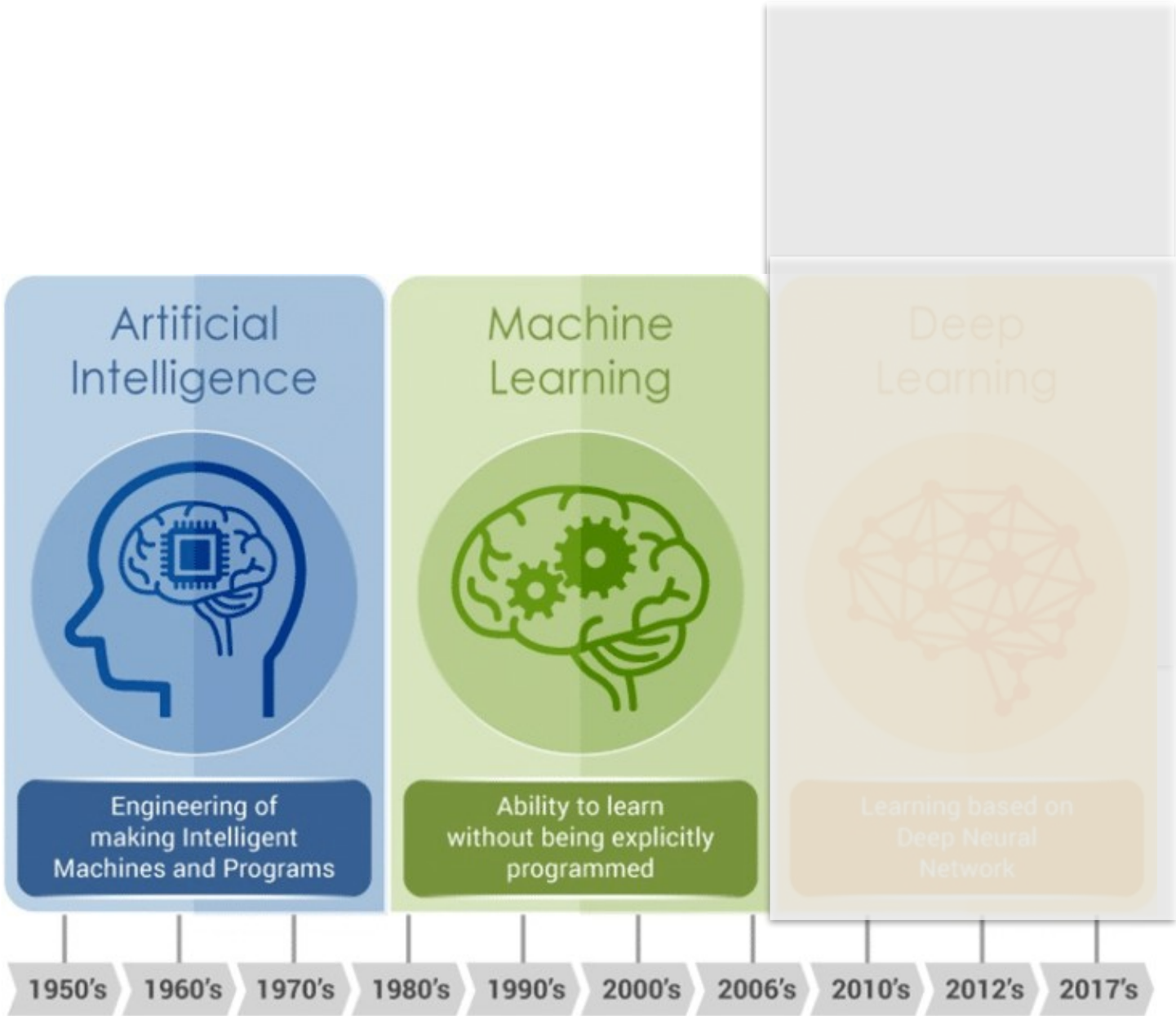
Marvin Minsky, 1970

image sources: data36.com / medium.com

Machine Learning





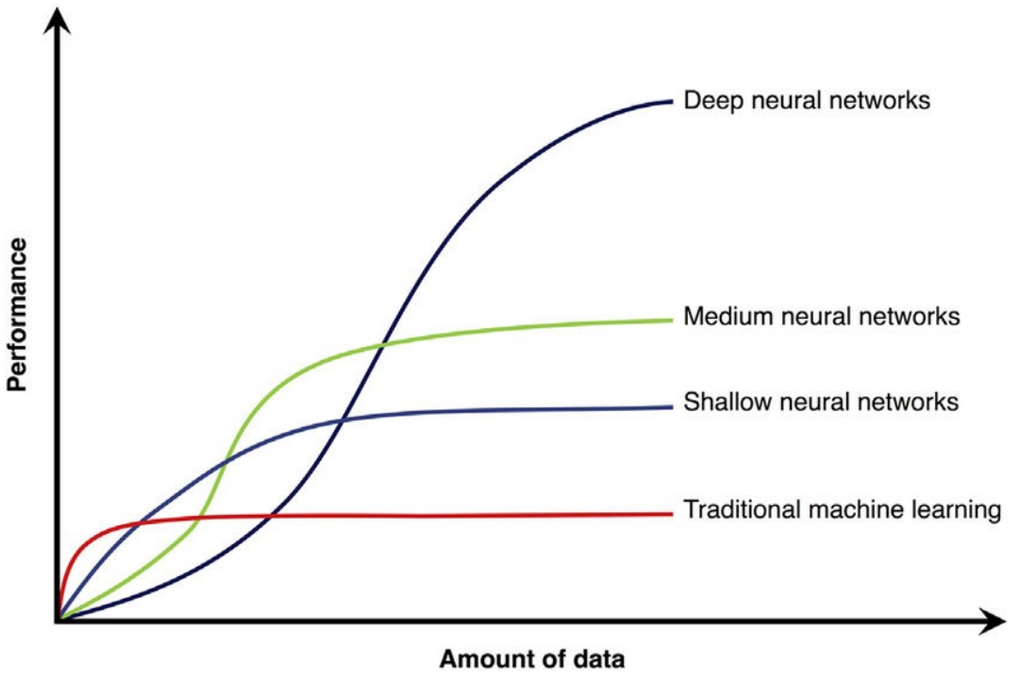


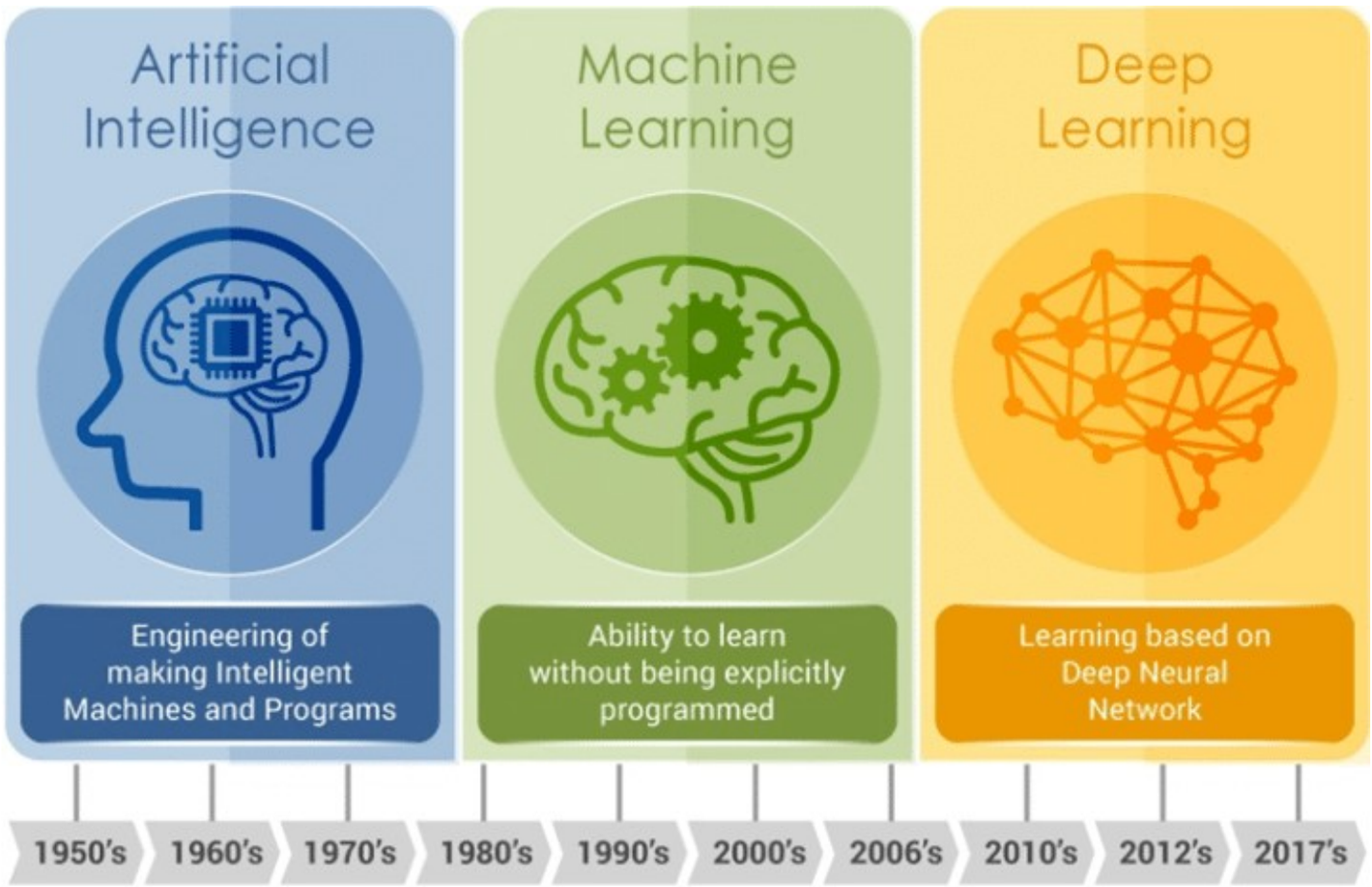
"I'm still a realist: If we work really hard - and smart - we can have something like a HAL in between four and four hundred years. I suppose if we're lucky, then, we can make it by 2001!" .

Marvin Minsky, 1997

image sources: wikipedia / medium.com

Deep Learning





"I'm increasingly inclined to think that there should be some regulatory oversight, maybe at the national and international level, just to make sure that we don't do something very foolish. I mean with artificial intelligence we're summoning the demon."

Elon Musk, 2014

image sources: wikipedia / medium.com

Deep Learning

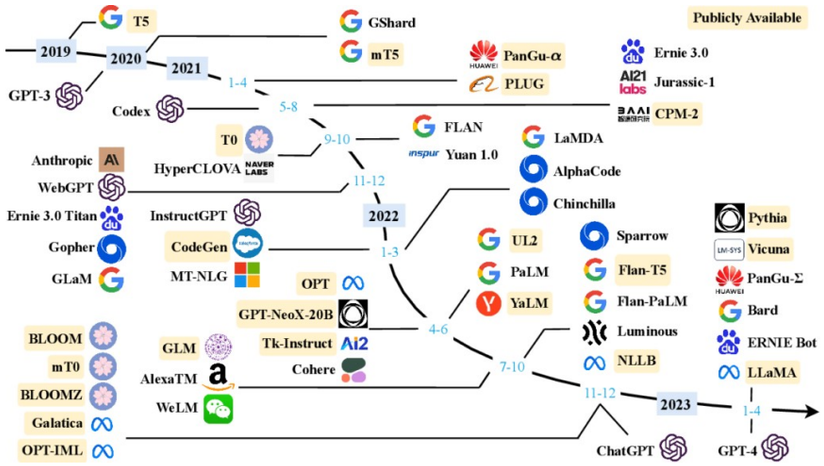
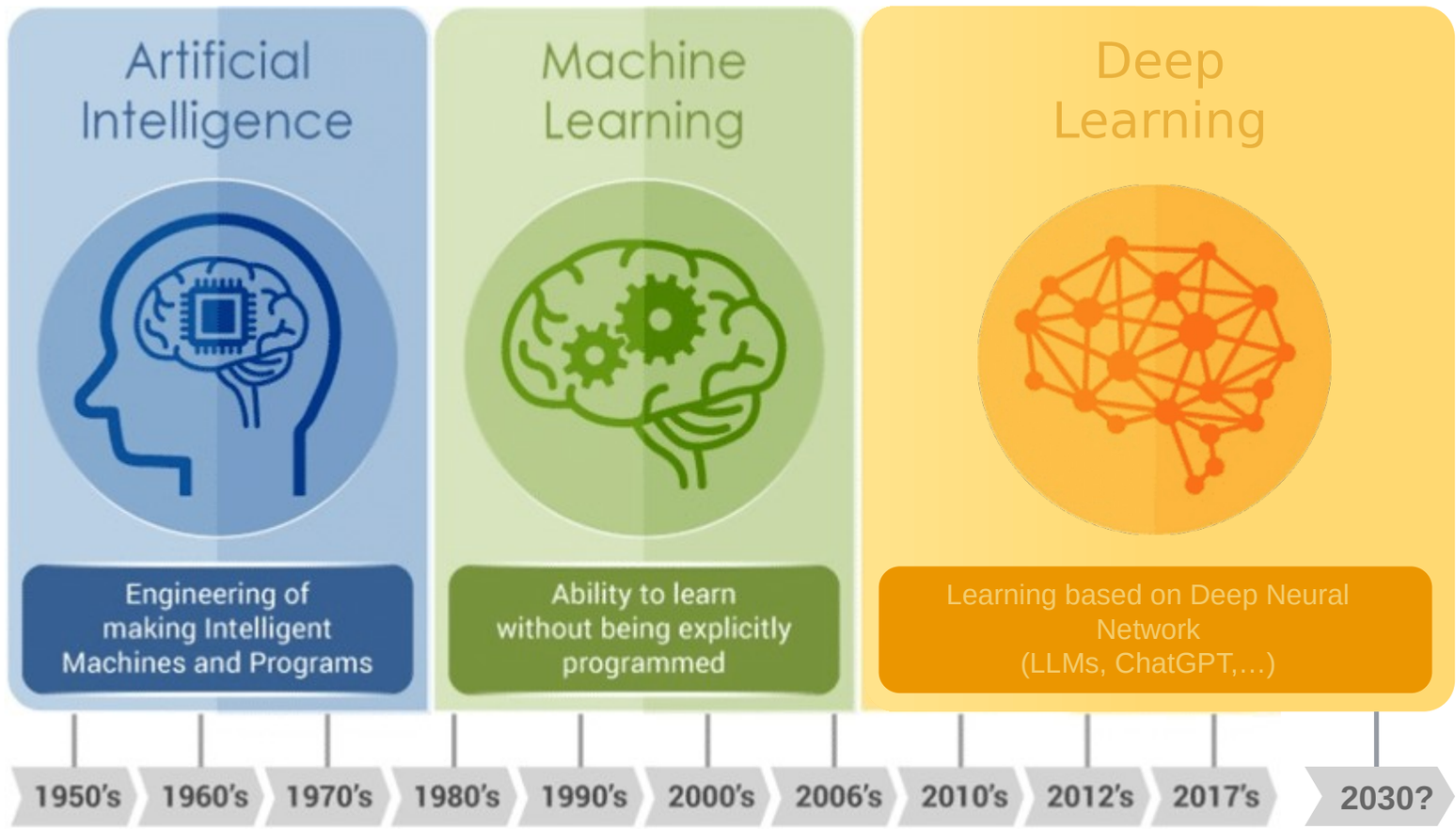
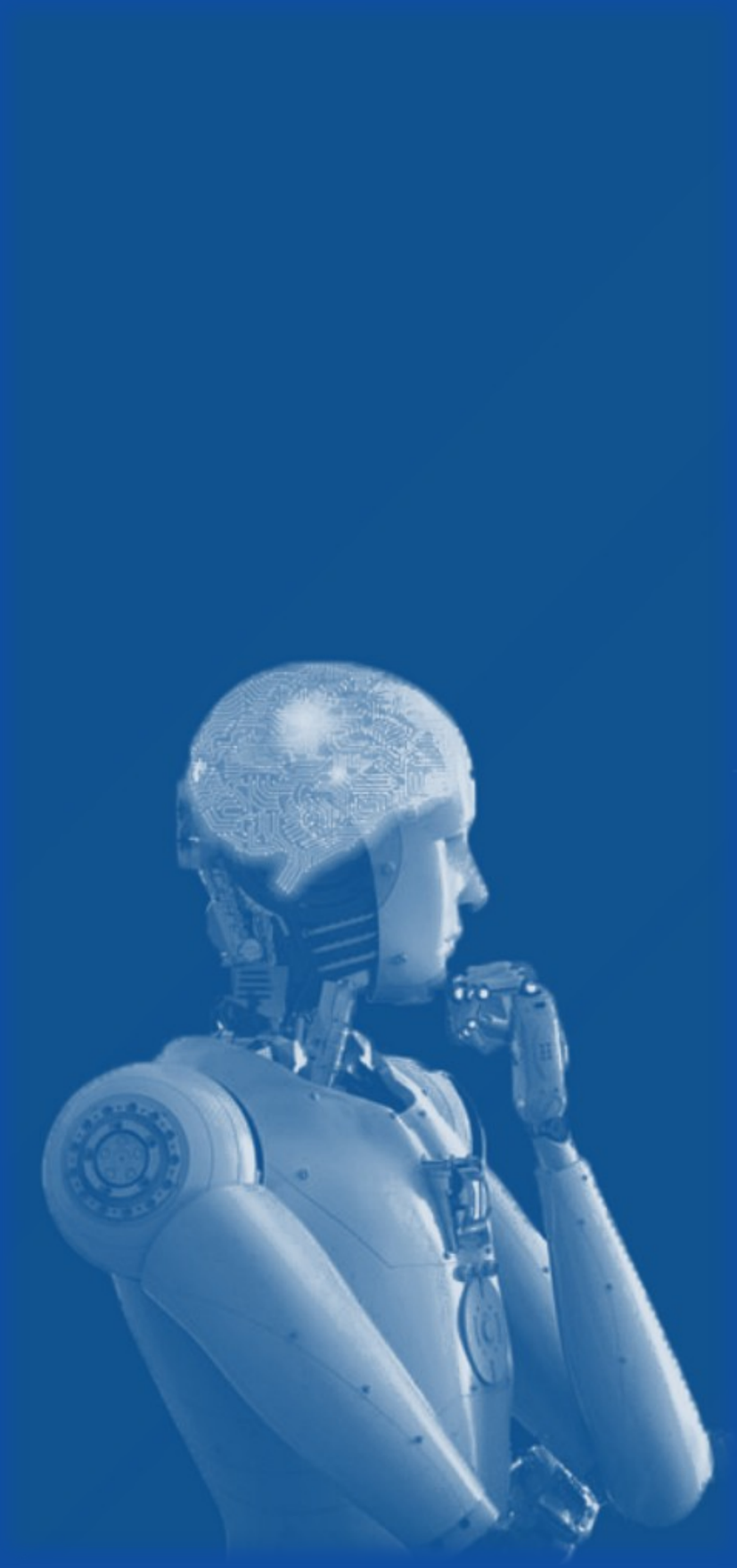


image source: A Survey of Large Language Models



"Generative AI is the most powerful tool for creativity ever created. It has the potential to unleash a new era of human innovation.".

Elon Musk, 2023



Why now?

Why now?

BIG DATA

Larger datasets

- Easy collection and storage

HARDWARE

Graphics Processing Units (GPUs)

- Massively parallelizable

SOFTWARE

Improved techniques
Tools

- New models

Big Data

90% of data in the world was generated over the last 2 years: Forbes

short by Roshan Gupta / 09:00 am on 05 Nov 2019,Tuesday

According to Forbes, 90% of the world's data was generated in the last two years with 2.5 quintillion bytes data being created each day. To meet this growing demand, Jigsaw Academy partnered with the University of Chicago, ranked among the top 10 universities globally, to launch 'PG Program in Data Science & Machine Learning', combined with AI & deep learning.

read more at Jigsaw Academy

Hardware

Supercomputer performance, according to data from the top500.org site. The logarithmic y-axis shows the performance in GFLOPS.

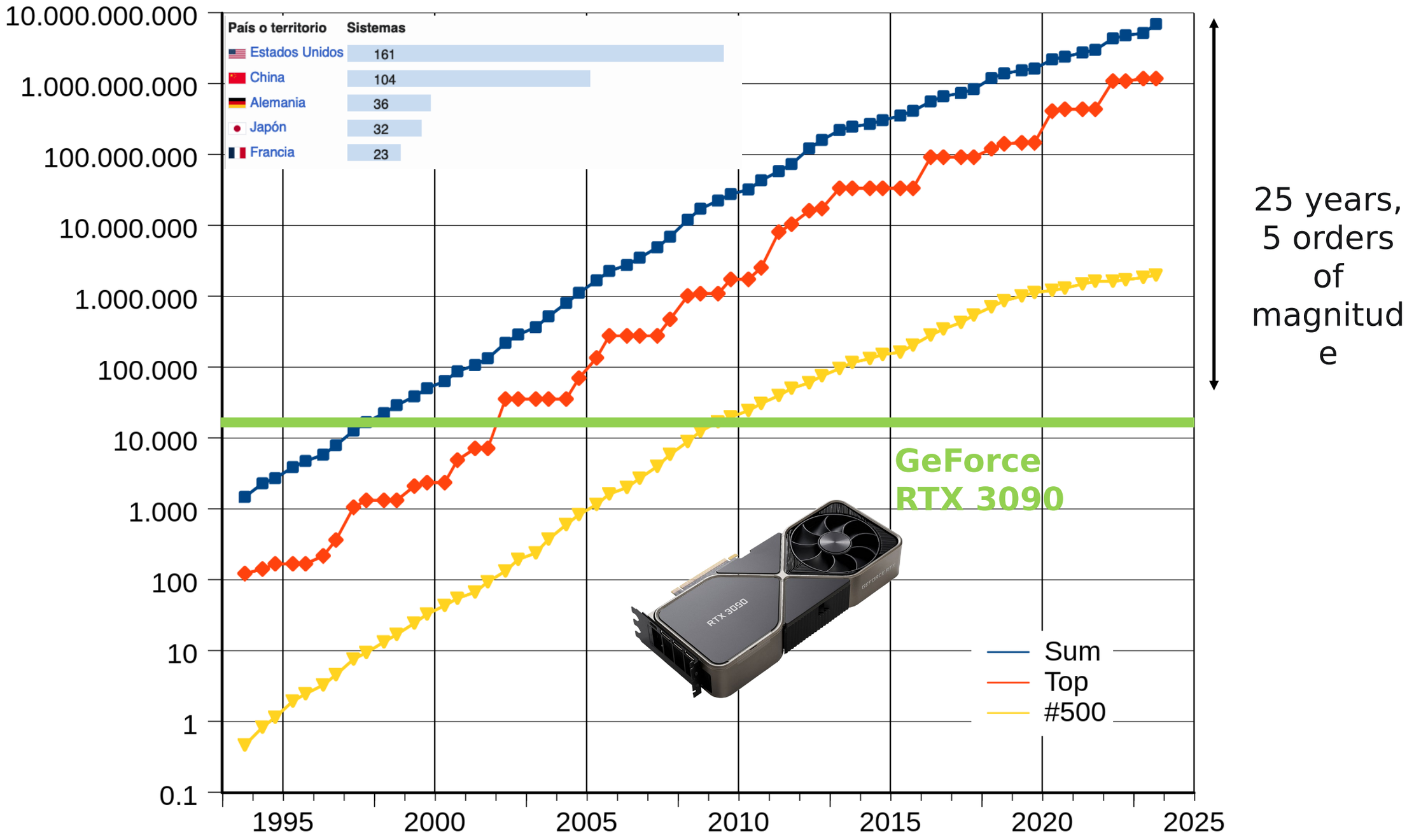
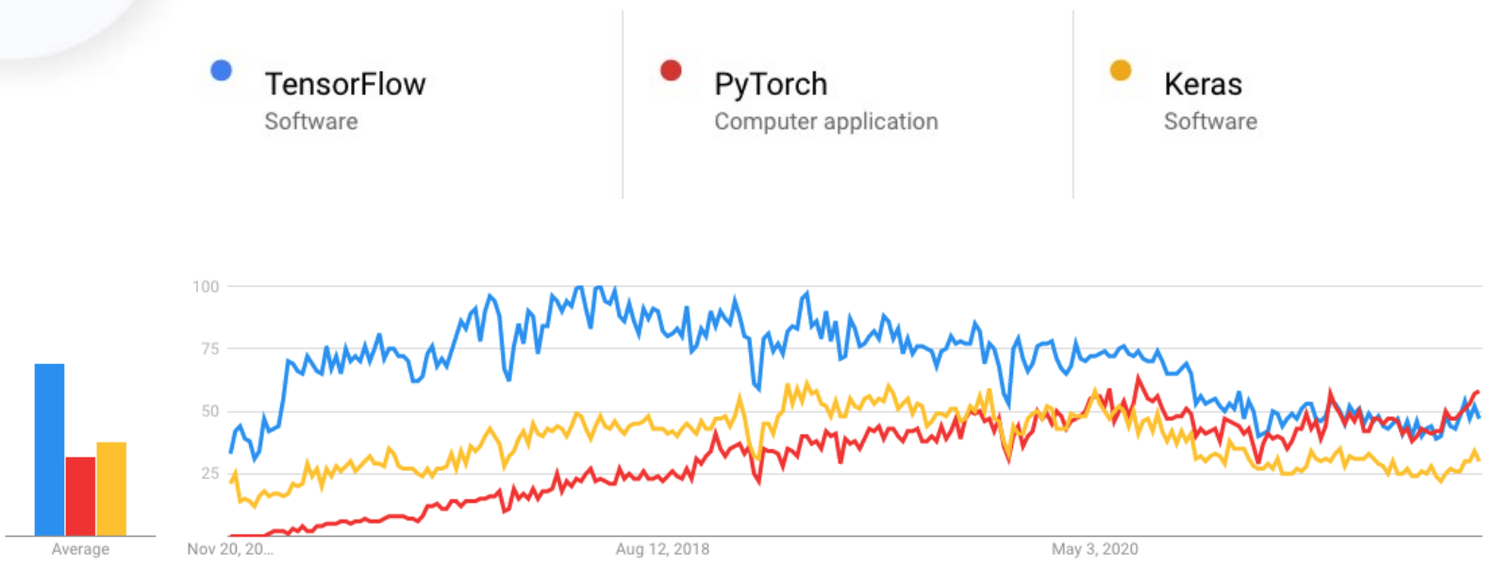
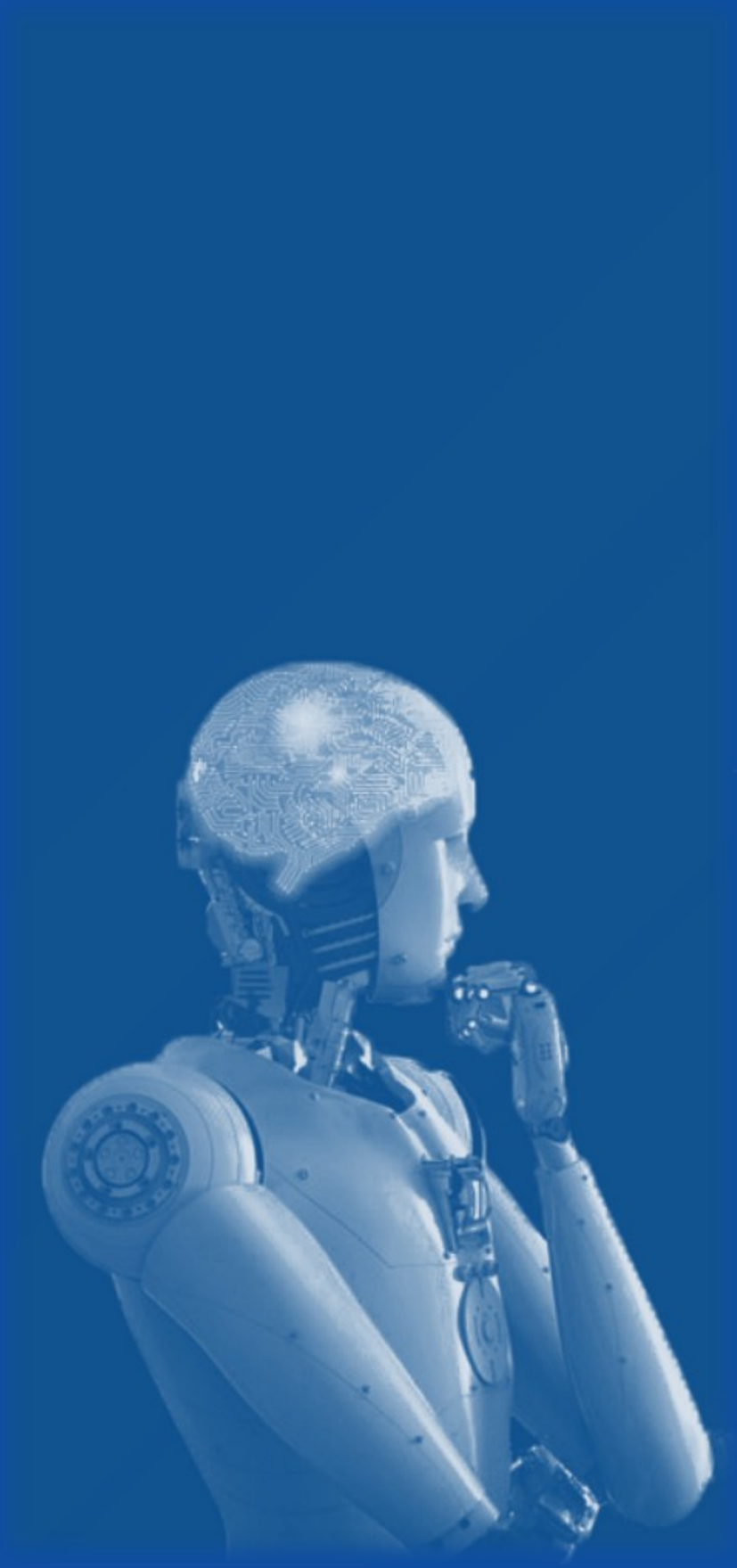


image sources: wikipedia

Software & Tools



Popularity



AI Models

AI Models / Techniques

Convolutional neural networks

***M**ulti-layered 'deep' neural networks, that are particularly adapted to image classification tasks by being able to identify the relevant features required to solve the problem.*

Transfer learning

***O**ld idea of using concepts learned in one domain on a new unknown one, this idea has enabled the use of deep convolutional nets trained on labelled data to transfer already-discovered visual features to classify images from different domains with no labels.*

Generative adversarial networks

***P**itching the computer against itself by co-evolving the neural network classifier with the difficulty of the training data set.*

Reinforcement learning

***A** method for finding optimal strategies for an environment by exploring many possible scenarios and assigning credit to different moves based on performance.*

sources: royalsociety.org

Large Language Models (LLMs)

Large Language Models are general-purpose Artificial Intelligence models developed within the field of Natural Language Processing (NLP) that can understand and generate human-like text.

ChatGPT

1.Generative

This tool generates written data. After receiving a substantial amount of natural human language, it uses what it has learned to generate a response.

2.Pre-trained

ChatGPT is pre-trained on human language patterns to produce written content that makes sense and is as accurate as possible, similar to how we would write it.

3.Transformer

The ‘transformer’ algorithm allows ChatGPT to process incredibly large volumes of data and condense them into simple conversational text.

AI in Our Life

AI in Our Life

Virtual Assistants

Virtual assistants like Siri, Alexa, and Google Assistant manage voice commands, reminders, and smart home control.

Recommendation Systems

Netflix, Amazon, and Spotify provide personalized content recommendations based on user preferences.

Smart Home

Smart devices like Nest thermostats and Philips Hue enable home automation and energy management.

Navigation

Navigation tools such as Google Maps and Waze offer real-time traffic updates and optimized routes.

AI in Our Life

Healthcare & Fitness

Wearables (Fitbit, Apple Watch,...) track health and enable virtual doctor visits.

Customer Service

Chatbots provide instant help and resolve inquiries.

Finance & Banking

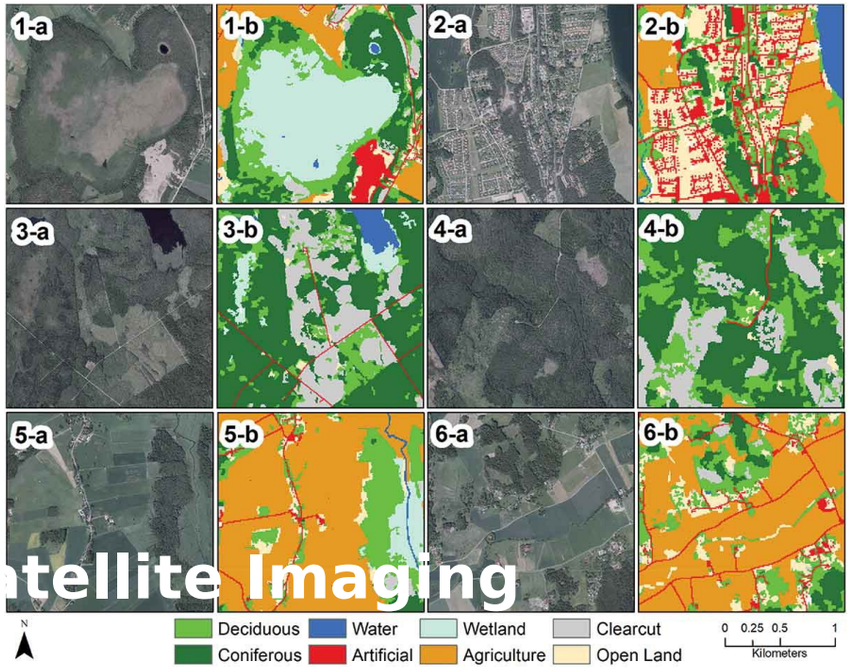
Apps monitor transactions and guide budgeting.

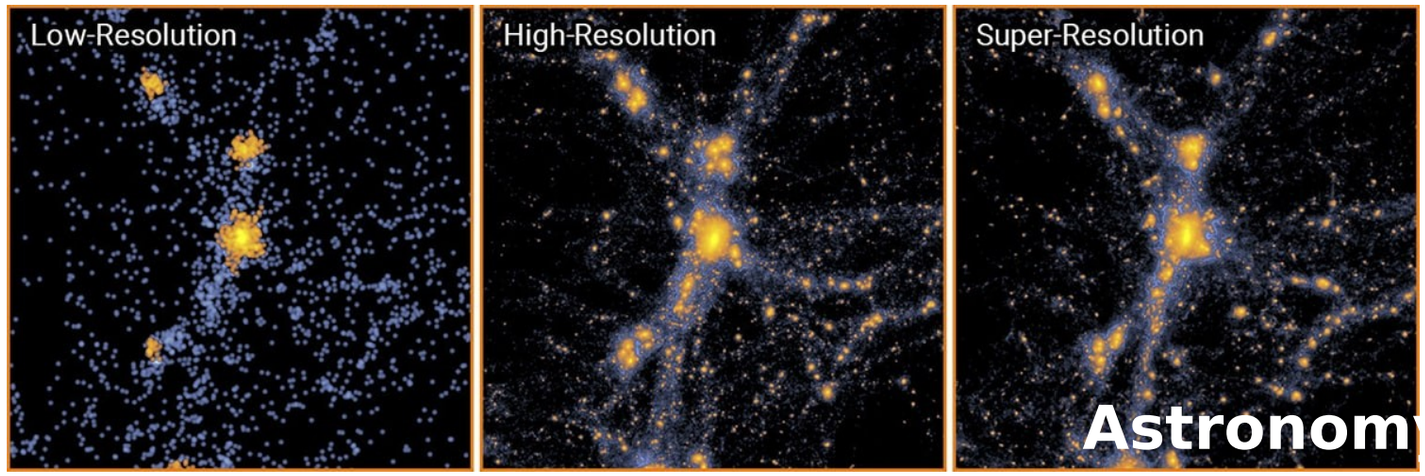
Entertainment

AI-driven video games, interactive storytelling. Creating immersive experiences, adapting content based on user interactions

AI in Science

AI in Science





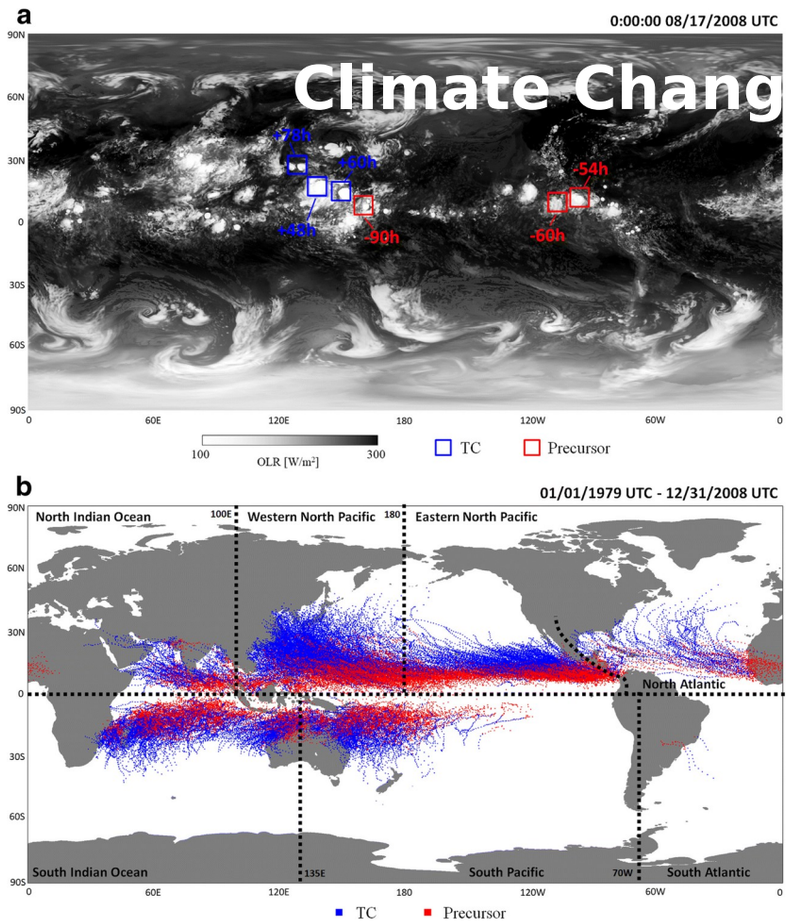
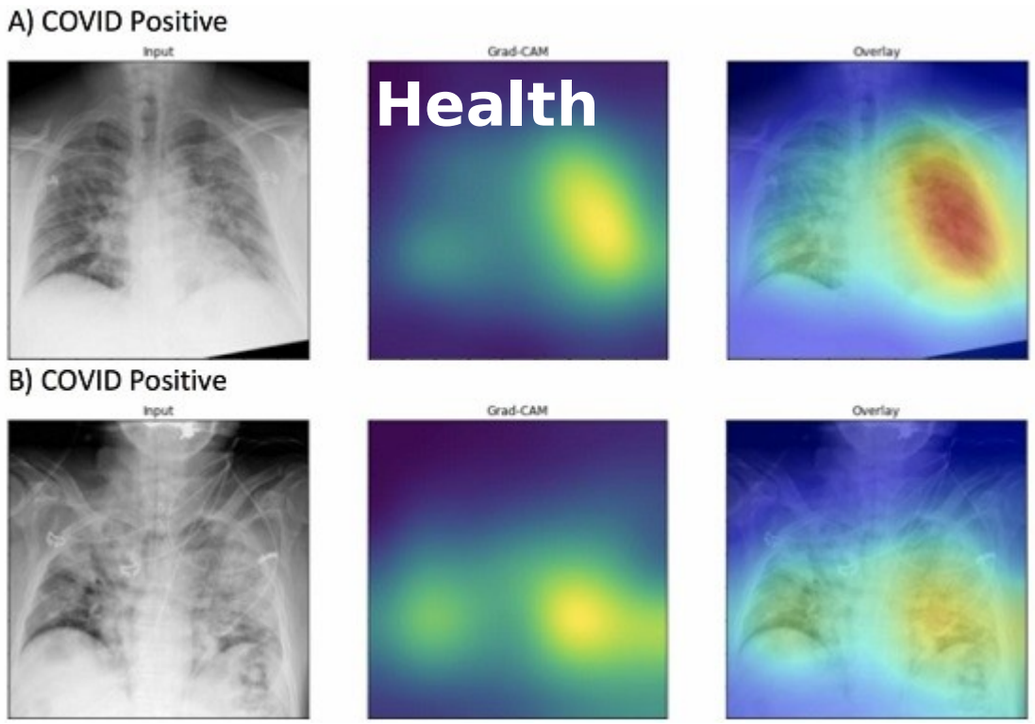
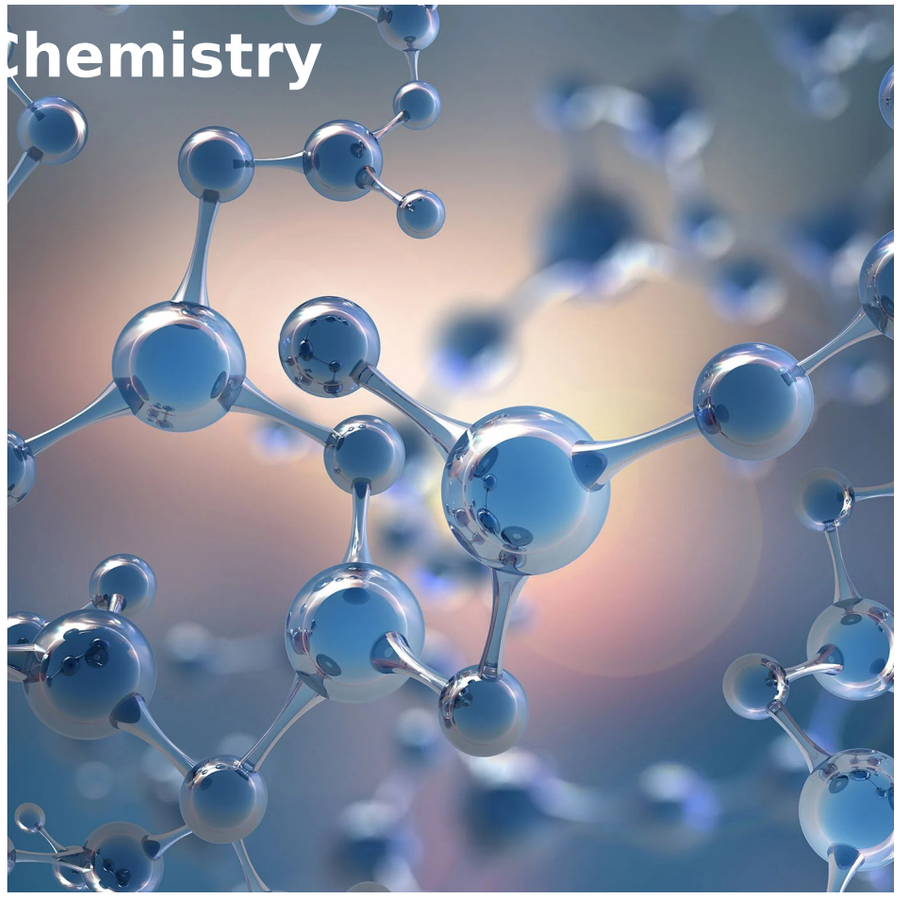


image sources: wikipedia / medium.com

AI in Science





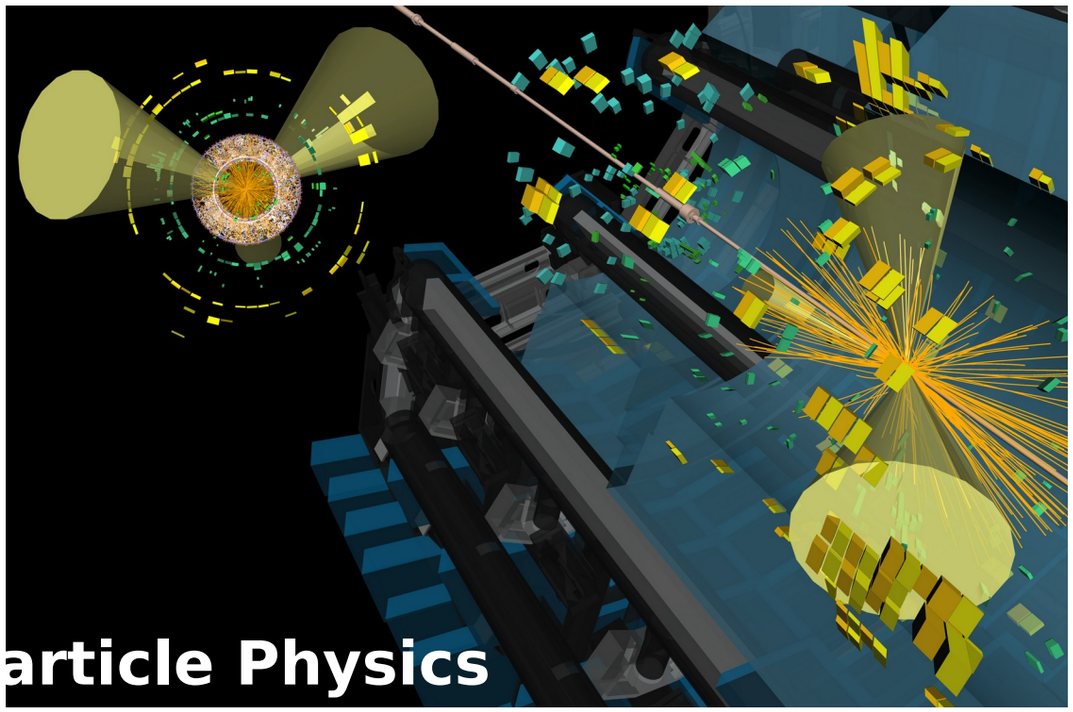


image sources: wikipedia / medium.com

Artemisa

Artificial Environment For MI And Innovation In Scientific Advanced Computing

April 8th, 2026


Artemisa
ARTificial Environment for ML and Innovation
in Scientific Advanced Computing
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Artemisa

Artemisa created from using funds of the FEDER 2014-2020 Comunidad Valenciana (**IDEFEDER/2018/048**, bugdet: **1 M€**).

Fons Europeu de Desenvolupament Regional

Una manera de fer Europa

UNIÓ EUROPEA

Granted a new project within the call “Recuperación y Resiliencia” (ASFAE/2022/024).

Artemisa (IFIC) was part of the InnDIH (Digital Innovation Hubs) as part of CSIC and Universitat de Valencia.

INNDIH

A €1.2 Million grant for **Artemisa** from the program ”Equipamiento Científico-Técnico”, co-financed by the **Ministry of Science and Universities, CSIC, and IFIC.**

With this grant, Artemisa will double its current computing capacity.

Plan is to acquire new high-performance GPU servers and improving its storage and data connectivity infrastructure.

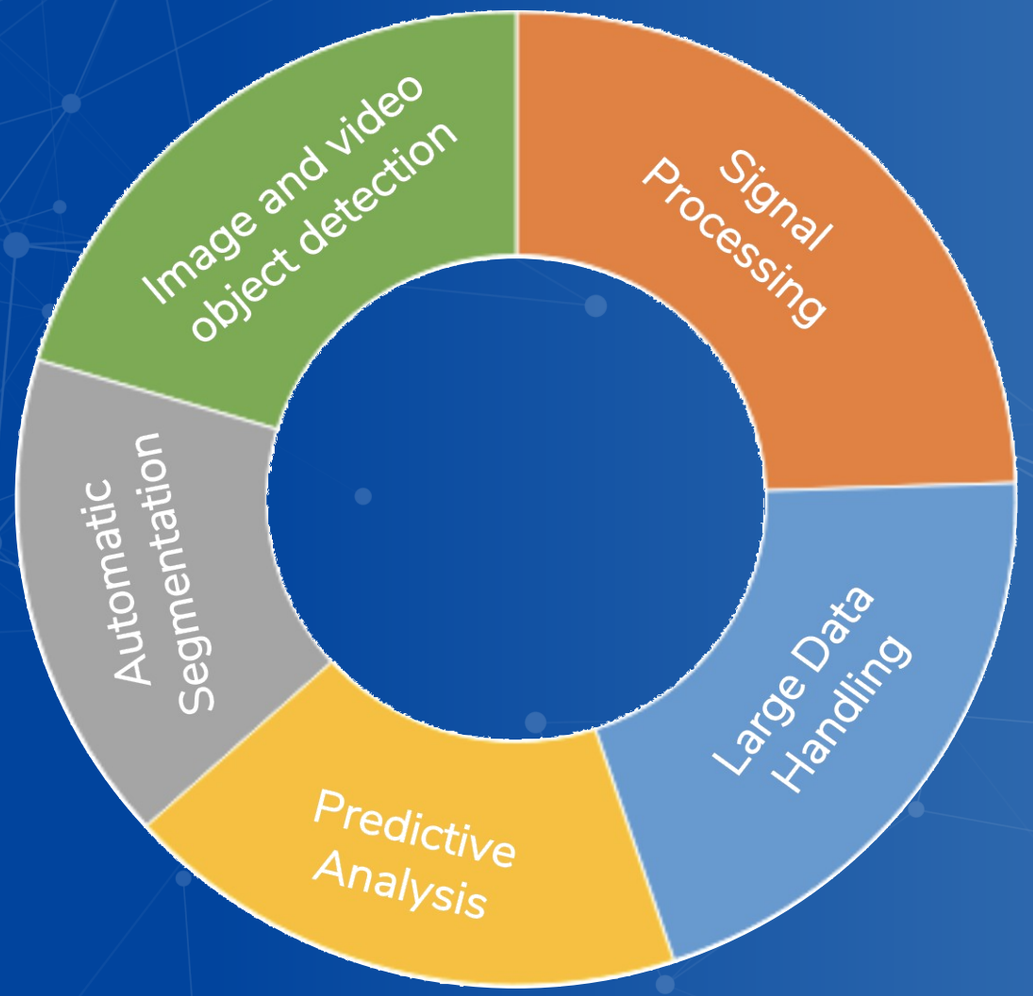
The upgrades will strengthen Artemisa’s role as a leading facility for AI and machine learning applied to particle physics and other scientific domains.

Artemisa

Artemisa is a GPU-intensive computing infrastructure dedicated to artificial intelligence and machine learning located at IFIC´s data centre. Its advanced features and excellent performance make possible the accelerated development of projects involving artificial intelligence areas.

Artemisa has machine learning capacity for handling large amounts of data to produce empirical models in physics, chemistry, biology and social studies.

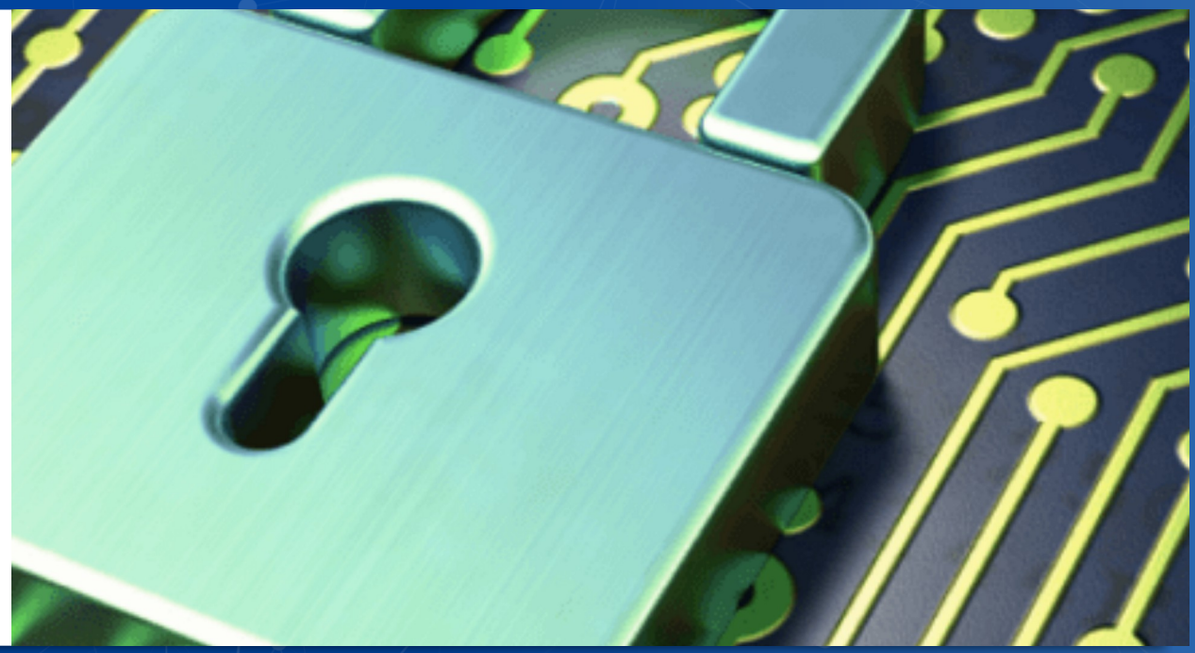
The facility is very well endowed with last generation GPUs plus ancillary CPU and disk space. It features some specific equipment such a modern 8-GPU (A100) Server for special applications.



Artemisa ISO 27001

What is ISO 27001?

ISO 27001 is the standard created by the International Organisation for Standardization (ISO) which deals with Information Security Management. It is a way of making sure that an entity is managing information security risks and data effectively.



“The ISO 27001 standard helps organisations to establish and maintain an effective Information Security Management System (ISMS), using a continual improvement approach. You will systematically assess any risks to the organisation’s information security and put in place policies and procedures to manage those risks.”

Artemisa Management

- Project applications :
  - **3 Calls per year, 4 months each**
  - **Call is open for a month, accepting projects during that period.**
- Projects are discussed and evaluated by a commit
- Access through **Artemisa** Intranet.

Logged as User(Change) Home Calls Projects Log Out

Welcome to the Artemisa Intranet

Artemisa is the ML computing infrastructure @ IFIC

Next Artemisa Call: 2025.2

New applications from 12 May to 9 June 2025.

All the scientific groups affiliated to any Spanish public university or public research institution are entitled to apply.

To request a project one member of the research group (the applicant/contact person) should register and fill in the forms. This person will be the liaison with Artemisa.

Artemisa is co-funded by the European Union through the 2014-2020 FEDER Operative Programme of Comunitat Valenciana, project IDIFEDER/2018/048

Unión Europea
Fondo Europeo de Desarrollo Regional "Una manera de hacer Europa"
GENERALITAT VALENCIANA
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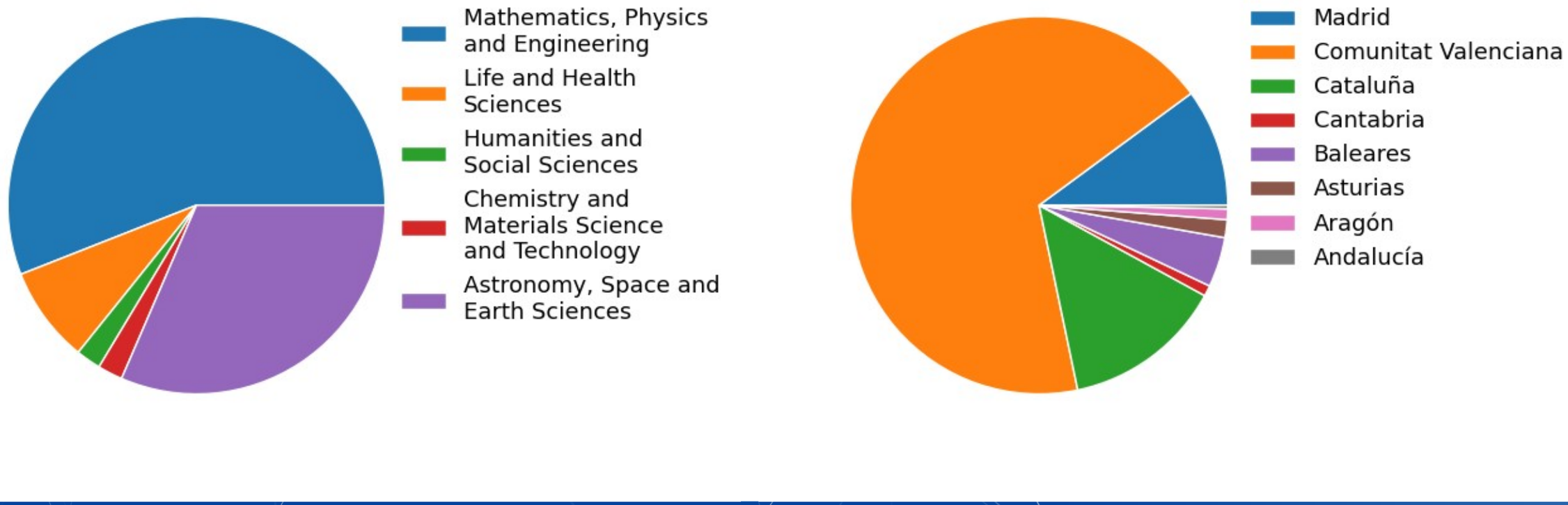
VNIVERSITAT DE VALÈNCIA
CSIC

Artemisa-site Contact

Artemisa



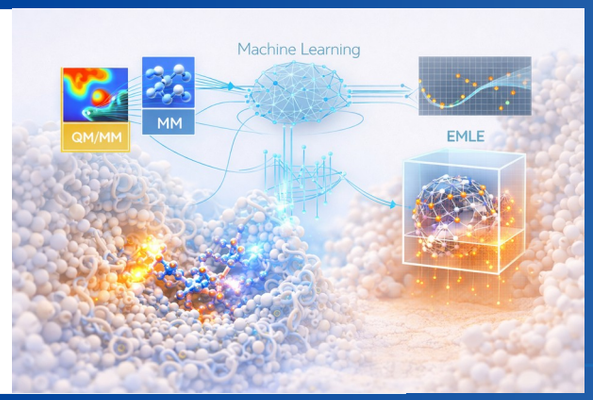
Breakdown by **region** and **research area** for the projects in **Artemisa**. Most of the projects are from “Comunidad Valenciana” and ”*Mathematics, Physics and Engineering*” but other regions and fields growing.

AI in Artemisa

Faster and Smarter Molecular Simulations

Chemistry

Physics-based machine learning models to replace expensive quantum calculations in molecular simulations. This allows accurate and efficient study of large and complex systems, such as chemical reactions in enzymes, which are otherwise too costly to model.



Protecting Submarine Cables

Earth Sciences

Submarine cables are essential for global communication but are vulnerable to damage and sabotage. This work explores using existing cables as large-scale acoustic sensors, combined with machine learning, to detect and track vessels in real time. High detection accuracy and distance estimation, with strong potential for practical maritime surveillance.

Emotion Recognition

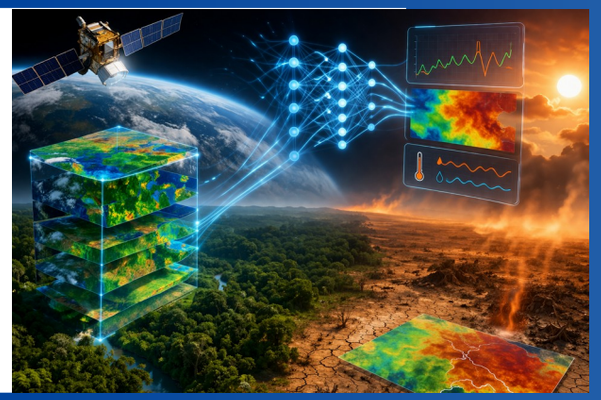
Technology

Machine learning approach that adapts speech emotion recognition systems to new speakers with limited data. By incrementally selecting and refining the most informative samples, the method improves accuracy and generalization, outperforming traditional approaches in challenging, data-scarce scenarios.

Predicting Climate Impacts with AI

Climate

Advanced machine learning to analyze large-scale Earth observation data and predict how extreme climate events affect ecosystems. Trained on a global satellite dataset, the model accurately forecasts vegetation changes and identifies key environmental drivers before and during extreme events, improving understanding and early warning of climate impacts.

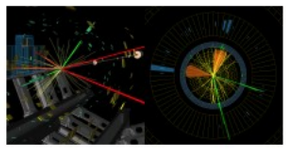


AI in Artemisa

CHEST SCREENING EVALUATION FOR COVID-19 PATIENTS

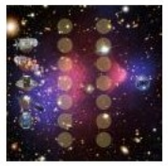
A project funded by Instituto de Salud Carlos III and led by IFIC researchers is carrying out radiological imaging analysis using machine learning techniques with the aim of enhancing patient diagnose and evolution assessment.

MACHINE LEARNING @ ATLAS EXPERIMENT



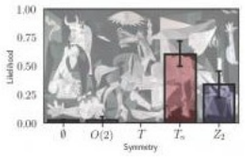
The ATLAS experiment at the Large Hadron Collider (LHC) is looking beyond the Standard Model of particle physics, searching for signs of unknown new physics. An important aspect to be able to find this new physics is the identification of the interesting events within all the events available. Interesting events are called "signal", while others are "background". Individuating these signal events, which are indeed extremely rare, is a really challenging task. The LHC has delivered billions of collisions which have been recorded by the ATLAS detector.

DARK MACHINES



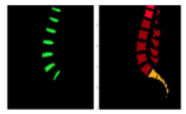
Dark Machines (www.darkmachines.org) is an initiative to develop and apply machine learning methods to accelerate dark matter searches. It is composed of more than 300 high-energy physicists, astroparticle physicists and astrophysicists, from theory and experiment, as well as computer scientists.

IDENTIFYING SYMMETRIES THROUGH AI



Since the dawn of humanity, our species has tried to decipher the world around us, through art, literature, music or science. The skills developed and the tools used are different, as different as the audiences targeted. But the goals are basically the same: to dealing with complexity using the tools at hand.

MACHINE LEARNING IN MAGNETIC RESONANCE



Low back pain (LBP) is a very prevalent pathology and a frequent cause of disability. It is associated with rising costs for the health system and for society in developed countries, affecting 70% of the general population at some time in their lives, with an annual incidence of 40%

The multidisciplinary group lead by María de la Iglesia-Vayá from the Prince Felipe Research Center (CIPF) uses Artemisa to develop the first massive and open-access data repository of lumbar MRI for International collaborative research.

CUSTOM-DHM: DIGITAL HUMAN MODELING APPLICATIONS

The objective of the project is to advance in the integration of 3D models of the body in the development of digital products and applications, developing innovative tools that allow their 3D and / or 4D analysis for the clothing, health and wellness, audiovisual and orthopedic sectors, or any other sector that is interested in incorporating digital information from users.

IDENTIFYING WEED SPECIES IN CROP FIELDS

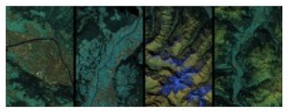
Convolutional Neural Networks (CNN) are currently being implemented in a wide variety of applications. This subdomain of Artificial Intelligence shows a powerful performance in machine vision applications and may be used to categorise and classify objects, amongst other image processing tasks.

In the Artificial Perception Group of the Centre for Automation and Robotics (CAR) we are interested in identifying and classifying weed species within crop fields, which is a very specific problem, as the system will only need to process images of soil and plants.

NEUROCONVO: BRAIN WAVES WITH NEURAL NETWORKS

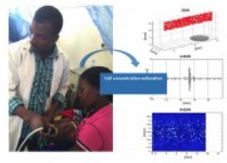
The brain generates activity in the form of oscillations. Brain waves span from very slow rhythms, typical of sleep, to faster oscillations during attention and cognitive processing. Moreover, changes of brain oscillations are markers of some neurological diseases. Given the dynamism of brain activity, these events are far from stationary and thus their identification in real time is a daunting task.

SENTIFLEX



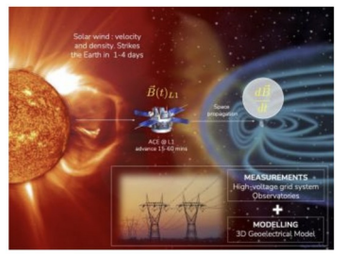
Machine learning is one of the keys in the development of modern Earth Observation satellite missions. Model training requires precise Earth simulation as basis of applications such as vegetation monitoring, prospecting for minerals, soil use and climate change studies, among others.

NON-INVASIVE SCREENING FOR MENINGITIS



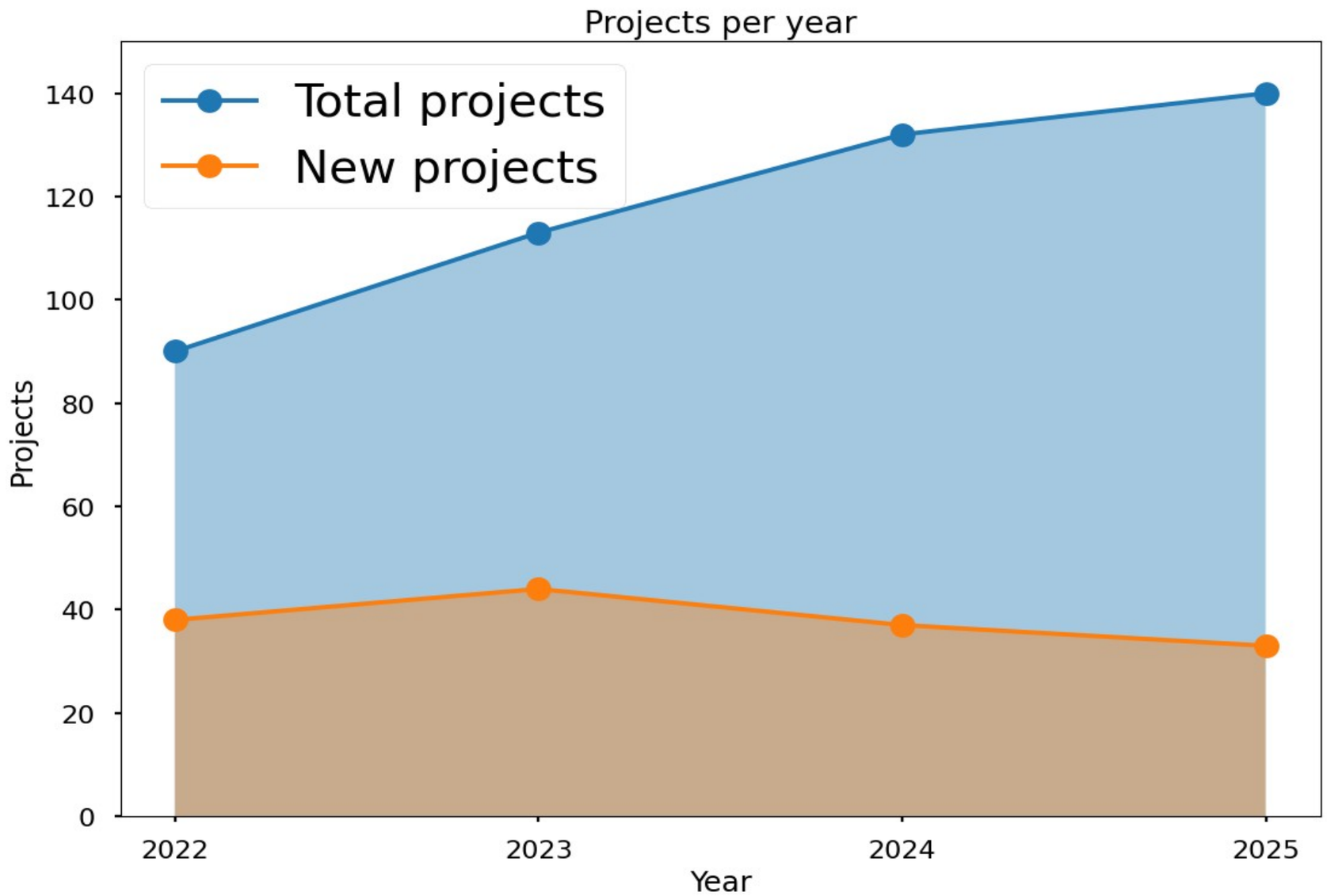
165 newborns die every day of Bacterial Meningitis (BM), an aggressive infection that leaves severe sequelae among 30% of survivors. Rapid detection, particularly in this age group, is difficult due to the little specificity and overlap of its symptoms with those of more common and less severe diseases. Current strategy to improve prognosis is the prompt antibiotic treatment after an early diagnosis by means of a lumbar puncture (LP), invasive and potentially harmful procedure.

SOLAR STORMS AND THE SPANISH CRITICAL INFRASTRUCTURES



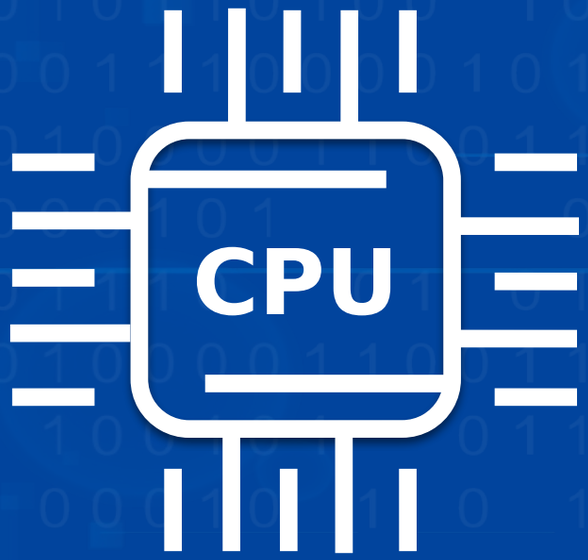
In the last decades, our society has become more interdependent and complex than ever before. Local impacts can cause global issues, as the current pandemic clearly shows, affecting the health of millions of human beings. It is also highly dependent on relevant technological structures, such as communications, transport, or power distribution networks, which can be very vulnerable to the effects of Space Weather. The latter has its origin in solar activity and their associated events, such as solar flares and

Artemisa in Numbers



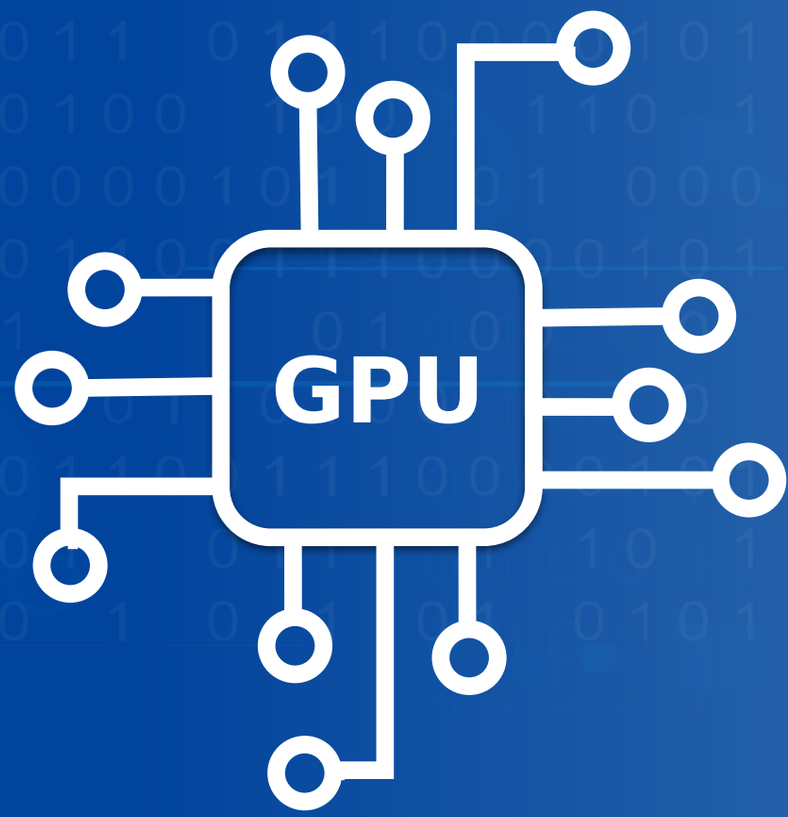
Number of **NEW** projects are increasing yearly

Artemisa in Numbers



3600 CPUs

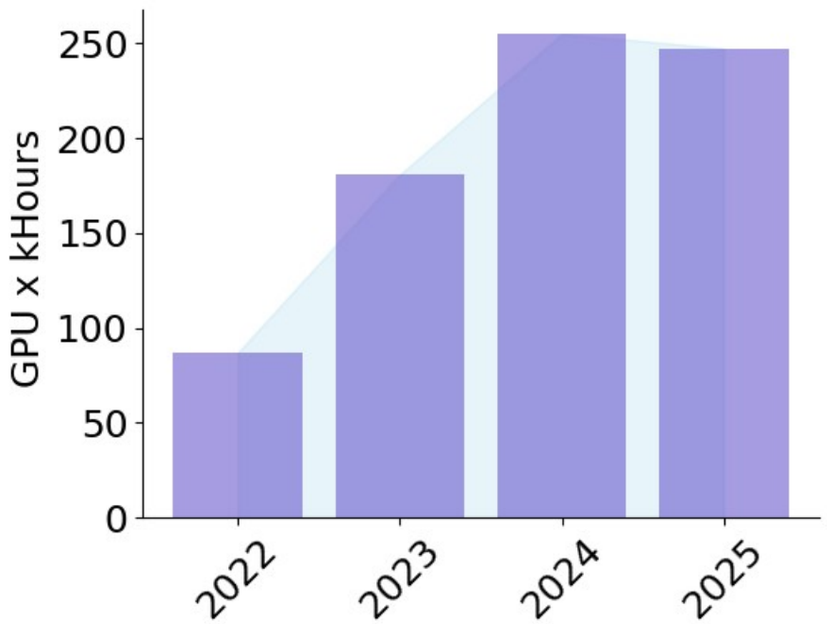
+1000k Hours Delivered in 2025

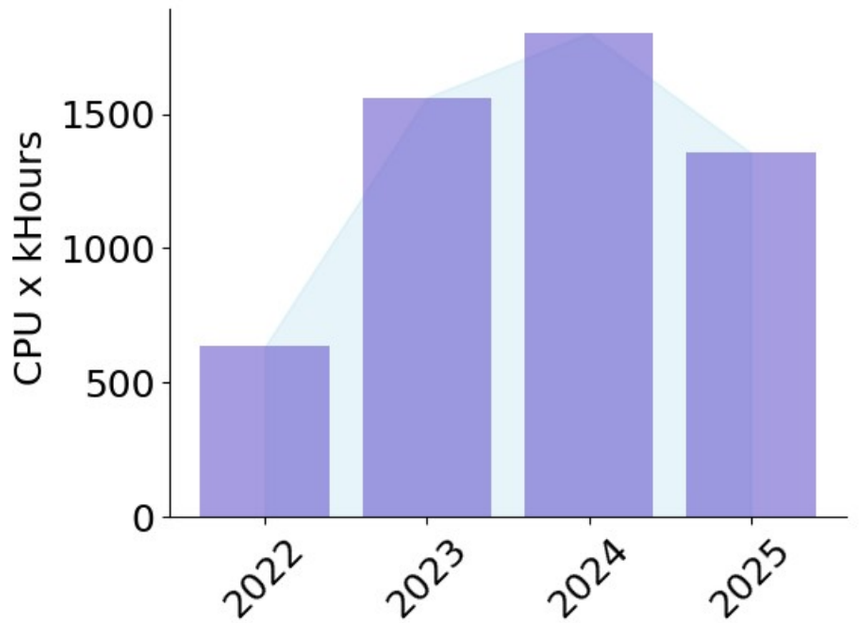


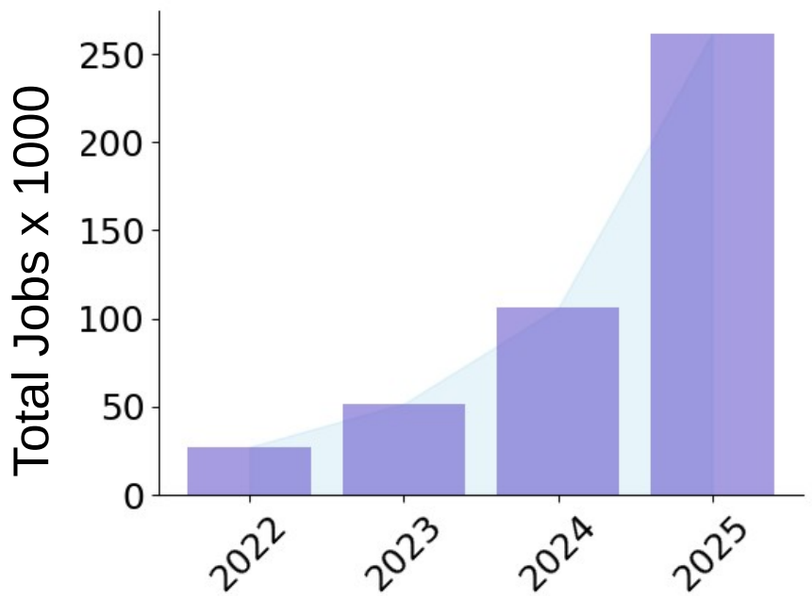
48 GPUs

~250k Hours Delivered in 2025

Artemisa in Numbers







Infrastructure

Artemisa Facility Details

#	Usage	General Characteristics	GPU
2	User interface	2 Intel Xeon Gold 6130 (16c), 192 GB RAM	2 GPU NVIDIA
2	Batch	2 Intel Xeon Gold 8160 (24c), 384 GB RAM	1 GPU NVIDIA Tesla V100 32GB
20	Batch	2 Intel Xeon Gold 6248 (20c), 384 GB RAM	1 GPU NVIDIA Tesla V100 32GB
11	Batch	2 AMD EPYC 7532 (32c), 384 GB RAM	1 GPU NVIDIA Ampere A100 40GB
2	**Batch**	**2 x AMD EPYC 9454 (48c) 384 GB RAM**	**2 GPU H100 NVL 94 GB with NVLink**
1	Batch	2 Intel Xeon Platinum 8180 (28c), 768 GB RAM	4 CPUs NVIDIA Tesla V100 32GB SMX2 with NVLink
1	Batch	2 AMD EPYC 7642 (48c), 512 GB RAM	8 GPUs NVIDIA Ampere A100 40GB SMX2 with NVLink
5	Disk Servers	387 TB Lustre	-
3	Disk Servers	150 TB Lustre (SSD)	-

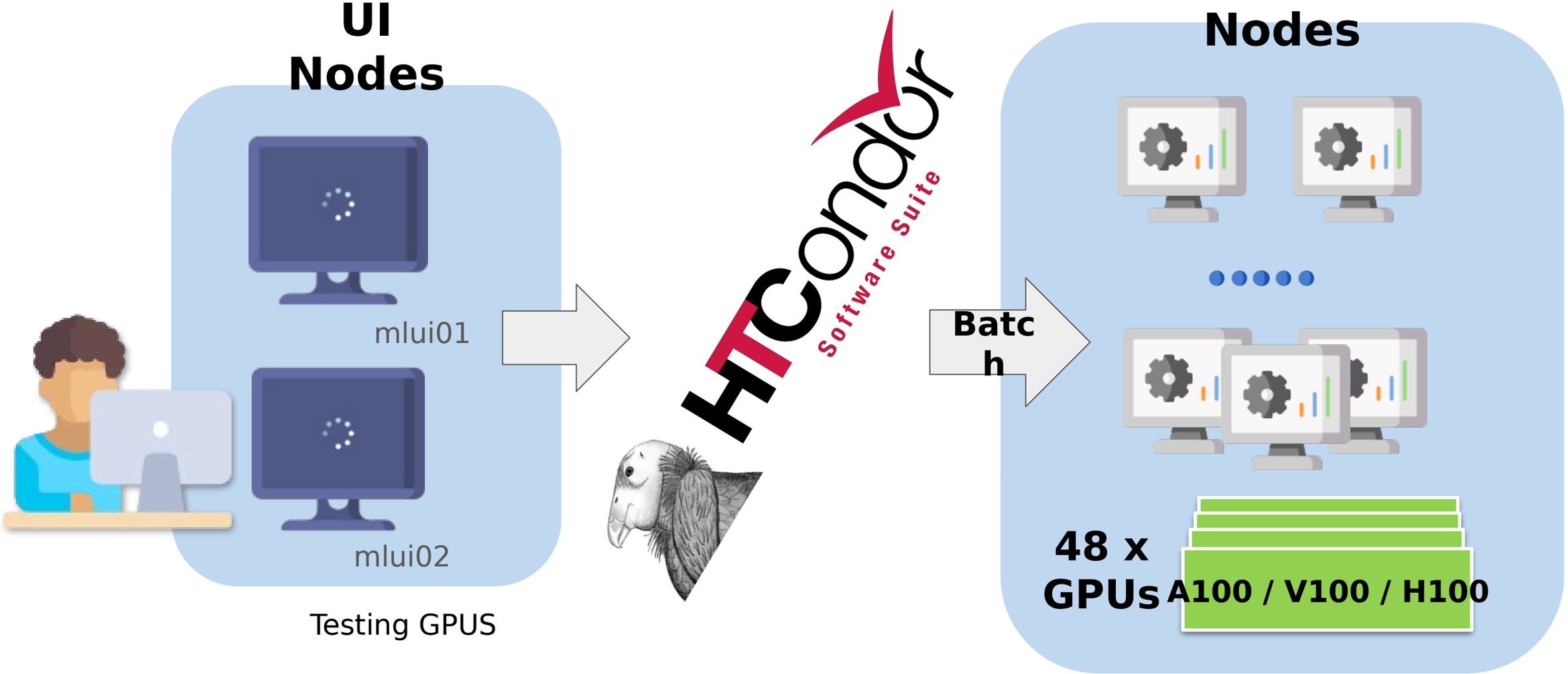
Infrastructure

User Interfaces (UIs): Entry points for users, which provide a working environment where they can test their programs or send them to WNs. These machines have two GPUs and access to storage devices.

Worker Nodes (WN): where batch tasks are executed. They have high-end CPUs, higher memory availability, and different GPU configurations to run tasks.

Storage Nodes(SN): stores user and project data, accessible from UIs and WNs.

Infrastructure



Task management

Users do not have direct access to WNs.

The execution of user jobs on WNs is managed by **HTCondor**.

HTCondor is a specialized workload management system aimed at executing compute-intensive tasks.

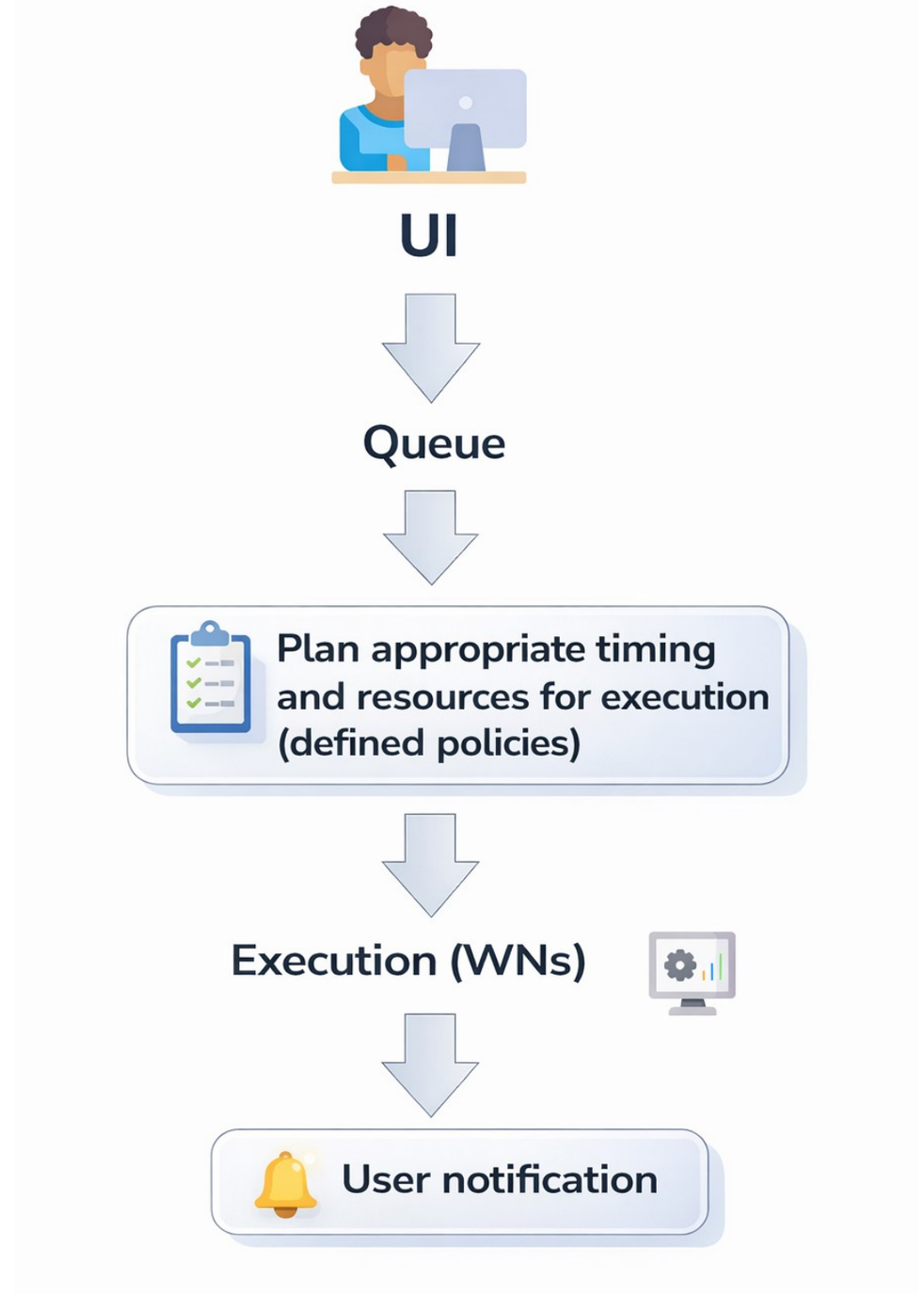
Work gluing mechanism

Planning policies

Priority schemes

Resource and task monitoring

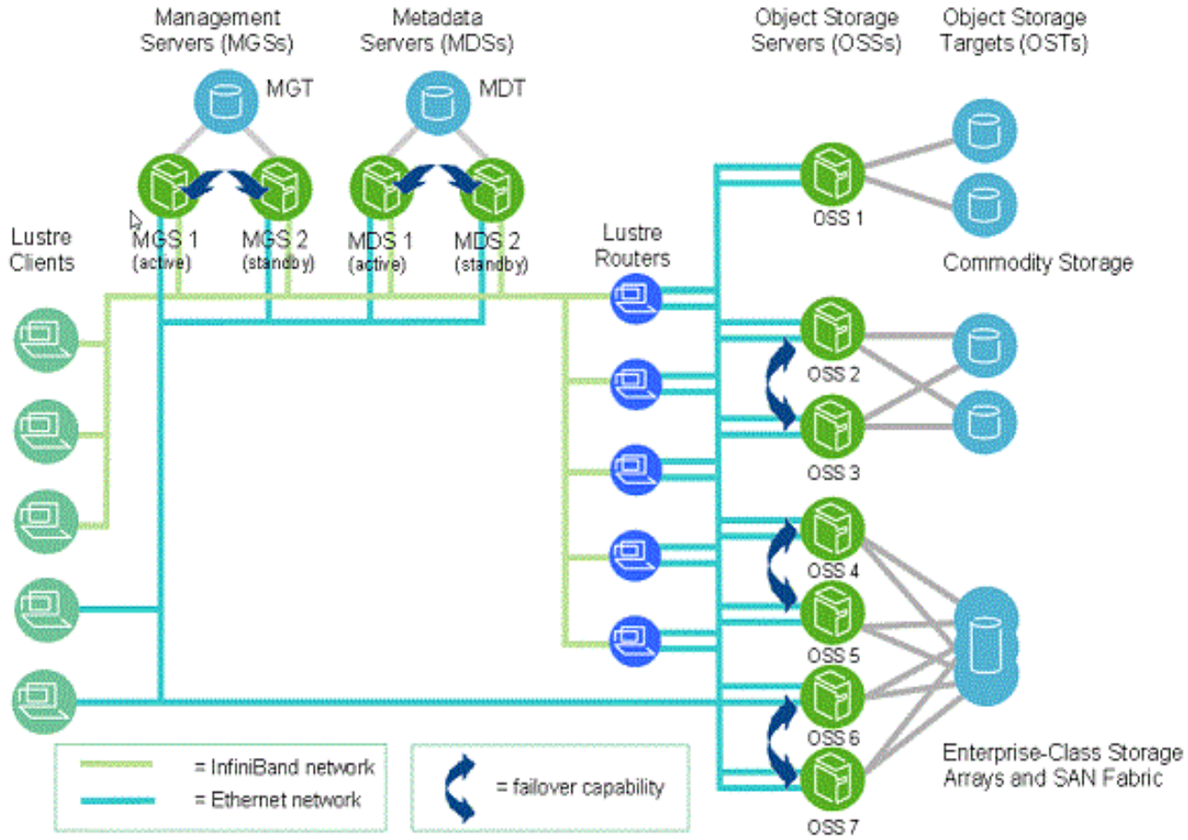
- Resource Management



File System

lustre®

- Distributed and open-source storage system
- Add servers (OSSs) and their disks (OSTs) recreating a large disk
- Provides POSIX services
- Allows for storage scalability.
- Supports ACLs and quotes (user, group, project)



En ARTEMISA: /lustre/ific.uv.es/ml

- Operating system: Formerly CentOS7, UIs and WNs have been migrated to AlmaLinux 9.6

- Nvidia's parallel computing platform for encoding algorithms on GPUs.

- Apptainer(Singularity): Running containers.
  - Compatible con Docker
  - High compatibility with HTCondor jobs

- Compilers and Tools

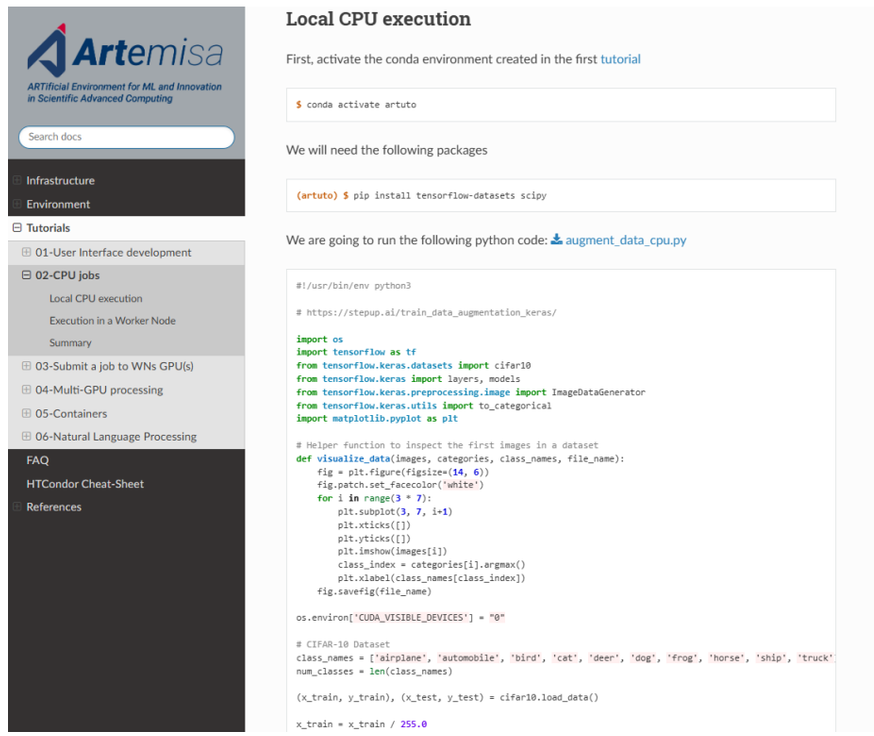
Support

- Assistance with specific user needs
  - Technical advice: bookstores, queues, resources, etc
  - Specific requirements: disk, compute time
  - Common issues: Account issues, etc
- Hardware and software failure recovery
- Update
- Installation of new equipment

artemisa-support@ific.uv.es

Documentation

- Usage Guide and Documentation: https://artemisa.ific.uv.es/docs/
  - System Overview and Specifications
  - FAQ
  - User tutorials



Artemisa JupyterLab

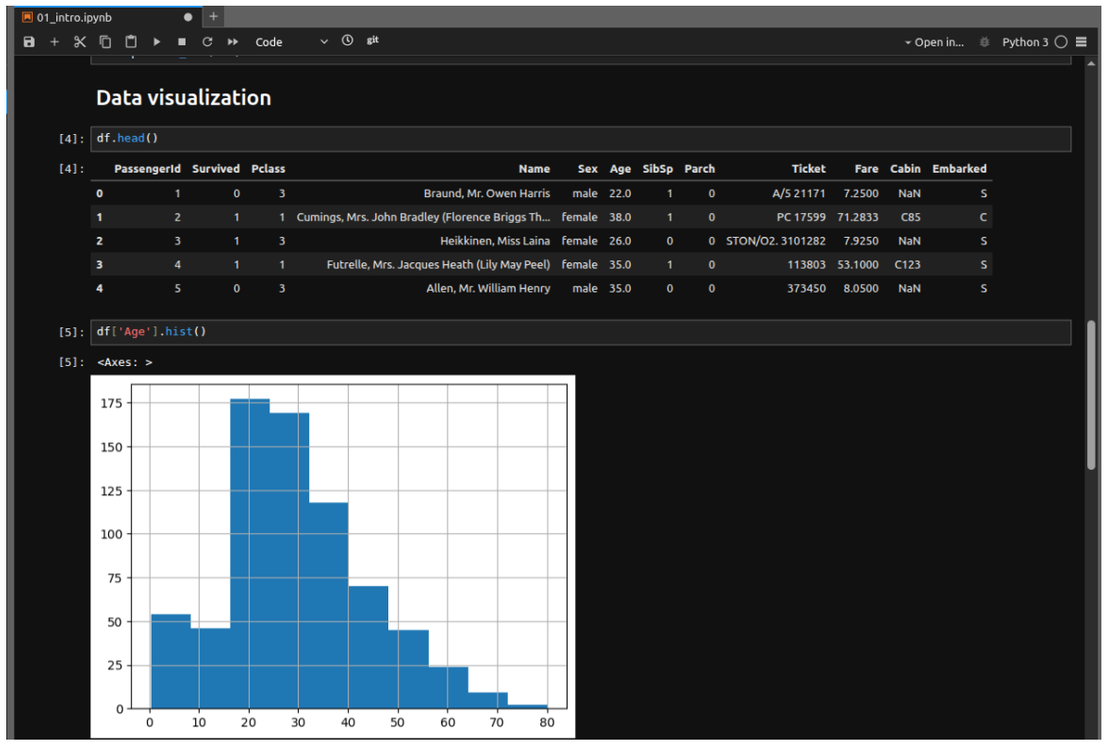
- JupyterLab: Web application where you can edit and run notebooks.

- Notebook: Document that combines executable code, text, visualization (graphs, tables, figures) organized in cells.

- Useful for sharing and playback

- Use a WN for now, expandable in the future
  - 7 independent instances available, using NVIDIA MIG (multi instance GPU), which partitions the GPU.

https://artemisahub.ific.uv.es/



Artemisa JupyterLab

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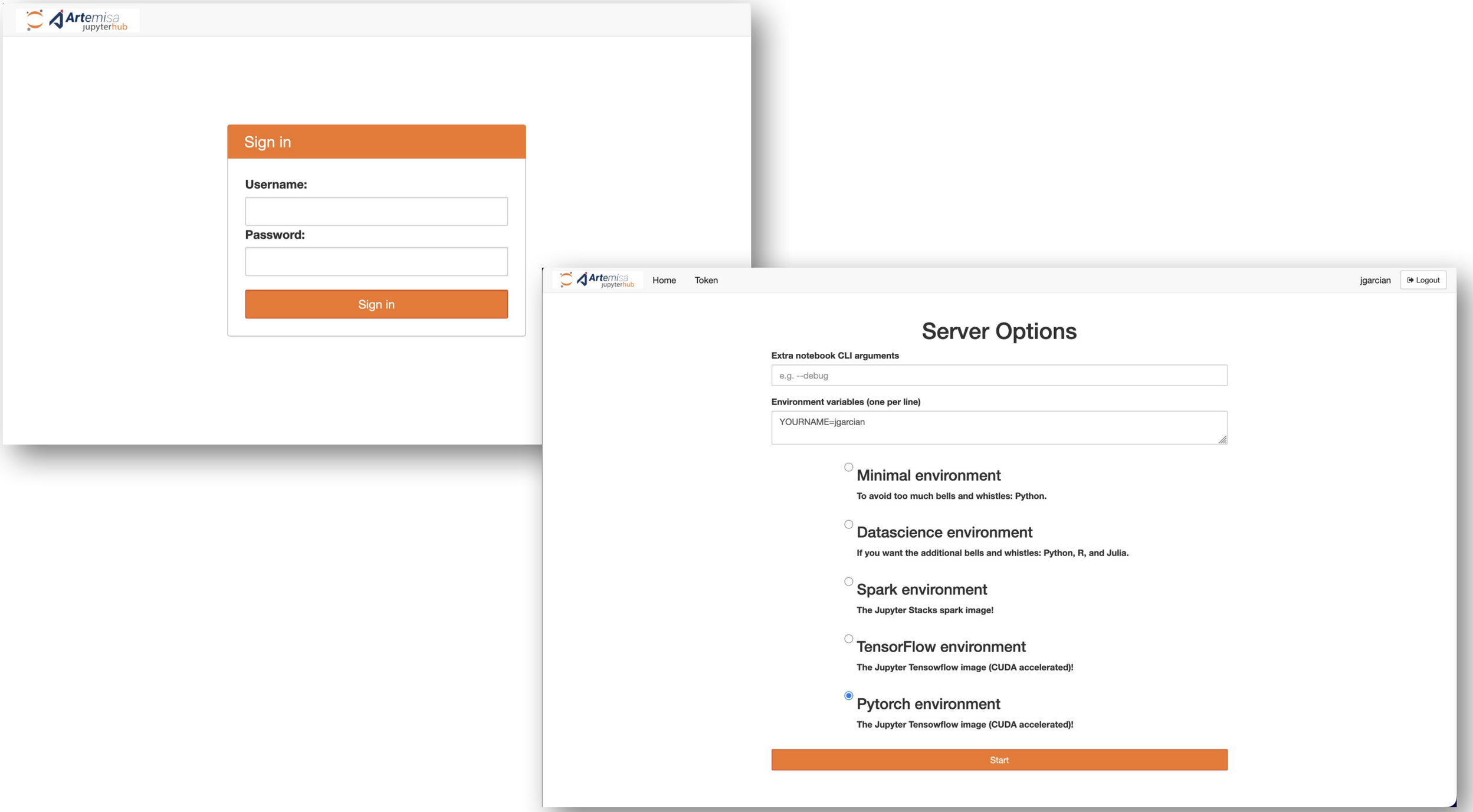
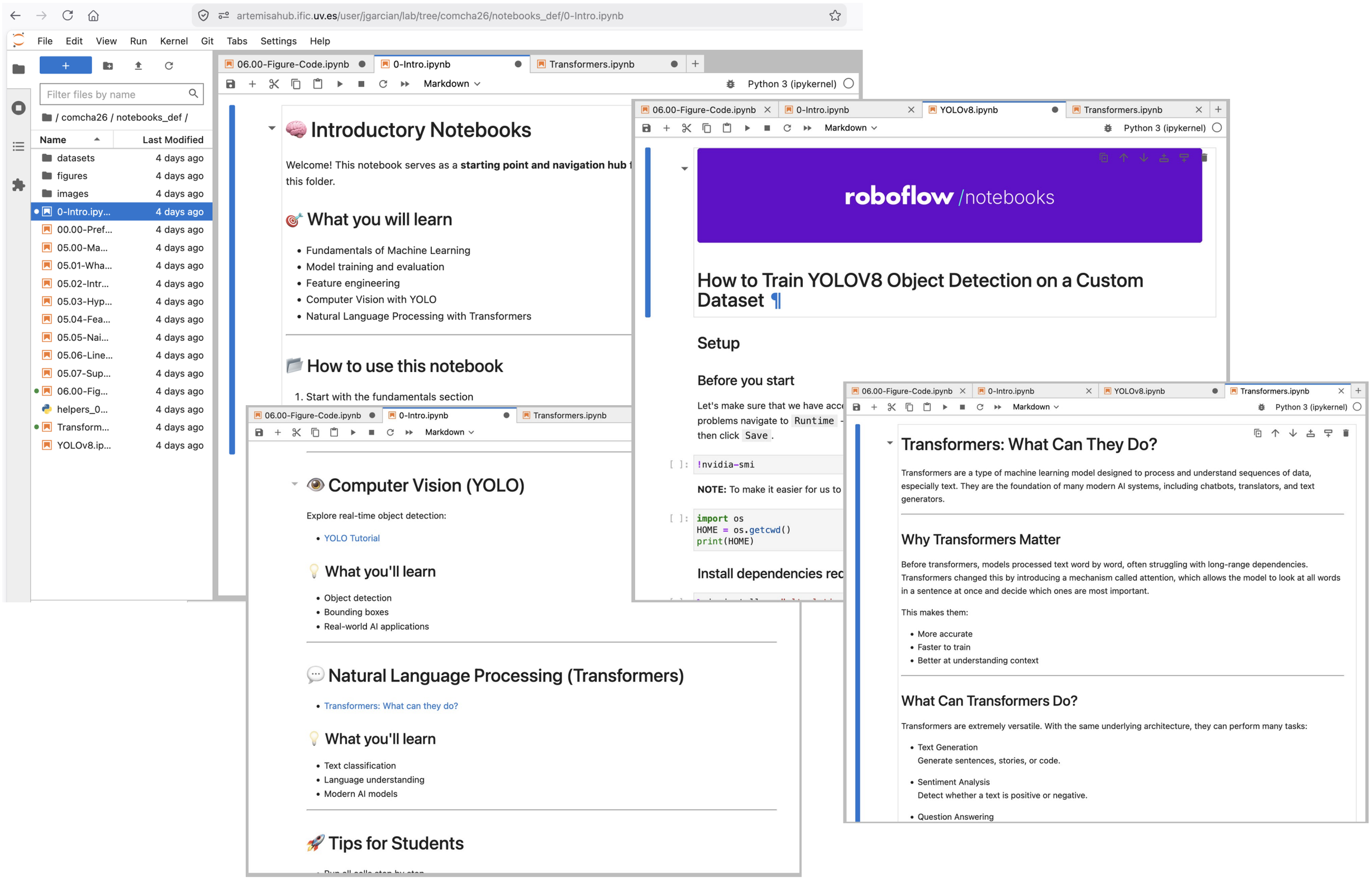


Artemisa JupyterLab



ARTificial Environment for ML and Innovation in Scientific Advanced Computing

Jose Enrique García

Financiado por la Unión Europea NextGenerationEU

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Plan de Recuperación, Transformación y Resiliencia

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ASFAE

Multi-Agent Hide and Seek

Red Dead Redemption 2's AI Even Corrects Itself When It Messes Up A Scripted Scene

After failing to dispose of a body, this brilliant NPC realizes their mistake and tries again.

thegamer.com

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