

INTELIGENCIA ARTIFICIAL

PASADO, PRESENTE y FUTURO

Pedro Larrañaga

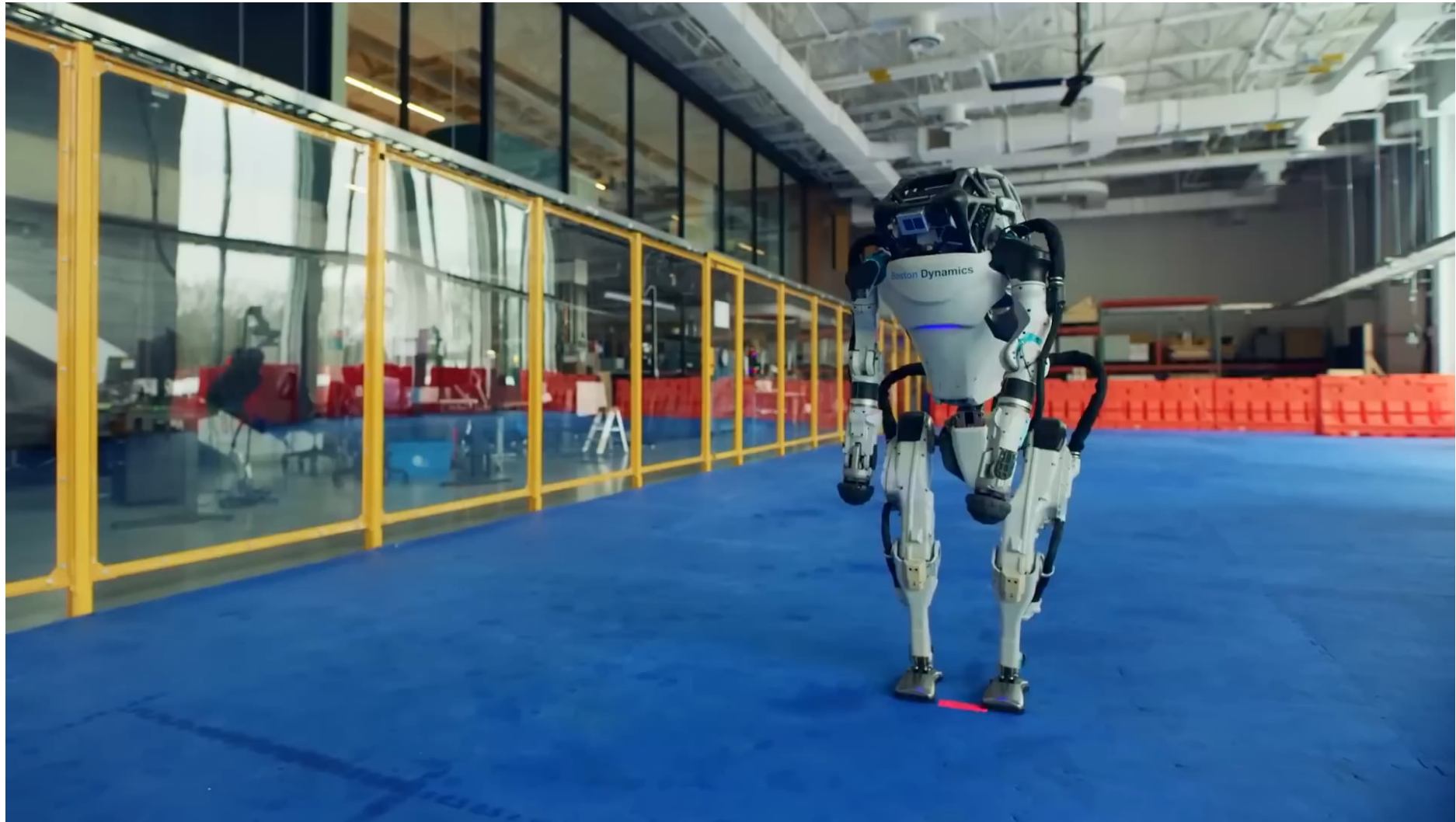


Madrid, 18 diciembre de 2023

EJEMPLOS



Robots bailando

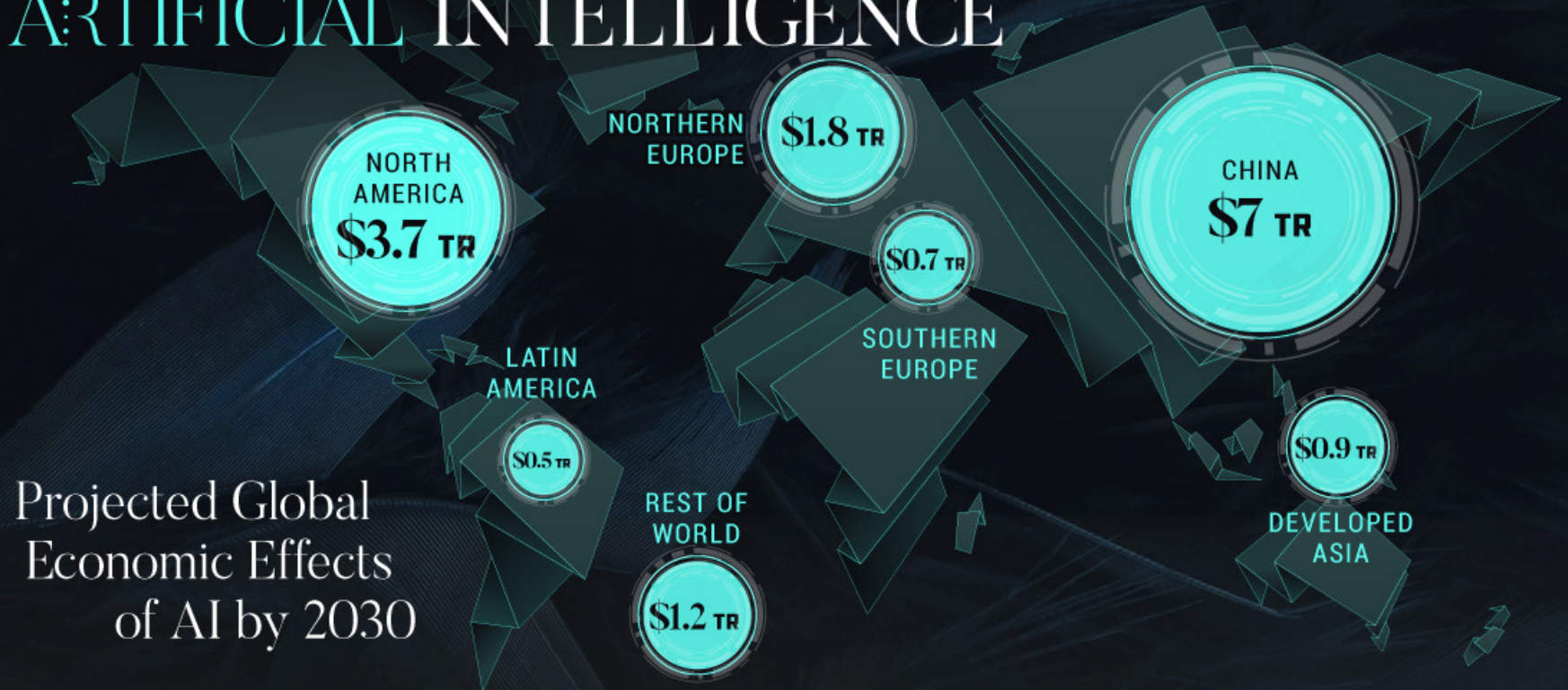


Coche autónomo

,

Influencia económica de la IA

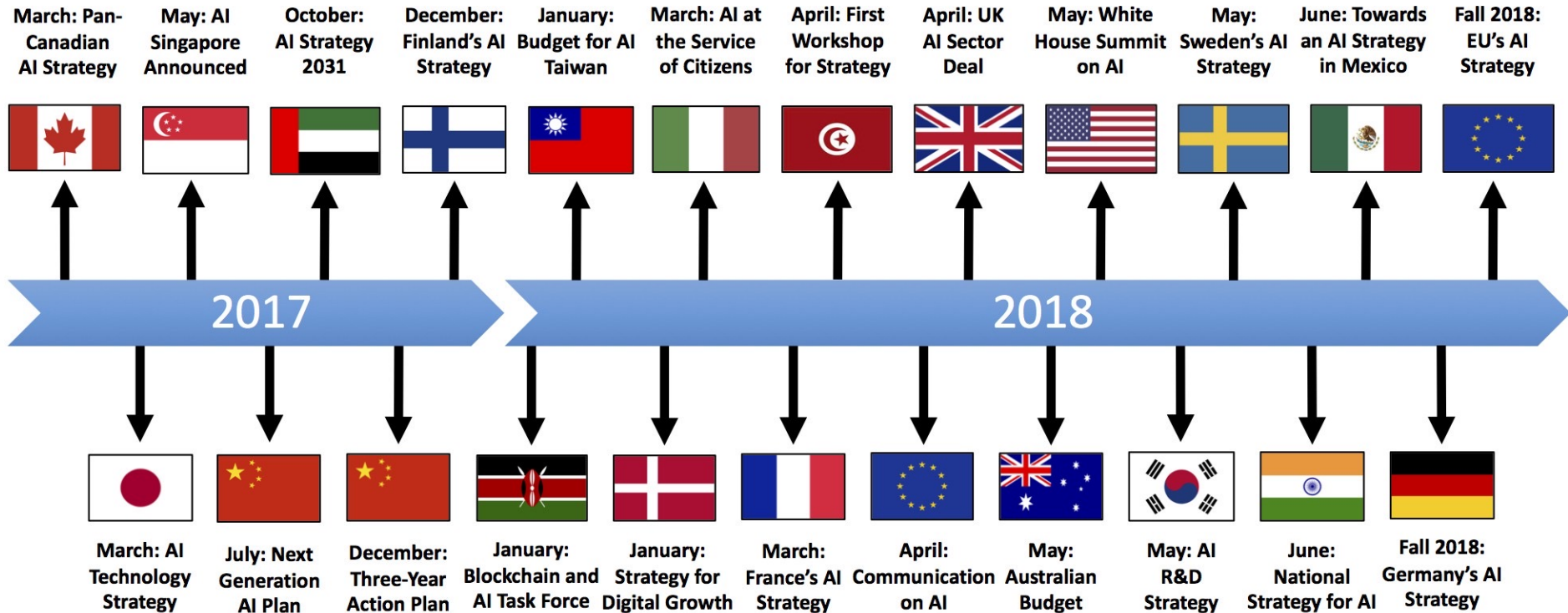
THE ECONOMIC IMPACT OF ARTIFICIAL INTELLIGENCE



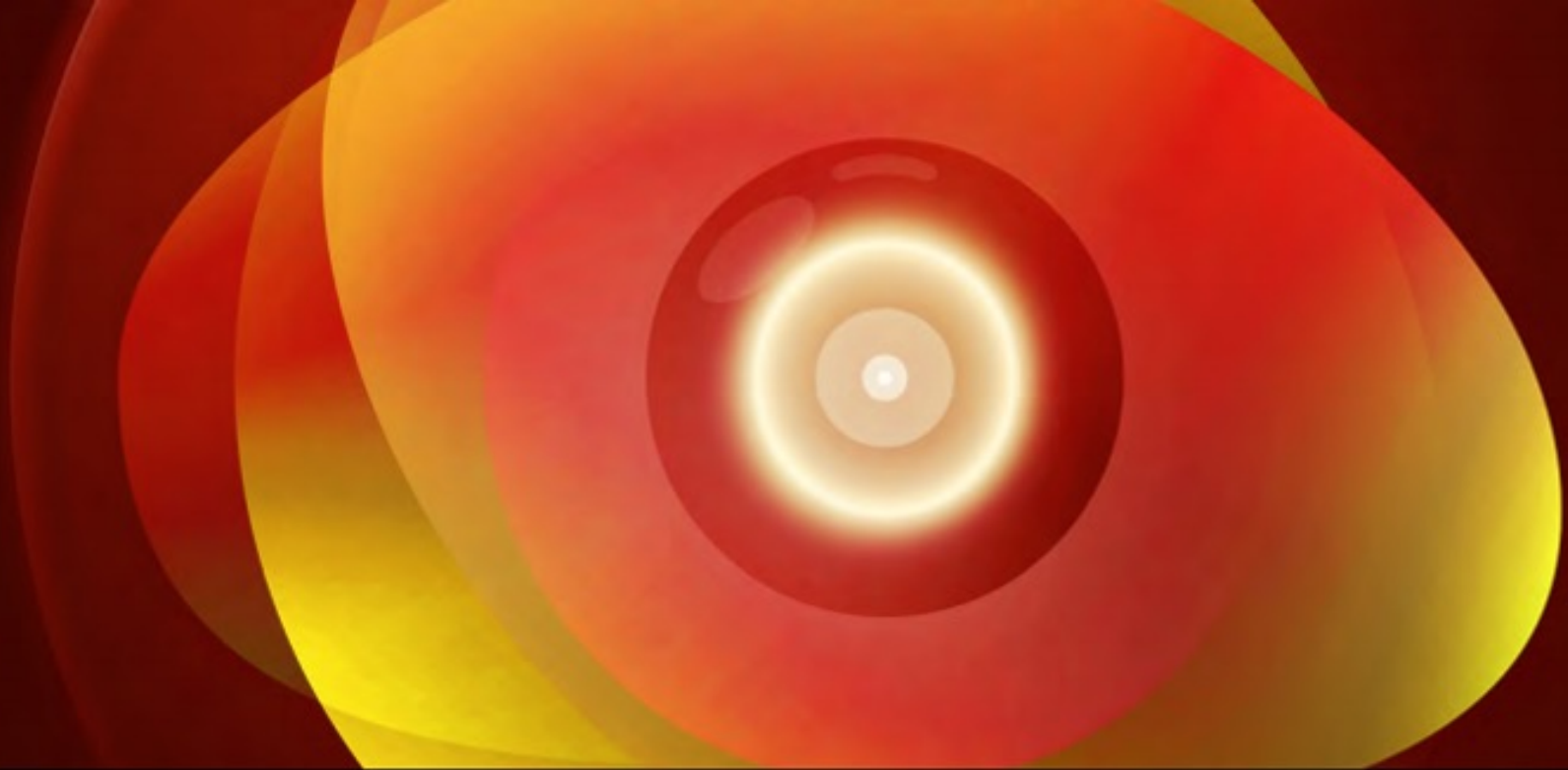
Source: PwC

Estrategias nacionales

Artificial Intelligence Strategies



Estrategia española de I+D+I en IA, 2019



GOBIERNO
DE ESPAÑA

MINISTERIO
DE CIENCIA, INNOVACIÓN
Y UNIVERSIDADES

ESTRATEGIA ESPAÑOLA
DE I+D+I EN INTELIGENCIA
ARTIFICIAL

¿Un ministerio de IA?

Edición: **España** + **Donar** Boletín de noticias - Suscripción

Regístrese como Autor

Regístrese como Lector

Iniciar sesión

THE CONVERSATION

Rigor académico, oficio periodístico

Q Buscar análisis, investigaciones...

Ciencia + Tecnología Cultura Economía Educación Medicina + Salud Medioambiente + Energía Política + Sociedad

Por qué un Ministerio de Inteligencia Artificial no es una idea descabellada

Publicado: 14 febrero 2019 22:27 CET

Gennady Danilkin / Shutterstock

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A sus 27 años, [Omar bin Sultan Al Olama](#), fue nombrado ministro de Inteligencia Artificial (IA) en los Emiratos Árabes Unidos en octubre de 2017. Su país, pionero en crear un ministerio en este ámbito, trata de colocarse a la cabeza de la IA en el mundo, buscando desbancar a países como [Estados Unidos](#) o China, en la actualidad líderes en esta carrera tecnológica.

Autoría

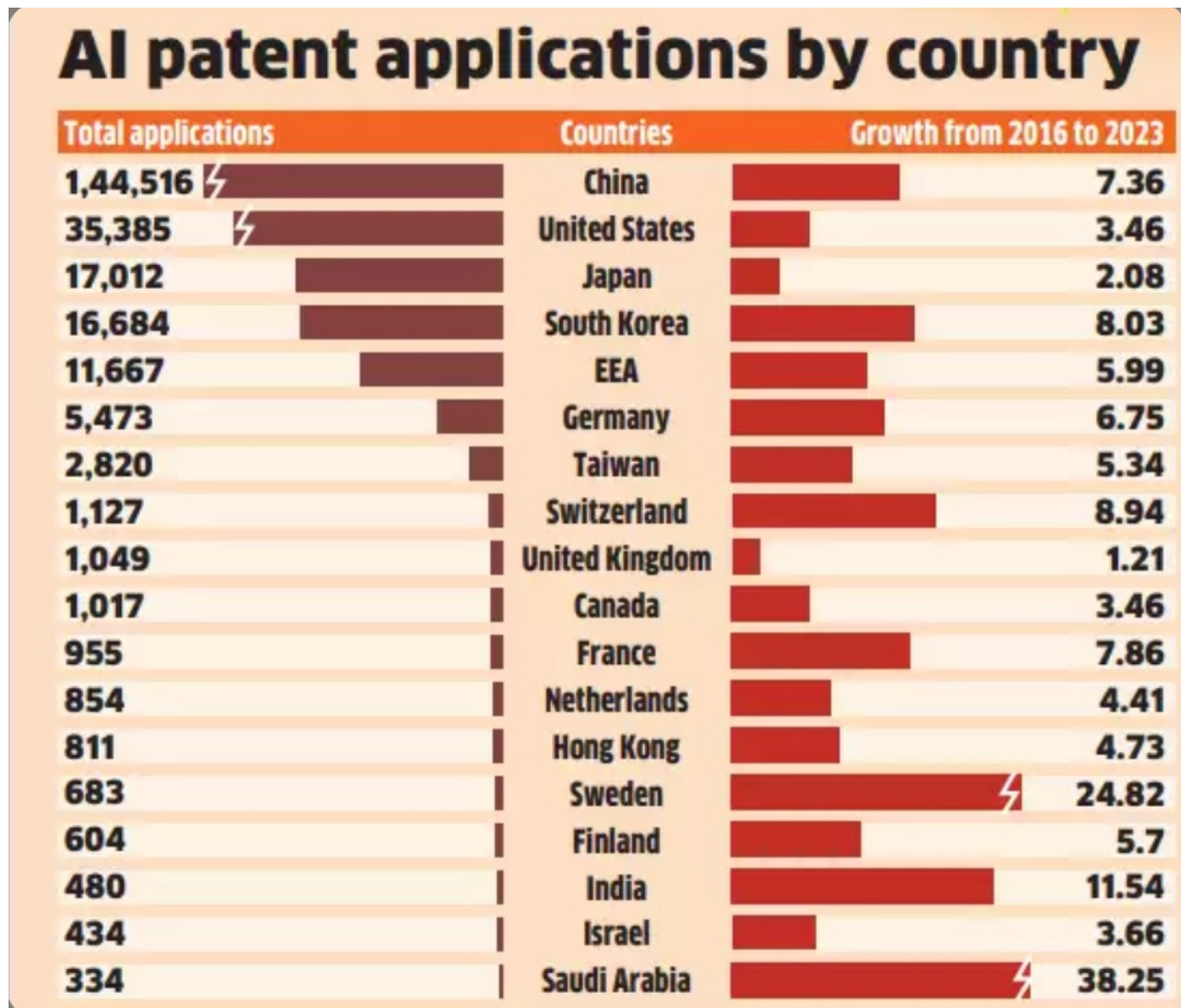


Pedro Larrañaga

Profesor e investigador en el Departamento de Inteligencia Artificial, Universidad Politécnica de Madrid (UPM)

Cláusula de Responsabilidad

Peticiones de patentes en IA por naciones



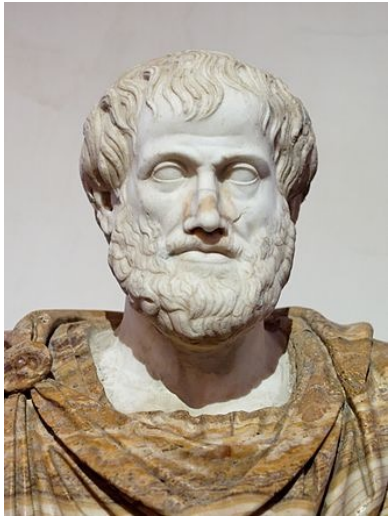
Datos generados por minuto en 2021



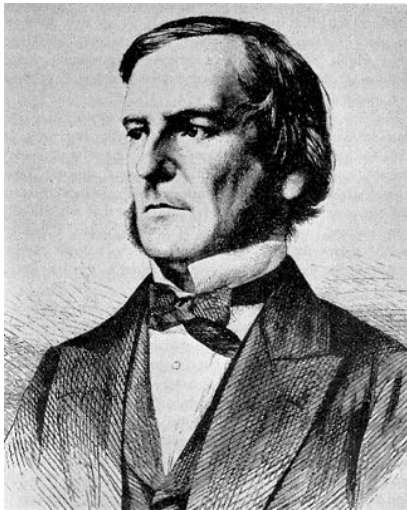
PASADO



Primeros pasos



Aristóteles (300 BC)
Silogismos



George Boole (1847)
Lógica proposicional



Gottlob Frege (1879)
Lógica de primer orden

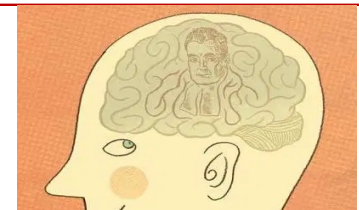
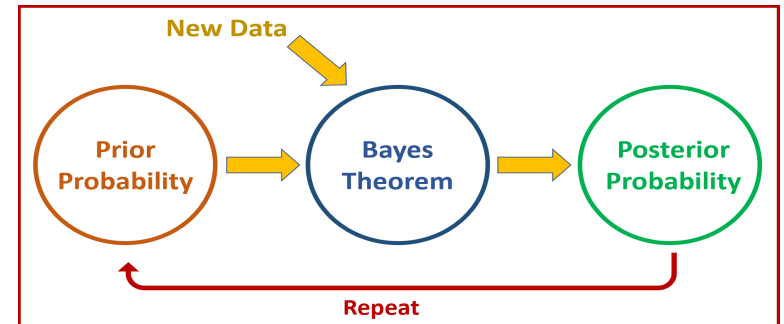
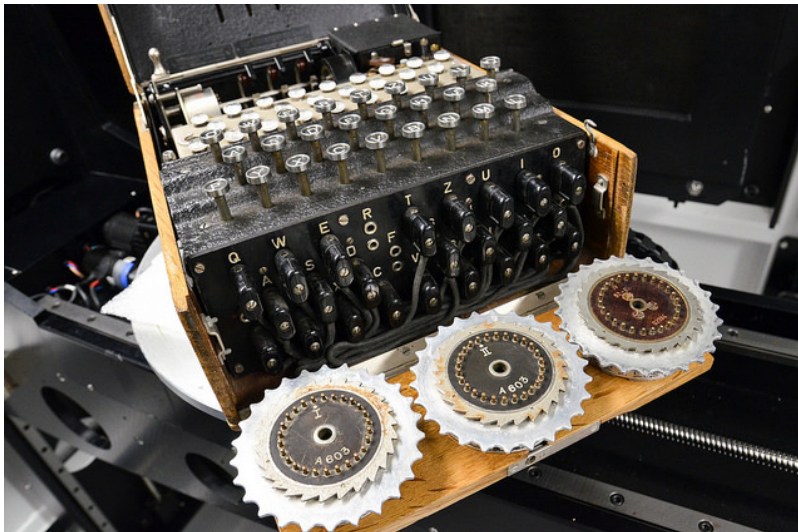


Andréi Kolmogórov (1931)
Lógica probabilista



Lotfi A. Zadeh (1965)
Lógica borrosa

Alan Turing (1940)

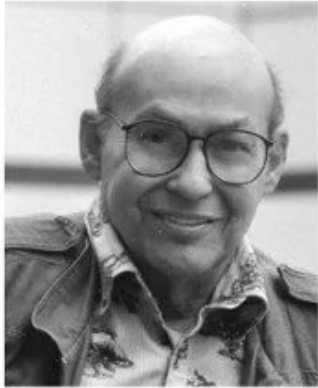


La reunión de Dartmouth (1956)

The Founding Fathers of AI



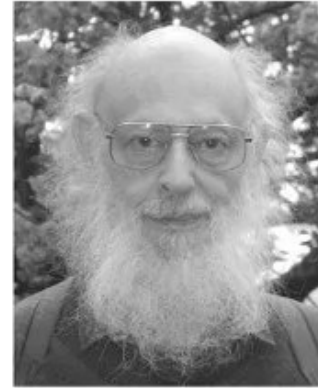
John MacCarthy



Marvin Minsky



Claude Shannon



Ray Solomonoff



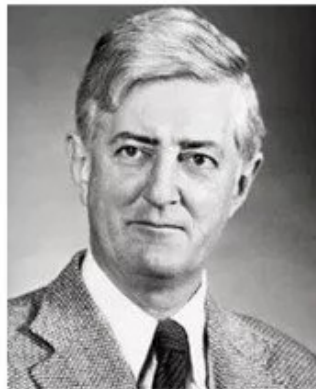
Alan Newell



Herbert Simon



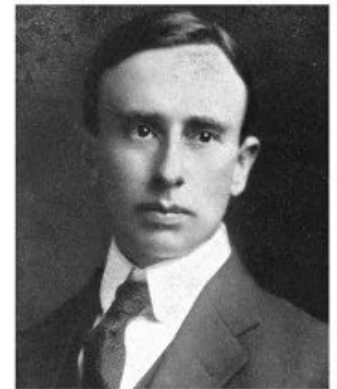
Arthur Samuel



Oliver Selfridge

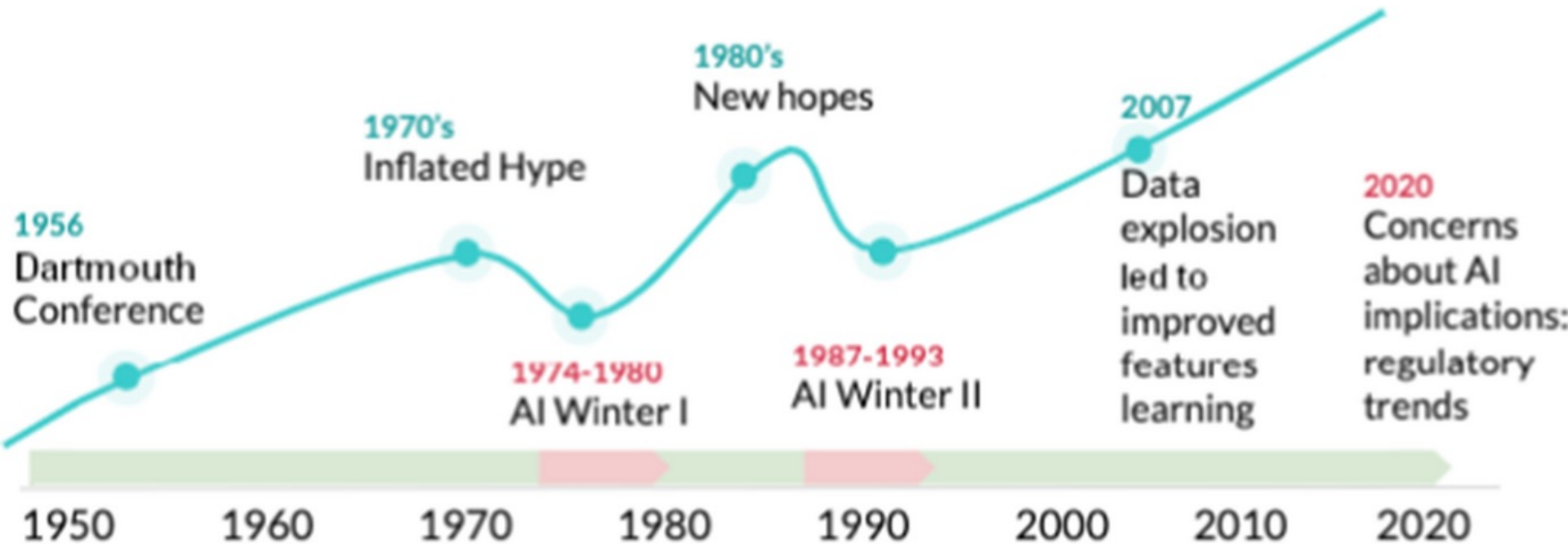


Nathaniel Rochester

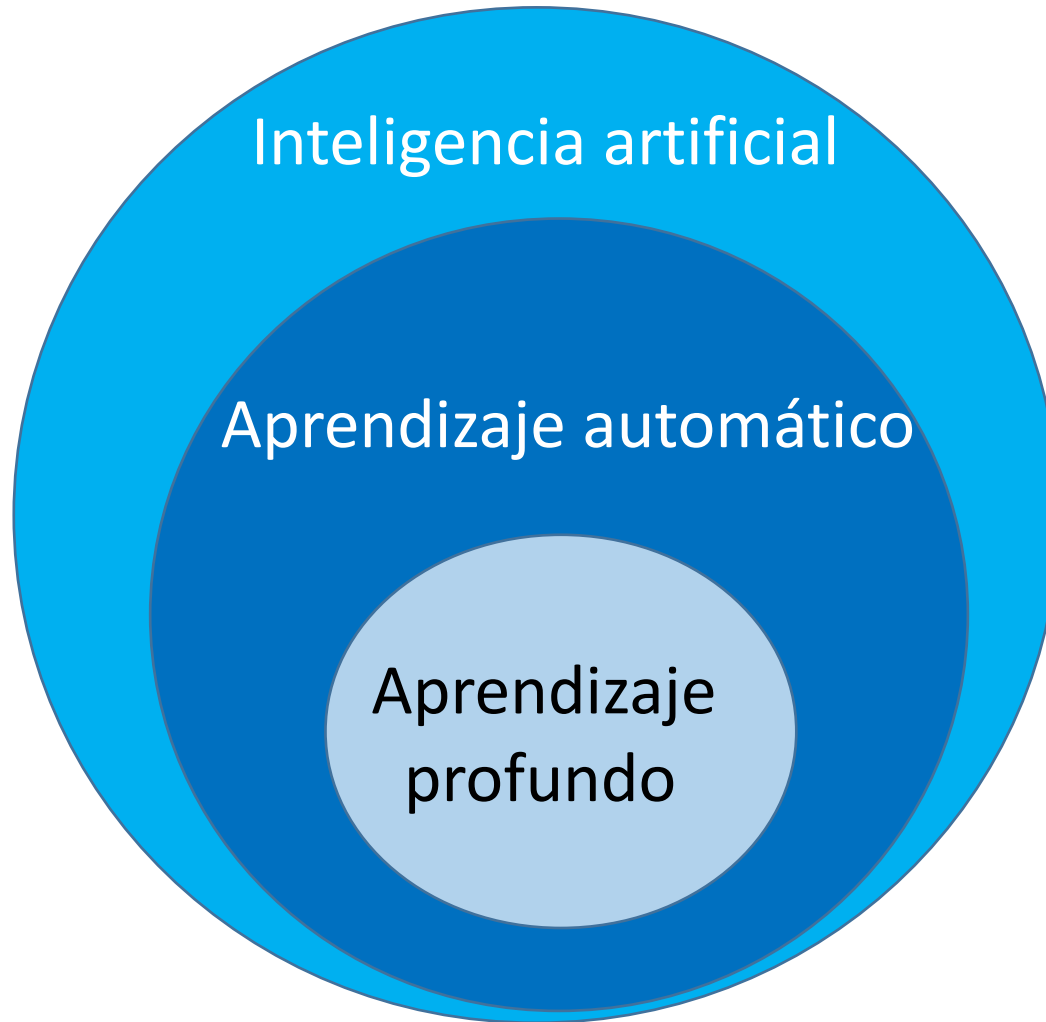


Trenchard More

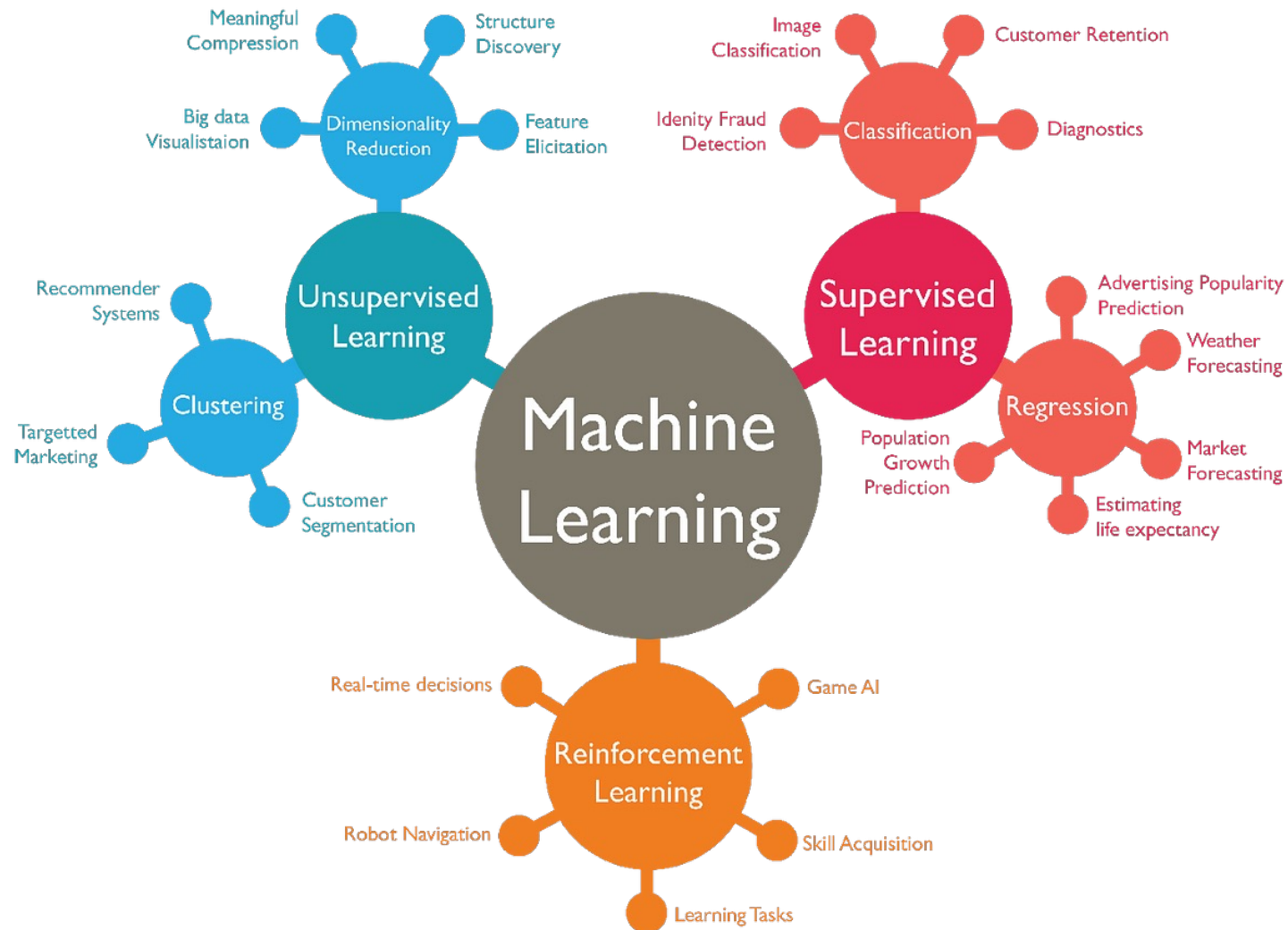
Primaveras e inviernos de la IA



Inteligencia artificial

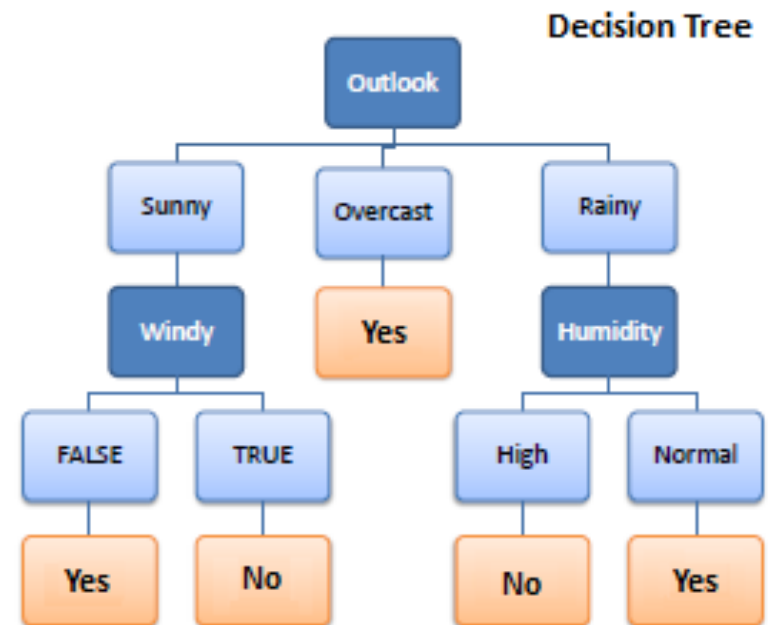


Aprendizaje automático



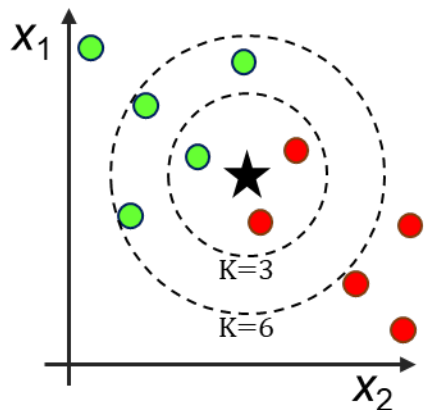
Clasificación supervisada

Predictors				Target
Outlook	Temp.	Humidity	Windy	Play Golf
Rainy	Hot	High	False	No
Rainy	Hot	High	True	No
Overcast	Hot	High	False	Yes
Sunny	Mild	High	False	Yes
Sunny	Cool	Normal	False	Yes
Sunny	Cool	Normal	True	No
Overcast	Cool	Normal	True	Yes
Rainy	Mild	High	False	No
Rainy	Cool	Normal	False	Yes
Sunny	Mild	Normal	False	Yes
Rainy	Mild	Normal	True	Yes
Overcast	Mild	High	True	Yes
Overcast	Hot	Normal	False	Yes
Sunny	Mild	High	True	No

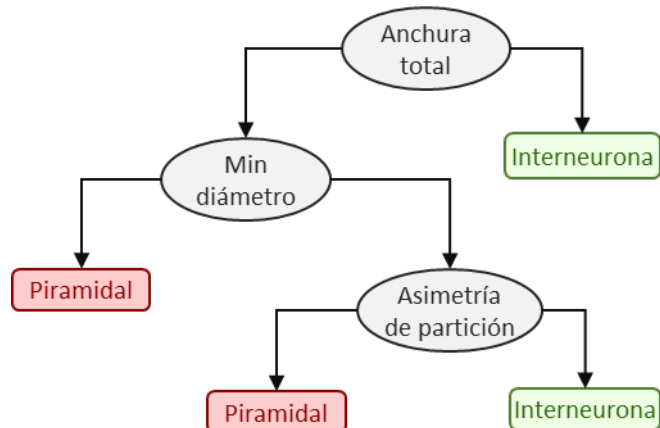


Clasificación supervisada

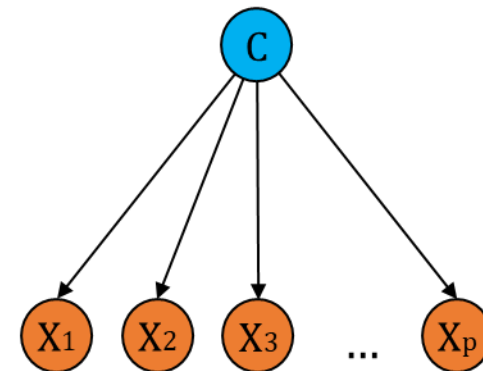
K vecinos más cercanos



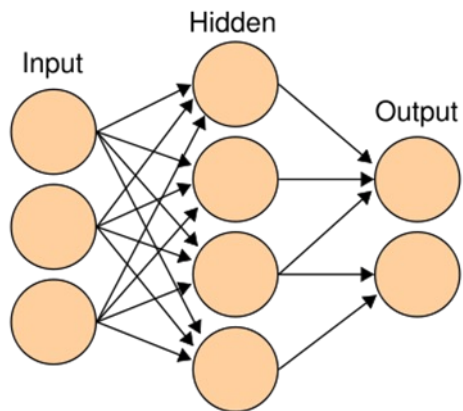
Árboles de clasificación



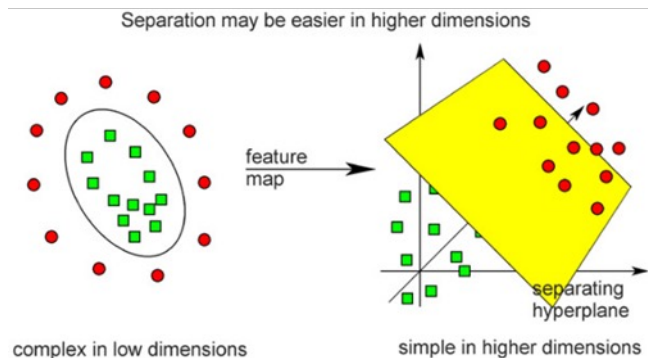
Naïve Bayes



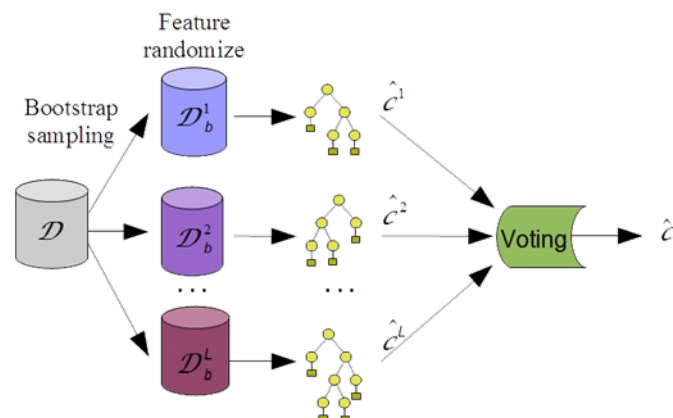
Redes neuronales



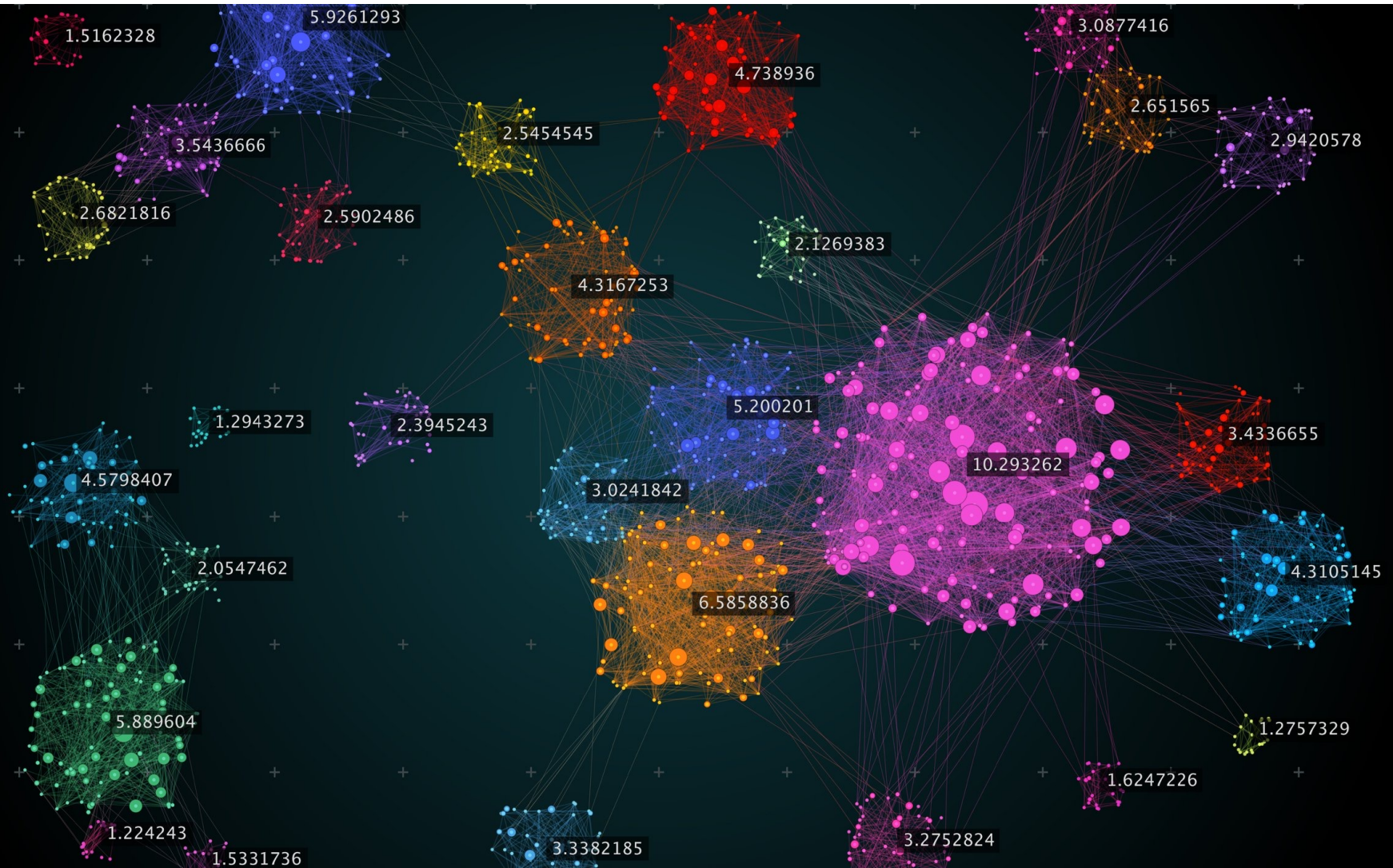
Máquinas de vectores soporte



Bosque aleatorio

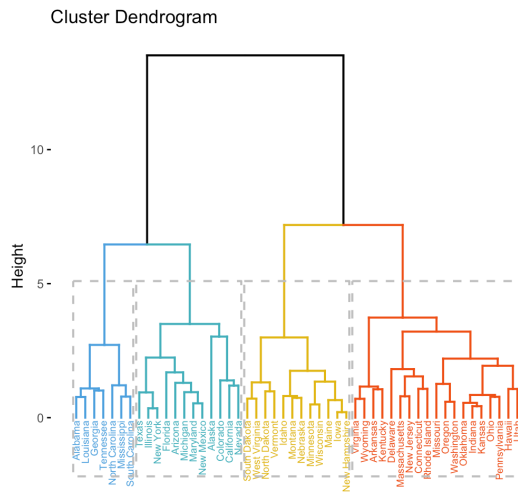


Clustering

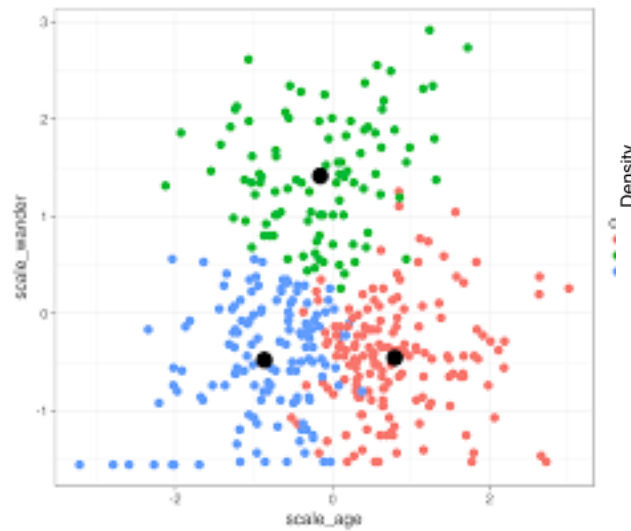


Clustering

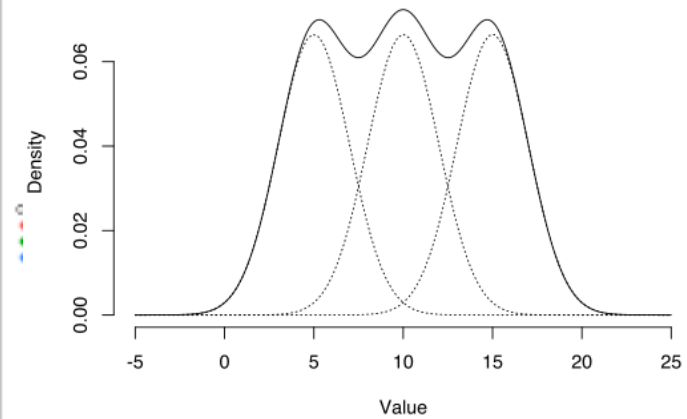
Clustering jerárquico (1951)



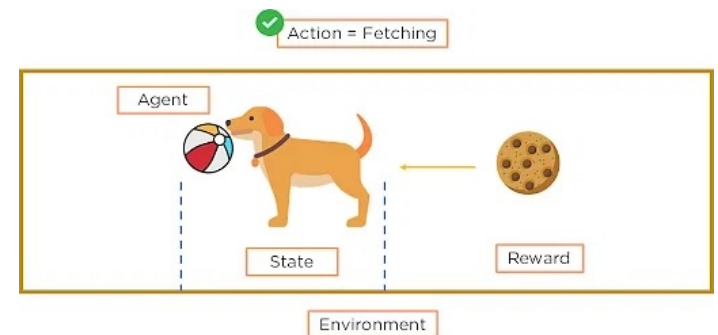
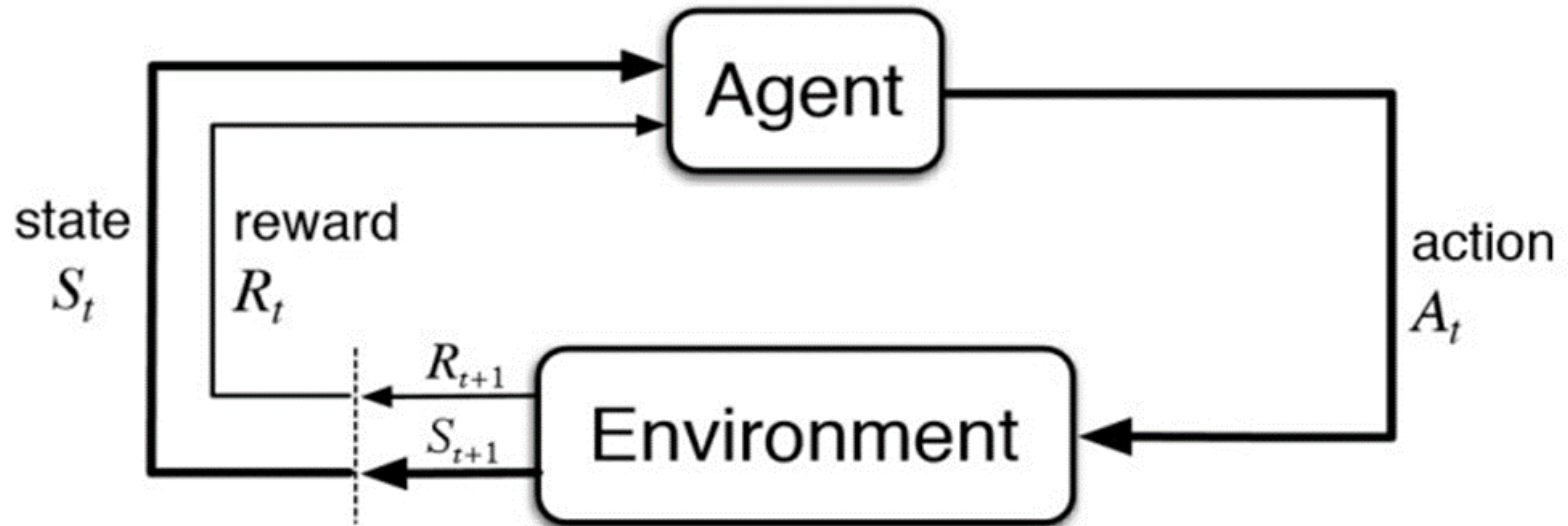
Clustering particional (1967)



Clustering probabilista (1985)

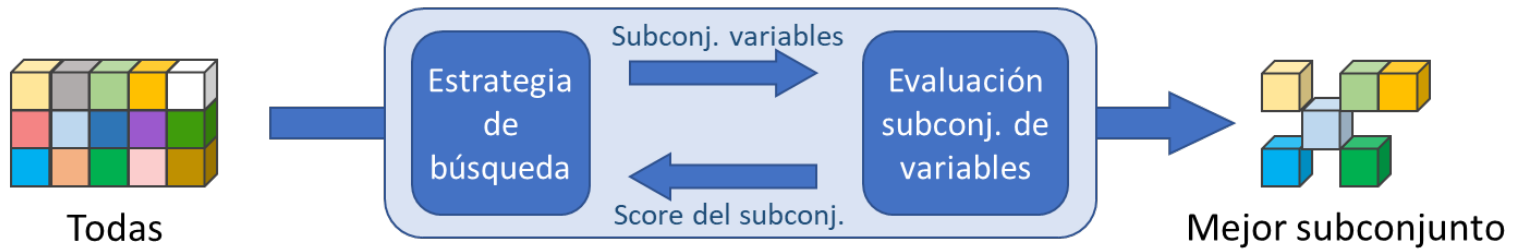


Aprendizaje por refuerzo

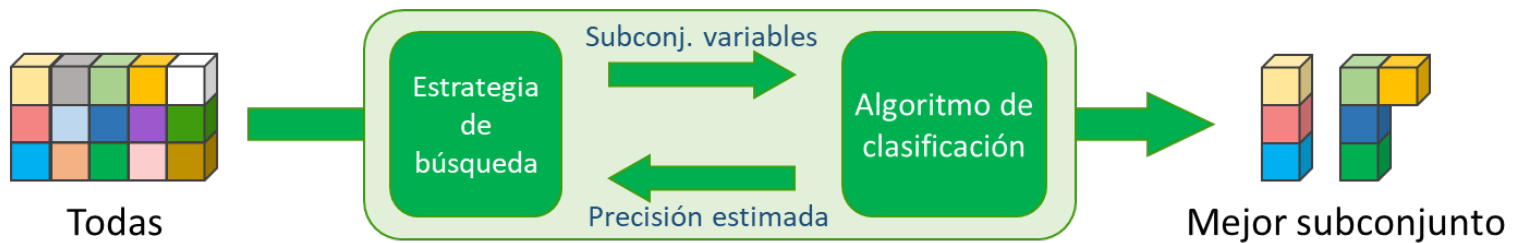


Selección de variables

Filtrado



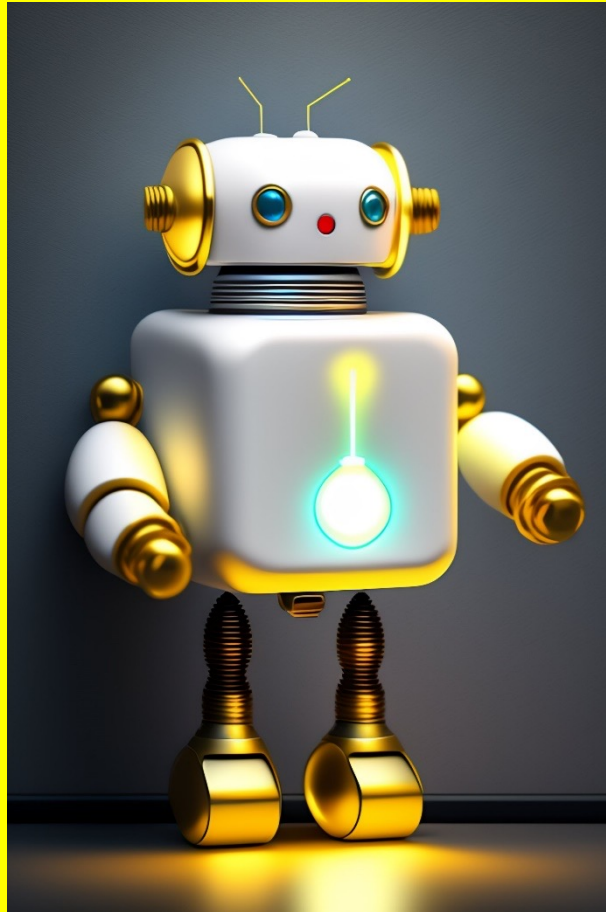
Envoltura



Optimización heurística



Actualidad

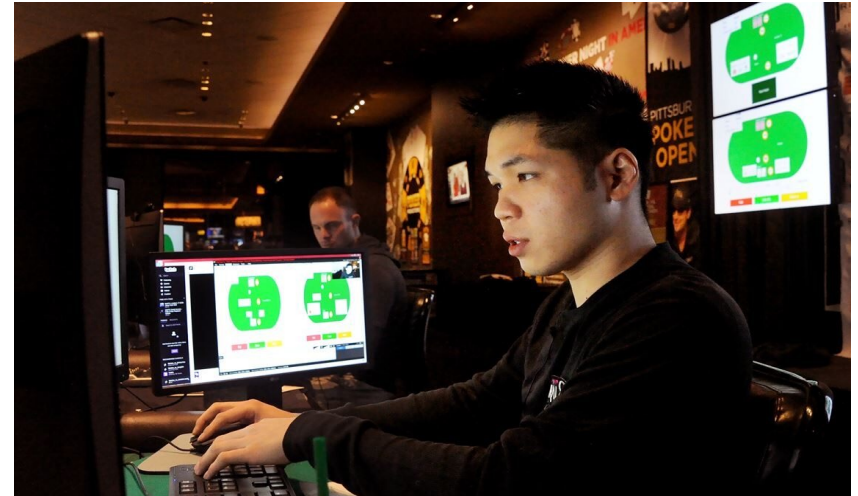


Ajedrez – Póquer - Go

1996: Deep Blue vs. Kasparov



2017: Poker - AI Libratus



2016: AlphaGo vs Lee Sedol



2018: AlphaGo Zero



Presentadores virtuales de TV

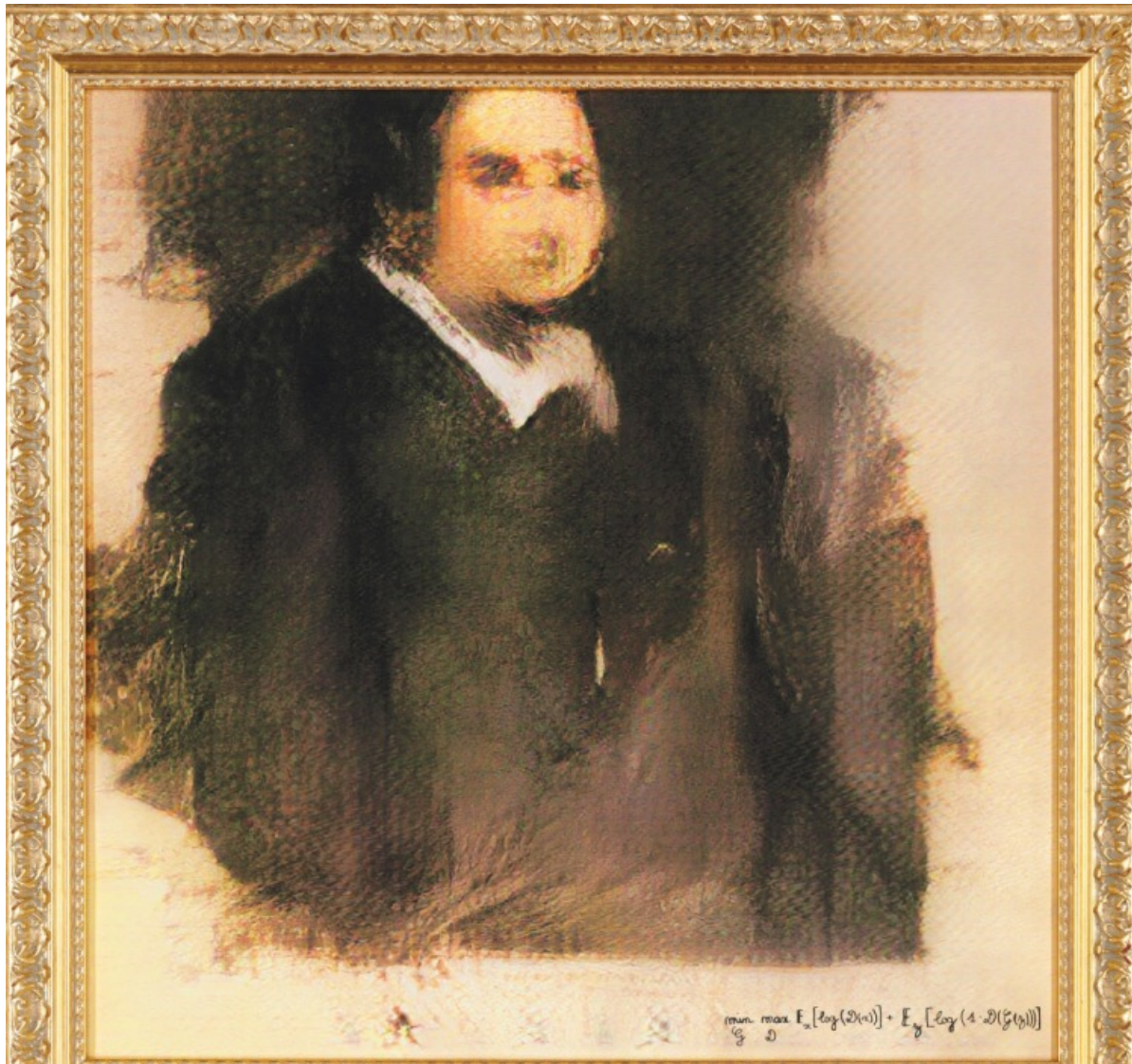


Sistemas de recomendación



How Does
Netflix
Use
Machine Learning

Pintura



Moda. Autenticación de objetos y ropa

entrupy

SOLUTIONS ▾

BUSINESS TYPES ▾

PRICING ▾

RESOURCES ▾

ABOUT ENTRUPY ▾

CONTACT US

SEARCH CERTIFICATE



Luxury Authentication

Entrupy's flagship solution certifies the authenticity of luxury products using an objective, scientifically-proven approach that better protects buyers and sellers of frequently-counterfeited, high-value items.

PRADA GIVENCHY PARIS BALENCIAGA BURBERRY Dior

GOYARD CHANEL SAINT LAURENT Chloé CELINE

BOTTEGA VENETA LOUIS VUITTON VALENTINO HERMÈS PARIS COACH

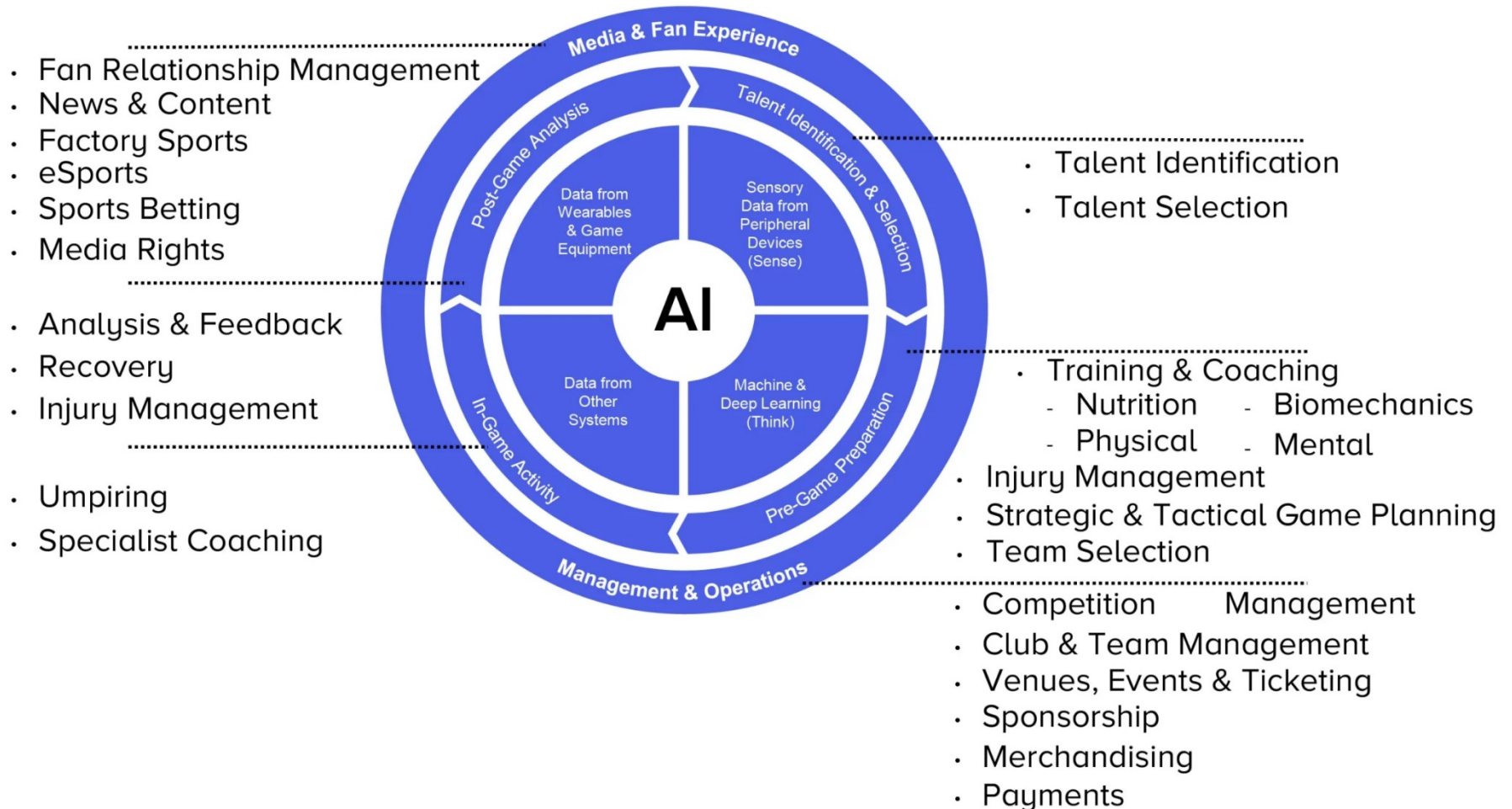
Salvatore Ferragamo LOEWE MCM GUCCI FENDI ROMA

Moda



Deporte

"AI framework for sports industry"



How Analytics FC helped De Bruyne negotiate new Man City deal

ARTICLES / ANALYTICS / MANCHESTER CITY



Penning new deal: De Bruyne with Man City Director of Football Txiki Begiristain

WRITTEN BY SIMON AUSTIN – APRIL 11, 2021

Asistentes



Traductores

W08 Artificial Intelligence Voice Translator

One machine in hand, the world I have

✓ Simultaneous translation in 127 languages
Covering 188 countries and regions

✓ Offline translation
Unlimited communication without internet

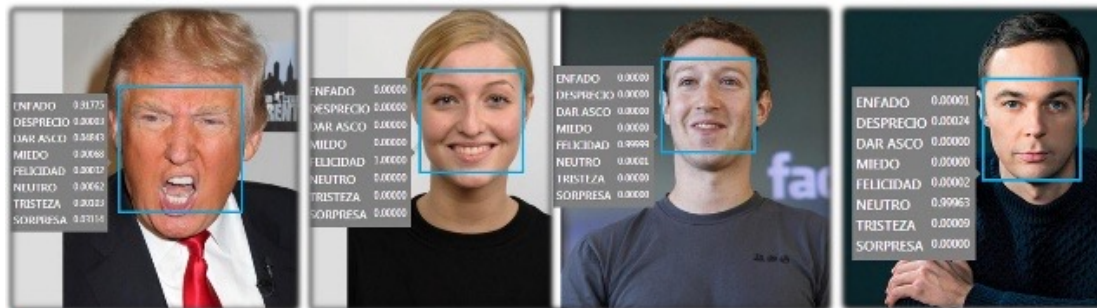
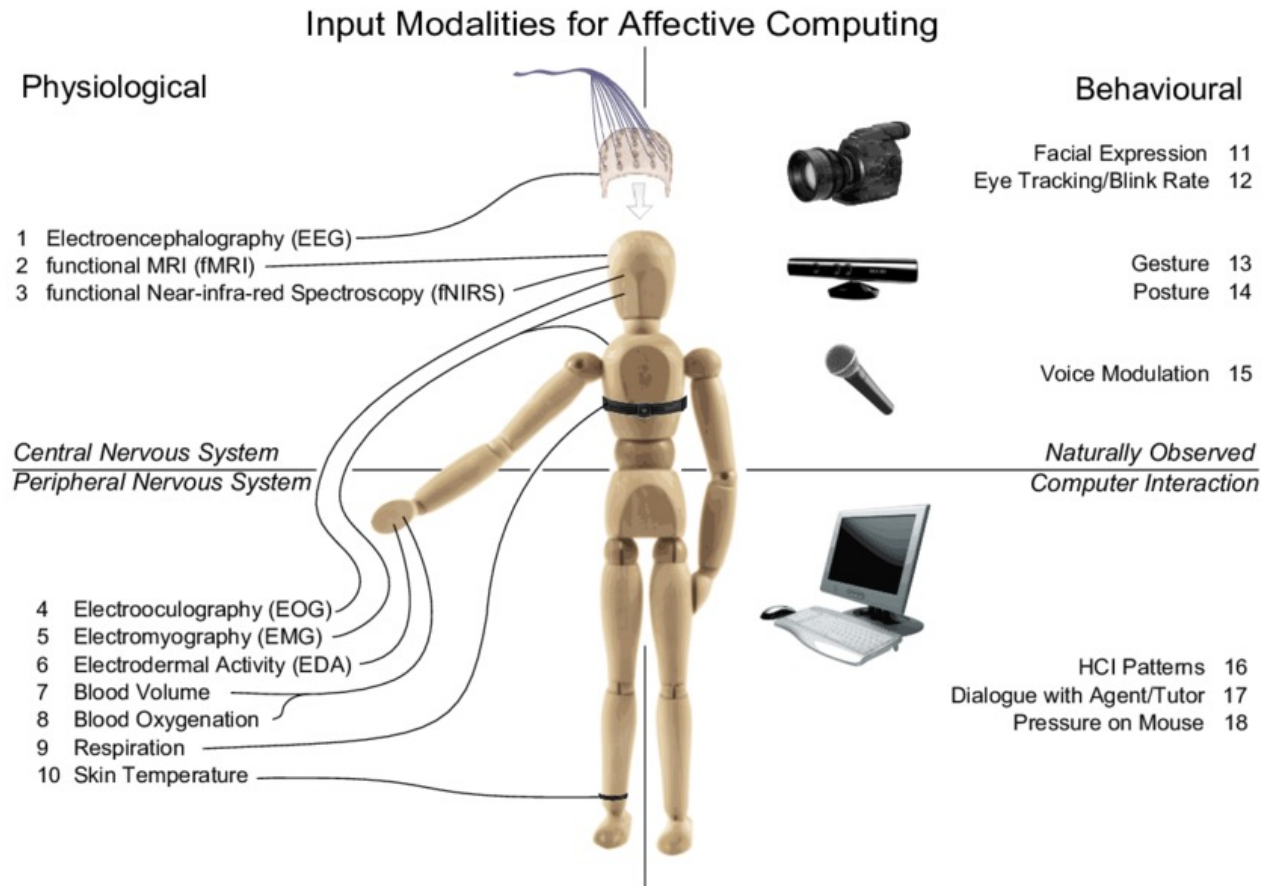
✓ photo translation
Support 42 languages for translation

✓ HD touch pad
2.4 inch IPS display

✓ International agency certification quality worry-free
CE RoHS PS E FC



Computación afectiva



Monitorización de la Tierra

Copernicus
Europe's eyes on Earth

AI FOR EARTH MONITORING MOOC

WEKEO
BY COPERNICUS

 **Copernicus**
Europe's eyes on Earth

IMPLEMENTED BY

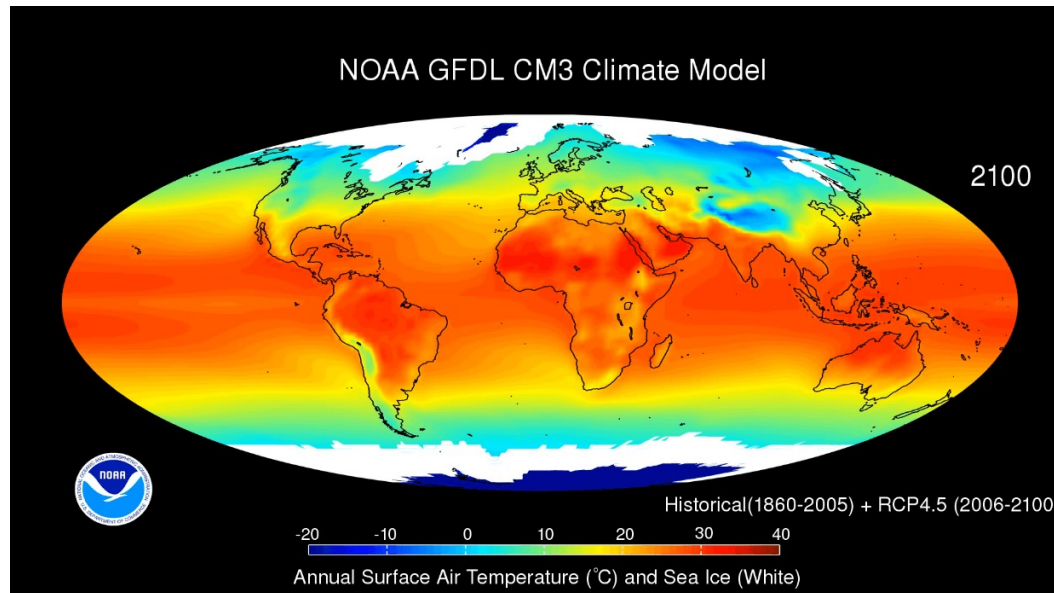
 **EUMETSAT**  **MERCATOR OCEAN**
INTERNATIONAL  **ECMWF**  **European Environment Agency**

 **Marine Monitoring**

 **Atmosphere Monitoring**

 **Land Monitoring**

 **Climate Change**



Cazadores furtivos de elefantes



IA en medicina



IA en medicina

Molecular biology

Sequencing technologies

Medical technologies

CLINICAL
PROCEDURES

Big data

Processing capacity

Connectivity technologies

INFORMATION
TECHNOLOGY

Structured, stratified
and relevant approaches
for P4 health care:

**Predictive
Preventive
Personalized
Participatory**

IA en medicina

REVIEW ARTICLE | FOCUS

<https://doi.org/10.1038/s41591-018-0300-7>

nature
medicine

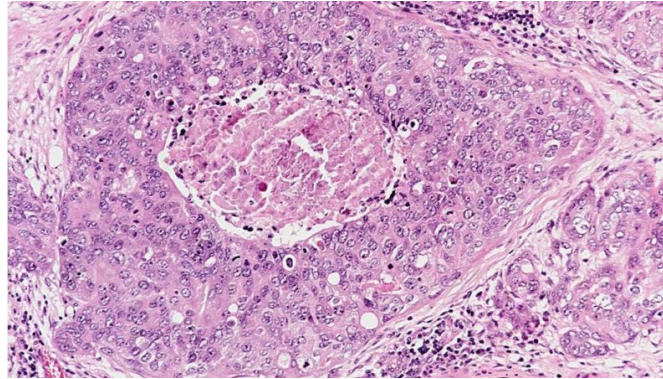
High-performance medicine: the convergence of human and artificial intelligence

Eric J. Topol 

NATURE MEDICINE | VOL 25 | JANUARY 2019 | 44-56 | www.nature.com/naturemedicine



Radiología



Patología



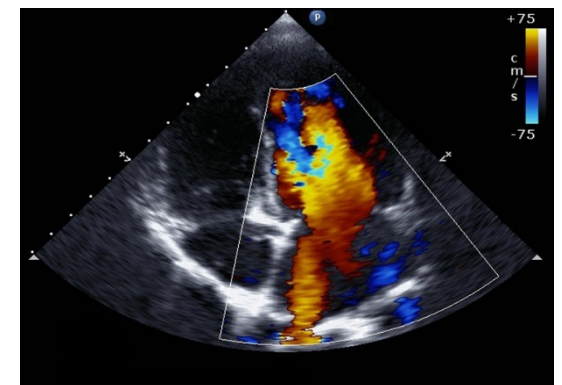
Dermatología



Oftalmología



Gastroenterología



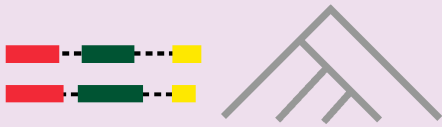
Cardiología

Bioinformática

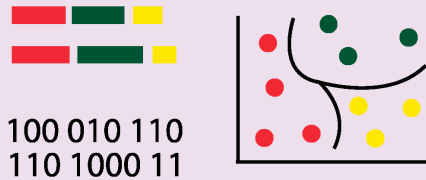
Machine and deep learning integration with bioinformatics

Molecular evolution

Phylogenetic inference



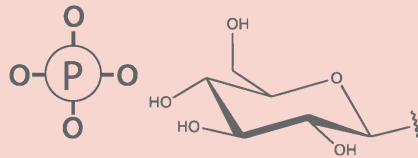
*Alignment-free
sequence classification*



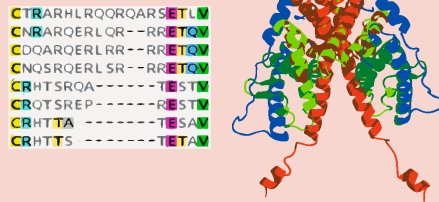
- Inference of tree topology
- Sequence classification
- Viral sequence identification
- functional annotation

Protein structure Analysis

Post translational modification



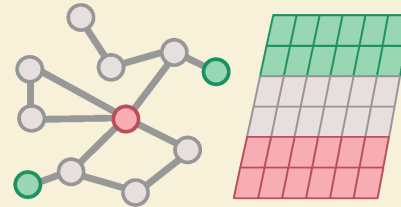
Folding and structure



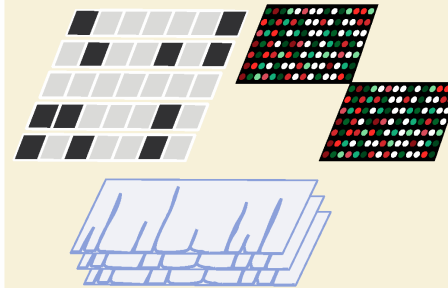
- Phosphorylation site prediction
- Protein glycosylation prediction
- Protein contact maps prediction
- Structural homology prediction

Systems biology

Biological Networks



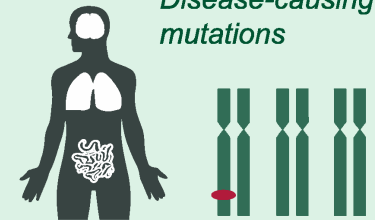
Multi-Omics integration



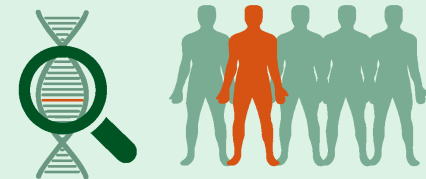
- Biological networks construction
- Biological interactions prediction
- Pathway dynamics prediction
- Platform integration frameworks

Genomics for Disease Research

*Disease-causing
mutations*

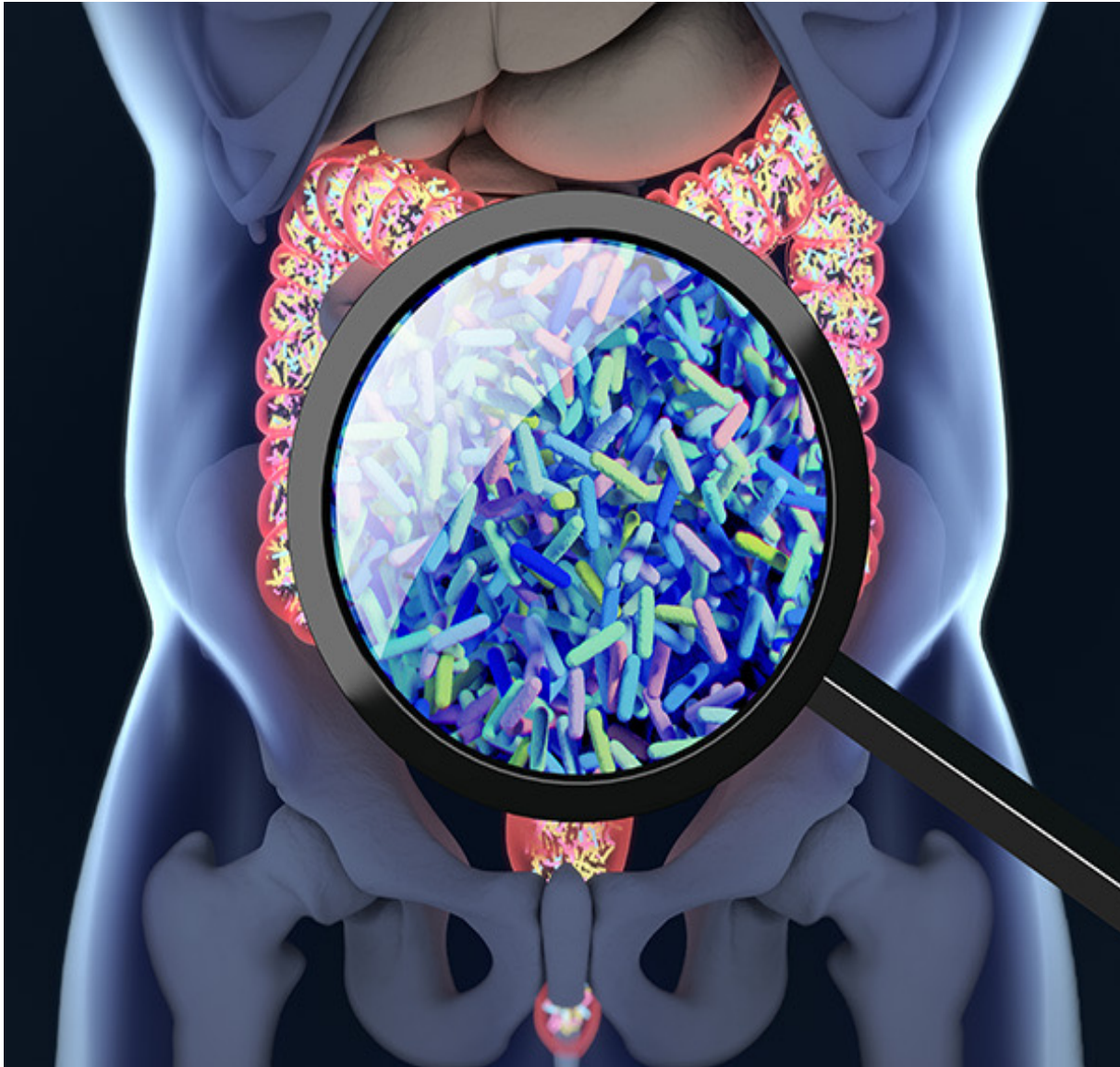


Biomarkers discovery



- Disease associated genes and mutations
- Biomarkers
- Precision medicine applications

Microbiota

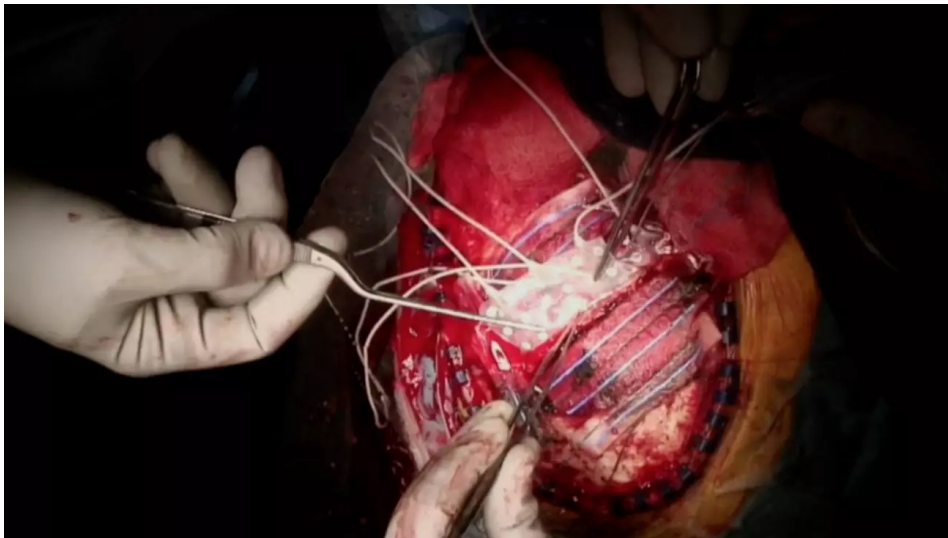
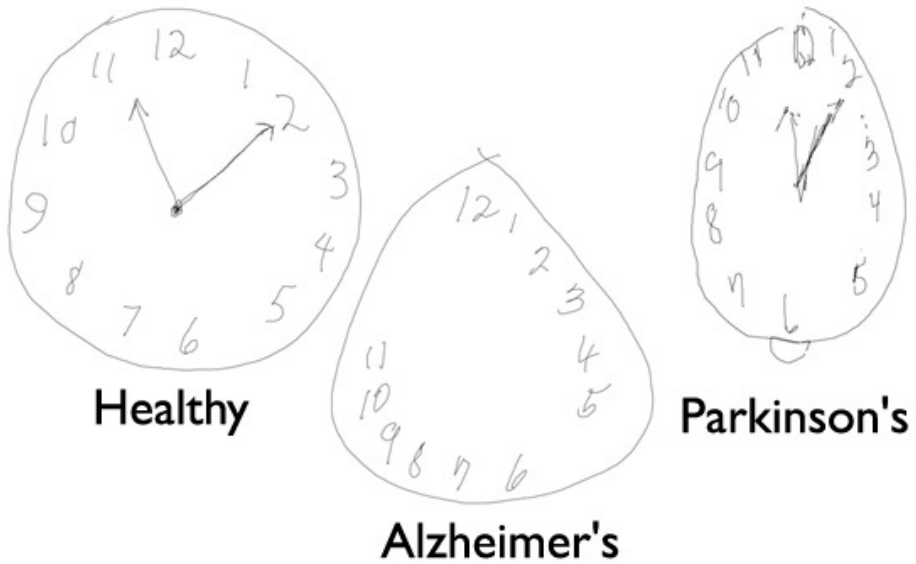


Robot Xiaoyi (2017)

Source:CCTV



Neurociencia



Neurociencia

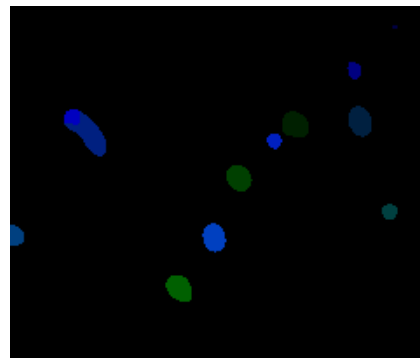
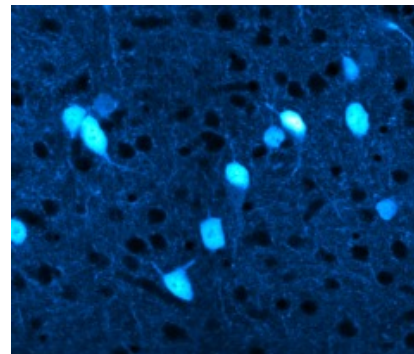
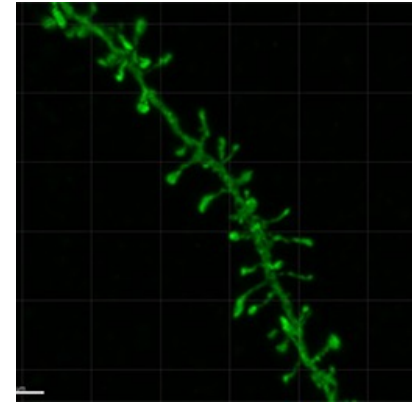
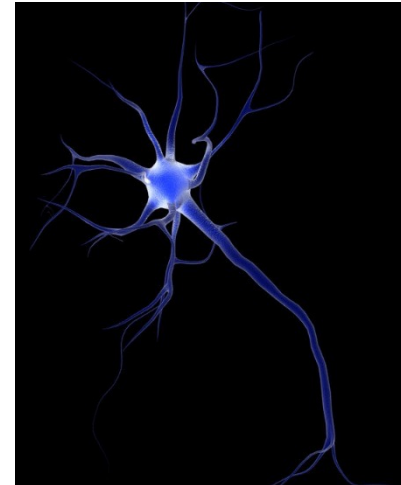
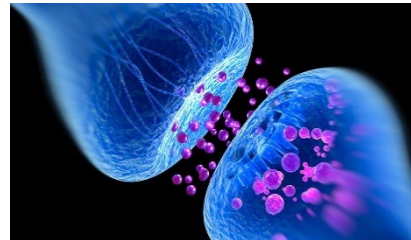
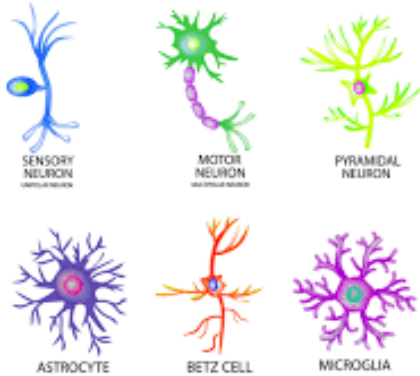
Dendritas

Espinas

Sinapsis

2020

TYPES OF NEURONS



Human Brain Project
(2013-2023)

DATA-DRIVEN COMPUTATIONAL NEUROSCIENCE

Machine Learning and Statistical Models

CONCHA BIELZA • PEDRO LARRAÑAGA



Food and Drug Administration (FDA)

← → ↻ 🏠 <https://medicalfuturist.com/fda-approved-ai-based-algorithms/> ☆ ⏏ ⬇ 📱 🔍 ☰

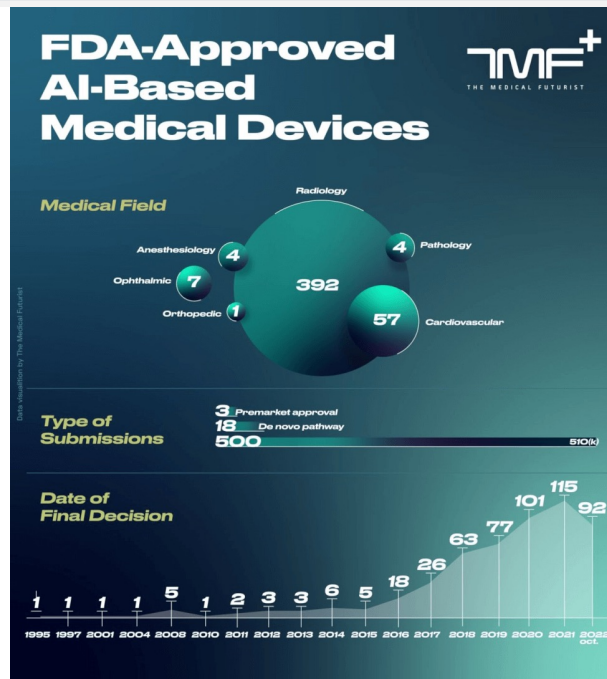
TMF⁺ The Medical Futurist Magazine Keynotes Courses Impact Research Our vision [Contact us](#)

FDA-approved A.I.-based algorithms

[+ Submit a new item here](#)

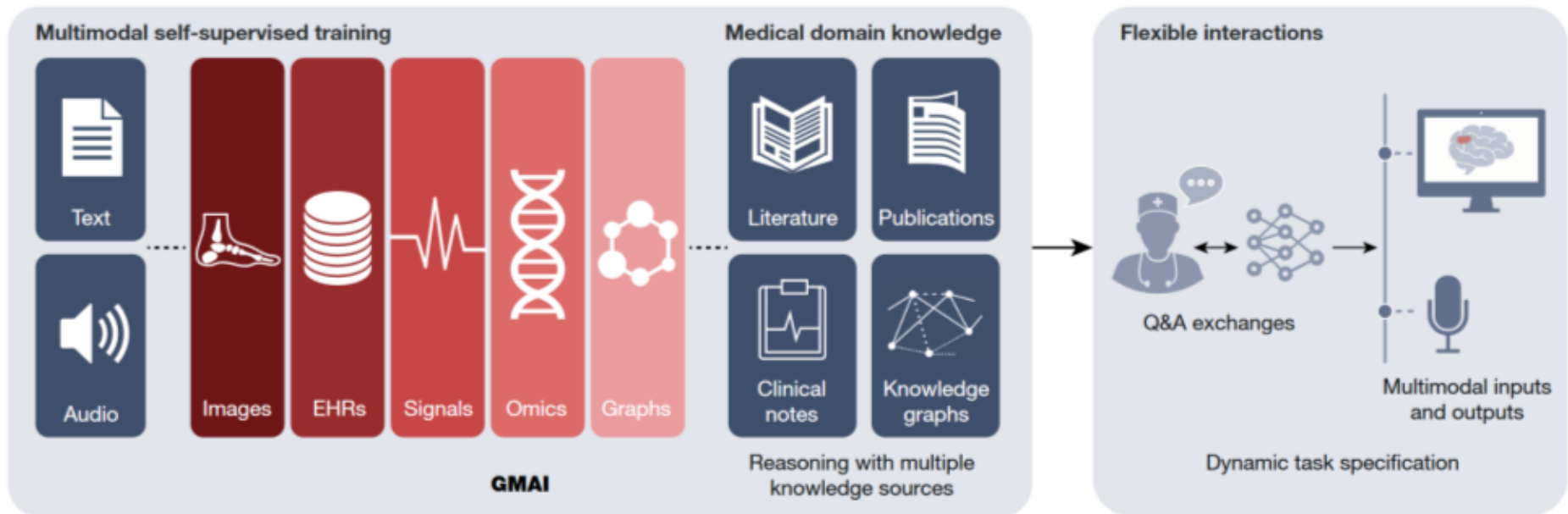
Type to filter data...

Name of device or algorithm	Name of parent company	Short description	FDA approval number	Type of FDA approval	Mention of A.I. in announcement	If no mention of A.I. in FDA announcement	Date	Medical specialty	Secondary medical specialty
Arterys Cardio DL	Arterys Inc	software analyzing cardiovascular images from MR	K163253	510(k) premarket notification	deep learning		2016 11	Radiology	Cardiology
EnsoSleep	EnsoData, Inc	diagnosis of sleep disorders	K162627	510(k) premarket notification	automated algorithm		2017 03	Neurology	
Arterys Oncology DL	Arterys Inc	medical diagnostic application	K173542	510(k) premarket notification	deep learning		2017 11	Radiology	Oncology
Idx	IDx LLC	detection of diabetic retinopathy	DEN180001	de novo pathway	A.I.		2018 01	Ophthalmology	

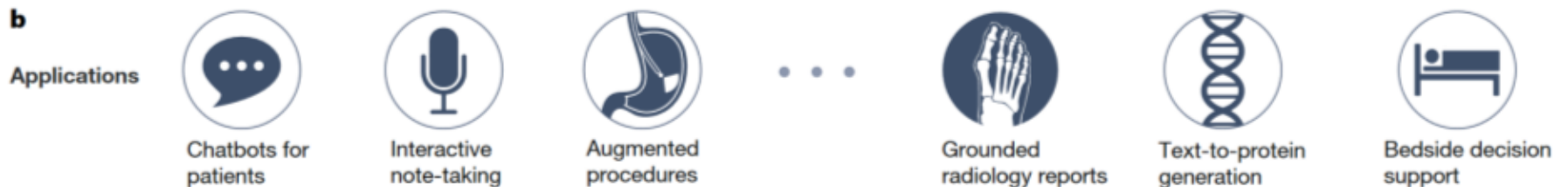


IA generalista en medicina

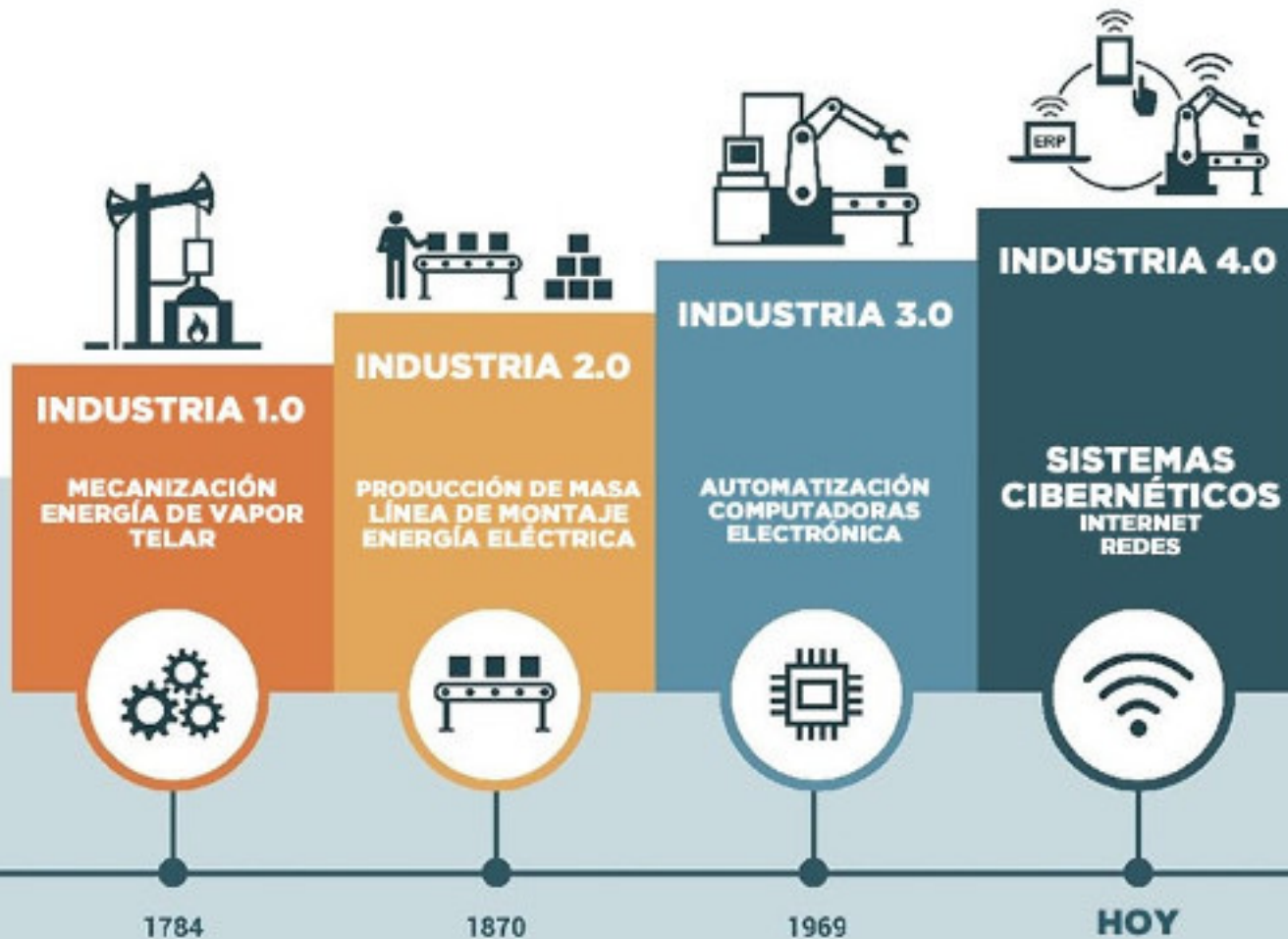
a



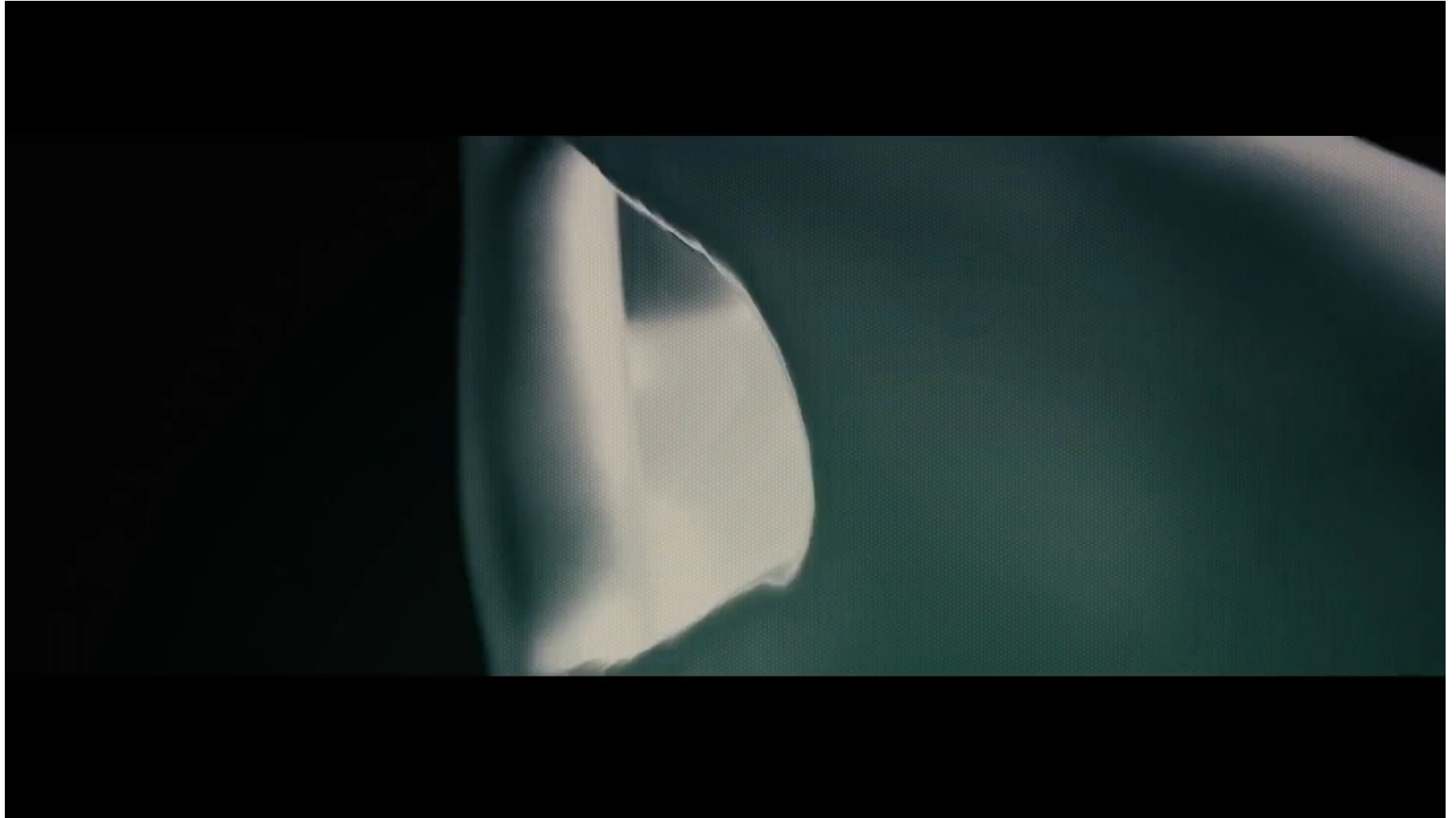
b



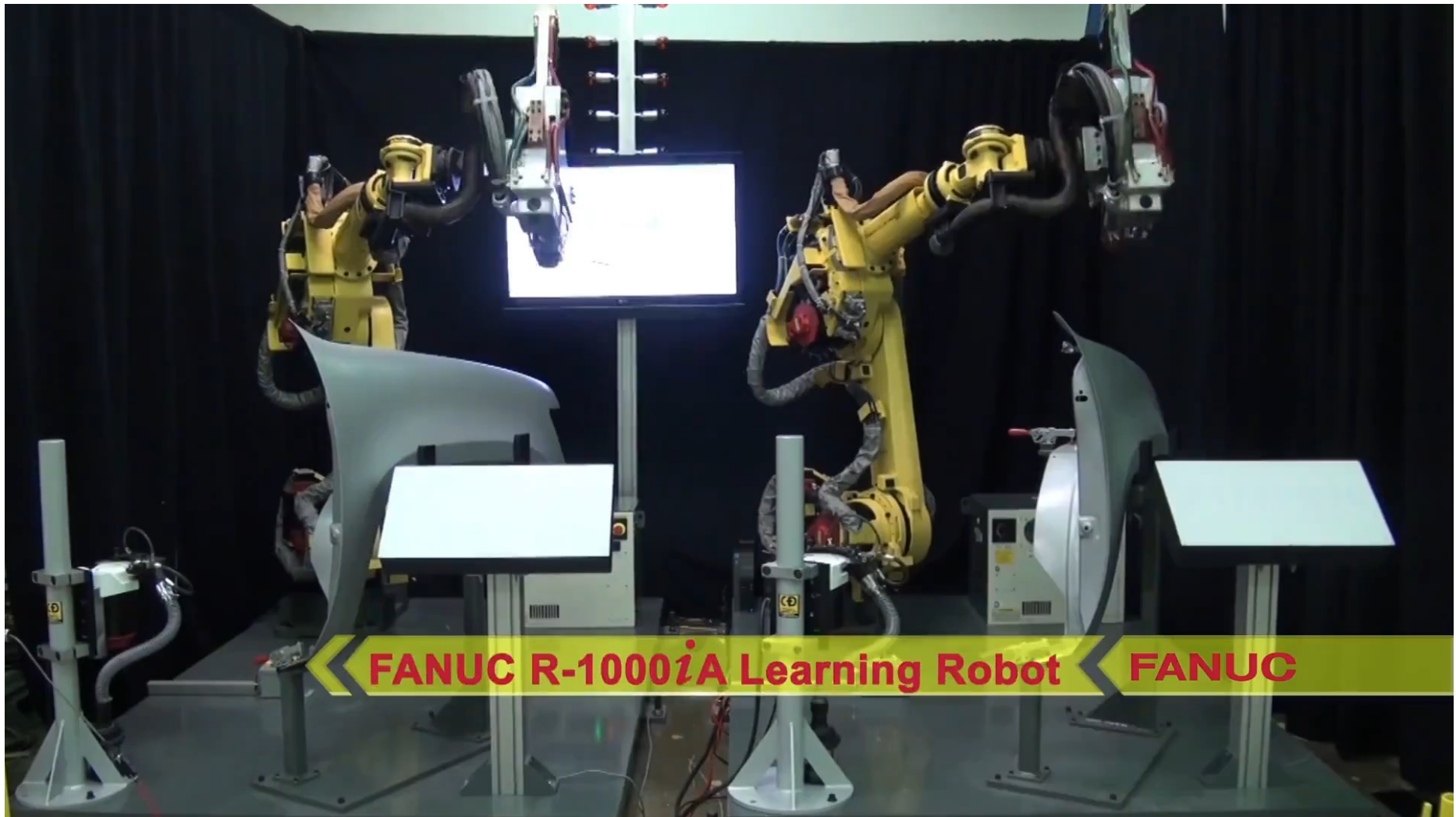
IA en la industria



Fabricación avanzada – Diseño



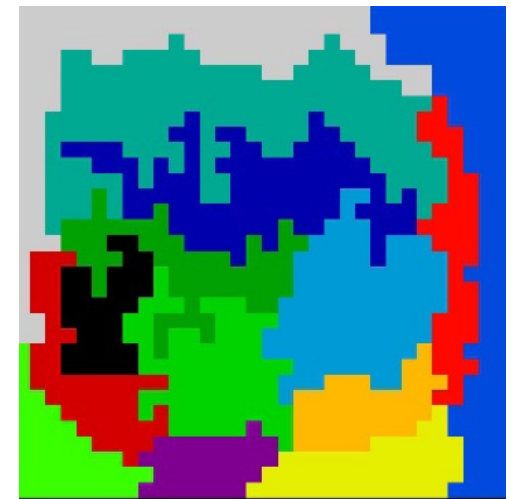
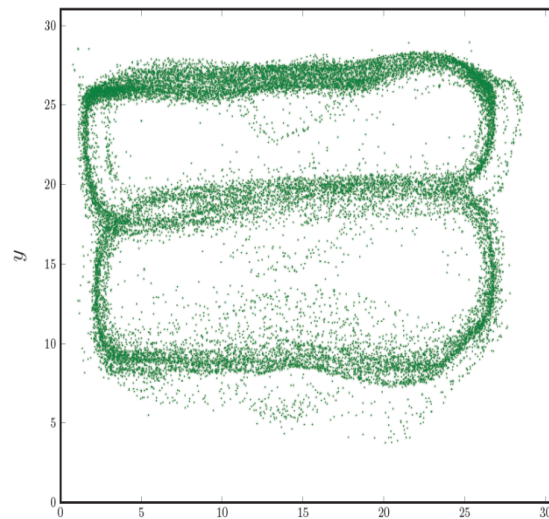
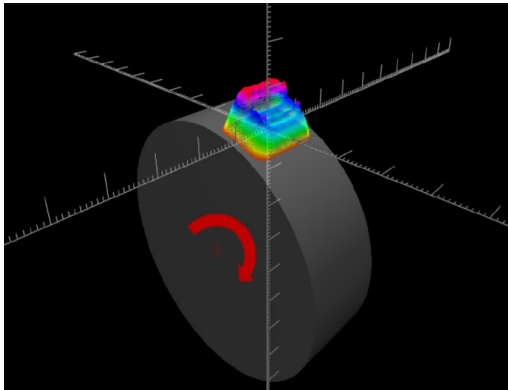
Fabricación avanzada – Aprendizaje por refuerzo



FANUC R-1000iA Learning Robot

FANUC

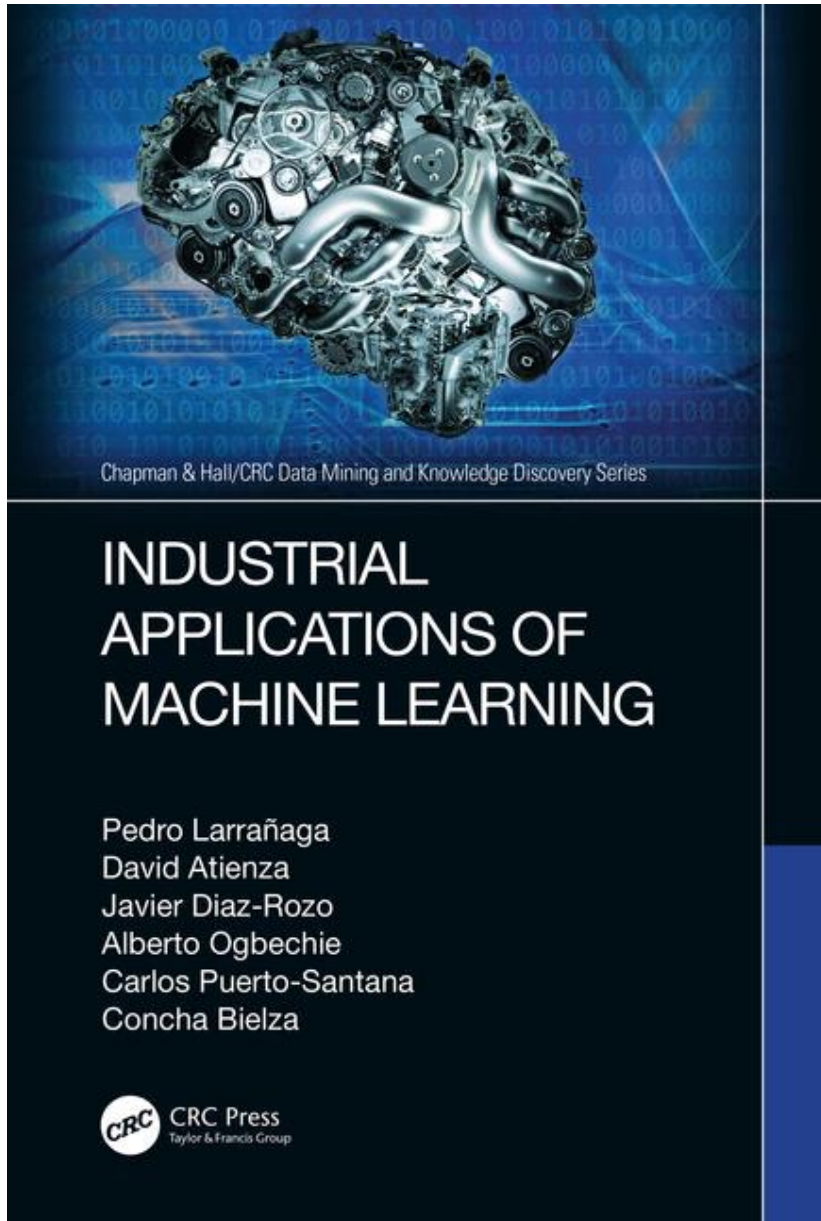
Fabricación avanzada – Detección de anomalías



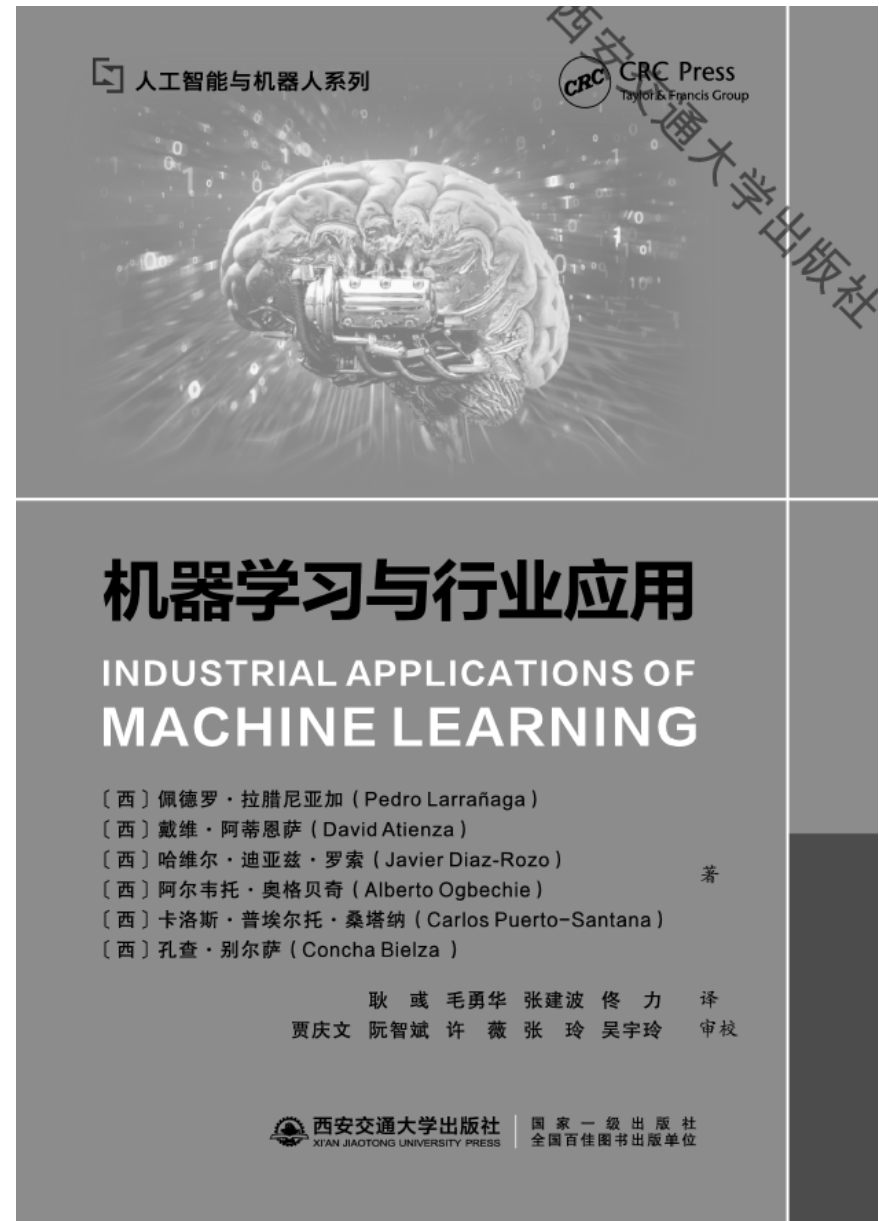
Fabricación avanzada – Tiempo de vida útil



Nuestro libro

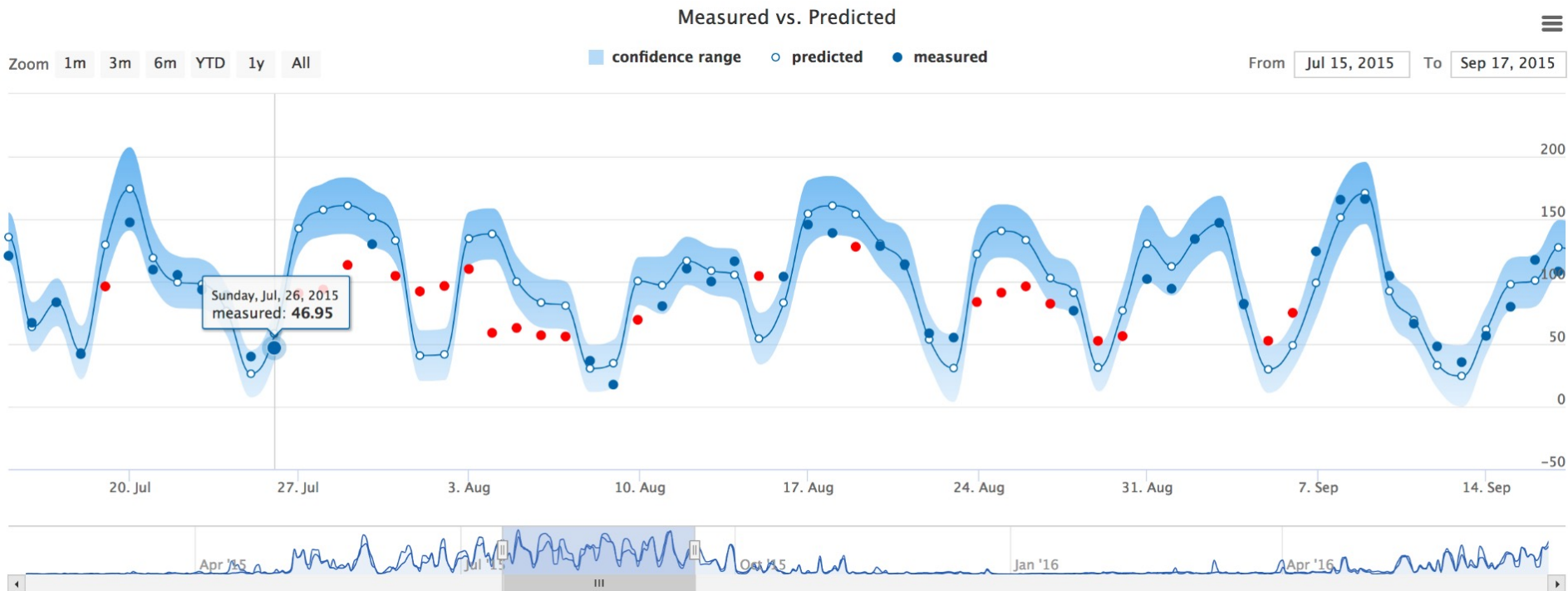


2019

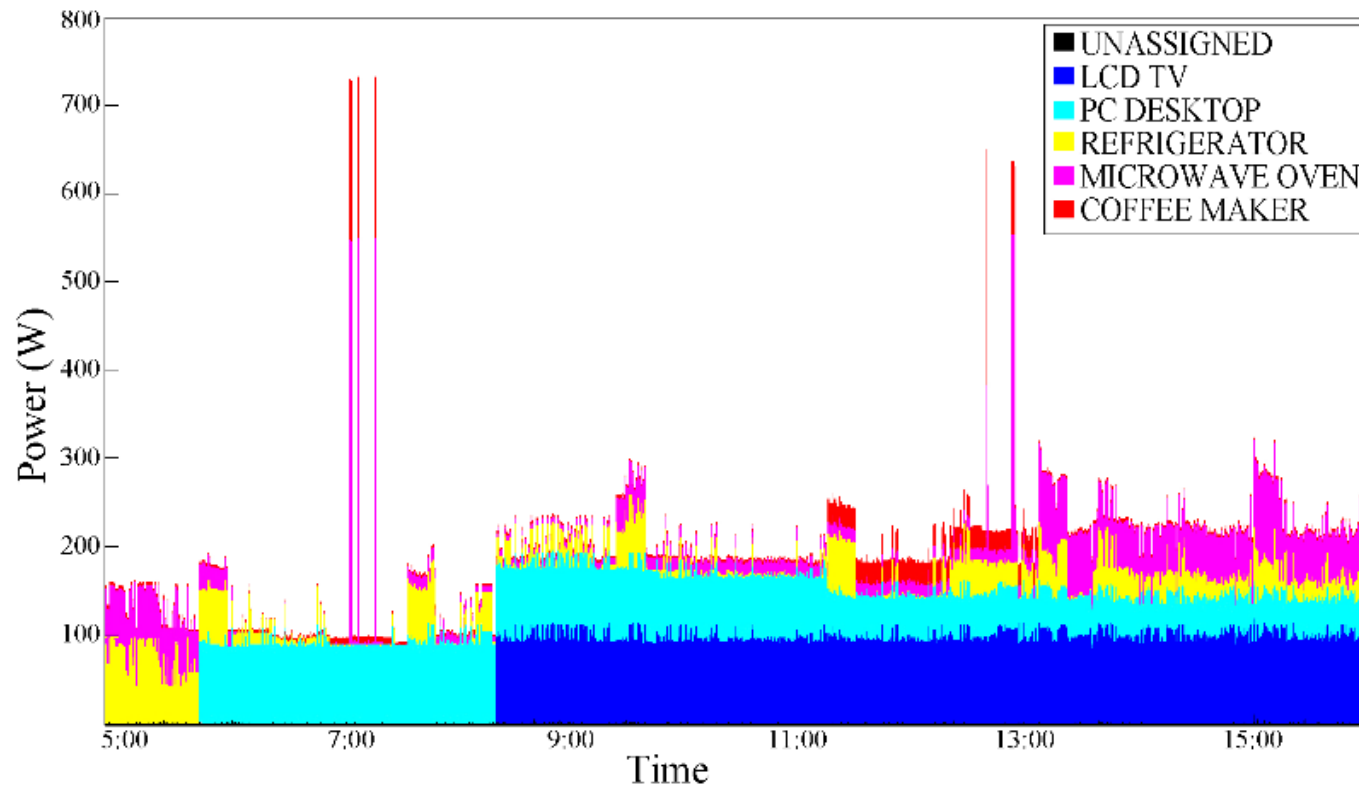
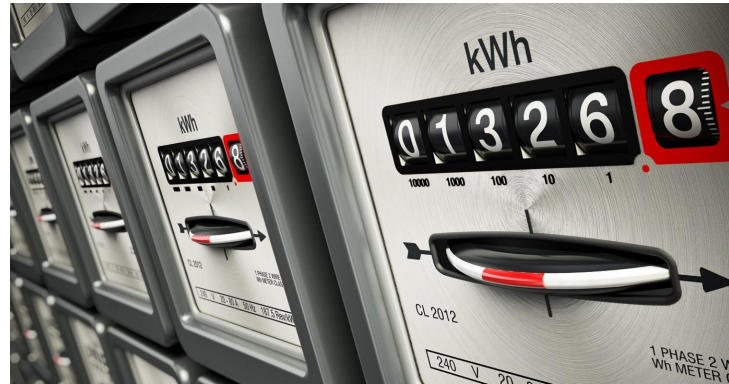


2021

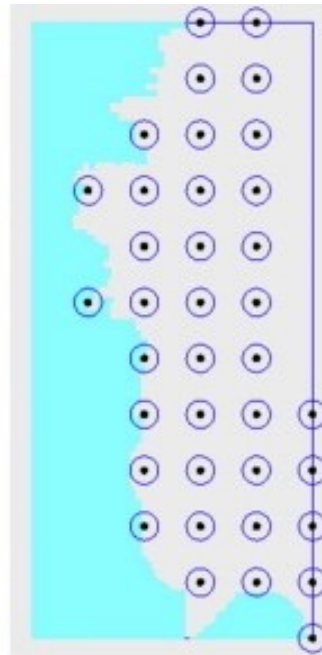
Energía. Precio, oferta y demanda



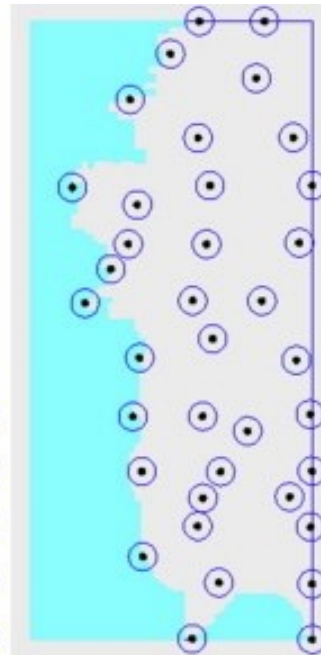
Energía. Desagregación del consumo



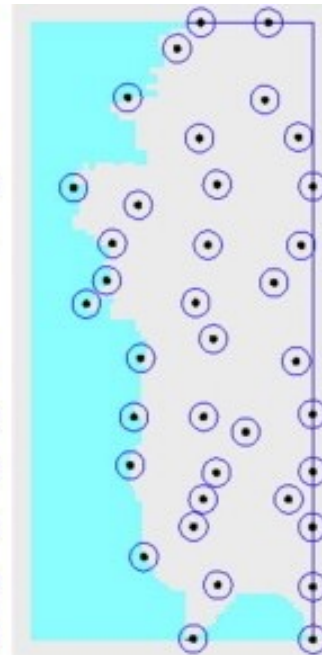
Energía eólica



16.9 MW



17.6 MW

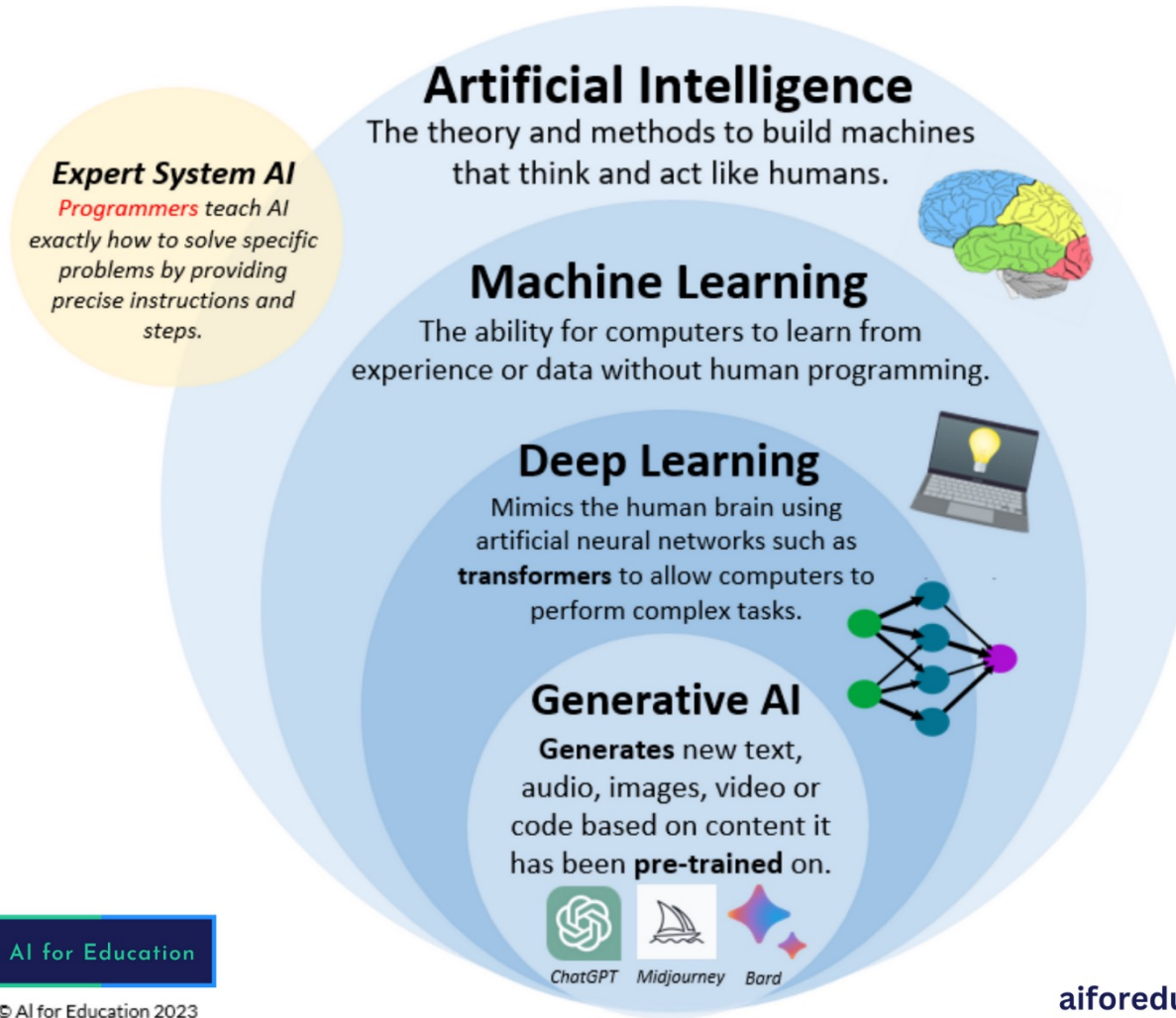


17.7 MW

IA generativa

Defining Generative AI

To understand generative artificial intelligence (GenAI), we first need to understand how the technology builds from each of the AI subcategories listed below.



ChatGPT-3.5: Chat Generative Pretrained Transformer

ChatGPT 3.5 ▾



Tú

Código python para aproximar el número pi con 20 decimales



ChatGPT

Puedes usar la biblioteca `mpmath` en Python para realizar cálculos con precisión arbitraria y así aproximar el número pi con 20 decimales. A continuación, te proporciono un ejemplo de código:

```
python Copy code

from mpmath import mp

# Configura la precisión
mp.dps = 20

# Aproxima pi con la precisión especificada
pi_aproximado = mp.pi

# Imprime el resultado
print("Aproximación de pi con 20 decimales:", pi_aproximado)
```

Asegúrate de tener la biblioteca `mpmath` instalada en tu entorno de Python. Puedes instalarla utilizando el siguiente comando:

```
bash Copy code

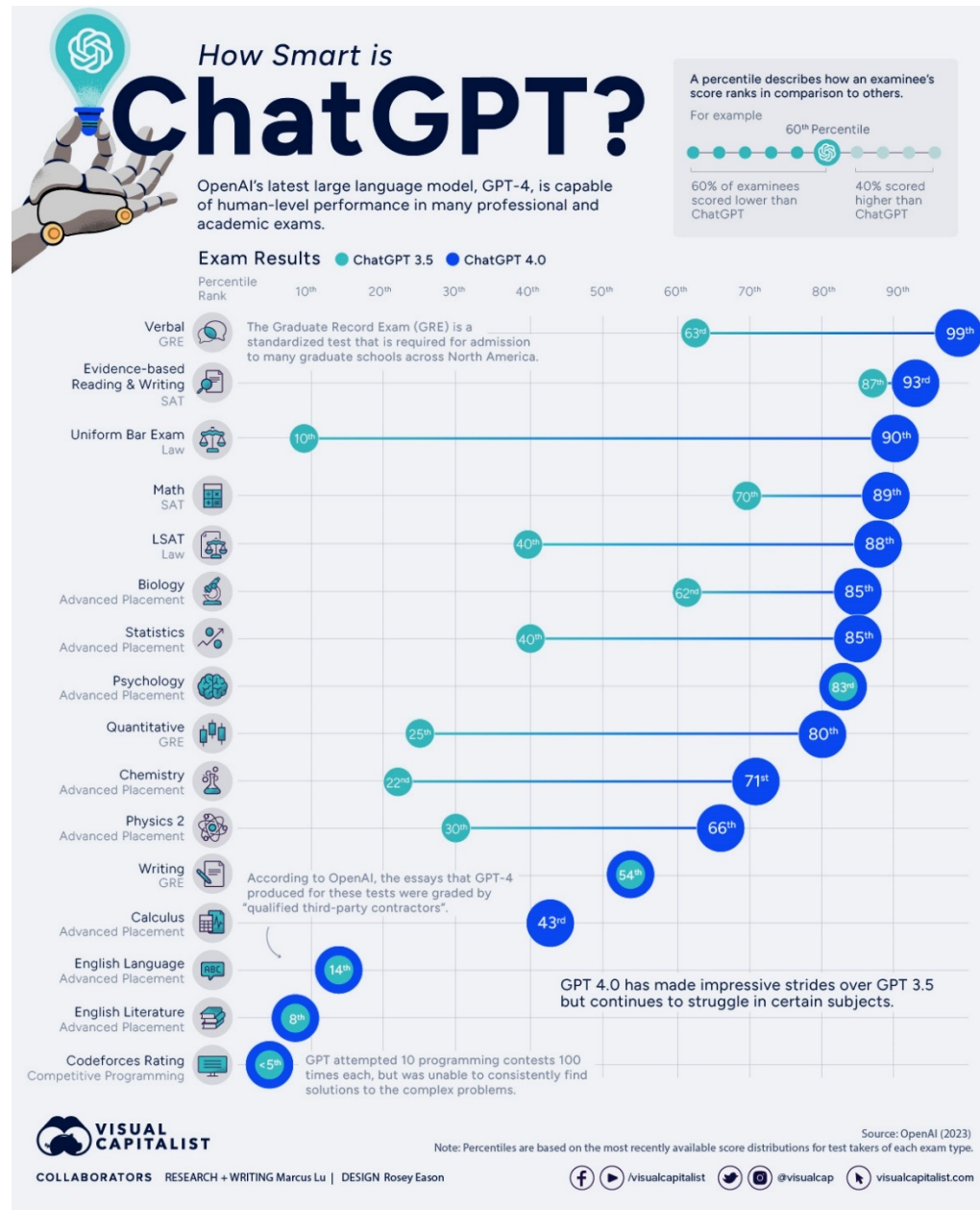
pip install mpmath
```

Este código utiliza la biblioteca `mpmath` para configurar la precisión decimal a 20 y luego calcula la aproximación de pi con esa precisión. La variable `pi_aproximado` contendrá el valor aproximado de pi con 20 decimales, y se imprimirá en la consola.



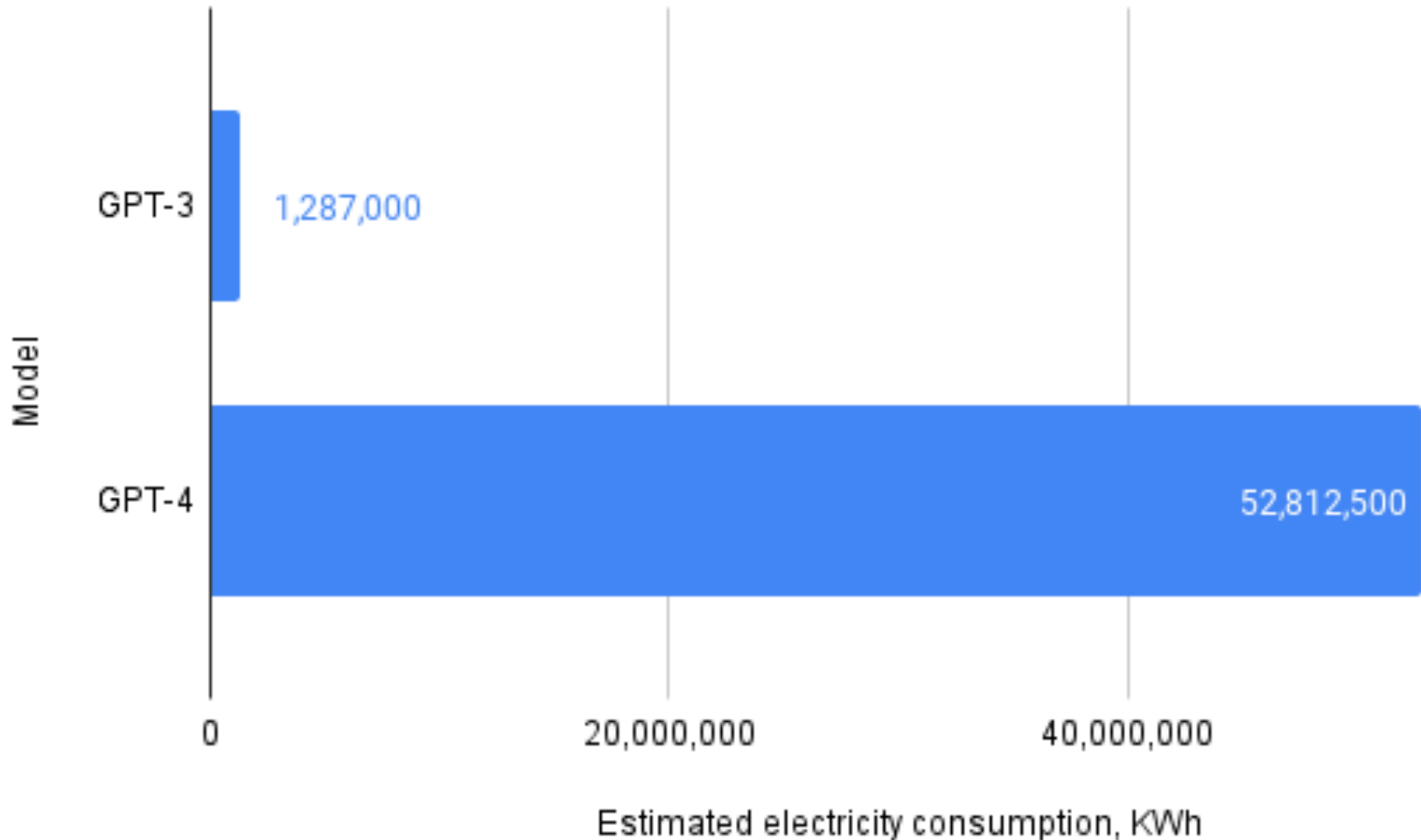
<https://chat.openai.com/>

ChatGPT-3.5 versus ChatGPT-4.0 versus Humanos

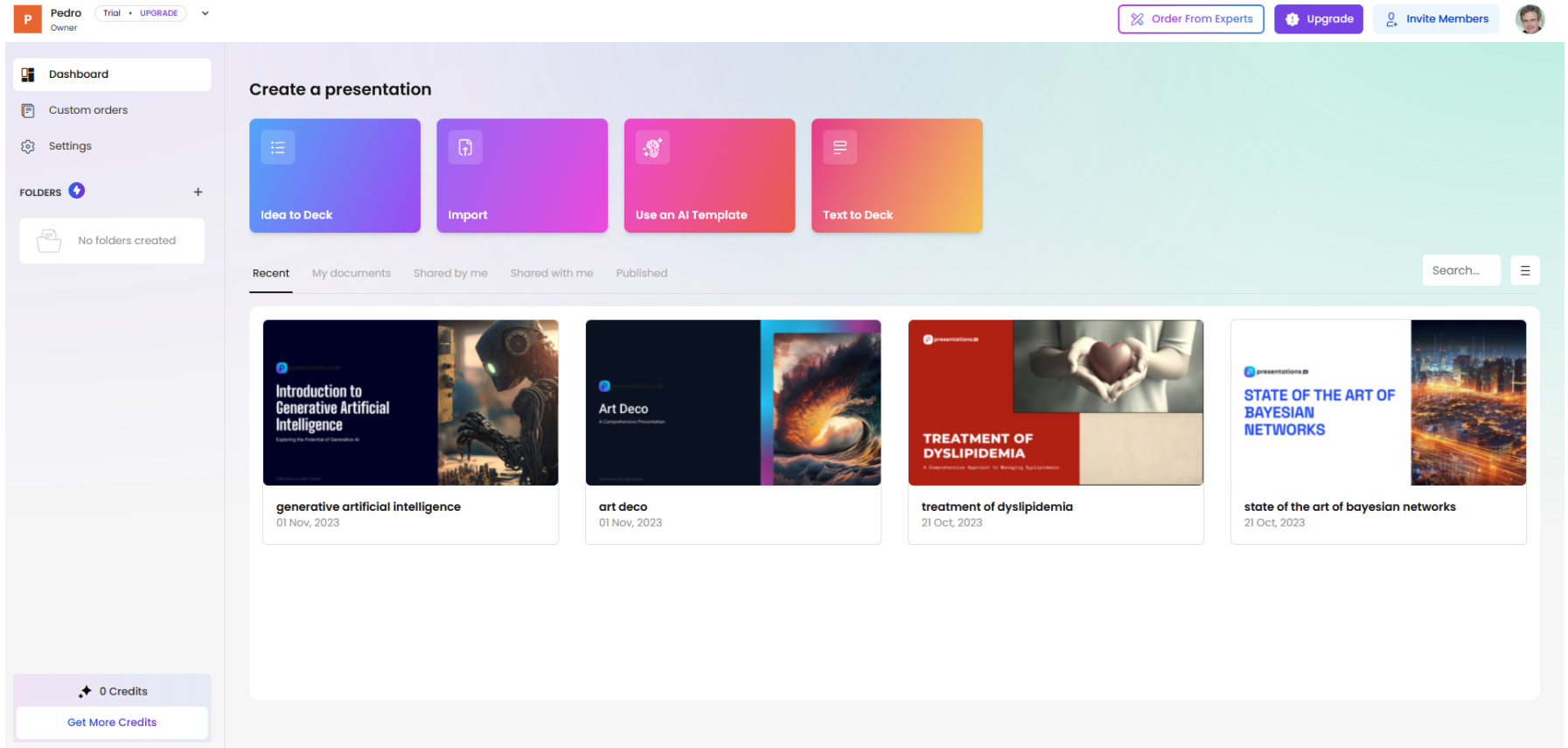


ChatGPT-3.5 versus ChatGPT-4.0 en gasto energético

Estimated training electricity consumption of GPT-3 and GPT-4

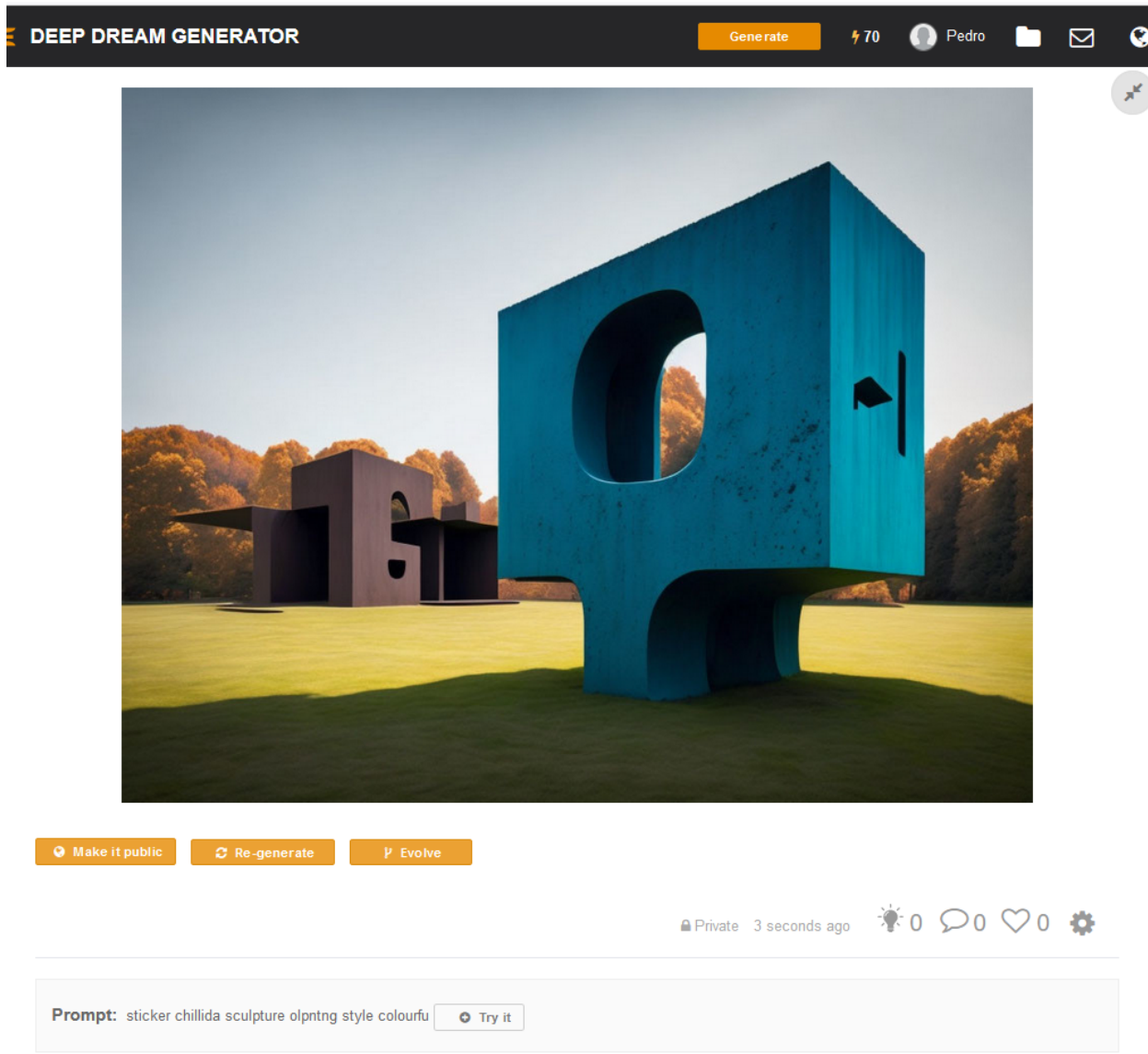


ChatGPT para presentaciones



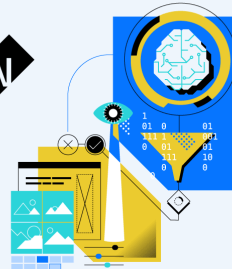
<https://www.presentations.ai/>

Deep Dream Generator: de texto a imagen

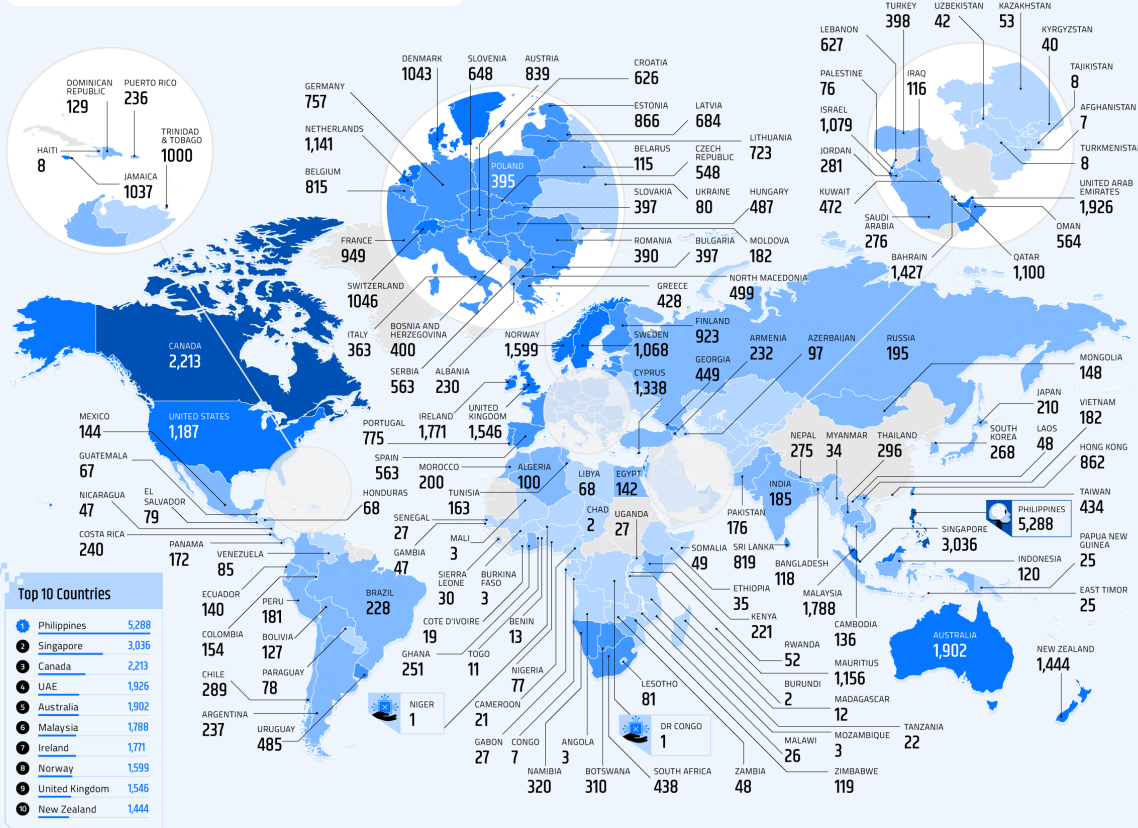
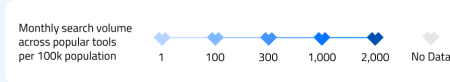


<https://deepdreamgenerator.com/>

WHICH COUNTRIES ARE Most Interested Generative-AI?



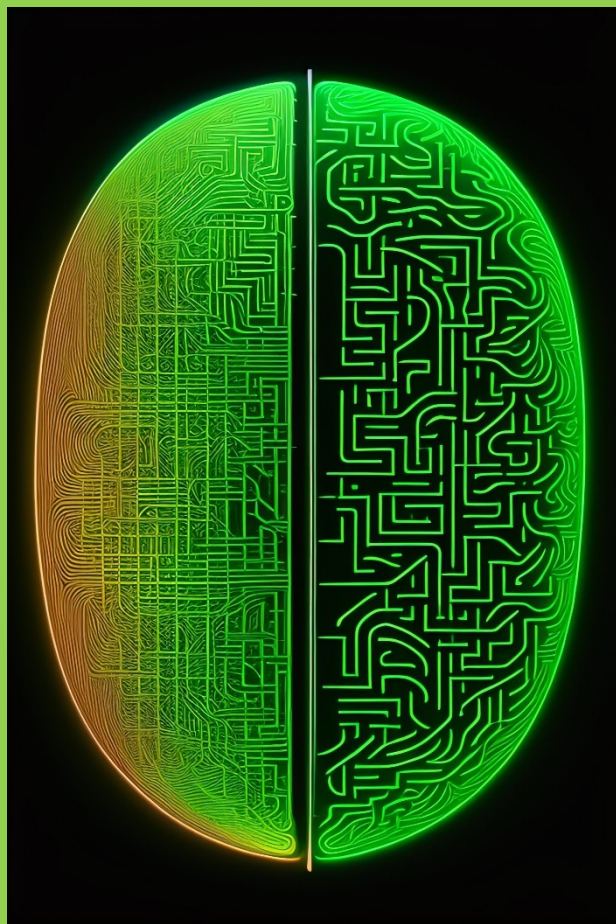
Our analysis shows that people in the **Philippines** are keenest on AI technology, with **5,288 searches** for popular generative AI tools per 100k of its population. Users in Singapore (3,036 searches per 100k) and Canada (2,213 searches per 100k) also have high levels of interest.



Methodology: We built a seed list of over 90 of the most popular generative AI tools across four categories (text, voice, audio and image). We then recorded the monthly Google search volume for each in every country and calculated the overall volume across all tools per 100k population. All search volumes were scaled up according to the search engine market share in each country, using figures from [statscounter.com](https://www.statscounter.com).

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FUTURO



Tipos de IA

3 Types of Artificial Intelligence

Artificial Narrow Intelligence (ANI)



Stage-1

Machine Learning

- Specialises in one area and solves one problem



Siri



Alexa



Cortana

Artificial General Intelligence (AGI)



Stage-2

Machine Intelligence

- Refers to a computer that is as smart as a human across the board

Artificial Super Intelligence (ASI)



Stage-3

Machine Consciousness

- An intellect that is much smarter than the best human brains in practically every field

Predicción de la reincidencia en criminología

Machine Bias

Prediction Fails Differently for Black Defendants

	WHITE	AFRICAN AMERICAN
Labeled Higher Risk, But Didn't Re-Offend	23.5%	44.9%
Labeled Lower Risk, Yet Did Re-Offend	47.7%	28.0%

A Popular Algorithm Is No Better at Predicting Crimes Than Random People

Wisconsin Supreme Court allows state to continue using computer program to assist in sentencing

Tutorial: 21 fairness definitions and their politics

7,985 views

88 3



Arvind Narayanan

Published on Mar 1, 2018

VERNON PRATER Prior Offenses 2 armed robberies, 1 attempted armed robbery Subsequent Offenses 1 grand theft LOW RISK 3	BRISHA BORDEN Prior Offenses 4 juvenile misdemeanors Subsequent Offenses None HIGH RISK 8
---	--

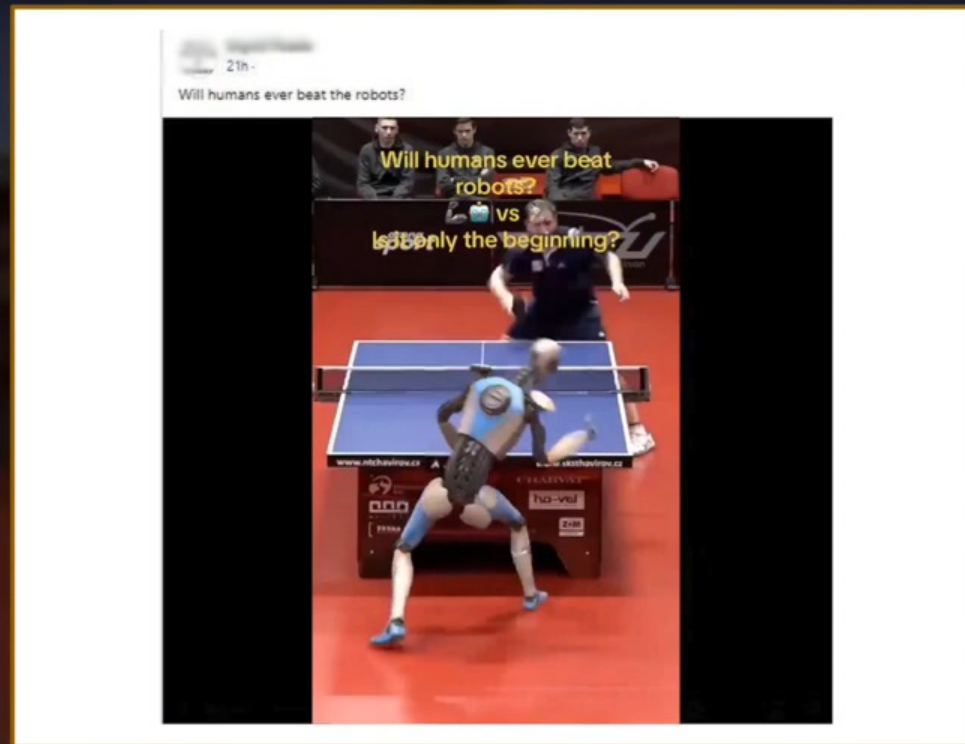
DYLAN FUGETT LOW RISK 3	BERNARD PARKER HIGH RISK 10
--	--

JAMES RIVELLI LOW RISK 3	ROBERT CANNON MEDIUM RISK 6
---	--

JAMES RIVELLI Prior Offenses 1 domestic violence aggravated assault, 1 grand theft, 1 petty theft, 1 drug trafficking Subsequent Offenses 1 grand theft LOW RISK 3	ROBERT CANNON Prior Offense 1 petty theft Subsequent Offenses None MEDIUM RISK 6
---	---

De nuevo jugando al ping-pong ...

PAUSE



Regulando la IA

The
Economist

Menu

Weekly edition

The world in brief

Search

Business | Of evils and evals

The world wants to regulate AI, but does not quite know how

There is disagreement over what is to be policed, how and by whom

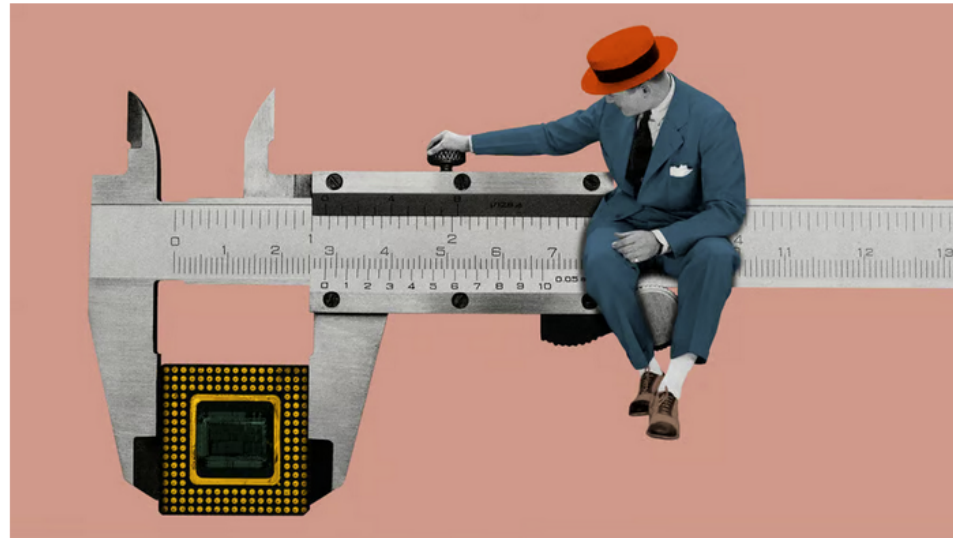


IMAGE: MARI FOUZ

Oct 24th 2023 | BLETCHLEY PARK

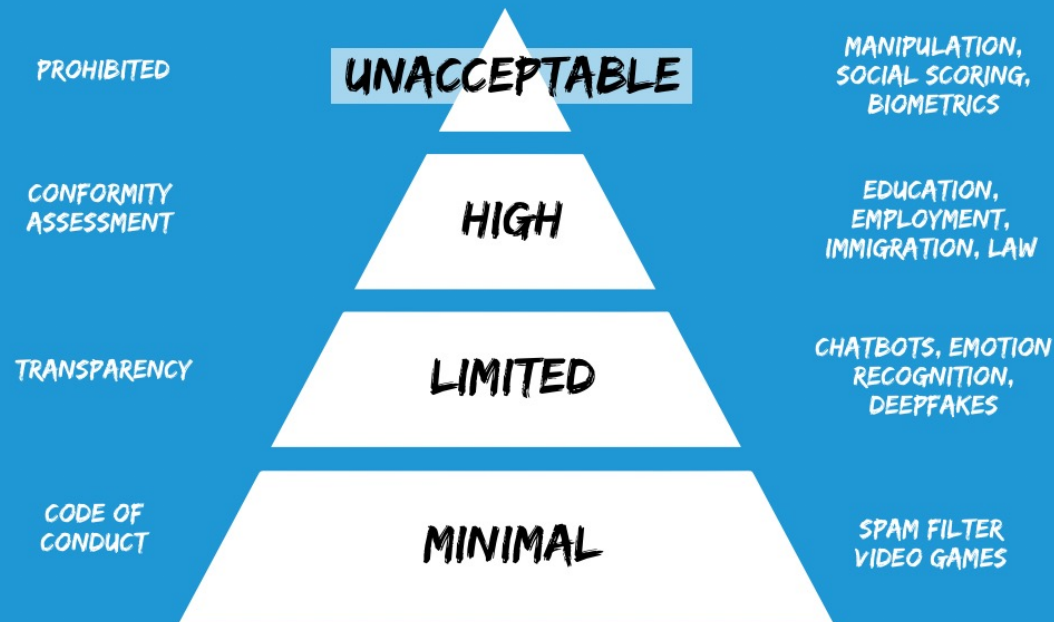
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La declaración de Bletchley Park: desarrollo seguro de la IA



Regulando la IA

THE 4 TYPES OF RISKS IN THE E.U. AI ACT

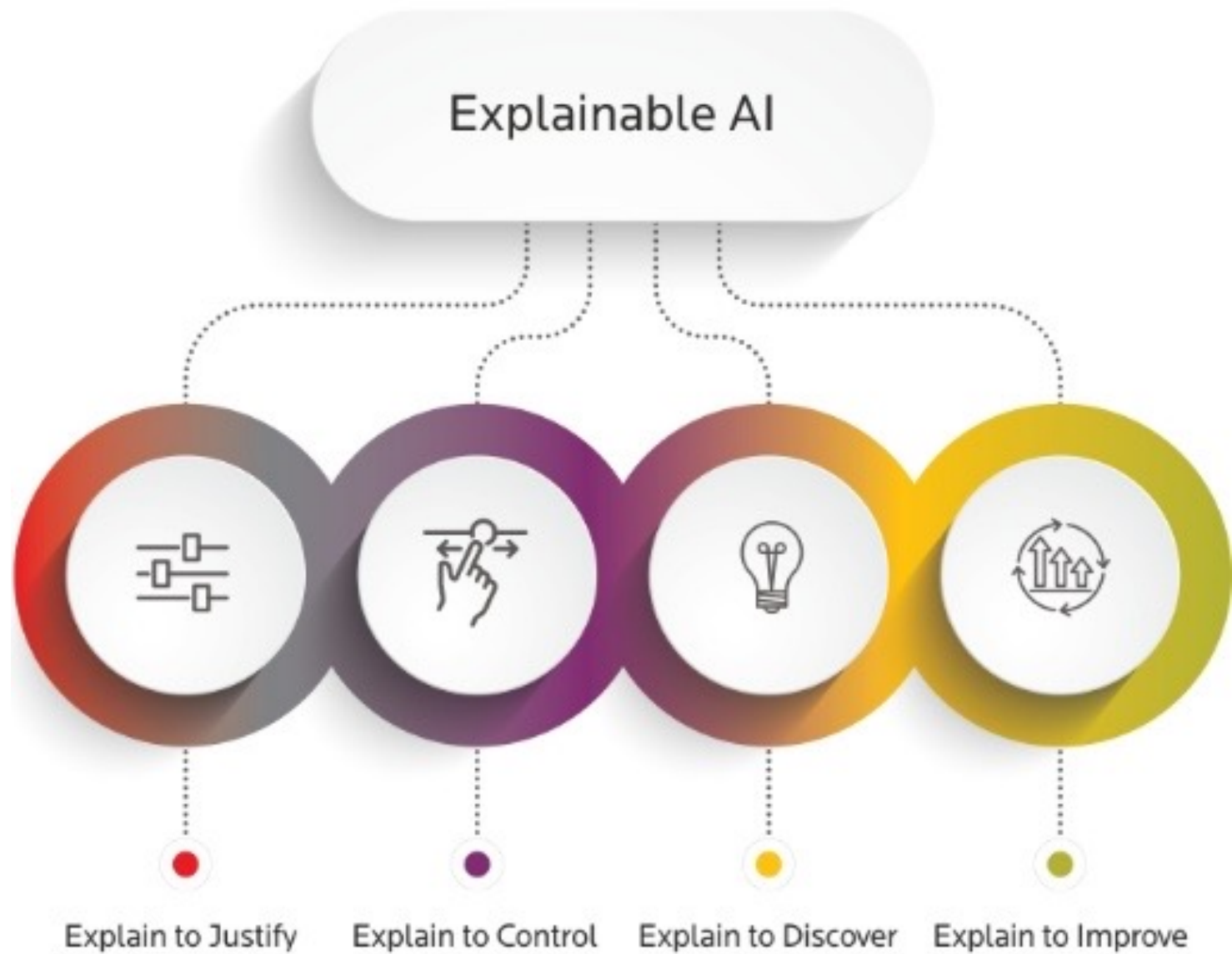


INTELLIGENCE
BRIEFING

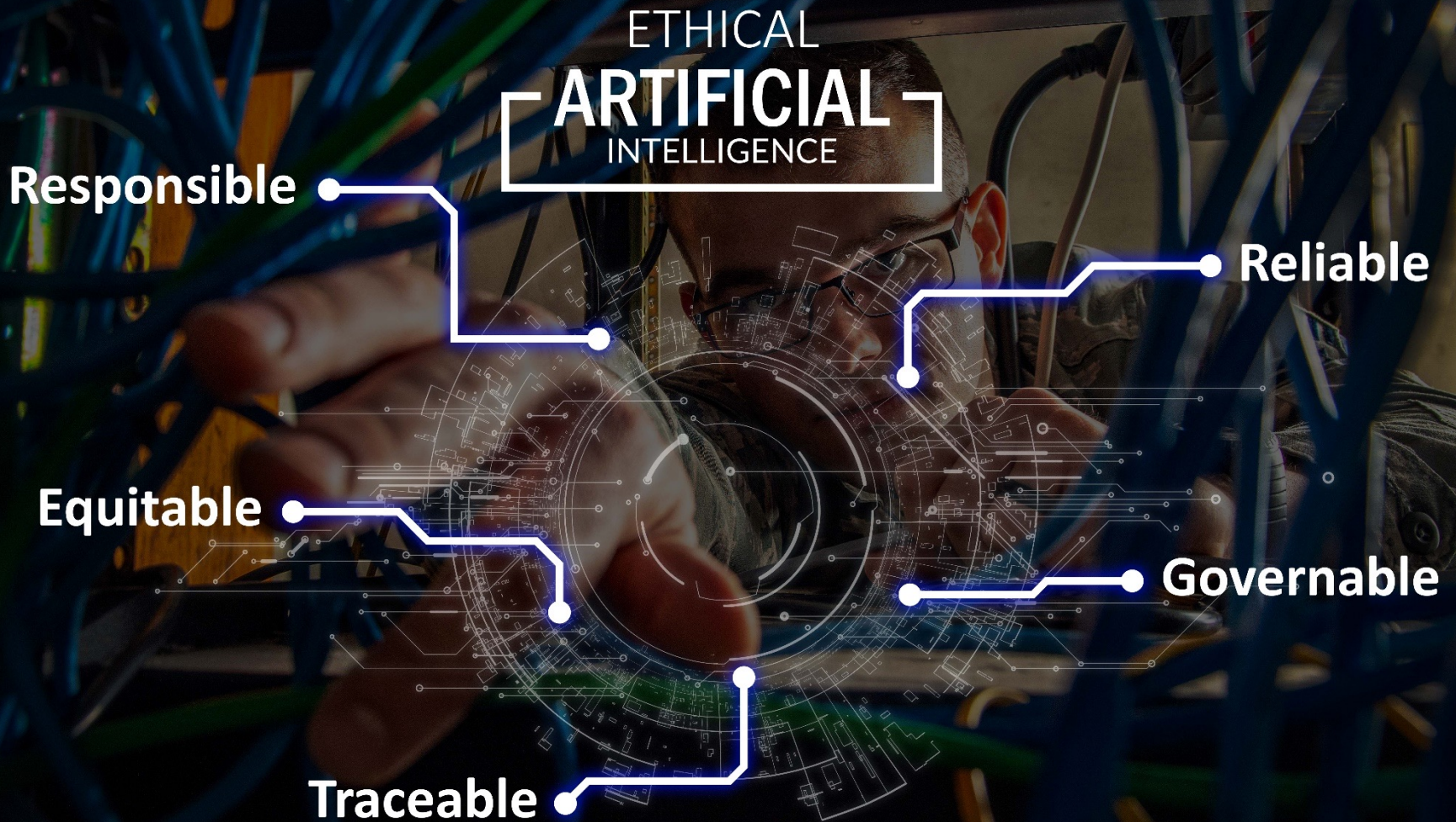
TURN HYPE INTO OUTCOME.

VIEWS ARE MY OWN.

XAI



Ética de la IA



IA revolucionando la ciencia

The
Economist

Menu

Weekly edition

The world in brief

Search

Leaders | When robots do research

How artificial intelligence can revolutionise science

Consider the historical precedents

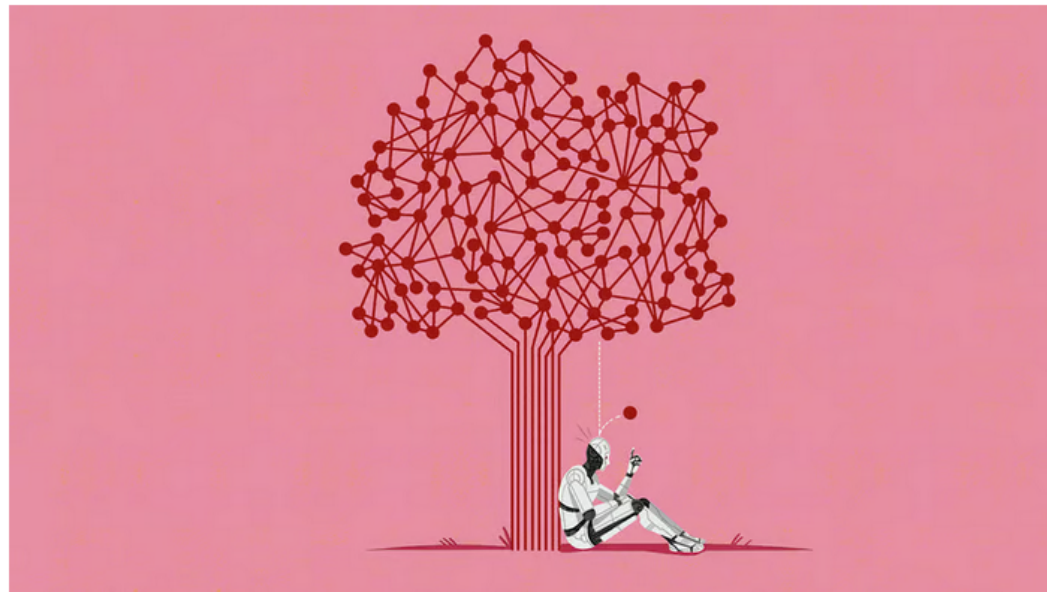


IMAGE: PETE RYAN

Sep 14th 2023

Share

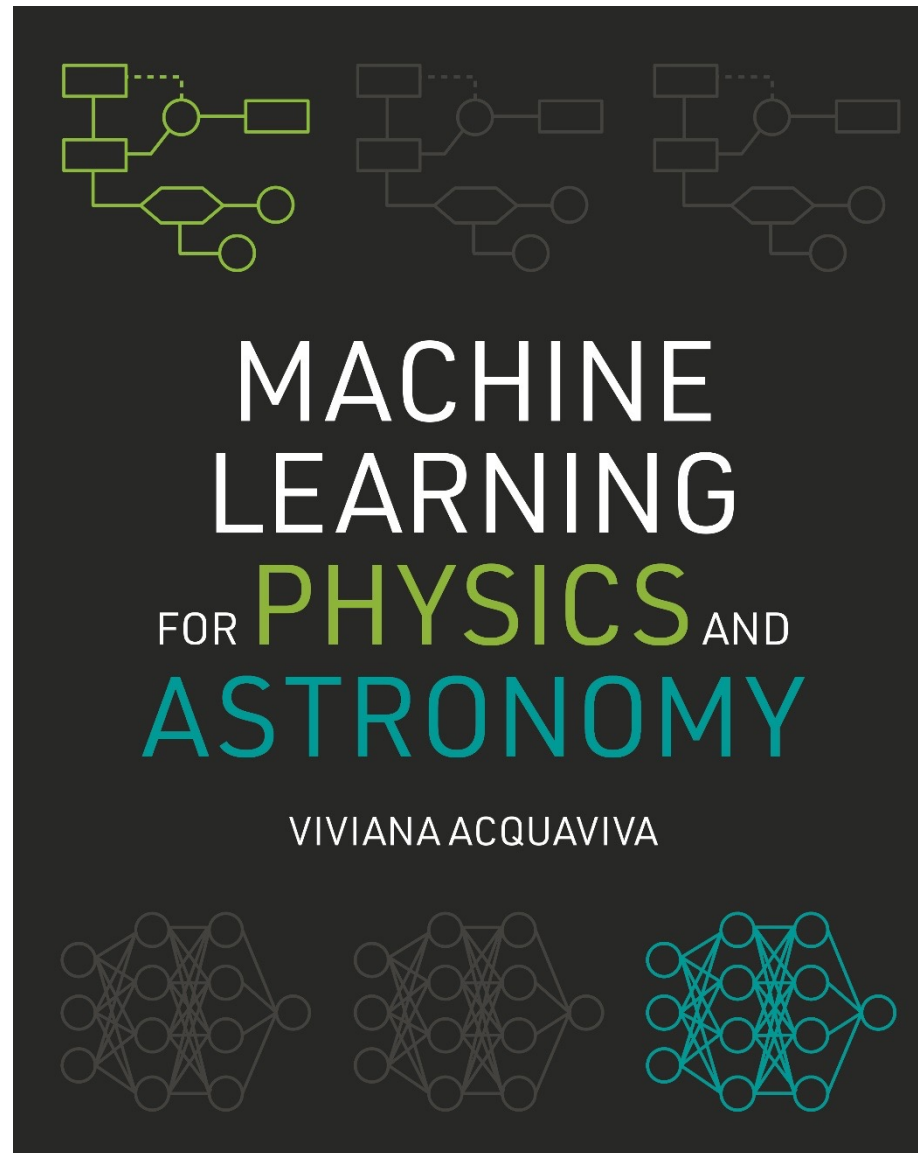
IA en Matemáticas

NATIONAL
ACADEMIES *Sciences
Engineering
Medicine*

Artificial Intelligence to Assist Mathematical Reasoning



Proceedings of a Workshop



IA en el diseño de nuevos materiales



IAS DISTINGUISHED LECTURE

Designing New Materials with Artificial Intelligence

Alán ASPURU-GUZI

Professor of Chemistry and of Computer Science
University of Toronto

October 13, 2023 (Fri)
2:30 – 4:00 pm



IA en el descubrimiento de nuevos fármacos



Artificial Intelligence for Drug Discovery

Landscape Overview
Q1 2023



www.deep-pharma.tech



Thousands Lose Jobs to Artificial Intelligence



IA en el empleo



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[Business](#) | [Market Data](#) | [New Tech Economy](#) | [Companies](#) | [Technology of Business](#) | [Economy](#) | [CEO Secrets](#) | [Artificial Intelligence](#)

AI will create as many jobs as it displaces - report

🕒 17 July 2018 · 💬 [Comments](#)

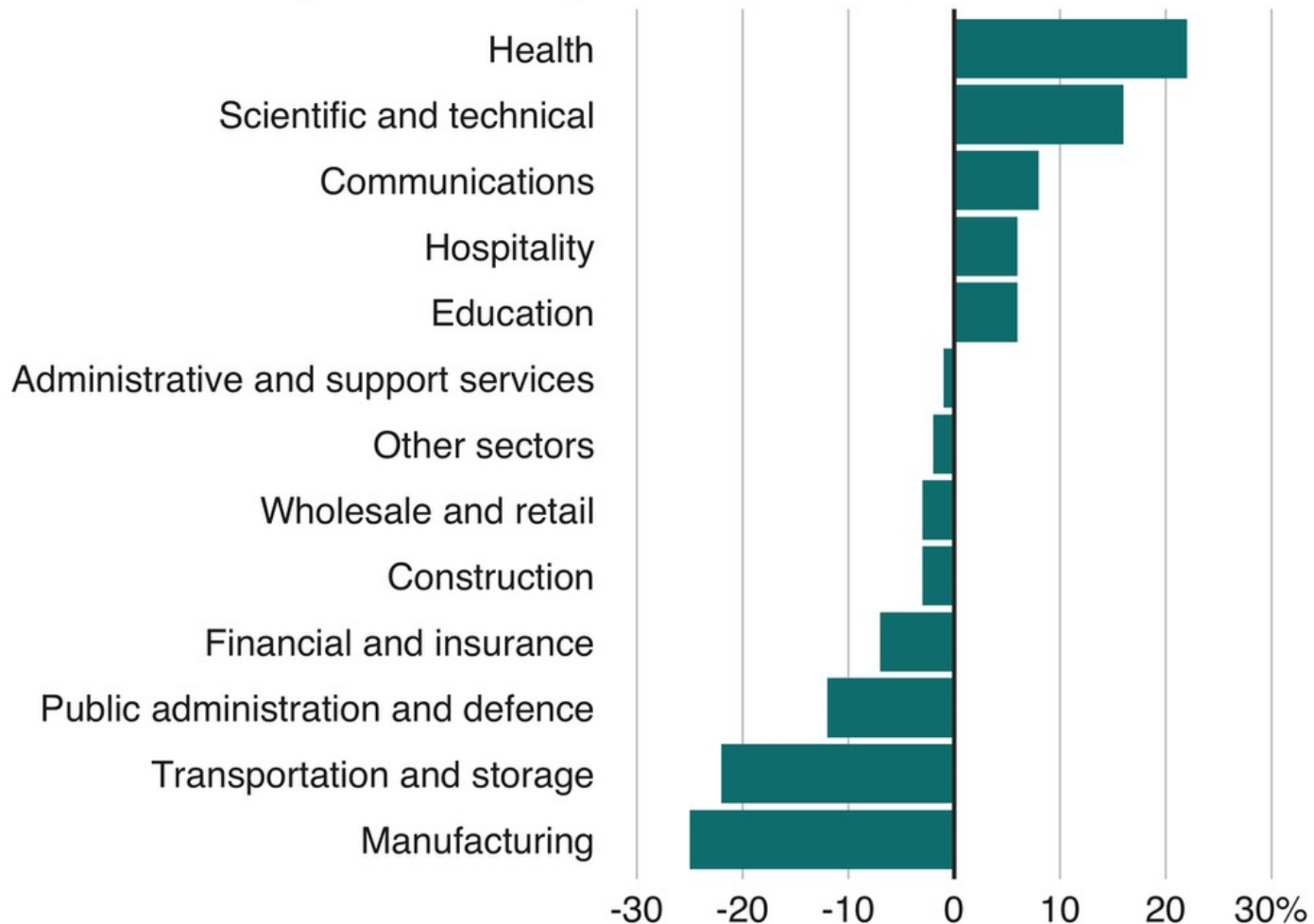


GETTY IMAGES

IA en el empleo

How AI could change the job market

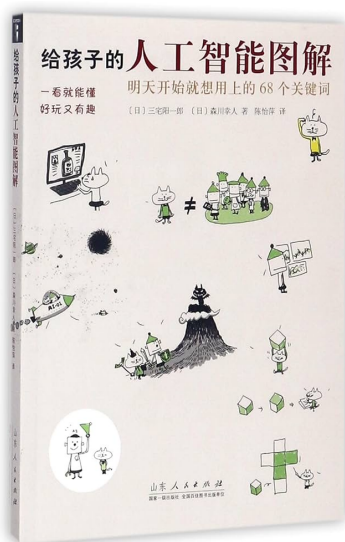
Estimated net job creation by industry sector, 2017-2037



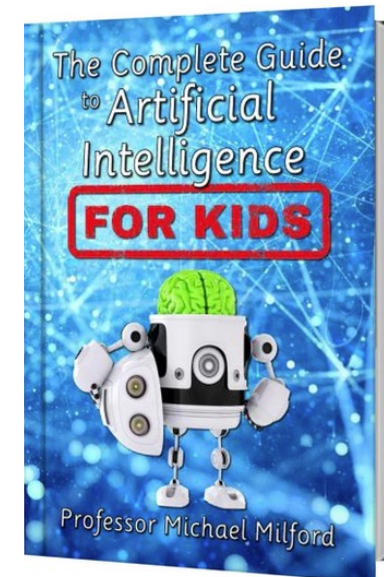
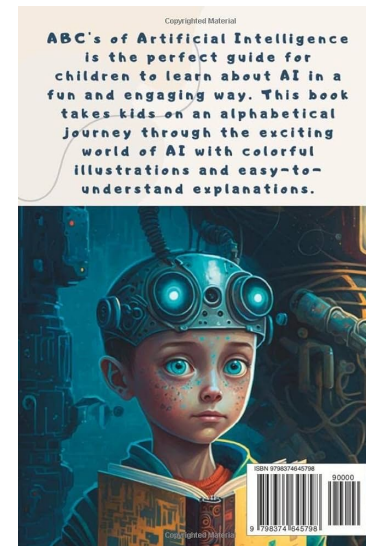
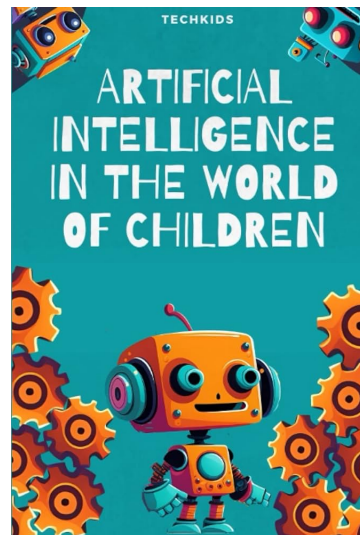
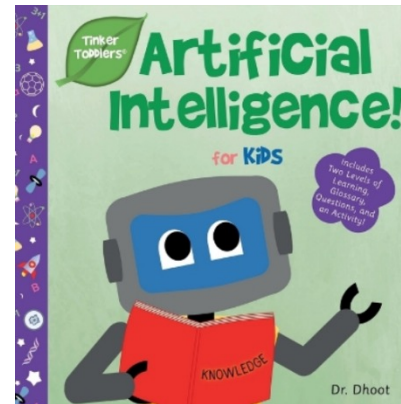
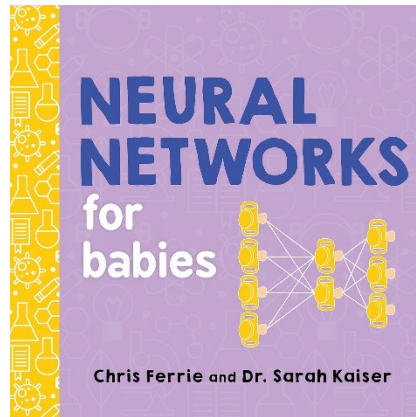
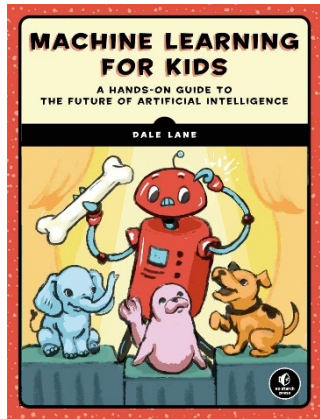
Source: PwC

BBC

IA para niños



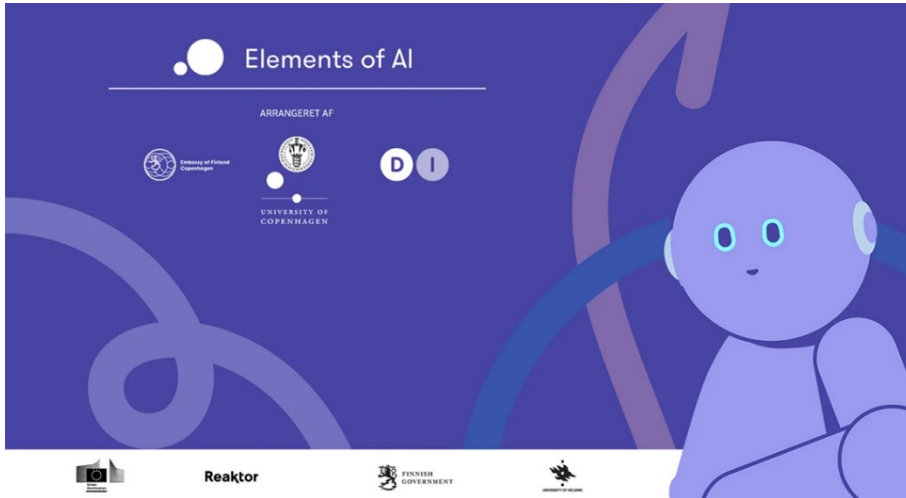
IA para niños

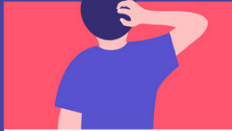


IA para niños



Educando a la sociedad en IA





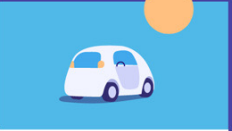
Chapter 1
What is AI?

Section	Exercises
I. How should we define AI?	0/1
II. Related fields	0/2
III. Philosophy of AI	0/1



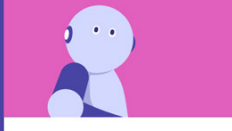
Chapter 2
AI problem solving

Section	Exercises
I. Search and problem solving	0/2
II. Solving problems with AI	---
III. Search and games	0/1



Chapter 3
Real world AI

Section	Exercises
I. Odds and probability	0/2
II. The Bayes rule	0/2
III. Naive Bayes classification	0/2



Chapter 4
Machine learning

Section	Exercises
I. The types of machine learning	---
II. The nearest neighbor classifier	0/2
III. Regression	0/4



Chapter 5
Neural networks

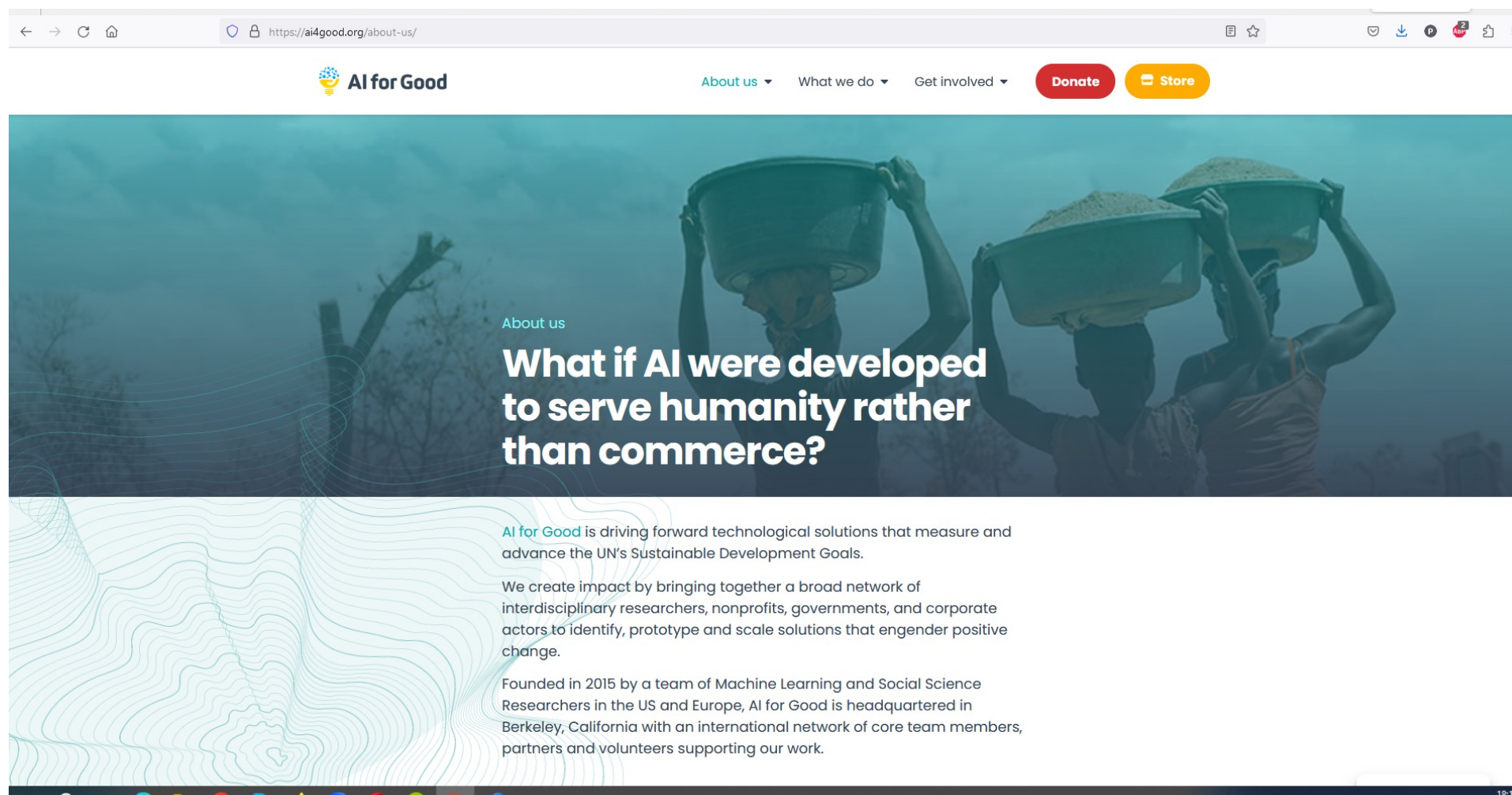
Section	Exercises
I. Neural network basics	0/1
II. How neural networks are built	0/2
III. Advanced neural network techniques	---



Chapter 6
Implications

Section	Exercises
I. About predicting the future	0/1
II. The societal implications of AI	0/1
III. Summary	0/1

AI for Good

A screenshot of the AI for Good website. The browser address bar shows 'https://ai4good.org/about-us/'. The website has a green header with the 'AI for Good' logo and navigation links: 'About us', 'What we do', and 'Get involved'. There are 'Donate' and 'Store' buttons. The main content area features a large image of people carrying bowls on their heads, overlaid with a teal gradient. The text 'About us' is in small teal letters, followed by the main heading 'What if AI were developed to serve humanity rather than commerce?' in large white letters. Below this, a paragraph states: 'AI for Good is driving forward technological solutions that measure and advance the UN's Sustainable Development Goals.' Another paragraph follows: 'We create impact by bringing together a broad network of interdisciplinary researchers, nonprofits, governments, and corporate actors to identify, prototype and scale solutions that engender positive change.' The final paragraph reads: 'Founded in 2015 by a team of Machine Learning and Social Science Researchers in the US and Europe, AI for Good is headquartered in Berkeley, California with an international network of core team members, partners and volunteers supporting our work.' The bottom of the page has a decorative wavy line pattern on the left and a small '100%' zoom indicator on the right.

https://ai4good.org/about-us/

AI for Good

About us ▾ What we do ▾ Get involved ▾

Donate Store

About us

What if AI were developed to serve humanity rather than commerce?

AI for Good is driving forward technological solutions that measure and advance the UN's Sustainable Development Goals.

We create impact by bringing together a broad network of interdisciplinary researchers, nonprofits, governments, and corporate actors to identify, prototype and scale solutions that engender positive change.

Founded in 2015 by a team of Machine Learning and Social Science Researchers in the US and Europe, AI for Good is headquartered in Berkeley, California with an international network of core team members, partners and volunteers supporting our work.

Human-in-the-Loop in Machine Learning: What is it and How Does it Work?



INTELIGENCIA ARTIFICIAL

PASADO, PRESENTE y FUTURO

Pedro Larrañaga



Madrid, 18 diciembre de 2023