

Inteligencia Artificial

Historia de la Inteligencia Artificial

Contenidos

- Definición de Inteligencia Artificial
- Áreas
- Aplicaciones (estado del arte)
- Fundamentos

¿Qué es la IA?

¿IA = Ciencia Ficción?



¿IA = Ciencia Ficción?



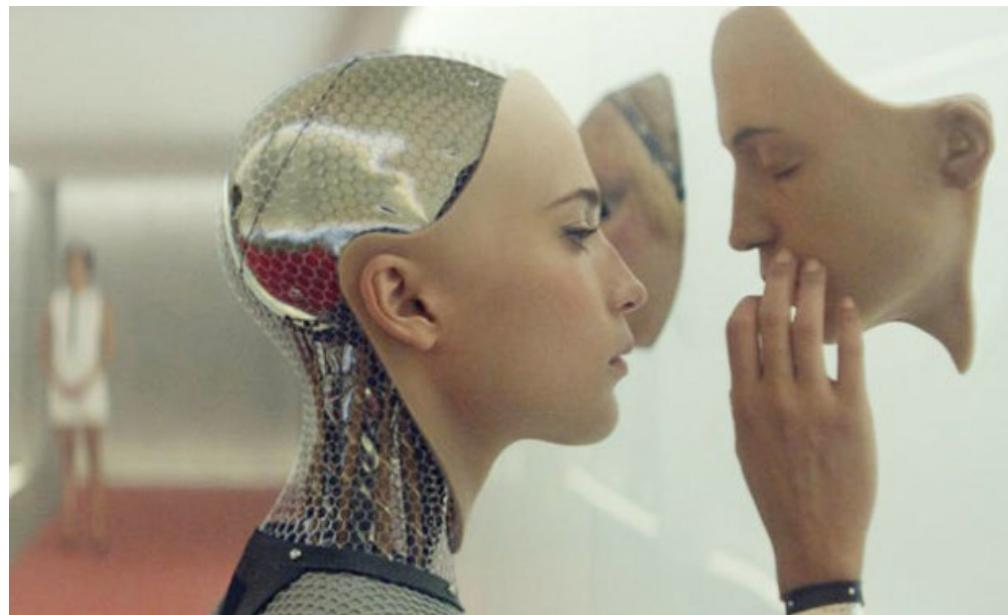
<http://en.wikipedia.org/wiki/AIBO>



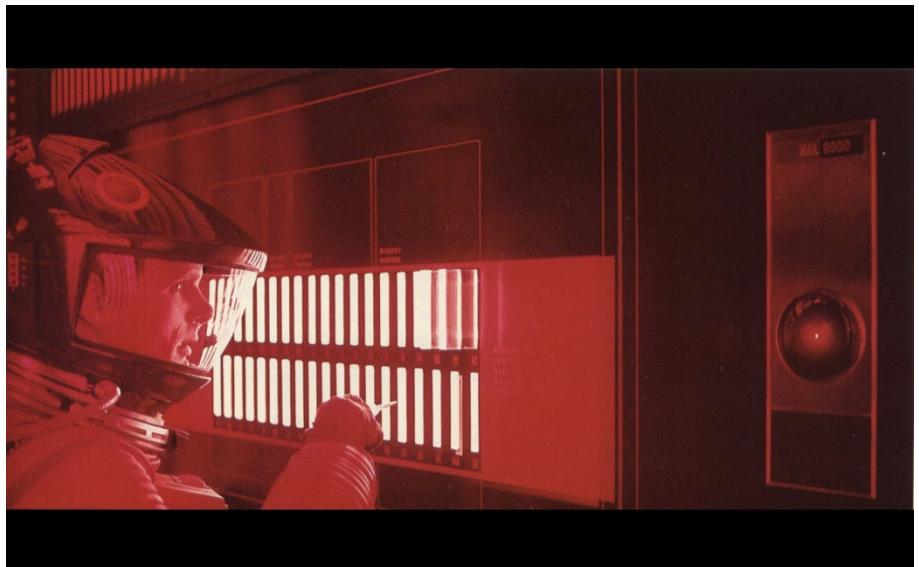
<https://www.sphero.com/bb-8-app-enabled-droid>



¿IA = Ciencia Ficción?



¿IA = Ciencia Ficción?



IA: definición

Coloquialmente:

“Cuando una máquina imita funciones cognitivas (como la resolución de problemas o el aprendizaje) que los humanos comúnmente asocian con otros seres inteligentes.”

Ej's:

- Aprender a traducir
- Planificar una ruta



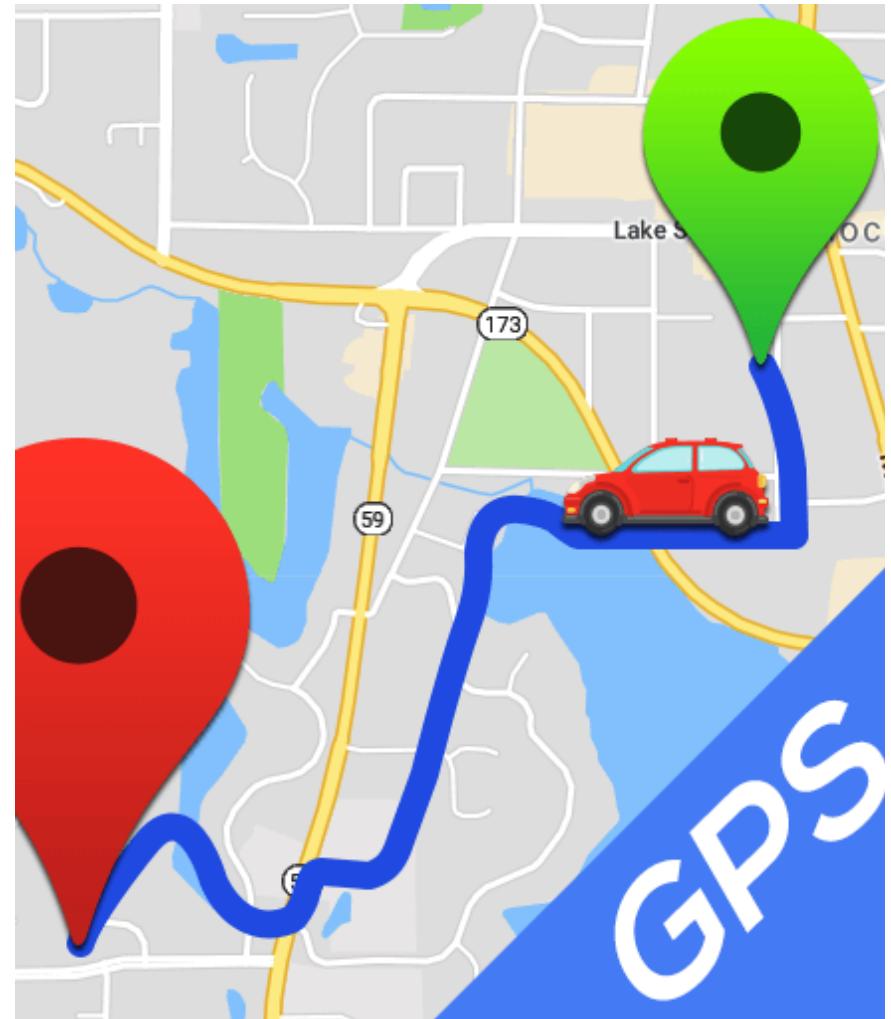
IA: definición

De forma más técnica:

“Estudio de ‘agentes inteligentes’ capaces de percibir su entorno y tomar medidas (acciones) que maximicen sus objetivos.”

Ej’s:

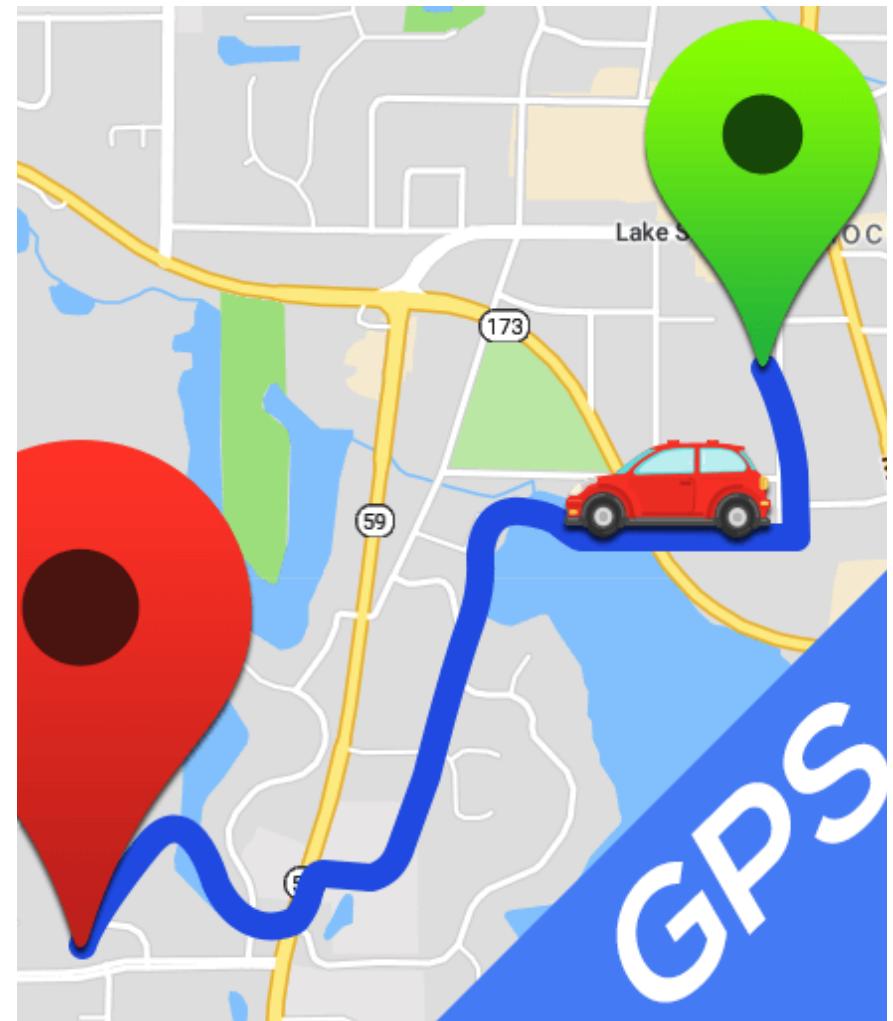
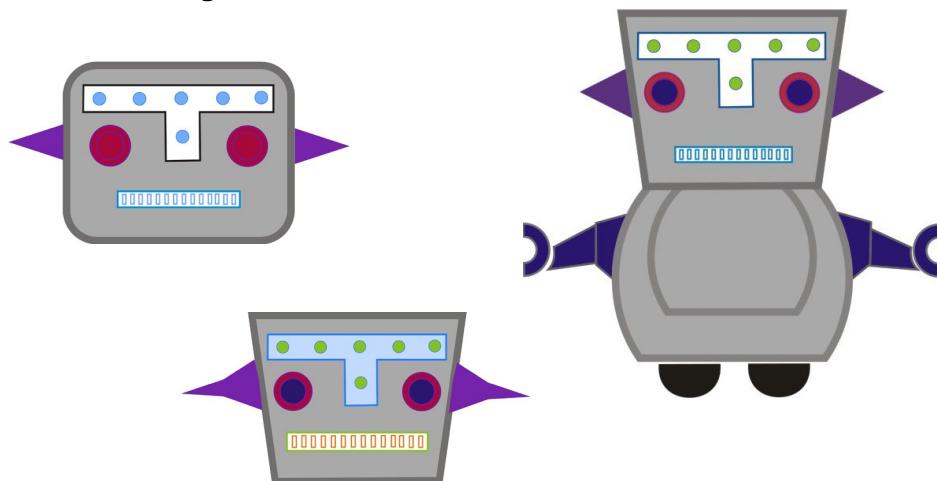
- Aprender a traducir
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IA: definición

De forma más técnica:

“Estudio de ‘**agentes inteligentes**’ capaces de percibir su entorno y tomar medidas (acciones) que maximicen sus objetivos.”



IA: definición

Efecto IA:

“AI es lo que no se ha hecho todavía”



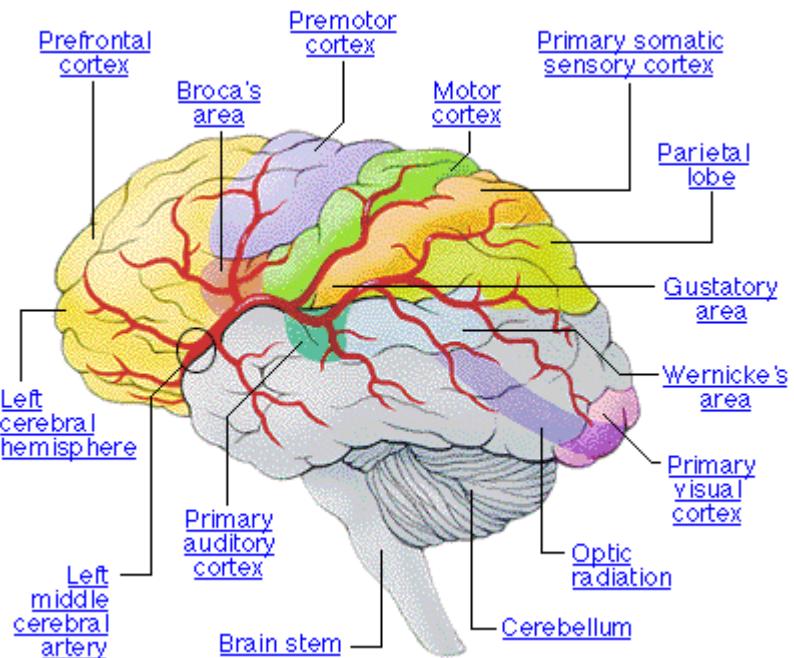
¿Qué es la IA?

- Algunas definiciones de IA según la literatura (taxonomía):



¿Y el cerebro?

- El cerebro es muy bueno tomando decisiones racionales (pero no perfecto).
- "El cerebro es a la inteligencia artificial, lo que las alas son a volar "



¿Qué es la IA?

- Algunas definiciones de IA según la literatura (taxonomía):

<p>Sistemas que piensan como humanos</p> <p>“El nuevo y excitante esfuerzo de hacer que los computadores piensen... máquinas con mentes, en el más amplio sentido literal” (Haugeland, 1985)</p> <p>“[La automatización de] actividades que vinculamos con procesos de pensamiento humano, actividades como la toma de decisiones, resolución de problemas, aprendizaje...” (Bellman, 1978)</p>	<p>Sistemas que piensan racionalmente</p> <p>“El estudio de las facultades mentales mediante el uso de modelos computacionales” (Charniak y McDermott, 1985)</p> <p>“El estudio de los cálculos que hace posible percibir, razonar y actuar”. Winston, 1992.</p>
<p>Sistemas que actúan como humanos</p> <p>“El arte de desarrollar máquinas con capacidad para realizar funciones que cuando son realizadas por personas requieren de inteligencia” (Kurzweill, 1990)</p> <p>“El estudio de cómo lograr que los computadores realicen tareas que, por el momento, los humanos hacen mejor” (Rich y Knight, 1991)</p>	<p>Sistemas que actúan racionalmente</p> <p>“La Inteligencia computacional es el estudio del diseño de agentes inteligentes” (Poole y et al., 1998)</p> <p>“IA... está relacionada con conductas inteligentes en artefactos” (Nilsson, 1998)</p>

¿Qué es la IA?

- Algunas definiciones de IA según la literatura (taxonomía):

Estándar humano

Sistemas que piensan como humanos

“El nuevo y excitante esfuerzo de hacer que los computadores piensen... máquinas con mentes, en el más amplio sentido literal” (Haugeland, 1985)

“[La automatización de] actividades que vinculamos con procesos de pensamiento humano, actividades como la toma de decisiones, resolución de problemas, aprendizaje...” (Bellman, 1978)

Racionalidad (ideal)

Sistemas que piensan razonadamente

“El estudio de las facultades mentales mediante el uso de modelos computacionales” (Charniak y McDermott, 1985)

“El estudio de los cálculos que hace posible percibir, razonar y actuar”. Winston, 1992.

Sistemas que actúan como humanos

“El arte de desarrollar máquinas con capacidad para realizar funciones que cuando son realizadas por personas requieren de inteligencia” (Kurzweill, 1990)

“El estudio de cómo lograr que los computadores realicen tareas que, por el momento, los humanos hacen mejor” (Rich y Knight, 1991)

Sistemas que actúan razonadamente

“La Inteligencia computacional es el estudio del diseño de agentes inteligentes” (Poole y et al., 1998)

“IA... está relacionada con conductas inteligentes en artefactos” (Nilsson, 1998)

¿Qué es la IA?

- Resumen:

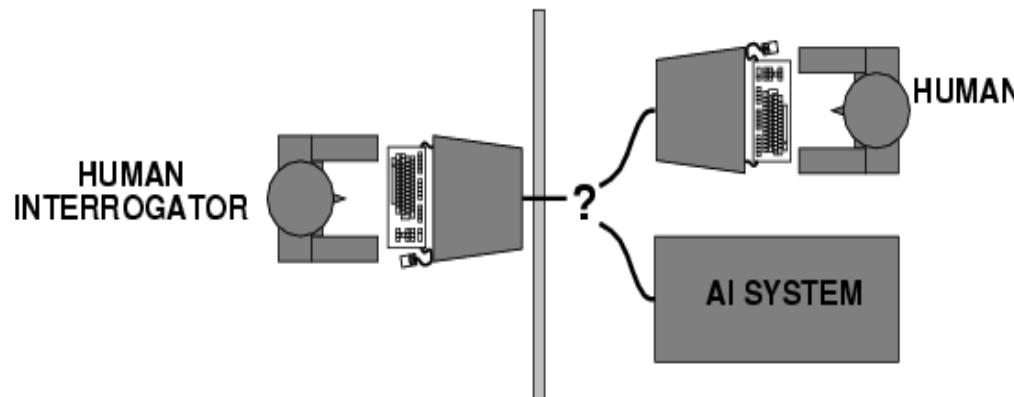
Énfasis/criterio	Inteligencia humana	Racionalidad
Pensamiento	Sistemas que piensan como humanos: <i>Enfoque cognoscitivo</i>	Sistemas que piensan racionalmente: <i>Enfoque lógico</i>
Comportamiento	Sistemas que actúan como humanos: <i>Enfoque «prueba de Turing»</i>	Sistemas que actúan racionalmente: <i>Enfoque de agentes racionales</i>

Actuando como humanos: El test de Turing

http://ca.wikipedia.org/wiki/Alan_Turing

Alan Turing (1950) "Computing machinery and intelligence":

- "¿Pueden las máquinas pensar?" → "¿Pueden las máquinas comportarse de manera inteligente?"
- Test operativo para evaluar el pensamiento inteligente: el juego de imitación



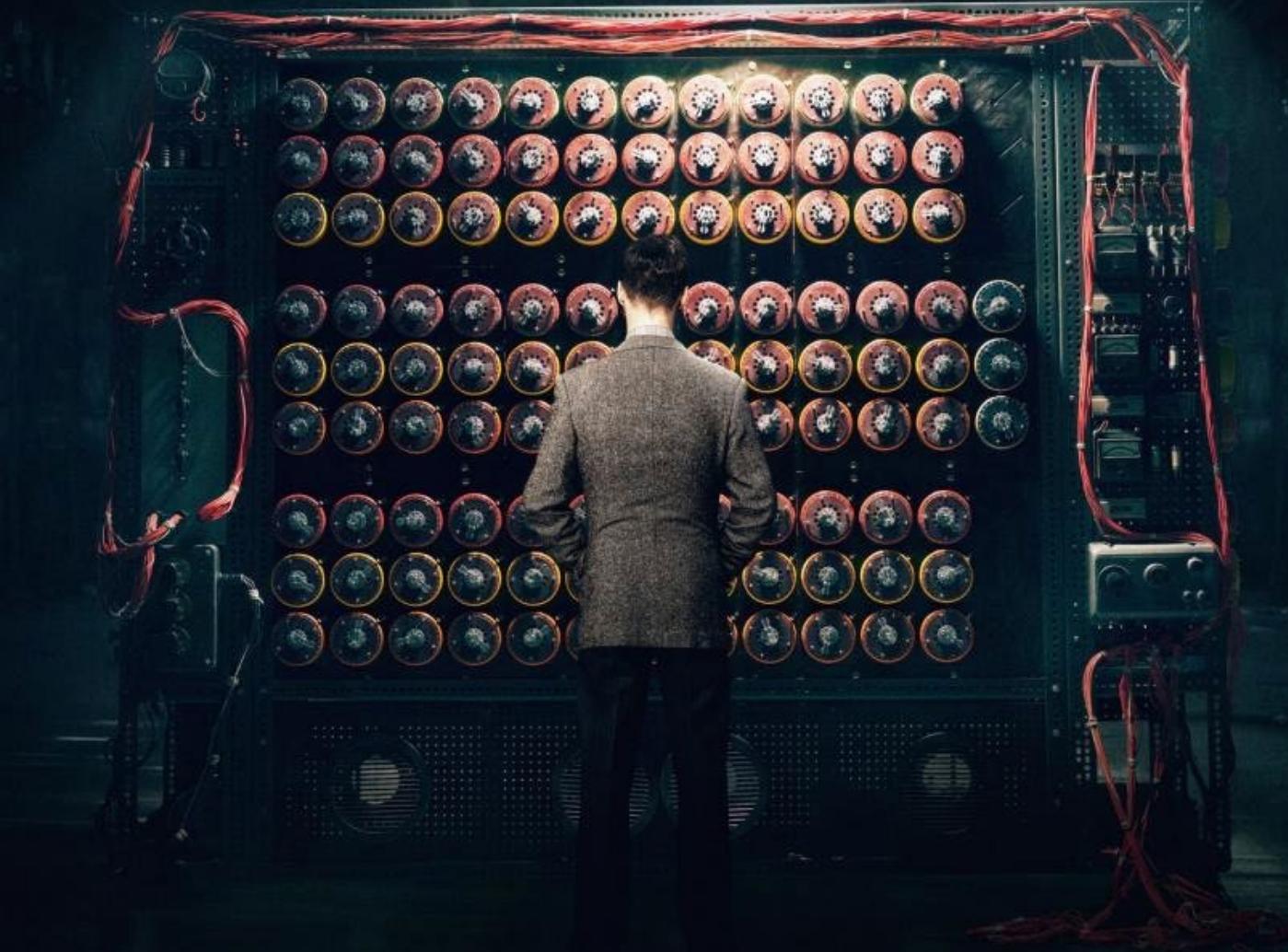
- Predijo que por el año 2000 una máquina tendría un 30% de probabilidades de engañar a una persona durante 5 minutos.
- Anticipó los principales argumentos en oposición a la IA en los siguientes 50 años.
- Sugirió los principales componentes de IA: representación del conocimiento, razonamiento, comprensión del lenguaje, aprendizaje.

Problema: El test de Turing no es **reproducible**, **constructivo**, o susceptible al **análisis matemático**.



UNIVERSITAT
DE
BARCELONA

THE TRUE ENIGMA
WAS THE MAN WHO CRACKED
THE CODE



BENEDICT CUMBERBATCH

KEIRA KNIGHTLEY

THE IMITATION GAME

I failed the Turing test



¿Cuál es vuestra aproximación a la IA preferida?

Énfasis/criterio	Inteligencia humana	Racionalidad
Pensamiento	Sistemas que piensan como humanos: <i>Enfoque cognoscitivo</i>	Sistemas que piensan racionalmente: <i>Enfoque lógico</i>
Comportamiento	Sistemas que actúan como humanos: <i>Enfoque «prueba de Turing»</i>	Sistemas que actúan racionalmente: <i>Enfoque de agentes racionales</i>

Definición IA (EU)

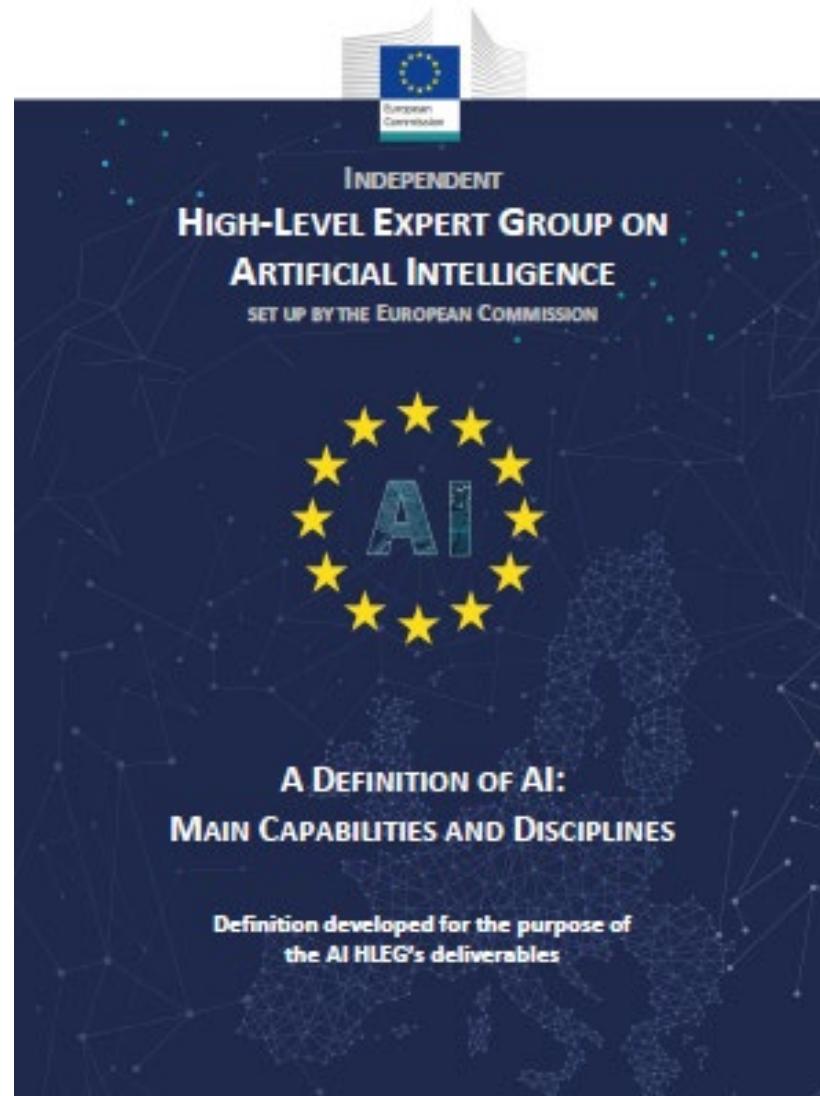
Definición de IA en Europa (2018)

High-Level Expert Group on AI <https://ec.europa.eu/digital-single-market/en/high-level-expert-group-artificial-intelligence>

Sistemas que muestran un comportamiento inteligente analizando su entorno y realizando acciones –con cierto grado de **autonomía**– para conseguir objetivos específicos.

Los sistemas basados en IA pueden estar:

- basados en SW, actuando en el mundo virtual (p.ej. asistentes de voz, programas de análisis de imágenes, motores de búsqueda, sistemas de reconocimiento de voz y de cara)
- incrustados en dispositivos de HW (p.ej. robots avanzados, coches autónomos, drones o aplicaciones del Internet de las cosas IoT).





Requirements for Trustworthy AI

High-Level Expert Group on AI (EU) - April 2019



1. **Human agency and oversight** - Including fundamental rights, human control
2. **Technical robustness and safety** - Including resilience to attack and security, fall back plan and general safety, accuracy, reliability and reproducibility
3. **Privacy and data governance** - Including respect for privacy, quality and integrity of data, and access to data
4. **Transparency** - Including traceability, **explainability** and communication
5. **Diversity, non-discrimination and fairness** - Including the avoidance of unfair bias, accessibility and universal design, and stakeholder participation
6. **Societal and environmental wellbeing** - Including sustainability and environmental friendliness, social impact, society and democracy
7. **Accountability** - Including auditability, minimisation and reporting of negative impact, trade-offs and redress.

Tool: Assessment List for Trustworthy AI - ALTAI

<https://ec.europa.eu/digital-single-market/en/high-level-expert-group-artificial-intelligence>

Francesco Favretti

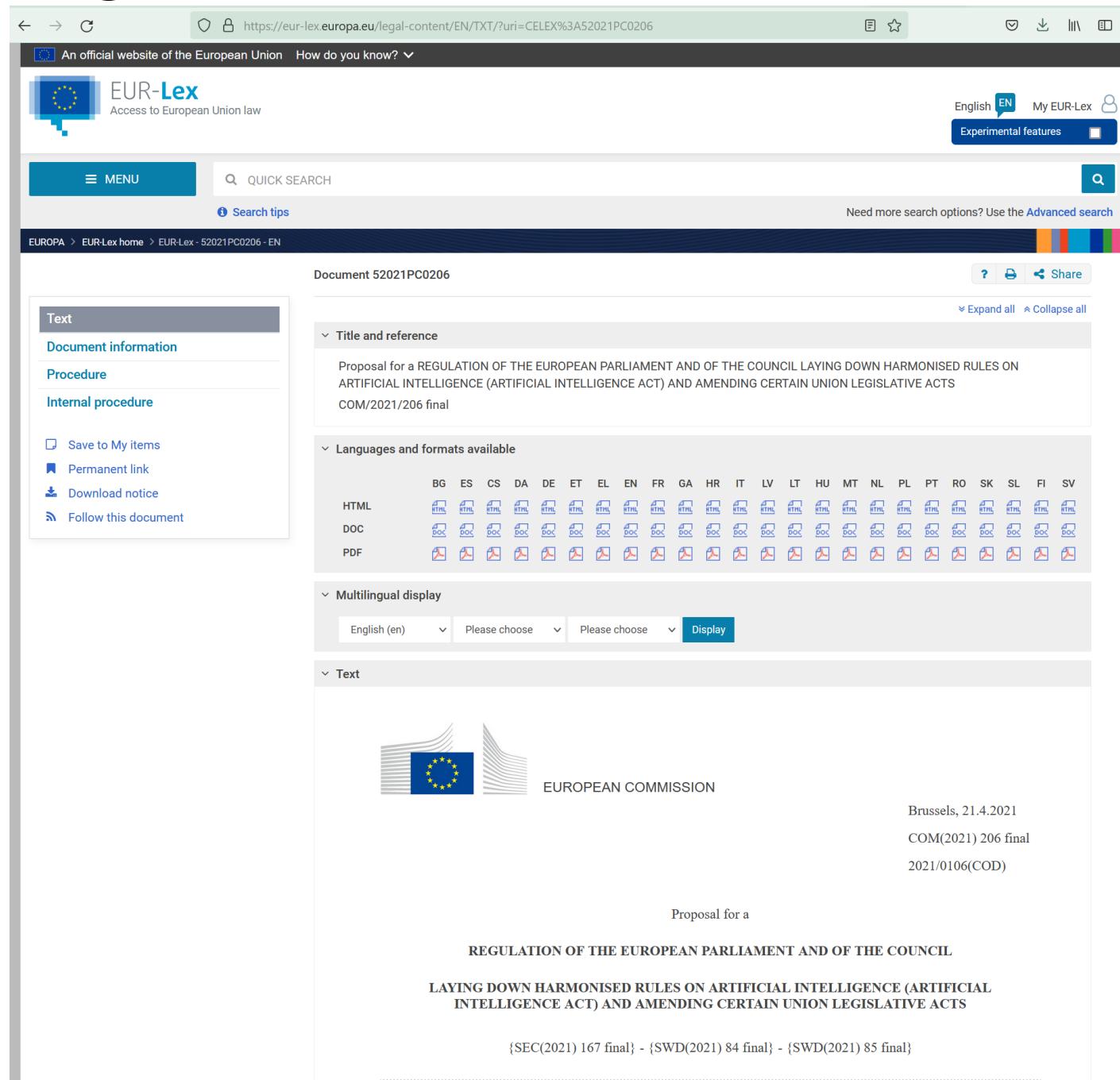


Extraído del seminario del Prof. Raja Chatila

Regulación de la IA en EU

The AI Act proposal

- Abril 2021

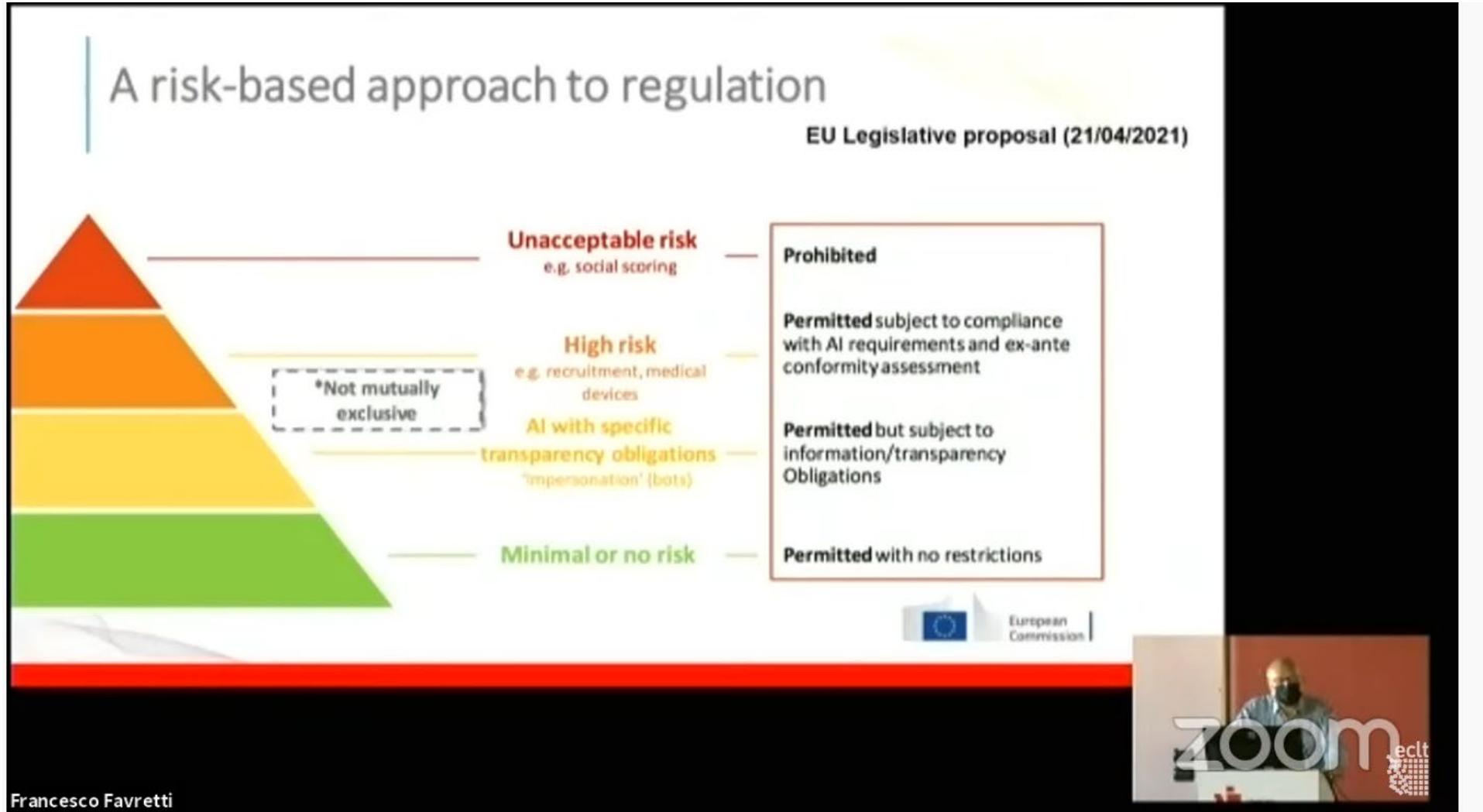


The screenshot shows the EUR-Lex website interface. At the top, there's a header with the URL <https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A52021PC0206>, a shield icon, and a search bar. Below the header, the EUR-Lex logo and the text "Access to European Union law" are visible. On the right side, there are language selection buttons (English EN), a user profile icon, and a "Experimental features" button. A navigation bar includes "MENU", "QUICK SEARCH", "Search tips", and "Need more search options? Use the Advanced search". The main content area displays the document details for "Document 52021PC0206". It includes sections for "Title and reference", "Languages and formats available", "Multilingual display", and "Text". The "Text" section features the European Commission logo and the document title: "Proposal for a REGULATION OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL LAYING DOWN HARMONISED RULES ON ARTIFICIAL INTELLIGENCE (ARTIFICIAL INTELLIGENCE ACT) AND AMENDING CERTAIN UNION LEGISLATIVE ACTS". It also shows the date "Brussels, 21.4.2021" and the identifier "COM(2021) 206 final". The footer contains the copyright notice "© European Union 2021" and the document identifier "2021/0106(COD)".

Regulación de la IA en EU

En base al riesgo que supone (esp. para las personas usuarias)

- Se pueden interpretar en términos de los valores éticos que afectan



Extraído del seminario del Prof. Raja Chatila

Ley de la IA

- Europa: 2021-23 Ley de la IA (AI act)

Niveles de riesgos/límites:

- Prohíbe sistemas que representen una amenaza para las personas
- Evaluación continuada de sistemas que impacten negativamente la seguridad o derechos fundamentales
- Pide transparencia a sistemas de riesgo limitado



<https://www.reneweuropegroup.eu/news/2023-05-11/ai-act-eu-paves-the-way-for-worlds-first-comprehensive-rulebook>

Ley de la IA

- Europa: 2021-23 Ley de la IA (AI act)

Sistemas:

- seguros,
- transparentes,
- rastreables,
- no discriminatorios,
- respetuosos con el medio ambiente,
- con supervisión humana



<https://www.reneweuropegroup.eu/news/2023-05-11/ai-act-eu-paves-the-way-for-worlds-first-comprehensive-rulebook>

Global AI Legislation Tracker

<https://iapp.org/resources/article/global-ai-legislation-tracker/>

- https://iapp.org/media/pdf/resource_center/global_ai_legislation_tracker.pdf

Navigate to: Australia | Brazil | Canada | China | EU | India | Israel | Japan | New Zealand | Saudi Arabia | Singapore

Country (A-Z)	Specific AI governance law and policy	Relevant authorities	Other relevant and policies
EU	The EU AI Act moved to the trilogue stage, where a final version will be debated June 2023. Passage of the act is expected by the end of 2023 or in early 2024. The three positions in the trilogue discussions are put forward by the commission, council and European Parliament. In brief, most of the proposed rules being debated in trilogue are designed to do the following:	<ul style="list-style-type: none"> Prohibit certain types of AI systems, i.e., those that are manipulative, explosive, perform social scoring or use “real-time” biometric ID systems. Classify high-risk AI systems and set out requirements with which these systems and their providers must comply. Delegate regulatory and enforcement authorities. Prescribe standards of conformity which may be applied by high-risk systems. Ensure transparency obligations for AI systems which interact with natural persons. Provide innovation measures. Set up a governance framework divided between the EU AI Board and national authorities. Create a database for high-risk systems. Requires an iterative process of review after-market deployment. Promote the formation of codes of conduct for AI systems which are not high-risk. Stipulate confidentiality requirements for authorities dealing with proprietary data. Afford the power to adopt delegated acts to the European Commission. 	<ul style="list-style-type: none"> Proposed Future EU AI Board European Data Protection Board Member state AI authorities, for example: <ul style="list-style-type: none"> Spain's AI supervision agency, the Agencia Espaola de Supervision de la Inteligencia Artificial Member state data protection authorities, for example: <ul style="list-style-type: none"> Portuguese Commissione, Comissão de Informática e das Liberdades Germany's Federal Commissioner for Data Protection and Freedom of Information Bulgaria's State Agency for Personal Data Protection Belgium's Data Protection Authority Poland's Urząd Ochrony Danych Osobowych Austria's Data Protection Authority Hungary's National Authority for Data Protection and Freedom of Information
	<p>There are no laws and policies specific to AI governance in Australia, but the government highlighted the application of existing regulatory frameworks for AI. The Human Technology Institute and the University of Technology Sydney recently released The State of AI Governance in Australia. See Australia's Government's roadmap on safe and responsible AI. Its AI Roadmap. The roadmap sets out the focus on AI development in high potential areas, such as natural resources and infrastructure.</p>		
	<ul style="list-style-type: none"> General Data Protection Regulation (in force) Digital Services Act (in force) AI Liability Directive (draft) 		
	<ul style="list-style-type: none"> Department of Industry, Science and Resources Commonwealth Scientific and Industrial Research Organisation Office of the Safety Commissioner Office of the Victorian Information Commissioner Competition and Consumer Commission 		
	<ul style="list-style-type: none"> Patents Act (in force) Copyright Act (in force) Privacy Act (in force) Data Availability Transparency Act (in force) Consumer Data (in force) Competition and Consumer Act (in force) 		
	<p>There are no laws and policies specific to AI governance in Brazil, but the government highlighted the application of existing regulatory frameworks for AI. The proposed AI Bill aims to establish a civil liability regime for AI developers. The proposed AI Bill would:</p> <ul style="list-style-type: none"> Prohibit certain “excessive risk” systems. Establish a regulatory body to enforce the law. Create civil liability for AI providers. Require reporting obligations for significant security incidents. Guarantee various individual rights, such as explanation of AI-based decisions, nondiscrimination, rectification of identified biases and due process mechanisms. 		
	<ul style="list-style-type: none"> Ministry of Science, Technology and Innovation National Data Protection Authority, Autoridade Nacional de Proteção de Dados 		
	<ul style="list-style-type: none"> General Data Protection Regulation (in force) Civil Rights Framework for Internet (in draft) Consumer Protection Code (in force) 		

Global AI Legislation Tracker



This map shows which jurisdictions are in focus and covered by this tracker. It does not represent the extent to which jurisdictions around the world are active on AI governance legislation.

Jurisdictions in focus

Australia | Brazil | Canada | China | EU | India | Israel | Japan | New Zealand | Saudi Arabia | Singapore | South Korea | United Arab Emirates | U.K. | U.S.

*Click on the country names above to navigate to its location in the tracker.

Global AI Legislation Tracker • International Association of Privacy Professionals • IAPP.org

Regulación USA

Blueprint for an AI Bill of Right

- Making Automated systems work for the American People
- April 2022

Navigate to: Australia | Brazil | Canada | China | EU | India | Israel | Japan | New Zealand | Saudi Arabia | Singapore | South Korea | United Arab Emirates | U.K. | U.S.

Country (A-Z)	Specific AI governance law and policy	Relevant authorities	Other relevant laws and policies	Wider AI context
EU	<p>The EU AI Act moved to the trilogue stage, where a final version will be debated, June 2023. Passage of the act is expected by the end of 2023 or in early 2024. The three positions in the trilogue discussions are put forward by the commission, council and European Parliament. In brief, some of the proposals being debated in trilogue include measures that:</p> <ul style="list-style-type: none"> Prohibit certain types of AI systems, i.e., those that are manipulative, exploitative, perform social scoring or use "real-time" biometric ID systems. Classify high-risk AI systems and set out requirements with which these systems and their providers must comply. Delegate regulatory and enforcement authorities. Prescribe standards of conformity which may be applied by high-risk systems. Ensure transparency obligations for AI systems which interact with natural persons. Provide innovation measures. Set out a governance framework divided between the EU Board and national authorities. Create a database for high-risk systems. Requires an iterative process of review after-market deployment. Prompt the formation of codes of conduct for AI systems which are not high-risk. Stipulate confidentiality requirements for authorities dealing with proprietary data. Afford the power to adopt delegated acts to the European Commission. 	<ul style="list-style-type: none"> Proposed future EU AI Board European Data Protection Board Member state AI authorities, for example: <ul style="list-style-type: none"> Spain's AI supervision agency, the Agencia Española de Supervisión de la Inteligencia Artificial Member state data protection authorities, for example: <ul style="list-style-type: none"> France's Commission nationale de l'informatique et des libertés Germany's Federal Commissioner for Data Protection and Freedom of Information Italy's Garante Spain's Agencia Española de Protección de Datos Belgium's Data Protection Authority Poland's Urząd Ochrony Danych Osobowych Austria's Data Protection Authority Hungary's National Authority for Data Protection and Freedom of Information 	<ul style="list-style-type: none"> General Data Protection Regulation (in force) Digital Services Act (in force) Digital Markets Act (in force) AI Liability Directive (draft) 	<p>Some EU member states have national AI strategies, many of which emphasize research, training and labor preparedness, as well as multistakeholder and international collaboration. For example:</p> <ul style="list-style-type: none"> France's national AI strategy lays out three main objectives: improve the AI education and training ecosystem, establish an open data policy for implementing AI applications and pooling assets, and develop an ethical framework for fair and transparent use of AI.

THE WHITE HOUSE
Administration Priorities The Record Briefing Room Español MENU

BLUEPRINT FOR AN AI BILL OF RIGHTS

MAKING AUTOMATED SYSTEMS WORK FOR THE AMERICAN PEOPLE

OSTP

Among the great challenges posed to democracy today is the use of technology, data, and automated systems in ways that threaten the rights of the American public. Too often, these tools are used to limit our opportunities and prevent our access to critical resources or services. These problems are well documented. In America and around the world, systems supposed to help with patient care have proven unsafe, ineffective, or biased. Algorithms used in hiring and credit decisions have been found to reflect and reproduce existing unwanted inequities or embed new harmful bias and discrimination. Unchecked social media data collection has been used to threaten people's opportunities, undermine their privacy, or pervasively track their activity—often without their knowledge or consent.

These outcomes are deeply harmful—but they are not inevitable. Automated systems have brought about extraordinary benefits, from technology that helps farmers grow food more efficiently and computers that predict storm paths, to algorithms that can identify diseases in patients. These tools now drive important decisions across sectors, while data is helping to revolutionize global industries. Fueled by the power of American innovation, these tools hold the potential to redefine every part of our society and make life better for everyone.

This important progress must not come at the price of civil rights or democratic values, foundational American principles that President Biden has affirmed as a cornerstone of his Administration. On his first day in office, the President ordered the full Federal government to work to root out inequity, embed fairness in decision-making processes, and affirmatively advance civil rights, equal opportunity, and racial justice in America.^[i] The President has spoken forcefully about the urgent challenges posed to democracy today and has regularly called on people of conscience to act to preserve civil rights—including the right to privacy, which he has called “the basis for so many more rights that we have come to take for granted that are ingrained in the fabric of this country.”^[ii]

To advance President Biden's vision, the White House Office of Science and Technology Policy has identified five principles that should guide the design, use, and deployment of automated systems to protect the American public in the age of artificial intelligence. The Blueprint for an AI Bill of Rights is a guide for a society that protects all people from these threats—and uses technologies in ways that reinforce our highest values. Responding to the experiences of the American public, and informed by insights from researchers, technologists, advocates, journalists, and policymakers, this framework is accompanied by From Principles to Practice—a handbook for anyone seeking to incorporate these protections into policy and practice, including detailed steps toward actualizing these principles in the technological design process. These principles help provide guidance whenever automated systems can meaningfully impact the public's rights, opportunities, or access to critical needs.



Safe and Effective Systems



Algorithmic Discrimination Protections



Data Privacy



Notice and Explanation



Human Alternatives, Consideration, and Fallback

Applying the Blueprint for an AI Bill of Rights Download the Blueprint for an AI Bill of Rights



Safe and Effective Systems

You should be protected from unsafe or ineffective systems. Automated systems should be developed with consultation from diverse communities, stakeholders, and domain experts to identify concerns, risk, and potential impacts of the system. Systems should undergo pre-deployment testing, risk

Agentes racionales

Un **agente** es una entidad que percibe y actúa.

Este curso trata sobre el diseño de **agentes racionales**.

De forma abstracta, un agente es una función que va desde un histórico de precepciones hasta las acciones:

$$f: P^* \rightarrow A$$

Para cualquier clase de entornos y tareas dadas, buscamos el agente (o clase de agentes) con el mejor resultado.

Advertencia: **las limitaciones computacionales hacen que la racionalidad perfecta sea inalcanzable.**

→ diseño del mejor **programa** para recursos de máquina determinados

Decisiones racionales

- Utilizamos el término racional de una forma concreta:
 - Racional: Aquel que maximiza unos objetivos establecidos.
 - Las decisiones son racionales o no *independientemente de los procesos mentales que las generen*.
 - Los objetivos se expresan mediante una función de utilidad.
 - Ser racional significa *maximizar la utilidad esperada*
- En ocasiones calcular la mejor decisión costaría meses de cómputo.
Necesitamos **racionalidad limitada**.
- Título alternativo del curso: **Racionalidad computacional**

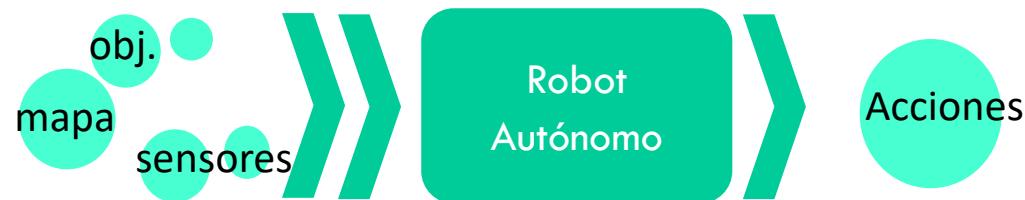
Autonomía

O-R3 (Otsaw Digital)



Griego: αύτο (auto: propio) + νόμος (nomos: ley)

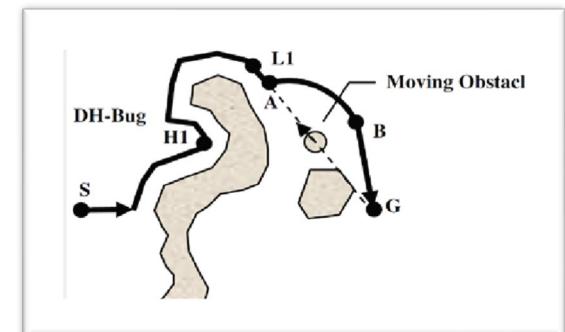
Agente autónomo: ente artificial capaz de actuar (tomando decisiones para conseguir sus objetivos) sin intervención humana



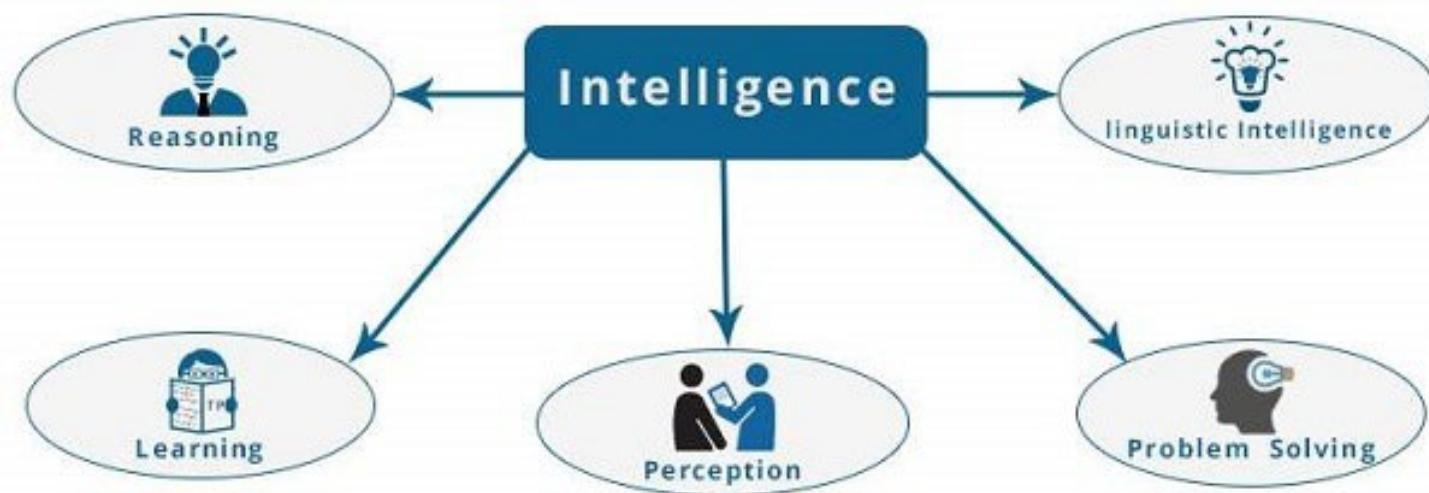
Ej.: Robot autónomo que se dirige hacia un destino

Inteligencia: rel. con la complejidad de la tarea y la capacidad de adaptación

Aprendizaje



Àrees de la IA



https://www.tutorialspoint.com/artificial_intelligence/artificial_intelligent_systems.htm

https://en.wikipedia.org/wiki/Artificial_intelligence

Problems

- Reasoning, problem solving
- Knowledge representation
- Planning
- Learning (ML)
- Natural Language Processing
- Perception (CV,...)
- Motion and Manipulation
- Social Intelligence (effect,..)
- General Intelligence

Approaches

- Symbolic
- Sub-symbolic
- Statistical learning
- Multi-Agent Systems

Tools

- Search and optimization
- Logic
- Probabilistic methods for uncertain reasoning
- Classifiers
 - Decision Trees, Support Vector Machine,..
- Artificial Neural Networks
 - Deep Learning
- Reinforcement Learning
- ...

Subject Areas from IJCAI'22

Agent-based and Multi-agent Systems	Multidisciplinary Topics and Applications	Other	Local search
Agent Communication	AI Hardware	Parallel, Distributed and Cloud-based High Performance Mining	Meta-Reasoning and Meta-Heuristics
Agent Societies	Arts and Creativity	Privacy-Preserving Data Mining	Mixed Discrete/Continuous Search
Agent Theories and Models	Bioinformatics	Recommender Systems	Other
Agent-Based Simulation and Emergence	Computational Sustainability	Theoretical Foundations of Data Mining	Search and Machine Learning
Agreement Technologies: Argumentation and Consensus-Based Systems	Computer Games	Humans and AI	Uncertainty in AI
Algorithmic Game Theory	Databases	Applications	Applications
Applications	Economics	Brain Sciences	Bayesian Networks
Computational Social Choice	Education	Cognitive Modeling	Causality, Structural Causal Models and Causal Inference
Cooperative Games	Finance	Cognitive Systems	Decision and Utility Theory
Coordination and Cooperation	Game Playing	Computational Sustainability and Human Well-Being	Graphical Model
Economic Paradigms, Auctions and Market-Based Systems	Health and Medicine	Computer-Aided Education	Inference
Engineering Methods, Platforms, Languages and Tools	Humanities	Human-Computer Collaboration	Nonprobabilistic Models
Formal Verification, Validation and Synthesis	Interactive Entertainment	Human-Computer Interaction	Other
Human-Agent Interaction	Life Science	Intelligent User Interfaces	Probabilistic Programming
Mechanized Design	News and Media	Other	Sequential Decision Making
Multi-agent Learning	Other	Personalization and User Modeling	Statistical Relational AI
Multi-agent Planning	Physical Science	Knowledge Representation and Reasoning	Tractable Probabilistic Models
Noncooperative Games	Real-Time Systems	Applications	Uncertainty Representations
Normative systems	Security and Privacy	Argumentation	
Other	Smart Cities	Automated Reasoning and Theorem Proving	
Resource Allocation	Social Sciences	Belief Change	
Trust and Reputation	Software Engineering	Case-based Reasoning	
AI Ethics, Trust, Fairness	Sports	Causality	
Accountability	Sustainable Development Goals	Common-Sense Reasoning	
AI and Law, Governance, Regulation	Transportation	Computational Complexity of Reasoning	
Bias	Ubiquitous Computing Systems	Descriptive Logics and Ontologies	
Ethical, Legal and Societal Issues	Validation and Verification	Diagnosing and Abstraction Reasoning	
Explanation and Interpretability	Web and Social Networks	Knowledge Compilation and Tractable Languages	
Fairness & Diversity	Natural Language Processing	Knowledge Representation Languages	
Moral Decision Making	Applications	Learning and reasoning	
Other	Coreference Resolution	Logic Programming	
Robot Rights	Dialogue and Interactive Systems	Non-monotonic Reasoning	
Safety & Robustness	Embeddings	Other	
Social Impact of AI	Information Extraction	Preference Modelling and Preference-Based Reasoning	
Trustworthy AI	Information Retrieval and Text Mining	Qualitative, Geometric, Spatial, Temporal Reasoning	
Values	Interpretability and Analysis of Models for NLP	Reasoning about actions	
Computer Vision	Knowledge Extraction	Reasoning about Knowledge and Belief	
3D Computer Vision	Language Generation	Semantic Web	
Action and Behaviour Recognition	Language Grounding	Machine Learning	
Adversarial learning, adversarial attack and defense methods	Language Models	Active Learning	
Applications	Machine Translation and Multilinguality	Adversarial Machine Learning	
Bias, Fairness & Privacy	Named Entities	Applications	
Biomedical Image Analysis	Natural Language Semantics	Attention Models	
Biometrics, Face, Gesture and Pose Recognition	Other	Autorecoders	
Computational photography	Phonology, Morphology, and Word Segmentation	Automated Machine Learning	
Image and Video Retrieval	Psycholinguistics	Bayesian Learning	
Interpretability and Transparency	Question Answering	Causality	
Machine Learning for Vision	Resources and Evaluation	Classification	
Motion and Tracking	Sentiment Analysis and Text Mining	Clustering	
Neural generative models, auto encoders, GANs	Speech	Convolutional Networks	
Other	Summarization	Cost-Sensitive Learning	
Recognition (object detection, categorization)	Tagging, Chunking, and Parsing	Deep Reinforcement Learning	
Representation Learning	Text Classification	Ensemble Methods	
Scene analysis and understanding	Tools	Evaluation	
Segmentation	Planning and Scheduling	Evolutionary Learning	
Structural and Model-Based Approaches, Knowledge Representation and Reasoning	Activity and Plan Recognition	Explanatory Methodology	
Transfer, low-shot, semi- and un-supervised learning	Applications	Explainable/Interpretable Machine Learning	
Video analysis and understanding	Distributed: Multi-agent Planning	Feature Extraction, Selection and Dimensionality Reduction	
Vision and language	Hierarchical Planning	Federated Learning	
Visual reasoning and symbolic representation	Learning in Planning and Scheduling	Few-shot learning	
Constraint Satisfaction and Optimization	Markov Decisions Processes	Generative Adversarial Networks	
Applications	Mixed Discrete/Continuous Planning	Geometric Learning	
Constraint Optimization	Model-Based Reasoning	Hyperparameter Optimization	
Constraint Programming	Planning Algorithms	Inductive Learning	
Constraint Satisfaction	Planning under Uncertainty	Kernel Methods	
Constraints and Machine Learning	Planning with Incomplete Information	Knowledge Aided Learning	
Distributed Constraints	POMDPs	Learning Graphical Models	
Mixed Discrete and Continuous Modeling	Real-time Planning	Learning Preferences or Rankings	
Other	Robot Planning	Learning Sparse Models	
Satisfiability	Routing	Learning Theory	
Solvers and Tools	Scheduling	Meta-Learning	
Data Mining	Search: Planning and Scheduling	Multi-instance	
Anomaly/Outlier Detection	Theoretical Foundations of Planning	Multi-label	
Applications	Robotics	Multi-modal learning	
Big Data and Scalability	Applications	Multi-task and Transfer Learning	
Class Imbalance and Unequal Cost	Behavior and Control	Multi-view learning	
Collaborative Filtering	Cognitive Robotics	Neuro-Symbolic Methods	
Data Visualisation	Human-Robot Interaction	Online Learning	
Exploratory Data Mining	Learning in Robotics	Optimisation	
Federated Learning	Localization, Mapping, State Estimation	Other	
Frequent Pattern Mining	Manipulation	Probabilistic Machine Learning	
Information Retrieval	Motion and Path Planning	Recommender Systems	
Inductive Database Systems	Multi-Robot Systems	Recurrent Networks	
Knowledge Graphs and Knowledge Base Completion	Other	Regression	
Mining Codebase and Software Repository	Perception	Reinforcement Learning	
Mining Data Streams	Robotics and Vision	Relational Learning	
Mining Graphs	Search	Representation learning	
Mining Heterogeneous Data	Algorithm portfolios and configuration	Robustness	
Mining Multi-structured Data	Combinatorial Search and Optimisation	Self-supervised Learning	
Mining Spatial and/or Temporal Data	Batched Search	Semi-supervised Learning	
Mining Text, Web, Social Media Networks	Evolutionary Computation	Sequence and Graph Learning	
Other	Game Playing	Structured Prediction	
	Heuristic Search	Symbolic methods	
	Local search	Theory of Deep Learning	
		Time-series: Data Streams	
		Unsupervised Learning	
		Weakly Supervised Learning	

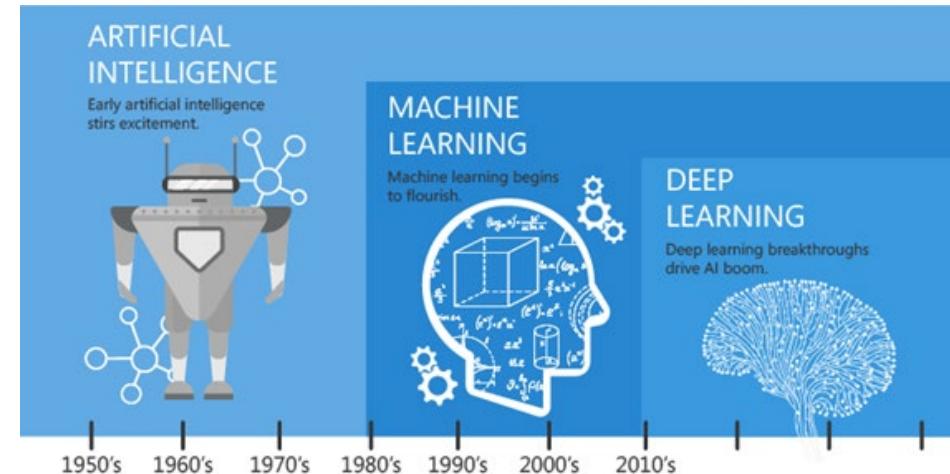
Master interuniversitario en

Inteligencia Artificial

Master interdisciplinar (como la IA):

Machine Learning,
Natural Language Processing,
Computer Vision,
Autonomous Agents,
Robotics,

Knowledge Representation & Reasoning



+ Human Computer Interaction, 3D Virtual Worlds, ...

Interuniversitario: UPC+UB+URV

Semester 1

Computational Intelligence
(CI - 5 ECTS)



Computational Vision
(CV - 5 ECTS)



Introduction to Human Language
Technology
(IHLT - 5 ECTS)



Introduction to MultiAgent Systems
(IMAS - 5 ECTS)



Introduction to Machine Learning
(IML - 5 ECTS)



Planning and Approximate Reasoning
(PAR - 5 ECTS)



Semester 2

Assistive and Health-Care
Technologies
(AHCT - 4'5 ECTS) 

Advanced Human Language
Technologies
(AHLT - 5 ECTS) 

Artificial Intelligence
Seminar
(AIS - 3 ECTS) 

Advanced Topics in
Computational Intelligence
(ATCI - 4 ECTS) 

Complex Networks
(CN - 5 ECTS) 

Cognitive Robotics
(COR - 4'5 ECTS) 

Deep Learning
(DL - 4'5 ECTS) 

Human-Computer
Interaction
(HCI - 4'5 ECTS) 

Machine Learning in
Computer Graphics
(MLCG - 3 ECTS) 

Knowledge Representation
and Engineering
(KRE - 6 ECTS) 

Logics for Artificial
Intelligence
(LAI - 6 ECTS) 

Multi-Agent Systems Design
(MASD - 4 ECTS) 

Minds, Brains and Machines
(MBM - 4 ECTS) 

Object Recognition
(OR - 4 ECTS) 

Probabilistic Graphical
Models
(PGM - 4'5 ECTS) 

Personalized Multi-Criteria
Decision Support Systems
(PMCDSS - 4'5 ECTS) 

Professional Practice in
Artificial Intelligence
(PPAI- 3 ECTS) 

Self Organizing Agent
Systems
(SOAS - 4'5 ECTS) 

Supervised and Experiential
Learning
(SEL - 4'5 ECTS) 

Unsupervised and
Reinforcement Learning
(URL - 4'5 ECTS) 

Semester 3

Artificial Intelligence in Health Care
(AIHC - 3 ECTS) 

Artificial Vision and Pattern Recognition
(AVPR - 4'5 ECTS) 

Big Data Analytics
(BDA - 4'5 ECTS) 

Cognitive Interaction with
Robots
(CIR - 4'5 ECTS) 

Constraint Processing and
Programming
(CPP - 4'5 ECTS) 

Human Language
Engineering
(HLE - 4'5 ECTS) 

Intelligent Data Analysis
Applications in Business
(IDAAB - 2 ECTS) 

Intelligent Data Analysis and Data
Mining
(IDADM - 4'5 ECTS) 

Intelligent Decision Support Systems
(IDSS - 4'5 ECTS) 

Intelligent System Project
(ISP - 3 ECTS) 

Deep Learning for Medical
Image Analysis
(DLMIA - 3 ECTS) 

Multi-Robot Systems
(MRS - 4'5 ECTS) 

Normative and Dynamic
Virtual Worlds
(NDVW - 4'5 ECTS) 

New Trends in Robotics
(NTR - 3 ECTS) 

Master Thesis
(MT - 18 ECTS)

Aplicaciones de la IA

- Sanidad



Aplicaciones

- Medicina
 - Diagnóstico (clasificación)



Aplicaciones

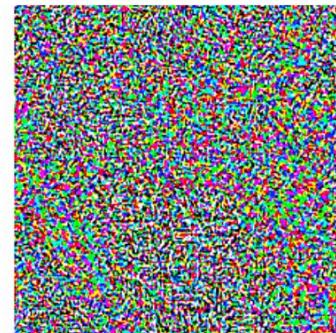
- Adversarial images: de oso panda a gibón



“panda”

57.7% confidence

+ .007 ×



noise



“gibbon”

99.3% confidence



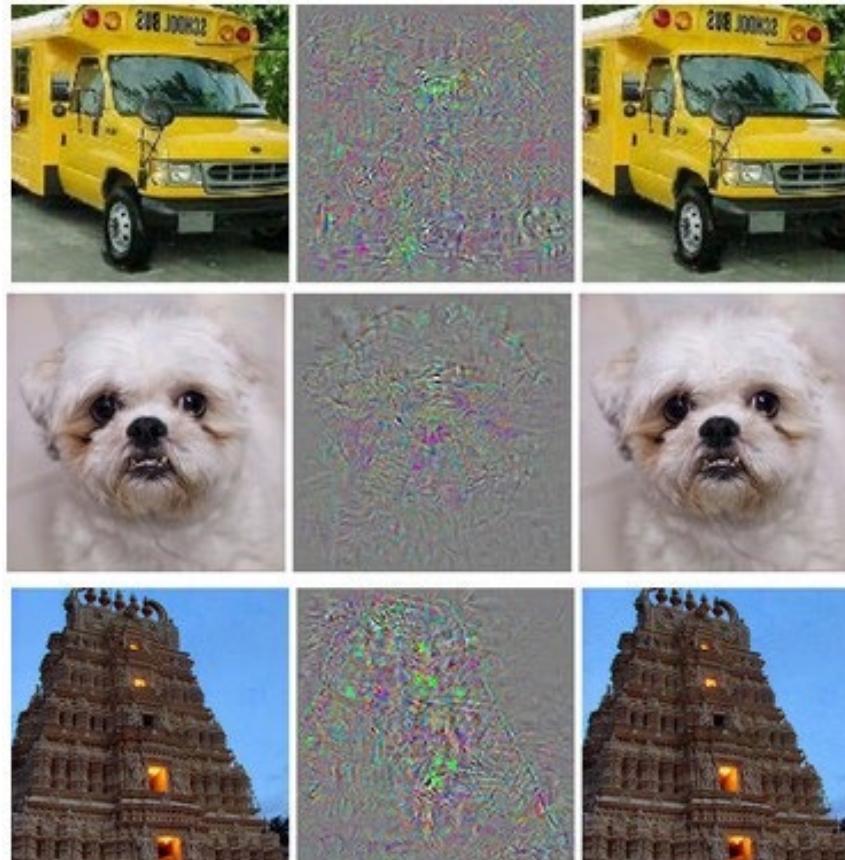
Explaining and Harnessing Adversarial Examples

Aplicaciones

- *Adversarial images: diseñadas para clasificar como una avestruz*

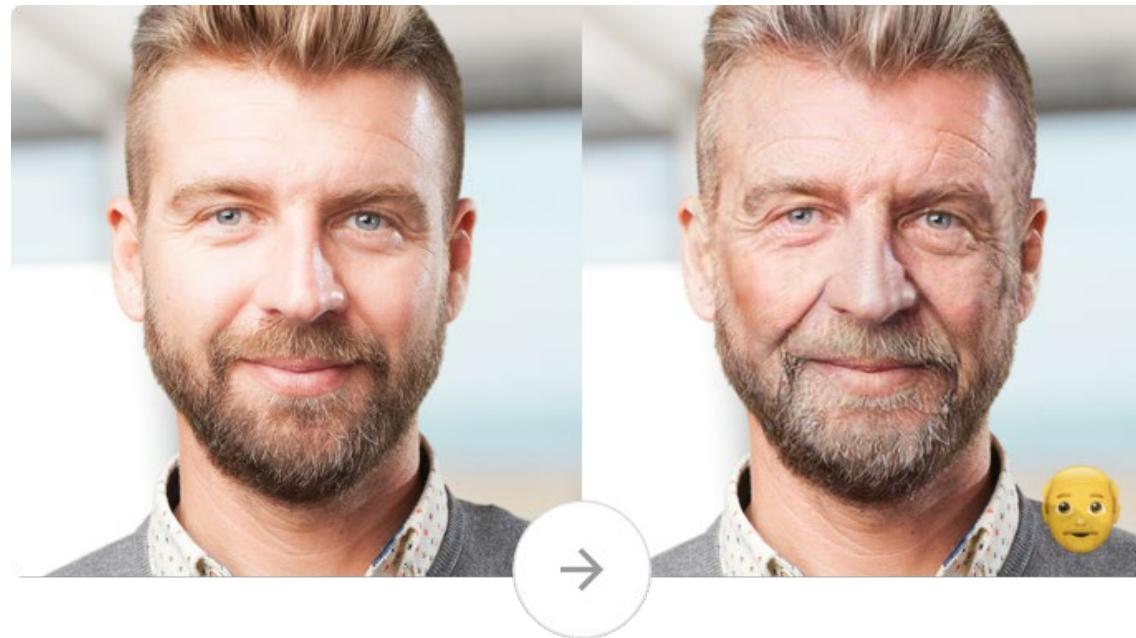


<https://arxiv.org/pdf/1312.6199.pdf>



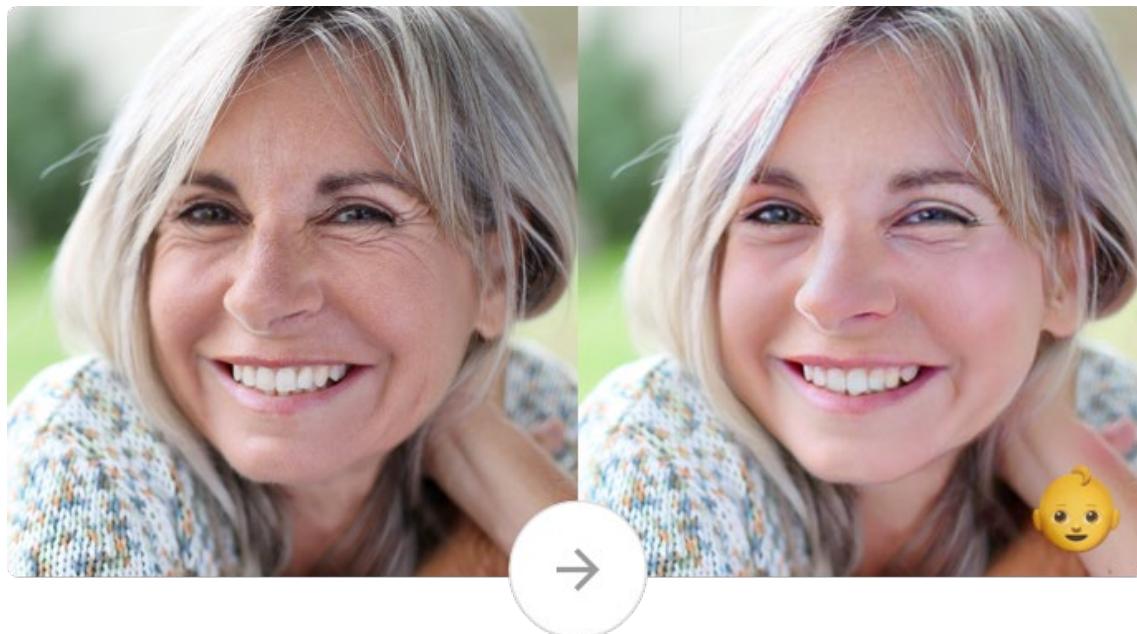
Aplicaciones

- Cambio apariencia (envejecimiento):
<https://www.faceapp.com/>



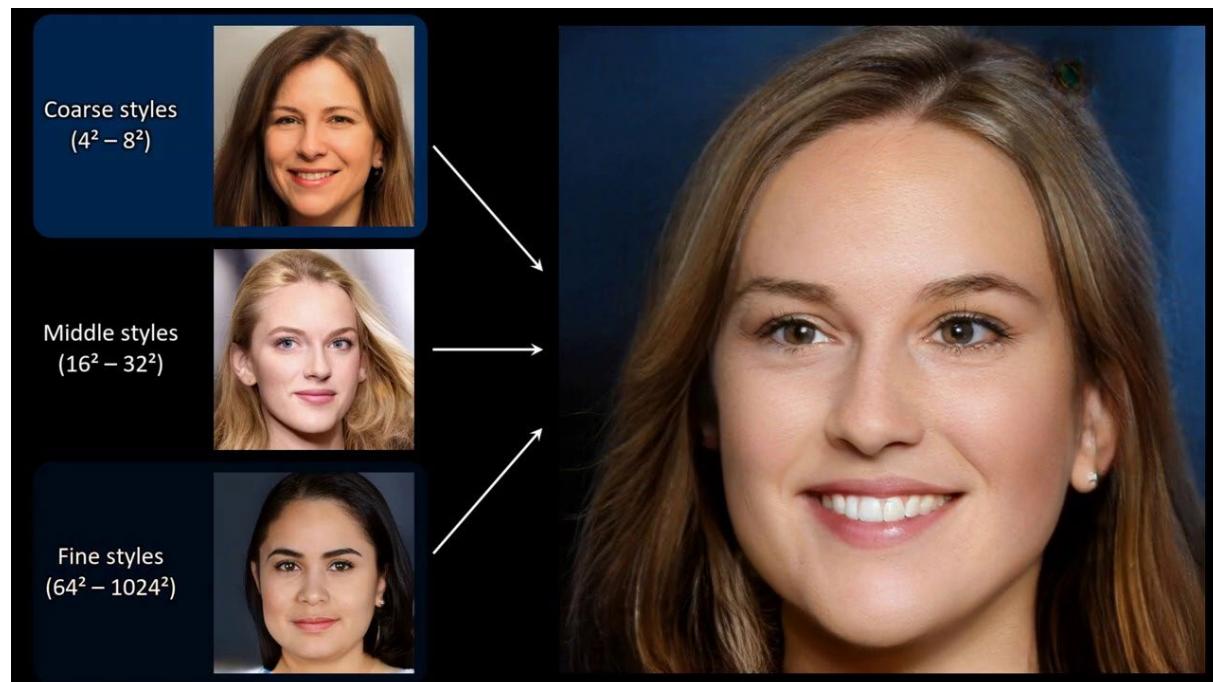
Aplicaciones

- Cambio apariencia (rejuvenecer): <https://www.faceapp.com/>



Aplicaciones

- Síntesis de caras no reales con Generative Adversarial Networks: 0:26-1:03
<https://www.youtube.com/watch?v=kSLJriaOumA>



- *Síntesis de caras no reales con Generative Adversarial Networks: 0:26-1:03*
<https://www.youtube.com/watch?v=kSLJriaOumA>
-

All images in this video
were produced by our generator,
they are not photographs of real people

Aplicaciones

- Medicina
 - Diseño de nuevos medicamentos



China, Switzerland

Aplicaciones

- Robots cuidadores geriátricos
 - Dar de comer
 - Compañía y soporte emocional



Kim Kyung Hoon / Reuters

Aplicaciones

- Coches autónomos

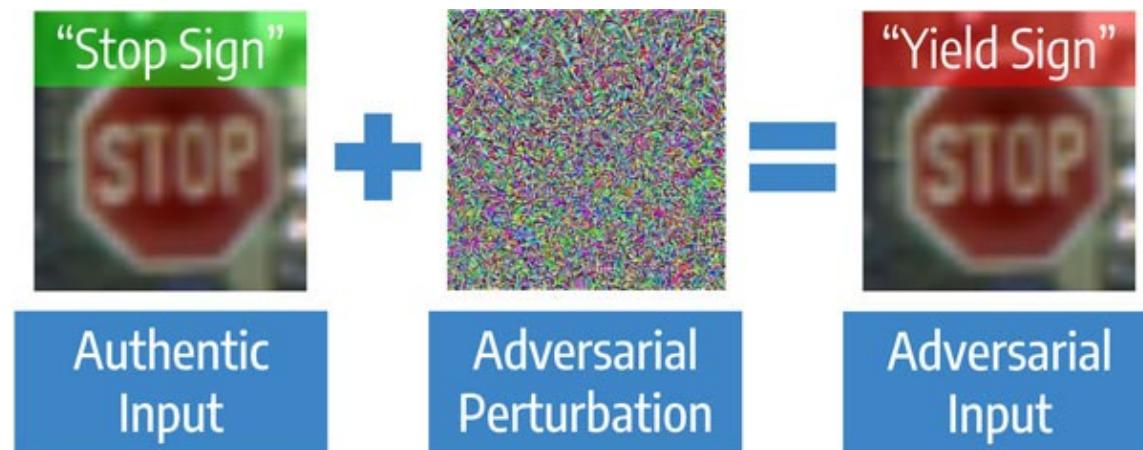


Coche Wymo (Google) sin conductor (Phoenix, Arizona)
<https://www.youtube.com/watch?v=2hqTnmn51Fg>



Aplicaciones

- *Adversarial images*



<https://ercim-news.ercim.eu/en116/special/detecting-adversarial-inputs-by-looking-in-the-black-box>

Aplicaciones

Traducción automática

Google translator:

Noticia:

Edtech unicorn Udacity lays off 125 people in global strategy shift

(13/9/2019): Català: Edtech unicorn Udacity representa 125 persones en el canvi d'estratègia global

(14/9/2020): L'unicorn Edtech Udacity acomiada 125 persones en un canvi d'estratègia global

(28/11/2022): Edtech unicorn Udacity acomiada 125 persones en el canvi d'estratègia global

El unicornio Edtech Udacity despide a 125 personas en un cambio de estrategia global.

Edtech es la abreviación de “tecnología para la educación”.
Startup companies qualify for unicorn status with valuations in excess of \$1B.

(24/10/2023): Edtech unicorn Udacity acomiada 125 persones en el canvi d'estratègia global

El unicornio de tecnología educativa Udacity despide a 125 personas en un cambio de estrategia global

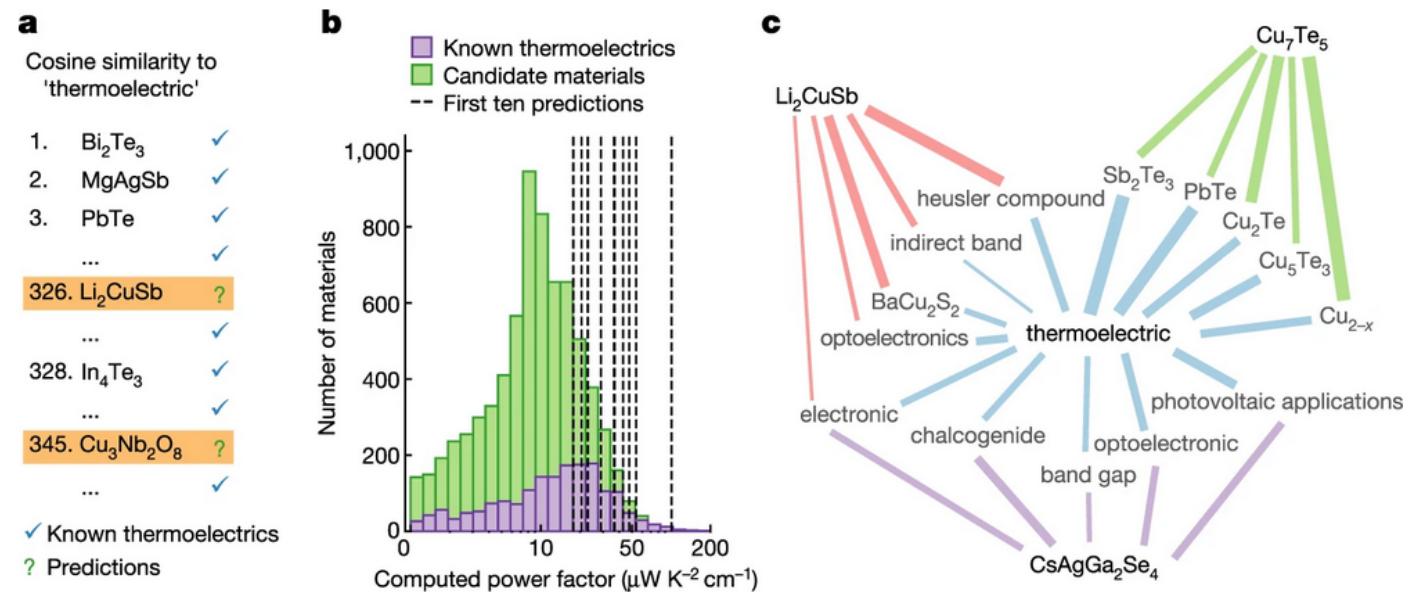
Aplicaciones

Procesamiento de Lenguaje Natural (NLP)

Word2vec: co-ocurrencias de palabras en
3.3 millones de documentos científicos

Fig. 2: Prediction of new thermoelectric materials.

From: [Unsupervised word embeddings capture latent knowledge from materials science literature](#)



Nature

Procesamiento de Lenguaje Natural (NLP)

Galactica: Artículos científicos

<https://galactica.org/mission/>

Nov 2022: demo closed

(<https://www.aiweirdness.com/>)



The screenshot shows the Galactica website homepage. At the top, there's a navigation bar with icons for back, forward, search, and a URL field showing <https://galactica.org/mission/>. The page has a dark background. A large white title "GALACTICA" is centered at the top. Below it are two purple buttons: "OUR MISSION" and "ORGANIZE SCIENCE". To the left is a large, stylized illustration of a mountain range composed of numerous small documents or papers, with a figure standing on top. To the right of the illustration, the text reads: "The original promise of computing was to solve information overload in science. But classical computers were specialized for retrieval and storage, not pattern recognition. As a result, we've had an explosion of information but not of intelligence: the means to process it. Researchers are buried under a mass of papers, increasingly unable to distinguish between the meaningful and the inconsequential. GALACTICA aims to solve this problem. Our first release is a powerful large language model (LLM) trained on over 48 million papers, textbooks, reference material, compounds, proteins and other sources of scientific knowledge. You can use it to explore the literature, ask scientific questions, write scientific code, and much more." At the bottom right is a graphic of an open book titled "BOOK OF NATURE" with text visible on its pages.

GALACTICA

OUR MISSION

ORGANIZE SCIENCE

The original promise of computing was to solve information overload in science.

But classical computers were specialized for retrieval and storage, not pattern recognition.

As a result, we've had an explosion of information but not of intelligence: the means to process it.

Researchers are buried under a mass of papers, increasingly unable to distinguish between the meaningful and the inconsequential.

GALACTICA aims to solve this problem.

Our first release is a powerful large language model (LLM) trained on over 48 million papers, textbooks, reference material, compounds, proteins and other sources of scientific knowledge.

You can use it to explore the literature, ask scientific questions, write scientific code, and much more.

We believe models should be open source and so we open source the model for those who want to extend it.

```
pip install galai
```

```
import galai as gal

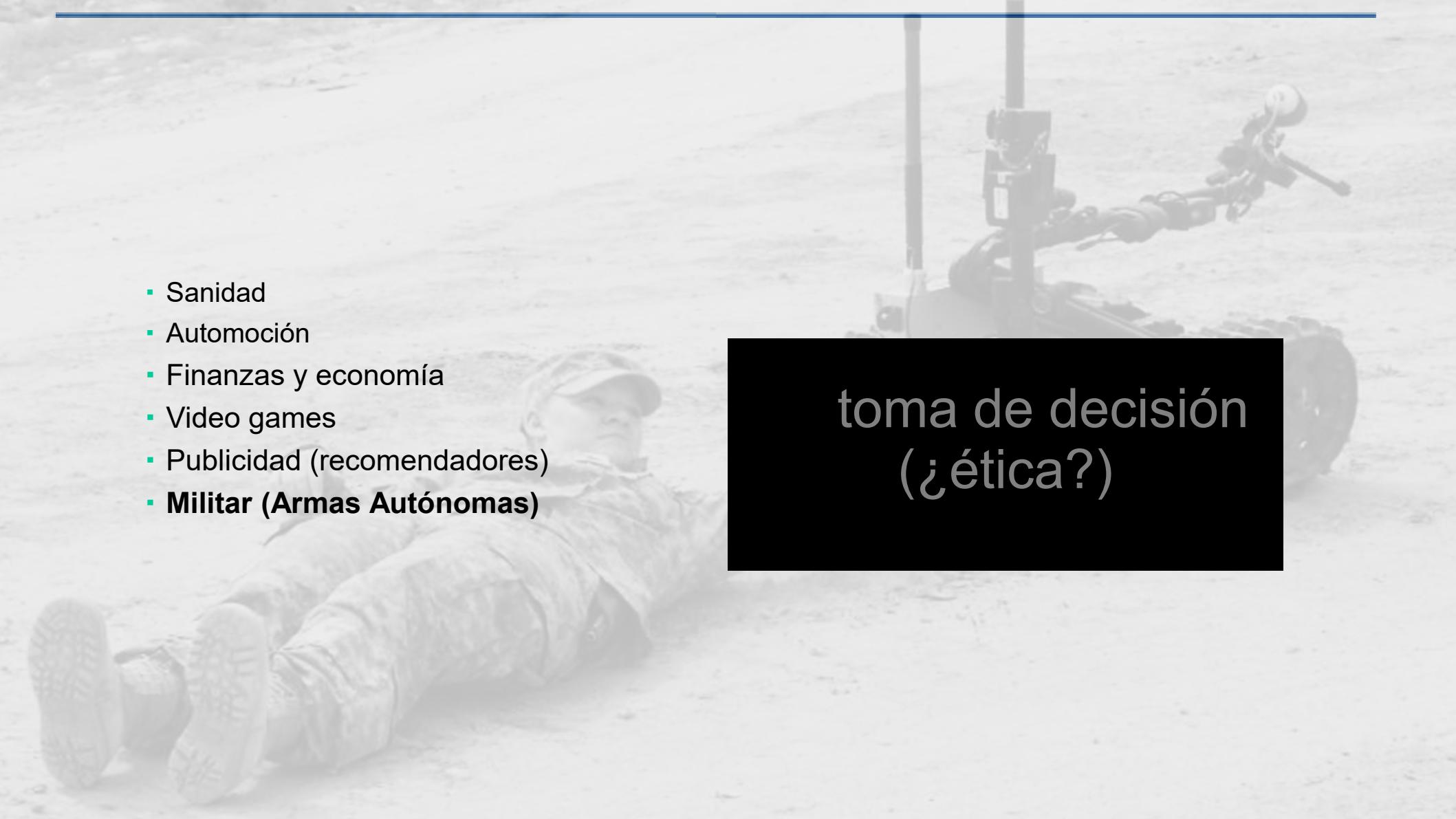
model = gal.load_model("huge")
model.generate("The Transformer architecture [START_REF]")
# The Transformer architecture [START_REF] Attention is All you Need,
# Vaswani(ET AL.) have been widely used in natural language processing.
```

Aplicaciones de la IA

- Sanidad
- Automoción
- Finanzas y economía
- Video games
- Publicidad (recomendadores)
- **Militar (Armas Autónomas)**

Aplicaciones de la IA

- Sanidad
- Automoción
- Finanzas y economía
- Video games
- Publicidad (recomendadores)
- **Militar (Armas Autónomas)**



toma de decisión
(¿ética?)

Aplicaciones de la IA

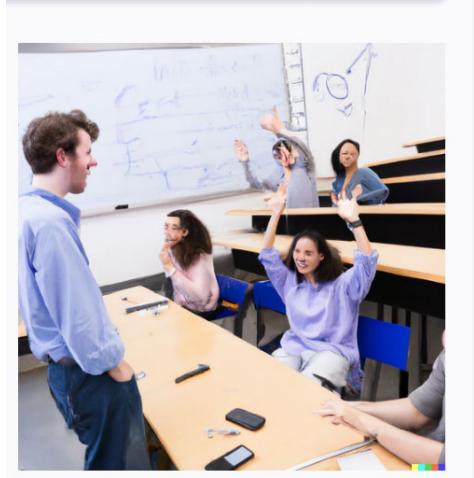
- Sanidad
- Automoción
- Finanzas y economía
- Video games
- Publicidad (recomendadores)
- Militar (Armas Autónomas)
- Asistencia (acompañantes)
- Arte...



Alba (o el jardí de les delícies): Teatre Nacional de Catalunya
<https://www.tnc.cat/ca/alba>

Aplicaciones de la IA

- Sanidad
- Automoción
- Finanzas y economía
- Video games
- Publicidad (recomendadores)
- Militar (Armas Autónomas)
- Asistencia (acompañantes)
- Arte: DALL-E (Open AI)

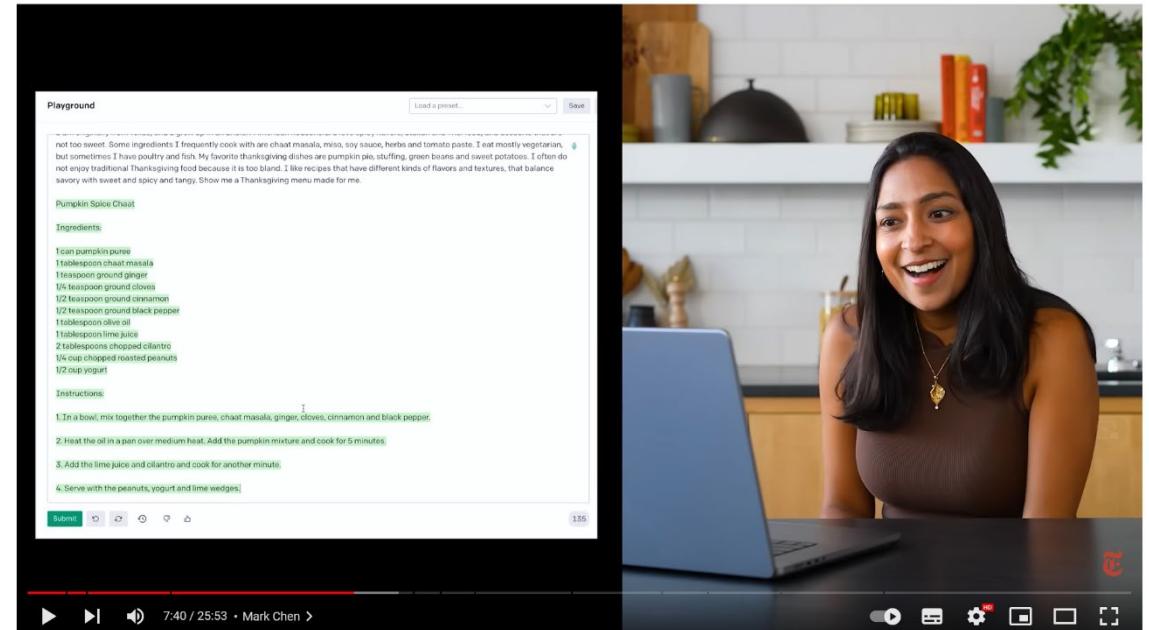


My AI students at class at University of
Barcelona looking very excited about what do I
explain (by Van Gogh, Monet) Nov 2022

<https://openai.com/dall-e-2/>

Aplicaciones de la IA

- Sanidad
- Automoción
- Finanzas y economía
- Video games
- Publicidad (recomendadores)
- Militar (Armas Autónomas)
- Asistencia (acompañantes)
- Arte...
- Recetas (Open AI: GPT-3 as recipe generator)



Can A.I. Generate the Perfect Thanksgiving? | Priya Krishna | NYT Cooking

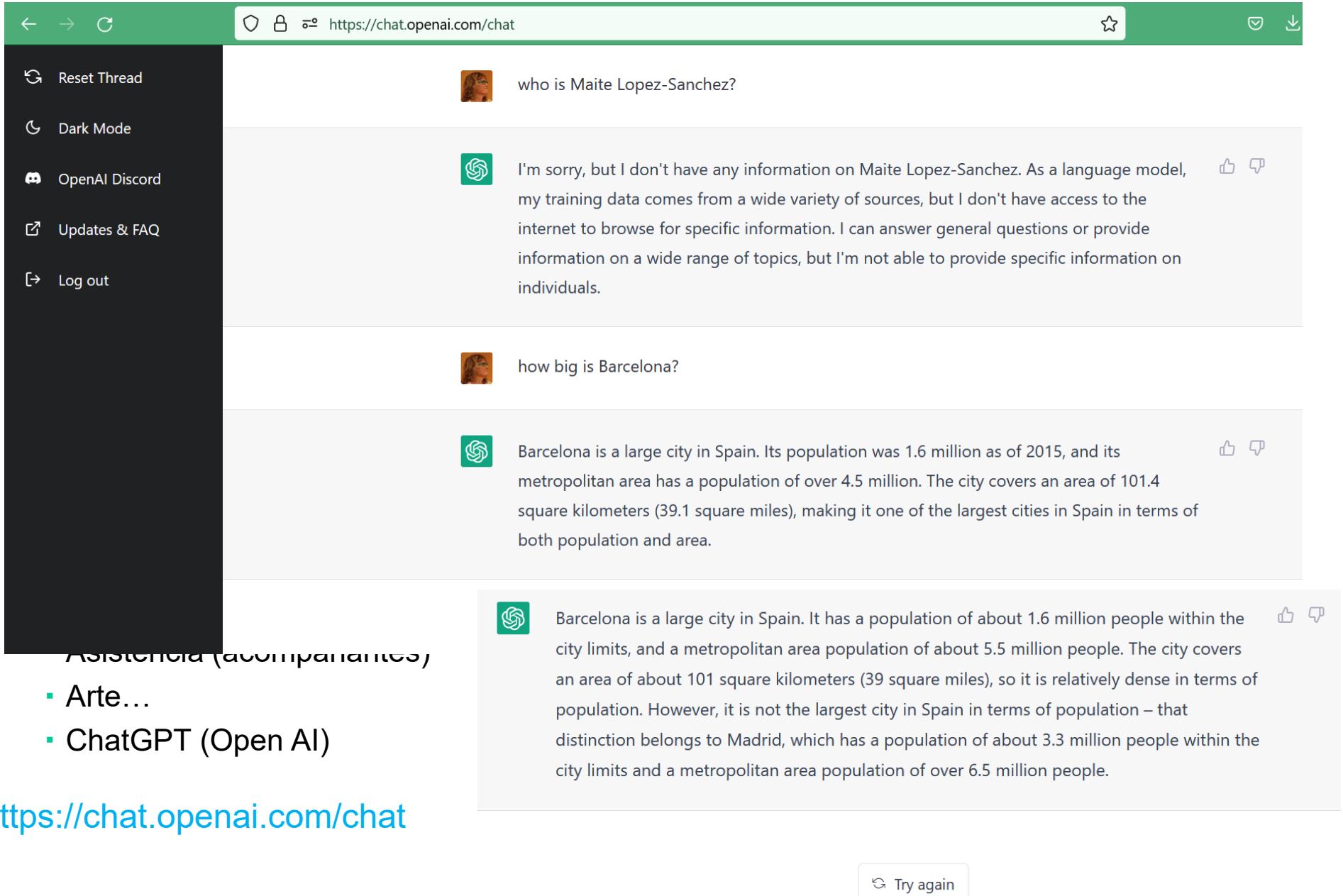


NYT Cooking  538.000 suscriptores

Suscríbeme

<https://www.youtube.com/watch?v=yT8KoWpqUgg&t=1s>

Aplicaciones de la IA



The screenshot shows a web browser window with the URL <https://chat.openai.com/chat>. On the left, there is a sidebar with various options: Reset Thread, Dark Mode, OpenAI Discord, Updates & FAQ, and Log out. The main area displays three messages from the user and the AI. The first message is "who is Maite Lopez-Sanchez?", followed by a response from the AI stating it doesn't have information on that person. The second message is "how big is Barcelona?", followed by a response from the AI providing population and area details. The third message is identical to the second, showing the AI's previous response again.

Reset Thread

Dark Mode

OpenAI Discord

Updates & FAQ

Log out

who is Maite Lopez-Sanchez?

I'm sorry, but I don't have any information on Maite Lopez-Sanchez. As a language model, my training data comes from a wide variety of sources, but I don't have access to the internet to browse for specific information. I can answer general questions or provide information on a wide range of topics, but I'm not able to provide specific information on individuals.

how big is Barcelona?

Barcelona is a large city in Spain. Its population was 1.6 million as of 2015, and its metropolitan area has a population of over 4.5 million. The city covers an area of 101.4 square kilometers (39.1 square miles), making it one of the largest cities in Spain in terms of both population and area.

Barcelona is a large city in Spain. It has a population of about 1.6 million people within the city limits, and a metropolitan area population of about 5.5 million people. The city covers an area of about 101 square kilometers (39 square miles), so it is relatively dense in terms of population. However, it is not the largest city in Spain in terms of population – that distinction belongs to Madrid, which has a population of about 3.3 million people within the city limits and a metropolitan area population of over 6.5 million people.

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

Try again

Aplicaciones de la IA



how big is Barcelona?

24/10/23:

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

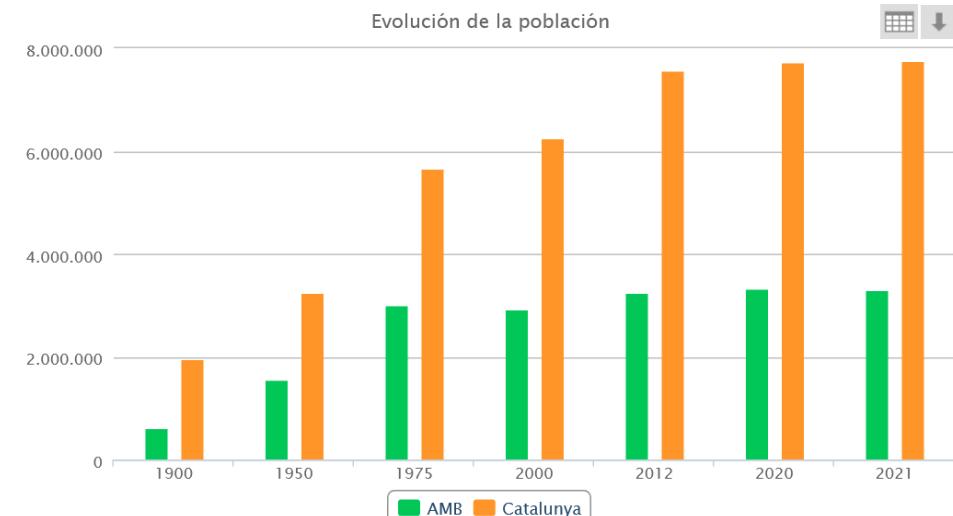
Barcelona is the capital city of the Catalonia region in Spain, and it has an area of approximately 101.4 square kilometers (39.1 square miles). Its population within the city limits is estimated to be around 1.6 million people. The broader metropolitan area of Barcelona, which includes the city and its surrounding municipalities, has a population of approximately 5.2 million people. Please note that these figures are approximate and can change over time due to population growth and urban development.



Home > El àrea metropolitana > Conocer el àrea metropolitana > Población

Población

A l'àrea metropolitana de Barcelona viuen **3.303.927 persones**.



Àmbit metropolità de Barcelona

	Àmbit metropolità de Barcelona	Catalunya
Dades territorials i demogràfiques		
Superficie	2.348	32.108
Densitat de població	2.102,9	242,7
Població (2022)	4.938.404	7.792.611

Try it out 

← → ⌂

https://chat.openai.com/chat

[Reset Thread](#)
[Dark Mode](#)
[OpenAI Discord](#)
[Updates & FAQ](#)
[Log out](#)

 who is Maite Lopez-Sanchez?

 I'm sorry, but I don't have any information about Maite Lopez-Sanchez. My training data comes from a wide variety of sources on the internet to browse for specific information. I can provide general information on a wide range of topics, but not about specific individuals.

 how big is Barcelona?

 Barcelona is a large city in Spain. Its population was 1.6 million as of 2015, and its metropolitan area has a population of over 4.5 million. The city covers an area of 101.4 square kilometers (39.1 square miles), making it one of the largest cities in Spain in terms of both population and area.

ASISTENCIA (accompanying)

- Arte...
- ChatGPT (Open AI)

<https://gptzero.me>

Barcelona is a large city in Spain. Its population was 1.6 million as of 2015, and its metropolitan area has a population of over 4.5 million. The city covers an area of 101.4 square kilometers (39.1 square miles), making it one of the largest cities in Spain in terms of both population and area.

Barcelona is a large city in Spain. Its population was 1.6 million as of 2015, and its metropolitan area has a population of over 4.5 million. The city covers an area of 101.4 square kilometers (39.1 square miles), making it one of the largest cities in Spain in terms of both population and area.

or, choose a file to upload

EXAMINAR...

No se ha s...n archivo.

Accepted file types: pdf, docx, txt

I agree to the [terms of service](#)

GET RESULTS

Your text is likely to be written entirely by AI

The nature of AI-generated content is changing constantly. While we build more robust models for GPTZero, we recommend that educators take these results as one of many pieces in a holistic assessment of student work.

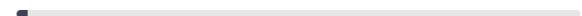
Barcelona is a large city in Spain.

Its population was 1.6 million as of 2015, and its metropolitan area has a population of over 4.5 million.

The city covers an area of 101.4 square kilometers (39.1 square miles), making it one of the largest cities in Spain in terms of both population and area.

Stats

Average Perplexity Score: 20.000



A document's perplexity is a measurement of the randomness of the text

Burstiness Score: 68.649



A document's burstiness is a measurement of the variation in perplexity

Your sentence with the highest perplexity, "Barcelona is a large city in Spain.", has a perplexity of: 32

← → C

https://chat.openai.com/chat

- Reset Thread
- Dark Mode
- OpenAI Discord
- Updates & FAQ
- Log out

ASISTENCIA (accompanying)

- Arte...
- ChatGPT (Open AI)

<https://gptzero.me>

Aplicaciones de...



who is Maite Lopez-Sanchez?



I'm sorry, but I don't have any information about Maite Lopez-Sanchez. My training data comes from a wide variety of sources on the internet to browse for specific information. I can provide general information on a wide range of topics, but not specific details about individuals.



how big is Barcelona?



Barcelona is a large city in Spain. Its population is approximately 1.6 million. The metropolitan area has a population of over 4.5 million. It covers an area of 101.4 square kilometers (39.1 square miles), making it one of the largest cities in Spain in terms of both population and area.

Try it out

Barcelona is a large city in Catalonia, an autonomous region in Spain. Its population was 1.6 million as of 2015, and its metropolitan area has a population of over 4.5 million. The city covers an area of 101.4 square kilometers (39.1 square miles), making it one of the largest cities in Spain in terms of both population and area.



or, choose a file to upload

EXAMINAR...

No se ha subido ningún archivo.

Accepted file types: pdf, docx, txt

I agree to the [terms of service](#)

GET RESULTS

Your text is likely to be written entirely by AI

The nature of AI-generated content is changing constantly. While we build more robust models for GPTZero, we recommend that educators take these results as one of many pieces in a holistic assessment of student work.

Barcelona is a large city in Catalonia, an autonomous region in Spain.

Its population was 1.6 million as of 2015, and its metropolitan area has a population of over 4.5 million.

The city covers an area of 101.4 square kilometers (39.1 square miles), making it one of the largest cities in Spain in terms of both population and area.

Stats

Average Perplexity Score: 14.667

A document's perplexity is a measurement of the randomness of the text

Burstiness Score: 70.791

A document's burstiness is a measurement of the variation in perplexity

Your sentence with the highest perplexity, "Its population was 1.6 million as of 2015, and its metropolitan area has a population of over 4.5 million.", has a perplexity of: 19

← → ⌂

🛡️ 🔒 https://chat.openai.com/chat

- ⟳ Reset Thread
- 🌙 Dark Mode
- 🤖 OpenAI Discord
- ✉️ Updates & FAQ
- ➡️ Log out

ASISTENCIA (accompanying)

- Arte...
- ChatGPT (Open AI)

<https://gptzero.me>

Aplicaciones d

Try it out 🤖

Barcelona is a large city in Catalonia, an autonomous region in Spain. Its population was 1.6 million as of 2015 (so it may be larger nowadays), and its metropolitan area has a population of over 4.5 million. The city covers an area of 101.4 square kilometers (39.1 square miles), making it one of the largest cities in Spain in terms of both population and area.



or, choose a file to upload

EXAMINAR... No se ha s...n archivo.

Accepted file types: pdf, docx, txt

I agree to the [terms of service](#)

GET RESULTS

Your text is likely to be written entirely by AI

The nature of AI-generated content is changing constantly. While we build more robust models for GPTZero, we recommend that educators take these results as one of many pieces in a holistic assessment of student work.

Barcelona is a large city in Catalonia, an autonomous region in Spain.

Its population was 1.6 million as of 2015 (so it may be larger nowadays), and its metropolitan area has a population of over 4.5 million.

The city covers an area of 101.4 square kilometers (39.1 square miles), making it one of the largest cities in Spain in terms of both population and area.

Stats

Average Perplexity Score: 17.333

A document's perplexity is a measurement of the randomness of the text

Burstiness Score: 69.728

A document's burstiness is a measurement of the variation in perplexity

Your sentence with the highest perplexity, "Its population was 1.6 million as of 2015 (so it may be larger nowadays), and its metropolitan area has a population of over 4.5 million.", has a perplexity of: 27

← → ⌂

https://chat.openai.com/chat

- Reset Thread
- Dark Mode
- OpenAI Discord
- Updates & FAQ
- Log out

ASISTENCIA (accompanyantes)

- Arte...
- ChatGPT (Open AI)

<https://gptzero.me>

Aplicaciones de...



who is Maite Lopez-Sanchez?



I'm sorry, but I don't have any information on Maite Lopez-Sanchez. My training data comes from a wide variety of sources on the internet to browse for specific information. I can provide general information on a wide range of topics, but I cannot identify specific individuals.



how big is Barcelona?



Barcelona is a large city in Spain. Its population was 1.6 million as of 2015. Its metropolitan area has a population of over 4.5 million. It covers an area of 101.4 square kilometers (39.1 square miles), making it one of the largest cities in Spain in terms of both population and area.

Try it out 

Barcelona is a large city in Catalonia, an autonomous region in Spain. Its population was 1.6 million as of 2015 (so it may be larger nowadays). Moreover, its metropolitan area has a population of over 4.5 million. The city covers an area of 101.4 square kilometers (39.1 square miles), making it one of the largest cities in Spain in terms of both population and area.

or, choose a file to upload

EXAMINAR...

No se ha s...n archivo.

Accepted file types: pdf, docx, txt

I agree to the [terms of service](#)

GET RESULTS

Your text is likely to be written entirely by AI

The nature of AI-generated content is changing constantly. While we build more robust models for GPTZero, we recommend that educators take these results as one of many pieces in a holistic assessment of student work.

Barcelona is a large city in Catalonia, an autonomous region in Spain.

Its population was 1.6 million as of 2015 (so it may be larger nowadays).

Moreover, its metropolitan area has a population of over 4.5 million.

The city covers an area of 101.4 square kilometers (39.1 square miles), making it one of the largest cities in Spain in terms of both population and area.

Stats

Average Perplexity Score: 24.000

A document's perplexity is a measurement of the randomness of the text

Burstiness Score: 60.244

A document's burstiness is a measurement of the variation in perplexity

Your sentence with the highest perplexity, "Its population was 1.6 million as of 2015 (so it may be larger nowadays).", has a perplexity of: 39

[ASISTENCIA \(accompanyantes\)](#)

- Arte...
- ChatGPT (Open AI)

<https://gptzero.me>

Try it out 

Barcelona is a large city in Catalonia, an autonomous region in Spain. Its population may be larger than 1.6 million, as this is the official record from 2015. Moreover, its metropolitan area has a population of over 4.5 million. The city covers an area of 101.4 square kilometers (39.1 square miles), making it one of the largest cities in Spain in terms of both population and area.



← → C  https://chat.openai.com/chat

- ↻ Reset Thread
- ☾ Dark Mode
- 🤖 OpenAI Discord
- ✉️ Updates & FAQ
- ➡ Log out

 who is Maite Lopez-Sanchez?

 I'm sorry, but I don't have any information on Maite Lopez-Sanchez. My training data comes from a wide variety of sources on the internet to browse for specific information. I can provide general information on a wide range of topics, but I don't have individual profiles for individuals.

 how big is Barcelona?

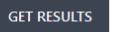
 Barcelona is a large city in Spain. Its population is approximately 1.6 million, and its metropolitan area has a population of over 4.5 million. The city covers an area of 101.4 square kilometers (39.1 square miles), making it one of the largest cities in Spain in terms of both population and area.

or, choose a file to upload

No se ha subido ningún archivo.

Accepted file types: pdf, docx, txt

I agree to the [terms of service](#) 



Your text is likely to be written entirely by AI

The nature of AI-generated content is changing constantly. While we build more robust models for GPTZero, we recommend that educators take these results as one of many pieces in a holistic assessment of student work.

Barcelona is a large city in Catalonia, an autonomous region in Spain. Its population may be larger than 1.6 million, as this is the official record from 2015. Moreover, its metropolitan area has a population of over 4.5 million. The city covers an area of 101.4 square kilometers (39.1 square miles), making it one of the largest cities in Spain in terms of both population and area.

Stats

Average Perplexity Score: 23.250

A document's perplexity is a measurement of the randomness of the text

Burstiness Score: 60.400

A document's burstiness is a measurement of the variation in perplexity

Your sentence with the highest perplexity, "Its population may be larger than 1.6 million, as this is the official record from 2015.", has a perplexity of: 36

Aplicaciones d...

← → ⌂

🛡️ 🔒 https://chat.openai.com/chat

- Reset Thread
- Dark Mode
- OpenAI Discord
- Updates & FAQ
- Log out

 who is Maite Lopez-Sanchez?

 I'm sorry, but I don't have any information on Maite Lopez-Sánchez. My training data comes from a wide variety of sources on the internet to browse for specific information. I can provide information on a wide range of topics, but I'm not able to identify individuals.

 how big is Barcelona?

 Barcelona is a large city in Spain. Its population in the metropolitan area has a population of over 4 square kilometers (39.1 square miles), making it one of the largest cities in both population and area.

ASISTENCIA (acumulativas)

- Arte...
- ChatGPT (Open AI)

<https://gptzero.me>

Reescrito:

Barcelona is a nice tourist city in Catalonia (Spain). With a population of more than one and a half million, it receives many tourists throughout the year. It is surrounded by other cities in the metropolitan area, which concentrates most population in Catalonia. The average city size in Spain is lower than that of Barcelona, so although it is not the capital, it is definitely one of the most important cities in the country.

← → ⌂

https://gptzero.me

Try it out 🤖

Barcelona is a nice tourist city in Catalonia (Spain). With a population of more than one and a half million, it receives many tourists throughout the year. It is surrounded by other cities in the metropolitan area, which concentrates most population in Catalonia. The average city size in Spain is lower than that of Barcelona, so although it is not the capital, it is definitely one of the most important cities in the country.

or, choose a file to upload

EXAMINAR... No se ha s...n archivo.

Accepted file types: pdf, docx, txt

I agree to the [terms of service](#) GET RESULTS

Your text is likely to be written entirely by AI

The nature of AI-generated content is changing constantly. While we build more robust models for GPTZero, we recommend that educators take these results as one of many pieces in a holistic assessment of student work.

Barcelona is a nice tourist city in Catalonia (Spain). With a population of more than one and a half million, it receives many tourists throughout the year. It is surrounded by other cities in the metropolitan area, which concentrates most population in Catalonia. The average city size in Spain is lower than that of Barcelona, so although it is not the capital, it is definitely one of the most important cities in the country.

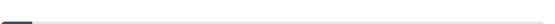
Stats

Average Perplexity Score: 46.750



A document's perplexity is a measurement of the randomness of the text

Burstiness Score: 56.350



A document's burstiness is a measurement of the variation in perplexity

Your sentence with the highest perplexity, "Barcelona is a nice tourist city in Catalonia (Spain).", has a perplexity of: 79

[← → C](#)

[Reset Thread](#)

[Dark Mode](#)

[OpenAI Discord](#)

[Updates & FAQ](#)

[Log out](#)

ASISTENCIA (accompanying)

- Arte...
- ChatGPT (Open AI)

<https://gptzero.me>

Aplicaciones de

[← → C](#)

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

who is Maite Lopez-Sanchez?

I'm sorry, but I don't have any information on Maite Lopez-Sanchez. My training data comes from a wide variety of sources on the internet to browse for specific information. I can provide information on a wide range of topics, but I'm not able to identify individuals.

how big is Barcelona?

Barcelona is a large city in Spain. Its population and metropolitan area has a population of over 4.5 million people. It covers an area of approximately 102 square kilometers (39.1 square miles), making it one of the largest cities in both population and area.

Mi propio texto:
 I used to live in Barcelona. At some point I got tired of so many tourists visiting the city, taking public transportation, and causing prices to be artificially high (especially at restaurants and housing), but you know, some people make a living from that.....

Try it out 

I used to live in Barcelona. At some point I got tired of so many tourists visiting the city, taking public transportation, and causing prices to be artificially high (especially at restaurants and housing), but you know, some people make a living from that.....



or, choose a file to upload

EXAMINAR...

No se ha s...n archivo.

Accepted file types: pdf, docx, txt

I agree to the [terms of service](#)

GET RESULTS

Your text is most likely human written but there are some sentences with low perplexities

The nature of AI-generated content is changing constantly. While we build more robust models for GPTZero, we recommend that educators take these results as one of many pieces in a holistic assessment of student work.

I used to live in Barcelona.

At some point I got tired of so many tourists visiting the city, taking public transportation, and causing prices to be artificially high (especially at restaurants and housing), but you know, some people make a living from that.....

 Sentences highlighted are more likely to be written by AI

Stats

Average Perplexity Score: 36.500

A document's perplexity is a measurement of the randomness of the text

Burstiness Score: 69.299

A document's burstiness is a measurement of the variation in perplexity

Your sentence with the highest perplexity, "At some point I got tired of so many tourists visiting the city, taking public transportation, and causing prices to be artificially high (especially at restaurants and housing), but you know, some people make a living from that....", has a perplexity of: 43

Aplicaciones d...

[←](#) [→](#) [G](#)   https://chat.openai.com/chat

-  Reset Thread
-  Dark Mode
-  OpenAI Discord
-  Updates & FAQ
-  Log out

 who is Maite Lopez-Sanchez?

 I'm sorry, but I don't have any information on Maite Lopez-Sanchez. My training data comes from a wide variety of sources on the internet to browse for specific information. I can provide information on a wide range of topics, but I'm not able to identify individuals.

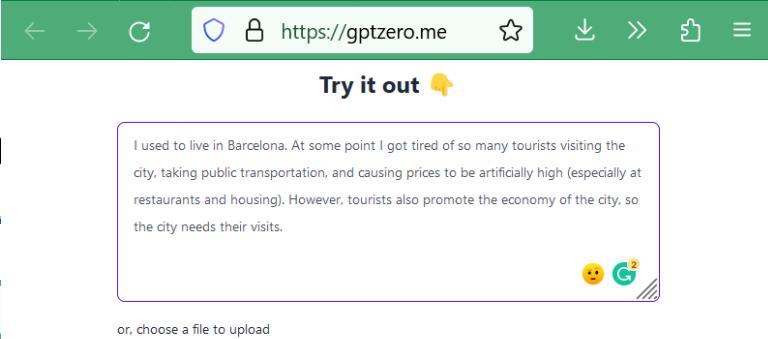
 how big is Barcelona?

 Barcelona is a large city in Spain. Its population is approximately 1.6 million people. The metropolitan area has a population of over 4.5 million people. The city covers an area of about 102 square kilometers (39.1 square miles), making it both population and area.

ASISTENCIA (accompiantos)

- Arte...
 - ChatGPT (Open AI)

Mi propio texto (menos personal):
I used to live in Barcelona. At some point I got tired of so many tourists visiting the city, taking public transportation, and causing prices to be artificially high (especially at restaurants and housing). **However, tourists also promote the economy of the city, so the city needs their visits.**



I used to live in Barcelona. At some point I got tired of so many tourists visiting the city, taking public transportation, and causing prices to be artificially high (especially at restaurants and housing). However, tourists also promote the economy of the city, so the city needs their visits.

or, choose a file to upload

EXAMINAR...

Accepted file types: pdf, docx, txt

I agree to the [terms of service](#)

GET RESULTS

Your text is likely to be written entirely by a human

The nature of AI-generated content is changing constantly. While we build more robust models for GPTZero, we recommend that educators take these results as one of many pieces in a holistic assessment of student work.

I used to live in Barcelona.

At some point I got tired of so many tourists visiting the city, taking public transportation, and causing prices to be artificially high (especially at restaurants and housing).

However, tourists also promote the economy of the city, so the city needs their visits.

Sentences highlighted are more likely to be written by AI

Stats

Average Perplexity Score: 52.333

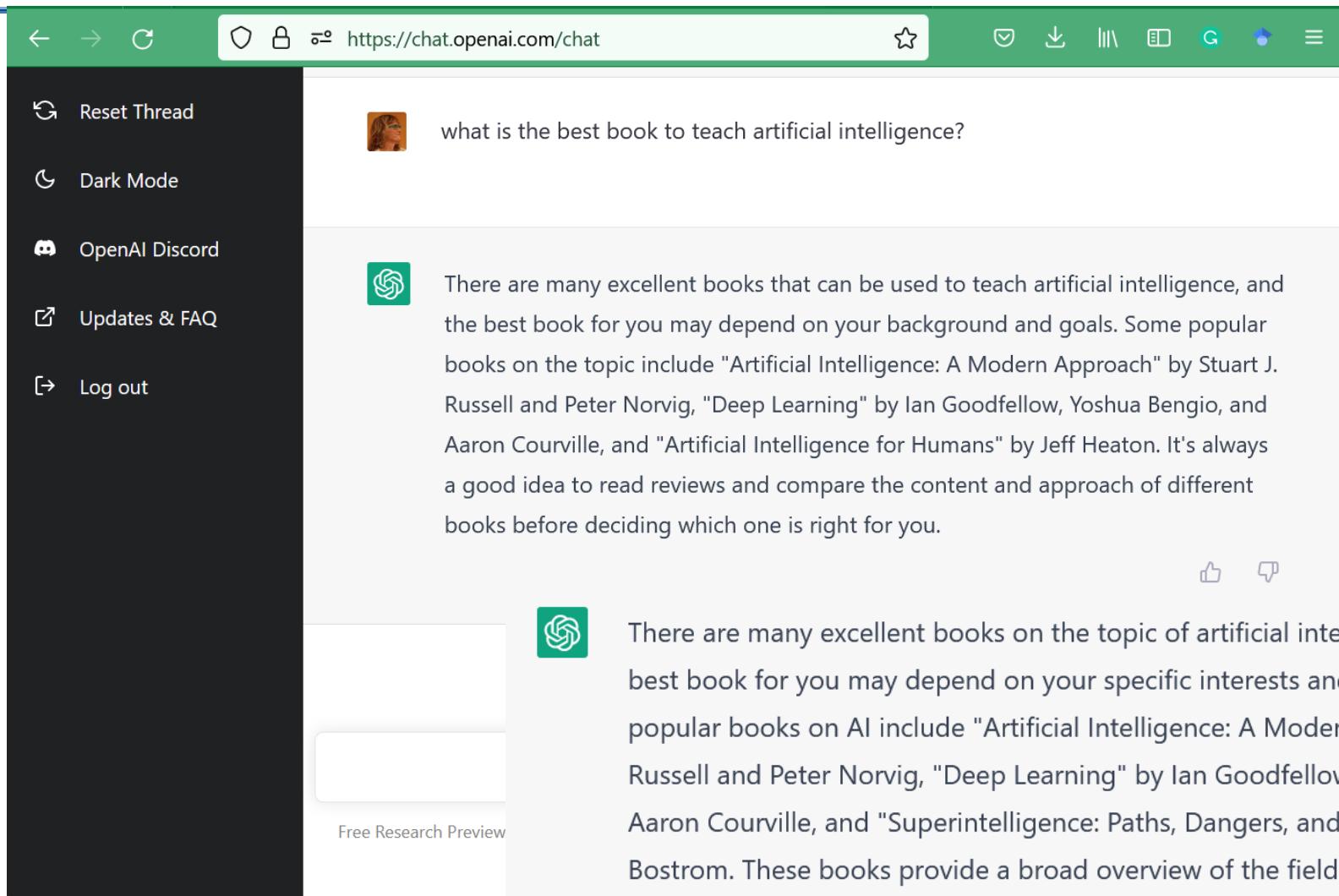
A document's perplexity is a measurement of the randomness of the text.

Burstiness Score: 56.252

A document's burstiness is a measurement of the variation in perplexity.

Your sentence with the highest perplexity, "However, tourists also promote the economy of the city, so the city needs their visits.", has a perplexity of: 82

Aplicaciones de la IA



The screenshot shows a web browser window with the URL <https://chat.openai.com/chat>. The page displays a conversation between a user and a GPT model. The user asks, "what is the best book to teach artificial intelligence?". The AI responds with a detailed answer, mentioning books like "Artificial Intelligence: A Modern Approach" by Stuart J. Russell and Peter Norvig, "Deep Learning" by Ian Goodfellow, Yoshua Bengio, and Aaron Courville, and "Artificial Intelligence for Humans" by Jeff Heaton. The AI also advises reading reviews and comparing different books. Below this response, there is another identical block of text, likely a duplicate or a summary of the previous response.

what is the best book to teach artificial intelligence?

There are many excellent books that can be used to teach artificial intelligence, and the best book for you may depend on your background and goals. Some popular books on the topic include "Artificial Intelligence: A Modern Approach" by Stuart J. Russell and Peter Norvig, "Deep Learning" by Ian Goodfellow, Yoshua Bengio, and Aaron Courville, and "Artificial Intelligence for Humans" by Jeff Heaton. It's always a good idea to read reviews and compare the content and approach of different books before deciding which one is right for you.

There are many excellent books on the topic of artificial intelligence (AI), and the best book for you may depend on your specific interests and background. Some popular books on AI include "Artificial Intelligence: A Modern Approach" by Stuart Russell and Peter Norvig, "Deep Learning" by Ian Goodfellow, Yoshua Bengio, and Aaron Courville, and "Superintelligence: Paths, Dangers, and Strategies" by Nick Bostrom. These books provide a broad overview of the field of AI and cover a range of topics, including machine learning, natural language processing, and the ethics of AI. Additionally, there are many more specialized books that focus on specific aspects of AI, such as computer vision or robotics. It's worth considering your level of experience and what you hope to learn from the book before deciding which one is best for you.

- ChatGPT (Open AI)

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

Fundamentos o Prehistoria de la IA

Filosofía

Lógica, métodos de razonamiento. Mente como sistema físico.
Fundamentos de aprendizaje, lenguaje, racionalidad.

Matemáticas

Representación formal y pruebas. Probabilidad
Algoritmos, computación, (in)decisión, (in)flexibilidad.

Psicología

Adaptación. Fenómenos de percepción y control motor.
Técnicas experimentales (psicofísica, etc.).

Economía

Teoría formal de las decisiones racionales.

Lingüística

Representación del conocimiento. Gramática.

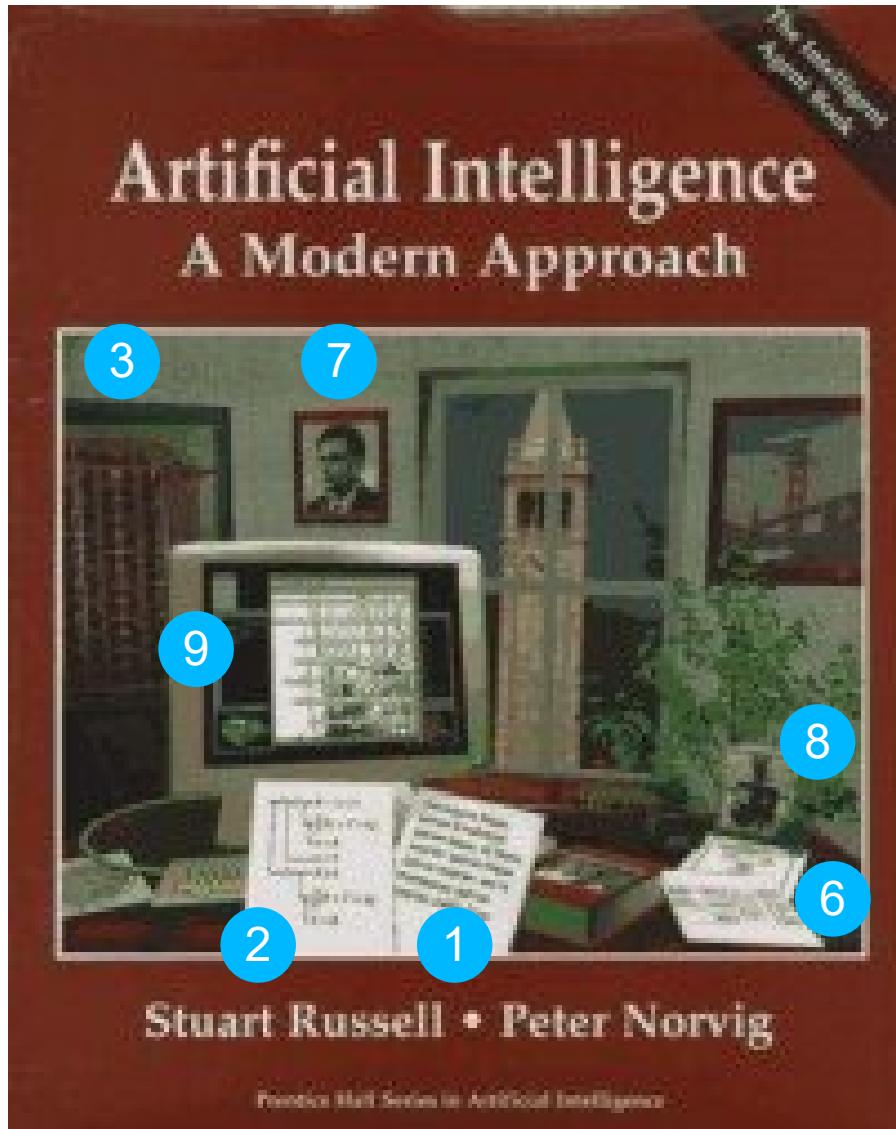
Neurociencia

Sustrato físico plástico para la actividad mental.

Teoría de control

Sistemas homeostáticos, estabilidad.
Diseños de agente óptimo simples.

Homenaje del libro de texto



<http://aima.cs.berkeley.edu/cover.html>
<http://aima.cs.berkeley.edu/2nd-ed/cover.htm>

1. Aristotle's planning algorithm from *De Motu Animalium* (c. 400 B.C.).
2. Ramon Lull's concept generator from *Ars Magna* (c. 1300 A.D.).
3. Charles Babbage's Difference Engine, a prototype for the first universal computer (1848).
4. Gottlob Frege's notation for first-order logic (1789).
5. Lewis Carroll's diagrams for logical reasoning (1886).
6. Sewall Wright's probabilistic network notation (1921).
7. Alan Turing (1912-1954).
8. Shakey the Robot (1969-1973).
9. A diagnostic expert system (1993).

Historia de la IA: Inicios

https://en.wikipedia.org/wiki/History_of_artificial_intelligence

- **1956:** inicio IA: conferencia de Dartmouth

Ver intervalo 1:30-7:17: <http://a16z.com/2016/06/10/ai-deep-learning-machines/>



Claude Shannon John McCarthy Marvin Minsky Nathaniel Rochester Ray Solomonoff
(Information Theory) (Lisp) (AI lab @MIT) (IBM) (Machine Learning)

https://en.wikipedia.org/wiki/Dartmouth_Conferences

Historia de la IA

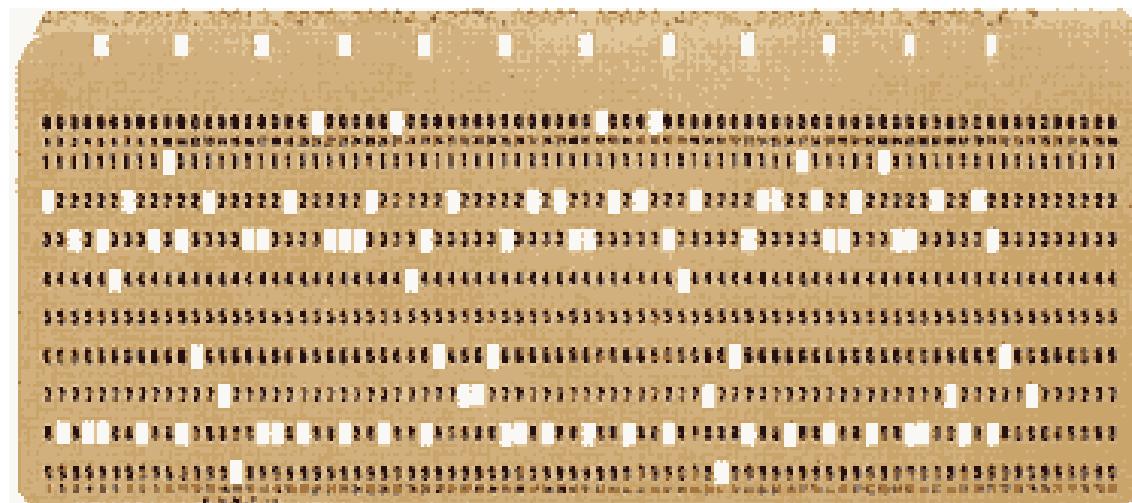
- Inviernos de la IA: grandes expectativas que tardan demasiado en cumplirse

(Ver intervalo 7:17- 21: <http://a16z.com/2016/06/10/ai-deep-learning-machines/>)



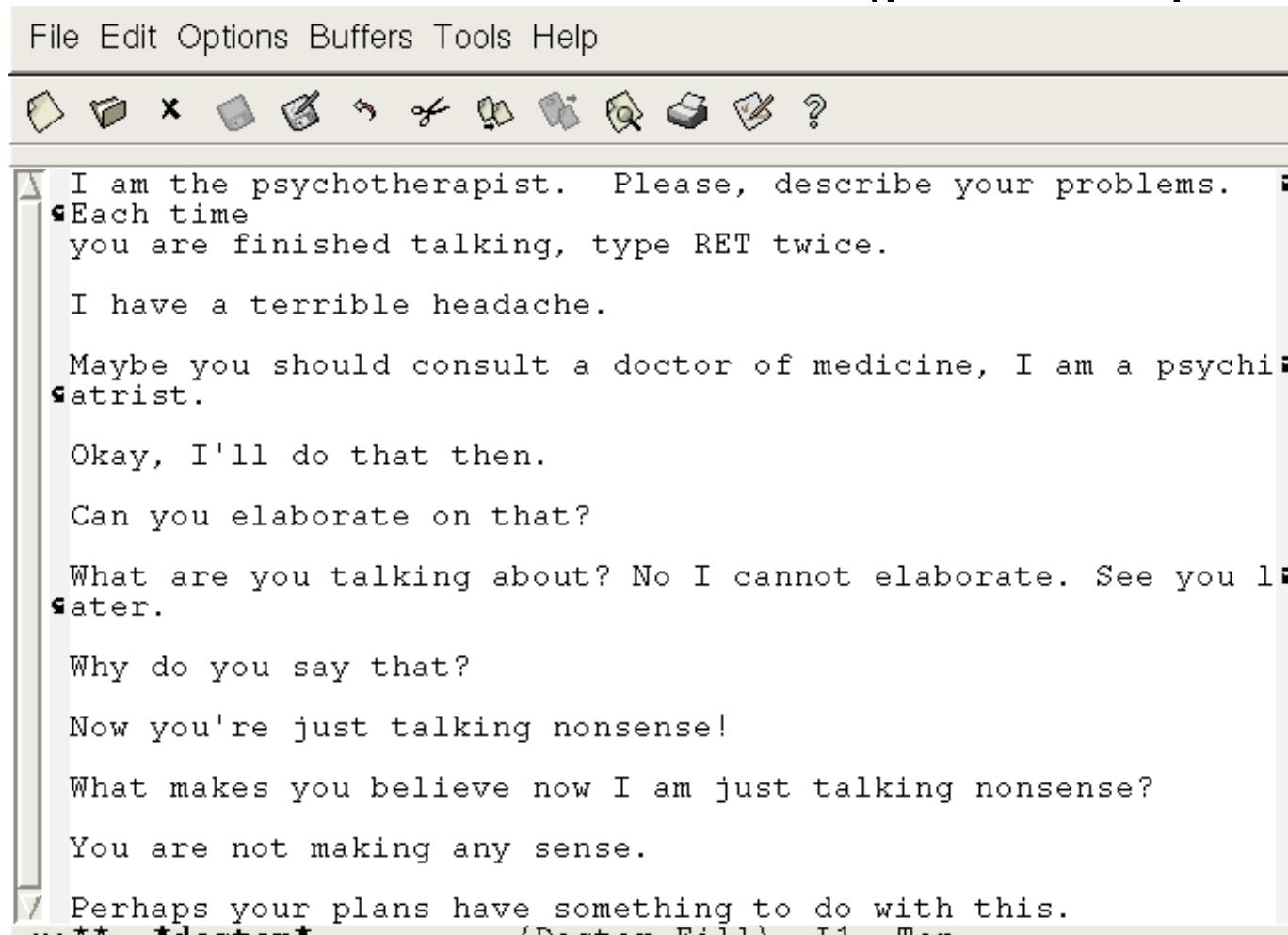
Historia de la IA

- Inviernos de la IA: grandes expectativas que tardan demasiado en cumplirse
 - Años 60: Significado en las traducciones
 - Ej.: “the spirit is willing, but the flesh is weak” -> “the whisky is strong, but the meat is rotten”



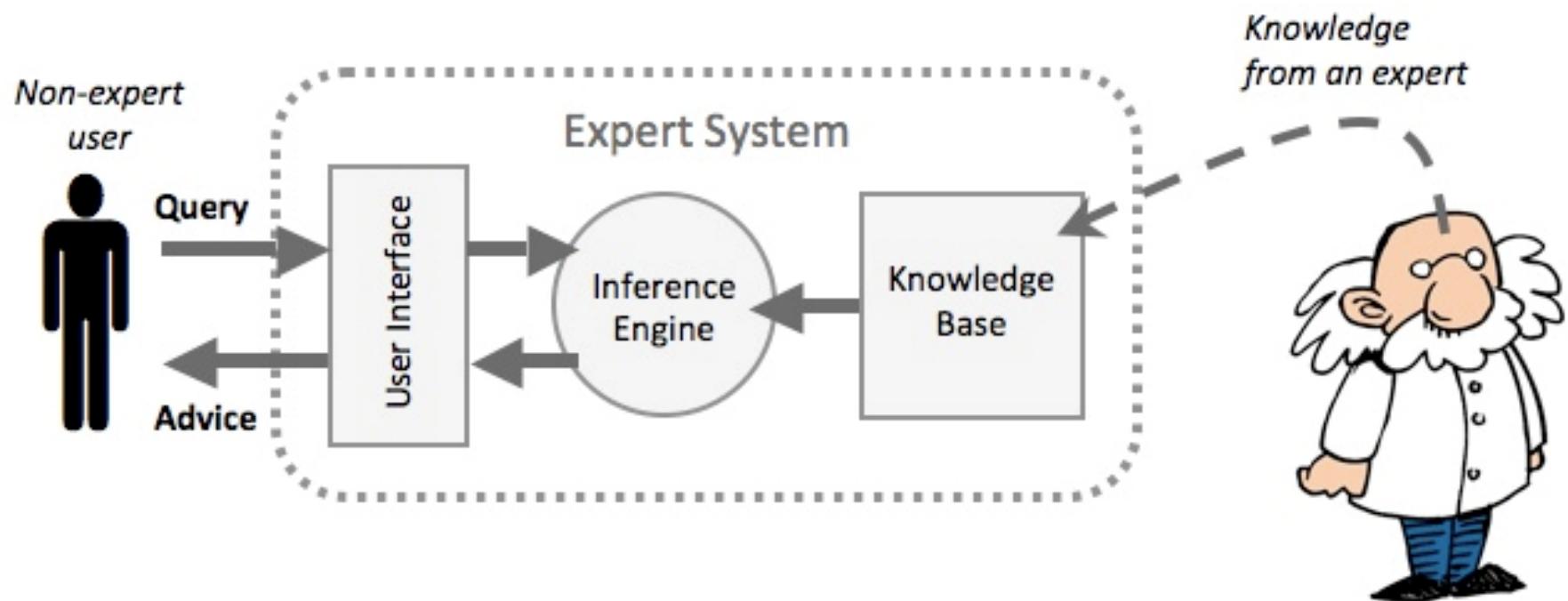
Historia de la IA

- Inviernos de la IA: grandes expectativas que tardan demasiado en cumplirse
 - Años 70: Micro-mundos: Eliza (psicoterapeuta)



Historia de la IA

- Inviernos de la IA: grandes expectativas que tardan demasiado en cumplirse
 - Años 80: Sistemas expertos: diagnóstico



Historia de la IA

- Años 90, 2000,:
 - Agentes Inteligentes,
 - Robótica de consumo



Historia de la IA

- 1997: Deep Blue (IBM) gana al campeón del mundo (Garry Kasparov) en ajedrez



Historia de la IA

- 2005: Stanford Gana el DARPA Grand Challenge con un coche autónomo que recorre 131 millas en el desierto

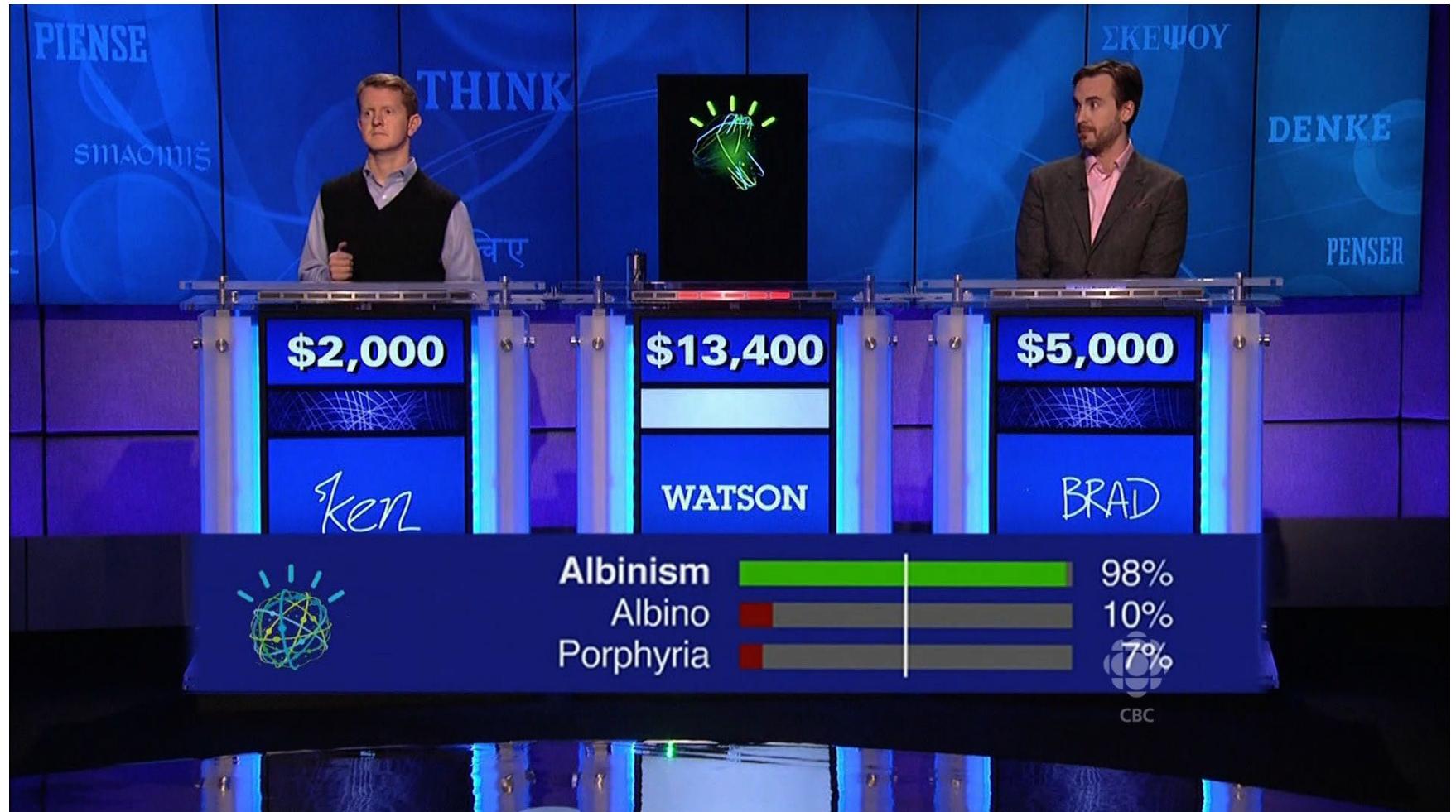
AI for robotics course <https://www.udacity.com/course/cs373>



WATCH VIDEO

Historia de la IA

- 2011: Watson (IBM) gana en el concurso Jeopardy!



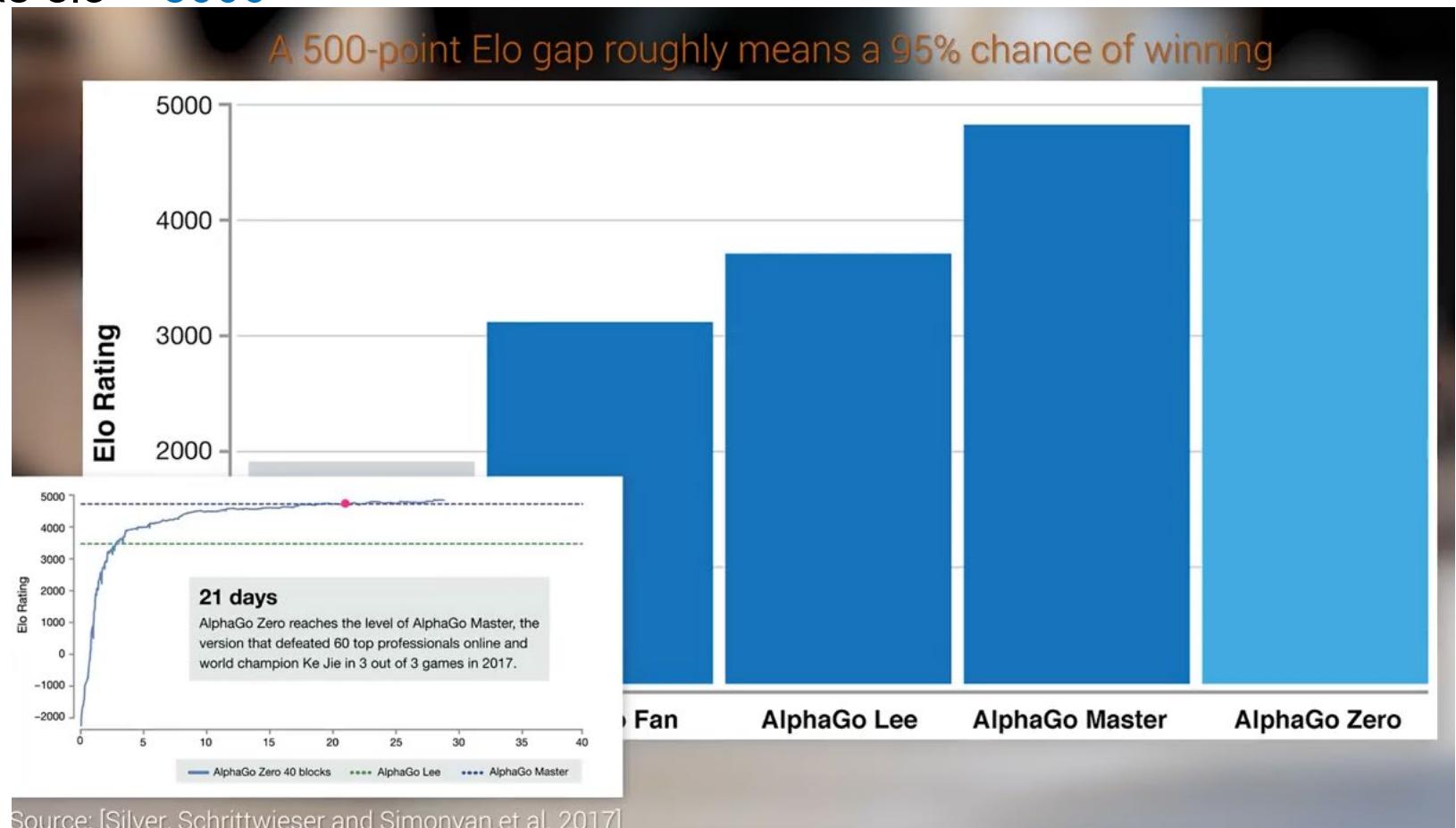
Historia de la IA

- Algunos hitos recientes :
 - 2016: AlphaGo (Google) gana al campeón del mundo (Lee Sedol) en el juego de go <https://deepmind.com/research/alphago/>



Historia de la IA

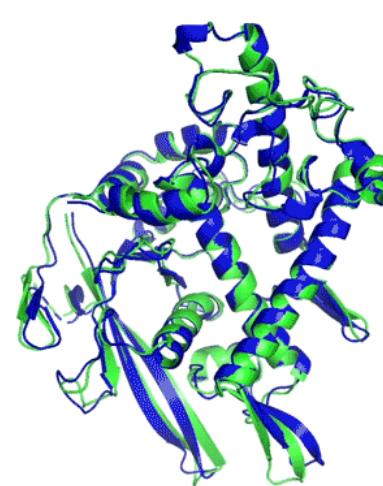
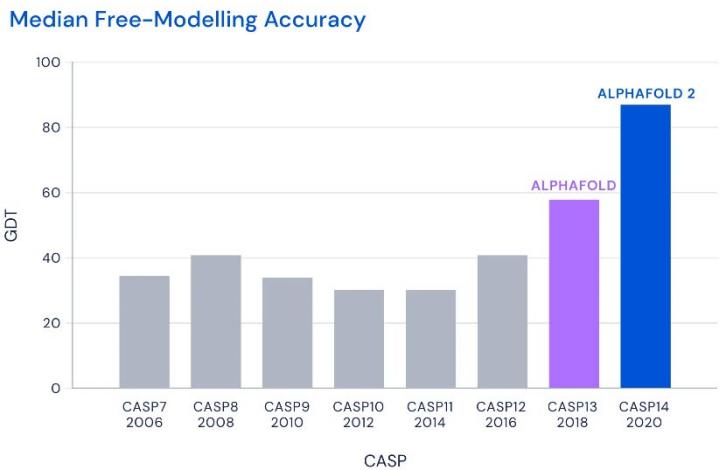
- 2016: AlphaGo gana 4-1 al campeón del mundo (Lee Sedol, elo 3511)
- AlphaGo Master: gana 60-0 a los mejores jugadores del mundo
- **2017:** AlphaGo Zero: 3 días: nivel AlphaGo, 21 días: AlphaGo Master, 40 días elo > **5000**



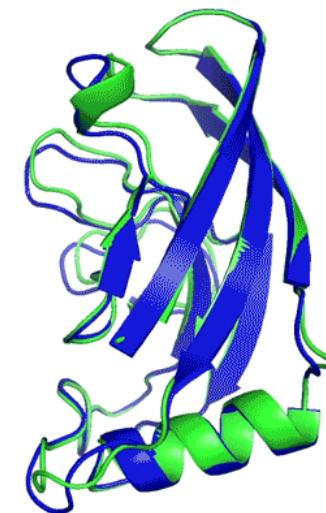
Técnica: Deep RL: entrenando desde 0 jugando contra él mismo (self-play)

Historia de la IA

- Nov 2020: AlphaFold gana el CASP challenge de plegado de proteínas (sacar la estructura 3D a partir de la secuencia de sus aminoácidos):
<https://deepmind.com/blog/article/alphafold-a-solution-to-a-50-year-old-grand-challenge-in-biology>
 - Los métodos experimentales dan una puntuación de aprox. 90 GDT, alphaFold 2 dio 92,4 en el conj de objetivos del reto.



T1037 / 6vr4
90.7 GDT
(RNA polymerase domain)

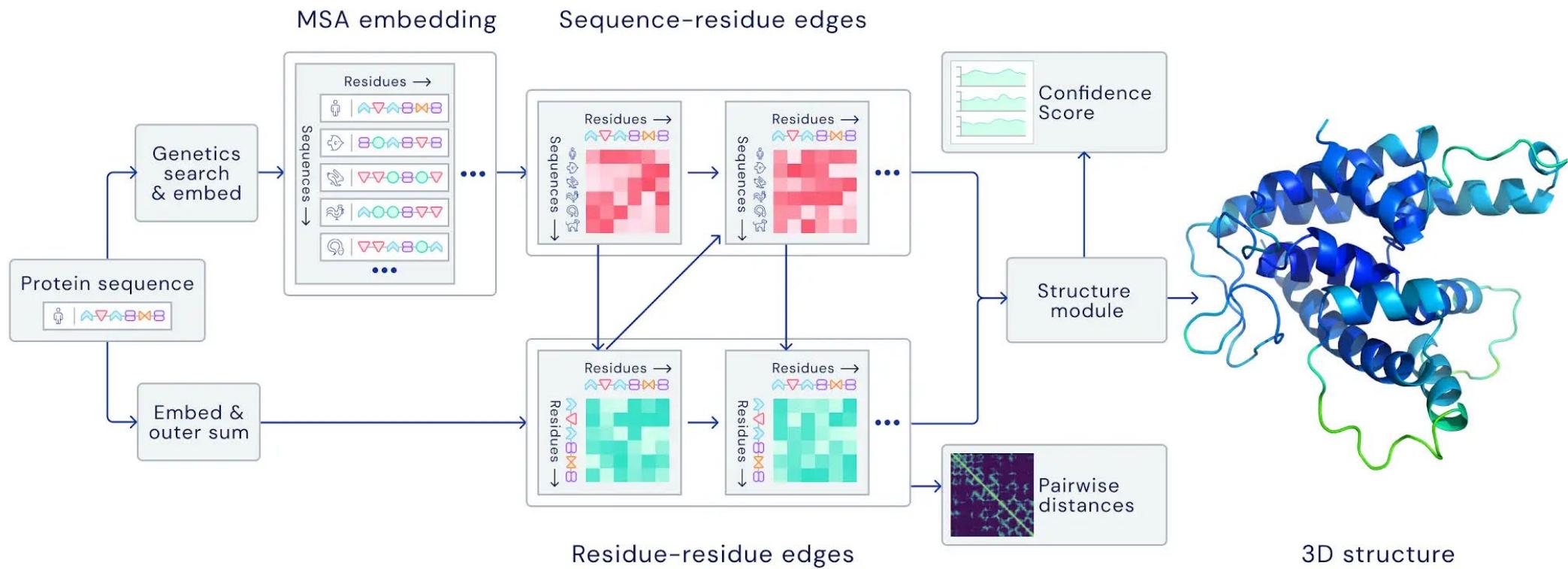


T1049 / 6y4f
93.3 GDT
(adhesin tip)

- Experimental result
- Computational prediction

Historia de la IA

- AlphaFold: estructura 3D de proteínas a partir de la sec. de aminoácidos
 - Iterated process. Attention-based neural network related to the the structure of the graph (nodes: residues). It uses evolutionarily related sequences, multiple sequence alignment (MSA), and a representation of amino acid residue pairs.
 - Training: public ~170,000 protein structures + [large databases](#) containing protein sequences of unknown structure. It uses approx 16 [TPUv3s](#) (roughly equivalent to ~100-200 GPUs) run over a few weeks.



Historia de la IA

2023: ChatGPT y otras IAs generativas



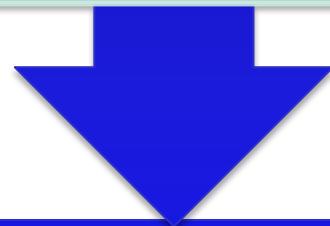
The screenshot shows a news article from the website of the newspaper La Vanguardia. The URL in the address bar is <https://www.lavanguardia.com/tecnologia/innovacion/20230311/881>. The main headline reads: "STABLE DIFFUSION Crean una inteligencia artificial generativa que es capaz de dibujar lo que estás pensando". Below the headline, there is a bullet point: "• Investigadores proponen un nuevo método para reconstruir imágenes de la actividad del cerebro humano obtenidas a través de imágenes de resonancia magnética funcional". At the bottom of the screenshot, there is a caption: "Los autores reconstruyeron imágenes visuales a partir de señales funcionales de fMRI, utilizando después la herramienta de Stable Diffusion (Getty Images/iStockphoto)".

Avance decisivo

Redes Neuronales (NN)

Identificación de códigos postales
escritos a mano

...



Deep feedforward NN (recurrent long-short term memories)

Reconocimiento de voz (speak
to text) en Android

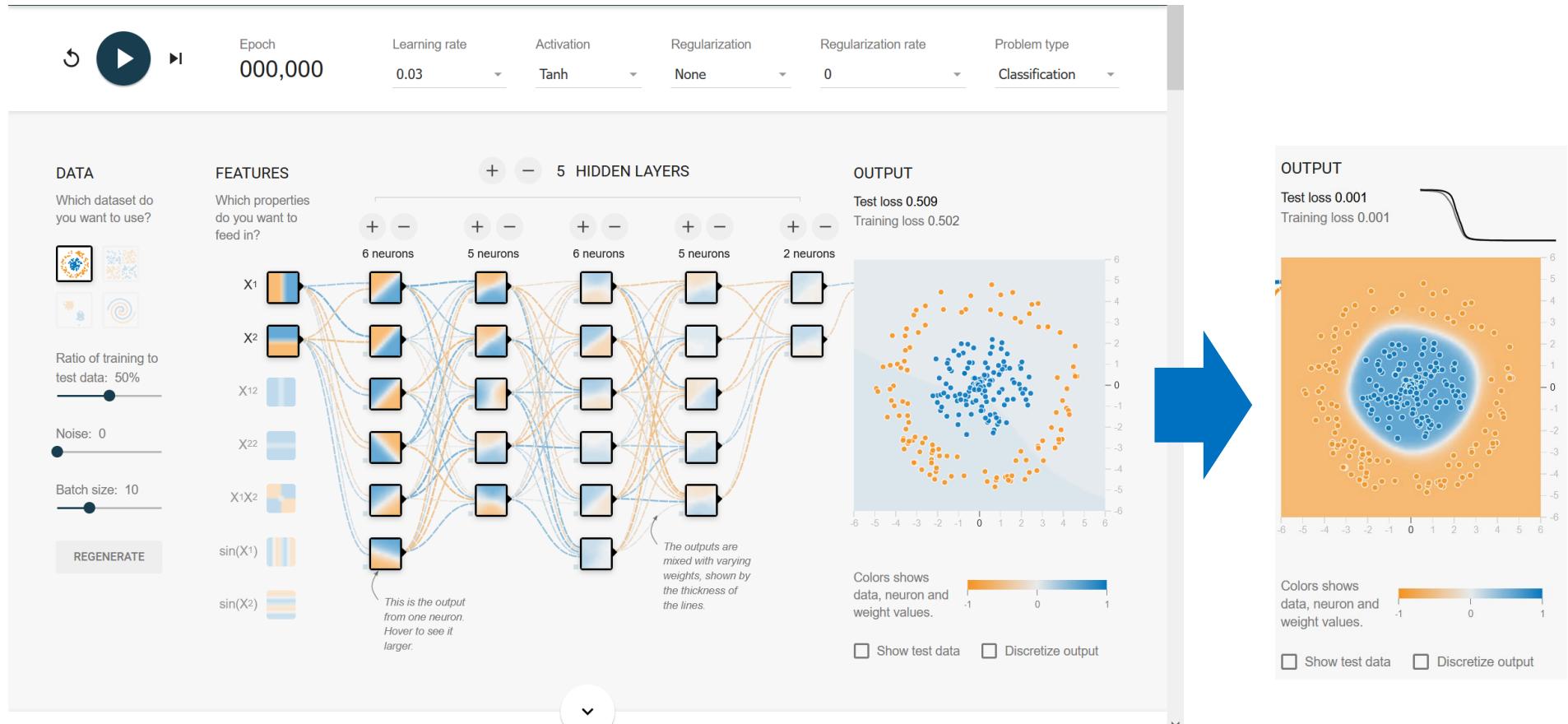
Otros
reconocimientos
de patrones

Avance decisivo: Deep Learning

27:12-31': google tensor flow (deep significa que hay muchas capas intermedias en la NN).

<http://a16z.com/2016/06/10/ai-deep-learning-machines/>

<https://playground.tensorflow.org/>



Deep Learning

- Previo: Codificación de conocimiento experto en reglas

Deep Learning (tipo de Machine Learning)

- Actualmente: datos alimentan algoritmos de aprendizaje
- Historia:
 - Origen: 1940: Neural Network (red neuronal)
 - 80's: reconocim. códigos postales escritos a mano
 - Algoritmo speech-to-text
 - Recurrent Long-Short Term Memories

Deep Learning

Google/Stanford:

- Gran cantidad de datos (10M videos YouTube)
- Gran poder computacional: 1000 servers (16000 cores, 1 semana)
- Reconocimiento de objetos
 - Gatos
 - 16% BD de 20.000 obj's.

Google Tensor Flow:

- 2 clases de datos (puntos naranja y azul)
- Tarea NN: frontera entre las clases
- Izq: inputs
- Der: resultado
- Múltiples capas de neuronas conectadas
- Al entrenar se ajustan los pesos de las conexiones
 - Ej: 200; nvidia (GPU) varios millones, cerebro: mucho más.

Avance decisivo: Deep Learning

27:12-31: google tensor flow (deep significa que hay muchas capas intermedias en la NN).

<http://a16z.com/2016/06/10/ai-deep-learning-machines/>

33-34': deep learning en muchas de las aplicaciones que usamos habitualmente

- Recomendadores (airbnb)
- Reconocimiento de caras/imágenes (google, pinterest,
- Procesamiento del lenguaje natural (Facebook)

Conducción automática

Niveles de conducción automática (xataka.com)

<https://www.youtube.com/watch?v=rnM0n-Vci8Q>

Basados en aspectos clave de la conducción
(3:48'-5:51):

- Movimiento:
 - Longitudinal o/y lateral
 - Respuesta a eventualidades
 - Respaldo al control del coche
 - Condiciones de funcionamiento
 - Visibilidad
 - Mapas GPS precisos

Poster by

AAAI

Association for the Advancement
of Artificial Intelligence

Al magazzino

Poster development supported in part by



Microsoft
Research

YAHOO!

Microsoft Research

第10页

Autonomous Vehicles & Safety

Gesture Recognition

Multimodal Interfaces

Humanoid Robot

1

$$PV=nRT$$

100

10

1

UR

1

10

10

10

10

See the AI timeline and more at
www.aaai.org/AILandscape

The AI Landscape

David Leake, Indiana University, Poster Development Committee Chair
Poster Design: Giacomo Marchesi, www.GiacomoMarchesi.com

Inteligencia Artificial como evolución:

https://www.youtube.com/watch?v=Gq3_G3_wylo

¿Futuro? Trabajo

Sense ficció (TV3): trabajar después de la crisis

<http://www.ccma.cat/tv3/alacarta/sense-ficcio/treballar-despres-de-la-crisi/video/5701210/>

- Cuando la última crisis aún colea, se nos viene encima la llamada Cuarta Revolución Industrial, con robots y algoritmos que cambiarán para siempre el mundo del trabajo tal como lo conocemos
 - 2:55-5: robots en el trabajo... C. Frey (Oxford): 47% de los puestos de trabajo son susceptibles de ser automatizados
 - 9:26-10:50: uber, nuevos lugares de trabajo, conducción automática, 18:05-18:53: amazon... 21:48-24: Call centers
 - 29:30: Compra WhatsApp por 19.000M\$ con 55 empleados
 - 34:15-36:29: robots sociales, en casa

¿Futuro?

36-37:25: How AI is going to replace humans and make them better

<http://a16z.com/2016/06/10/ai-deep-learning-machines/>

Humans need no apply

**Suplemento ideas El PAIS:
11/09/2016**
**“la revolución tecnológica
relanza el debate sobre la
renta básica”**



<https://www.youtube.com/watch?v=6C8OJsHfmpI>

<https://ideas.ted.com/quadcopters-join-the-circus-in-this-magical-video-from-raff-dandrea-and-cirque-du-soleil/>

Cortometraje de Verity Studios realizado en colaboración con Cirque du Soleil es un proyecto de Raffaello D'Andrea ([The astounding athletic power of quadcopters](#)) y su equipo de [ETH Zurich](#). No se usaron efectos especiales para animar las pantallas de lámparas; debajo de cada uno hay un quadcoptero.

“Advanced” intelligence

Design / inventions

https://www.ted.com/talks/maurice_conti_the_incredible_inventions_of_intuitive_ai#t-909972

1:05-4:06: Augmented age

12:53: sistema nervioso en las cosas

Superintelligence

https://www.ted.com/talks/sam_harris_can_we_build_ai_without_losing_control_over_it#t-845008