Inteligencia Artificial (y cambio climático)

Claudio Gutierrez
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AI-Powered Climate Change Adaptation and Mitigation

Screenshot 2024-11-27 at 08.04.38

Publisher: IEEE | Cite This | PDF

Thati Ramya ; Singupurapu Sai Charan Dondy ; L. Pallavi

57 Full Text Views

Abstract

Abstract:

Given the rapid pace

for both prevention a

Document Sections

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Mitigating Climate Change using Artificial Intelligence

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Abstract- In this article, we analyse the role that artificial intelligence (AI) could play, and is playing, to combat global climate change. We outline how machine learning can be an effective tool for cutting greenhouse gas emissions and assisting society with climate chan

learn, and modify a system based on past data. Due to the inclusion of intelligence, flexibility, and intentionality in AI-based systems' proposed algorithms, AI's importance is continuously growing throughout time. [6]. Artificial intelligence (AI), has a lot of potential to speed up plans adaptation and mitigation in fields disaster response (see

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(REVIEW ARTICLE)

Artificial Intelligence in Climate Change Mitigation: A Review of Predictive Modeling and Data-Driven Solutions for Reducing Greenhouse Gas Emissions

Oluiuwon Adegbite [1], Ibrahim Barrie [2,*], Saheed Femi Osholake [3], Tunde Alesinloye [4] and

Nigeria. ville, USA.

PERSPECTIVE
https://doi.org/10.1038/s41558-022-01377-7

nature climate change

Check for updates

Aligning artificial intelligence with climate change mitigation

Lynn H. Kaack[1,2,3], Priya L. Donti[4,5], Emma Strubell[4], George Kamiya[6], Felix Creutzig[7,8] and David Rolnick[9,10]

There is great interest in how the growth of artificial intelligence and machine learning may affect global GHG emissions

Chapter 20 - Development of mitigation strategies for the climate change using artificial intelligence to attain sustainability

Kartikey Sahil [a], Purnima Mehta [a], Satish Kumar Bhardwaj [a], Lakhvir Kaur Dhaliwal [b]

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Abstract

Chapter 3

Climate Change Mitigation Through AI Solutions

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SR University, India

D. P. Divya Vani
SR University, India

K. P

use of large-scale human migration, and the United multiplier" that can trigger social, political, ural and anthropogenic activities such nment, deforestation, gree that cause glob rains

The AI gambit: leveraging artificial intelligence to combat climate change—opportunities, challenges, and recommendations

Josh Cowls[1,2] · Andreas Tsamados[1] · Mariarosaria Taddeo[1,2] · Luciano Floridi[1,2]

Received: 1 February 2021 / Accepted: 6 September 2021 / Published online: 18 October 2021

Abstract
In this article, we analyse the role that artificial intelligence (AI) could play, and is playing, to combat global climate change. We identify two crucial opportunities that AI offers in this domain: it can help improve and expand current understanding of climate change, and it can contribute to combatting the climate crisis effectively. However, the development of AI also raises two sets of problems when considering climate change: the possible exacerbation of social and ethical challenges already associated with AI, and the contribution to climate change of the greenhouse gases emitted by training data and computation-intensive AI systems. We assess the carbon footprint of AI research, and the factors that influence AI's green-house gas (GHG) emissions in this domain. We find that the carbon footprint of AI research may be significant and highlight the need for more evidence concerning the trade-off between the GHG emissions generated by AI research and the energy and resource efficiency gains that AI can offer. In light of our analysis, we argue that leveraging the opportunities offered by AI may help combat climate change whilst limiting its risks is a gambit which requires responsive, evidence-based, and effectiv bal climate change. We conclude by identifying the European Union as being especially well-plac e a winning strategy. We conclude and provide 13 recommendations that are designed to identify and harness olicy response and climate change, while reducing its impact on the environment.

ge endangers humanity. Glo
nge mitigation and scientific
greatly impact climate chang
ges energy, and analyzes indu
ability, and transparency. The
timizes and simplifies supply ch
vironmental consequences. Clima
can benefit from AI-driven sustaina

ual ethics · Digital governance · Environment · Sustainability

Oportunidades y problemas

Oportunidades

can help **improve and expand current understanding** of climate change

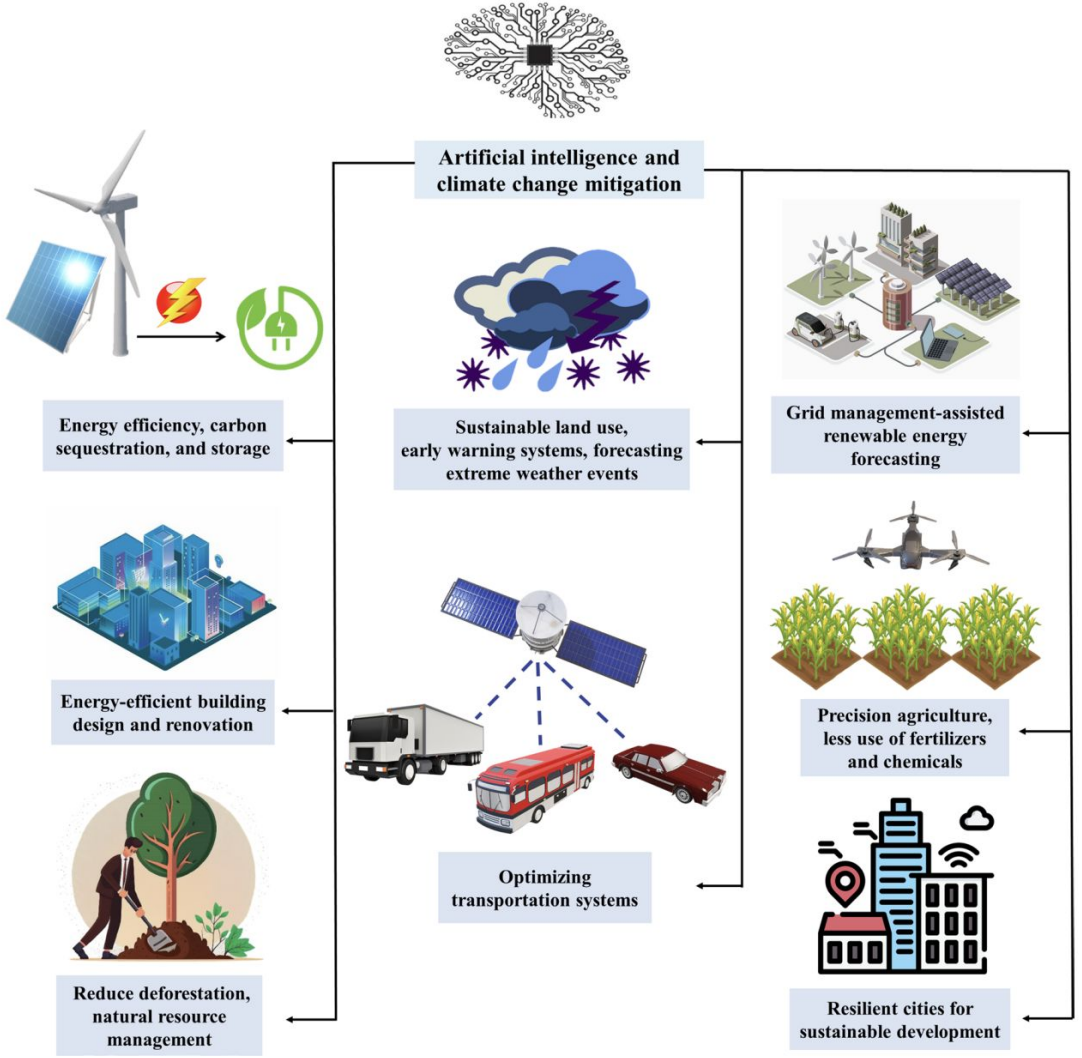
can **contribute to combating** the climate crisis effectively.

Problemas

the possible exacerbation of social and ethical challenges already associated with AI, and the contribution to climate change of the greenhouse gases emitted by training data and computation-intensive AI systems.

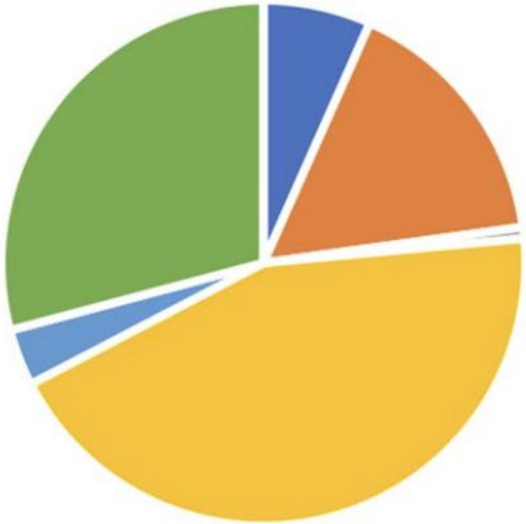
J. Cowls et al. (2021) The AI gambit: leveraging artifcial intelligence to combat climate change—opportunities, challenges, and recommendations

IA en tareas de cambio climático



L. Chen (2023) Artifcial intelligence-based solutions for climate change: a review

Disciplinas de los Proyectos financiados Por la EU que usan IA Para abordar el Cambio climático



Tareas y métodos de IA en áreas de investigación de cambio climático

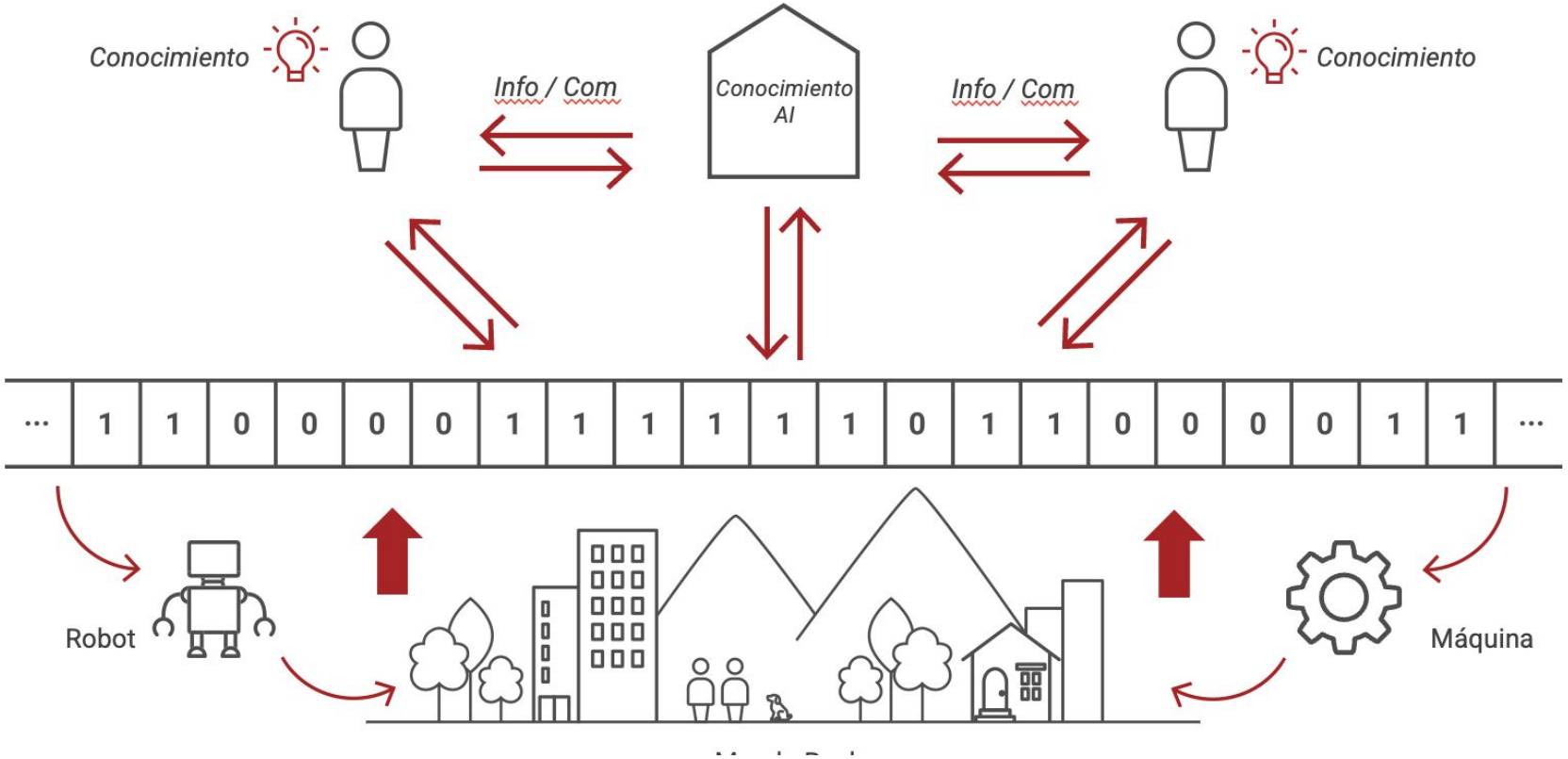
Perspective Discover Artificial Intelligence (2024) 4:64 | https://doi.org/10.1007/s44163-024-00170-z

Table 5 Mapping AI Tasks and Methods within Climate Change Research Subfields

	Causal Interference	Computer Vision	Graphs	Methodology	Natural Language Processing	Neural Networks	Reinforcement Learning	Robots	Time Series
Climate Impacts	✓	✓			✓	✓		✓	✓
Climate Modeling		✓	✓			✓		✓	✓
Emissions Trends						✓		✓	✓
Energy Efficiency		✓				✓		✓	
Energy Technologies		✓		✓	✓		✓		
Energy Trends				✓					
Land Use Change		✓				✓	✓		
Public Perception					✓				
Transportation				✓		✓			

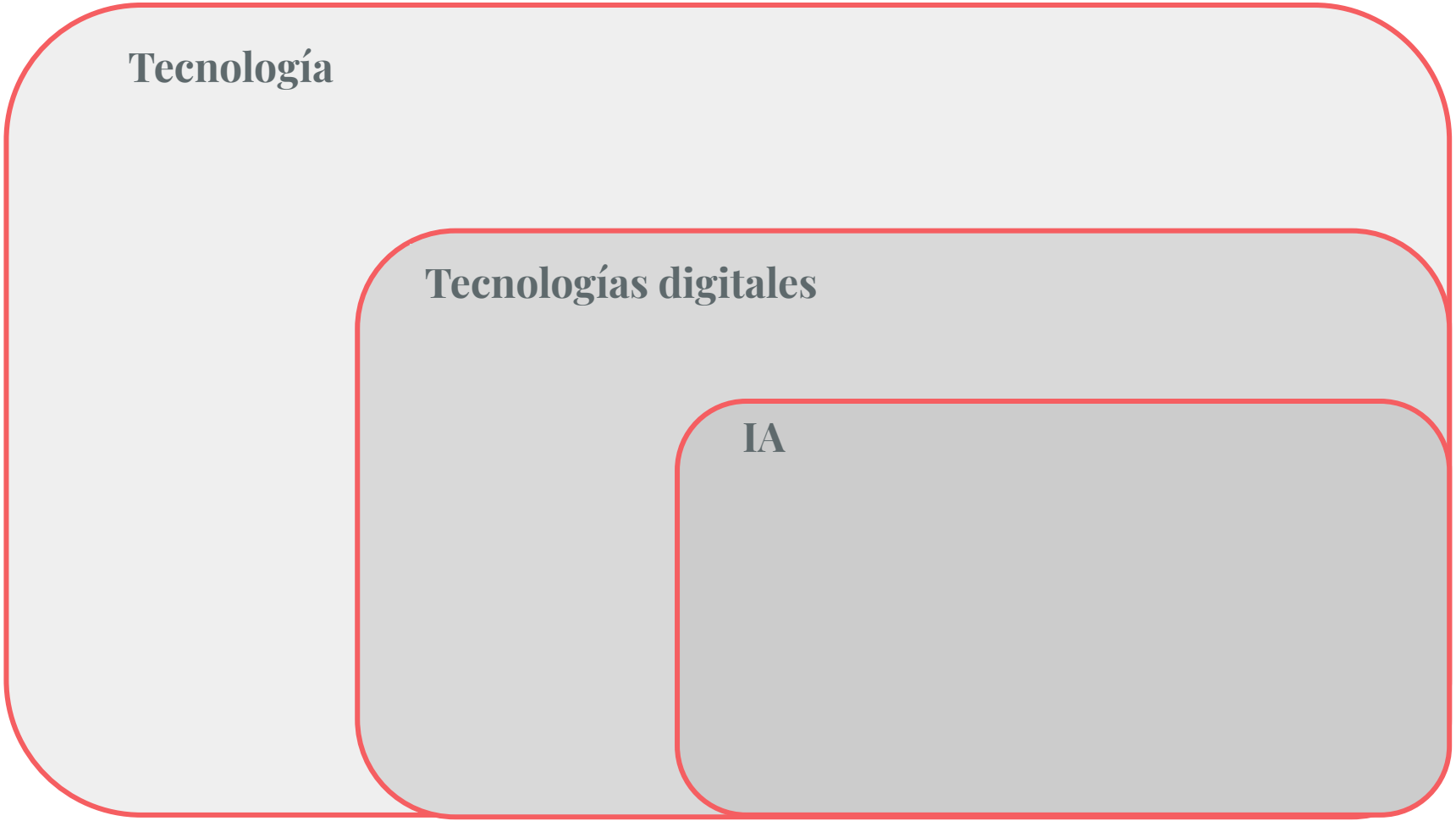
Artificial intelligence contributes to climate change mitigation in the energy sector by predicting energy demand and enhancing energy efficiency to reduce environmental pollution. Numerous nations use artificial intelligence to improve energy efficiency and reduce energy waste.

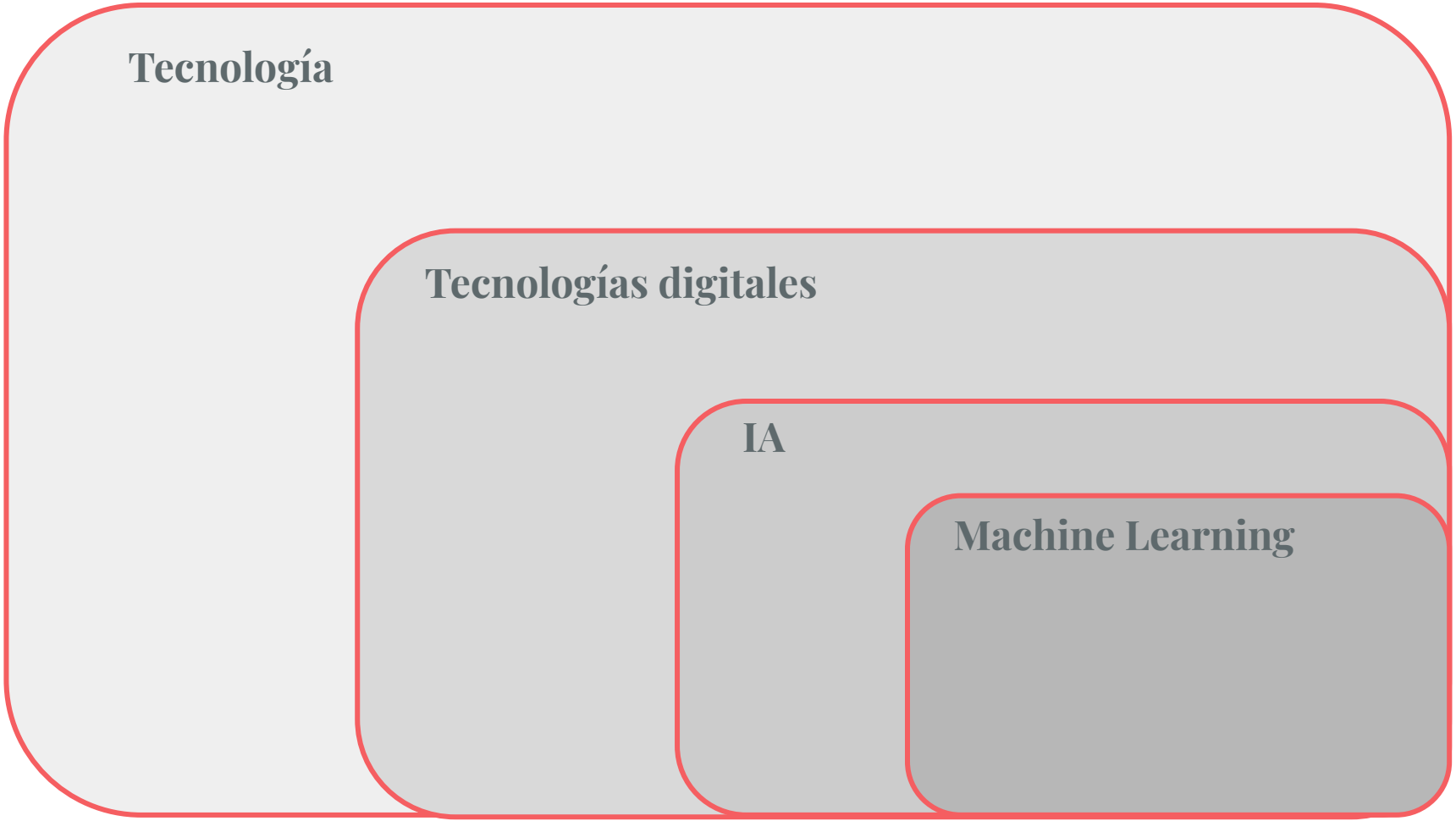
La “inteligencia artificial”

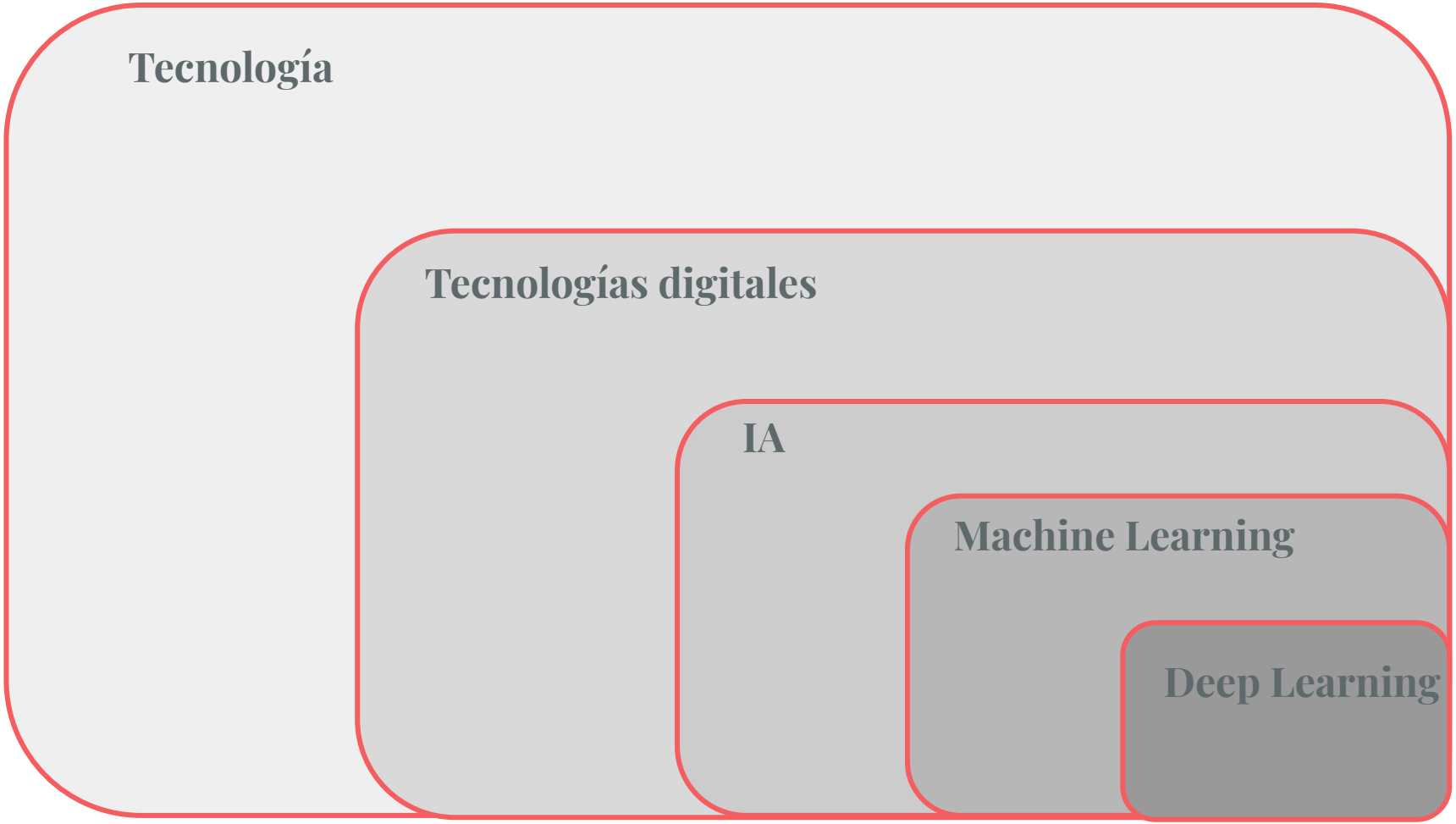

Conocimiento
Info / Com
Conocimiento
AI
Info / Com
Conocimiento
... 1 1 0 0 0 0 1 1 1 1 1 1 0 1 1 0 0 0 0 1 1 ...
Robot
Máquina

Tecnología


Tecnología
Tecnologías digitales


Tecnología
Tecnologías digitales
IA


Tecnología
Tecnologías digitales
IA
Machine Learning


Tecnología
Tecnologías digitales
IA
Machine Learning
Deep Learning

(Paréntesis)
Lo que es necesario saber sobre la revolución de “deep learning”

El gran cambio / amenaza

Máquinas que se *programan*

- Las “máquinas” son commodities (“computadores”)
- La tarea es alimentarlas con los programas adecuados: instrucciones para indicarles *cómo* hacer

Máquinas que *aprenden*

- Hoy (aún) diseñamos y construimos esas máquinas. (Pronto serán commodities)
- La tarea es alimentarlas con las tareas adecuadas: instrucciones para indicarles *qué* hacer

El gran cambio / amenaza

Máquinas que se *programan*

- Las “máquinas” son commodities (“computadores”)
- La tarea es alimentarlas con los programas adecuados: instrucciones para indicarles *cómo* hacer

Grandes temas:

- Cómo codificar las ideas en programas
- Cómo estructurar y ensamblar diferentes programas / sistemas
- Cómo gestionar y mantener esos programas / sistemas
- …

Máquinas que *aprenden*

- Hoy (aún) diseñamos y construimos esas máquinas. (Pronto serán commodities)
- La tarea es alimentarlas con las tareas adecuadas: instrucciones para indicarles *qué* hacer

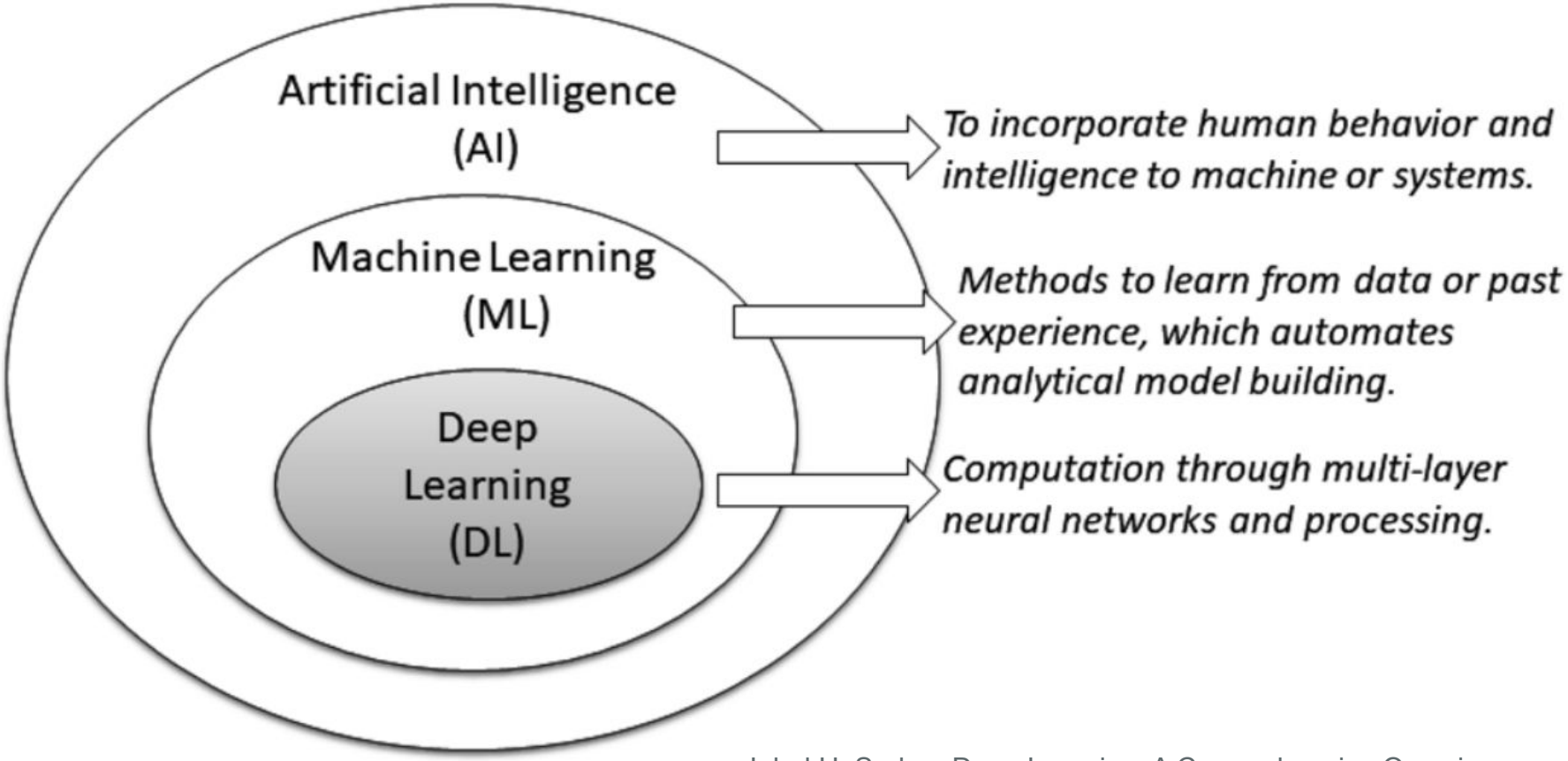
Grandes temas:

- Cómo “pasarles” los objetivos, las métricas de calidad, los datos de entrenamiento
- Cómo estructurar y ensamblar diferentes sistemas (de máquinas que aprenden)
- Cómo gestionar y mantener esos sistemas (de máquinas que aprenden)

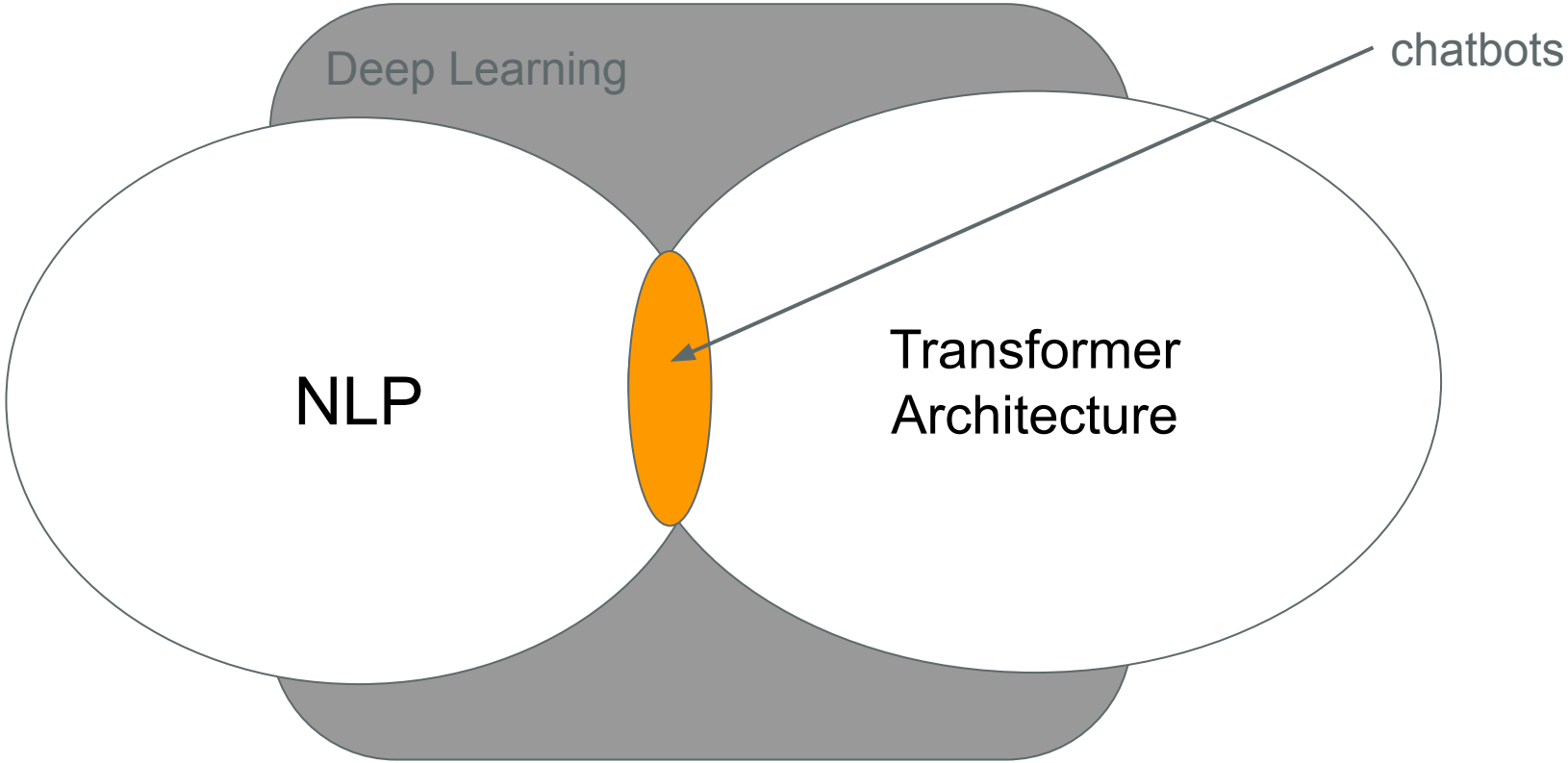
Lo que (al menos) es necesario saber sobre las nuevas máquinas

A. Teoría de Máquinas que Aprenden (los nuevos “computadores”)
   - Machine Learning
   - Redes neuronales
B. Aplicación de AI en diferentes áreas de la computación clásica
   a. Ing. Software, Algoritmos, Comp. gráfica, Datos, Interfaces, etc.
C. “Prompting” y un “poco” de NLP
D. Sistemas (como ahora, pero en un nivel más “arriba”, agentes)
E. Procesamiento de datos

Chatbots et al.

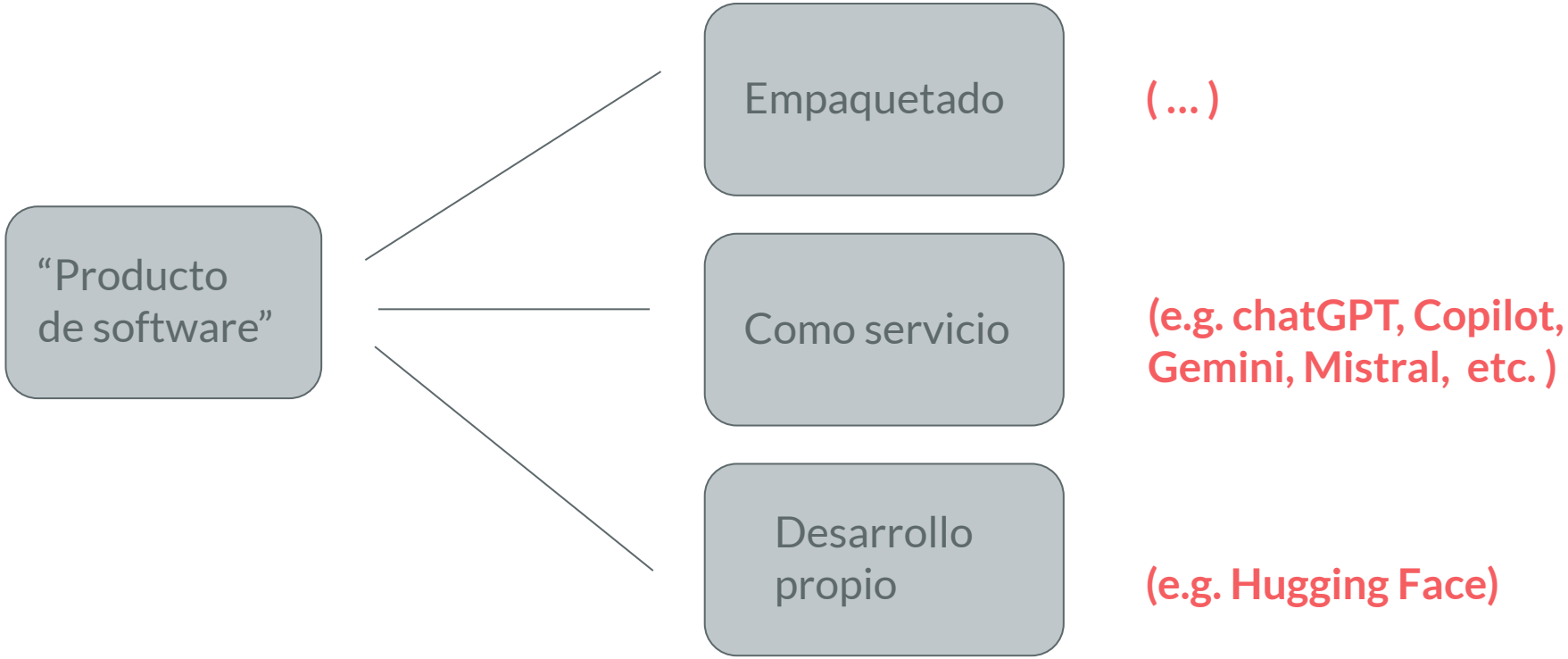


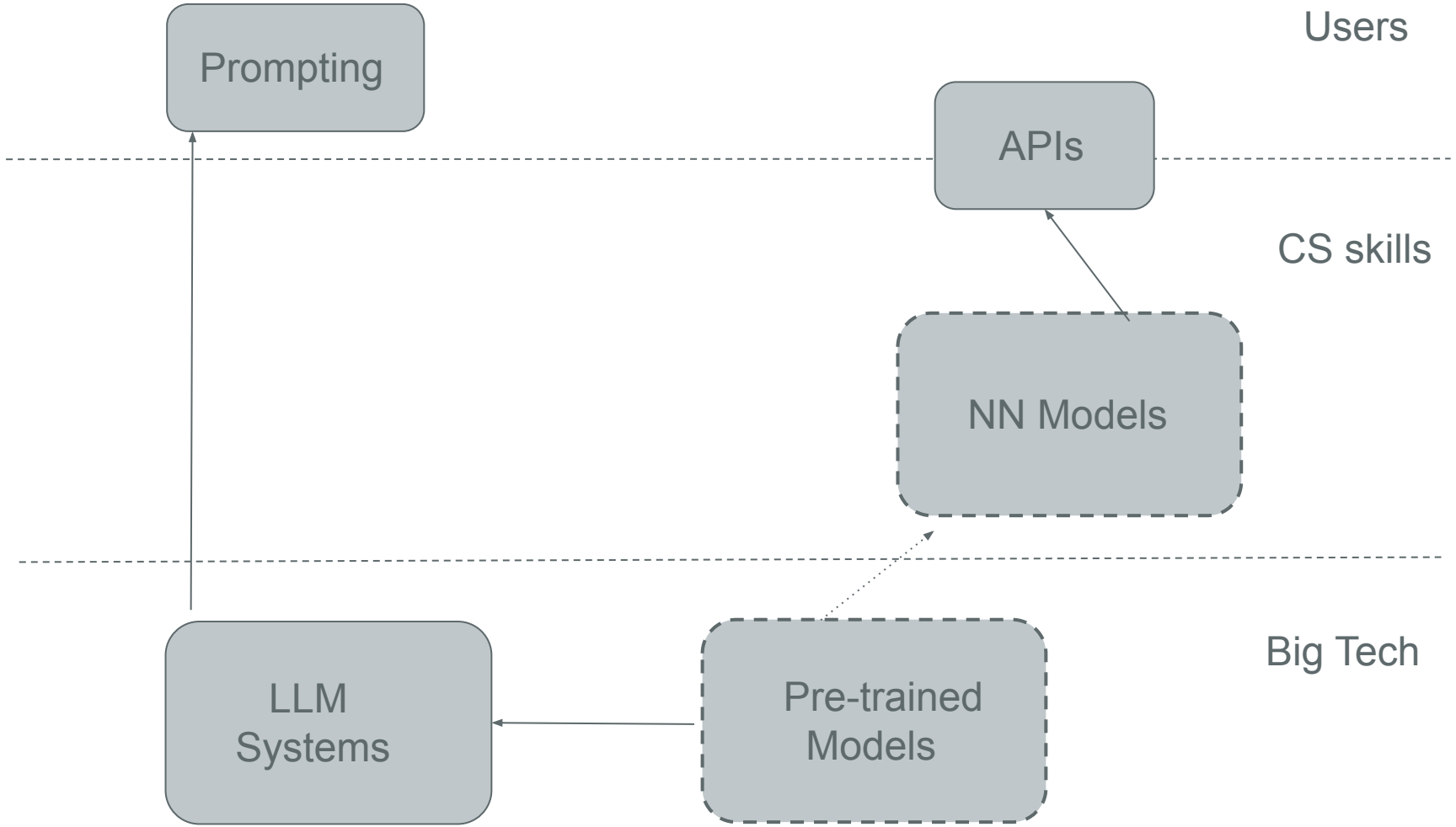
Iqbal H. Sarker. Deep Learning: A Comprehensive Overview on Techniques, Taxonomy, Applications and Research Directions

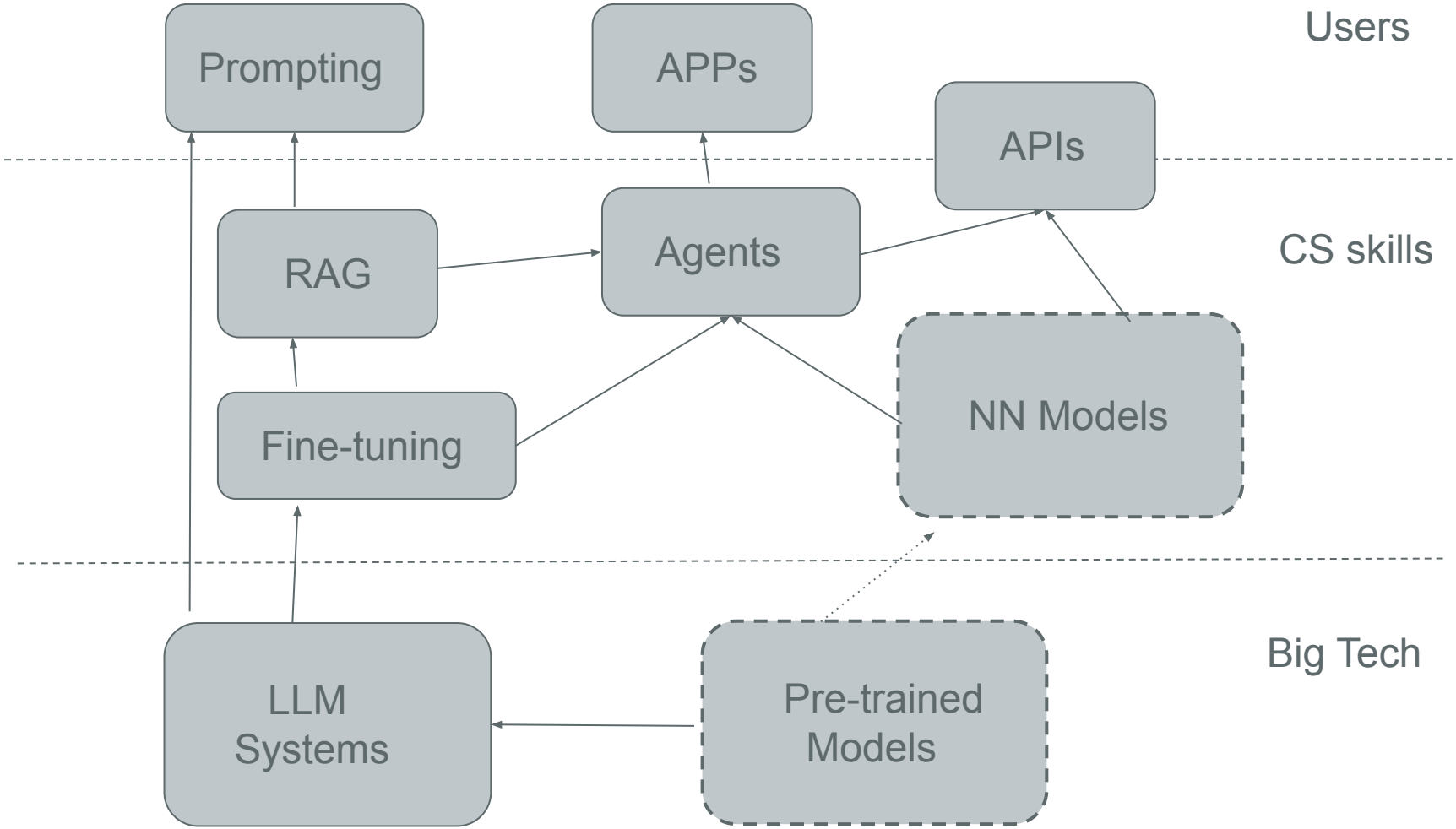

Deep Learning
chatbots
NLP
Transformer
Architecture

Arquitectura de chatGPT

Productos de software

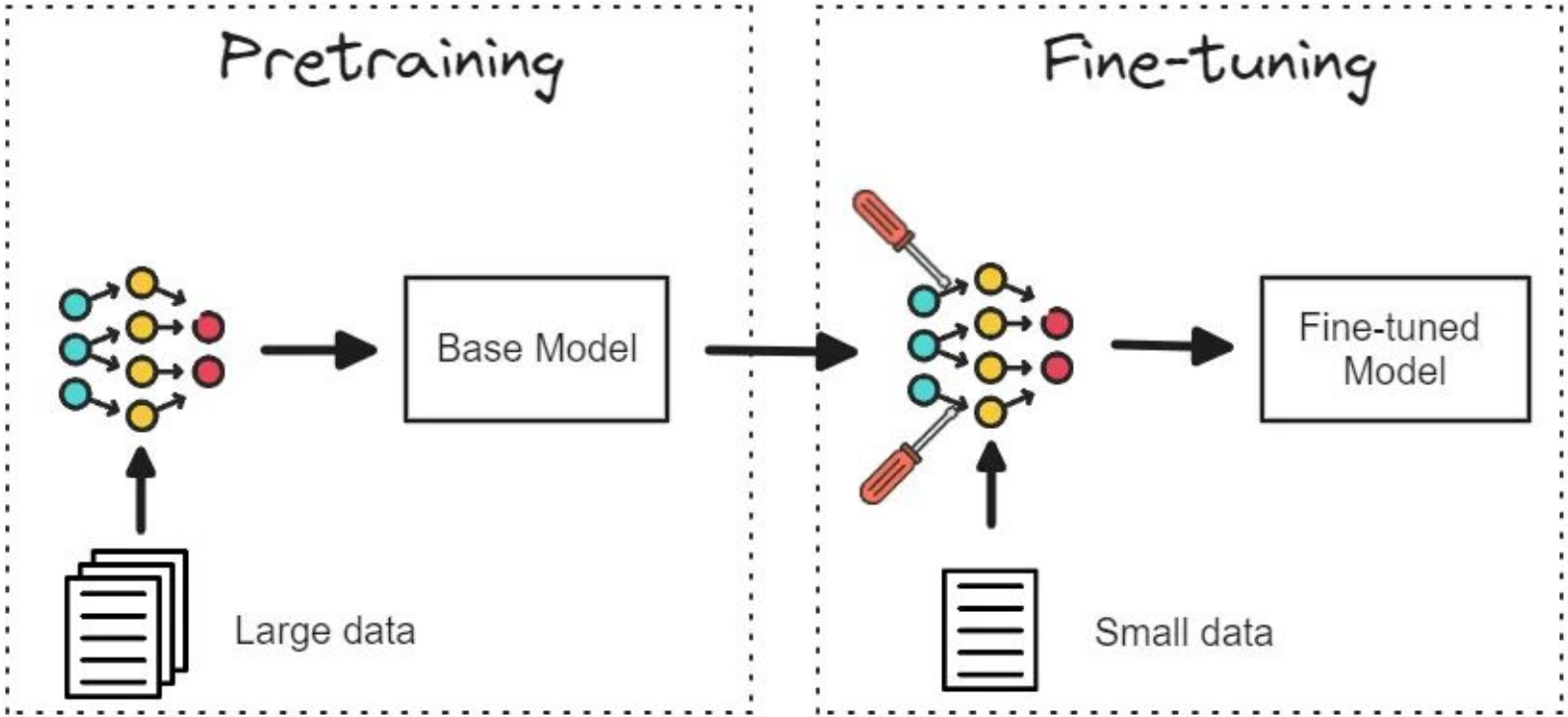



Users
Prompting
APIs
CS skills
NN Models
Big Tech
LLM
Systems
Pre-trained
Models


Users
Prompting
APPs
APIs
CS skills
RAG
Agents
NN Models
Fine-tuning
Big Tech
LLM
Systems
Pre-trained
Models

Fine Tuning

Large Language Model



Prasad Mahamulkar, 2024.

Tipos of Fine Tuning

No supervisado

- No requiere datos etiquetados
- El LLM se expone a un gran corpus del dominio
- Ha funcionado bien para áreas médicas o legales
- Es menos preciso para tareas específicas que clasificación o resumen

Supervisado

- Se provee al LLM con datos etiquetados según la tarea objetivo
- Requiere muchos datos
- Muy efectivo

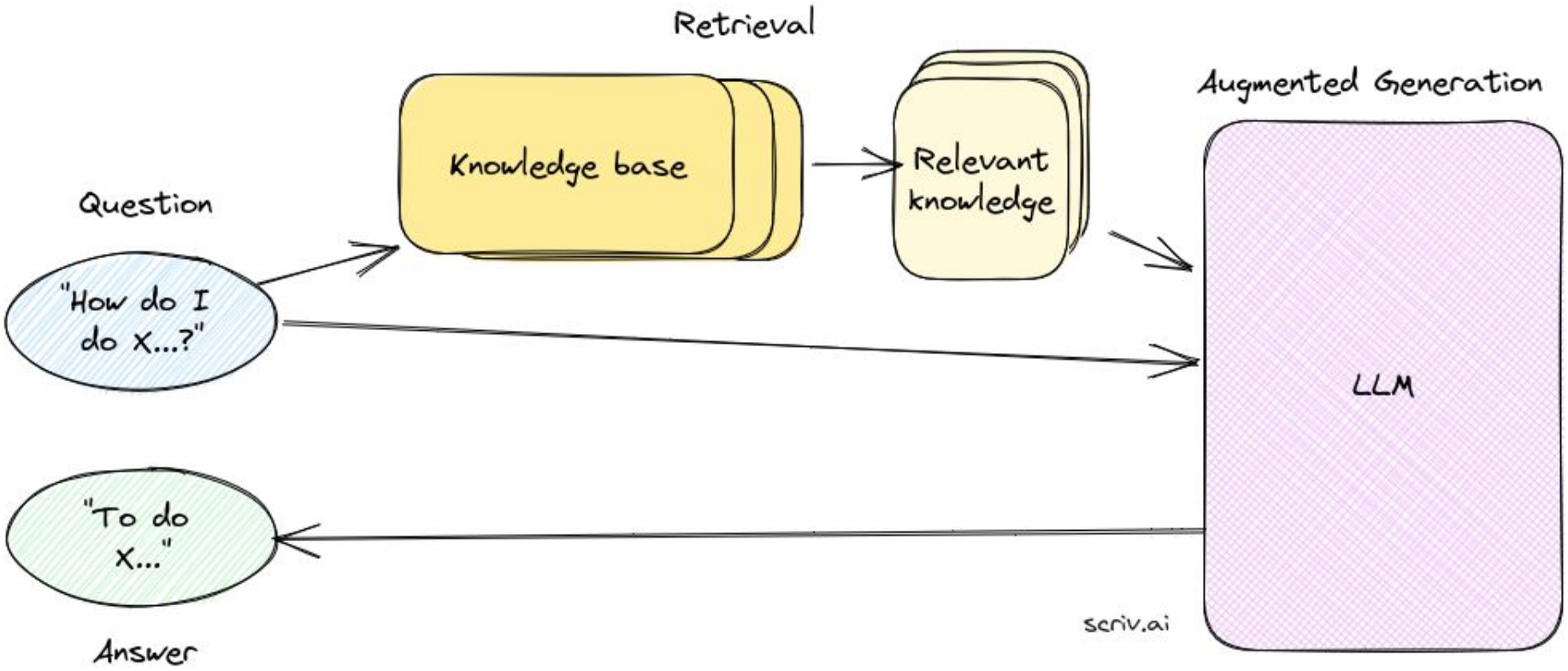
Tipos de fine tuning: Ingeniería de Prompting

- Proveer al LLM con instrucciones en lenguaje natural
- Útil para crear “asistentes” especializados
- Reduce la necesidad de grandes cantidades de datos
- Depende de la calidad de los prompts

Aspect	Pre-training	Fine-tuning
Definition	Training on a vast amount of unlabelled text data	Adapting a pre-trained model to specific tasks
Data Requirement	Extensive and diverse unlabelled text data	Smaller, task-specific labelled data
Objective	Build general linguistic knowledge	Specialise model for specific tasks
Process	Data collection, training on large dataset, predict next word/sequence	Task-specific data collection, modify last layer for task, train on new dataset, generate output based on tasks
Model Modification	Entire model trained	Last layers adapted for new task
Computational Cost	High (large dataset, complex model)	Lower (smaller dataset, fine-tuning layers)
Training Duration	Weeks to months	Days to weeks
Purpose	General language understanding	Task-specific performance improvement
Examples	GPT, LLaMA 3	Fine-tuning LLaMA 3 for summarisation

Table 1.1: A Comparative Overview of Pre-training and Fine-tuning in Large Language Models (LLMs).

Retrieval Augmented Generation (RAG)


Retrieval
Knowledge base
Relevant knowledge
Augmented Generation
Question
"How do I do X...?"
LLM
"To do X..."
Answer
scriv.ai

RAGs

1. Indexación de los datos
2. Procesamiento de la consulta de entrada
3. Búsqueda y Ranking
4. Prompt Augmentation
5. Generación de las respuestas

Prompting

Algunos patrones de prompting

Single shot: pregunta concisa y autocontenida

Few shot: indique junto con la pregunta una serie de ejemplos

Patrón invertido: indique al chat que le haga preguntas a ud.

Patrón reflexivo: pregúntele al chat que evalúe su propia respuesta

Chain of Thought: indique al chat que vaya

Verificación cognitiva: preguntar al chat si entendió la pregunta; que la explique

Subdivisión de preguntas: dividir la pregunta en una serie de sub-preguntas

Patrón de audiencia: indicar al chat que responda para determinada audiencia

gracias por su atención

(lo que sigue tomado de: **Foundational Large Language Models & Text Generation)**

Authors: Mohammadamin Barektain, Anant Nawalgaria, Daniel J. Mankowitz, Majd Al Merey, Yaniv Leviathan, Massimo Mascaro, Matan Kalman, Elena Buchatskaya, Aliaksei Severyn, and Antonio Gulli

(Google)

Código y matemáticas

Comprensión y generación de código y algoritmos para apoyar desarrolladores

- Generación de código
- Completación de código
- Refactorización y debugging de código
- Traducción de código
- Generación de casos de prueba
- Documentación y “entendimiento” de código