Lisbon School of Economics & Management
Universidade de Lisboa

LISBOA
UNIVERSIDADE DE LISBOA

Artificial Intelligence in Management and Economics

Carlos J. Costa

Index

- Presentation
- Concepts
- Research
- Use Cases (AI & GenAI)



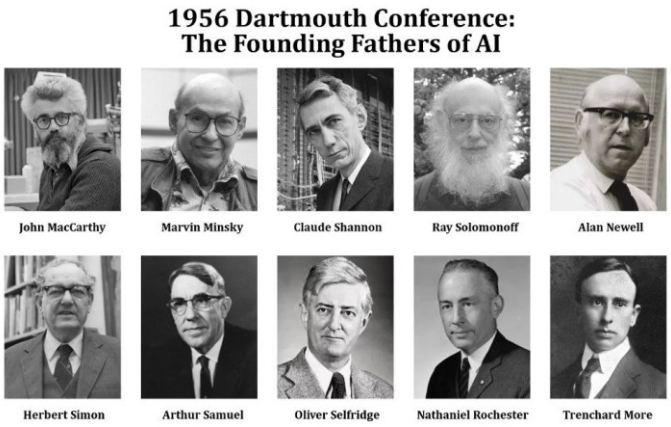
WHAT IS A.I.?

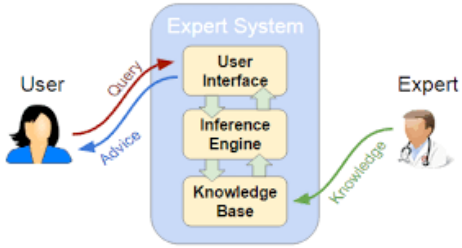


WHAT IS A.I.?

Artificial Intelligence(AI)

- Artificial intelligence refers to the development of computer-based solutions that can perform tasks which mimic human intelligence.











Symbolic AI

Euristic Search

Winter 1

Expert Systems

Knowledge Engineering

Winter 2

1950 1960 1970 1980 1990 2000 2010 2020

1956

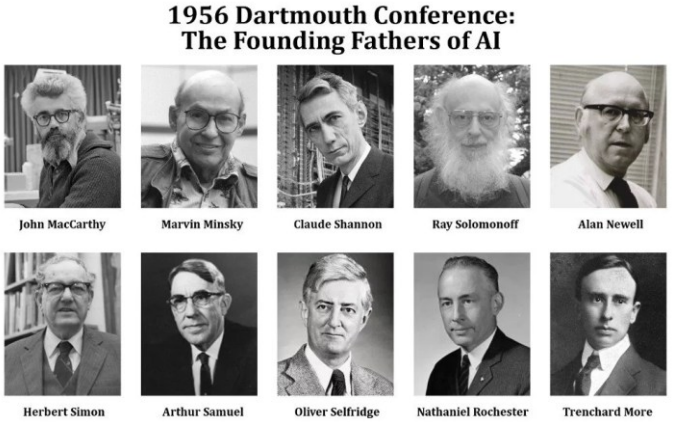


A PROPOSAL FOR THE
DARTMOUTH SUMMER RESEARCH PROJECT
ON ARTIFICIAL INTELLIGENCE

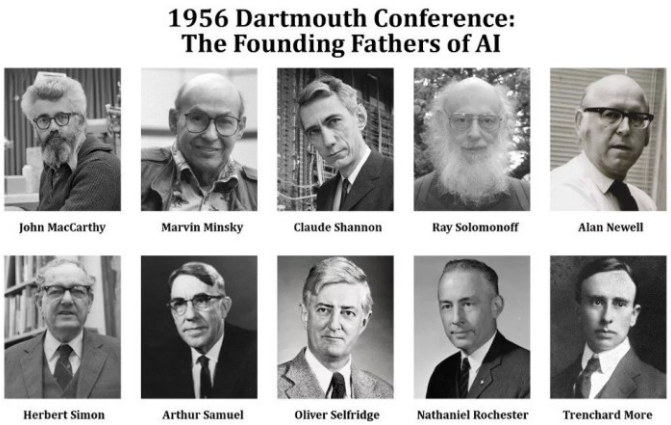
J. McCarthy, Dartmouth College
M. L. Minsky, Harvard University
N. Rochester, I.B.M. Corporation
C.E. Shannon, Bell Telephone Laboratories

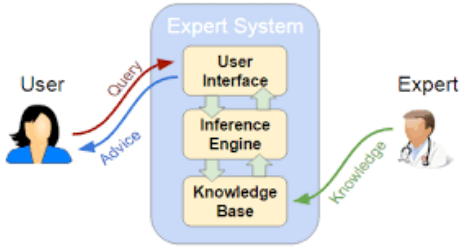
August 31, 1955

1



- Ray Solomonoff
- Marvin Minsky
- John McCarthy
- Claude Shannon
- Trenchard More
- Nat Rochester
- Oliver Selfridge
- Julian Bigelow
- W. Ross Ashby
- W.S. McCulloch
- Abraham Robinson
- Tom Etter
- John Nash
- David Sayre
- Arthur Samuel
- Kenneth R. Shoulders
- Shoulders' friend
- Alex Bernstein
- Herbert Simon
- Allen Newell











Symbolic AI

Euristic Search

Winter 1

Expert Systems

Knowledge Engineering

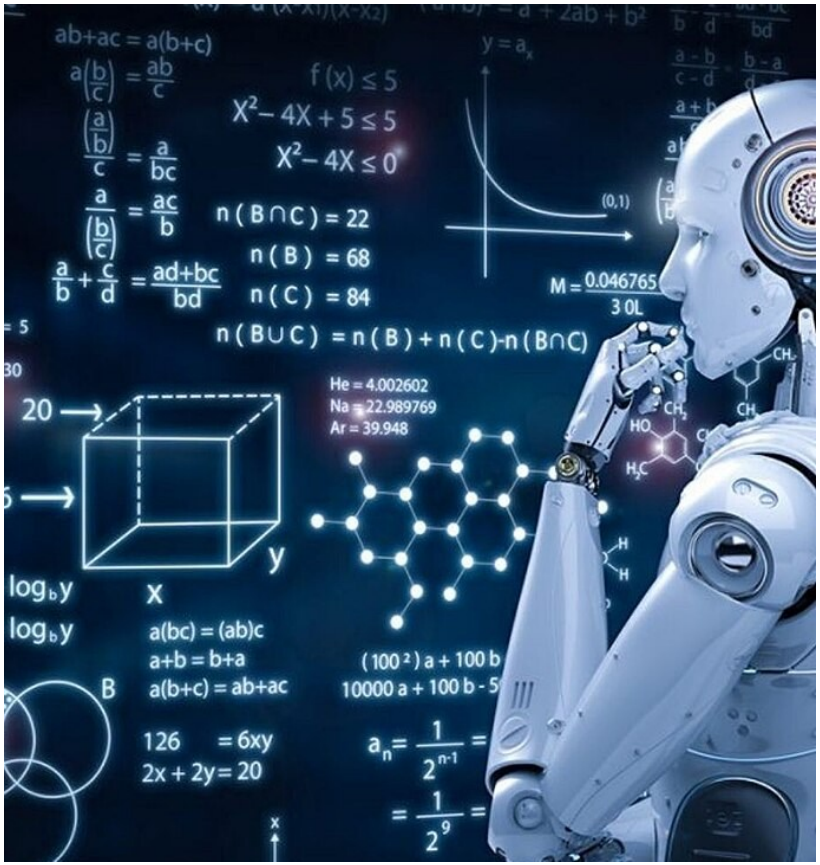
Winter 2

1950 1960 1970 1980 1990 2000 2010 2020

What is Machine Learning?



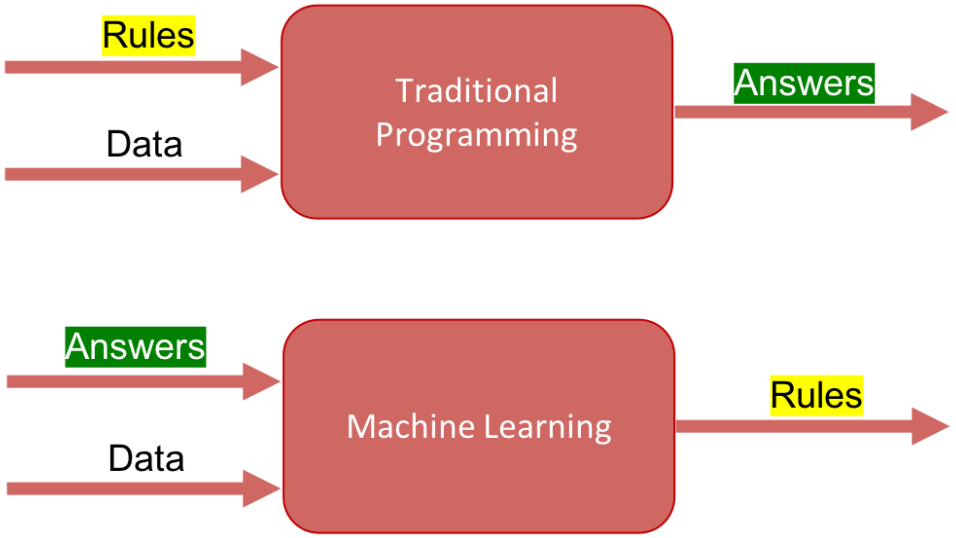
What is Machine Learning?

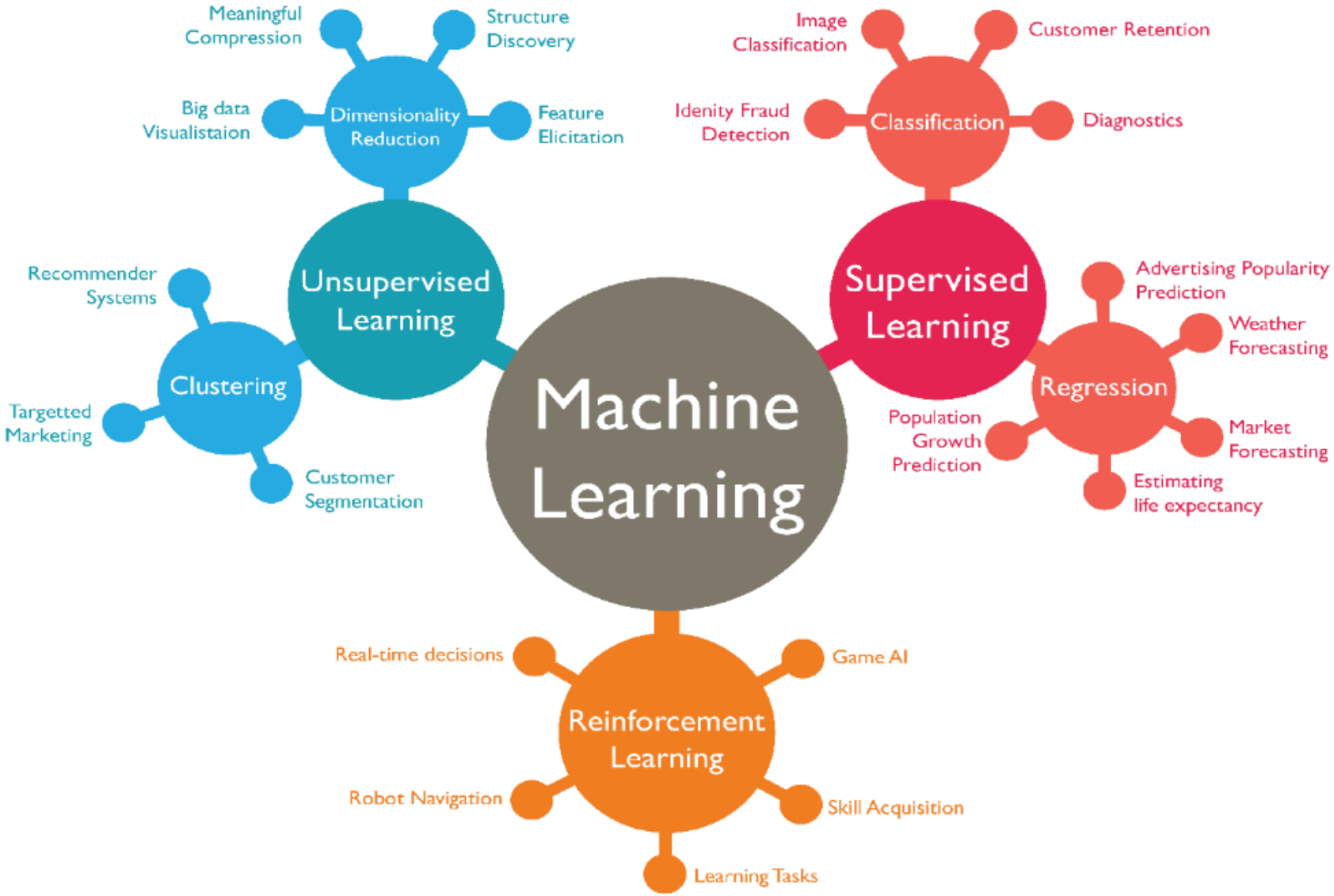


Machine Learning

- **is as a subset of artificial intelligence that enable systems to learn patterns from data and subsequently improve from experience**

Tradicional programming vs. Machine Learning

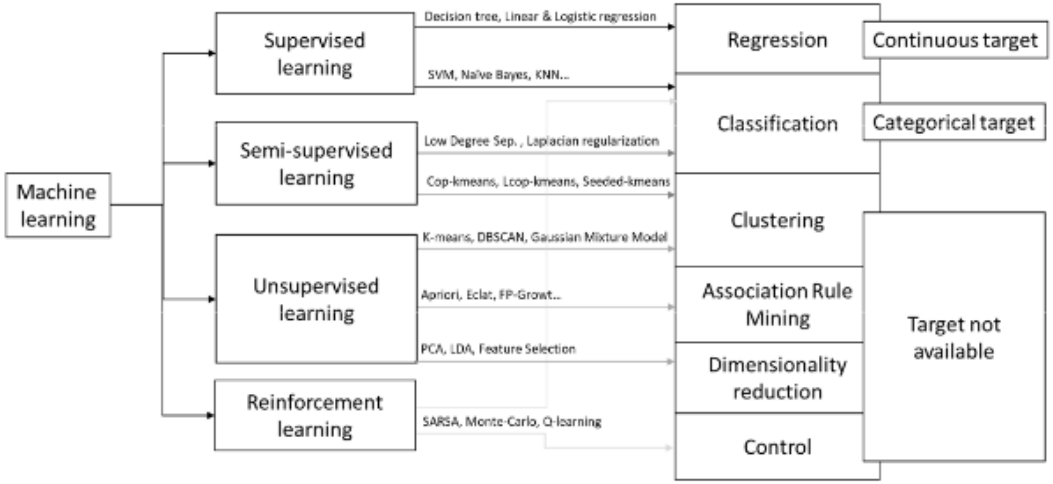



Machine Learning
Unsupervised Learning
Dimensionality Reduction
Meaningful Compression
Structure Discovery
Big data Visualistaion
Feature Elicitation
Clustering
Recommender Systems
Targetted Marketing
Customer Segmentation
Supervised Learning
Classification
Image Classification
Customer Retention
Idenity Fraud Detection
Diagnostics
Regression
Advertising Popularity Prediction
Weather Forecasting
Population Growth Prediction
Market Forecasting
Estimating life expectancy
Reinforcement Learning
Real-time decisions
Game AI
Robot Navigation
Skill Acquisition
Learning Tasks

- Machine Learning Algorithms

I. INTRODUCTION

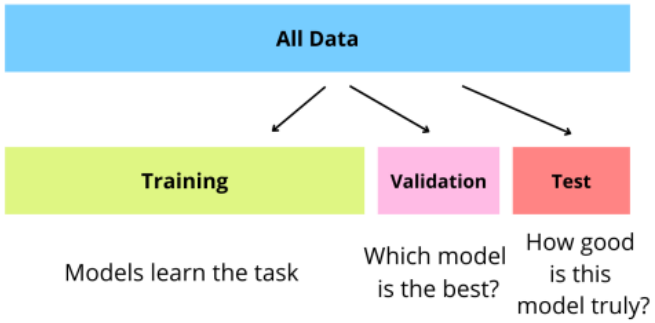
Prediction has been one of the main objectives of pursuit science is or at least creating models that may help understand reality and further help prediction. [12] In recent years statistics, energy price, and alternative investment (or cost of opportunity) on bitcoins prices. The second purpose is to identify the algorithm with better predicting power. To do it, we use several machine learning algorithms.



- Aparicio, Romao & Costa (2022)

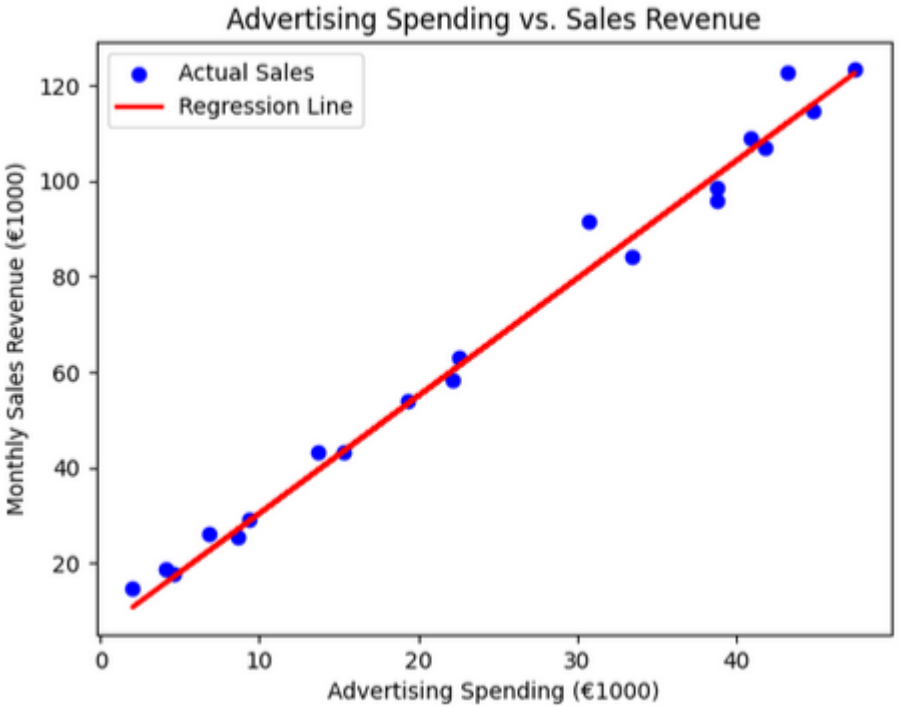
```python
import numpy as np
from sklearn.linear_model import LinearRegression
from sklearn.model_selection import train_test_split
from sklearn.metrics import mean_squared_error, r2_score
# Simulated data: Advertising Spending and Monthly (X) Sales Revenue (Y)
X = 2* np.random.rand(100,1)
y = 4 + 3 * X + np.random.rand(100,1)
# Split into training and testing sets
X_train, X_test, y_train, y_test = train_test_split(X, y, test_size=0.2, random_state=42)
# Create and train the regression model
model = LinearRegression()
model.fit(X_train, y_train)
# Make predictions
y_pred = model.predict(X_test)
# Model performance metrics
mse = mean_squared_error(y_test, y_pred)
r2 = r2_score(y_test, y_pred)

# Display results
print("Intercept",model.intercept_)
print("Coefficient:",model.coef_[0])
print("Mean Squared Error:",mse)
print("R² Score",r2)
```




```
Intercept [4.60117579]
Coefficient: [2.9097001]
Mean Squared Error: 0.07131786715135546
R² Score 0.9806885236616626
```

```
import matplotlib.pyplot as plt
# Plot the results
plt.scatter(X_test, y_test, color='blue', label='Actual Sales')
plt.plot(X_test, y_pred, color='red', linewidth=2, label='Regression Line')
plt.xlabel("Advertising Spending (€1000)")
plt.ylabel("Monthly Sales Revenue (€1000)")
plt.title("Advertising Spending vs. Sales Revenue")
plt.legend()
plt.show()
```

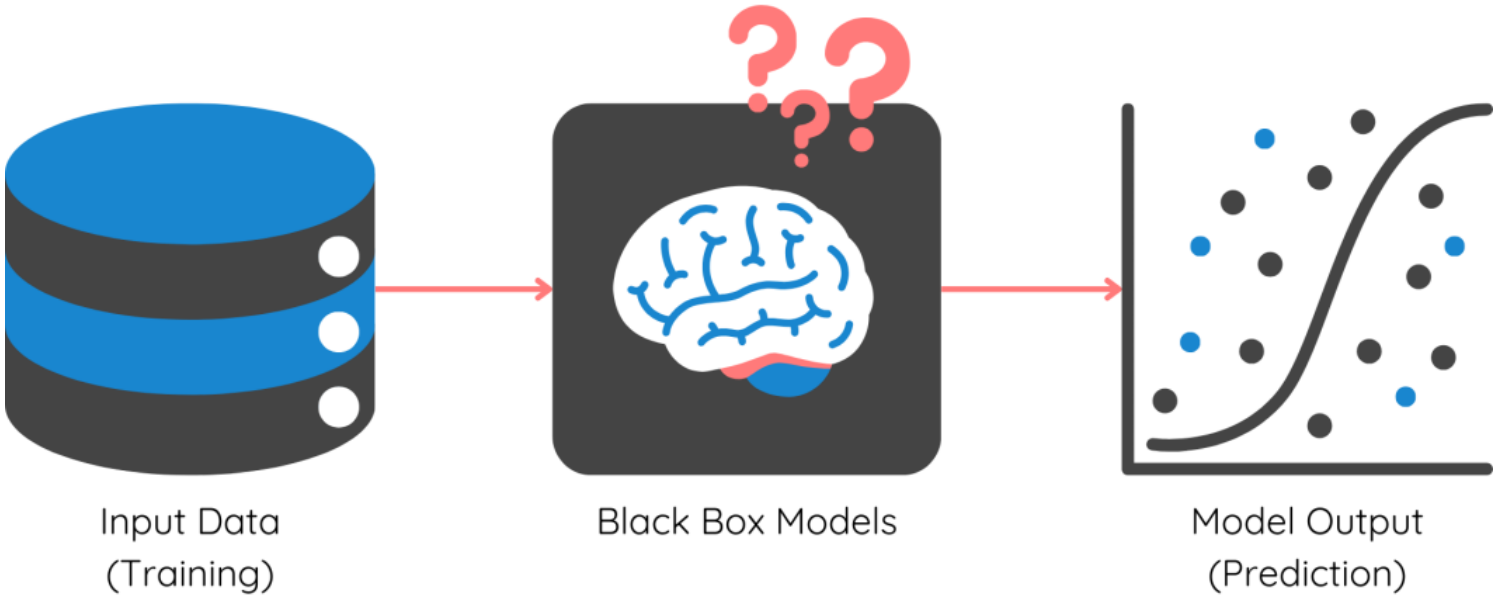


	Prediction	Inference
Goal	Robust model using all predictors to accurately predict the outcome variable (Y) with high accuracy and low error.	Estimate the relationship between an outcome variable and predictor variable(s), while accounting for confounding factors.
Question Answered	How can I accurately predict new data points?	What do the relationships between the variables signify?
Example	Predicting house prices based on features like size, location, and number of bedrooms using regression models.	Inferring the impact of education level on income while controlling for factors such as experience and occupation using linear regression analysis.



Inference

- Given a dataset, the purpose is to infer how the output is generated as a function of the data.
- Use the model to learn about the data generation process.
- Understand the way the independent variables X affect the target variable Y.
- Ex: find out what the effect of passenger gender, class and age, has on surviving the Titanic Disaster
- Model interpretability is a necessity for inference
- **Causal inference** provides a rigorous framework for identifying cause-and-effect relationships from data.



- Explainable artificial intelligence (XAI)
- is a set of processes and methods
- that allows human users to comprehend and trust
- the results and output created by machine learning algorithms

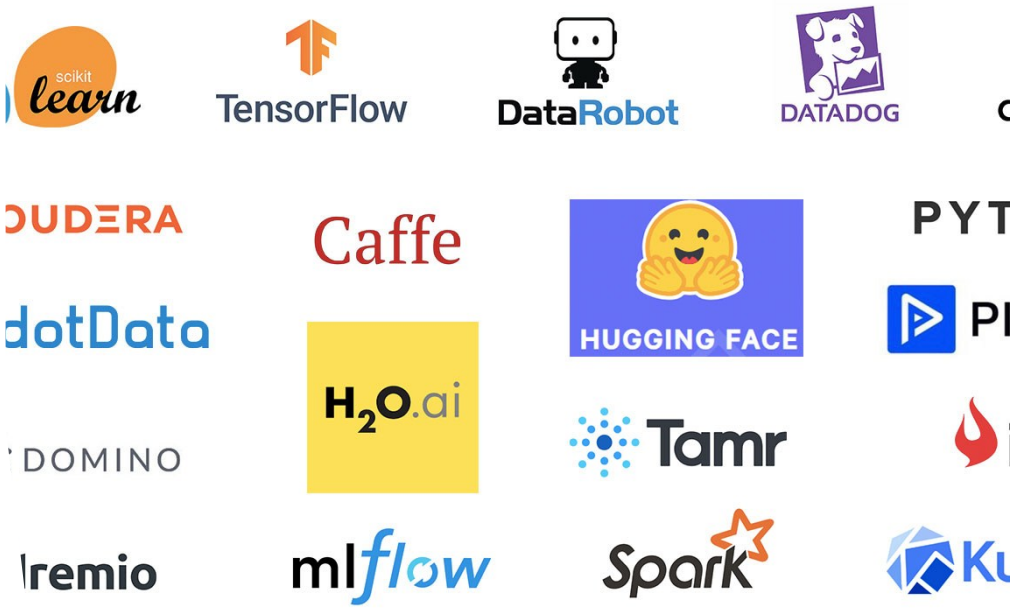


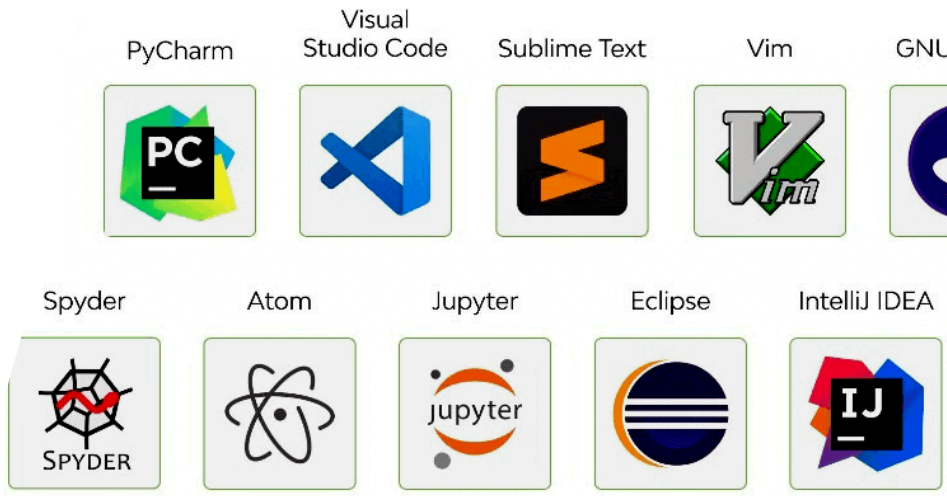
Prediction

- Use the model to predict the outcomes for new data points.
- When performing predictions over data, the purpose is estimating f in y=f(x)
- The purpose is not understanding the exact form of the estimated function, as far as it can perform predictions quite accurately.
- To be able to predict what the responses are going to be to future input variables.
- Ex: predict prices of oil

Machine Learning

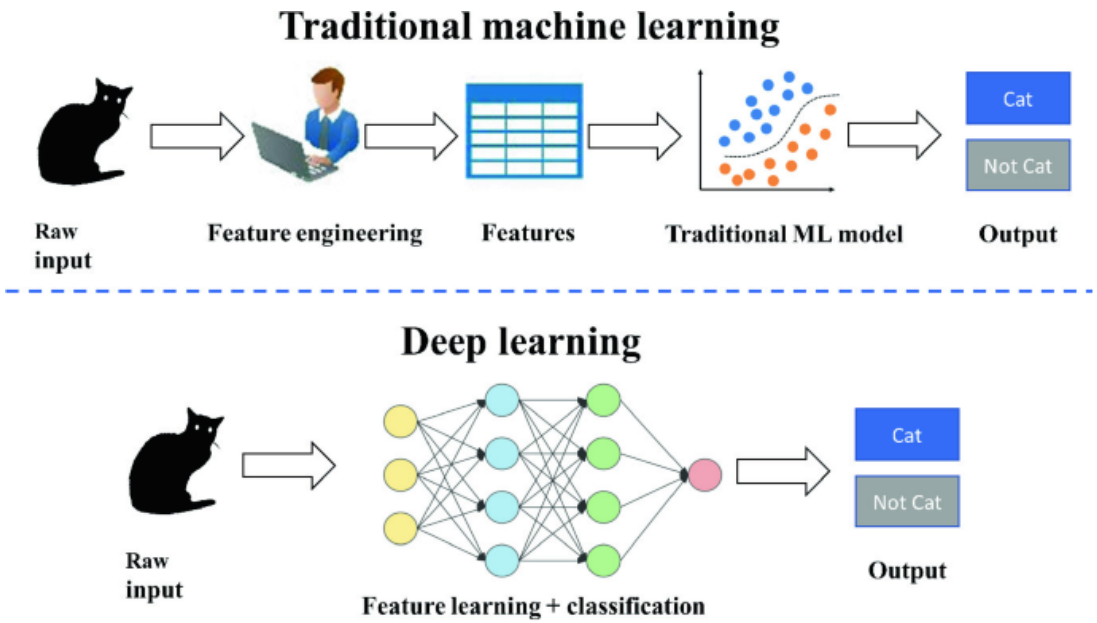
- Supervised Learning:
  - Classification
  - Regression
- Unsupervised Learning
  - Clustering
  - Dimensional Reduction
- Reinforcement Learning





Deep learning

- is a subfield of machine learning
- focuses on the development and application of artificial neural networks, particularly deep neural networks.
    - composed of layers of interconnected nodes (artificial neurons) that can learn and make decisions.
- The term "deep" refers to the use of multiple layers in the neural network.



Natural Language Processing (NLP)

- subfield of artificial intelligence
- focuses on the interaction between computers and human language.
- The goal of NLP is to enable computers to understand, interpret, and generate human language in a way that is both meaningful and contextually relevant.
- involves the application of computational techniques and models to analyze and derive meaning from natural language data.
- Sentiment Analysis e increasing importance (Aparicio et al, 2021, Costa et al., 2021)

Emotion analysis of Portuguese Political Parties Communication over the covid-19 Pandemic

Joao Tiago Aparicio
Instituto Superior Técnico,
University of Lisbon
Lisbon, Portugal
joao.aparicio@tecnico.ulisboa.pt

João Salema de Sequeira
Instituto de Estudos Politicos
Universidade Católica Portuguesa
joaosalemasequeira@gmail.com

Carlos J. Costa
Instituto Universitário de Lisboa
(ISCTE-IUL), ISTAR-IUL,
Lisboa, Portugal
ISEG, Universidade de Lisboa,
Lisboa, Portugal
carlos.costa@acm.org

Abstract — In this paper, we explore the use of emotions in the Portuguese political parties' (with a seat in the Portuguese Parliament) communication as expressed by their official Twitter accounts, as of March 2020. The chosen period of our investigation is particularly interesting because political parties had a chance to communicate their views during a pandemic situation and over a period of one year. These views include possible solutions to face the crisis and their comments on the development of the whole situation. Using a standard lexicon we classified the amount of particular emotions in different tweets. Using this method we plotted the average positivity and negativity along time per party. We also analyzed the impact of each emotion to classify positivity using the present corpus. Finally, we considered some important words regarding the pandemic and their average positivity score. The analysis allows us to identify different approaches to participation in social media according to different strategies, more than political ideology.

Keywords - political communication; Portuguese political parties; Portuguese parliament; Portuguese; lexicon; sentiment analysis; emotions; visualization; social media; twitter; covid-19.

I. INTRODUCTION

Now-a-days, different political actors are increasingly using social media platforms to communicate their worldviews. American Presidents have used Twitter heavily to communicate their position in relation to specific ideas and to specific policies [5]. Hence it is essential to analyse what is being communicated and even more important how this communication is being done in order to best assess their impact. Political communication can help us explain the ups and downs of the electoral polls and the electoral success of a certain political party or individual in the following election.

The publication of *The Gutenberg Galaxy: The Making of Typographic Man* [8] considers the effects of social media in different human dimensions. However, a new empirical approach is needed, one that considers the effects of social networks or to put it simply a Zuckerberg Galaxy approach which demonstrates how Facebook, Twitter, and other social media are used and to what extent they have a more decisive influence on some of the voters, in comparison to the traditional media. In this context, the evolution in Natural Language Processing (NLP) and sentiment analysis is significant, however the political communication in Portugal has not yet been a subject of this kind of study, since the available models and lexicons are not yet adapted to European Portuguese. In this sense, we aim to answer the following question: What are the prevalent emotions in the Portuguese political parties' tweets during over the first year of the covid-19 pandemic?

The purpose of the work performed in this paper is to analyse the communication of the official Twitter accounts of the Portuguese political parties. The time frame ranges through 3200 last tweets, going as back as March 2020, when the first case of covid-19 was registered in the country. This period is specially interesting because political parties had a chance to communicate to the electorate their ideas in face of a social and economic crisis. It is important to take into consideration that the different parties tweeted with a different frequency, however the reality they were facing was one and the same.

II. LITERATURE REVIEW

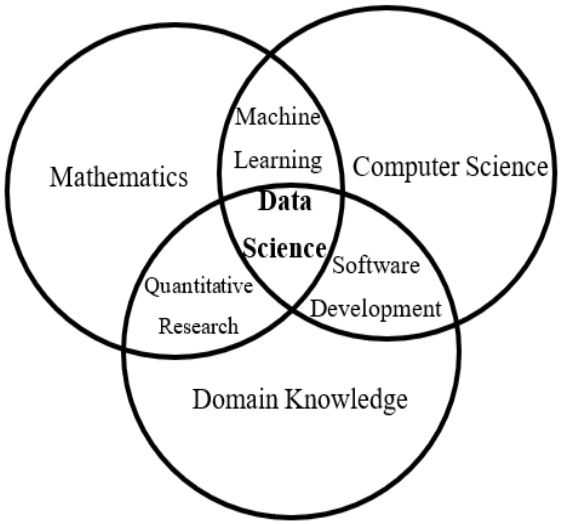
Sentiment analysis refers to using several approaches, such as: natural language processing, text analysis, computational linguistics, and biometrics, to systematically identify, extract, quantify, and study affective states and subjective information.

Emotions can be reactions to internal stimuli (such as thoughts or memories) or events in our environment. To analyze emotions, Mohammad and Turney [1] proposed a lexicon. This lexicon uses six emotions [2], [3]: joy, sadness, anger, fear, disgust, and surprise, along with how positive and negative the words are. These are a subset of the eight emotions proposed in Plutchik [4] which are still relevant today [10]. Recently the study of the impact of texts on such emotions has been done, namely in the USA political context [5]. This was done with a focus on awareness and topical emergence. However, there was no analysis over the emotion on the content of the message shared by the political parties, instead it was focused on its reception using Twitter users from states with opposing political views. This analysis was done over the covid-19 pandemic period, from 9th of March to the 13th of December, not encompassing any analysis over 2021. The study was composed of three stages, unigram frequencies identification, sentiment analysis and then topic modeling. The

2021 16th Iberian Conference on Information Systems and Technologies (CISTI)
23 – 26 June 2021, Chaves, Portugal
ISBN: 978-989-54659-1-0

Data Science

- includes techniques developed in some traditional fields like artificial intelligence, statistics or machine learning.



Aparicio et al. (2019).



Generative AI

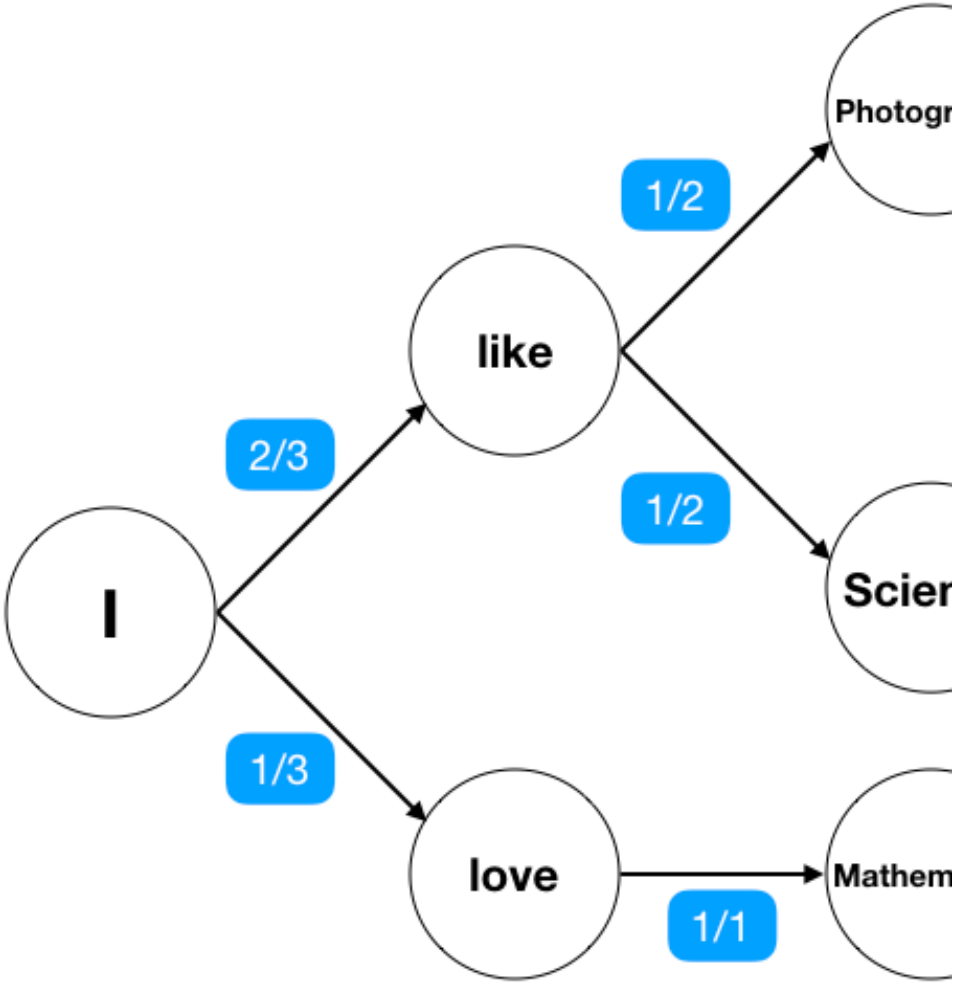
- Class of AI algorithms and models that are designed to generate new, original content.
- Gen AI learn the underlying patterns and structures in the data and can generate novel outputs.
- *Instead of being trained on specific examples and then making predictions or classifications*
- These models are particularly good at creating content that resembles or is similar to the data they were trained on.

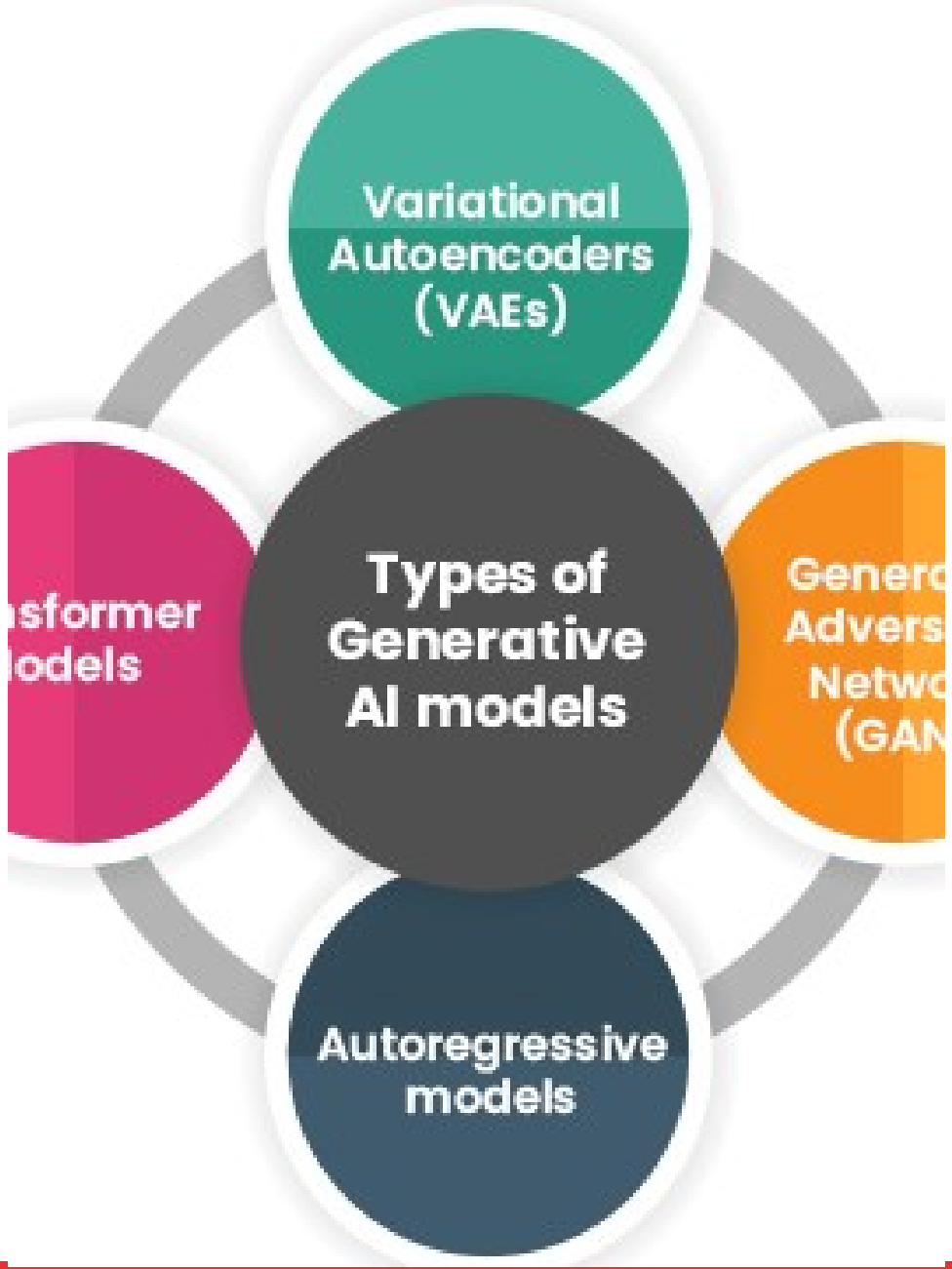
Generative AI

Guessing next word

Markov Chain

Training model

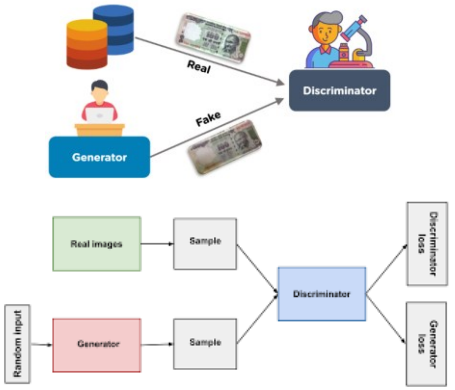


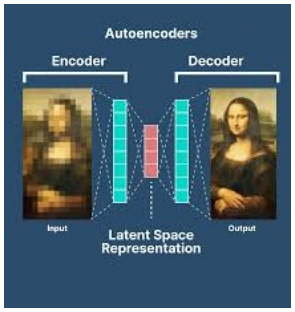


Types of generative AI models

- Generative Adversarial Networks (GANs)
- Variational Autoencoders (VAEs)
- Autoregressive Models
- Recurrent Neural Networks (RNNs)
- Transformer-based Models
- Reinforcement Learning for Generative Tasks
- Generative AI for Data Privacy, Security and Governance.

Types of generative AI models



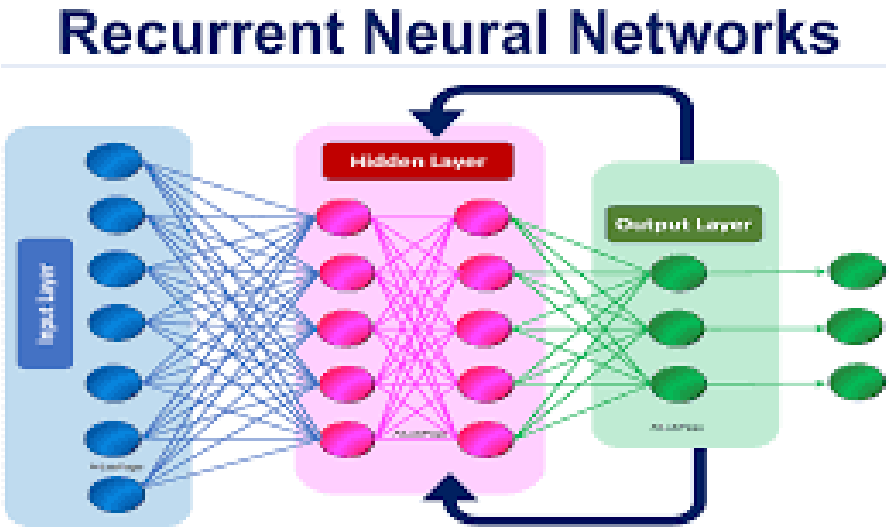


$$y_t = c + \sum_{i=1}^{p} a_{t-i} y_{y-i} + e_t$$

- Generative Adversarial Networks (GANs):
  - a **generator** and a **discriminator** are trained simultaneously through adversarial training.
- Variational Autoencoders (VAEs):
  - learn a probabilistic mapping from the observed data to a latent space.
  - Good to generate new samples from the learned latent space.
- Autoregressive Models:
  - the probability distribution of the next value in a sequence depends on the previous values.

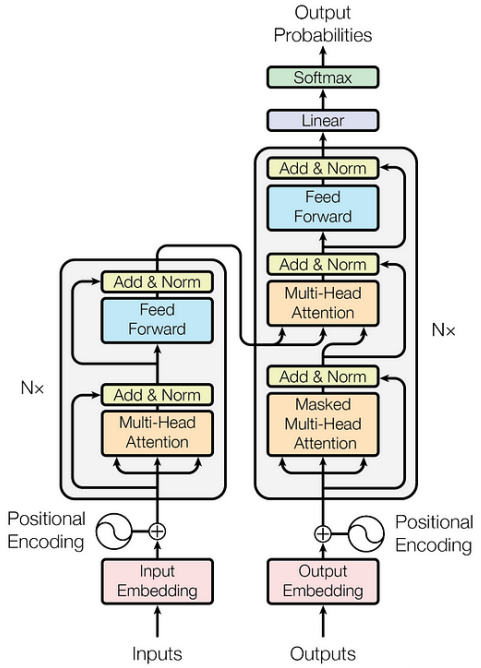
Types of generative AI models

- Recurrent Neural Networks (RNNs):
  - RNNs are commonly used for sequence tasks, including some generative tasks, they are not exclusively generative models.
  - Variants like **LSTM** and GRU are popular choices.
- Transformer-based Models:
  - Transformers, especially large language models.
- Reinforcement Learning for Generative Tasks:
  - can be used in conjunction with generative models, and this combination is powerful in scenarios where the generative model needs to produce sequences or structures guided by a reward signal.



BERT

Encoder

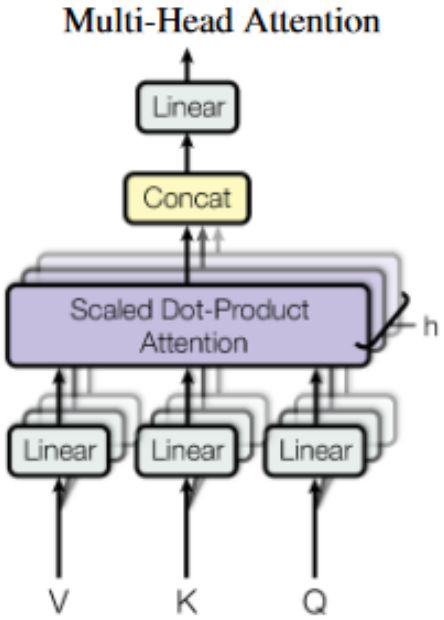


GPT

Decoder

Transformer

- Deep learning architecture based on the multi-head attention mechanism





Attention Is All You Need

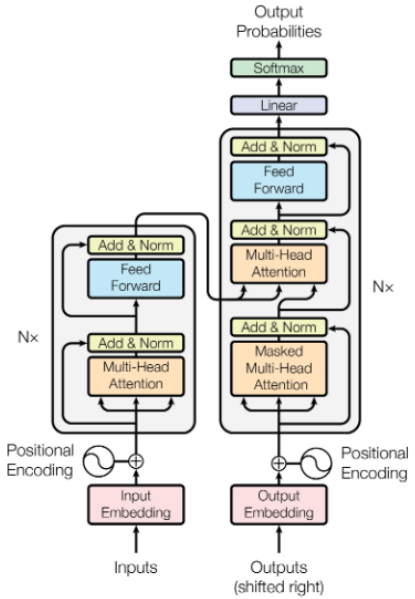
Ashish Vaswani* Google Brain avaswani@google.com
Noam Shazeer* Google Brain noam@google.com
Niki Parmar* Google Research nikip@google.com
Jakob Uszkoreit* Google Research usz@google.com
Llion Jones* Google Research llion@google.com
Aidan N. Gomez* † University of Toronto aidan@cs.toronto.edu
Łukasz Kaiser* Google Brain lukaszkaiser@google.com
Illia Polosukhin* ‡ illia.polosukhin@gmail.com

Abstract

The dominant sequence transduction models are based on complex recurrent or convolutional neural networks that include an encoder and a decoder. The best performing models also connect the encoder and decoder through an attention mechanism. We propose a new simple network architecture, the Transformer, based solely on attention mechanisms, dispensing with recurrence and convolutions entirely. Experiments on two machine translation tasks show these models to be superior in quality while being more parallelizable and requiring significantly less time to train. Our model achieves 28.4 BLEU on the WMT 2014 English-to-German translation task, improving over the existing best results, including ensembles, by over 2 BLEU. On the WMT 2014 English-to-French translation task, our model establishes a new single-model state-of-the-art BLEU score of 41.0 after training for 3.5 days on eight GPUs, a small fraction of the training costs of the best models from the literature.

1 Introduction

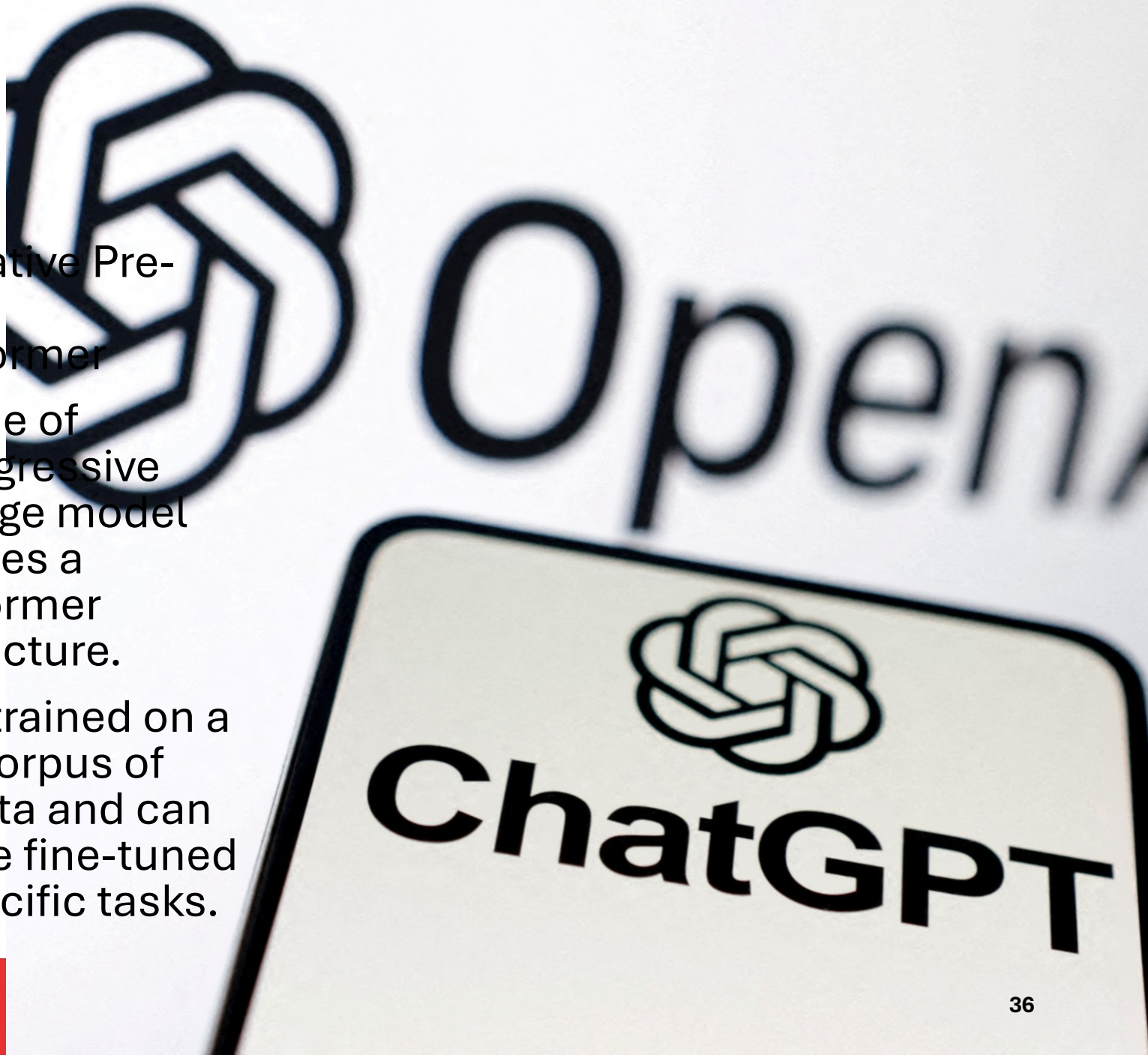
Recurrent neural networks, long short-term memory [12] and gated recurrent [7] neural networks in particular, have been firmly established as state of the art approaches in sequence modeling and transduction problems such as language modeling and machine translation [29, 2, 5]. Numerous efforts have since continued to push the boundaries of recurrent language models and encoder-decoder architectures [31, 21, 13].



Vaswani, et al. (2017)

GPT

- Generative Pre-trained Transformer
- Is a type of autoregressive language model that uses a transformer architecture.
- Is pre-trained on a large corpus of text data and can then be fine-tuned for specific tasks.





Feature	LaMDA	PaLM	Gemini
Release Date	2021	2022	December 2023
Focus	Conversational AI	General-purpose	Multimodal
Strengths	Realistic dialogue	Large & diverse dataset	Understanding & processing various data formats
Successor	Gemini/ PaLM	Gemini	N/A

Google Gemini

Bard is a conversational AI chatbot powered by a combination of generative AI techniques, including:

- **Transformer-based models:**
  - Google's Pathways Language Model (PaLM) is used to generate text that is fluent, coherent, and grammatically correct.
- **Autoregressive models**
  - to predict the next word in a sequence, which helps to ensure that its responses are natural and engaging.
- **Reinforcement learning:**
  - it is rewarded for generating responses that are informative, comprehensive, and relevant to the user's query.

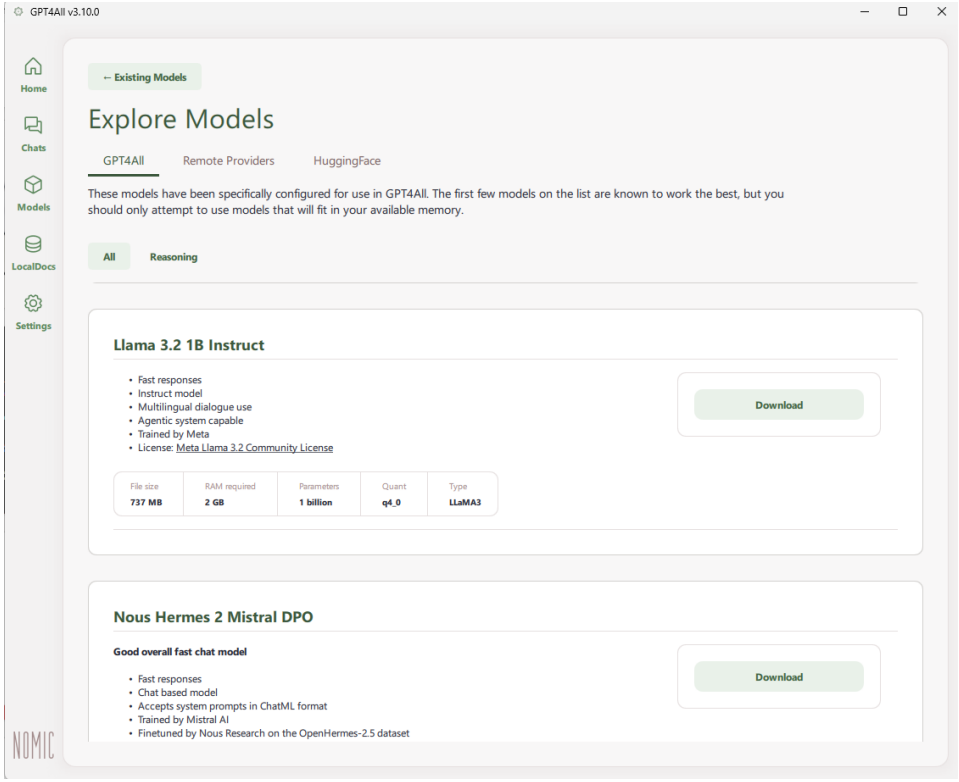
RAG

- retrieval-augmented generation
- is an AI framework for retrieving facts from an external knowledge base to ground large language models (LLMs) on the most accurate, up-to-date information and to give users insight into LLMs' generative process

Source: IBM

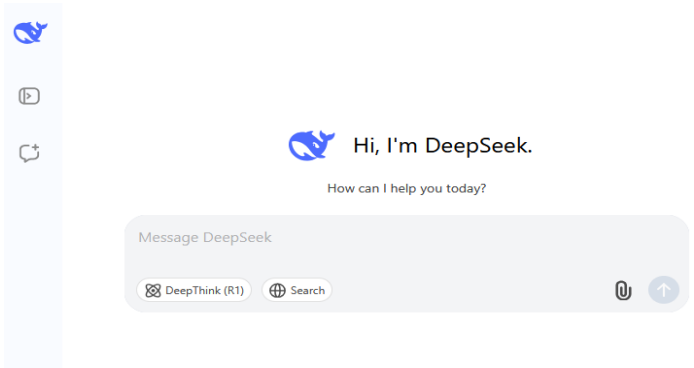
Your Own LLM locally

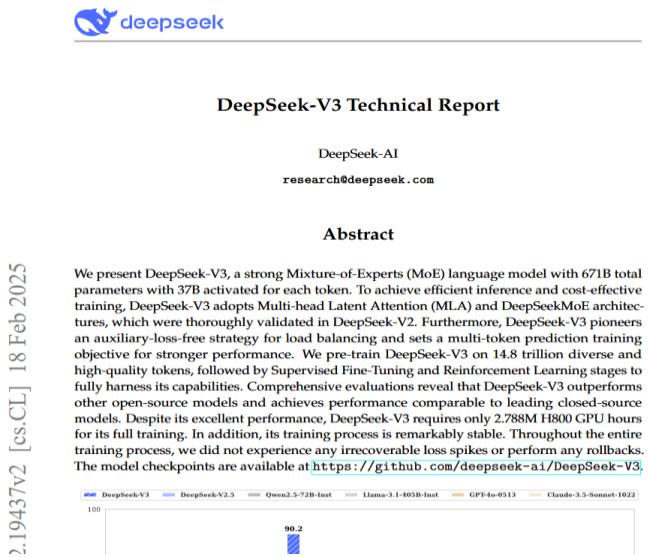
gpt4all



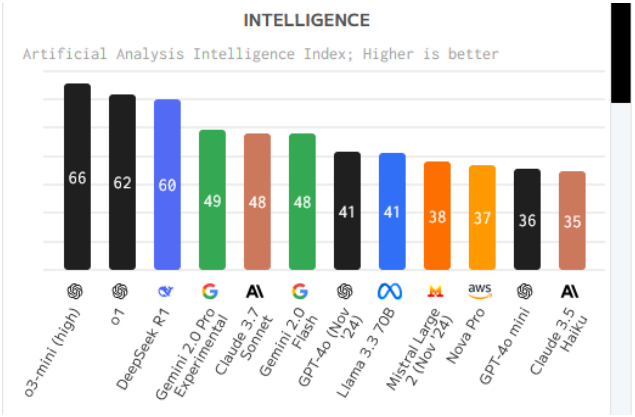
DeepSeek

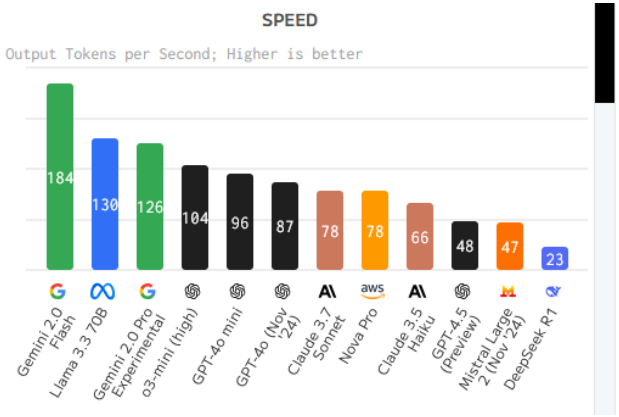
- Founded by Liang Wenfeng
- Headquarters: Hangzhou, Zhejiang, China
- iu, A., Feng, B., Xue, B., Wang, B., Wu, B., Lu, C., ... & Piao, Y. (2024). Deepseek-v3 technical report. *arXiv preprint arXiv:2412.19437*.

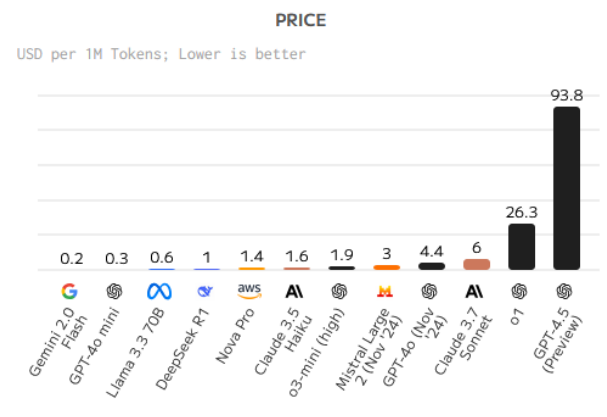




Comparing Models





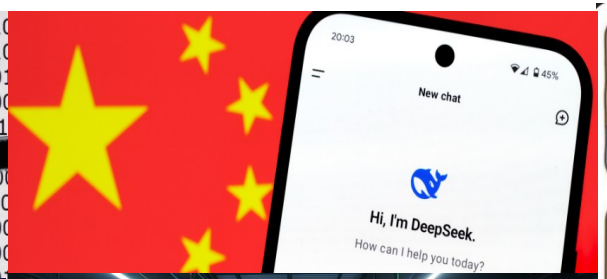


- https://artificialanalysis.ai/

Some issues...

- Hidden costs
- Ethical control vs. Political censorship
- Corporations or government are stealing data?
- Bad practices











AI Agents

- **Custom GPT-style Chatbots**
- **Specialized Virtual Assistants**
- **AI Agents**

Custom GPT-style Chatbots

- Tailored configurations of a standard LLM that follow strict **system instructions** and use **Retrieval-Augmented Generation (RAG)** to restrict their knowledge to specific uploaded documents (like a school's internal policy manual).
- They remain purely reactive, waiting for a user prompt to generate text.

Specialized Virtual Assistants

- AI tools built to solve a niche industry workflow or narrow task.
- In education, this is an assistant specifically optimized to act as a **lesson planner, grading co-pilot, or personal tutor**, combining specialized knowledge bases with pre-defined conversational scripts

AI Agents

- Autonomous entities driven by an LLM loop that can break down a complex, high-level goal into a series of **independent sub-tasks**.
- They observe their environment, create a plan, choose external tools (like a calculator, web browser, or file system), execute actions, and self-correct their errors without human intervention at every step.

Custom GPT-style Chatbots/Specialized Virtual Assistants vs AI Agents

Layer	Custom GPT & Virtual Assistants	AI Agents
Brain / Reasoning	Base LLMs (e.g., GPT-4o, Claude 3.5 Sonnet) responding directly to a single prompt.	Advanced reasoning LLMs (e.g., OpenAI o1/o3 series) running in a Reasoning Loop (ReAct framework).
Data Storage	Vector databases (Pinecone, Chroma) for fetching context from static files.	Short-term In-context Memory (chat history) + Long-term Graph Databases to track task states over hours or days.
Action & Execution	None (Text output only).	Tool Calling APIs allowing the AI to run Python code, search the live web, or send API requests to external apps.
Orchestration	Simple RAG pipelines built with LlamaIndex or LangChain.	Multi-Agent Orchestration Frameworks like LangGraph, Microsoft AutoGen, or CrewAI that let agents debate and review each other's work.

WAIM Workshop on Artificial Intelligence and Management

- Social and Economic Impact of AI
- AI and Finances
- AI Maturity
- Digital Transformation and AI
- Robotic Process Automation
- AI Users
- AI and Communication
- Ai and Ethics
- AI Democratization











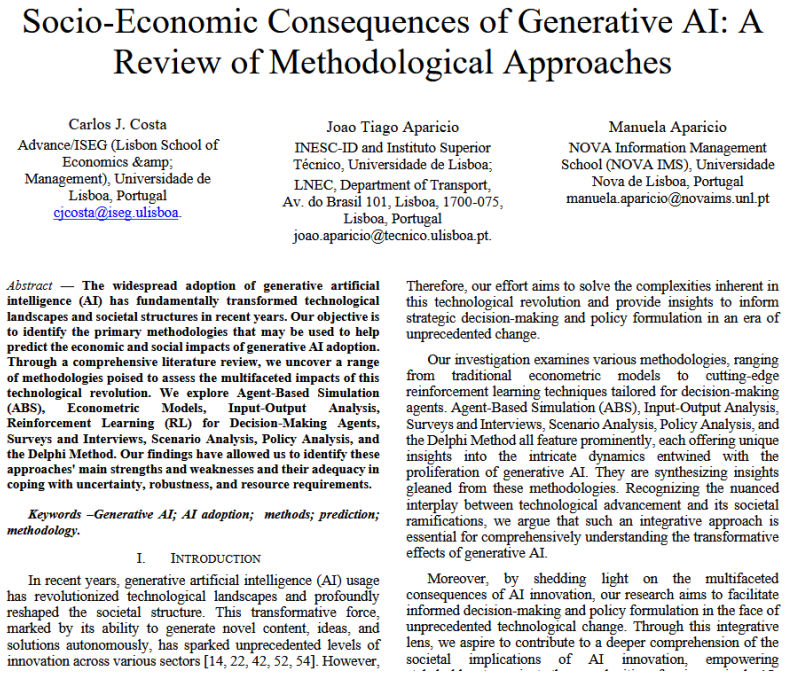






Social and Economic Impact of AI

- Increase Unemployment?
- Increase Employment?
- Several techniques may be used to help predicting and deciding



Socio-Economic Consequences of Generative AI: A Review of Methodological Approaches

Carlos J. Costa
Advance/ISEG (Lisbon School of Economics & Management), Universidade de Lisboa, Portugal
cjcosta@iseg.ulisboa.

Joao Tiago Aparicio
INESC-ID and Instituto Superior Técnico, Universidade de Lisboa; LNEC, Department of Transport, Av. do Brasil 101, Lisboa, 1700-075, Lisboa, Portugal
joao.aparicio@tecnico.ulisboa.pt.

Manuela Aparicio
NOVA Information Management School (NOVA IMS), Universidade Nova de Lisboa, Portugal
manuela.aparicio@novaims.unl.pt

Abstract — **The widespread adoption of generative artificial intelligence (AI) has fundamentally transformed technological landscapes and societal structures in recent years. Our objective is to identify the primary methodologies that may be used to help predict the economic and social impacts of generative AI adoption. Through a comprehensive literature review, we uncover a range of methodologies poised to assess the multifaceted impacts of this technological revolution. We explore Agent-Based Simulation (ABS), Econometric Models, Input-Output Analysis, Reinforcement Learning (RL) for Decision-Making Agents, Surveys and Interviews, Scenario Analysis, Policy Analysis, and the Delphi Method. Our findings have allowed us to identify these approaches' main strengths and weaknesses and their adequacy in coping with uncertainty, robustness, and resource requirements.**

Keywords –Generative AI; AI adoption; methods; prediction; methodology.

I. INTRODUCTION

In recent years, generative artificial intelligence (AI) usage has revolutionized technological landscapes and profoundly reshaped the societal structure. This transformative force, marked by its ability to generate novel content, ideas, and solutions autonomously, has sparked unprecedented levels of innovation across various sectors [14, 22, 42, 52, 54]. However, Therefore, our effort aims to solve the complexities inherent in this technological revolution and provide insights to inform strategic decision-making and policy formulation in an era of unprecedented change.

Our investigation examines various methodologies, ranging from traditional econometric models to cutting-edge reinforcement learning techniques tailored for decision-making agents. Agent-Based Simulation (ABS), Input-Output Analysis, Surveys and Interviews, Scenario Analysis, Policy Analysis, and the Delphi Method all feature prominently, each offering unique insights into the intricate dynamics entwined with the proliferation of generative AI. They are synthesizing insights gleaned from these methodologies. Recognizing the nuanced interplay between technological advancement and its societal ramifications, we argue that such an integrative approach is essential for comprehensively understanding the transformative effects of generative AI.

Moreover, by shedding light on the multifaceted consequences of AI innovation, our research aims to facilitate informed decision-making and policy formulation in the face of unprecedented technological change. Through this integrative lens, we aspire to contribute to a deeper comprehension of the societal implications of AI innovation, empowering

- Costa, C. J., Aparicio, J. T., & Aparicio, M. (2024). Socio-Economic Consequences of Generative AI: A Review of Methodological Approaches. *arXiv preprint arXiv:2411.09313*.

Future Scenarios

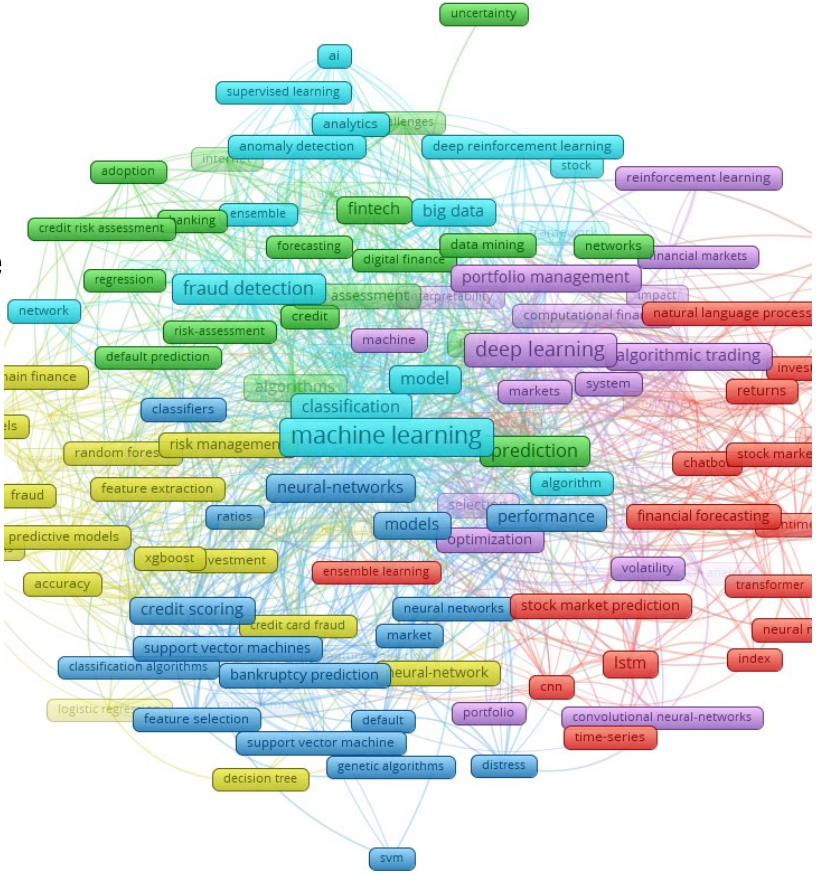
- AI Scenarios

Scenarios / Dimensions	AI and Digital Education	Renewable Energy and Sustainability	Financial Markets and Fintech
Scenario 1: Optimistic Future	Rapid advancements	Rapid transition to renewables	Stable markets, fintech growth
Scenario 2: Technological Stagnation	Slow progress	Moderate renewable adoption	Market volatility
Scenario 3: Sustainability Focus	Moderate progress	High investment in renewables	Stable markets, green finance
Scenario 4: Economic Downturn	Limited funding	Low investment in renewables	Market decline

- Bibliographic dataset
- Topic Model
- Classification
- Impact Uncertinty Matrix

AI and Finance

- Widespread use:
  - Fraud Detection and Risk Management:
  - Credit Scoring and Financial Inclusion
  - Investment & Portfolio Manageme
  - Customer Service
  - Algorithmic Trading
  - Regulatory Compliance & Automation
- Challenges:
  - Data Quality and Bias
  - Regulatory Compliance
  - Integration with Legacy Systems
  - Ethical and Privacy Concerns



What's your company's AI maturity level?

Four Stages of Enterprise AI Maturity

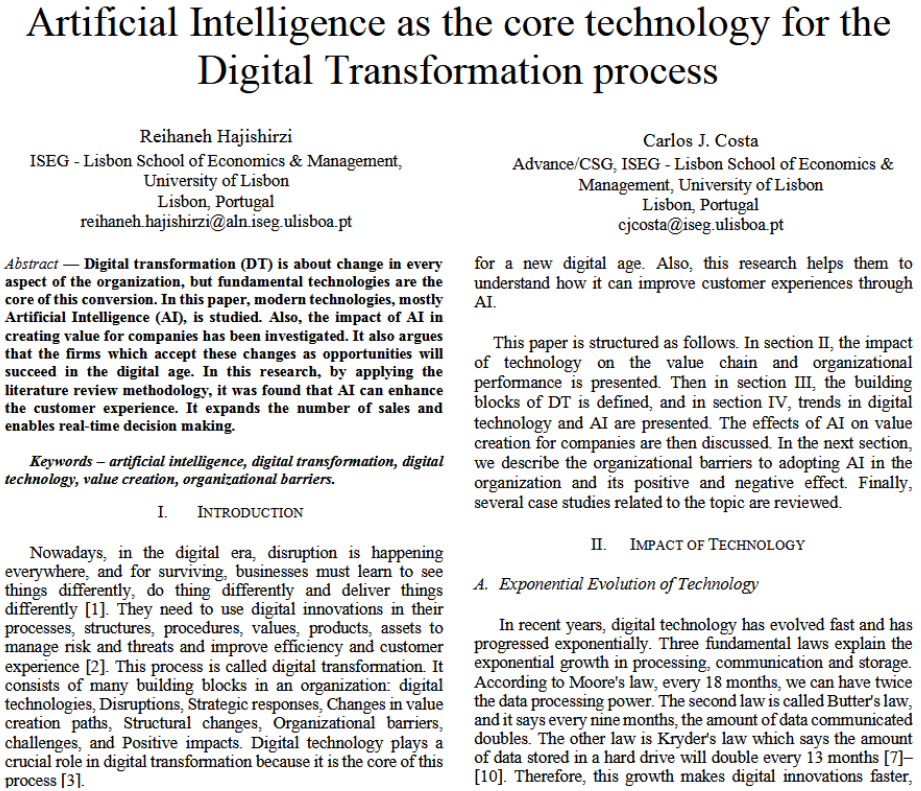
AI STAGE	Experiment and prepare	Build pilots and capabilities	Develop AI ways of working	Become AI future-ready
PERCENTAGE OF FIRMS	28%	34%	31%	7%
ATTRIBUTES	• Educating the workforce on AI • Setting up acceptable-use policies • Working on making data accessible • Ensuring that decision-making uses data • Identifying where humans need to be in the loop	• Beginning to simplify and automate processes • Creating use cases • Sharing data via APIs • Leveraging a coach-and-communicate management style • Using LLMs – both out-of-the-box traditional and generative AI models – to augment work	• Expanding process automation efforts • Changing to a more test-and-learn way of working • Architecting for reuse • Incorporating pretrained models into work and investigating the use of proprietary AI models • Exploring autonomous agents	• Embedding AI into decision-making and processes • Creating and selling AI-augmented business services • Combining traditional, generative, agentic, and robotic AI
FOCUS	Exploration and education	Business cases and pilots	Scaling AI platforms and dashboards	Continuous innovation and new revenue streams

© MIT CISR 2024. Source: MIT CISR 2022 Future Ready Survey (N=721) and interviews in 2024 with 16 executives at nine enterprises. Respondents were grouped into four stages using a measure of Total AI Effectiveness, the equally weighted combination of three measures: effectiveness of AI to (i) improve operations, (ii) improve customer experience, and (iii) support and develop the ecosystem. On a 0%–100% scale of Total AI Effectiveness, Stage 1 AI Capability=0%–49%, Stage 2=50%–74%, Stage 3=75%–99%, Stage 4=100%.

MIT MANAGEMENT SLOAN SCHOOL

Digital Transformation and AI

- Machine learning
- Deep learning
- NLP
- Improve competitive advantage
  - Effectiveness
  - Efficiency
- Improve organization



Artificial Intelligence as the core technology for the Digital Transformation process

Reihaneh Hajishirzi
ISEG - Lisbon School of Economics & Management, University of Lisbon
Lisbon, Portugal
reihaneh.hajishirzi@aln.iseg.ulisboa.pt

Carlos J. Costa
Advance/CSG, ISEG - Lisbon School of Economics & Management, University of Lisbon
Lisbon, Portugal
cjcosta@iseg.ulisboa.pt

Abstract — **Digital transformation (DT) is about change in every aspect of the organization, but fundamental technologies are the core of this conversion. In this paper, modern technologies, mostly Artificial Intelligence (AI), is studied. Also, the impact of AI in creating value for companies has been investigated. It also argues that the firms which accept these changes as opportunities will succeed in the digital age. In this research, by applying the literature review methodology, it was found that AI can enhance the customer experience. It expands the number of sales and enables real-time decision making.**

Keywords – artificial intelligence, digital transformation, digital technology, value creation, organizational barriers.

I. INTRODUCTION

Nowadays, in the digital era, disruption is happening everywhere, and for surviving, businesses must learn to see things differently, do thing differently and deliver things differently [1]. They need to use digital innovations in their processes, structures, procedures, values, products, assets to manage risk and threats and improve efficiency and customer experience [2]. This process is called digital transformation. It consists of many building blocks in an organization: digital technologies, Disruptions, Strategic responses, Changes in value creation paths, Structural changes, Organizational barriers, challenges, and Positive impacts. Digital technology plays a crucial role in digital transformation because it is the core of this process [3].

for a new digital age. Also, this research helps them to understand how it can improve customer experiences through AI.

This paper is structured as follows. In section II, the impact of technology on the value chain and organizational performance is presented. Then in section III, the building blocks of DT is defined, and in section IV, trends in digital technology and AI are presented. The effects of AI on value creation for companies are then discussed. In the next section, we describe the organizational barriers to adopting AI in the organization and its positive and negative effect. Finally, several case studies related to the topic are reviewed.

II. IMPACT OF TECHNOLOGY

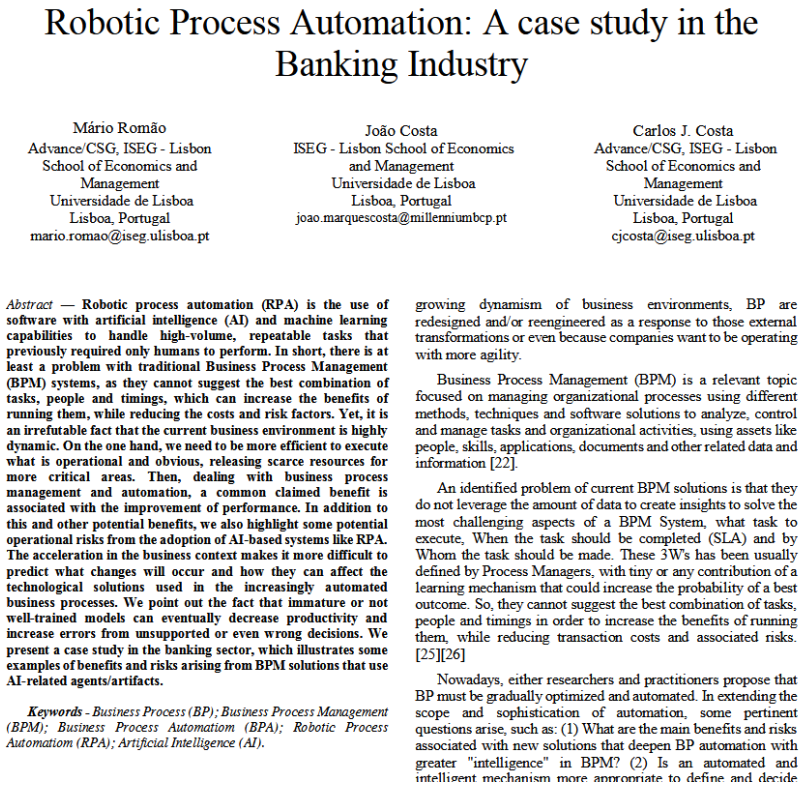
A. Exponential Evolution of Technology

In recent years, digital technology has evolved fast and has progressed exponentially. Three fundamental laws explain the exponential growth in processing, communication and storage. According to Moore's law, every 18 months, we can have twice the data processing power. The second law is called Butter's law, and it says every nine months, the amount of data communicated doubles. The other law is Kryder's law which says the amount of data stored in a hard drive will double every 13 months [7]–[10]. Therefore, this growth makes digital innovations faster,

- Hajishirzi, R., & Costa, C. J. (2021, June). Artificial Intelligence as the core technology for the Digital Transformation process. In *2021 16th Iberian Conference on Information Systems and Technologies (CISTI)* (pp. 1-6). IEEE..

Robotic Process Automation

- RPA is not AI
- RPA may be integrated with AI
- AI may help redesign processes



Robotic Process Automation: A case study in the Banking Industry

Mário Romão
Advance/CSG, ISEG - Lisbon School of Economics and Management
Universidade de Lisboa
Lisboa, Portugal
mario.romao@iseg.ulisboa.pt

João Costa
ISEG - Lisbon School of Economics and Management
Universidade de Lisboa
Lisboa, Portugal
joao.marquescosta@millenniumbcp.pt

Carlos J. Costa
Advance/CSG, ISEG - Lisbon School of Economics and Management
Universidade de Lisboa
Lisboa, Portugal
cjcosta@iseg.ulisboa.pt

Abstract — **Robotic process automation (RPA) is the use of software with artificial intelligence (AI) and machine learning capabilities to handle high-volume, repeatable tasks that previously required only humans to perform. In short, there is at least a problem with traditional Business Process Management (BPM) systems, as they cannot suggest the best combination of tasks, people and timings, which can increase the benefits of running them, while reducing the costs and risk factors. Yet, it is an irrefutable fact that the current business environment is highly dynamic. On the one hand, we need to be more efficient to execute what is operational and obvious, releasing scarce resources for more critical areas. Then, dealing with business process management and automation, a common claimed benefit is associated with the improvement of performance. In addition to this and other potential benefits, we also highlight some potential operational risks from the adoption of AI-based systems like RPA. The acceleration in the business context makes it more difficult to predict what changes will occur and how they can affect the technological solutions used in the increasingly automated business processes. We point out the fact that immature or not well-trained models can eventually decrease productivity and increase errors from unsupported or even wrong decisions. We present a case study in the banking sector, which illustrates some examples of benefits and risks arising from BPM solutions that use AI-related agents/artifacts.**

Keywords *- Business Process (BP); Business Process Management (BPM); Business Process Automatiom (BPA); Robotic Process Automatiom (RPA); Artificial Intelligence (AI).*

growing dynamism of business environments, BP are redesigned and/or reengineered as a response to those external transformations or even because companies want to be operating with more agility.

Business Process Management (BPM) is a relevant topic focused on managing organizational processes using different methods, techniques and software solutions to analyze, control and manage tasks and organizational activities, using assets like people, skills, applications, documents and other related data and information [22].

An identified problem of current BPM solutions is that they do not leverage the amount of data to create insights to solve the most challenging aspects of a BPM System, what task to execute, When the task should be completed (SLA) and by Whom the task should be made. These 3Ws has been usually defined by Process Managers, with tiny or any contribution of a learning mechanism that could increase the probability of a best outcome. So, they cannot suggest the best combination of tasks, people and timings in order to increase the benefits of running them, while reducing transaction costs and associated risks. [25][26]

Nowadays, either researchers and practitioners propose that BP must be gradually optimized and automated. In extending the scope and sophistication of automation, some pertinent questions arise, such as: (1) What are the main benefits and risks associated with new solutions that deepen BP automation with greater "intelligence" in BPM? (2) Is an automated and intelligent mechanism more appropriate to define and decide

- Romao, M., Costa, J., & Costa, C. J. (2019, June). Robotic process automation: A case study in the banking industry. In *2019 14th Iberian Conference on information systems and technologies (CISTI)* (pp. 1-6). IEEE.
- Ortiz, F. C. M., & Costa, C. J. (2020, June). RPA in Finance: supporting portfolio management: Applying a software robot in a portfolio optimization problem. In 2020 15th Iberian Conference on Information Systems and Technologies (CISTI) (pp. 1-6). IEEE.

Type of AI User

- Important Identify di
  type of users (HR, MI
- Not all the users are
  - React
  - Fit
  - Champion
  - Addicted
  - Successful
  - loose

AI User Archetype Model

Carlos J. Costa [1[0000-0002-1037-0561]]

[1] ISEG, Universidade de Lisboa, Lisboa, Portugal
[2] cjcosta@iseg.ulisboa.pt

Abstract. The rapid development of AI technologies has resulted in diverse interactions between users and AI systems. This paper introduces an AI User Archetype Model, classifying users based on their AI literacy, engagement levels, motivations, and governance. The model provides a structured approach to understanding users' behavior, enabling the design of AI systems that align with user needs and enhance AI democratization. The archetypes include The Sage, The Warrior, The Creator, The Producer, and others, each representing a unique combination of these dimensions. This model can be used to optimize AI product design, inform AI education strategies, and guide policy-making for more inclusive AI development.

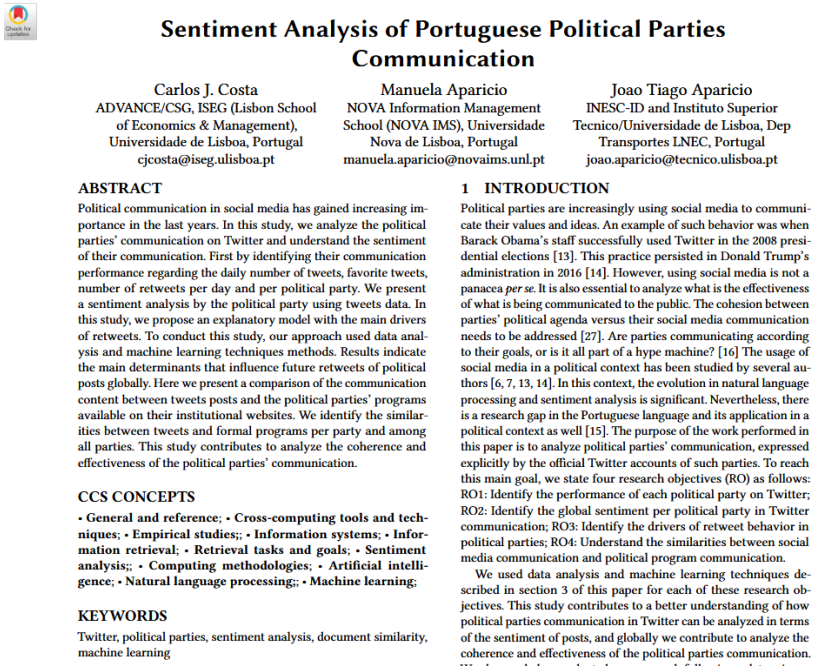
Keywords: Artificial Intelligence, Gamification, GenAI, .User Archetype

1 Introduction

There is a need to explore AI users, why they interact with AI daily, and how AI technologies have resigned themselves. There are user systems developed for AI thinkability-around-and-user engagement. Thus, fully understanding their differences would be instrumental in delivering AI systems that suit user needs and broaden their basis. Further reflections on this attempt to characterize the AI user elucidate their engagement with AI systems. Besides, it explores in detail the most dominant dimensions of user engagement with AI, indicating how users relate and interact with these technologies. The research reported in this paper aims to illuminate a particular model that categorizes AI users based on their literacy, engagement, motivations, and governance while establishing a comprehensive and broad-source framework for user-centered AI design. The methodological approach consisted of a multidimensional analysis of AI users. The proposed factors are selected according to four main dimensions: AI literacy, level of engagement, motivation, and governance. User archetypes are formed from multidimensional analyses; this may lend itself well to the differences in users' relationships

AI and Communication

- What make messages more effective?
- Small messages
- Negative Sentiment



Sentiment Analysis of Portuguese Political Parties Communication

Carlos J. Costa
ADVANCE/CSG, ISEG (Lisbon School of Economics & Management), Universidade de Lisboa, Portugal
cjcosta@iseg.ulisboa.pt

Manuela Aparicio
NOVA Information Management School (NOVA IMS), Universidade Nova de Lisboa, Portugal
manuela.aparicio@novaims.unl.pt

Joao Tiago Aparicio
INESC-ID and Instituto Superior Tecnico/Universidade de Lisboa, Dep Transportes LNEC, Portugal
joao.aparicio@tecnico.ulisboa.pt

ABSTRACT

Political communication in social media has gained increasing importance in the last years. In this study, we analyze the political parties' communication on Twitter and understand the sentiment of their communication. First by identifying their communication performance regarding the daily number of tweets, favorite tweets, number of retweets per day and per political party. We present a sentiment analysis by the political party using tweets data. In this study, we propose an explanatory model with the main drivers of retweets. To conduct this study, our approach used data analysis and machine learning techniques methods. Results indicate the main determinants that influence future retweets of political posts globally. Here we present a comparison of the communication content between tweets posts and the political parties' programs available on their institutional websites. We identify the similarities between tweets and formal programs per party and among all parties. This study contributes to analyze the coherence and effectiveness of the political parties' communication.

CCS CONCEPTS

• **General and reference**; • **Cross-computing tools and techniques**; • **Empirical studies;**; • **Information systems**; • **Information retrieval**; • **Retrieval tasks and goals**; • **Sentiment analysis;**; • **Computing methodologies**; • **Artificial intelligence**; • **Natural language processing;**; • **Machine learning**;

KEYWORDS

Twitter, political parties, sentiment analysis, document similarity, machine learning

1 INTRODUCTION

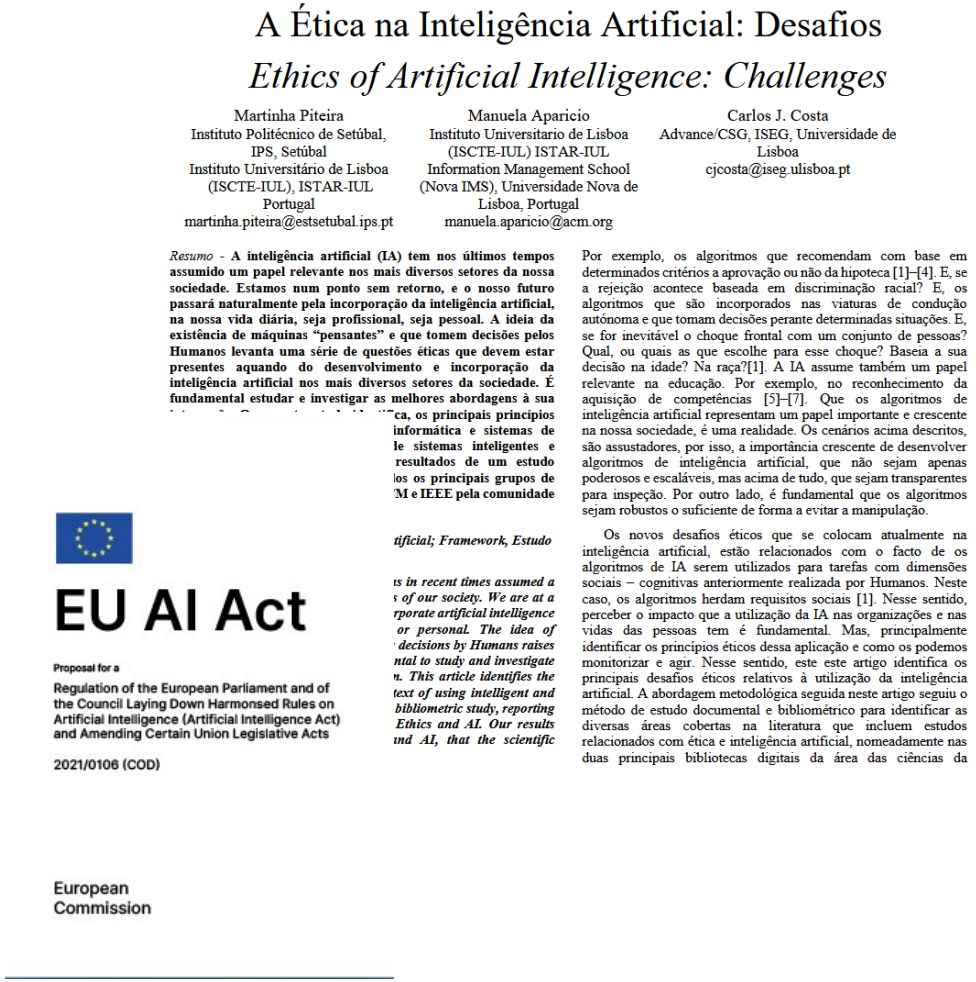
Political parties are increasingly using social media to communicate their values and ideas. An example of such behavior was when Barack Obama's staff successfully used Twitter in the 2008 presidential elections [13]. This practice persisted in Donald Trump's administration in 2016 [14]. However, using social media is not a panacea *per se*. It is also essential to analyze what is the effectiveness of what is being communicated to the public. The cohesion between parties' political agenda versus their social media communication needs to be addressed [27]. Are parties communicating according to their goals, or is it all part of a hype machine? [16] The usage of social media in a political context has been studied by several authors [6, 7, 13, 14]. In this context, the evolution in natural language processing and sentiment analysis is significant. Nevertheless, there is a research gap in the Portuguese language and its application in a political context as well [15]. The purpose of the work performed in this paper is to analyze political parties' communication, expressed explicitly by the official Twitter accounts of such parties. To reach this main goal, we state four research objectives (RO) as follows: RO1: Identify the performance of each political party on Twitter; RO2: Identify the global sentiment per political party in Twitter communication; RO3: Identify the drivers of retweet behavior in political parties; RO4: Understand the similarities between social media communication and political program communication.

We used data analysis and machine learning techniques described in section 3 of this paper for each of these research objectives. This study contributes to a better understanding of how political parties communication in Twitter can be analyzed in terms of the sentiment of posts, and globally we contribute to analyze the coherence and effectiveness of the political parties communication.

- Aparicio, J. T., de Sequeira, J. S., & Costa, C. J. (2021, June). Emotion analysis of Portuguese political parties communication over the COVID-19 pandemic. In *2021 16th Iberian Conference on Information Systems and Technologies (CISTI)* (pp. 1-6). IEEE
- Costa, C., Aparicio, M., & Aparicio, J. (2021, October). Sentiment analysis of Portuguese political parties communication. In *Proceedings of the 39th ACM international conference on design of communication* (pp. 63-69), ACM

Ai and Ethics

- ACM and IEEE have discussed proposals
- Robotics
- Privacy
- Responsibility
- Transparency
- AI Act
- REGULATION (EU) 2024/1689 OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 13 June 2024



A Ética na Inteligência Artificial: Desafios

Ethics of Artificial Intelligence: Challenges

Martinha Piteira
Instituto Politécnico de Setúbal, IPS, Setúbal
Instituto Universitário de Lisboa (ISCTE-IUL), ISTAR-IUL
Portugal
martinha.piteira@estsetubal.ips.pt

Manuela Aparicio
Instituto Universitario de Lisboa (ISCTE-IUL) ISTAR-IUL
Information Management School (Nova IMS), Universidade Nova de Lisboa, Portugal
manuela.aparicio@acm.org

Carlos J. Costa
Advance/CSG, ISEG, Universidade de Lisboa
cjcosta@iseg.ulisboa.pt

Resumo - **A inteligência artificial (IA) tem nos últimos tempos assumido um papel relevante nos mais diversos setores da nossa sociedade. Estamos num ponto sem retorno, e o nosso futuro passará naturalmente pela incorporação da inteligência artificial, na nossa vida diária, seja profissional, seja pessoal. A ideia da existência de máquinas "pensantes" e que tomem decisões pelos Humanos levanta uma série de questões éticas que devem estar presentes aquando do desenvolvimento e incorporação da inteligência artificial nos mais diversos setores da sociedade. É fundamental estudar e investigar as melhores abordagens à sua**

ca, os principais princípios informática e sistemas de le sistemas inteligentes e resultados de um estudo los os principais grupos de M e IEEE pela comunidade

Por exemplo, os algoritmos que recomendam com base em determinados critérios a aprovação ou não da hipoteca [1]–[4]. E, se a rejeição acontece baseada em discriminação racial? E, os algoritmos que são incorporados nas viaturas de condução autónoma e que tomam decisões perante determinadas situações. E, se for inevitável o choque frontal com um conjunto de pessoas? Qual, ou quais as que escolhe para esse choque? Baseia a sua decisão na idade? Na raça?[1]. A IA assume também um papel relevante na educação. Por exemplo, no reconhecimento da aquisição de competências [5]–[7]. Que os algoritmos de inteligência artificial representam um papel importante e crescente na nossa sociedade, é uma realidade. Os cenários acima descritos, são assustadores, por isso, a importância crescente de desenvolver algoritmos de inteligência artificial, que não sejam apenas poderosos e escaláveis, mas acima de tudo, que sejam transparentes para inspeção. Por outro lado, é fundamental que os algoritmos sejam robustos o suficiente de forma a evitar a manipulação.

Os novos desafios éticos que se colocam atualmente na inteligência artificial, estão relacionados com o facto de os algoritmos de IA serem utilizados para tarefas com dimensões sociais – cognitivas anteriormente realizada por Humanos. Neste caso, os algoritmos herdam requisitos sociais [1]. Nesse sentido, perceber o impacto que a utilização da IA nas organizações e nas vidas das pessoas tem é fundamental. Mas, principalmente identificar os princípios éticos dessa aplicação e como os podemos monitorizar e agir. Nesse sentido, este este artigo identifica os principais desafios éticos relativos à utilização da inteligência artificial. A abordagem metodológica seguida neste artigo seguiu o método de estudo documental e bibliométrico para identificar as diversas áreas cobertas na literatura que incluem estudos relacionados com ética e inteligência artificial, nomeadamente nas duas principais bibliotecas digitais da área das ciências da

tificial; Framework, Estudo

s in recent times assumed a s of our society. We are at a rporate artificial intelligence or personal. The idea of decisions by Humans raises ntal to study and investigate n. This article identifies the text of using intelligent and bibliometric study, reporting Ethics and AI. Our results nd AI, that the scientific

EU AI Act

Proposal for a

Regulation of the European Parliament and of the Council Laying Down Harmonsed Rules on Artificial Intelligence (Artificial Intelligence Act) and Amending Certain Union Legislative Acts

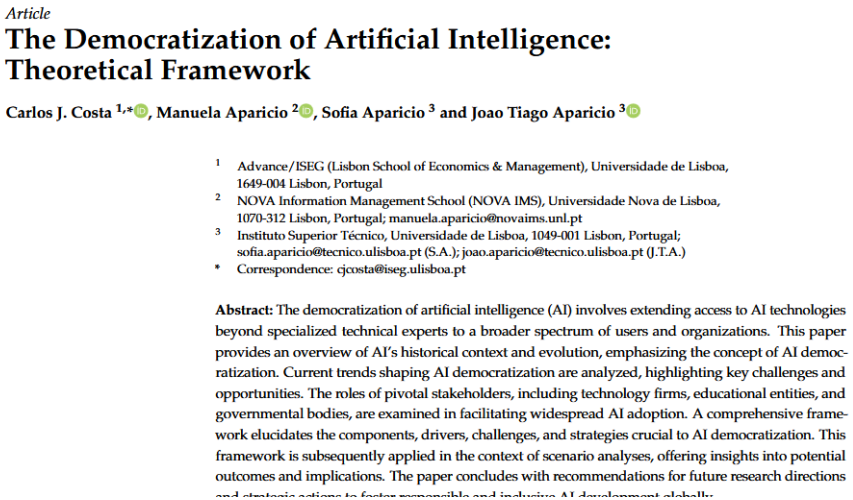
2021/0106 (COD)

European Commission

- Piteira, M., Aparicio, M., & Costa, C. J. (2019, June). Ethics of artificial intelligence: Challenges. In 2019 14th Iberian Conference on Information Systems and Technologies (CISTI) (pp. 1-6). IEEE.
- Veiga, M., & Costa, C. J. (2024). Ethics and Artificial Intelligence Adoption. *arXiv preprint arXiv:2412.00330*.

AI Democratization

- Access to all
- Distributed models
- Centralized models
- Personal models
- Governance



Article

The Democratization of Artificial Intelligence: Theoretical Framework

Carlos J. Costa [1,*], Manuela Aparicio [2], Sofia Aparicio [3] and Joao Tiago Aparicio [3]

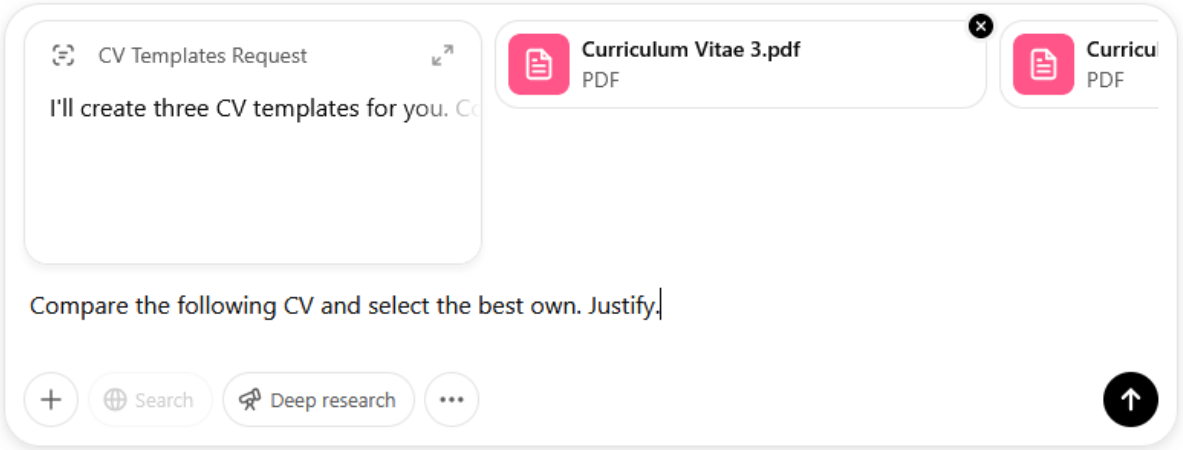
[1] Advance/ISEG (Lisbon School of Economics & Management), Universidade de Lisboa, 1649-004 Lisbon, Portugal
[2] NOVA Information Management School (NOVA IMS), Universidade Nova de Lisboa, 1070-312 Lisbon, Portugal; manuela.aparicio@novaims.unl.pt
[3] Instituto Superior Técnico, Universidade de Lisboa, 1049-001 Lisbon, Portugal; sofia.aparicio@tecnico.ulisboa.pt (S.A.); joao.aparicio@tecnico.ulisboa.pt (J.T.A.)
* Correspondence: cjcosta@iseg.ulisboa.pt

Abstract: The democratization of artificial intelligence (AI) involves extending access to AI technologies beyond specialized technical experts to a broader spectrum of users and organizations. This paper provides an overview of AI's historical context and evolution, emphasizing the concept of AI democratization. Current trends shaping AI democratization are analyzed, highlighting key challenges and opportunities. The roles of pivotal stakeholders, including technology firms, educational entities, and governmental bodies, are examined in facilitating widespread AI adoption. A comprehensive framework elucidates the components, drivers, challenges, and strategies crucial to AI democratization. This framework is subsequently applied in the context of scenario analyses, offering insights into potential outcomes and implications. The paper concludes with recommendations for future research directions

- Costa, C. J., Aparicio, M., Aparicio, S., & Aparicio, J. T. (2024). The Democratization of Artificial Intelligence: Theoretical Framework. *Applied Sciences*, *14*(18), 8236. https://doi.org/10.3390/app14188236

Use cases

- Choosing the right CV
- Churn
- Best prescription
- Sentiment analysis
- Business Strategy & Decision-Making
- Economic Analysis & Policy Recommendations
- Market Research & Consumer Behavior
- Operations & Supply Chain Management
- Game Theory & Strategic Interaction
- Data-Driven Decision-Making



Final Selection

- If you need a strong leader for **branch management and compliance** → **John Anderson (CV 1)**
- If the role is **customer-focused with wealth management expertise** → **Maria Gonzalez (CV 2)**
- If the role involves **fintech, digital transformation, and data analytics** → **David Patel (CV 3)**

Would you like a revised CV template based on any of these profiles?

Churn

age	address	income	ed	employ	equip	callcard	wireless	churn
33.0	7.0	136.0	5.0	5.0	0.0	1.0	1.0	Yes
33.0	12.0	33.0	2.0	0.0	0.0	0.0	0.0	Yes
30.0	9.0	30.0	1.0	2.0	0.0	0.0	0.0	No
35.0	5.0	76.0	2.0	10.0	1.0	1.0	1.0	No

age	address	income	ed	employ	equip	callcard	wireless	churn
35.0	5.0	76.0	2.0	10.0	1.0	1.0	1.0	No
35.0	14.0	80.0	2.0	15.0	0.0	1.0	0.0	?



Best prescription

Age	Sex	BP	Cholesterol	Na	K	Drug
23	F	HIGH	HIGH	0.793	0.031	drugY
47	M	LOW	HIGH	0.739	0.056	drugC
47	M	LOW	HIGH	0.697	0.069	drugC
28	F	NORMAL	HIGH	0.564	0.072	drugX
61	F	LOW	HIGH	0.559	0.031	drugY
22	F	NORMAL	HIGH	0.677	0.079	drugX
49	F	NORMAL	HIGH	0.79	0.049	drugY
41	M	LOW	HIGH	0.767	0.069	drugC
60	M	NORMAL	HIGH	0.777	0.051	drugY
43	M	LOW	NORMAL	0.526	0.027	drugY

Categorical Variable



Age	Sex	BP	Cholesterol	Na	K	Drug
36	F	LOW	HIGH	0.697	0.069	

Sentiment analysis

- You said:
- Analyze the sentiment of the following newspaper article written in portuguese: https://sustentix.sapo.pt/quais-as-principais-riquezas-da-gronelandia/?utm_source=SAPO_HP&utm_medium=web&utm_campaign=destaques
- ChatGPT said:
- O artigo "Porque é a Gronelândia cobiçada? A culpa é do degelo que dá acesso a ..." aborda a crescente atenção internacional sobre a Gronelândia devido ao aquecimento global, que está facilitando o acesso aos seus vastos recursos naturais. Com o degelo das camadas de gelo, tornam-se mais acessíveis depósitos de metais de terras raras, como neodímio, prasodímio, disprósio e térbio, além de minérios de ferro, ouro e rubi. Adicionalmente, há vastas reservas de gás e petróleo que podem ser exploradas.
- O artigo também destaca a importância geopolítica da região, mencionando o interesse dos Estados Unidos, que já abriram um consulado na Gronelândia e mantêm uma base aérea no norte da ilha. O degelo não só facilita a exploração de recursos, mas também abre novas rotas marítimas, o que pode alterar significativamente as dinâmicas comerciais e estratégicas globais.
- A análise do artigo revela um tom factual e informativo, apresentando dados e opiniões de especialistas sobre as oportunidades e desafios decorrentes das mudanças climáticas na Gronelândia. Embora o texto aborde as potencialidades econômicas e estratégicas, também sugere uma preocupação subjacente com as implicações ambientais e geopolíticas associadas ao degelo e à exploração dos recursos naturais da região.
- You said:
- describe interns of positive or negative sentiment.
- ChatGPT said:
- The sentiment of the article is neutral to slightly negative.
- Neutral aspects: The article presents a factual and informative perspective on the natural resources of Greenland and the geopolitical interest in the region. It discusses the economic and strategic opportunities in a straightforward manner.
- Slightly negative aspects: The underlying concern about climate change and the environmental consequences of the melting ice adds a negative tone. While the economic potential is highlighted, the mention of geopolitical tensions and environmental impact suggests a cautious or critical perspective.
- Overall, the article does not express strong positivity or negativity but leans slightly negative due to concerns about climate change and resource exploitation.

Business Strategy & Decision-Making

Usage: Analyzing competitive strategies and decision-making frameworks.

Prompt:

"Compare the competitive strategies of Porter's Five Forces and Blue Ocean Strategy, providing examples of companies that have successfully implemented them."

Economic Analysis & Policy Recommendations

Usage: Assessing economic policies and their implications.

Prompt:

- *"Analyze the potential economic impact of an increase in the minimum wage in the European Union. Discuss both short-term and long-term effects."*

Market Research & Consumer Behavior

Usage: Understanding consumer trends and behaviors.

Prompt:

- *"What are the main factors influencing consumer purchasing decisions in e-commerce, and how do companies use behavioral economics to increase sales?"*

Operations & Supply Chain Management

- **Usage: Optimizing supply chain efficiency.**
- **Prompt:**
- "Discuss how Just-in-Time (JIT) inventory management can improve efficiency and reduce costs in manufacturing. What are the risks associated with this approach?"

Game Theory & Strategic Interaction

Usage: Applying game theory to business and economics.

Prompt:

- *"Explain the concept of the Nash Equilibrium in game theory. How does it apply to pricing strategies in oligopolistic markets?"*

Data-Driven Decision-Making

Usage: Using data for business insights.

Prompt:

- *"How can businesses use regression analysis to predict sales trends? Provide an example with key variables that should be considered."*

Summary

- Concepts: AI, ML, GenAI
- Research: AIM
- Use Cases: AI & GenAI

Bibliography

Aparicio, J. T., de Sequeira, J. S., & Costa, C. J. (2021). Emotion analysis of portuguese political parties communication over the covid-19 pandemic. In 2021 16th Iberian Conference on Information Systems and Technologies (CISTI) (pp. 1-6). IEEE.

Aparicio, J. T., Romao, M., & Costa, C. J. (2022). Predicting Bitcoin prices: The effect of interest rate, search on the internet, and energy prices. In 2022 17th Iberian Conference on Information Systems and Technologies (CISTI) (pp. 1-5). IEEE.

Aparicio, S., Aparicio, J. T., & Costa, C. J. (2019,). Data Science and AI: trends analysis. In 2019 14th Iberian Conference on Information Systems and Technologies (CISTI) (pp. 1-6). IEEE.

Arriaga, A., & Costa, C. J. (2023, May). Modeling and Predicting Daily COVID-19 (SARS-CoV-2) Mortality in Portugal: The Impact of the Daily Cases, Vaccination, and Daily Temperatures. In Proceedings of International Conference on Information Technology and Applications: ICITA 2022 (pp. 275-285). Singapore: Springer Nature Singapore.

Costa, C. J. (2023). Artificial Intelligence in Management: Enhancing Planning, Organization, Direction, and Control. *OAE – Organizational Architect and Engineer Journal*. https://doi.org/10.21428/b3658bca.b55ee6ae

Costa, C. J. (2024). Neural Networks: A Comprehensive Overview of Their History, Development, and Future in AI. *OAE – Organizational Architect and Engineer Journal*. https://doi.org/10.21428/b3658bca.13fccc0e

Costa, C. J. (2025). Introduction to Machine Learning. *OAE – Organizational Architect and Engineer Journal*. https://doi.org/10.21428/b3658bca.35c216ce

Costa, C. J., & Aparicio, J. T. (2020). POST-DS: A methodology to boost data science. In 2020 15th Iberian Conference on Information Systems and Technologies (CISTI) (pp. 1-6). IEEE.

Costa, C. J., & Aparicio, M. (2023). Applications of Data Science and Artificial Intelligence. Appl. Sci, 13, 9015.

Costa, C., Aparicio, M., & Aparicio, J. (2021). Sentiment analysis of portuguese political parties communication. In Proceedings of the 39th ACM International Conference on Design of Communication (pp. 63-69).

Costa, C. J., Aparicio, J. T., & Aparicio, M. (2024). Socio-Economic Consequences of Generative AI: A Review of Methodological Approaches. *arXiv preprint arXiv:2411.09313*

Costa, C. J., Aparicio, M., Aparicio, S., & Aparicio, J. T. (2024). The Democratization of Artificial Intelligence: Theoretical Framework. *Applied Sciences*, *14*(18), 8236. https://doi.org/10.3390/app14188236

Custódio, J. P. G., Costa, C. J., & Carvalho, J. P. (2020). Success prediction of leads–A machine learning approach. In 2020 15th Iberian Conference on Information Systems and Technologies (CISTI) (pp. 1-6). IEEE.

Hajishirzi, R., & Costa, C. J. (2021). Artificial Intelligence as the core technology for the Digital Transformation process. In 2021 16th Iberian Conference on Information Systems and Technologies (CISTI) (pp. 1-6). IEEE.

Ortiz, F. C. M., & Costa, C. J. (2020, June). RPA in Finance: supporting portfolio management: Applying a software robot in a portfolio optimization problem. In 2020 15th Iberian Conference on Information Systems and Technologies (CISTI) (pp. 1-6). IEEE.

Piteira, M., Aparicio, M., & Costa, C. J. (2019, June). Ethics of artificial intelligence: Challenges. In 2019 14th Iberian Conference on Information Systems and Technologies (CISTI) (pp. 1-6). IEEE.

Samadani, S., & Costa, C. J. (2021). Forecasting real estate prices in Portugal: A data science approach. In 2021 16th Iberian Conference on Information Systems and Technologies (CISTI) (pp. 1-6). IEEE.

Vaswani, A.; Shazeer, N.; Parmar, N. Uszkoreit, J.; Jones, L.; Gomez, A; Kaiser, Ł; Polosukhin, I (2017). "Attention is All you Need" Advances in Neural Information Processing Systems. Curran Associates, Inc. 30.

Veiga, M., & Costa, C. J. (2024). Ethics and Artificial Intelligence Adoption. *arXiv preprint arXiv:2412.00330*.


Q&A