DS Journal of Artificial Intelligence and Robotics
Volume 2 Issue 4, 1-15, Oct - Dec 2024
ISSN: 2583-9926 / https://doi.org/10.59232/AIR-V2I4P101

Review Article

The History of the Artificial Intelligence Revolution and the Nature of Generative AI Work

Ahmed Shaker Alalaq

University of Kufa, Iraq.

Ahmed.alallaq@uokufa.edu.iq

Received: 08 October 2024; Revised: 07 November 2024; Accepted: 01 December 2024; Published: 26 December 2024;

Abstract - Historians suggest that employing modern computer sciences to understand ancient history enables them to connect disparate historical record threads in previously unavailable ways. It also helps correct distortions resulting from studying historical events in isolation. However, relying on these technologies carries risks, such as the potential bias of machine learning algorithms or their falsification of the historical record. This raises a fundamental question for historians and others who believe in understanding the present through studying the past: to what extent should we entrust the past to machines as their role in shaping our future increases?. Discussing the history of AI requires us to scrutinize the scientific records and literature that have addressed such vital and intriguing topics. It also gives us an idea of how scientists and discoverers thought in ancient times and about the workings of the mechanisms and technical software that emerged early in the history of computer sciences. Research Problem: The study explores the history of AI development from ancient times until 2024 and the updates to computer science and technical software systems during those historical periods. It aims to highlight the key features of that historical era and compare them with the current technological revolution in artificial intelligence. Our world is witnessing a technological revolution in generative artificial intelligence, raising questions. These questions encompass ethical issues, intellectual property rights, and how laws can keep pace with this rapid development. These topics form the core of research into the history of the AI revolution. Study Boundaries: The study is limited to exploring the earliest origins of historical discoveries in the technical and digital revolution field up to 2024 and comparing those discoveries with what we have achieved today. Previous Studies: Our research relies on a set of scientific studies that have addressed the history of the technical revolution, with the most prominent of these studies being:

- Shalin (2024), generative AI and the Expansion of the Solitary Human Imagination. Advances in multimedia and interactive technologies book series, 172-197.
- Moor, J (2006), the Dartmouth College Artificial Intelligence Conference: The Next Fifty Years.
- arjian, Ron (2023), the history of artificial intelligence: Complete AI timeline.

Other studies have addressed the history of artificial intelligence technology. These studies have highlighted the significant historical events that accompanied this revolution. They were rigorous scientific studies that should be relied upon in crucial scientific research. All studies discuss social and economic impacts. There is a common interest in ethical and legal issues. What distinguishes our research:

- The unique combination of historical development and current reality.
- Specific focus on generative artificial intelligence.

What distinguishes other studies:

- In-depth analysis of technical aspects.
- Focus on specific sectors.

Recommendations:

- Add practical case studies.
- Expand the discussion on global regulations.
- Include future forecasts.

Keywords - Artificial Intelligence, History, Generative technology, Neurons, Generative intelligence, Computational technology.

1. Introduction

In our research, we relied on two methodologies. The first is the historical method, in which we detailed the history of the digital revolution and artificial intelligence based on solid scientific principles. We started from the 19th century, progressing through the 20th century (the 1940s and 1950s) to the 21st century, highlighting the advancements in AI technologies and applications over these years, culminating in the 2024 revolution.

In the second instance, we employed the descriptive approach to analyze the developing relationship between the AI revolution and the technical phenomena accompanying it, as well as their characteristics, forms, relationships, and influencing factors. This implies concentrating efforts on studying current processes and events while also trying to predict how these processes and events will evolve later. This method focuses on measuring the occurrence of a phenomenon or an event, be it over time or at a specific point in time, as a qualitative or quantitative variable to comprehensively understand the phenomenon or the event and draw conclusions and generalizations that foster realistic improvement.

2. The Early History of Digital Technology

The concept of artificial intelligence has its roots in ancient times. In her latest book, Adrienne Mayor, a researcher at Stanford University, delves into how ancient cultures envisioned future technologies and left behind these imaginative accounts in epics and sculptures. These tales, such as Ashoka's battles with robots, are found in epics like the Ramayana, Mahabharata, and other Hindu mythologies, where gods and sorceresses create realistic human-like robots. Similarly, in Greek mythology, Hephaestus, the god of technology, and Daedalus, the craftsman, created Talos, a giant moving warrior programmed to guard the island of Crete (Mijwel, 2015). While no one knows if it was actually created, machine learning and artificial intelligence have been contemplated for a long time (Saluja,2019).

Since the advent of AI, philosophical questions about its complexity have attracted attention from different philosophers. Prime philosophers like Aristotle, Saint Thomas Aquinas, William of Ockham, Rene Descartes, Thomas Hobbes, and Gottfried Wilhelm Leibniz have raised important questions such as: What are the most basic mental functions? What are the basic requirements for a formal worldview to be accurately and clearly painted with language? And is it possible for thought to be mechanized? These questions have opened doors for further arguments and inquiries in the development of artificial intelligence (Flasiński, 2016). These philosophical inquiries, which date back to ancient times, revolve around the possibility of creating machines that can think and behave like humans, performing tasks and activities with the same level of intelligence and autonomy

The origins of the first computer are often credited to Charles Babbage, who 1822 designed the "Difference Engine," a pioneering concept that laid the groundwork for modern computing. This early design was primarily paper-based (Andrzej et al., 2024). As the concept of the Difference Engine gained traction, scientists of the era began to envision the potential of computers and calculators. What was once a distant dream became a tangible reality as these machines were designed and brought to life, marking a significant turning point in the development of computing technology (Marquis et al., 2020). As technology began to permeate human life in the mid-20th century (Tableau, n.d.).

3. The Early Stage of AI Technologies

3.1. The 1940s and 1950s Period

Artificial neurons were developed by Warren McCullock and Walter Pitts in 1943, laying the grounds for creating an artificial intellgence model. In 1944, the authors J. Neumann and O. Morgenstern articulated the theory of decisions that gave formal and integrated ways of specifying agents' orders of preference. In 1949, Donald Hebb created the rule to change the weight of the connections between artificial neurons, making learning possible (Benko, 2009; Lányi). A book by computer scientist Edmund Callis Berkeley also appeared this year, called "Giant Brains, or Machines That Think," which compared contemporary computers to the human brain (Tableau, n.d.). It shows how all these theoretical leaps translate into real-world advancement that helped lay the foundations for many of the concepts and structures that would be developed in the coming decades (José, 2023).

Prior to 1949, computers were limited in their ability to demonstrate intelligence, as they could only execute commands but could not store them. In essence, computers could be instructed on what to do but could not recall their previous actions. Furthermore, computing was an extremely costly endeavor. The cost of renting a computer was a staggering $200,000 per month, making it inaccessible to all but the most prestigious universities and major technology companies. Funding sources could only be convinced of the value of pursuing AI research through proof of concept and advocacy by prominent figures (Anyoha, 2017).

1950 In 1950, British mathematician Alan Turing gave a revolutionary paper called "Computing Machinery and Intelligence", where he tried to answer the question of whether machines can be made to think like men and reason. This insightful paper inspired him to create the Turing Test, a criterion of intelligence referring to a human-level performance equal to or indistinguishable from an intelligent agent-achieving artificial machine (Vivek Kaul, et al., 2020). This test determines whether a computer can think intelligently like a human (Turing, 2009). In 1950, Alan Turing prophesied that by the turn of the century, a computer would have advanced to the point where it could convincingly mimic human thought, with a 70% chance of deceiving an average interrogator into believing it was human after just five minutes of conversation (Manhattan Rare Book Company, n.d.).

In the early 1950s, significant milestones were achieved in the development of computer systems. Claude Shannon, a pioneer in the field, created the first computer system, Theseus, in 1950. This innovative system was a remotely controlled mouse that could navigate a maze and recall its path. The following year, 1951 (Copeland, 2024).

In 1956, the activation of the Logic Theorist program written by Allen Newell, Cliff Shaw and Herbert Simon marked a turning point in the perlaboration of artificial intelligence. The RAND Corporation funded it, which is thus commonly referred to as one of the first AI programs; however, it was truly a groundbreaking program designed to simulate human problem-solving ability. A milestone in this process was the Dartmouth Conference, organized at Dartmouth College. In this conference, he hosted at Dartmouth in 1956, John McCarthy — a mathematician gathered the most prominent researchers from multiple disciplines to talk about artificial intelligence (a term that McCarthy coined during the conference). That spirit of optimism and experimentation pervaded the community as academics struggled but largely failed to establish standardized protocols outside of a few de facto agreements (as seen in the Gezhi case, where exactly no one agreed on who was right or what all this meant). Researchers freely pursued any vision of AI that they could dream up. McCarthy saw his glass as half-full, and the conference ushered in a new era in the race to attain an AI (Anyoha, 2017).

The conference was when AI gained its name, mission, first success, and key players (Moor, 2006). As the dust settled after the conference, the term "Artificial Intelligence" underwent a profound transformation, evolving from a narrow focus on rule-based systems to encompass the broader realm of complex, data-driven decision-making and predictive analytics, fueled by the exponential growth of massive datasets and sophisticated machine learning algorithms (Matthew, 2023).

Between 1957 and 1974, The field of artificial intelligence witnessed rapid development and significant growth in a short period. This was largely due to significant improvements in computer technology, which enabled machines to store more information, process data faster, and become more affordable and accessible. As a result, machine learning algorithms continued to evolve, and experts became increasingly adept at selecting the most suitable algorithms to tackle specific problems. This confluence of technological advancements and expertise laid the foundation for further innovation and progress in AI (Anyoha, 2017).

In 1966, This pioneering program was designed to mimic a therapy session by reusing user-provided answers to questions, prompting further conversation. Weizenbaum intended to demonstrate machine intelligence's simplicity by showcasing ELIZA's limited capabilities. However, the chatbot's ability to engage users in conversation was surprisingly effective, and many people were convinced that they were interacting with a human therapist. In a research paper, Weizenbaum himself noted the astonishing phenomenon, stating, "It was difficult to convince some people that ELIZA was not human." (Coursera Staff, 2024).

3.2. The 1970, 1980 and 1990 Period

Since the mid-1970s, researchers' focus on artificial intelligence has shifted from experimental projects to building practical systems, with knowledge representation methods taking the forefront. As AI gained popularity, expert systems emerged as one of the most prominent research areas. These systems represented specialized knowledge in specific fields using large databases and rules to support decision-making across various domains (Mijwel, 2015).

The 1980s witnessed a significant surge in AI development, driven by two main factors: the expansion of algorithmic tools and increased funding. During this period, "deep learning" techniques pioneered by John Hopfield and David Rumelhart emerged, enabling computers to learn from experience and improve their performance over time (Anyoha, 2017).

The leaders of the Fifth Generation Project envisioned it as a revolutionary leap in computer technology with the potential to propel Japan to the forefront of technological innovation for years to come. Unlike traditional computers, which relied on standard microprocessors, the project focused on developing multi-processor machines designed explicitly for logic programming. The project's proponents believed that these powerful logic machines would profoundly impact the world of information processing, ultimately enabling the achievement of artificial intelligence (Smith, 2006). In 1985, Dr. Geoffrey Hinton introduced a multi-layer neural network with greater capabilities called the “Boltzmann Machine.” It was one of the first multi-layer neural networks capable of learning internal representations and solving combinatorial problems in a given time (Basuru, 2020).

In the late 1980s, the American Association for Artificial Intelligence (AAAI) was established, driven by the rapid advancements in AI research and the desire to develop further and promote the field. The organization's initial goals included publishing a journal, hosting workshops, and organizing an annual conference. Over time, the AAAI became a leading authority in the field, aiming to advance the scientific understanding of the mechanisms underlying thought and intelligent behavior and explore ways to embody these mechanisms in machines (Coursera Staff, 2024).

The concept of digitizing physical literature gained momentum when The initiative focused on analyzing a digital collection of 359 astronomy textbooks published between 1472 and 1650 to uncover new insights into developing scientific thought and understanding (Cainm, 2023). One of the most ambitious efforts is being led by Jürgen Renn, a physicist turned historian and director at the Berlin-based Max Planck Institute for History of Science. Renn imagines putting all knowledge written over the past millennium within reach of everyone on Earth with a computer and Internet connection, thereby breaking down constraints imposed by language and academic specialization. Digitizing historical documents is not new, but Renn is part of a new generation of historians who want to push it further. They have layered many annotation types and are organizing their databases to be fully searchable so researchers can follow concepts across languages and fields. Renn is also involved in another collaboration with a team based in Florence to create "The Dome Years," an electronic archiving of more than 14,000 administrative entries on the construction of the city's cathedral (Abbott, 2001).

In 1992, Jürgen Renn, Peter Damerow, and Paolo Galluzzi launched the "Galileo Einstein Electronic Archive," a groundbreaking initiative to make historical sources freely accessible online, supported by the European community. Building on this success, Renn established the European Cultural Heritage Online (ECHO) initiative to promote the study of historical sources online and foster a new era of digital scholarship (Wikipedia, 2024).

3.3. Maturity of AI Applications

In later years, in-depth writings and studies began to take their place in search engines and libraries when Tom Mitchell published his book "Machine Learning" in 1997. For the first time, Mitchell formally defined machine learning as "a computer program that learns from experience." Building on this concept, a team of researchers, including Ian Goodfellow, Yoshua Bengio, and Aaron Courville, further developed the idea in their study "Deep Learning." They attributed the success responsible for many recent advancements in AI to its ability to "experience a dataset," allowing it to learn and improve over time (Joshua, 2023). Thus, by the end of the 1990s, a sufficient understanding of computer-based learning had been established, laying the foundations and concepts of computing and integrating them into the core operations of scientific institutions. Concepts such as deep learning and artificial intelligence began to emerge.

In 1997, Through the power of deep learning and artificial intelligence, AI systems are capable of more than just optimizing processes. They can collect, classify, analyze, interpret, and store historical data, much like historians, for future use. This complex process requires a deep understanding of historical awareness, encompassing memory, critical analysis, contextualization, and causality theory. This phenomenon has been aptly described by researcher Joshua Sternfeld as "AI as Historian," highlighting the AI system's ability to mimic the work of historians in its analysis and interpretation of historical data (Joshua, 2023).

In 2000, a social robot named Kismet was created, capable of recognizing and mimicking human emotions. The robot was developed in the AI Lab at MIT under the leadership of Dr. Cynthia Breazeal's groundbreaking creation. Kismet was a pioneering robot that embodied the concept of emotional intelligence, equipped with a suite of sensors, a microphone, and sophisticated programming that allowed it to perceive, interpret, and mimic a wide range of human emotions, from joy and excitement to sadness and fear (Coursera Staff, 2024).

A breakthrough moment in the history of deep learning arrived in 2009, when a trio of innovators - Rajat Raina, Anand Madhavan, and Andrew Ng - published a seminal paper, "Using GPUs for Unsupervised Deep Learning", which revolutionized the field by harnessing the power of Graphics Processing Units (GPUs) to accelerate the development of unsupervised deep learning algorithms," introducing the concept of using GPUs to train expansive neural networks (Javatpoint, n.d.).

In 2015, the development of artificial intelligence faced a significant challenge when a group of prominent figures signed an open letter addressed to the world's governments, calling for a ban on the development of autonomous weapons (Biswas, 2024). In the same year, researchers at Stanford University published a groundbreaking paper titled "Unsupervised Deep Learning Using Nonequilibrium Thermodynamics," which introduced a method for reverse-engineering. Concurrently, it made a significant breakthrough, as outlined in the pioneering." This work inspired subsequent research in tools that can automatically analyze unlabeled text, ultimately leading to the development of Large Language Models (LLMs) (Karjian, 2023).

In 2018, AI became smarter and surpassed human intelligence in language processing in a standard reading and comprehension test (Biswas, 2024). 2019 a groundbreaking artificial intelligence system featuring 17 billion parameters was developed. In 2020, Oxford University introduced the AI-powered Curial test, and OpenAI launched the GPT-3 Large Language Model (LLM) program, comprising 175 billion parameters, to generate human-like text. In 2021, OpenAI introduced DALL-E, a multimodal AI system that generates images based on textual prompts. The University of California, San Diego, also invented a soft quadruped robot powered by air instead of electronics. Finally, in 2023, OpenAI developed the multimodal GPT-4 LLM program, which can process both text and image prompts, significantly expanding the capabilities of AI (Karjian, 2023).

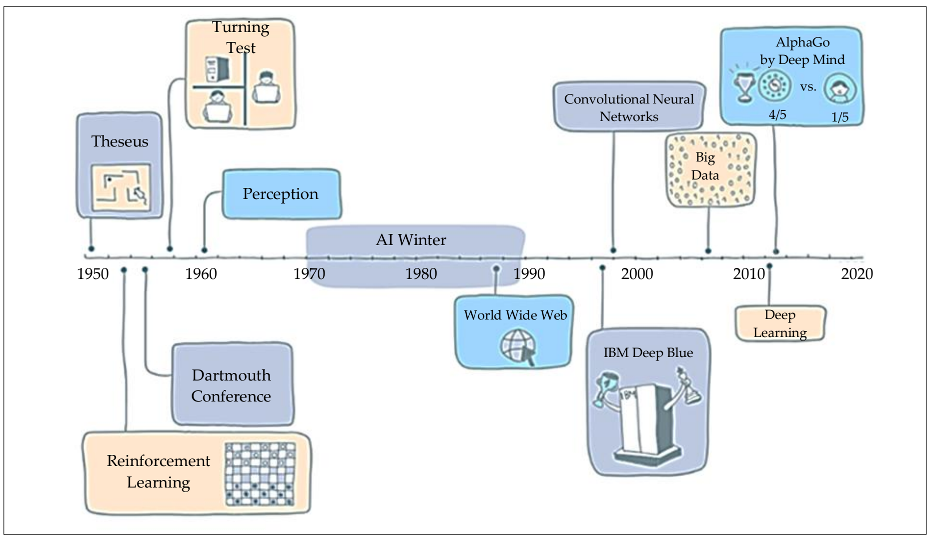

Fig. 1 The evolution of AI up to the year 2024

Table 1. The evolution of AI up to the year 2024

Year	Event / Development	Description
1943	First AI Concept	In a groundbreaking paper, Warren McCulloch and Walter Pitts laid the groundwork for the development of Artificial Intelligence by conceptualizing a model of artificial neurons. This pioneering idea would later influence the creation of neural networks and machine learning algorithms.
1958	LISP Programming Language	John McCarthy's visionary creation, LISP, revolutionized the field of Artificial Intelligence by providing a programming language designed explicitly for symbolic reasoning and AI research. This influential language would shape the development of AI for decades, leaving a lasting impact on the field.
1966	ELIZA Chatbot	Joseph Weizenbaum created ELIZA, a pioneering natural language processing program that revolutionized the field of artificial intelligence. ELIZA utilized pattern matching techniques to simulate conversation with humans, allowing

		it to engage in a seemingly intelligent dialogue. This groundbreaking achievement demonstrated the potential of AI to mimic human-like communication, paving the way for further advancements in the field.
1980	Expert Systems	AI sees renewed interest in developing expert systems, like MYCIN, which uses rule-based logic to diagnose diseases. These systems are widely adopted in industries and healthcare.
1987–1993	Second AI Winter	Another AI Winter occurs as expert systems fail to meet high expectations, leading to reduced investment in AI research.
1997	Deep Blue Defeats Chess Champion	In a historic showdown, IBM's Deep Blue, a supercomputer powered by AI, emerged victorious against the world chess champion Garry Kasparov, demonstrating the remarkable capabilities of AI in tackling complex, strategic challenges and cementing its place as a formidable opponent in the realm of human intellect.
2002	AI in Consumer Products	AI starts appearing in consumer products with the introduction of Roomba, an autonomous robotic vacuum cleaner by iRobot.
2011	IBM Watson Triumphs in Jeopardy	n a groundbreaking moment, IBM's Watson, a cutting-edge AI system, triumphed over two human champions on the popular game show "Jeopardy!", showcasing its unparalleled ability to process and analyze vast amounts of unstructured data rapidly, and cementing its status as a pioneering force in the development of artificial intelligence
2012	Deep Learning Breakthrough	A major breakthrough in AI occurs, mainly through neural networks. AlexNet won the ImageNet competition, drastically improving image recognition performance.
2014	Turing Test Milestone	A chatbot named "Eugene Goostman" passes a limited version of the Turing Test, simulating a 13-year-old Ukrainian boy in an online chat.
2016	AlphaGo Defeats Go Champion	DeepMind's AlphaGo, powered by deep learning and reinforcement learning, defeats world Go champion Lee Sedol, a monumental achievement due to the game's immense complexity and number of possible moves.
2017	AlphaZero	DeepMind introduces AlphaZero, an advanced version of AlphaGo that teaches itself from scratch and masters complex games like chess, Go, and shogi without human data.
2018	BERT by Google	Designed to improve natural language understanding, it has profoundly impacted search engine accuracy and various NLP tasks. By leveraging the power of transformers and bidirectional encoding, BERT has set a new standard for AI-powered language understanding, enabling more precise and effective search results and enhanced performance in a range of NLP applications.
2020	AI in Healthcare (COVID-19)	AI plays a crucial role in drug discovery, predicting virus spread, and accelerating the development of vaccines.
2021	OpenAI's GPT-3 Released	OpenAI releases GPT-3, the largest language model to date, capable of generating human-like text based on context, greatly advancing NLP and chatbot technology.
2022	DALL·E 2 by OpenAI	In a major breakthrough, OpenAI unveiled DALL·E 2, a revolutionary AI model that transforms textual descriptions into stunning, high-quality images.
2023	GPT-4 Released	OpenAI launches GPT-4, an even more powerful and refined version of GPT-3, demonstrating impressive abilities in understanding and generating complex and nuanced text across multiple languages.

2024	AI Regulations and Ethical AI	Governments and organizations worldwide implement stricter AI regulations and focus on ethical AI development, emphasizing transparency, bias reduction, and safety in AI systems.

3.4. Generative AI

Since the end of 2023 and the beginning of 2024, significant progress has been made in updating and developing AI systems. Developers have enhanced the performance of intelligent programs and applications, leading to the next step known as Generative AI (GenAI).

The emergence of generative AI represents the evolution of AI, as it transcends traditional AI's limitations in data analysis and process automation. By generating novel and original content, this advanced technology demonstrates a remarkable capacity for human-like intelligence characterized by logical thinking, behavioral imitation, and decision-making capabilities. As a result, generative AI is poised to revolutionize how individuals interact, strategize, and engage with each other across various fields (Savica, 2024). At the heart of these innovative web programs, chatbots is a sophisticated (LLM) neural network designed to mirror the intricate structures of the human brain.

This cutting-edge technology enables the chatbots to predict the next word in a sequence of texts with uncanny accuracy, allowing for seamless and natural language interactions (Romera et al., 2024). These large language models represent a true revolution in smart technology. When trained on trillions of words from texts, they began unexpected translation, coding, and other tasks that previously challenged researchers and programmers (Humphries, 2023). This is achieved by producing outputs that mimic human creativity.

The essence of Generative AI is identifying patterns and relationships within data that are not visible. Generative AI can create new, accurate, and realistic content by doing so. This holds tremendous potential for many industries, including entertainment, advertising, and education (Thom Baxter, 2023).

The cornerstone of Generative AI is the generative model, a sophisticated algorithm designed to uncover the underlying patterns and structures within a dataset. By learning from these patterns, generative models can create novel data samples that closely resemble the original training examples. This is achieved by capturing statistical properties, which are then leveraged to generate new instances. With various generative models existing, each with its distinct approach to learning and data generation, the possibilities for innovation and creativity are vast.

- VAEs, particularly useful for generating images, have been successfully applied in various creative fields, such as generating artwork and creating realistic faces.
- Generative Adversarial Networks (GANs) represent a groundbreaking approach to generative modeling, comprising two interconnected components while the discriminator becomes increasingly adept at distinguishing between genuine and fabricated data. This adversarial relationship has led to the development of GANs capable of generating photorealistic images, creating convincing fake videos, and even composing original music.
- Autoregressive models take a unique approach to data generation, modeling the conditional probability distribution of each data point based on its predecessors. This methodology excels at producing sequences, such as text or music. It has been successfully applied to tasks like generating realistic text, composing music in various styles, and even producing code snippets (Dasha, 2023).

In other words, such technologies enhance collaboration between humans and intelligent machines to create digital informational content in various classifications and forms (Shalin, 2024).

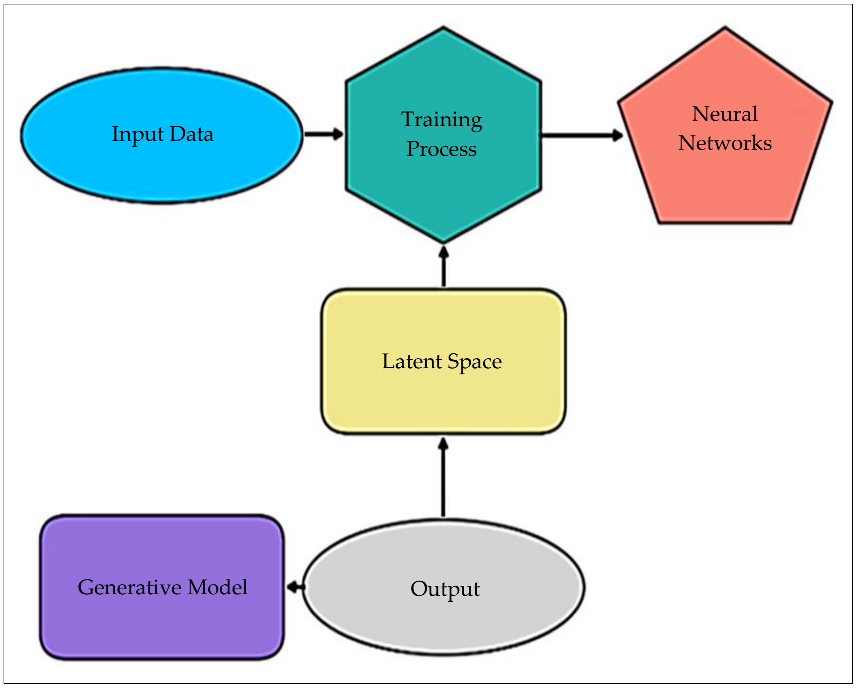

Fig. 2 The basic components of generative AI: (app. napkin)

This document explores the fundamental components that make up generative AI systems, providing insights into their architecture, functionality, and applications. Understanding these components is essential for grasping how generative AI operates and its potential impact on various industries.

Data

At the heart of generative AI lies data, the foundation for training models. Large, high-quality datasets are crucial for developing effective generative models, as they provide the necessary examples for the AI to learn from. The diversity and quality of the data have a significant impact on the performance of generative models. Some familiar sources of data for generative AI include:

- Text corpora for Natural Language Processing (NLP) tasks.
- Image datasets for visual content generation.
- Audio samples for music and speech synthesis.

Algorithms

Generative AI relies on sophisticated algorithms to process data and generate new content. Some of the most prominent algorithms include:

- Variational Autoencoders (VAEs)
- Transformers have had a profound impact on (NLP), transforming the way text is generated.

Neural Networks

Some of the key types of neural networks used in generative AI include,

- As mentioned, they excel in handling sequential data and have become the standard for many generative tasks.

Training

The training phase,

- Supervised Learning
- Unsupervised Learning
- Reinforcement Learning

Evaluation

- Inception Score (IS)
- BLEU Score: Used in NLP to evaluate the quality of generated text against reference texts.

App

Extending across multiple fields, including:

- Content Creation: Automated writing, graphic design, and video generation.
- Entertainment: Music composition and game design.
- Healthcare: Drug discovery and medical imaging.
- Marketing: Personalized advertising and customer engagement.

Among the most notable outcomes of generative AI are:

- Enhancing Individual Creativity: Generative AI can enhance creativity by providing new ideas and feedback.
- Improving Team Performance in Collaborative Environments: Generative AI has been shown to enhance team performance, often outperforming traditional team dynamics. The centralized use of generative AI by selected team members leads to better results (Hai-Jew, 2024).

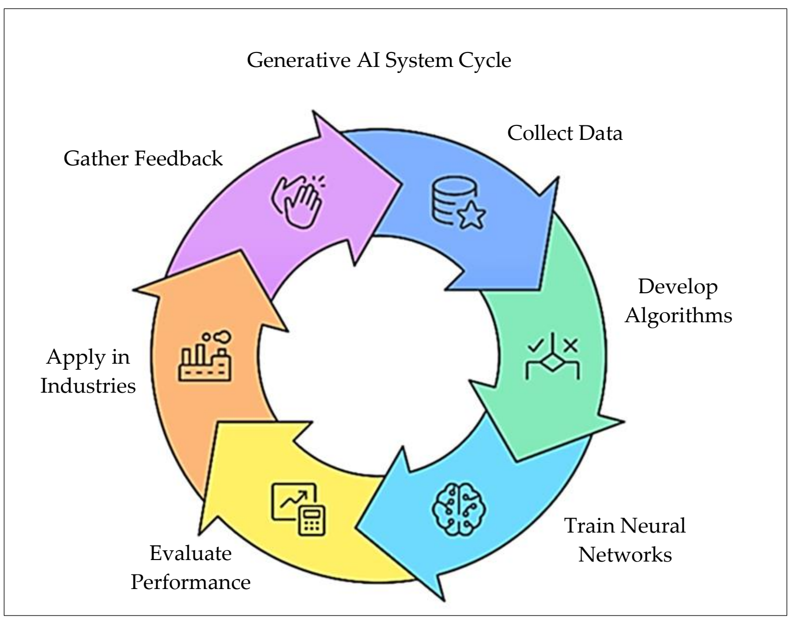

Fig. 3 Patterns (Plainconcepts, 2024)

3.5. Ethical Challenges of Using Artificial Intelligence

Artificial Intelligence technologies represent a promising field for researchers and constitute a uniquely distinguished relationship through which some historical elements hidden in previous books can be uncovered.

However, it is important to recognize that technological innovations often have unintended consequences. Understanding how generative AI approaches scientific research is crucial, so adopting a cautious approach is necessary.

While integrating AI in scientific research presents several challenges, including the risk of introducing bias or falsification into the historical record, the potential benefits are substantial. By leveraging AI, historians can uncover connections and patterns across a broader range of historical data than would be feasible by traditional methods, ultimately enriching our understanding of the past (Huggett, 2021). Using computational machines can raise ethical and practical challenges, as creating false records, whether intentionally or by mistake, would distort our shared sense of scientific understanding (Cain, 2023).

Language posed another problem: many texts were written in regional Latin dialects that machines not trained in these languages often could not recognize. Experts say, "This poses a major constraint on natural language processing when you do not have the necessary vocabulary for training in the background" (Dzieza, 2024). This is part of why natural language processing succeeds in dominant languages like English but is less effective in, for example, ancient Hebrew (Donovan, 2023).

The intelligent revolution faces another challenge among those that may obstruct the path to expanding the base of mutual benefit between researchers and AI tools. Many AI models are trained on datasets from the past fifteen years of contemporary life features, such as mobile phones, cars, or recent historical data. All this makes computer vision less accurate when applied to historical images or ancient manuscript models (Donovan, 2023).

Moreover, attention must be paid to another issue related to the same problem we are addressing. The radical changes in lifestyle and work patterns between yesterday's and today's populations in all aspects can be a stumbling block in the way computational models try to understand and analyze ancient literature correctly. Therefore, developing effective AI models for dealing with old images and manuscripts requires a set of foundations and practical steps:

- The ability to train the computational model on diverse and comprehensive scientific data, including images and manuscripts with various imaging techniques.
- The possibility of developing specialized algorithms that consider the nature of scientific forms, symbols, and literature shows the difference between them and their contemporary counterparts.
- Rigorous Assessment: Historians must conduct a thorough and critical examination of the results produced by AI tools
- Transparency and Accountability (Liyy, 2024).

AI models demonstrate remarkable capabilities in handling historical texts that cannot be denied. However, we must explicitly acknowledge the constraints that researchers face when working with them (Langer, 2023). They cannot be considered a complete substitute for human expertise. Among these limitations, as outlined by Aparna Ayyar and other writers, are:

1. Limitations of AI Interpretation: Although AI can offer valuable insights, it is essential to recognize that AI lacks the nuanced understanding and expertise of human researchers in designing scientific experiments, selecting tests, and applying appropriate methodologies. As a result, researchers must draw upon their own knowledge and field experience to ensure the accuracy and reliability of their findings (Liyy, 2024).
2. Algorithmic Biases: AI systems, trained on existing data, risk perpetuating biases or inaccuracies present in historical records. This phenomenon, known as AI bias, occurs when machine learning algorithms amplify or diminish the importance of information previously existing in training datasets, inheriting the biases present

in the data, particularly regarding racial, religious, or geographical aspects. Historians must be aware of these biases and take a precise approach to mitigate AI output bias, including selecting and preprocessing data, designing algorithms, and ensuring fairness in the results (Learn, 2024).

3. Ethical Considerations: AI tools, while powerful, lack the ethical awareness and literary nuance required to navigate complex ethical dilemmas inherent in research. As a result, researchers must exercise their judgment and adhere to ethical principles when conducting studies, particularly those involving surveys and people's opinions on sensitive issues (Liyy, 2024).
4. Conducting a comprehensive necessitates. While AI tools can facilitate basic search processes, researchers must undertake meticulous manual reviews to identify relevant studies, assess their credibility, and integrate them effectively into their work.
5. Personal Guidance and Mentorship: While AI models can offer general guidance, they cannot replicate the personalized support and mentorship experienced researchers and advisors provide (Ayyar, 2023)

Without clear guidelines for using artificial intelligence in scientific research, we navigate a vast and uncharted world, just as with any other significant transformation in diverse scientific fields, discussions about the importance of AI and encouraging its use. While non-specialists may attempt to develop strategies for generative AI in academic work, well-informed, research-based approaches are essential for establishing best practices. Fortunately, guidelines are beginning to emerge. For instance, UNESCO issued a guidance statement in September 2023, highlighting the challenges posed by AI in education, particularly in the absence of effective national or international regulation. States must establish legal and ethical guidelines to define the optimal use of AI and prevent students and researchers from over-relying on it (UNESCO, 2023).

After establishing guiding principles and regulations, the next challenging step is that most academic institutions lack trained specialists in AI technologies. Thus, training educators on proper AI methods is among the biggest challenges facing historians. Historians must be thoroughly knowledgeable about the theory and practice of how AI works before delving into this world, which requires more time. Educational institutions must build robust infrastructures capable of handling the complexities of modern technology (Jackson, 2023). Furthermore, the issue of not fully trusting the results generated by these tools remains one of the most significant challenges facing historians. Everyone must recognize the seriousness of this particular point.

4. Conclusion

After conducting this research, it has become clear that the smart digital revolution has a long history that began decades ago. It has gone through tough times, periods of prosperity, growth, development, and other times of stagnation and experimentation until it reached us as it is today, with immense technical capabilities that often surpass human thinking and behavior. The AI revolution is one of the chapters of modern technology that has accompanied the history of the emergence of sciences and scientific experiments. It was carried out by individuals described as scientists and inventors who presented us with a high and wonderful model of this great revolution.

The history of artificial intelligence has gone through many stages, starting with the invention of the traditional calculator, which was used to overcome some of the difficulties that hindered the development of previous civilizations. This invention was followed by the birth of some important technical models, such as the computer and the semi-intelligent computer, until the mid-20th century, which saw a remarkable invention and the first mention of artificial intelligence at a global conference.

It is no secret that artificial intelligence is paramount in helping humanity and overcoming the obstacles that hinder the development of societies. Through this research, we aim to comprehensively study the history of the AI revolution and its various impacts. The main goals and foundations of our study are as follows:

4.1. What We Aim to Achieve

- Tracing the Journey of AI:
  - ➢ Our exploration begins by tracing the present day, allowing us to comprehend the milestones and developments that have led to our current understanding and capabilities in AI.
  - ➢ We are also interested in understanding the nature of the creations produced by generative AI, whether they are artistic, literary, or programmatic.
- Understanding AI's Impact:
  - ➢ We want to comprehend how AI has changed our daily lives and work and its effects on the economy and society.
  - ➢ We cannot overlook the ethical and legal aspects, especially regarding intellectual property rights.
- Providing Practical Recommendations:
  - ➢ Finally, we aim to provide practical recommendations to regulate the responsible use of this technology.

4.2. Foundations of Our Research

We build our research on several key points:

- Rapid Technological Advancement: We recognize that technological development is accelerating at an unprecedented pace.
- Transformations in the Job Market: We believe that the job market is undergoing fundamental changes due to these technologies.
- Intellectual Property Ambiguities: We acknowledge the ambiguity in intellectual property issues related to AI-generated works.
- Need for Regulations: As we embark on this journey, we recognize the pressing need for. This framework will serve as a guiding principle for our exploration, enabling us to revolutionise its far-reaching implications for our collective future.

References

[1] Alison Abbott, “The ‘Time Machine’ Reconstructing Ancient Venice’s Social Networksm,” *Nature*, vol. 546, pp. 341–344, 2017. [CrossRef] [Google Scholar] [Publisher Link]

[2] Andy Phippen, “Artificial Intelligence,” *Encyclopedia of Libraries, Librarianship, and Information Science*, vol. 4, pp. 3-11, 2025. [CrossRef] [Publisher Link]

[3] Anyoha Rockwell, “*The History of Artificial Intelligence*,” Harvard University, 2017. [Google Scholar]

[4] Aparna Ayyar, Researchers Beware—8 Things Chat GPT cannot Help you with, Editage Insights, 2023. [Online]. Available: https://www.editage.com/insights/researchers-beware-8-things-chat-gpt-cannot-help-you-with

[5] Vikas Basuru, The Evolution of Artificial Intelligence, 2020. [online]. Available: https://www.linkedin.com/pulse/evolution-artificial-intelligence-vikas-basuru

[6] Attila Benko, and Cecília Sik Lányi, *History of Artificial Intelligence,* Encyclopedia of Information Science and Technology, Second Edition, IGI global, pp. 1759-1762, 2009. [CrossRef] [Google Scholar] [Publisher Link]

[7] Maialen Berrondo-Otermin, and Antonio Sarasa-Cabezuelo, “Application of Artificial Intelligence Techniques to Detect Fake News: A Review,” *Electronics*, vol. 12, no. 24, 2023. [CrossRef] [Google Scholar] [Publisher Link]

[8] Hasan Biswas, History of AI: A Fascinating Journey through Time, 2024. [Online]. Available: https://dorik.com/blog/history-of-ai

[9] David Cain, Decoding History: The Role of AI in Unearthing Ancient Secrets David Cain, 2023. [Online]. Available: https://www.linkedin.com/pulse/ai-study-history-david-cain

[10] B.J. Copeland, History of Artificial Intelligence (AI), Encyclopedia Britannica, 2024. [Online]. Available: https://www.britannica.com/science/history-of-artificial-intelligence

[11] Coursera Staff, The History of AI: A Timeline of Artificial Intelligence, Coursera, 2024. [Online]. Available: https://www.coursera.org/articles/history-of-ai

[12] What Is Generative AI? (A Deep Dive into Its Mechanisms), Dasha, 2023. [Online]. Available: https://dasha.ai/en-us/blog/what-is-generative-ai-a-deep-dive-into-its-mechanisms

[13] Moira Donovan, How AI is Helping Historians better Understand our Past, MIT Technology Review, 2023. [Online]. Available: https://www.technologyreview.com/2023/04/11/1071104/ai-helping-historians-analyze-past

[14] Josh Dzieza, How AI can Make History, The Verge, 2024. [Online]. Available: https://www.theverge.com/24068716/ai-historians-academia-llm-chatgpt

[15] Mariusz Flasiński, "History of Artificial Intelligence," *Introduction to Artificial Intelligence*, 2016. [CrossRef] [Google Scholar] [Publisher Link]

[16] Jeremy Huggett, "Algorithmic Agency and Autonomy in Archaeological Practice," *Open Archaeology*, vol. 7, no. 1, pp. 417-434, 2021. [CrossRef] [Google Scholar] [Publisher Link]

[17] Mark Humphries, Generative AI and the (Tame) Digital History Revolution, Historica, 2023. [Online]. Available: https://www.historica.org/blog/generative-ai-digital-history-revolution

[18] Stephen Jackson, Don't Stop Worrying or Learn to Love AI, Perspectives on History, 2023. [Online]. Available: https://www.historians.org/perspectives-article/dont-stop-worrying-or-learn-to-love-ai-a-plea-for-caution-november-2023/

[19] History of Artificial Intelligence, Javatpoint. [Online]. Available: https://www.javatpoint.com/history-of-artificial-intelligence

[20] José María Guerrero, *Chapter 5 - The History of Modern Artificial Intelligence*, Mind Mapping and Artificial Intelligence, Academic Press, USA, pp. 131-161, 2023. [Google Scholar]

[21] Joshua Sternfeld, "AI-as-Historian," *The American Historical Review*, vol. 128, no. 3, pp. 1372–1377, 2023. [CrossRef] [Google Scholar] [Publisher Link]

[22] Ron Karjian, The History of Artificial Intelligence: Complete AI Timeline, TechTarget, 2024. [Online]. Available: https://www.techtarget.com/searchenterpriseai/tip/The-history-of-artificial-intelligence-Complete-AI-timeline

[23] Adina Langer, Generative AI and Historical Authority, NCPH, 2023. [Online]. Available: https://ncph.org/history-at-work/generative-ai-and-historical-authority/

[24] Aditya Kumar, Top 15 Challenges of Artificial Intelligence in 2025, Simplilearn, 2024. [Online]. Available: https://www.simplilearn.com/challenges-of-artificial-intelligence-article

[25] Ember Liyy, AI Tools for Writing Historical Content, Medium, 2024. [Online]. Available: https://medium.com/@emberliyy2024/ai-tools-for-writing-historical-content-3bc8ceb26e13

[26] Turing Alan, Computing Machinery and Intelligence [in MIND], Manhattan Rare Book Company. [Online]. Available: https://www.manhattanrarebooks.com/pages/books/1842/alan-turing/computing-machinery-and-intelligence-in-mind?soldItem=true

[27] Pierre Marquis, Odile Papini, and Henri Prade, "Elements for a History of Artificial Intelligence," *A Guided Tour of Artificial Intelligence Research*, pp. 1-43, 2020. [CrossRef] [Google Scholar] [Publisher Link]

[28] Matthew L. Jones, "AI in History," *The American Historical Review*, vol. 128, no. 3, pp. 1360–1367, 2023. [CrossRef] [Publisher Link]

[29] Max Roser, The Brief History of Artificial Intelligence: the World has Changed Fast — What Might be Next?, Our World inData, 2022. [Online]. Available: https://ourworldindata.org/brief-history-of-ai

[30] Maad M. Mijwel, History of Artificial Intelligence Yapay Zekânın T arihi, *Computer Science*, 2015.[Google Scholar] [Publisher Link]

[31] Deepanjali Mishra, and Sasmita Rani Samanta, "*Digitalization of Culture through Technology: Proceedings of the International Online Conference On Digitalization And Revitalization Of Cultural Heritage Through Information Technology- ICDRCT-21, 23-24 Nov 2021, KIIT University, Bhubaneswar*," 1st ed., Routledge, 2022. [CrossRef] [Google Scholar] [Publisher Link]

[32] James Moor, "The Dartmouth College Artificial Intelligence Conference: The Next Fifty Years," *AI Magazine*, vol. 27, no. 4, 2006. [CrossRef] [Google Scholar] [Publisher Link]

[33] Generative AI Beyond: How it Works and Real Use Cases, Plainconcepts, 2024. [Online]. Available: https://www.plainconcepts.com/generative-ai-guide/

[34] Bernardino Romera-Paredes et al., "Mathematical Discoveries from Program Search with Large Language Models," *Nature*, vol. 625, pp. 468-475, 2024. [CrossRef] [Google Scholar] [Publisher Link]

[35] Savica, Dimitrieska, "Generative Artificial Intelligence and Advertising," *Trends in Economics, Finance and Management Journal*, vol. 6, no. 1, pp. 23-34, 2024. [CrossRef] [Google Scholar] [Publisher Link]

[36] Shalin Hai-Jew, "Generative AI and the Expansion of the Solitary Human Imagination: An Experiential Case," *Computational Practices and Applications for Digital Art and Crafting*, 2024. [CrossRef] [Google Scholar] [Publisher Link]

[37] Chris Smith, The History of Artificial Intelligence, University of Washington, 2006. [Online]. Available: https://courses.cs.washington.edu/courses/csep590/06au/projects/history-ai.pdf

[38] What is the History of Artificial Intelligence (AI)?, Tableau. [Online]. Available: https://www.tableau.com/data-insights/ai/history

[39] DM. Thom Baxter, Generative AI: Models, Mechanisms, and Future Directions, Linkedin, 2023. [Online]. Available: https://www.linkedin.com/pulse/generative-ai-models-mechanisms-future-directions-dr-thomas-baxter-sgvrf

[40] Alan M. Turing, "Computing Machinery and Intelligence," *Parsing the Turing Test*, pp. 23-65, 2007. [CrossRef] [Google Scholar] [Publisher Link]

[41] Miao Fengchun, and Holmes Wayne, "Guidance for Generative AI in Education and Research," *UNESCO*, 2023. [CrossRef] [Google Scholar] [Publisher Link]

[42] Vivek Kaul, Sarah Enslin, Seth A. Gross, "History of Artificial Intelligence in Medicine," *Gastrointestinal Endoscopy*, vol. 92, no. 4, pp. 807-812, 2020. [CrossRef] [Google Scholar] [Publisher Link]

[43] What is CorDeep?, CorDeep, 2022. [Online]. Available: https://cordeep.mpiwg-berlin.mpg.de/

[44] Jürgen Renn, Wikipedia, 2024. [Online]. Available: https://en.wikipedia.org/wiki/J%C3%BCrgen_Renn