

Major Milestones in Artificial Intelligence history

In the last few years, Artificial Intelligence (AI) has taken centre stage in the tech industry, emerging as a ubiquitous term. Despite its recent surge in popularity, the concept has been in existence since 1955, when John McCarthy organized a workshop on artificial intelligence at Dartmouth College. However, the true viability of AI, has only really manifested in recent times, fuelled by advancements in technologies such as GPUs, the internet and Large Language Models (LLMs).

AI is no longer confined to theoretical discussions but has become an integral part of our daily lives.

From supermarkets and suppliers predicting consumer behaviour, to the more personal task of eliminating an ex-boyfriend/girlfriend from a holiday photograph, AI is gradually becoming seamlessly integrated into almost every aspect of our routines. Whether we embrace it or not, AI adoption is accelerating rapidly. Even in instances where it operates discreetly, AI influences our experiences—targeting web advertisements on social media, predicting behaviour on gambling websites, enabling facial recognition in security systems, and facilitating support and advice through chatbots. The pervasive nature of AI underscores its transformative impact on diverse aspects of modern life.

The History of AI

Multiple definitions of AI exist, but the one that captures the essence of AI is: "Artificial Intelligence encompasses a collection of sciences, theories, and techniques, including mathematical logic, statistics, probabilities, computational neurobiology, and computer science. Its objective is to replicate the cognitive abilities exhibited by human beings."

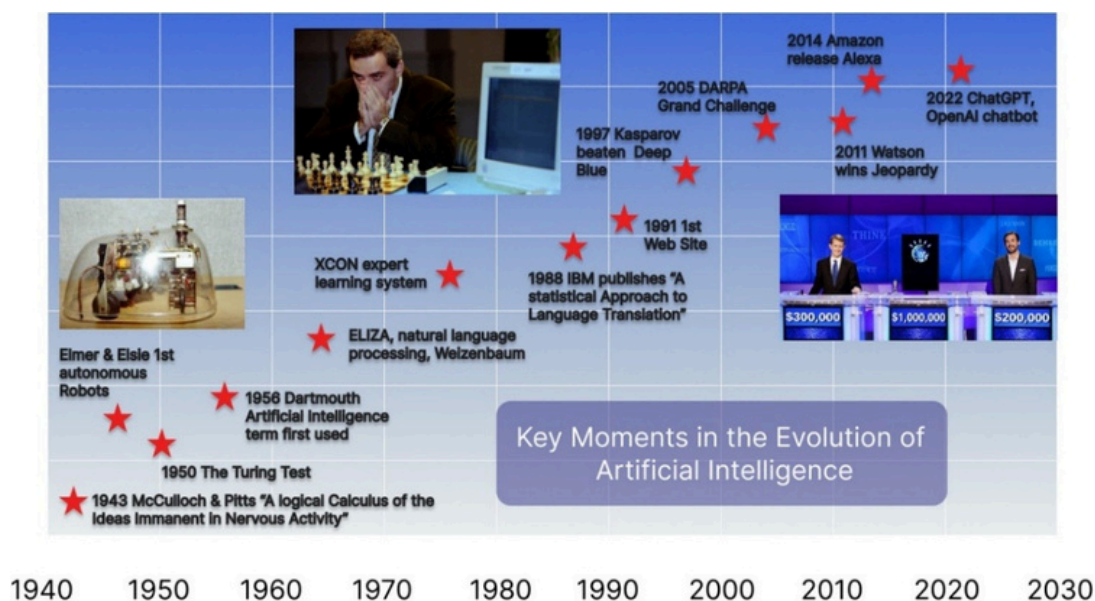


Figure 1: Key Moments in the History and Development of Artificial Intelligence

The roots of AI can be traced back to the Second World War when computers began undertaking complex tasks that were once the exclusive domain of human operators. This marked the inception of a tenuous link to human intelligence. However, the AI of that era was vastly different from the sophisticated systems we witness today. Despite advancements during that time, these early AI tasks remained far removed from achieving human-like intelligence in its strictest sense. The key moments in history are shown in Figure 1 and described below.

The 1940s to 1950s

In 1943, neurophysiologist Warren McCulloch and logician Walter Pitts collaborated on a ground-breaking paper titled "A Logical Calculus of the Ideas Immanent in Nervous Activity," published in the "Bulletin of Mathematical Biophysics." The central aim of their work was to investigate the possibility of representing logical functions through networks of artificial neurons.

McCulloch and Pitts adopted a binary logic approach, portraying neural states as either "on" or "off."

This binary abstraction facilitated the application of mathematical principles to characterize neural behaviour. Their paper illustrated that by interconnecting these artificial neurons into networks, it became feasible to execute logical operations. The authors demonstrated how intricate logical functions could be achieved through the amalgamation of simple threshold logic units. The concept of a "universal Turing machine" was introduced and discussed in relation to their model. They argued that their artificial neural network could theoretically simulate any computation performed by a Turing machine.

The content presented in this seminal paper is foundational in the realm of artificial neural networks. It laid the essential groundwork for developing computational models inspired by the structure and function of the human brain. Furthermore, it exerted a profound influence on subsequent research in the domains of artificial intelligence and machine learning. Although the model proposed by McCulloch and Pitts appears rudimentary when compared to contemporary artificial neural networks, their pioneering work played a pivotal role in shaping early concepts and theories in neural computation, providing a theoretical cornerstone for subsequent advancements in artificial intelligence. In the late

1940s, W. Grey Walter, a British neuroscientist and roboticist, pioneered the development of the first autonomous robots known as "tortoises," named Elmer and Elsie. These small electro-mechanical wonders were crafted to exemplify key principles in cybernetics and behaviour-based robotics. Going beyond mere autonomy, Elmer and Elsie showcased what Walter termed "machina speculatrix" behaviour, encapsulating the essence of a "contemplative machine." Equipped with light

sensors, touch sensors, and basic control mechanisms, these robots possessed the ability to navigate their surroundings and respond dynamically. Walter's ingenious work with Elmer and Elsie marked a significant contribution to the early evolution of robotics and cybernetics. His experiments provided valuable insights into the intricate interplay between machines and their environment, laying crucial foundations for subsequent advancements in these fields.

The 1950s to 1960s

Another figure to have a great impact on the fundamentals of computing and AI was Alan Turing, a mathematician, logician, computer scientist, and cryptanalyst, who made a significant impact with his 1950 publication, "Computing Machinery and Intelligence." In this seminal work, Turing introduced the concept of The Turing Test, offering a method to evaluate a machine's capacity to demonstrate intelligent behaviour indistinguishable from that of a human. Despite facing critiques, the test has played a pivotal role in shaping discussions surrounding artificial intelligence, leaving an enduring mark on the field.

However, the term "Artificial Intelligence" (AI) itself was officially introduced during the Dartmouth Conference/Workshop in 1956 by John McCarthy. Recognized as a landmark event in the history of AI, the conference gathered a community of researchers united by a shared interest in investigating how machines could emulate human intelligence. John McCarthy, alongside influential figures such as Marvin Minsky, Nathaniel Rochester, and Claude Shannon, orchestrated this significant gathering at Dartmouth College. It was during this pivotal occasion that McCarthy coined the term "Artificial Intelligence," encapsulating the field's focus on the study and research aimed at creating machines capable of undertaking tasks traditionally associated with human intelligence.

The 1970s to 1990s

There existed a notable hiatus in the progress of AI between the 1950s and the 1970s, primarily attributed to the lack of technology development required to propel progress. It wasn't until the late 1970s, with the emergence of the first microprocessors, that AI experienced a resurgence, marking the commencement of the golden age of expert systems.

The groundwork for this resurgence was laid at MIT in 1965 with the creation of DENDRAL, an expert system specializing in molecular chemistry. Subsequently, in 1972, Stanford University unveiled MYCIN, a system designed for diagnosing blood diseases and prescribing medications. These pioneering systems were based on an "inference engine" programmed to emulate human reasoning logically. While they yielded expert-level responses upon inputting data, their development was short-lived due to the labour-intensive programming required and the need for 200 to 300 rules. This approach resulted in a "black box" effect, obscuring the machine's reasoning process.

As a consequence, the complexity of programming rendered these systems challenging to develop and maintain, prompting the exploration of faster, less intricate, and more cost-effective alternatives.

The 1990s to 2000s

The landscape shifted with the emergence of the internet in the early 1990s, ushering in a wealth of data for training models. In 1997, IBM's Deep Blue, an expert system, achieved a milestone by defeating the chess champion Garry Kasparov. Deep Blue operated on a systematic brute force algorithm, meticulously evaluating and weighting all possible moves. While the defeat of the human opponent stood as a symbolic moment in history, the reality was that Deep Blue had only succeeded within a highly circumscribed realm—the rules of the chess game. Its capability fell notably short of modelling the intricate complexities inherent in the broader world.

The 2000s to 2020s

In 2011, IBM's computer system, Watson, entered the renowned game show Jeopardy and emerged victorious. Watson, meticulously crafted to comprehend natural language and answer questions, competed against two of Jeopardy's most accomplished champions, Ken Jennings and Brad Rutter. The competition unfolded as Watson showcased its prowess in processing and understanding natural language, analysing vast datasets, and delivering accurate responses. This event served as a showcase of significant advancements in artificial intelligence and natural language processing capabilities.

IBM's triumph with Watson represented a noteworthy milestone in the evolution of AI. The system's triumph on Jeopardy underscored the extensive potential applications of AI across diverse fields such as healthcare, finance, and customer service, where the capacity to understand and respond to natural language is paramount.

The 2020s to Present

A pivotal milestone in the evolution of artificial intelligence is arguably marked by the development of Generative Pre-Trained Transformers (GPTs). OpenAI, the innovator behind ChatGPT, has introduced several GPTs, with GPT-1 debuting in 2018. GPT-2 was not released to the general public, and GPT-3, unveiled in June 2020, escalated the benchmark with an impressive 175 billion parameters, establishing itself as one of the most potent language models of its era. GPT-3's capabilities extend to generating coherent, contextually relevant, and human-like text based on input prompts. It can perform various natural language processing tasks, answer questions, compose essays, create poetry, and engage in conversation, among other applications. The model was made available through OpenAI's API (Application Programming Interface), allowing developers to integrate its language generation capabilities into their applications and services. In 2022, OpenAI introduced ChatGPT, featuring a chat-based interface built on the foundation of GPT-3.5 LLM.

This technological leap has yielded substantial public successes and catalysed increased funding.

Summary

The future of AI's evolution is unclear, but what is evident is the transformational potential it has to change our daily lives. From autonomous cars, to advancements in healthcare and impacting the dynamics of social media, predicting the future AI impact is almost impossible.

What remains unequivocal is the continuing demand on technology development to improve and support future AI. Requirements to increase processing capability, memory capacity, and memory bandwidth will continue, whilst the need to reduce power consumption will continue, with the aim to prevent further damage to the environment and forge a safer and better world for future generations.