
The Birth and Evolution of Artificial Intelligence: From Dartmouth to Modern Systems

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ABSTRACT

In 1956, during a workshop in Dartmouth that John McCarthy had arranged, the phrase artificial intelligence was established. All present consented to use McCarthy's proposed term, "Artificial Intelligence," to describe the emerging discipline. There was a lot of excitement when it happened. It seems like everything went swimmingly. It felt like the age of really intelligent systems was finally here just a short time ago, when computers were seen as massive calculators. Amazing things were accomplished by early programs only by describing domain knowledge and looking for a solution. For instance, the 'Logic Theorist' by Newell and Simon proved certain qualitative mathematical theorems, and they even discovered a way to prove one of the theorems in Russell and Whitehead's 'Principia Mathematica' in less time. To apply the same paradigm to commonsense thinking, McCarthy proposed in 1958 that we utilize it to express information about the daily,

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Introduction

World as a set of presumptions based on logic, and then utilize that information to make decisions. For example, it is astounding that a general-purpose logical theorem prover could devise a strategy for getting to the airport. Playing a lot of games against itself, Arthur Samuel's checkers playing program—possibly the first compelling machine learning program—learned to play better from its terrible beginnings. This software eventually outperformed Samuel, proving the (still-made) claim that computers can only obey commands [1–10].

The Eliza software, developed by Joseph Weizenbaum and designed to mimic a Rogerian psychotherapist, is a prime illustration of how a little set of instructions can generate apparently complicated behavior. It wasn't meant to be a serious attempt at machine intelligence, but Eliza's algorithms—which are best described as rudimentary pattern matching—still managed to provide proper replies to a number of claims. A future when computers might pass the Turing Test for artificial intelligence was also within reach, thanks to initiatives like Eliza. As part of the Turing Test, a human judge uses instant messenger to converse with one of two parties: another person or an artificial intelligence computer program. In this scenario, both the human and the machine would make efforts to pass themselves off as human to the human judge. A program is said to have passed the Turing Test if the judge cannot distinguish between a person and an AI chatbot. Everything looked great.

It is not my intention to shock or surprise you; nonetheless, the simplest way to put it is that computers capable of thinking, learning, and creating have recently entered the globe. In addition, their capabilities in this area will continue to grow at a rapid pace until, in the not-too-distant future, the variety of issues they can solve will match the breadth of human intelligence.

To be more specific: a computer will prove a significant new mathematical theory and become the chess champion within the next decade. It took computers more than ten years to accomplish any of these milestones, but it took closer to forty. After the initial excitement wore off, the reality set in: problems are more complex and difficult to solve than one had imagined, and that quick fixes don't cut it. As an example, Eliza's rule was to reply "Tell me more about your family" if the user spoke "mother." This can produce some quite artificial reactions, but it also has its uses. Eliza could ask, "Tell me more about your family," in response to the statement, "I wanted to adopt a puppy, but it's too young to be separated from its mother." (Eliza, 2018). Machine translation is another example.

After Sputnik was launched in 1957, a lot of resources were poured into creating systems that could translate Russian texts into English automatically. Because deciphering language appears to need a great deal of specialized expertise, this proved to be a very challenging challenge. "The spirit is willing but the flesh is weak" is a well-known illustration of this: it underwent a Russian translation and a subsequent English translation [1215-133].

How about we Tackle AI?

Although the vodka is potent, the meat has gone bad. Two factors were apparent at that moment, making the AI challenge more challenging than anticipated (1) Rigid rules for word shuffling or doing Russian-to-English dictionary lookups are insufficient for any practical activity. Complex syntactic manipulation is required. To the contrary, in order to think critically about anything, we need to be well-versed in all aspects of the world. Take the translation example as an example.

It's important to note that the word "spirit" in this context does not mean alcohol but rather the mystical or metaphorical human spirit. (2) Difficulty with computation. The objective of AI was established prior to the development of the notion of NP-completeness. People back then believed that bigger and faster computers were all we needed to tackle complex challenges. Specifically, the phenomenon of exponential scaling—wherein the computational effort increases at an exponential rate as the issue size increases—remained a mystery. Because they relied on solving NP-hard issues, many of the first AI approaches struggled to handle bigger challenges.

Perspectives on AI?

So, where does AI stand right now? Artificial intelligence has come a long way as a discipline, and we know more about what works and what could scale. These days, when it comes to creating AI techniques, there are probably two main schools of thought: (i) Logic and doing what's right; (ii) Being human.

Pretending to be People

One of the best-known examples of the former is the Turing Test (Fig. 1.1), which states that a computer is considered intelligent if it can be mistaken for a person. Nowadays, passing the Turing test is not given much serious consideration. Alan Turing foresaw several significant criticisms of artificial intelligence (AI) in the next half-century and estimated that, by the year 2000, a computer may deceive a non-specialist for five minutes. Additionally, he

proposed the cornerstones of contemporary AI, which are knowledge, reasoning, language understanding, and learning. On the other hand, there is a tiny but increasing group of academics that are aiming to create AI on par with humans by studying human brains. This area of study is motivated by the hypothesis that a large portion of the human brain could be running a learning algorithm. This thesis has sparked a number of ongoing efforts by various research groups to deduce what the brain's learning algorithm could be and then apply it or something close to a computer. The hope is that this will be a first step towards creating artificial intelligence systems that can compete with humans. A significant subfield within computational neuro-science, which seeks to understand "how the brain thinks," is the study of the brain and its cognitive processes.

Moving Logically

A large number of artificial intelligence researchers have shifted their attention from the first approach—attempting to program computers to mimic human behavior—to the second—training them to think logically. This class of methods is going to be our main emphasis. Doing the right thing is the essence of rational action. The correct course of action, then, is one that, given the facts at hand, is likely to maximize the attainment of the established objectives. Thinking is not required for this, but it should be used to rationally behave.

An agent is often a creature that observes and acts; many AI systems nowadays consider rational agents. One way to conceptualize an agent in an abstract manner is as a function that maps perception histories to actions: $(f: P^* \rightarrow A)$

It is our goal to identify the agent or agents that perform the best across all possible contexts and jobs. Crucially from a practical standpoint, complete rationality is usually not feasible due to computing constraints. Therefore, in reality, our primary focus is on creating the optimal program within the constraints of the available machine resources. A great deal of progress in creating AI systems that are both socially and economically beneficial has occurred under the framework of rational action. Using web search engines, sending US mail or writing checks (where software reads zip codes or handwritten checks automatically), finding driving directions online, receiving recommendations for books or movies you might like from Amazon, Netflix, etc., using your credit card for legitimate purchases, spam filters, and countless other ways AI algorithms are used every day without you even realizing it. In a nutshell, this branch of artificial intelligence makes use of methods including search, machine learning, probabilistic models, and constraint satisfaction. A wide range of intelligent system construction activities can benefit from these methods, including perception (i.e., making sense of the physical world through sensor inputs), planning, navigation, and many more. One to many relationship: There are a plethora of methods that can accomplish the same goal, and a single approach can serve as a building block for even more methods.

machine learning domains

Search and state graphs

Missing information

Iterative search

Representation of knowledge and expert systems

machine learning domains

Logic that is formal (first-order, propositional)

reasoning using semantic networks and cases

Probabilistic reasoning and machine learning

Systems for Support Vector Machines and Artificial Neural Networks

Machine learning models

Markov hidden models with Kalman filters

Fundamental ideas and practical uses

Agent systems that are intelligent and reasonable

Making plans and decisions

Machine translation

Games

Conclusion

fundamental search techniques and the formulation of AI applications as search problems. Next, we'll zero in on machine learning, an area that has seen tremendous development as of late. Among the topics covered will be supervised and unsupervised learning, an overview of probabilistic reasoning, and a look at where the field is headed in terms of current research.

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