The History of Artificially Intelligent Technology

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Abstract

Limited knowledge of AI history is one of the factors undermining the effective utilization of AI technology. This research paper analyzes the history of AI to identify the factors that catalyzed the development of the technology. The findings suggest that desire to generate massive improvements in human beings' physical and psychological wellbeing had a significant influence on AI inventions. According to the reviewed studies, these inventions commenced in the 1950s with the visionary works of pioneers like McCarthy and Minsky. It manifested in the current AI developments like Siri, Watson, and Alexa. In the future, the desire to improve people's lives will be represented in the general-purpose AI and unsupervised learning AIs.

Introduction

Artificial intelligence, (AI) technologies are filtering through all aspects of people's professional and personal environments. AI applications that are currently part of human beings' everyday activities include self-driving vehicles, predictive analytics based shopping forecasts, behavioral algorithms, and voice-based personal assistants, (Tang, et al., 2018). Experts have predicted that, within the next 50 years, AI technologies will become smarter, faster, more efficient, and easier to use. By 2070, AI will have superior physical, cognitive, and social capabilities, (Manyika, 2017). From the physical standpoint, AI technologies will have mobility, gross motor skills, fine motor skills, sensory perception, and navigation capabilities, (Manyika, 2017). From the cognitive perspective, AI technologies will have the capacity to collaborate with human agents, articulate output, optimize activities, undertake strategic planning, engage in logical reasoning, solve problems, formulate new patterns, recognize existing patterns, and understand natural language, (Manyika, 2017). From the social point of view, AI tools will generate emotional output, generate social output, reason socially, reason emotionally, sense social cues, and sense emotional cues, (Manyika, 2017).

Certainly, the projected improvement in the convenience, efficiency, intelligence, and speed of future AI technology is best reflected in Google's *DeepMind's* and IBM's *Watson's* annihilation of the most talented human contenders in the world in *AlphaGo* and *Jeopardy*, respectively, (Jarrahi, 2018). Their ability to challenge and defeat the world's best at these sophisticated board games foretells a future in which AI applications will permeate all aspects of people's personal and professional lives, (Jarrahi, 2018). In this future, machine learning technologies will improve people and organization's ability to optimize clinical trials, diagnose diseases, undertake predictive maintenance, optimize merchandizing strategies, predict personalized health outcomes, discover new consumer trends, personalize crops to individual conditions, optimize pricing, optimize scheduling in real-time, personalize advertising, identify and navigate roads, personalize financial products, and identify fraudulent transactions, (Jarrahi, 2018). In the process, various aspects of people's professional life will benefit, including travel, logistics, media, health care energy, automotive, communication, manufacturing, finance, consumer, and agriculture.

In spite of these rosy predictions, a cross-section of experts is experiencing hardship in appreciating the essence of AI and the uses of AI. These experts have rubbished the claim that the permeation of AI will foster productivity, efficiency, convenience, and improvements. Instead, they have associated the infiltration of AI with negative outcomes like job losses, human beings' extinction, and manmade disasters. Grace et al., (2018) assert that the advent of AI will lead to many redundancies. According to Grace et al., (2018) unemployment will reach its peak when the development of high-level machine intelligence leads technology firms to create autonomous machines that can accomplish everyday tasks more efficiently, cheaply, and conveniently than human actors. The attainment of high-level machine intelligence in the automotive sector will contribute to the termination of millions of driving jobs. In addition to the predicted job losses, the widespread permeation of AI will necessitate the adoption of new laws, the implementation of new measures of safeguarding property, and the redevelopment of infrastructure, (Grace, et al., 2018). Similarly, Ahmad, (2018) argues that a strong correlation exists between AI infiltration and the extinction of human beings. Ahmad asserts that intelligence is one of the factors that contributed to the extinction of advanced ape species like Homo florensis, Homo denisova, Homo soloensis, and Homo neaderthalensis. Using the same logic, Ahmad, (2018) contends that the invention of AI robots with superior cognitive capabilities will lead to the extinction of human beings. These assertions underline the difficulties scholars are facing in understanding the value and uses of AI.

One part of the challenges in using AI technology is that many do not understand its history. The implicit value judgment in this research paper is that an appreciation of the history of AI technology will eliminate concerns and uncertainties surrounding its usefulness. The analysis will allay fears by showing that technology firms and other developers are not just making the AI technologies for the sake of replicating or surpassing human-level intelligence. The study's account on the history of AI will also reveal that technology firms and other stakeholders are not just developing AI to satisfy their personal interests at the expense of the masses. The evaluation of the historicity of AI will reveal that service to the society has always and will always be at the heart of AI innovations. It will show that technology developers are not focused on AI systems that want to foster social divisions and destroy human beings. Developers want to create AI technologies that will deliver net benefits for the human population. Their objective has always been to establish AI technologies that will lead to the effective and efficient management of natural disasters, natural resources, chronic illnesses, logistics, trade, armed conflict, and traffic flow.

Limitations of the Study

This study will focus exclusively on the history of AI. In analyzing the historicity of the technology, the researcher will focus on the motives behind the development of past, current, and future AI technologies. Nonetheless, the scope of the study will not extend into other areas like the functions of AI, the definition of AI, and the functional mechanisms supporting AI technology. Whereas an assessment of the functions of AI would enrich the present study, the time allocated for the completion of the present project would not allow for an in-depth investigation into the functions of AI. Concerning the definition of AI, the researcher will cover it in the literature review section. Adequate coverage in the literature review will mean that there is no reason for subsequent review of studies that have defined the concept. Functional mechanisms supporting AI will feature in the study, but it will not be part of a separate heading. Instead, the researcher will highlight the functional components in the course of the analysis of the history of AI.

Methodology

In the course of collecting data on the study, the researcher employed the qualitative research design. This research design is beneficial for studies with sufficient secondary data. In this regard, the topic on the history of AI has been the subject of extensive investigation. However, none of the past publications have undertaken a study that specifically investigates AI and its historical implications on contemporary society. Therefore, the findings in this study seal the gaping hole in literature.

Literature Review

Definition

The first step to understanding the use of AI is to define it. AI technologies have many variations. As the case with the diversity of technologies, experts have proposed varying definitions of AI, but several distinctive features cut across all of their definitions. Jarrahi, (2018) defines AI as super intelligent technologies and applications systems that can learn and think. Tang et al., (2018) states that artificial intelligence denotes a technology or machine’s capacity to mimic human intelligence. Wiskirchen et al., (2017) define AI as the modelling of super intelligent computer systems around human beings’ cognitive problem-solving practices. An analysis of the three definitions shows that a common thread cuts across them. In all the three definitions, AI experts have identified the replication of human-level thinking and problem-solving as the signature characteristic that would distinguish AI applications and concepts from other technology innovations. In this respect, a technology will quality as AI if has the internal mechanisms needed for it to learn, think, strategize, and make reasoned conclusions independently. Indeed, it is this ability to think and make reasoned judgments that distinguishes human beings from other species. Therefore, the same cognitive competencies differentiate AI from other technologies.

In addition to the cognitive capabilities, AI technologies encompass a diverse network of algorithms, techniques, and tools. Many tools, technologies, and applications fall within the broad scope of AI, (Jarrahi, 2018). These include deep learning, genetic algorithms, pattern recognition, speech recognition, neural networks, machine learning, reinforcement learning, recurrent neural networks, convolutional neural networks, and AutoEncoders, (Jarrahi, 2018). These tools, applications, and technologies have components that can strengthen human work and expand cognitive utility, (Jarrahi, 2018). Examples of components that can expand cognitive function and amplify the effectiveness of human beings include machine vision, machine learning, and natural language processes, (Jarrahi, 2018). Technologies with machine vision capabilities can use sophisticated algorithms to analyze and inspect images and videos, (Jarrahi, 2018). Technologies with machine learning competencies use complex algorithms to learn and develop new skills, (Jarrahi, 2018). Tools with language processing capabilities can capture, analyze, and understand all versions of written and spoken languages communicated by human, (Jarrahi, 2018). Based on this assessment of the functional components of the technology, AI is the system of tools, applications, and technologies with machine vision, machine learning, and natural language processing skills.

Historical Development

The review of texts on AI indicates that the development of innovations that support human beings' pressing needs is chief factor that characterizes the historical development of the AI concepts and AI technology. The emergence of the AI concept and AI technologies in the 1940s and 1950s owes a great deal to scientists' desire to improve people's quality of life and social wellbeing. The early years of AI were characterized by a mixture of visionary statements and AI-related development. Pioneers like John McCarthy, Herbert Simon, and Marvin Minsky made claims about their vision of a future world in which corporations would be developing technologies with human-level intelligence, (Wiskirchen, et al., 2017; Brynjolfsson & McAfee, 2017). In contrast, inventors like McCulloh, Pitts, and Rosenblatt created new technologies with AI-like features, (Tang, et al., 2018), but there was no convergence between the individuals making predictions about AI and the group of inventors developing technologies with AI features. This chaotic beginning did not prevent the visionaries and the inventors from formulating new AI ideas or putting in place the foundations that would lead to the eventual development of technologies with super intelligence. Instead of forestalling the growth, the chaos that characterized the start of AI proved beneficial in the eventual growth of the technology.

History of AI

Early Years of AI

The desire to improve human beings' livelihoods manifests in pioneers' assertions on the AI concept. John McCarthy, the individual credited with the development of the AI concept, had the improvement of human beings' wellbeing in mind when he formulated the concept. Technology historians and AI experts have traced the history of the innovation to 1955 when John McCarthy, a computer scientist and math professor at Dartmouth University, theorized about a concept that he referred to as artificial intelligence, (Wiskirchen, et al., 2017). After extensive research into artificial intelligence McCarthy concluded that scientists could develop or simulate human-level cognition by learning about and documenting the precise mechanisms that support learning and other spheres of intelligence, (Wiskirchen, et al., 2017). In the course of developing his vision of the AI with human-level intelligence, McCarthy reasoned that the technology would improve the efficiency of various forms of human activity, (Brynjolfsson & McAfee, 2017). In 1957, Herbert Simon, an Economist, predicted that technology companies would develop computer applications and computing systems that would defeat the chess grandmasters within 10 years. Although it took more than 40 years for inventors to create the technology that would realize that vision, Simon's use of chess as an illustration suggests that he regarded AI as a positive rather than a negative technology.

The focus on the link between AI and the improvement in people's lives was the influence between Marvin Lee Minsky's contributions to AI development. Marvin Lee Minsky, a mathematics professor and the founder of Massachusetts Institute of Technology's Artificial Intelligence Laboratory, had the same type of positive worldview when predicted in 1967 that inventors would resolve the problem of creating human-level intelligence within 30 years, (Brynjolfsson & McAfee, 2017). Building on the work of early pioneers and computer scientists like Allen Newell, Herbert Simon, and John McCarthy, Minsky called on researchers to undertake studies into AI and the strategies for endowing computers with human-level intelligence, (Brynjolfsson & McAfee, 2017). These efforts led to the formulation of many theories on AI. The theories suggested AI programs and proposed mechanisms for the development of applications and machines that would demonstrate the exercise of common sense, learn new things from individual examples, and answer queries drawn from children's storybooks. Minsky and his colleagues' focus on children's books, common sense, and machine learning provides further proof that service to human beings characterized the early years of AI development. Minsky and other visionaries who worked with him regarded AI as an invention that would revolutionize the way people and organizations conduct their work.

Certainly, this emphasis on the positive effects of AI characterized most of the AI-related progress that emanated from the Artificial Intelligence Laboratory at MIT. By the late 1960s, Minsky's Artificial Intelligence Lab had pioneered the development of a robotic arm. He argued that the robotic arm had simple manipulators that would be useful for nuclear-material processing and space exploration, (Winston, 2016). In the same period, Minsky worked with Seymour Papert, a mathematician at MIT, to develop the mathematics of perceptron mechanism, (Winston, 2016). Perceptron mathematics technology used simple neural networks to explain what the tasks they could or could not perform, (Winston, 2016). This development pushed studies into neutrally-inspired technologies to the next level. Between the 1970s and mid-1980, Minsk and Papert collaborations led to the formulation of new theories on the use of Logo Language to teach children, (Winston, 2016). In the mid-1970s, Minsky and Papert created the K-lines concept. The K-lines concept was a mechanism that explained how the brain represents, stores, retrieves, and uses information, (Winston, 2016). Minsky argued that K-lines are a crucial part of human cognition, (Winston, 2016). According to Minsky, K-lines help human beings in resolving complex problems by placing them in states that resemble previous situations in which they addressed similar problems, (Winston, 2016). Through K-lines and many other concepts, Minsky outlined the contours that governed human-level cognition, (Winston, 2016). He highlighted the characteristics of human-level intelligence and the types of cognitive capabilities scientists ought to focus on when developing AI technologies, (Winston, 2016). All of these AI inventions and AI concepts underscore Minsky’s belief that AI would be a positive influence on the human population. Minsky and his colleagues regarded AI as a technology or system that would improve human beings’ ability to undertake many of the activities that are different to perform.

As well as the visionaries, the development of AI-like technologies was an important part of the early history of the technology. In most of the early AI technologies, the developers sought to create inventions that could perform specific tasks. Unlike the visionaries who focused the possibility of developing AI technologies with general cognitive capabilities, early AI developers concentrated their efforts on the development of tools that could perform specific tasks. However, the focus on technologies that would be beneficial to humans is a thread that cut across the early AI applications. Lu and Burton, (2017) acknowledge that McCarthy is one of the key creators and pioneers of AI. However, they note that the thought processes behind the modern-day concepts of AI had begun as early as 1943, (Lu & Burton, 2017). In this respect, Lu and Burton, (2017) assert that McCulloh and Pitts, (1943 as cited in Lu and Burton 2017 at p. 51) kick started the move towards AI in 1943 when they used binary fusion technology to create the first ever AI-based health care neuron. In addition to McCarthy, McCulloh, and Pitts, other notable inventors and pioneers were Rosenblatt and Werbos. Rosenblatt, a legendary psychologist, provided further boost by developing *Perceptron*. Utilized widely in the modern-day medical applications, *Perceptron* can undertake an accurate analysis of artificial neural networks, (Lu & Burtonn, 2017). Werbos, a doctoral student pushed the shift towards AI a step further by introducing the backpropagation learning technique, (Lu & Burton, 2017). Backpropagation learning augmented the functionality of the standard network designs that supported the Self-Organizing Future Map and the Radical Basis Function technologies, (Lu &

Burtonn, 2017). As these early AI inventions suggest, inventors' objective was to create inventions that would solve everyday problems. They did not want to develop technologies that created the conditions necessary for increased human suffering. Rather, they wanted to create inventions that would improve the efficiency with which human beings diagnosed diseases and resolved other routine challenges.

Present-Day AI

In the present-day, the grand promises of visionaries like Minsky, Papert, and McCarthy have become reality. Technology companies have moved swiftly from Minsky, Papert, and McCarthy's visions to the development of technologies whose capabilities resembles some of their claims. In the new era of AI development, the claims and theories propounded by the pioneers and inventors have become principles that guide the direction of R&D activities, (Muller & Bostrom, 2016). Nonetheless, the emphasis of technology firms has not been on the development of AIs with general human-level intelligence, (Muller & Bostrom, 2016). It has been on the creation of applications that can address specific engineering, medical, or scientific problems. The technologies can perform specific cognitive tasks, but cannot undertake general human-level intelligence tasks, (Muller & Bostrom, 2016). Nonetheless, the lack of AI technologies with general human-level super intelligence does not imply that many of the existing inventions are ineffective. Reviews of developed AI applications and AI-based technologies show that they have one or many physical, cognitive, and social capabilities. The physical competencies include mobility, gross motor skills, fine motor skills, sensory perception, and navigation skills, (Manyika, 2017). The cognitive capabilities include collaboration skills, output articulation skills, activity optimization capabilities, strategic planning skills, logical reasoning skills, problem solving skills, pattern recognition skills, perception skills, voice recognition skills, vision recognition skills, and natural language discernment skills, (Manyika, 2017). The social abilities are social output generation skills, social reasoning skills, emotional reasoning skills, social cues sensing skills, and emotional cues sensing skills, (Manyika, 2017). None of the recently developed AIs have all these social, physical, and cognitive skills. Most have at least five of the identified cognitive skills or three of the outlined social skills.

Cognition has been an important feature in many of the present-day AI applications adopted by corporations. In fact, many of the biggest AI inventions have been in three broad categories related to cognition: perception, logical reasoning, and image recognition. Concerning perception, technology companies have created the most pragmatic AI advances based on speech or voice recognition. AI-based technologies like Google Assistant, Alexa, and Siri are now using voice recognition applications to address the needs of millions of consumers across the board, (Brynjolfsson & McAfee, 2017). Studies into the effectiveness of voice recognition applications indicate that applications like Google Assistant, Alexa, and Siri are up to three times as fast as typing text messages on a cellphone, (Brynjolfsson & McAfee, 2017). Further, the studies suggest that the error rate of the technologies has dropped from 8.5% to 4.9%, (Brynjolfsson & McAfee, 2017). This perception capability means that consumers can now dictate texts to a computer for purposes of transcribing, (Brynjolfsson & McAfee, 2017). The strange thing about the improvements in the perception capabilities of AI technologies is that many of them have occurred after 2016, (Brynjolfsson & McAfee, 2017). Over the three year period, technology firms like Google, Amazon, and Apple have made major breakthroughs in their research on perception, (Brynjolfsson & McAfee, 2017). The outcome has been the development of low-cost AI applications that improve the lives of consumers. Millions of consumers are now using smartphones, tablets, and virtual assistants with speech recognition competencies.

Image recognition is another aspect of AIs' cognitive competence that has witnessed dramatic improvement in recent years. Advancements in image recognitions have led to the creation of low-cost visual systems that have been incorporated into existing social media technologies, transportation systems, and security technologies. Facebook has incorporated vision systems into its social media application, (Brynjolfsson & McAfee, 2017). The image recognition application has now made it possible for the Facebook App to recognize the faces of individuals in the images subscribers are posting on their wall, (Brynjolfsson & McAfee, 2017). Within a matter of seconds, the Facebook App can recognizes the faces of friends, identifies their names, and prompts the Facebook subscriber to tag them by revealing their names. Other smartphone applications are also using visual systems to improve user experience, (Brynjolfsson & McAfee, 2017). A smartphone applications equipped with vision systems can now recognize and correctly identify the names of different birds in the wild. In corporate headquarters and secure installations, image recognition systems are rendering ID cards redundant, (Brynjolfsson & McAfee, 2017). The increased use of image recognition systems has arisen from advancements in their image recognition capabilities. In the past, vision systems made at least one mistake after every 30 frames, (Ahmad, 2018). Given that the cameras using vision systems record at least 30 frames per second, the mistake meant that the technologies would make a mistake every second. However, advancements have reduced the image recognition error rate to one mistake in every 30 million frames, (Brynjolfsson & McAfee, 2017). Similarly, the progressions have led to an improvement in the vision system's ability to recognize images in large databases. An assessment of vision systems' error rate in a database with more than one million weird, obscure, and common images dipped from 30% in 2010 to 4% in 2016. The dramatic improvement in image recognition capabilities has had a major influence on the development of low-cost vision systems for security and social media applications.

In addition to perception and image recognition capabilities, technology firms have developed AI applications with logical reasoning capabilities. Technologies with logical thinking skills have machine vision, machine learning, and natural language processing competencies. Machine vision, machine learning, and natural language processing competencies have been integral to the development IBM's *Watson's* super intelligence. These capabilities have helped *Watson* to learn new skills and improve existing competencies, hastening its deployment in sophisticated knowledge-based tasks that were within the exclusive domain of white-collar workers, (Jarrahi, 2018). The language processing capability has been particularly useful in enabling IBM's *Watson* to engage in the real-time analysis and interpretation of nuances that exist in spoken and written language, (Jarrahi, 2018). Machine learning competencies give Watson the ability to learn from its past interaction with different types of data and use insight drawn from those experiences to formulate reasoned judgments, (Jarrahi, 2018). With the aid of doctors' notes, electronic medical records, evidence-based studies, and machine learning, Watson has learned how to identify minute variations in cancer disease patterns among cancer patients at Memorial Sloan Kettering, (Jarrahi, 2018). The machine vision capability has helped *Watson* in the rapid processing of MRI scans of the human brain to help doctors at the same hospital in identifying minute hemorrhages, (Jarrahi, 2018). The technology's logical reasoning competencies have given it an edge over existing AI systems.

Future AI

In the coming years, inventions will focus on two broad domains of AI. They include unsupervised learning and general AI. Unsupervised learning is the branch of AI that is creating machines that can learn independently. The development of unsupervised learning will be the first step towards the development of superhuman and super intelligent AIs. Human beings excel at unsupervised learning activities. Human beings have developed most of their knowledge of their social environments, (like how to recognize soil texture or how to identify people from different racial groups) without any form of label data, (Brynjolfsson & McAfee, 2017). However, scientists are experiencing immense difficulty in developing AI applications that can mimic human beings' unsupervised learning skills, (Brynjolfsson & McAfee, 2017). Their success in developing the new technologies will signal the emergence of new ways of solving complex problems, (Brynjolfsson & McAfee, 2017). The technologies with unsupervised learning capabilities will discover new patterns in consumer purchase decisions, share price movements, and infectious disease epidemics, (Brynjolfsson & McAfee, 2017). These arguments suggest that scientists regard the development of AIs with unsupervised learning technologies as the holy grail of human-level intelligence. Technology companies can create substantial improvements in people's wellbeing by creating technologies with unsupervised learning competencies.

Along with unsupervised learning, future AI technologies will have general purpose cognition capabilities. Although general-purpose AI formed an important part of the AI concepts that pioneers like McCarthy and Minsky published in the 1950s and 1960s, companies are yet to make any breakthroughs in the development of general-purpose AIs. General-purpose AIs are different from existing AI applications because they would outperform humans in every level of cognitive intelligence, (Lu, Li, Kim, & Serikwa, 2018). Whereas existing AI applications outstrip human beings in specific activities like solving complex mathematical equation and playing chess, general AI technologies seek to outdo human beings in all tasks performed by human beings, (Lu, Li, Kim, & Serikwa, 2018). Nonetheless, the achievement of general intelligence is an issue that scientists have failed to master. Scientists are yet to develop models that can simultaneously think, strategize, and review various documents.

Conclusion

One part of the challenges in using artificial intelligence technology is that many do not understand the history of it. The assessment of the history of AI has revealed that pro-people motives were the chief influence behind the emergence and development of the technology. The emphasis on service to the masses characterized the early works of McCarthy and Minsky. In fact, this focus proved useful in guiding most of Minsky's early research into AI applications and AI theory. The desire to foster human progress is also the motive behind the development of current and future AI technologies. The creation of AI applications with extensive cognitive, social, and physical capabilities arose from scientists desire to tackle chronic diseases, traffic jams, transcription challenges, communication barriers, and image recognition challenges.

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