REVIEW ARTICLE

An Approach to Understanding Similarities Between AI and the Human Brain

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Abstract

Artificial intelligence (AI) and neuroscience have a long history of working together. The daily social and economic activities are supported by AI, which is a significant piece of technology. One of today's most hotly disputed topics is AI, and there doesn't seem to be much agreement on how human and artificial intelligence vary and overlap. Discussions on a variety of relevant subjects, including ethics, healthcare, agriculture, education, and trustworthiness, are marked by implicit anthropocentric and anthropomorphic assumptions. It significantly supports Japan's economy's sustainable growth and provides solutions to a number of societal issues. AI has gained attention recently as a means of fostering growth in industrialized nations like the United States and Europe, as well as developing nations like China and India. Deep neural networks (DNNs), which have grown to be potent and common tools to simulate human cognition and frequently generate similar behaviors, can also be described as AI. DNNs appear to categories real-world images in the same way as people do, for instance, thanks to their hierarchical, brain-inspired organization of computations. DNNs, a subset of the larger machine learning family, are becoming more and more effective in commonplace real-world applications like automated face recognition and self-driving automobiles. The School of Psychology and Neuroscience at the University of Glasgow has recently published new research in the journal Trends in Cognitive Sciences that takes an approach to understanding whether the human brain and its DNN models recognize things in the same way, using comparable steps of computation.

Keywords: Artificial intelligence, Human brain, Technology, Similarities, Healthcare, Education, Agriculture.
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Introduction

Real Intelligence

The idea that human (general) intelligence is the "true" form of intelligence is implicit in our goal of developing AGI systems with humanoid intelligence. Even the title "Artificial Intelligence" implies that this is the case, suggesting that it is not totally real, i.e., real like non-artificial (biological) intelligence. In fact, we humans are aware that we are the intelligent beings in the universe with the highest level of cognition ever recorded. Additionally, we prefer to think of ourselves as rational beings capable of employing our experience, judgment, and the laws of logic, decision analysis, and statistics to solve a variety of complex issues under a variety of conditions. Therefore, it is not unexpected that we find it difficult to accept the possibility that we may be a little less intelligent than we keep telling ourselves or that we may be "the next insult to humanity." This extends to the frequent redefining of what constitutes "real (general) intelligence," which goes hand in hand with the field of artificial intelligence's rapid advancement. The definition of intelligence is then continuously modified and further limited to "those things that only humans can do," i.e., the capacity to autonomously and effectively achieve complicated goals. Thus, AI is described as "the study of how to make computers perform things at which, at the present, people are better" in accordance with this.[4,10,11]

Artificial intelligence

What is Artificial Intelligence? Artificial Intelligence is a concept in which we make our computers or any kind of machines so strong enough that it gets the ability to think and get the clout to get "SMART."

John Mc Carthy was regarded as the father of AI, as he was the one who actually coined this terminology. Logic Theorist was the first program, which was developed in 1995 by Newell and Simon and was considered the first AI programming. The thought of AI is basically based on the idea and concept of machines to build up the capabilities to think, act and behave like humans. However, we should keep our facts clear on the part that Artificial Intelligence is different from machine learning because the author's scope is greater than the author's.[5,17,20] AI, on the other hand, is essentially a bigger collection of numerous algorithms, flowcharts, and language processing. Although many people believe that AI is a concept for the far future, it has already begun to show up in our daily lives. Consider Siri or Alexa, which have already ingrained themselves into each of our lives. It is a sort of human assistance that relies on AI because it is designed to think, read, and respond just like a human. Apple

Music, YouTube, and Spotify are further examples of AI-based applications that allow users to access their chosen music services. Today's self-driving Tesla cars and Google's NEST are just a few examples of artificial intelligence in action. By delivering mobile warnings, banks employ AI to fight fraud in another way.[26,39] The use of Google Maps, which once again makes use of AI to analyze traffic and assist us in finding the quickest route to our destination, is a suitable example to follow. The real-time gathering of student learning data will be quite simple in the big data era, to start with[27,36-38] time.

A second example is the implementation of a kitchen robot as a decision-making system that accepts input from the robot's body and issues commands to its sensors. The kitchen robot's main objective is to maximize a reward signal that measures cleanliness. 1 A kitchen robot must possibly possess abilities in perception (to distinguish between clean and dirty utensils), knowledge (to understand utensils), motor control (to manipulate utensils), memory (to recall locations of utensils), language (to understand dirty dishes from dialogue), and social intelligence in order to achieve the highest level of cleanliness (to encourage young children to make less mess). Understanding if machine learning matches how people process information is a current challenge for accurate AI development. According to the researchers, they believe that this new research will advance the development of more precise and dependable AI systems that process data more like our brains do.

According to Philippe Schyns, dean of research technology at the University of Glasgow, "having a deeper grasp of whether the human brain and its DNN models detect things in the same way will allow for more accurate real-world applications using DNNs."In order to improve the way DNNs are utilized in applications like facial recognition, where they are currently not always correct, a better understanding of the mechanisms of recognition in human brains is necessary, according to the author. "Or spoken human behavior is only one aspect of building human-like AI. If technology is to be fully relied upon, it must also be able to process information or "think" as well as or better than people. To ensure that we don't merely have the impression that the system is functioning, we want to ensure that AI models are recognising things in the same way that humans would.

Degrees of Algorithmic Equivalence Between the Brain and its DNN Models published in trends in Cognitive Sciences. Artificial intelligence (AI) and neuroscience have a long history of working together. A new generation of in silico neural networks inspired by the structure of the brain has emerged as a result of developments in neuroscience and significant increases in computer processing capacity over the past few decades.

Many of the sophisticated perceptual and psychological capabilities of biological systems, including as object recognition and decision-making, are now attainable by these AI systems. Additionally, AI is now more frequently used in neuroscience research as a tool, which is revolutionizing our understanding of how the brain works.[2] The daily social and economic activities are supported by AI, which is a significant piece of technology. It significantly supports Japan's economy's sustainable growth and provides solutions to a number of societal issues. AI has gained attention recently as a tool for promoting growth in industrialized nations like the United States and Europe as well as developing nations like China and India.[29]

One of today's most hotly disputed topics is AI, and there doesn't seem to be much agreement on how human and artificial intelligence vary and overlap. The quest of human-like intelligence as the gold standard for artificial intelligence is an example of how discussions on many important subjects, such as reliability, explainability, and ethics, are characterized by implicit anthropocentric and anthropomorphistic concepts. The intelligence of people is are a good example of AI. DNNs are used by researchers to model information processing and examine how well it resembles human information processing.

While DNNs have gained popularity as a tool to simulate brain functions, particularly the ability to visually recognize objects, the methods by which DNNs accomplish this might vary greatly.

AI seeks to adapt to the cognitive capabilities and constraints of the human team members as a "team member." Additionally, metaphors that highlight a high level of cooperation, likeness, and equality in "hybrid" people include "mate," "partner," "alter ego," "Intelligent Collaborator," "buddy," and "mutual understanding. "The ability to feel, understand, and respond to a variety of complex human behavioral characteristics, such as attention, motivation, emotion, creativity, planning, or argumentation, is a requirement for human-aware AI partners to work as "human collaborators."[1,3]

For as long as there have been businesses, understanding human behavior has been essential. How can people's motivation, involvement, and loyalty to a firm be revealed? How can you learn more about the wants and preferences of your customers?[8]

Deep Neural Network (DNN)

Computers can now perform cognitive tasks better handled by people thanks to artificial DNNs, which were first inspired by the brain. As a result of the lack of answers for these cognitive phenomena, cognitive scientists have begun employing DNNs as models to study biological cognition and its neurological foundation, generating a controversy discussion. Here, we consider the case from the standpoint of scientific philosophy. After putting DNNs as scientific models into perspective, we talk about how DNNs can significantly advance cognitive research. Beyond their ability to predict and explain cognitive processes, we contend that DNNs also have the potential to contribute to exploration, a common but essential use of scientific models that is frequently ignored.

Deep Neural Networks' Disputed Value in Cognitive Science

Artificial DNNs that are neurally inspired 1, 2 have revolutionized a variety of fields in recent years, including computer vision,[31] natural language processing,[32] control and planning (such as playing games like Joystick and Go 34, 35), and navigational tasks (such as finding the shortest path on a subway map).[33,30]

Similarities between AI and the Human brain in the Education system

In modern education, the traditional classroom learning environment has developed to utilize technological resources and to offer students of all ages, regardless of their physical locations, online classroom options. With distance learning, massive-open-online-courses (MOOCs), and electronic tablets in the classroom, technology has become an essential component of education and is changing how teachers impart knowledge to their pupils.

Artificial intelligence is a very new technology that has gained a lot of traction in the field of educational technology. In higher education, AI is important to e-teaching and e-learning. AI is advancing quickly and has been continuously changing the modern world for decades. All kinds of industries, including commerce, economics, transportation, healthcare, education, and so on, benefit from AI technologies.[25]

Similarities between AI and Human brain in healthcare

Oncologists typically use medical imaging techniques like computed tomography (CT) scans and magnetic resonance imaging (MRI) to undertake the initial evaluation of brain malignancies. The brain anatomy may be seen in great detail using these two modalities, and any alterations can be seen. However, a surgical sample from the suspected tissue (tumor) is required for a thorough diagnosis by the specialist if the doctor detects a brain tumor and needs more information about its nature. These many imaging techniques for brain tissue have improved recently for image contrast and resolution enhancement, enabling the radiologist to detect even minor abnormalities and, therefore, improving diagnosis precision.[18]

AI and psychiatry's intersection

Psychiatric and developmental disorders are still primarily diagnosed based on a patient's subjective behavioral symptoms and self-report measures, despite the adoption of standardized diagnostic criteria in clinical manuals like the diagnostic and manual of mental disorders (DSM) and the International Classification of Disease (ICD). Additionally, this method's subjectivity makes it frequently unreliable.[2] It is anticipated that AI will significantly increase augmentation and automation in the HR domain towards difficult jobs like communication and decision-making, as well as complete management.[16]

The incredible capacity of the brain to rearrange itself by creating new connections between brain cells (neurons). It was once thought that as we matured, our brain's neural connections solidified.

The brain changes continuously as a result of learning, according to research. The brain's ability to adapt to learning is known as plasticity. Learning-related changes mostly affect the connections between neurons.[19]

High-performance deep learning networks have been trained to identify voice, caption images, and translate text between languages. Despite the widespread use of deep learning networks in solving real-world issues, we still don't fully comprehend why they perform so well. High-performance deep learning networks have been trained to identify voice, caption images, and translate text between languages. Despite the widespread use of deep learning networks for solving real-world issues, we still don't fully comprehend why they perform so well.[15]

Human intelligence is ultimately creative, and artificial intelligence will always face this issue. Even technologically oriented AI cannot ignore it because innovative programmes may prove highly helpful in the marketplace or in the lab. Additionally, cognitive science-related AI models can assist psychologists in understanding how it is feasible for human minds to be creative. Human intellect is fundamentally creative, and artificial intelligence will always face this issue. Even technologically oriented AI cannot ignore it because innovative programmes may prove highly helpful in the marketplace or in the lab. Additionally, cognitive science-related AI models can assist psychologists in understanding how it is possible for human minds to be creative.[14,51-53]

In Agriculture, Between Ai And Human

The UN's Food and Agriculture Organization (FAO) projects that by 2050, there will be over 9 billion people on Earth. The agricultural production system is being forced into a new era as a result of rapid population expansion, declining cropland, depleting natural resources, unpredictable climate change, and shifting market needs. The new agricultural system needs to increase output productivity, operational efficiency, climate change resistance, and sustainability for future generations. In order to overcome the difficulties presented by this new era, AI shows promise. With more than 2000 scientists conducting agricultural research in more than 90 locations across the United States and in three other countries, the Agricultural Research Service (ARS) of the United States Department of Agriculture (USDA) is the world's leading organization for agricultural research. The ARS carries out research in a variety of fields, including food safety and nutrition, crop and animal production and protection, natural resource conservation, and sustainable agriculture. ARS has developed a virtual Center of Excellence (COE) to provide strategic leadership on the application of AI in agricultural research in order to utilize the potential of new technologies and transform this field of study.[24] Research using AI in agriculture.[24]

How to properly produce enough high-quality food for the rapidly expanding global population is the obvious topic at hand. Agricultural research experts have always used modern technology as they look for new methods to incorporate them into agricultural systems. Dynamic crop simulation models have proven to be effective tools for combining a variety of agricultural system components. Enabling us to investigate how certain components work internal functioning of the system.

We maintain that valid satellite-based crop status information can be obtained at broad scales using crop phenotypic data that was retrieved from UAS data.

Crop simulation models evaluate crop productivity using input variables such as crop management data, weather information, and soil data and have developed into effective tools for tying together physiology, genetics, and phenomics. The development of crop simulation models from the field to huge regions is the primary focus of current research in this direction.[23,41-43] Workforce and skills

According to Panpatte (2018), artificial intelligence enables farmers to compile vast amounts of data from public and government websites, analyze it all, and provide farmers with answers to many difficult given. It also gives us a wiser manner of irrigation, which increases the farmers' produce. In the near future, farming will be a combination of technology and biological skills thanks to artificial intelligence, which will not only improve quality for all farmers but also reduce their losses and increase their yields. With more people moving into cities, farmers will need to carry a lighter load. AI can be used in agriculture to automate various procedures, lower risks, and give farmers relatively simple and effective farming.[22,44-46]

Reduce the need for pesticides: AI manages weeds by incorporating computer vision, robotics, and machine learning that gathers data to keep a check on the weeds and helps farmers spray chemicals only where the weeds are present, reducing the need to treat a field with chemicals. In the end, it effectively lowers weeds while also using less pesticide in the field than is typically sprayed with chemicals.[21,47-49]

Potential Effect of AI on Clinical Care and Health Workforce

Machine learning has become a "General Purpose Technology", in that it is pervasive, can be improved over time and has the potential to spawn complementary innovations.[14] The implementation of such technologies tends to result in "widespread economic disruption, with concomitant winners and losers".[15] Economists Acemoglu and Restrepo, who studied the historical effects of automation – the process of substitution of mechanization for human labor – argue that automation exerts a *displacement effect* where machines displace human labor in areas where machines have differential advantages.[16] However, countervailing forces that increase demand for labor offset this displacement effect: a *productivity effect,* as operations become more efficient and less costly. This in turn, allows savings to be invested on existing non-automatable tasks and on the creation of new non-automatable tasks, some of which involve directly working on the automating technology.

To see how this general trend might apply to the health care workforce, it is useful to examine the clinical area that is currently best represented in machine learning literature, diagnostic radiology.

As deep learning algorithms have set new performance benchmarks in diagnostic image analysis, some commentators have forecast the inevitable demise of radiologists and questioned the need for training new radiologists.[17] It is plausible that machine learning will enable existing radiologists to handle more cases and then, as machine learning systems are able to work more autonomously, to transfer responsibility for diagnostic image analysis to non-radiologists supported by machine learning systems. Such reorientation of tasks would create an opportunity for health systems to recalibrate the skill mix of radiology teams and their distribution, with more tasks done at the primary care level and non-automatable work and rarer cases handled by a smaller number of radiologists at secondary and tertiary centers.

The researchers behind a machine learning system responsible for pneumonia diagnosis[18] have developed a tool where the technology system "reads" the image first and highlights areas for the human radiologist to focus on – thereby improving workflow efficiency by allowing a human decision maker to focus her limited attention where it can be most effectively deployed and deal with many more cases.[10] One would expect the same applications to also transform pathology and other specialties reliant upon image analysis.[19,20]

Machine learning will thus create processes performed by a hybrid of *humans and computers*. These instances offer the potential to achieve an optimal combination of leveraging human ability to generate hypotheses, collaborate and oversee AI systems to harness AI ability to analyze large volumes of data to find associations with predictive power or optimize against a success criterion. Jha and Topol propose that radiology and pathology should be amalgamated into a new specialty called an "information specialist," whose responsibility will not be so much to extract information from images and histology but to manage the information extracted by artificial intelligence in the clinical context of the patient (reference s21 in Online Supplementary Document (Online Supplementary Document)).

Implications

On a more fundamental level, using artificial intelligence for routine activities could make people lazy. If a machine can do something, why should I waste my time trying to do it myself? Humans are exceptionally good at reasoning, analyzing situations, and making decisions. The human brain and its powers can be wasted if artificial intelligence is employed for interpretation. The requirement to reform the judicial system is another matter that can cause controversy. Laws governing the social roles of robots would need to be changed if artificial intelligence develops as predicted, creating thinking robots that resemble humans in terms of feelings and emotions. Would they be held accountable for what they did? Do they share the same rights as us?[26]

Conclusion

The brain has been the main source of inspiration for the development of artificial systems of intelligence ever since the field of artificial intelligence research first emerged in the middle of the 20th century. This is largely supported by the argument that the brain provides an appealing architectural pattern for artificial intelligence since it serves as proof of concept for a full intelligence system capable of observation, planning, and decision-making.[2,7,9]

Both natural and artificial intelligence represent amazing engineering achievements. However, there are important distinctions between the two that help to distinguish them. For starters, unlike artificial intelligence, which is based on computer systems, human intelligence is based on the chemical and electrical activity of the brain. In addition, whereas artificial intelligence is utilized for activities like data mining and machine learning, human intelligence is employed for activities like pattern recognition and natural language processing. It is advised that computational studies involving the usage of artificial neural networks be included in the study of neuroscience because the benefits of understanding and implementing neural networks in medical science are fairly substantial. Additionally, by establishing facilities and providing staff with the necessary expertise, research in the developing subject of computational neuroscience should be strongly promoted. It is advised that computational studies involving the usage of artificial neural networks be included in the study of neuroscience because the benefits of understanding and implementing neural networks in medical science are fairly substantial. Additionally, by establishing facilities and providing staff with the necessary expertise, research in the developing subject of computational neuroscience should be strongly promoted.[5] The lack of effective irrigation systems, weeds, difficulties with plant monitoring owing to crop height, and harsh weather conditions are only a few of the difficulties the agricultural sector encounters. But with the help of technology, performance may be improved and these issues can be resolved. It can be improved with a variety of AI-driven strategies, such as automatic irrigation using GPS and remote sensors to determine soil moisture content. Farmers had the issue that precision weeding techniques outweighed the substantial number of crops lost throughout the weeding procedure. These autonomous machines not only increase productivity but also lessen the demand for pointless pesticides and herbicides. In addition, farmers can use drones to properly spray insecticides and herbicides on their land. First off, human-made brain power in agriculture challenges can be used to understand resource and job shortages. For crop parameters, including plant height, soil texture, and content, traditional methods needed a significant amount of effort, which resulted in repetitive manual testing. Quick and non-destructive high throughput phenotyping with the benefit of flexible and favorable activity, on-demand access to information, and spatial goals would be possible with the aid of the various technologies evaluated.[22]

Prediction is inherently difficult: technology modifies its environment and the environment then generates further opportunities and new constraints for the technology. Ultimately, general-purpose intelligence will be possible, as a version of it already exists in human brains. However, an extrapolation of existing techniques to re-create general intelligence artificially appears unlikely in the next 5 to 10 years.

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