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ARTIFICIAL INTELLIGENCE IMPACT & ITS APPLICATIONS: AN OVERVIEW

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Abstract: The efficiency of the current economy may be significantly increased by artificial intelligence. However, by functioning as a novel all-purpose "method of invention," it may have an even greater influence and change the structure of R&D and the innovation process itself. We discern between automation-focused uses, like robots, and the possibility that current advancements in "deep learning" may function as a versatile approach to innovation. We discover compelling proof of a "shift" in the significance of application-oriented learning research since 2009. Simultaneously, a period of competition is anticipated to be sparked by the possible financial benefits of perfecting this research approach, which will encourage individual businesses to get and manage crucial big datasets and application-specific algorithms. It is the engineering and science of creating intelligent devices, particularly computer programs. While the aim of utilizing computers to comprehend human intellect is comparable, artificial intelligence (AI) is not limited to techniques that may be seen through biological means.

I. INTRODUCTION

Artificial intelligence is developing at a rapid pace, which has significant effects on both the economy and society at large. These developments might have a significant impact on competitiveness, productivity, and employment by directly influencing the features and production of a broad variety of goods and services. As significant as these benefits are expected to be, artificial intelligence also has the ability to alter the process of innovation itself, potentially having equally significant effects that might eventually overshadow the direct results[1].

Think about Atomwise, a new company that is creating cutting-edge technology to forecast the bioactivity of candidate molecules in order to uncover possible medication candidates (and insecticides). According to the business, the performance of traditional "docking" methods is "far surpassed" by its deep convolutional neural networks. The company's AtomNet product is said to be able to "recognize" fundamental building blocks of organic chemistry and is capable of producing extremely accurate predictions of the results of actual physical experiments after proper training on massive amounts of data (Wallach et al., 2015). These kinds of discoveries might lead to significant increases in the effectiveness of early-stage drug screening. Naturally, Atomwise's technology—as well as those of other businesses employing artificial intelligence to improve medical diagnostics or drug discovery—is still in its infancy; despite encouraging early findings, no new medications have actually been released using these novel strategies. Regardless of whether Atomwise fulfills its potential, its technology exemplifies the continuous endeavor to create a novel innovation "playbook" that utilizes extensive datasets and machine learning algorithms to accurately predict biological phenomena and inform the creation of impactful interventions. For instance, Atomwise is now using this method to find and create novel insecticides and agents to combat agricultural diseases. Two possible ways that artificial intelligence advancements might influence innovation are demonstrated by Atomwise's example. First off, despite having its roots in computer science, artificial intelligence has primarily been used in relatively limited fields for

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commercial purposes, such as robotics. However, with the development of learning algorithms, artificial intelligence may eventually find use in a much wider range of fields[1-2].

The challenge of providing innovation incentives to develop technologies with a relatively narrow domain of application—such as robots designed for specific tasks—versus technologies with a wide—some would say practically limitless—domain of application, as may be true of the advancements in neural networks and machine learning, often referred to as "deep learning"—is seen from the perspective of the economics of innovation (Bresnahan and Trajtenberg, 1995, among others). Therefore, one of the first things to consider is whether advancements in artificial intelligence are merely new technology examples, or if they could instead be the kind of "general purpose technologies" (henceforth referred to as GPTs) that have historically played a significant role in advancing technology over the long term[3].

The Development of Artificial Intelligence: Neural Networks, Robotics, and Symbolic Systems

Nilsson (2010) defines AI as "that activity devoted to making machines intelligent, and intelligence is that quality that enables an entity to function appropriately and with foresight in its environment" in his comprehensive historical account of AI research. His account describes how various fields—such as biology, linguistics, psychology and cognitive sciences, neuroscience, mathematics, philosophy and logic, engineering, and computer science—have contributed to advancements in artificial intelligence. And, of course, regardless of their individual approach, artificial intelligence research has been unified by from the outset by its engagement with Turing (1950), and his exploration of the possibilities of mechanizing intelligence. Despite being frequently combined, robotics, neural networks, and symbolic systems are three linked but distinct fields that are helpfully distinguished from one another in the conceptual history of artificial intelligence as a scientific and technological subject. Under the general title of symbolic systems, perhaps the most fruitful research path in the early years of artificial intelligence (AI) dates back to the 1960s. The "symbol processing hypothesis" (Newell, Shaw, and Simon, 1958; Newell and Simon, 1976) was based on the idea that decisions made by humans can be replicated by processing symbols, even though early pioneers like Turing had stressed the value of teaching a machine as one might a child (i.e., emphasizing AI as a learning process). Early attempts to implement this strategy produced impressive results in demonstration projects, such as a computer that can follow certain heuristics and rules embedded in a program to navigate chess game elements or other board game elements, or have relatively simple conversations with humans. The symbolic systems approach has been severely criticized for its inability to significantly and scalable influence real-world processes, even though research based on the idea of a "general problem solver" has continued to be an area of significant academic interest and there have been periodic explosions of interest in the use of such approaches to assist human decision-making (e.g., in the context of early-stage expert systems to guide medical diagnosis). While breakthroughs in this field may still occur in the future, it is reasonable to say that, despite ongoing academic research, symbolic systems have not played a major role in the commercial application of artificial intelligence and have not been at the core of the recently reported advances in AI related to machine learning and prediction[4].

II. ARTIFICIAL INTELLIGENCE METHODS:

Machine Learning-

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This is an example of an artificial intelligence application where computers are naturally trained to learn from experience rather than having specific jobs explicitly coded into them. A branch of machine learning called "Deep Learning" uses artificial neural networks for predictive analysis. Numerous machine learning algorithms exist, including Reinforcement Learning, Supervised Learning, and Unsupervised Learning. The algorithm in unsupervised learning does not use categorized data to make decisions on its own without supervision. With supervised learning, a function is inferred from the training set, which consists of a collection of the intended output and an input object. Machines employ reinforcement learning to determine the best option that should be considered by taking appropriate activities that improve the reward[1][3].

Natural Language Processing(NLP)

The way in which computers are programmed to process natural languages is through their interactions with human language. When it comes to interpreting human languages, machine learning is a dependable technique for natural language processing. In NLP, a machine records the audio of a human speaking. Following the audio to text exchange, the text is handled such that the audio data is transformed. After that, the computer responds to people by using the audio. Applications of natural language processing include word processors like Microsoft Word for grammatical correction, IVR (Interactive Voice Response) systems used in contact centers, and language translation programs like Google Translate. However, due to the rules that are required in information transfer using natural language and which are difficult for computers to comprehend, the nature of human languages makes natural language processing challenging. Hence, natural language processing (NLP) employs algorithms to identify and abstract natural language rules, enabling the conversion of unstructured data from human languages into a machine-readable format[5].

Automation & Robotics-

The goal of automation is to have machines complete boring and repetitive jobs, increasing productivity and yielding more economical and effective outcomes. Neural networks, machine learning, and graphs are widely used in automation in many companies. By utilizing CAPTCHA technology, such automation can stop fraud concerns during online financial transactions. Robotic process automation is designed to carry out repetitive, high-volume activities that can adjust to changing conditions[5].

Machine Vision-

Machines are capable of gathering and analyzing visual data. Here, the visual information is recorded using cameras, the picture is converted to digital data using analogue to digital conversion, and the data is processed using digital signal processing. A computer receives the resultant data after that. Two essential components of machine vision are resolution—the distance at which the machine can discern objects—and sensitivity—the computer's capacity to detect weak signals. Machine vision is used in picture analysis for medical purposes, pattern recognition, and signature detection, among other applications.

Knowledge-Based Systems(K*BS):*

A knowledge-based system (KBS) is a computer program that uses the expertise of a human expert to offer advise in a specific field. The separation of the information—which can be expressed in a variety of forms,

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including rules, frames, or cases—from the inference engine or algorithm that draws conclusions from the knowledge base is one of KBS's key characteristics.

Neural Networks:

NNs are biologically inspired systems made up of a massively interconnected network of layered computational "neurons." NNs may be "trained" to approximate nearly any nonlinear function to the necessary level of accuracy by varying the network's weights. Usually, NNs are given a set of example input and output values. In a process known as supervised learning, a learning algorithm, such back propagation, would then be used to modify the network's weights in order to get the desired output[1][5][6].

What Potential Effects on Innovation Could Various Artificial Intelligence Fields Have?

Given that these three streams of AI differ greatly in their potential to be either GPTs or IMIs—or both—differentiating between them is an essential first step in gaining a clearer understanding of how AI is likely to impact the innovation process in the future. First off, while a large portion of public discourse on artificial intelligence centers on the possibility that AI will surpass human performance across a broad spectrum of cognitive abilities, it is crucial to remember that, at least thus far, the major advancements in AI have not come from the "general problem solver" approaches that formed the basis of early work in symbolic systems (and served as the impetus for considerations of human reasoning such as the Turing test).

While it is possible that future developments will result in a technology that can meaningfully mimic the nature of human subjective intelligence and emotion, the recent advancements in robotics and deep learning that have garnered scientific and commercial attention are largely outside of these domains and require a significant amount of human planning. Examples of these narrow problem-solving domains include face recognition, Go, picking up a specific object, and so on. Second, while most analyses of AI's economic and policy implications look to the past 20 years of automation to predict how AI will affect the economy going forward (such as by replacing workers with ever-more-skilled jobs), it's crucial to highlight that there is a significant difference between the robotics advancements that dominated AI research applications in the 2000s and the potential uses of deep learning that have emerged in recent years[7].

Applications of AI

There are several uses for artificial intelligence in modern culture. Because it can effectively handle complicated issues in a variety of areas, including healthcare, entertainment, banking, education, etc., it is becoming increasingly important in the modern world. AI is speeding up and improving the comfort of our daily lives. Following are some sectors which have the application of Artificial Intelligence[2]:

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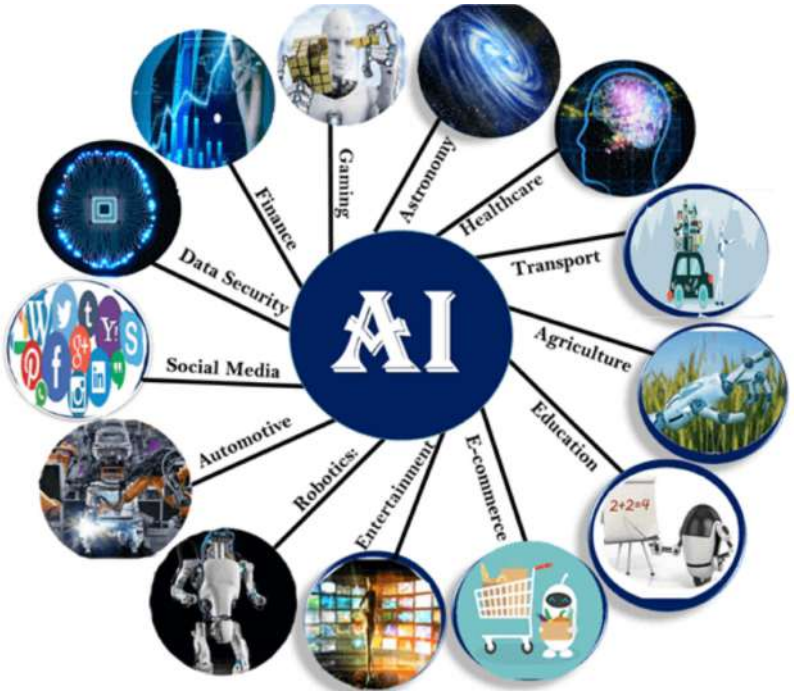

Figure 1: Applications of AI[2]

AI in Astronomy

Artificial intelligence has many applications in contemporary society. Its importance in the modern world is growing due to its ability to manage complex difficulties in a range of industries, such as healthcare, banking, education, and entertainment. Our daily lives are becoming more comfortable and faster thanks to AI.

AI in Healthcare

Over the past five to ten years, artificial intelligence has become more beneficial to the healthcare sector and is expected to have a big influence on it.

AI is being used by the healthcare industry to diagnose patients more quickly and accurately than humans. AI can assist medical professionals in diagnosing patients and alert them when their condition worsens, allowing for prompt delivery of medical care and avoidance of hospitalization.

AI in Gaming

AI has applications in games. AI devices are capable of playing strategic games such as chess, where the machine must consider a vast array of potential positions.

AI in Finance

The banking and AI sectors make the most sense together. Financial procedures are being automated, chatbots are being used, machine learning, adaptive intelligence, and algorithm trading are being used by the banking industry.

AI in Data Security

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Every business must prioritize data security, yet in the digital age, cyberattacks are becoming more frequent and more sophisticated. AI may be used to increase the security and safety of your data. AEG bot and AI2 Platform are two examples of tools that are used to more accurately identify software bugs and cyber attacks.

AI in Social Media

There are billions of user accounts on social media platforms like Facebook, Twitter, and Snapchat, all of which require extremely effective storing and management. Massive volumes of data can be managed and organized by AI. AI is capable of analyzing large amounts of data to determine the most recent hashtags, trends, and user requirements.

AI in Travel & Transport

The travel industry is starting to require more and more AI. AI is able to do a variety of travel-related tasks, including booking reservations and recommending to clients the best hotels, airlines, and itineraries. AI-powered chatbots are being used by the travel industry to engage with clients in a human-like manner for quicker and more accurate responses.

AI in Automotive Industry

AI is being used by several automotive companies to give users virtual assistants for improved performance. For instance, intelligent virtual assistant TeslaBot was unveiled by the company.

Many industries are actively working on creating self-driving automobiles that can increase the security and safety of your travels.

AI in Robotics:

Robotics has a fantastic function for Artificial Intelligence. Typically, conventional robots are programmed to carry out certain repetitive duties; however, with the use of artificial intelligence (AI), we may construct intelligent robots that can carry out activities based on their own experiences rather than being pre-programmed.

The finest examples of artificial intelligence in robotics are humanoid robots. Recently, two intelligent humanoid robots, Erica and Sophia, were created that had human-like speech and behavior.

AI in Agriculture

For the greatest results, agriculture is an industry that needs a variety of resources, including labor, money, and time. Agriculture is going digitized these days, and artificial intelligence is developing in this space. AI is being applied to agriculture through predictive analysis, solid and crop monitoring, and agro robots. For farmers, AI in agriculture can be highly beneficial.

AI in E-commerce

AI is giving the e-commerce sector a competitive edge, and it is becoming increasingly necessary for e-commerce enterprises. AI is assisting consumers in finding related goods with suggested brand, color, and/or size.

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AI in education:

AI can do the grading for you, freeing up the instructor to spend more time teaching. An AI chatbot can act as a teaching assistant by interacting with pupils.

In the future, artificial intelligence (AI) may serve as a convenient, anytime, anywhere personal virtual instructor for pupils[2].

III. FUTURE OF AI

Given its advantages and broad range of applications, artificial intelligence seems like the best option. Given the advancement of AI, does this mean that the world of the future is getting more artificial? The old, established paradigm of biological intelligence is fixed, whereas the emerging paradigm of non-biological computing and intellect is expanding rapidly.

Figure 2: Future of AI [10]

The human brain can most likely store information equivalent to ten thousand million binary digits. However, the majority of information is presumably wasted in other rather inefficient ways, such as recalling visual stimuli. Therefore, given that natural intellect is finite and unpredictable, the world may increasingly rely on computers to function properly.In the upcoming years and decades, artificial intelligence (AI), a genuinely breakthrough achievement in computer science, is expected to be a fundamental part of all software. Both a threat and an opportunity are presented by this. Artificial Intelligence will be used to support both offensive and defensive cyber operations. Furthermore, new methods of cyberattack will be developed to exploit the unique flaws in AI technology. Lastly, AI's voracious appetite for massive volumes of training data will increase the value of data and redefine our approach to data security. Careful global governance will be necessary to guarantee that this revolutionary technology will result in widely distributed prosperity and safety[7][8][9].

In fact, artificial intelligence is influencing almost every industry and determining the course of human history. In addition to generative AI, which is gaining popularity because to tools like ChatGPT and AI art generators, it is already the primary force behind developing technologies like big data, robots, and the Internet of Things. And for the foreseeable future, it will keep innovating in the field of technology.

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Approximately 44% of firms want to incorporate AI into their operations and make significant investments in the technology. Furthermore, AI accounted for 2,300 of the 9,130 patents that IBM inventors were awarded in 2021[10].

IV. CONCLUSION

This exploratory article does not aim to offer a methodical explanation or forecast of the probable influence of AI on innovation, nor does it offer precise recommendations for policy or innovation management. Rather, our aim has been to highlight a particular possibility, namely that deep learning is a new general-purpose invention of an invention process, and to highlight some first policy, institutional, and managerial consequences of that hypothesis. We have just touched on a cursory overview of artificial intelligence thus far. We have spoken about a few of its tenets, uses, accomplishments, etc. The bulk of issues and jobs that humans are unable to perform directly are what institutions and scientists working on AI want to address in the end. It is certain that advancements in computer science will fundamentally alter the global landscape. At the moment, it is the duty of the upper echelons of engineering to further this discipline.

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