A Review of Artificial Intelligence- An Update

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Abstract

Artificial intelligence (AI) has insidiously permeated the fabric of our daily existence, assuming multifaceted roles that transcend traditional boundaries in industries, healthcare, transportation, education, and numerous other domains intimately intertwined with the general public. As a transformative paradigm, AI is poised to precipitate a seismic shift in socio-economic structures, redefining the contours of our collective future. Moreover, AI serves as a potent catalyst for accelerating innovation, driving the advancement of cutting-edge technologies across a myriad of disciplines, and facilitating ground-breaking research that propels human knowledge forward. However, the ascendance of AI to its current zenith was not a teleological inevitability, but rather the culmination of a protracted and tortuous journey marked by numerous challenges, setbacks, and paradigmatic shifts. Recent developments have elevated AI to previously unheard-of levels, revolutionizing our interactions, work, and way of life. The current state of AI is examined in detail in this overview, which highlights its numerous applications, real advantages, and new difficulties. This review endeavors to furnish an exhaustive and nuanced understanding of artificial intelligence (AI), delineating its vast potential, inherent limitations, and societal implications. By elucidating the complexities and opportunities surrounding AI, this review underscores the imperative of sustained research, development, and multidisciplinary dialogue to guarantee that AI is harnessed to benefit humanity collectively.

Keywords

Artificial Intelligence, Technology, Applications

Introduction

"Think about it - human-created machines are already capable of handling all sorts of labour-intensive tasks. But, driven by our desire for even higher productivity and, let's be honest, sheer curiosity, we've been working to infuse machines with human-like intelligence for over 65 years. That's right, Artificial Intelligence (AI) has been around for decades, and its impact on medicine has been nothing short of revolutionary. From diagnosing diseases more accurately and quickly than human doctors to developing personalized treatment plans, AI is changing the face of healthcare. Plus, AI-assisted robots are helping surgeons perform complex procedures with greater precision. And, with the rise of telemedicine, AI-powered chatbots are even helping patients connect with medical professionals remotely. Today, AI is being used in nearly every industry, and its importance will only continue to grow - making it a crucial skill for the future." [1]

Artificial Intelligence (AI) involves the creation of intelligent systems within artificial devices, a concept formally introduced by McCarthy in 1956. At its essence, AI converges two pivotal elements:

1. Intelligence: The capacity for reasoning, learning, and problem-solving.

2. Artificial Device: A human-made system, such as a computer or robot, designed to simulate intelligent behaviour [2, 3, 4] .

Definitions of AI

There are many definitions of artificial intelligence

According to NASA

Artificial intelligence refers to computer systems that can perform complex tasks normally done by human reasoning, decision-making, creating, etc.

There is no single, simple definition of artificial intelligence because AI tools are capable of a wide range of tasks and outputs, but NASA follows the definition of AI found within EO 13960, which references Section 238 (g) of the National Defence Authorization Act of 2019.

- Any artificial system that performs tasks under varying and unpredictable circumstances without significant human oversight, or that can learn from experience and improve performance when exposed to data sets.
- An artificial system developed in computer software, physical hardware, or other context that solves tasks requiring human-like perception, cognition, planning, learning, communication, or physical action.
- An artificial system designed to think or act like a human, including cognitive architectures and neural networks.
- A set of techniques, including machine learning, that is designed to approximate a cognitive task.
- An artificial system designed to act rationally, including an intelligent software agent or embodied robot that achieves goals using perception, planning, reasoning, learning, communicating, decision-making, and acting [8].

According to John Mc Carthy

Artificial Intelligence (AI), a term coined by emeritus Stanford Professor John McCarthy in 1955, was defined by him as “The science and engineering of making intelligent machines”. Much research has humans programming machines to behave cleverly, like playing chess, but today, we emphasize machines that can learn, at least somewhat like human beings do [5].

According to B.J Copeland

Artificial intelligence (AI), the ability of a digital computer or computer-controlled robot to perform tasks commonly associated with intelligent beings. The term is frequently applied to the project of developing systems endowed with the intellectual processes characteristic of humans, such as the ability to reason, discover meaning, generalize, or learn from experience.

According to Marvin Minsky

Marvin Minsky, one of the pioneers of AI, defined AI as “Enabling machines to do things that require human intelligence”.

According to the Turing Test

In the Turing test, AI is defined as the ability of machines to communicate with humans (using electronic output devices) without revealing the identity that they are not humans, where the essential judgment criterion is binary.

The Turing Test

The Turing Test: A Quest to Answer "Can Machines Think?"

In 1950, Alan Turing, a British mathematician, computer scientist, and logician, proposed the Turing Test in his seminal paper "Computing Machinery and Intelligence." This ground-breaking experiment aimed to investigate whether machines could exhibit intelligent behaviour indistinguishable from that of humans.

Turing's motivations were multifaceted:

1. **Challenging machine intelligence scepticism:** Turing sought to counter the prevailing view that machines were incapable of thinking or intelligent behaviour.
2. **Exploring machine learning limitations:** Turing wanted to investigate whether machines could learn, reason, and adapt like humans.
3. **Investigating human intelligence**: By comparing machine behaviour to human behaviour, Turing aimed to gain insights into the nature of human intelligence.
4. **Developing artificial intelligence**: The Turing Test laid the foundation for artificial intelligence (AI) research, which has since become a thriving field.

Turing's objectives were ambitious:

1. **Demonstrate machine intelligence:** Turing aimed to show that machines could exhibit intelligent behaviour, challenging the notion that intelligence was unique to humans.
2. **Establish an AI benchmark:** The Turing Test provided a criterion for evaluating the success of AI systems in mimicking human intelligence.

3. **Spark debate and research:** Turing's test was designed to provoke discussion and inspire research into the possibilities and limitations of machine intelligence. The Turing Test has become a landmark in AI history, influencing the development of AI and continuing to inspire research and debate in the field.

These dual foundations form the basis of AI research and development.

According to the symbolic school, artificial intelligence (AI) is the operation of symbols, with the most basic symbols representing physical elements. The study theories, techniques, technologies, and applications for mimicking, extending, and growing human intelligence are generally accepted to be at the heart of artificial intelligence (AI), despite the fact that many definitions exist. These days, the idea of artificial intelligence has a bigger and bigger influence on people's lives. AI is the cornerstone of technology in the modern period and beyond, much like steam engines were in the Age of Steam, generators were in the Age of Electricity, and computers were in the Age of Information [1,7,10].

AI Renaissance

The years prior to 1956 are considered to be the AI incubation period. Up until that point, engineers and scientists attempted to use machines to do some of their mental labour. The theoretical groundwork for later electronic computers was established in 1936 when mathematician Alan Turing put forth a mathematical model of the perfect computer. In 1943, neurophysiologists W. Pitts and W. McCulloch created the first neural network model, known as the M-P model. The first mathematical model designed to replicate the composition and function of biological neurons is the M-P model. It is considered to be the first artificial neural network [15,20].

Hebb first postulated the neuropsychological learning mechanism in 1949. An unsupervised learning algorithm known as the "Hebb learning rule" is capable of classifying data based on data similarity and extracting statistical features from training sets [26]. This is the original concept of machine learning (ML), and it closely resembles how humans think. A checkers program that could learn implicit models from the current position and guide following moves was created in 1952 by IBM scientist Arthur Samuel. Chess programs were among the first examples of evolutionary computing in this regard. The winner becomes the new standard once the algorithm compares a modified copy to the best version [29].

During the 1956, Dartmouth Summer Research Project on Artificial Intelligence, John McCarthy was the first to use the word. For this reason, he is regarded as the originator of artificial intelligence. Machine learning, theorem proving, pattern recognition, problem-solving, expert systems, and natural language processing are just a few of the astounding advancements in AI research that have been made since this incident.

The "Perceptron" paradigm was first presented by American psychologist Frank Rosenblatt in 1957. The ability to learn had a significant influence on the later design of neural networks and the connection processes, and it can be used to create a system that uses "neurons" for recognition. Even today, the ground-breaking research on the perceptron is a popular subject in AI basic classes. An array of perceptrons coupled to a camera served as the artificial brain in 1960 when the perceptron method was transferred to a physical hardware implementation known as the "Mark 1 Perceptron." The fact that a machine could be trained to determine with a decent degree of accuracy whether a person in a photograph is male or female was amazing and motivating to the public at the time [31,32].

Using psychological experiments, Newell et al. compiled human thought norms that same year. They created a general software for addressing problems that could be used to eleven various kinds of challenges. A few years later, Stanford University's E. A. Feigenbaum created an expert system. The device might use experimental analysis of mass spectrometers to determine the molecular structure of molecules. AI research was innovative during this time, and the results showed promising future directions [34]. In the meantime, the discipline of computing emerged as a distinct one. As hardware and transistor architectures advanced annually, the necessary computer programs and software arose to put AI theories and algorithms into practice [36].

AI Categories

The field of Artificial Intelligence (AI) is rapidly evolving, driven by advancements like deep learning. As a result, our understanding of AI is constantly changing, leading to variations in how AI is categorized and described. To simplify this complex landscape, AI can be broadly classified into two categories:

1. **AI Capabilities**: What AI systems can do (tasks and functions).
2. **AI Functionalities**: How AI systems are applied (specific uses and applications).

Focusing on these two categories provides a clearer understanding of the diverse and dynamic field of AI.

Based on Capabilities, The Three Types of AI are

1. Narrow Artificial Intelligence

The only kind of artificial intelligence that is currently in use is artificial narrow intelligence, sometimes referred to as weak AI or narrow AI. AI in any other form is merely hypothetical. It may be taught to carry out a particular, limited task, frequently far more quickly and effectively than the human mind. It is limited to its designated task, nevertheless. It focuses on one subset of cognitive talents and advancements within that range instead.

Examples of narrow artificial intelligence include IBM Watson®, Amazon's Alexa, and Siri. Because it can only be used for text-based chat, even OpenAI's ChatGPT is regarded as a type of narrow artificial intelligence.

2. AI in General

Strong artificial intelligence (AI), another name for artificial general intelligence (AGI), is now only a theoretical idea. AGI does not require human training of the underlying models; instead, it can leverage prior knowledge and abilities to do new tasks in a different context. Because of this capability, AGI can learn and carry out any intellectual task that a person can.

3. Super AI

Like AGI, super AI is purely theoretical and is often referred to as artificial super intelligence. Super AI would be able to understand reason, learn, make decisions, and have cognitive capacities that are superior to those of humans if it were ever developed. Applications with Super AI capabilities will have advanced past the point where they can comprehend human emotions and experiences to be able to feel emotions, have wants, and have their own opinions and desires.

Based on Functionalities, The Four Types of AI are

1. AI Reactive Machine

AI systems with no memory that are built to carry out a single, highly specialized task are known as reactive machines. They only use the data that is currently accessible since they are unable to recall past results or choices. Based on statistical mathematics, reactive AI is able to evaluate enormous volumes of data and provide output that appears intelligent.

Example: IBM Deep Blue: By examining the pieces on the board and forecasting the likely outcomes of each move, IBM's chess-playing supercomputer AI defeated chess grandmaster Garry Kasparov in the late 1990s. The Netflix Recommendation Engine: Netflix uses algorithms to analyse information gathered from viewing history in order to suggest content that users are likely to find enjoyable.

2. AI with Limited Memory

This type of AI, in contrast to reactive machine AI, has the ability to remember previous occurrences and results as well as track certain items or circumstances over time. AI with limited memory can choose a course of action that will most likely assist it reach a desired goal by using data from the past and present. Though AI with limited memory can use historical data for a limited length of time, it is unable to store that data in a library of prior experiences for later use. Over time, Limited Memory AI might perform better as it is trained on more data.

Examples

a) Generative AI: To forecast the next word, phrase, or visual aspect in the content they are creating, generative AI systems like ChatGPT, Bard, and DeepAI rely on limited memory AI capabilities.

b) Chatbots and virtual assistants:

Natural language processing (NLP) and limited memory artificial intelligence (AI) are used by Siri, Alexa, Google Assistant, Cortana, and IBM Watson Assistant to comprehend queries and requests, respond appropriately, and provide responses.

c) Autonomous vehicles: Limited Memory AI is used by autonomous cars to comprehend their environment in real time and decide whether to brake, accelerate, turn, and other actions.

3. AI Theory of Mind

Mental Theory under the general category of artificial intelligence, AI is a functional class. Even though Theory of Mind AI is still in its infancy, it would be able to comprehend the feelings and thoughts of other beings. The AI's interactions with others may change as a result of this knowledge. This would theoretically enable the AI to mimic human-like interactions.

Theory of Mind AI would tailor its interactions with people according to their particular emotional needs and goals since it could deduce human motivations and reasoning. In addition, Theory of Mind AI would be able to comprehend and interpret essays and artwork, something that current generative AI tools cannot do. One idea of mind AI that is presently being developed is emotion AI.

In order to identify, mimic, observe, and react to people emotionally, AI researchers anticipate that their technology will be able to evaluate sounds, pictures, and other types of data. To date, Emotion AI is unable to understand and respond to human feelings.

4. Self-Aware Artificial Intelligence

A type of functional AI class for applications with super AI capabilities is called self-aware AI. Self-Aware AI is purely theoretical, just like the theory of mind AI. If it were ever accomplished, it would be able to comprehend human emotions and thoughts as well as its own internal conditions and characteristics. It would also have a unique set of needs, feelings, and convictions.

One Theory of Mind AI that is presently being developed is Emotion AI. Researchers anticipate that it will be able to recognize, mimic, observe, and react to people emotionally by analyzing sounds, pictures, and other types of data. Emotion AI is still unable to recognize and react to human emotions [4,27,45].

Paradigms and Intentions in AI

Methods: connectionist versus symbolic

The **symbolic** (also known as "top-down") and **connectionist** (sometimes known as "bottom-up") approaches are two different and rather conflicting approaches used in AI research. The top-down method analyses cognition in terms of symbol processing— hence the symbolic label— without taking into account the organic makeup of the brain in an attempt to reproduce intelligence. The connectionist term comes from the bottom-up technique, which creates artificial neural networks that mimic the organization of the brain [2].

The task of creating a system that can recognize the alphabet's letters using an optical scanner serves as an example of how different approaches differ from one another. An artificial neural network is usually trained using a bottom-up method, which entails showing it letters one at a time. This allows the network to be "tuned" to perform better over time. (Tuning modifies how receptive various brain pathways are to various stimuli) A top-down method, on the other hand, usually entails creating a computer program that contrasts every letter with geometric descriptions. To put it simply, the top-down approach is based on symbolic descriptions, whereas the bottom-up approach is based on brain processes [7,39].

Cognitive Simulation, Applied Artificial Intelligence, And Artificial General Intelligence (AGI)

Artificial general intelligence (AGI), applied AI, or cognitive simulation are the three objectives that AI research aims to achieve by using the techniques described above. The goal of AGI, often known as strong AI, is to create thinking machines. AGI's ultimate goal is to create a machine with an overall level of intelligence that is identical to that of a human. Progress has been inconsistent so far. It is questionable whether AGI can be derived from even more potent models or if a totally different strategy is required, despite advancements in large-language models. In fact, some researchers in the other two disciplines of AI believe that studying AGI is not worthwhile.

Advanced information processing, or applied AI, seeks to create commercially viable "smart" systems, such as "expert" stock-trading and medical diagnosis systems. Applied AI has achieved considerable success. Theories about how the human mind functions, such as those of facial recognition or memory recall, are tested on computers using cognitive simulation. In cognitive psychology and neuroscience, cognitive simulation is already a potent technique [41].

AI Technology

Early in the twenty-first century, artificial intelligence emerged from computer science departments and entered the general public sphere thanks to increased processing capacity and bigger datasets, or "big data." Moore's law, which states that computing power doubles approximately every 18 months, remained valid. The language model at the core of ChatGPT was trained on 45 terabytes of text, while the stock responses of the original chatbot Eliza fit neatly into 50 kilobytes [44].

Learning by Machine

The "greedy layer-wise pretraining" technique was developed in 2006 after it was discovered that it was simpler to train each layer of a neural network separately than to train the entire network from input to output. This technique allowed neural networks to handle more complex problems by adding more layers. Neural networks of four or more layers, encompassing the initial input and the final output, are used in "deep learning," a type of machine learning that emerged as a result of advancements in neural network training. Furthermore, these networks may train unsupervisedly, meaning they can find features in data without any prior guidance.

Advances in image classification, where specialized neural networks known as convolution neural networks (CNNs) are trained on features found in a series of photos of numerous item classes, are among the accomplishments of deep learning. After that, the CNN can identify whether an input image is of an apple or a cat by comparing it to features in photos in its training set. PReLU-net, developed by Kaiming He and colleagues at Microsoft Research, is one such network that has outperformed humans in picture classification.

Beyond picture categorization and gaming, machine learning has found use in many other domains. In order to develop the COVID-19 medication Paxlovid, the pharmaceutical company Pfizer employed the approach to rapidly search millions of potential molecules. Google filters spam out of Gmail users' inboxes using machine learning. To identify fraudulent transactions, banks and credit card firms train models using historical data.

DeepMind's AlphaGo surpasses Deep Blue's feat of defeating global chess champion Garry Kasparov by mastering go, a game far more complex than chess. AlphaGo's neural networks learned to play go by playing the game itself and by watching other players. In 2016, it defeated Lee Sedol, the best go player, 4-1. AlphaGo Zero, which began using only the rules of go and finally defeated AlphaGo 100–0, overtook AlphaGo. The same methods were used by Alpha Zero, a more broad neural network, to rapidly learn chess and shogi [41,45].

Artificial intelligence (AI)-generated media known as "deepfakes" are created by combining two distinct deep-learning algorithms: one that generates the best possible picture or video replica and another that determines whether the replica is a fake and, if so, highlights the differences between it and the original. After generating a synthetic image and getting input from the second algorithm, the first algorithm modifies it to make it seem more realistic. Until no false imagery is detected by the second algorithm, the process is repeated. Deepfake media depicts events or visuals that have never happened or do not exist. A video of Facebook CEO Mark Zuckerberg speaking on his company's evil power, an image of US President Donald Trump fighting with police, and a picture of Pope Francis wearing a puffer jacket are all examples of widely shared deep fakes. There were no such incidents in real life [47].

Natural Language Processing and Large Language Models

Analysing how computers can process and comprehend language similarly to humans is known as natural language processing, or NLP. NLP models need to make use of machine learning, deep learning, statistics, and computational linguistics in order to accomplish this. Hand-coded and rule-based, early NLP models failed to take linguistic nuances and exceptions into consideration. The next step was statistical NLP, which assigned the likelihood of specific meanings to various textual elements using probability. Deep learning models and methods are used by contemporary NLP systems to "learn" as they process data.

Language models that employ AI and statistics to anticipate a sentence's final shape based on its current parts are notable examples of contemporary natural language processing (NLP). The term "large" in large language models (LLMs) refers to the variables and weights that the model uses to affect the prediction output. The size of LLM training datasets varies from 110 million parameters (Google's BERTbase model) to 340 billion parameters (Google's PaLM 2 model), despite the fact that there is no set amount of parameters required. The term "large" also describes the enormous volume of data necessary to train an LLM, which can reach several petabytes in size and include trillions of tokens—the fundamental text or code units, typically a few characters long—that are processed by the model.

In June 2020, OpenAI released GPT-3, a popular language model that was one of the first LLMs to solve high school-level math problems and write computer programs. GPT-3 served as the basis for ChatGPT software, which was released in November 2022. Scholars, journalists, and others were immediately troubled by ChatGPT because they believed it was impossible to tell the difference between writing produced by ChatGPT and writing created by the computer.

After ChatGPT, a wave of LLMs and chatbots based on them emerged. In 2023, Microsoft integrated the chatbot Copilot into its Edge browser, Bing search engine, and Windows 11 operating system. Google launched Bard (later Gemini), a chatbot, in the same year. In 2024, the corporation declared that "AI Overviews" of topics would be displayed at the top of search results.

One problem with LLMs is "hallucinations": In response to a user's instructions, the model provides likely but incorrect text rather than acknowledging that it is ignorant of anything. One possible explanation for this problem is that LLMs are being used as search engines instead than as text generators, which is not how they were designed. Prompt engineering is a technique used to counteract hallucinations in which engineers create prompts that are intended to elicit the best possible result from the model. One such prompt style is chain-of-thought, where the first prompt serves as a guide for the LLM by providing both an example inquiry and a well-considered response.

Voice-activated GPS systems, chatbots for customer support, and language translation software are more instances of computers that use natural language processing (NLP). Additionally, by automatically answering search queries and keeping an eye on social media, companies employ natural language processing (NLP) to better understand and serve their customers. Using natural language processing (NLP), programs like OpenAI's DALL-E, Stable Diffusion, and Midjourney generate visuals in response to textual cues. These prompts can be as basic as "a red block on top of a green block" or as intricate as "a cube with the texture of a porcupine." Large datasets including millions or billions of text-image pairs—that is, photographs with textual descriptions—are used to train the systems.

NLP poses several challenges, particularly as machine-learning algorithms and similar systems can reveal biases that are not explicitly present in the data they are trained on. For instance, language models may exhibit innate gender bias when asked to describe a doctor by saying "He is a doctor" rather than "She is a doctor." Real-world repercussions can result from bias in NLP. Because women were underrepresented in the first training set gathered from employees, it was discovered in 2015 that Amazon's NLP algorithm for screening resumes to help choose job candidates discriminated against them [3,17,28,41].

Intelligent Vehicles

The core components of autonomous car systems are AI and machine learning. Machine learning helps to enhance the algorithms that vehicles operate under by training them on complex data, such as the movement of other vehicles and traffic signals. AI makes it possible for car systems to decide without requiring detailed instructions for every possible scenario.

Artificial simulations are developed to test the capabilities of autonomous vehicles in order to make them safe and efficient. Unlike white-box validation, black-box testing is utilized to develop such simulations. White-box testing can demonstrate the lack of failure since the tester is aware of the internal workings of the system being tested [41]. Black-box techniques require a more adversarial approach and are far more complex. With these techniques, the tester focuses on the exterior structure and architecture of the system rather than its internal design. These techniques look for flaws in the system to make sure it satisfies strict safety requirements [42,43].

Fully autonomous cars won't be on the market for consumers to buy until 2024. Some of the challenges have been difficult to overcome. For instance, in order for an autonomous vehicle to function properly, maps of the nearly four million miles of public highways in the US would be required, which poses a difficult challenge for manufacturers. Furthermore, the most well-known automobiles with "self-driving" capabilities, Tesla models, have sparked worries about safety because they have even been known to crash into metal objects and oncoming traffic. AI has not advanced to the point where vehicles can interact intricately with bikers, pedestrians, or other drivers. To avoid mishaps and establish a secure atmosphere, such "common sense" is required [44,45].

Digital Concierges

Making and receiving calls, assisting with job scheduling, and providing roadside assistance are just a few of the many services provided by virtual assistants (VAs).To improve their ability to predict human wants and behavior, these devices need a lot of data and learn from user interaction. Apple's Siri, Google Assistant, and Amazon Alexa are the most well-known virtual assistants available. Virtual assistants are more individualized than chatbots and conversational agents; they adjust to each user's unique behavior and use that information to get better over time.

Eliza marked the beginning of human-machine communication in the 1960s. In order to simulate a conversation with someone who has paranoid schizophrenia, the psychiatrist Kenneth Colby created PARRY in the early 1970s. One of the earliest gadgets that may be considered a "smartphone" was IBM's 1994 invention, Simon, which was marketed as a personal digital assistant (PDA). In addition to having a touchscreen, Simon was the first gadget with email and fax capabilities. Despite not being a VA in the strictest sense, Simon's evolution was crucial to the creation of subsequent assistants. With the release of the iPhone 4S in February 2010, Siri—the first contemporary virtual assistant—was unveiled for iOS, Apple's mobile operating system. The first virtual assistant that could be downloaded on a smartphone was Siri.

Voice assistants use automated speech recognition (ASR) systems to understand human speech by separating it into discrete sounds called phonemes. After dissecting the speech, the VA examines and "remembers" the voice's tone and other characteristics in order to identify the user. Because machine learning has given them access to millions of words and phrases, virtual assistants have evolved over time. They also frequently search the Internet for solutions to customer inquiries, such as when a user requests a weather forecast [41,47] .

Perils

There are certain ethical and socioeconomic risks associated with AI. Many individuals are at risk of losing their employment as more functions become automated, particularly in sectors like marketing and healthcare. While some new professions may be created by AI, they might demand greater technical skills than the jobs that AI has displaced. Furthermore, without the right training, it can be challenging to overcome certain of AI's prejudices. Predictive policing algorithms, for instance, have been used by U.S. police departments to identify crime hotspots. These systems, however, are partially predicated on arrest rates, which are already disproportionately high in communities of colour. Over policing in certain regions could result from this, which would further impact these algorithms. Algorithms will inevitably exhibit human biases since humans are biased by nature [1,25].

Another area of AI that worries experts is privacy. Because AI frequently entails gathering and analysing vast volumes of data, there is a chance that the incorrect individuals or groups will gain access to this data. Even image manipulation and the creation of phony profiles are feasible with generative AI. AI can also be used to follow people in public areas and conduct population surveys. Policymakers have been urged by experts to create procedures and guidelines that optimize AI's advantages while lowering any possible hazards.

Data centers that need a lot of electricity are where LLMs are situated. Microsoft promised to achieve carbon neutrality by 2030 in 2020. It was revealed in 2024 that its carbon emissions had risen by about 30% in the preceding fiscal year, primarily due to the hardware and building materials needed to construct additional data centers. Compared to a Google search, a ChatGPT query uses almost ten times as much electricity.

There aren't many rules governing AI as of 2024. AI models are governed by current regulations, such as the California Consumer Privacy Act (CCPA) and the General Data Protection Regulation (GDPR) of the European Union, but only to the extent that they use personal data. The EU's AI Act, which was passed in March 2024, is the most comprehensive regulation. Models that aim to influence user behavior and perform social scoring of citizen’s behaviour and attributes are prohibited by the AI Act. AI models that work with "high-risk" topics, such as infrastructure and law enforcement, have to be registered in an EU database.

AI has also given rise to problems with copyright policy and legislation. The U.S. government's copyright office launched an investigation into the problem of AI creating material from protected works in 2023. Nearly 15 additional copyright-related lawsuits were brought against businesses developing generative AI software in that year. One well-known business, Stability AI, faced criticism for creating fresh material using unlicensed photos. The lawsuit's filing company, Getty Images, responded in part to the plethora of services providing "stolen imagery" by incorporating its own AI capability into its platform. The topic of whether AI-generated content merits a copyright designation is also up for debate. Although there are reasons for and against copyrighting AI-generated content, it is currently not possible [3,45].

Even though a lot of AI companies say that their content doesn't need human labour, these "ground-breaking" technologies frequently depend on exploited people in poor nations. To help remove poisonous and sexually explicit material from ChatGPT, for instance, OpenAI employed Kenyan workers (paid less than $2 per hour) to sort through text snippets, according to a Time magazine study. Due to the unpleasant nature of the assignment for the workers, the project was discontinued in February 2022.

Can we achieve artificial general intelligence?

Strong artificial intelligence (AI), also known as artificial general intelligence (AGI), or AI that seeks to replicate human intellectual capacities, is still debatable and unattainable. It is impossible to overestimate how tough it is to scale up AI's small accomplishments. This lack of advancement, however, might just be evidence of AGI's complexity rather than its inability. Now, let's discuss the concept of AGI itself. Is it possible for a machine to think? According to theoretical linguist Noam Chomsky, there is little use in arguing about this issue because it is fundamentally up to the individual whether or not the word "think" should be used to refer to machines [41].

According to Chomsky, there is no factual question about whether any such decision is correct or incorrect, any more than there is about whether it is correct or incorrect for us to declare that ships swim or that airplanes fly.

This appears to oversimplify things, though. The crucial query is whether it is ever appropriate to claim that computers think and, if so, what requirements must be met by a computer in order to qualify as such. The Turing test is one way that some authors define intelligence. However, Alan Turing, a mathematician and logician, noted that if a computer couldn't successfully mimic a human, it might still fail his criteria even though it should be considered intelligent. For instance, ChatGPT frequently refers to itself as a huge language model, which makes it doubtful that it would pass the Turing test. The test cannot serve as a definition of intelligence if an intelligent entity is able to fail it.

As the information theorist Claude Shannon and the pioneer of artificial intelligence John McCarthy noted in 1956, it is even doubtful if completing the test would truly demonstrate that a computer is clever. According to Shannon and McCarthy, it is theoretically feasible to create a machine that has a comprehensive collection of pre-programmed answers to every question that an interrogator might ask during the test's allotted time. Similar to PARRY, this machine would search a massive table for relevant answers to the interviewer's queries. This argument appears to demonstrate that a system with no intelligence at all may theoretically pass the Turing test [5,49].

Even in the situation of subhuman intelligence, AI actually lacks a true definition of intelligence. Although rats are intelligent, what specific accomplishments must an artificial intelligence make before scientists can declare it to be on par with rats? There is no objective method to determine if an AI research program has been successful or unsuccessful if there is no fairly accurate standard for determining whether an artificial system qualifies as intelligent. As a result of AI's inability to generate a satisfactory standard of intellect, anytime researchers accomplish one of AI's objectives-Critics can respond, "That's not intelligence!" in response to a program that, for instance, can have a conversation like GPT or defeat the world chess champion like Deep Blue. Similar to Turing before him, Marvin Minsky argues that intelligence is only a term for any mental process that solves problems but which we do not yet fully comprehend. Minsky compares intellect to the idea of "unexplored regions of Africa"—it vanishes the moment we find it.

AI Statistics

AI Statistics You Must See By 2025, the AI market is expected to grow to $190.61 billion. AI will boost the world economy by about $15.7 trillion by 2030. Voice search is used every day by 40% of people. Nearly 77 % of smartphones today use AI technologies. The growth of AI start-ups has expanded 14-fold since 2000 [41].

Applications of Artificial Intelligence

AI is employed in many different ways nowadays. Because it can effectively manage complicated difficulties in a wide range of industries, including robotics, defence, transportation, healthcare, marketing, automotive, business, gaming, banking, chatbots, etc. It is becoming more and more significant in this age of modern technology.

Artificial Intelligence Applications in Defence

Defence is one of the most important areas where AI can be very helpful. Defence security systems are susceptible to hacker attacks that steal sensitive government or defence data, which can be harmful to any nation. Manually identifying and processing unusual activity can be time-consuming and may not detect potential threats.

Large-scale data analysis is made simple by artificial intelligence (AI), which also helps identify suspicious activity. AI algorithms are built to learn from data and differentiate between authorized and unauthorized access. They also monitor the security of military databases, ensuring that any changes made by an unidentified source are promptly addressed [41,42] .

Robotics Applications of AI

The design and construction of automated machines, or robots, with the capacity to carry out activities independently, is the domain of robotics. Now-a-days, robots are becoming more and more advanced and efficient in executing jobs without human assistance. This is due to the fact that AI methods and tools are specifically made for the robotics industry. High-definition cameras, voice recognition software, sensors, and other components are features of advanced robots.

These robots have the ability to adapt their algorithms to their surroundings and learn from their prior errors and experiences. For robotic applications, artificial intelligence is a very helpful tool. When it is paired with modern devices, it can help in optimizations. In sectors like aerospace, it helps to improve the intricate manufacturing process. AI is also used in the packaging process in industries to increase efficiency and reduce costs.

Applications of AI in Transportation

AI has revolutionized the transportation sector. Given the intense rivalry in the transportation sector, it is necessary to examine all the variables that affect the many aspects of the business, such as cost, time of year, holidays, passenger volume, etc.

Seasons, festivals, routes, halts, and the number of passengers on a route are some of the factors that can cause price fluctuations for flights on Google. Predictive analytics can be used to analyze data related to these factors, which affect transportation costs. Artificial intelligence (AI) tools perform predictive analytics on data efficiently, and the software or application can also predict the best prices for specific routes, which helps passengers find cheaper options. Additionally, AI-based applications notify passengers about price increases and decreases as well as available offers when booking tickets.

AI is also being used in the actual world of transportation in online ride-sharing services like Ola, Lyft, and Uber. These apps provide specialized services through the use of AI, ML, and data science. AI assists in displaying the best routes and ride costs [41,43,49].

AI Applications in Marketing

Marketing plays a major role in managing a profitable company. Effective marketing techniques result in significant financial gains. It is estimated by Forbes that the marketing sector brought in over $300 million in 2019. The use of AI is currently revolutionizing the marketing sector. AI is used to increase profitability in a variety of businesses, including media, entertainment, e-learning, e-commerce, and advertising. Let's say you are looking through Amazon for a product. A list of products that are suggested for you will be displayed alongside the product, along with the best sellers, comparable products, and variations of the same product.

Likely, you have also noticed that when you search for similar things, you are presented with ads. For example, you can get ads and suggestions for other comparable shows if you search for a particular Netflix series. This is accomplished when AI-powered ad algorithms attempt to comprehend the interests of their target audience. Additionally, they gain knowledge and enhance their performance over time. Personalized customer experiences, targeted advertising, and increased revenue are all facilitated by this kind of automated marketing.

Business Uses of AI

Companies are implementing AI to enhance their interactions with customers and to manage tasks that are typically performed by humans but can be expedited through robotic process automation. ML algorithms are also being used by businesses to decide which approaches to provide to customers. One of the many applications of AI in the business world is the integration of chatbots into companies to offer customers quick services. AI can do predictive analysis, boost sales, enhance customer connections by enhancing the whole customer experience, and develop effective and productive work processes.

Applications of AI in Gaming

In recent years, artificial intelligence has played a significant role in the game business. Since the gaming sector is one where the ultimate aim is constantly changing, it is the best example of intelligent AI applications. AI is used in many different contexts, such as character development and game development. AI in gaming refers to dynamic and customizable video game experiences. This kind of AI-powered original entertainment is usually produced by non-player characters, or NPCs; these characters behave creatively or intellectually as though they were guided by a human player. The behavior of an NPC in the game world is controlled by the AI engine [41].

Applications of AI in Banking

Another industry that makes substantial use of AI is banking. Financial operations use ML, chatbots, automation, adaptive intelligence, and algorithm trading. AI-based software and systems are already being used by a number of banks to detect fraud and provide customer support. The banking sector can greatly benefit from AI in terms of fraud detection. Humans may have trouble recognizing patterns, but robots are really good at it. Security professionals can prevent fraud by tracking card usage and endpoint access using AI and ML algorithms.

Chatbots with AI Applications

Artificial intelligence chatbots are able to comprehend natural language and respond to users that use the live chat feature that many companies provide for customer support. AI chatbots are made possible by machine learning (ML) and can be integrated into a range of websites and applications. AI chatbots can create a database of responses rather than collecting information from an existing selection of inclusive responses. As AI develops, these chatbots will be able to effectively handle consumer problems, respond to simple questions, improve customer service, and offer round-the-clock assistance. All things considered, AI chatbots help to improve customer happiness [41,44].

Applications of AI in the Automobile Sector

The automotive sector has also been transformed by the rise of AI. The automotive industry has undergone a radical transformation since the development of self-driving cars. Numerous businesses, including Tesla, Nissan, Audi, Volvo, and others, are working on self-driving automobiles. Artificial Intelligence (AI) is one of the key technologies utilized in the construction of self-driving cars [41,43,45].

Among many other gadgets, a self-driving automobile makes use of sensors, cameras, and voice detectors. By gathering information, it evaluates the environment and uses the software to provide commands that allow the vehicle to drive safely. All you need to do is enter the place on the route map, and the sophisticated AI-enabled systems will determine the best route to get there. AI can assist with issues like responding to natural catastrophes and traffic accidents, among other things. Artificial intelligence applications have turned out to be among the best human-made resources. The user experience is being altered in a number of ways by the diverse applications of artificial intelligence [47,48].

Applications of AI in Healthcare

For their daily operations, the majority of healthcare companies now rely on AI-based software. These duties range from managing hospital data to diagnosing patients. AI-based sophisticated processors that can extract, manipulate, analyze, and derive useful insights from the 44 trillion gigabytes of data generated daily by the healthcare sector are necessary.

The healthcare sector is thriving thanks to AI and ML technology. The systems are fed AI-based algorithms that are able to identify patterns far more quickly than people. Additionally, these algorithms aid in the examination of patient data, which aids in diagnosis. Real-time data, including body temperature, heart rate, blood pressure, and much more, can be measured with the aid of AI-based gadgets. From far away, they transmit the gathered data to physicians so they can assess the patients' health. Both patients and doctors may save time by doing this. By simplifying procedures, AI-based bots and assistants also help doctors save and manage patient’s time.

Additionally, pathologists can analyze tissues and genes with the aid of AI applications in healthcare, improving the accuracy of disease diagnosis [41,49].

The Contribution of Artificial Intelligence in Surgery

People can now choose from a variety of AI-based surgical treatments. Even while medical experts must still operate this AI, it can accomplish tasks with minimal harm to the body. Most hospitals now offer the da Vinci surgical system, a robotic device that enables surgeons to carry out minimally invasive surgeries. Compared to human processes, these systems provide for a significantly higher level of accuracy and precision. Less invasive surgery will result in fewer traumas, less blood loss, and less patient worry [41, 50, 51]

Conclusion

To sum up, artificial intelligence has completely changed many facets of contemporary society, including healthcare, financial, transportation, and educational sectors. AI has enormous potential to spur innovation, boost productivity, and improve decision-making as it develops. Artificial intelligence (AI) systems are becoming more complicated as a result of the development of machine learning, deep learning, and natural language processing. This allows them to evaluate complex data, gain experience, and communicate with people more successfully.

AI's effects on society are complex. On the one hand, artificial intelligence (AI) holds promise for resolving some of humanity's most urgent problems, including medical detection, climate change, and educational access. Systems with AI capabilities are able to examine enormous volumes of data, spot trends, and offer insights that help guide choices. AI can also automate repetitive activities, allowing human workers to concentrate on more strategic and creative work.

But as AI becomes more commonplace, it is imperative to confront the moral issues raised by its creation and application. It is important to give considerable thought to issues pertaining to prejudice, justice, transparency, and employment displacement. Furthermore, maximizing AI's advantages while lowering its risks requires that systems be developed and educated with human values such as empathy, compassion, and respect for human rights in mind.

Investing in AI education and training initiatives is crucial to achieving AI's full potential and guaranteeing that people have the know-how to prosper in an AI-driven economy. Governments, businesses, and civil society organizations must also collaborate to create regulatory frameworks that support the responsible development and application of AI.

Subsequently, every factor AI has a bright future ahead of it. We can build a future where AI improves human lives without sacrificing our morals or general well-being by giving responsible AI development top priority. It is imperative that we continue to stay watchful as AI develops to make sure that this potent technology is used to advance humankind.

Conflict of interest

The author’s declare no conflict of interests.

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NA

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