



IMPACT OF ARTIFICIAL INTELLIGENCE ON TECHNOLOGY AND ITS FUTURE

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Abstract:- This research paper introduces readers to the fundamentals of artificial intelligence by explaining the concept of AI along with an elaboration on its key components. It ponders into many examples of its current applications classified across various different sectors. It takes up three of the most influential and prominent applications of AI – autonomous vehicle technology, the healthcare industry, and the agricultural sector – and delves into the role it plays in the sector and presents a brief idea about the trajectory of AI in each sector. It discusses topics such as detection algorithms, autopilot, AI-enhanced features, etc. about autonomous vehicles; efficient distribution of workload, data analysis and medical research, analysis of medical imaging, etc. about the healthcare industry; and the benefits and challenges of AI usage and adoption in the agricultural industry. It presents data supporting the favorableness of its involvement in those sectors.

Keywords:- *Artificial Intelligence, Applications of Artificial Intelligence, Impact of Artificial Intelligence, Autonomous Vehicles, Healthcare, Agriculture, Key Components of AI, What is AI*

INTRODUCTION - WHAT IS ARTIFICIAL INTELLIGENCE?

CONCEPTUAL UNDERSTANDING:

Artificial intelligence (AI) can be defined as the ability of machines to replicate or enhance human intellect. It is also a field of computer science focused on creating systems that can perform tasks typically requiring human intelligence. These tasks include learning from data, reasoning, problem-solving, making decisions, etc. AI technologies leverage algorithms, data, and computational power to simulate human cognitive functions.

KEY COMPONENTS

The intricate combination of multiple different skills is what makes up artificial intelligence. Each skill shines through based on the required application. They are:

1. Reasoning
2. Problem-solving
3. Perception
4. Language-understanding
5. Learning

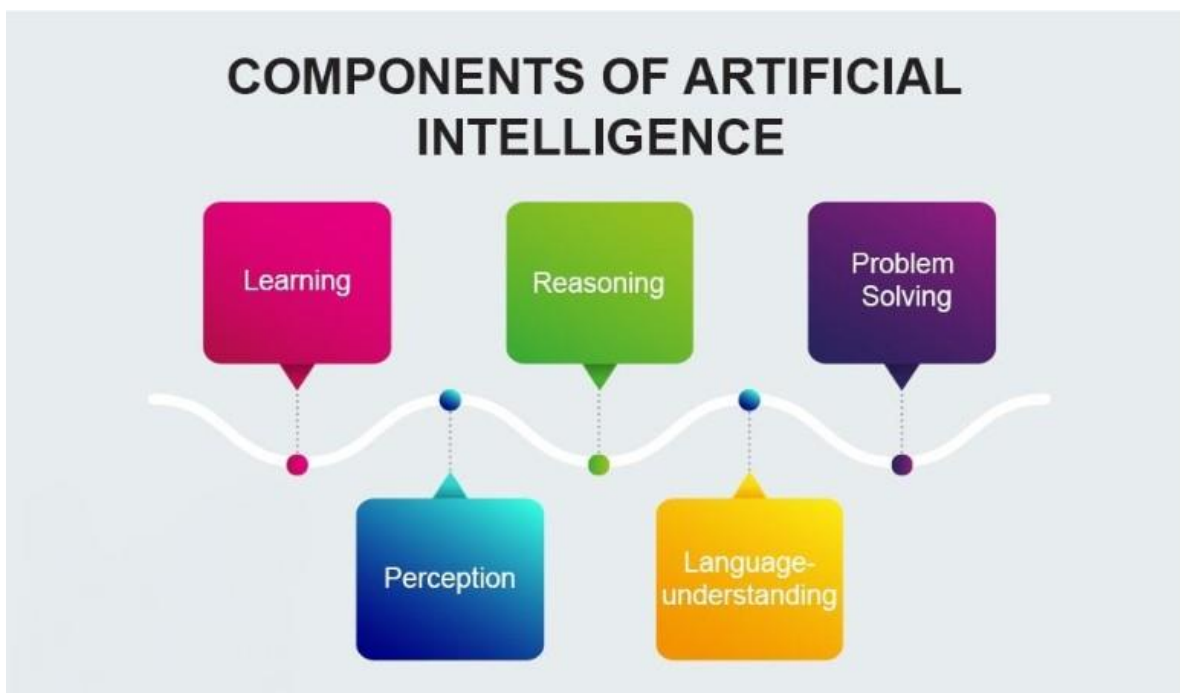


Fig 1 - key components of artificial intelligence

REASONING

Reasoning was limited to humans until five decades ago. It is the act of allowing the platform to draw inferences that fit with the provided situation. Further, these inferences are also categorized as either inductive or deductive. The difference is that a problem's solution guarantees a conclusion in an inferential case. In contrast, in the inductive case, the accident is always a result of instrument failure. The ability to differentiate makes Reasoning one of the most essential components of artificial intelligence. Deductive inferences have rewarded computer programs with their considerable success. However, reasoning is based on drawing relevant inferences from a particular situation.

PROBLEM-SOLVING

In general form, problem-solving in AI is used to create a solution using the given data to find x . AI witnesses a large variety of problems being addressed in the platform. The various problem-solving techniques that classify queries into specific and generic uses are considered essential components of AI. Special-purpose methods require that the solution to a given problem is tailor-made, often exploiting specific features provided in case a suggested problem is embedded. On the other hand, a general-purpose method implies a wide variety of vivid issues. Further, the problem-solving component in AI allows the programs to include step-by-step reduction of the difference between any goal state and the current state.

PERCEPTION

Perception involves scanning the environment using different sense organs, either natural or artificial. Further, the processes are maintained internally, allowing the perceiver to analyze other scenes in suggested objects and understand their relationship and features. This is a complicated analysis, and depending on the view of the recommended angle, similar items might pose considerable amounts of different appearances over different occasions. Presently, perception enables autonomous cars to propel at moderate speeds. FREDDY was a robot that used perception to recognize different objects and assemble various artifacts at its earliest stage.

LANGUAGE-UNDERSTANDING

A language is a set of different system signs that justify their means using convention. Language understanding uses distinctive types of languages over other forms of natural meaning. Human English is an excellent example of a language as it allows us to differentiate between

various objects. AI is conveniently designed in a manner that it can easily understand English. This way, the platform enables the computers to understand the different programs executed over them efficiently.

LEARNING

Computer programs learn in many different ways, just like humans. AI learning is further segregated into a varied number of forms. One of the essential components of AI learning includes the trial-and-error method. The program keeps on trying solutions until it comes across the right results. This way, the program keeps a note of all the moves that gave positive results and stores it in its database to use the next time the computer is given the same problem. The learning component of AI includes memorizing individual items like different solutions to problems, vocabulary, foreign languages, etc., also known as rote learning. This learning method is later implemented using the generalization method.

TYPICAL APPLICATIONS OF ARTIFICIAL INTELLIGENCE

Artificial Intelligence is used in various sectors for a myriad of specific applications. Here are some significant applications in a few sectors:

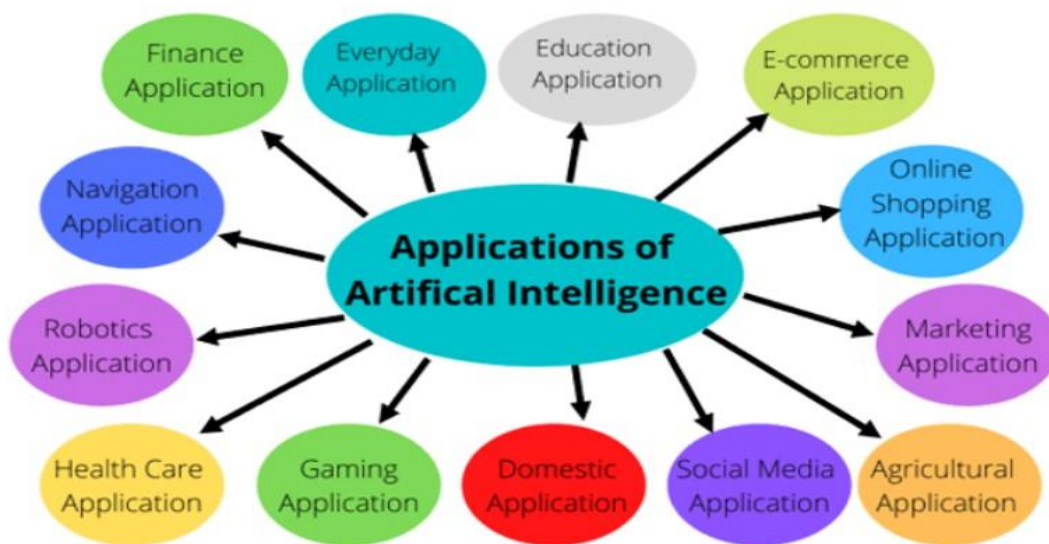


Fig 2 - examples of the various applications of artificial intelligence

E-COMMERCE

1. **PERSONALIZED SHOPPING** - Artificial Intelligence technology enables the creation of recommendation engines that enhance customer engagement by providing customized suggestions based on browsing history, preferences, and interests, ultimately fostering stronger customer-brand relationships and loyalty.
2. **AI-POWERED ASSISTANTS** - Virtual shopping assistants and chatbots enhance the online shopping experience by employing Natural Language Processing for human-like conversations and real-time customer engagement, with the potential for chatbots to handle customer service on Amazon.com.
3. **FRAUD PREVENTION** - AI plays a crucial role in mitigating credit card fraud by analyzing usage patterns and addressing the problem of fake reviews by identifying and managing them, helping companies tackle these prominent challenges.

EDUCATION

1. **AUTOMATED ADMINISTRATIVE TASKS** - Artificial Intelligence can help educators with non-educational tasks like task-related duties like facilitating and automating personalized messages to students, back-office tasks like grading paperwork,

arranging and encouraging parent and guardian interactions, routine issue feedback facilitating, managing enrollment, courses, and HR-related topics.

2. **CREATING SMART CONTENT** - Artificial Intelligence facilitates the digitization of educational content, enabling the customization of learning materials with features like animations and grade-specific content while enriching the learning experience by creating audio and video summaries and comprehensive lesson plans.
3. **PERSONALIZED LEARNING** - By leveraging advanced AI technologies, hyper-personalization techniques can extensively monitor students' data and generate customized content like lesson plans, reminders, study guides, and revision schedules based on their habits and needs.

LIFESTYLE

1. **AUTONOMOUS VEHICLES** - Companies in the automotive manufacturing industry, such as Toyota, Audi, Volvo, and Tesla, employ machine learning to teach computers to emulate human thinking and adapt to various driving conditions.
2. **FACIAL RECOGNITION** - Facial recognition, employed in personal devices for secure access and across various industries, is a versatile and widely used AI application.
3. **SPAM FILTERS** - Everyday email services, including Gmail, utilize AI to filter spam emails, directing them to spam or trash folders, resulting in a remarkable filtration success rate of about 99.9%.

ROBOTICS

Artificial intelligence applications are also commonly found in robotics. AI-powered robots use real-time updates to sense and evade obstacles in their path and pre-plan their journey instantly. It can be used for:

- Carrying goods in hospitals, factories, and warehouses
- Cleaning offices and large equipment
- Inventory management

HEALTHCARE

Artificial Intelligence has a wide range of applications within the healthcare industry, including the development of advanced machines capable of disease detection and cancer cell identification, early diagnosis of chronic conditions through the analysis of medical and lab data, and the utilization of historical data and medical expertise to explore new drug discoveries.

AGRICULTURE

Artificial Intelligence is used to identify defects and nutrient deficiencies in the soil. It uses automated drones that scan the cultivated land and analyze weed growth using computer vision, robotics, and machine learning applications. AI bots can help harvest crops faster and at higher volumes than human laborers, increasing agricultural efficiency and decreasing cultivation costs.

NAVIGATION

According to findings from MIT, GPS technology enhances safety by delivering precise and up-to-date information to users, employing a blend of Convolutional Neural Networks and Graph Neural Networks to automatically discern road attributes such as lane counts and types even when obscured by obstacles. Uber and numerous logistics firms leverage AI extensively to enhance operational efficiency, assess traffic conditions, and optimize navigation routes.

IMPACT OF ARTIFICIAL INTELLIGENCE ON AUTONOMOUS VEHICLE TECHNOLOGY

Autonomous vehicles are arguably AI's most important and influential application due to their potential to revolutionize transportation as we know it. The market cap of autonomous vehicle technology has been skyrocketing recently due to the advancements made by AI in the field. The overall market value of autonomous vehicles can be aptly displayed by fig 3.

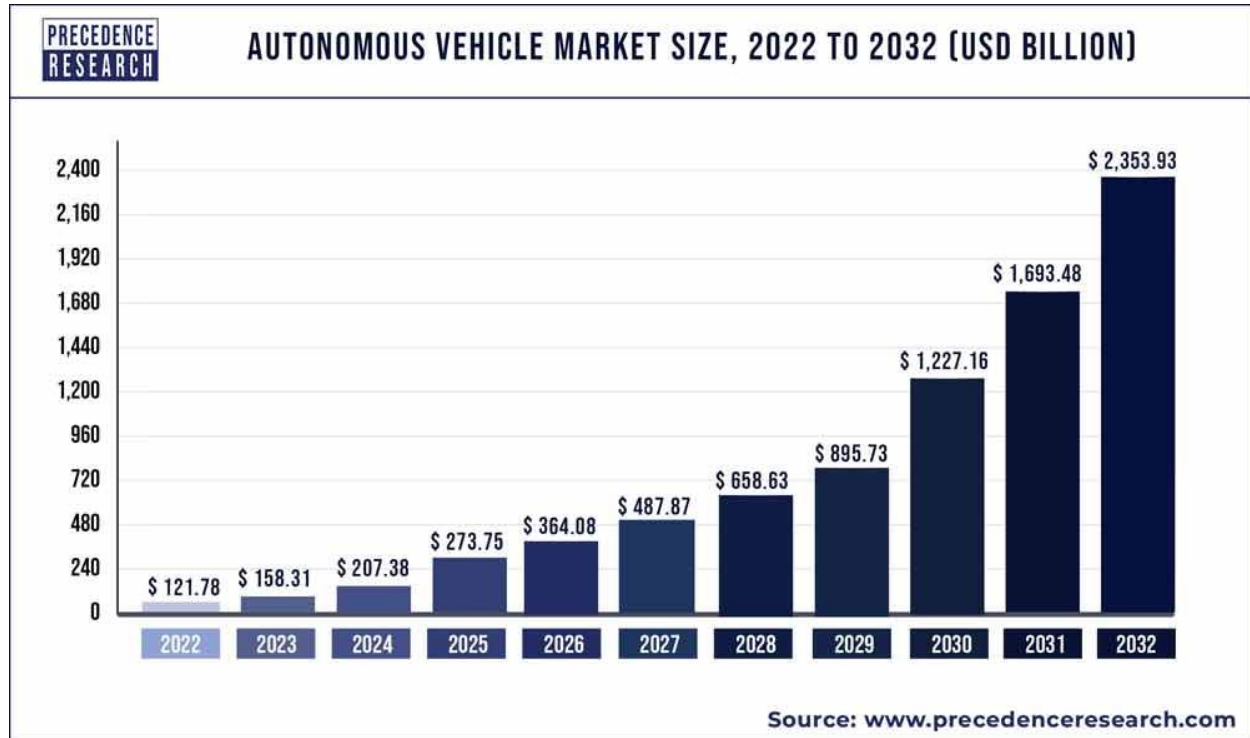


Fig 3 - predicted growth of autonomous vehicle market size from 2022 to 2032 in billions usd

This shows a projected 1,800% increase in the market value in the next decade. AI-powered autonomous vehicles can drive themselves, navigate through traffic, and make accurate, apt decisions based on real-time data. This technology can reduce accidents, improve traffic flow, and save lives. Furthermore, it can improve transportation accessibility for the disabled or people living in areas with limited access to public transportation. The development of autonomous vehicles is a significant step forward in the application of AI, and it can potentially transform how we move. AI aids the autonomy of vehicles in various aspects, but let's discuss the most vital features.

DETECTION ALGORITHMS

Autonomous vehicles have neural networks and specific algorithms, namely Artificial Intelligence (AI) and Machine Language (ML) based object detection algorithms. These algorithms play a crucial role in gathering data, analyzing objects, and making precise decisions during travel. These capabilities empower these intelligent machines to proactively address issues by predicting events through rapid data processing.

For example, autonomous vehicles can predict a potential threat like a car collision ahead or behind and decide in real-time to avert it. With high-quality data sensors, this information is processed, yielding actionable outcomes. Besides the neural network and specific algorithms, autonomous cars incorporate five fundamental components for real-time optimization: computer vision, sensor fusion, localization, path planning, and control. Furthermore, they boast advanced AI perception technology for recognizing pedestrians, vehicles, cyclists, and work-related obstacles up to 300 yards away. These embedded algorithms enable these automobiles to recommend alternative routes based on traffic conditions.

AI-ENHANCED FEATURES

Recently, some automotive companies have manufactured autonomous vehicles with enhanced AI features like personal AI assistants, radar detectors, and cameras, all of which prioritize security, among other functions. These autonomous cars have implemented AI-enhanced features, a massive advancement over their predecessors. Autonomous cars can learn about traits the driver exhibits, like driving speed, preferred car temperature, driving mood, observance of traffic signs, regular songs, or favorite radio stations. By rating driving skills, these autonomous vehicles have helped to change destructive driving behaviors and habits.

AUTOPILOT

Recently, Tesla manufactured electric cars that are self-driving and equipped with autopilots to enable automatic steering, accelerating braking, lane changing, and parking actions. Added to these features is the fact that these cars have the potential to reduce emissions globally, a milestone achievement from fuel-driven vehicles. Autonomous vehicles are in some of the world's biggest cities today. Even heavy-duty trucks without drivers that can deliver goods over long distances have been manufactured. This has reduced transportation costs significantly and reduced the loss of human lives through accidents arising from human errors. In 2020 alone, 38,824 Americans were killed in car accidents. 94% of all car accidents occur due to human error, and AI has the potential to reduce the number of annual accidents by up to 34%.

DISADVANTAGES OF AUTONOMOUS VEHICLES

Like all machines, autonomous vehicles have their own limitations and disadvantages, some issues being more exigent than others. Let's look at a few examples.

- Autonomous vehicles are limited to a narrow range of situations and clear weather for optimal performance. Like the human eye, sensors do not work efficiently in harsh weather conditions like rain or snow.
- Autonomous vehicles rely on maps and sensors to function effectively. At the moment, limited areas around the world are mapped. The remaining regions must be mapped to ensure free-flowing drives. In the US alone, detailed maps would have to be built and maintained across 4 million miles of public roads, a tedious task yet to be done. Until then, we cannot fully trust the navigation of autonomous vehicles.
- Being bound together by technology, autonomous vehicles are still vulnerable to cyber attacks, which could potentially override and take control of the vehicle, posing a significant risk to the passengers, obstructing the flow of traffic, causing collisions, and many more problems.

THE FUTURE OF AUTONOMOUS VEHICLES

From what they are today, autonomous vehicles have a long way to go. There are still many different regions where self-driving cars are yet to develop. But at the current rate of expansion and discovery of new technology, we can be sure to see a majorly automated public transport system picking up in cities as soon as a decade from now. Testing has begun in cities, most notably San Francisco and Phoenix, and problems are being identified and worked on. Autonomous vehicles are far ahead of their time, and we must wait for infrastructure to catch up to the unprecedented levels of innovation lying in AI-powered vehicles.

IMPACT OF ARTIFICIAL INTELLIGENCE ON THE HEALTHCARE INDUSTRY

Most hospitals' medical practitioners, nurses, and other staff are usually severely overworked and understaffed. This takes a toll on their performance, which could adversely affect their patient's health. A study published in Mayo Clinic Proceedings demonstrated that more than 3 in 5 physicians reported at least one manifestation of burnout in 2021. A recent time-allocation study showed that physicians, on average, spend 49% of their work time on administrative tasks and just 29% caring for patients. Special AI programs are designed to take care of tedious deskwork and free up a doctor's schedule, leading to decreased workload and increased efficiency. One example is Regard, an AI system that can perform similar tasks to reduce physician burnout. In a case study with Torrance Memorial Medical Center following 15 users over more than a year, Regard reduced measures of burnout by 50%, reduced documentation time by 25%, and enabled more time for

patient care. In many instances, AI can complete tasks with greater perfection and accuracy than medical staff. AI is developed to tutor such cases to improve overall treatment efficiency and automate time-consuming tasks. Let's delve into some of its other critical applications.

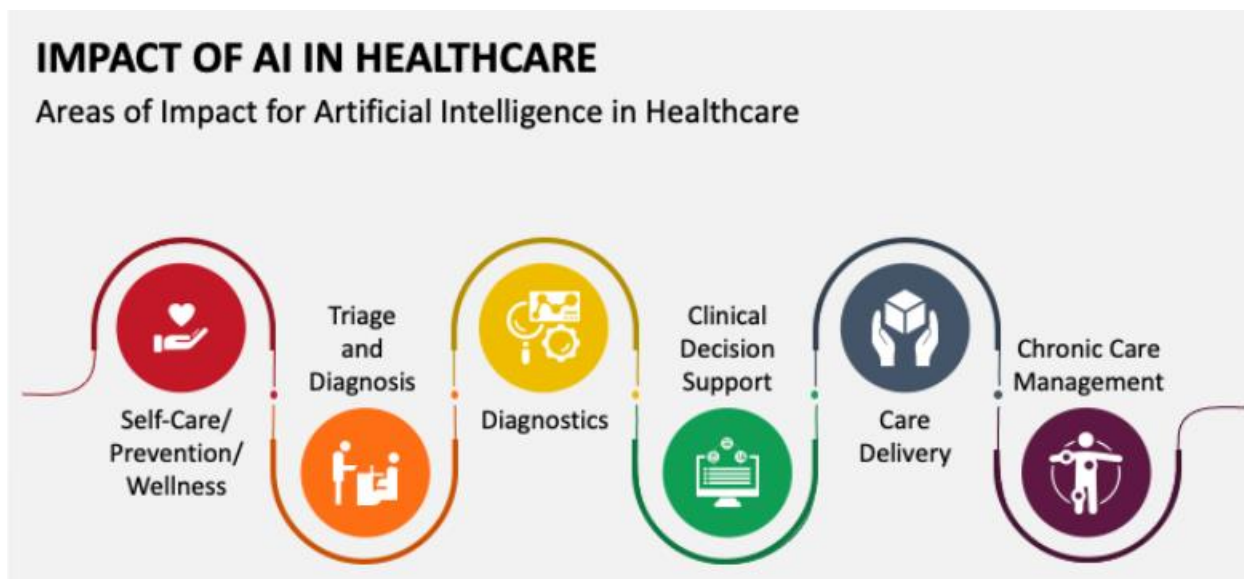


Fig 4 - some examples of various impacts of artificial intelligence in the healthcare industry

EFFICIENT DISTRIBUTION OF WORKLOAD

In many regions, there exists a great demand for healthcare with a limited supply of healthcare providers. These medical staff often struggle to tend to all the patients. Specialized AI-driven chatbots are used to relieve the workload of medical staff by performing tasks typically done by doctors. Machine Learning algorithms are trained using historical data to produce insights, improve decision-making, and optimize health outcomes. They analyze scans and past health records to produce accurate diagnoses and detect issues that doctors may miss. Ultimately, doctors have more time to tend to other patients.

VIRTUAL ASSISTANTS AND CHATBOTS

AI-powered virtual chatbots are essential for helping patients remotely and guiding them during their diagnoses. These intelligent tools give personalized health advice and support. For instance, patients can ask these chatbots about their medicines and any possible side effects without waiting for a doctor. Also, these virtual assistants can explain symptoms and suggest home remedies, letting people know when they might need to see a doctor. Moreover, these AI helpers manage tasks like scheduling appointments and handling paperwork, making things easier for healthcare staff. Patients can use chatbots to set up appointments or ask questions about their upcoming visits. Additionally, these virtual helpers are incredibly accurate, significantly surpassing doctors. In a study conducted between doctors and Ada, an artificial intelligence-based symptoms checker, 132 vignettes were presented, and the accuracy of the diagnoses was calculated. With a 70 vs 54% accuracy rate between Ada and the doctors respectively, we can conclude that this technology is highly trustworthy.

DATA ANALYSIS AND MEDICAL RESEARCH

Medical research heavily relies on comprehensive data analysis to gain insights into diseases, treatments, and patient outcomes. Researchers meticulously gather and study vast datasets, utilizing statistical methods and AI algorithms to detect patterns, correlations, and potential breakthroughs. This data-driven approach significantly expedites discoveries, advances drug development, and enhances clinical practices. For instance, researchers may collect patient records, clinical trial results, and genetic data to analyze the efficacy of a new cancer treatment. By employing statistical methods and AI algorithms, they can pinpoint specific genetic markers that indicate which patients are more likely to respond favorably to the treatment. This enables targeted and personalized therapies, improving patient outcomes while avoiding

unnecessary treatments for those less likely to benefit. Through profound data analysis, medical researchers can uncover insights that lead to more precise and effective medical interventions.

ANALYSIS OF MEDICAL IMAGING

AI algorithms can accurately analyze medical images such as computed tomography (CT) scans, magnetic resonance imaging (MRI), and X-rays, which provide medical professionals with vital insights into patients' conditions. This technology enhances the diagnosis's accuracy and speed, ultimately improving patient outcomes. Several specific examples of AI applications in medical imaging are discussed below. AI algorithms can analyze radiology images such as X-rays and CT scans to aid in diagnosing diseases like pneumonia and tuberculosis. This approach can lead to faster and more accurate diagnoses, which ultimately help to improve patient outcomes. AI-powered algorithms can assist in identifying lung nodules in CT scans, thus reducing the possibility of missing any cancerous nodules, particularly in smokers or individuals with a history of lung cancer. Overall, AI has the potential to revolutionize medical imaging, thereby improving healthcare outcomes for patients.

PATH TO THE FUTURE

The future of AI in healthcare promises to bring about revolutionary changes. It is expected to bring advancements in diagnostics, personalized treatments, predictive analytics, and administrative efficiency. AI-based diagnostic tools will provide faster and more precise analysis through image interpretation and predictive algorithms. Personalized medicine will become more prevalent, with treatments tailored to individual patient data. Predictive analytics will forecast outbreaks and patient risks, allowing for proactive interventions. AI's administrative solutions will also help streamline healthcare operations. Ethical considerations will guide responsible AI deployment, emphasizing transparency and patient privacy. In conclusion, AI is expected to deliver improved patient outcomes, streamlined healthcare, and a paradigm shift in medical practice.

IMPACT OF ARTIFICIAL INTELLIGENCE ON THE AGRICULTURAL INDUSTRY

The agricultural industry is the last place you'd expect to see AI involvement. Surprisingly, modern farmers are beginning to incorporate various techniques to optimize production, maximize yield, and decrease labor costs. Although this sector is currently in the testing stage of AI applications, it is predicted to embrace its features soon. Let's examine how AI plays an influential role in agriculture.

BENEFITS OF AI INVOLVEMENT IN AGRICULTURE

- 1. IMPROVES HARVEST QUALITY** - Precision agriculture is the science of analyzing crops and using modern techniques to produce high-quality yields. AI technology assists in the detection of plant diseases, malnourished plants, pest infestations, etc. It allows for the constant monitoring of crop and soil health. This gives farmers control over the harvest quality. Computer vision and deep learning algorithms capture visual input data from flying drones over the field. Image recognition identifies potential defects from the images captured by the camera.
- 2. FORECASTS WEATHER** - Agricultural output depends greatly upon weather. Bad weather can adversely affect farmers; sudden weather changes give farmers insufficient time to prepare their crops. A computer model helps forecasters predict possible weather threats to their crops. AI detects rotational cloud movement from satellite imagery to forewarn farmers of upcoming climatic situations. This helps farmers maximize yields and profits with fewer risks. It also gives farmers sufficient time to take precautionary measures. AI facilitates smart decisions taken at the right time.
- 3. LABOR ISSUE** - The agricultural industry is a dying sector. Most farmers face labor shortages, as few people enter this profession these days. Farms are labor-intensive and require an especially large workforce at certain seasons. Industrialization has reduced rural populations, leaving fewer potential laborers. AI provides a solution to this problem: AI Agriculture Bots. These AI-powered robots perform manual labor faster and more efficiently than human laborers. Having computer leverage, these bots are prone to higher work accuracy.

4. **REDUCTION OF PESTICIDE/FERTILIZER USE** - Pesticides are used over an agricultural field to remove pests and weeds, while fertilizer helps nourish plants in need. By implementing machine learning, robotics, and computer vision, AI locates the exact regions with pest/weed infestations or malnourishment and informs farmers. As farmers know their precise locations, they can apply pesticides or fertilizers only in those places, effectively minimizing their use and making crops healthier. Pesticides and fertilizers contain harmful chemicals and toxins that adversely affect both crops and consumers. This, in turn, dramatically reduces costs incurred for them, increasing profit margin for farmers.
5. **COST SAVINGS** - AI-based farming equipment is not cheap, but the investment proves profitable in the long run. Fertilizer is to be used in areas of undernourishment. Since farmers cannot know which areas genuinely require it, they tend to coat the entire field with it. AI image processing software tells farmers exactly where to apply fertilizer in the field. The price of fertilizers has steadily increased over the past few years, as shown in fig 5 with an upward trend.

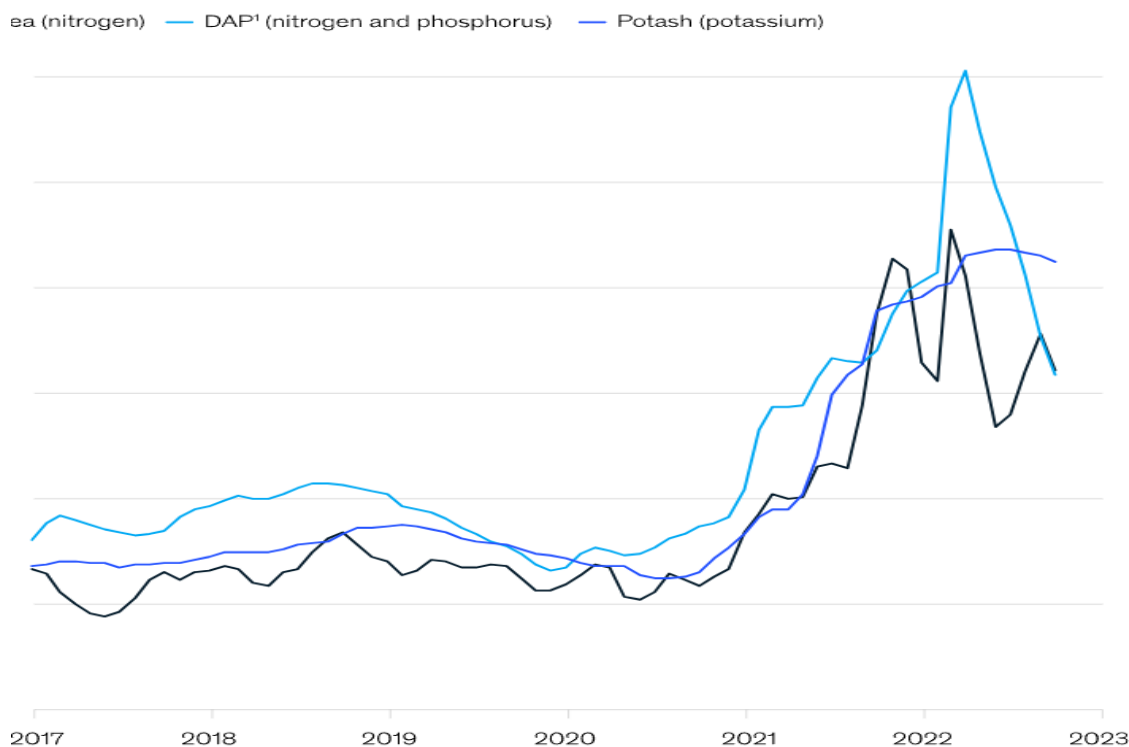


Fig 5 - price of different fertilizers in North America from the year 2017 to 2023

CHALLENGES OF ADOPTING AI TECHNIQUES IN AGRICULTURE

AI is at the very beginning of its journey in agriculture. Today, only a small percentage of farms are exploiting AI in agriculture. Being a very unfamiliar territory to traditional farmers, it will be challenging for them to adopt such new complex methods of agriculture. Thus, the adoption rate of AI in agriculture can be compared to a positive exponential curve, as once a sufficient number of farmers try this method and prove it to be successful, farmers worldwide will begin to venture into new farming techniques. Until then, they need someone's help to begin AI farming. A lack of experience in this method inhibits their growth potential as there aren't many people to take advice from. Lastly, all software is vulnerable to cyber attacks, and AI robots are no exception. Farmers must take the risk of sensitive farming data being leaked and farming equipment being remotely hacked.

FUTURE OF AI IN THE AGRICULTURAL INDUSTRY

The future of AI in the agricultural industry greatly depends upon the adoption of AI-based agriculture. Farmers have been using relatively unchanged farming methods for centuries, and such a dramatic change in process can startle most. Most farmers would stay hostile towards new methods until a considerable number of successful farming attempts using the new method surface. We need agricultural gatherings with various farmers to inform them of newer, more efficient farming technology and methods. Making farmers understand the growth

potential of these unprecedented methods is crucial in hoping for a greater adoption rate of said method. Artificial intelligence will only live up to its potential if people take the initiative and brief farmers.

CONCLUSION

Artificial intelligence is a sector with unprecedented potential to revolutionize many industries. AI is the future, and there is no avoiding it. It is only a matter of time before we begin to observe various industries utilize AI in one form or another. We have sufficient technology to begin with, as technological breakthroughs occur in Artificial Intelligence extremely frequently. However, the adoption rate of these new technologies is currently meager, and understandably so. AI has only recently become a viable software, and many quickly began trials with it.

I can already envision our world becoming a different place in the upcoming decades as AI pierces deeper into our fundamental technology. With superior forms of intelligence like this, we can expect answers to questions and conjectures previously regarded as insolvable. There are many more instances where AI can benefit us than what has been mentioned in this paper. AI is undeniably the single most groundbreaking invention in recent technological history.

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