Research Paper

Artificial Intelligence (AI) and Robot: History, Impact and Future of the World

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Abstract: *Modern information technologies and the advent of machines powered by artificial intelligence (AI) have already strongly influenced the world of work in the 21st century. Artificial Intelligence (AI) is a technology that can replicate the human brain or intelligence. It allows computer programs to learn from experience through iterative processing and algorithmic training. Every day, AI has become more practical and innovative in almost all aspects of life. AI has become a crucial issue in the 21st century, as it might affect the job market and general employment. Most individuals wish to claim that the widespread usage of AI would result in employment losses for people. However, People are gradually realizing that AI can improve the creative, lucrative, constructive, adaptable, and accessible nature of professions. AI could lead to a more innovative, diversified, and skilled economy. We must need to change the education system, including the curriculum, teaching methods, and many things that need to be done for schooling. Our mass or general education system needs to be aligned with modern and advanced technology, which will change the whole school system and must be purposeful and sustainable for the long term. It is an analytical study in which the researcher has tried to evaluate the diversified implication of AI and robots and future consequences of world along with its history, impact, global education system and other relevant issues.*
Key Words: *AI, ML, KM, logic, algorithm, networks, robot, singularity*

I. Introduction

A procedure or formula used to solve a problem or a series of instructions that tell a computer how to transform a data set into helpful information. All branches of information technology heavily rely on algorithms. Computer science's multidisciplinary field of artificial intelligence (AI) develops intelligent machines. AI is the replication of the human brain or intelligence by machines, like computers, to accomplish tasks requiring human aptitude or talent, such as seeing, hearing, making decisions, translating between languages, driving a vehicle or boat, operating equipment, etc. A few common and widespread uses and examples of AI are Siri by Apple,[1,2] Alexa by Amazon,[3,4] Maps by Google,[5,6] and ChatGPT by OpenAI. AI systems are getting smarter with each successful round of data processing because each communication and interface gives the system a chance to test and measure solutions and get better at the job it has been designed to do.[7] Since this can be done quickly and is far quicker than a human could.[8] AI systems are tremendously effective alternatives for any process involving intelligent decision-making and repeated tasks since they can become experts and do it much more quickly and perfectly than humans.[9] This makes AI an extremely authoritative and priceless technology because it essentially allows computers to think and behave like humans, which should be much faster and have more processing power than the human brain.[10] Again, Machine learning (ML) is the science of using machines to interpret process and analyze data in order to solve real-world and real-time problems instantly.[11]Deep Learning is an advanced field of ML that can be used to solve more advanced problems.[12] Robotics is a branch of AI which focuses on different branches/sectors and applications of robots.[13] AI is going to dominate the car industry by creating a self-driving car in the very near future.[14] Today's AI programs are applied to practice such as diagnostics, treatment protocol development, drug development, personalized medicine, patient monitoring and any physical or mental care.[15,16] Robotics, AI, and ML have advanced significantly in recent years. Automation and extensive use of AI can help organizations, companies, or industries do better in production or service by reducing errors, improving quality and speed, accuracy and integrity, and, in most cases, achieving results that are impossible for humans.

Peter Norvig, Google's director of research and a pioneer of ML has said that the most important thing is to figure out how to make sure that these new systems related to AI, help society as a whole and not just those who control them. He added, 'AI has shown that it can do a lot of useful things.' From an extensive study, it has been shown that automation or the introduction of AI could boost global productivity growth by 0.8% to 1.4% per year, which is equivalent to more than 2,000 work tasks in 800 occupations. When proven technologies can only automate less than 5% of all jobs, about 60% of all jobs have at least 30% of their tasks that a machine could do. Therefore, a number of professions will experience change.[17] As a result, advances in AI and related automation technologies have led to growing fears about job losses and increasing inequality in society. This concern is widespread in high-income countries. Developing countries and emerging market economies should be even more concerned than high-income countries, as their comparative advantage in the world economy relies on abundant labour and natural resources.[18] Again, declining labour and natural resource returns, as well as the winner-take-all dynamics brought on by new information technologies, may lead to a further loss of control in the developing and labour-intensive world. This has the potential to slow the rapid progress made over the last fifty years. It may also jeopardize progress toward reducing poverty and inequality in societies around the world. The great thinker of AI, Professor Yann LeCun, said that the fear of AI being a threat to humanity is preposterously ridiculous. According to him, the entire concept of AI taking over the globe is a 'projection of human nature on machines'. He wants to say that 'keeping AI research 'under lock and key' would be a 'huge mistake'.[19] According to the Meta scientist, when people express concerns about future robots working at or beyond human-level capabilities, 'they refer to artificial general intelligence (AGI) systems capable of handling a wide range of problems, similar to humans'. He emphasized that AGI development would be slow to eventually achieve a level of intelligence similar to that of a rat's brain. AI technology is becoming an increasingly important component for many products and will continue in the future; that will become a fundamental part of many people's lives. At the same time, the amount of effort AI puts into the economy will likely vary from region to region. This may depend more on the type of economic activity that is most common in a region than on the region's economic status. AI technology has the potential to give benefits to different income choices and bring significant gains to both developed and developing countries.[20] AI also has the potential to create new and innovative job opportunities, leading to a more productive and efficient economy.[21] Any technology usually eliminates employment that creates.

It is the reality that, with the advancement of AI, the world will become more complex and self-centred in the future, as well as there will not be enough jobs for all, or it will not ensure employment for everyone. So, the new generation should be educated with advanced technology and valuable skills. Therefore, the current education system must be transformed with a pragmatic solution.[22] AI is already pervasive and will soon be in every corner of the world. Currently, AI influences almost every aspect of our lives, from deciding which books, chocolates, mobile sets, cars, houses, goods, electronic household items, or flights to purchase online to determining whether our job applications are accepted, if we get a bank loan, and even what care we receive for any diseases, among many other things. Complex and advanced AI and related software systems can now find out and help to decide us to all of these things and something more on their own. Today, all big hi-tech companies, like Amazon, Facebook, Google and Microsoft have opened new study labs and own R&D cells for AI.[23] So, AI is revolutionizing modern life. However, some experts are concerned that it will one day take over the world or threaten human jobs. Millions of people, mainly industrial workers, fear AI will take over the globe or result in irreversible job losses. As we know, economic theory warns that civilization as the growth in technology will likely make both winners and losers.[24] Again, both the winners and losers from technological progress are located within the same society or country so that suitable domestic policy measures can compensate the losers. However, if the winners remain within one country and compensate the losers, from other countries that is create complicacy which is politically very difficult.[25] In this investigative study, the author has tried to evaluate the advantage of AI and robots in different sectors, and the impact of AI, along with other contemporary issues like future employment, education and future global consequences.

History of AI

New digital tools generate new terms and phrases, as well as new conceptual frameworks for comprehending how these tools affect and interact with society. Words like disinformation and doxing have entered the mainstream as we deal with new and increased forms of harm. Moreover, concepts like digital rights and data governance have come into existence amidst the push to align today's technology with our vision for a better future. The voices of women, girls and other marginalized groups, historically sidelined or absent in tech spaces, are urgently needed in decision-making processes.[26] AI first appeared as a storytelling device in antiquity and has since become prevalent in literature, like in Mary Shelley's Frankenstein. [27] In the first half of the 20th century, science fiction familiarized the world with the concept of AI robots. It began with the heartless Tin Man from the '*Wizard of Oz*' and continued with the humanoid robot that impersonated 'Maria in *Metropolis*'. By the 1950s, we had a generation of scientists, engineers, technology specialists,

mathematicians, and philosophers with the concept of AI ethnically assimilated in their minds.[28] As humans use available information and reason in order to solve problems and make decisions, so why can't machines do the same thing? Alan Turing, a young British genius who looked into the math behind AI, was one of these people. This was the logical framework of his 1950 paper named 'Computing Machinery and Intelligence'. In it, he talked about how to make intelligent machines and how to test their intelligence. [29]

Figure 1: Robots working with human[30] and digital revolution relate technology and human[31]

Before 1949, computers were unable to remember commands; they could only execute them, so this prevented them from possessing a crucial aspect of intelligence. In other words, while computers could carry out instructions, they lacked memory. Second, using computers was very expensive. Up to US$ 200,000 per month was required to rent a computer at the start of the 1950s. Only big tech companies and prestigious colleges could afford to take a chance in these uncharted waters.[32]Proof of concept and advocacy from high-profile people were needed to persuade funding sources that machine intelligence was worth pursuing. In 1956, AI research was born at a workshop at Dartmouth College. The attendees became the founders and leaders of AI research. They and their students produced programs and the then, the press described as astonishing;[33] as computers were learning checkers strategies, solving word problems in algebra, proving logical theorems and speaking English.[34]By the middle of the 1960s, research in the US was heavily funded by the Department of Defense[35] and at the same time laboratories had been established around the world.[36] Researchers in the 1960s and the 1970s were convinced that symbolic approaches would ultimately succeed in creating a machine with artificial general intelligence (AGI) and considered this the goal of their field.[37] Herbert Simon predicted, 'Machines will be capable, within twenty years, of doing any work a man can do.'[38] Marvin Minsky agreed, saying that "the problem of making AI will be mostly solved within a generation." Between 1957 and 1974, AI developed and improved. Computers became more affordable, quicker and user-friendly. They were simpler to access and had more information storage capacity. Additionally, ML algorithms got better, and people got better at knowing which algorithm to use for what task.

Ironically, AI performed better when neither the public nor the government discussed it. Many of AI's most significant objectives were accomplished in the 1990s and 2000s. Gary Kasparov was the current world champion at the time, but IBM's Deep Blue, a chess-playing computer program, defeated him in 1997. Because this was the first time a reigning world chess champion had lost to a computer, the match received a lot of media attention. In terms of creating a program that can make decisions on its own, it was also a significant step.In the middle of the 1980s, Geoffrey Hinton, David Rumelhart, and others reignited interest in neural networks and "connectionism."[39] In the 1980s, soft computing methods such as neural networks, fuzzy systems, grey system theory, evolutionary computation, and a variety of tools derived from statistics or mathematical optimization were developed. In the late 1990s and early 2000s, AI gradually rehabilitated its reputation by solving specific problems. Because of the emphasis, researchers were able to produce verifiable results, employ more quantitative approaches, and collaborate with academics from other fields (such as statistics, economics, and mathematics). Even though AI researchers' solutions were rarely referred to as AI in the 1990s, they were widely used by 2000.[40]

Our current era of "big data" allows us to gather enormous amounts of data that are challenging for a single person to process. Technology, banks, marketing, finance, automobiles, management, health care, and entertainment are just a few of the industries where AI has already proven to be very helpful. There may be signs that Moore's law is slowing down, but the increase in data has not lost any speed.[41] Breakthroughs in computer science, mathematics, or neuroscience all serve as potential outs through the ceiling of Moore's Law. The next big thing in the near future seems to be AI language. It has already started. Advances in ML and perception were made possible by faster computers, better algorithms, and access to vast amounts of data;

around 2012, data-hungry deep learning methods began to rule accuracy benchmarks.[42] According to Bloomberg's Jack Clark, 2015 was a landmark year for AI due to the number of software projects that use AI.[43] In 2017, a survey observed that one in five companies reported they had 'incorporated AI in some offerings or processes. The amount of research that has been done into AI increased by 50% in the years 2015–2019.[44] In April 2023, computer scientist Jaron Lanier published an alternative view of AI in The New Yorker[45] less intelligent than the name, and popular culture, may suggest. Lanier concludes his essay as follows: 'Think of people. People are the answer to the problems of bits.'[46]

We now live in the age of big data, in which we can collect huge amounts of information that are too cumbersome for a person to process. We can also expect to see driverless cars on the road in the next twenty years or less. In the long term, the goal is general intelligence, a machine surpassing human cognitive abilities in all tasks. This is similar to the sentient robot we are used to seeing in movies.[47]It seems implausible that this could be achieved within the next fifty years. Even if the capability exists, the ethical concerns would pose a formidable obstacle to completion. We will have to discuss machine policy and ethics in depth when that time arrives. Nonetheless, we will permit AI to consistently advance and run amok in society.[48] AI control computers and machines to mimic the problem-solving and decision-making capabilities of the human mind. AI is shaping the future of humanity across nearly every industry. It is already the main driver of emerging technologies like big data, robotics and IoT, and it will continue to act as a technological innovator for the foreseeable future. The application of AI in this regard has already been quite fruitful in several industries, such as technology, banking, marketing, entertainment, health care, automobile, agriculture, etc. Today, we can also expect to see driverless cars on the road in the next ten years.[49] In the long term, general intelligence aims to create a machine that surpasses human cognitive abilities in all tasks, including emotional activities.

History of Industrial Revolution and Consequences

Industrial revolution is a global phenomenon and continuous process. AI is going to lead to a redefinition and a disruption of service models and products. Although the technical development leads primarily to an efficiency enhancement in the production sectors, new creative and disruptive service models will revolutionize the service sector. These are adapted with the support of big data analyses at the individual requirements of the client and not at the needs of a company. Chronological development of industrialization has been discussed below.

INDUSTRY 1.0: INDUSTRIALIZATION or Industry 1.0 is known as the beginning of the industrial age, in 18th century. For the first time, goods and services were produced by machines. Besides the first railways, coal mining and heavy industry, the steam engine was the essential invention of the first industrial revolution; steam engines replaced many employees, which led to social unrest. At the end of the 18th century, steam engine wasinvented and introduced for the first time in factories in the Great Britain andit was a great driving force for industrialization, since they provided energy at any location for any purpose.[50]

INDUSTRY 2.0: ELECTRIFICATION The second industrial revolution began at the beginning of electrification at the end of the 19th century. The equivalent of the steam engine in the first industrial revolution was the assembly line, which was first used in the automotive industry.It helped accelerate and automate production processes. The term Industry 2.0 is characterized by separate steps being executed by workers specialized in respective areas. Serial production was born. At the same time, automatically manufactured goods were transported to different continents for the first time. This was aided by the beginning of aviation.[51]

INDUSTRY 3.0: DIGITALISATION The third industrial revolution began in the 1970s and was distinguished by IT and further automation through electronics. When personal computers and the internet took hold in working life. So, from this age, global access to information and automation of working has taken placed. Moreover, human labour was replaced by machines in serial production. A process that was intensified in the context of Industry 4.0 was already in the offing at that time.[52]

INDUSTRY 4.0: AUTOMATIZATION The term Industry 4.0 means in essence the technical integration of cyber physical systems (CPS) into production and logistics and the use of the 'internet of things (IoT)' or connection between everyday objects[53]and services in (industrial) processes including the consequences for a new creation of value, business models as well as downstream services and work organization.[54] CPS refers to the network connections between humans, machines, products, objects and ICT (information and communication technology) systems.[55]Within the next few years, it is expected that over hundred billion connected machines will exist throughout the world. The introduction of AI in the service sector distinguishes the fourth industrial revolution from the third.

In the field of industrial production, the term 'automatization' is characterized essentially by four elements: 1) the production is controlled by machines. Owing to the use of intelligent machines, production processes will be fully automated in the future, and humans will be used as a production factor only in individual cases. The so

called 'smart factory', a production facility with few or without humans, is representative of this. 2) the real-time production is a core feature of Industry 4.0. An intelligent machine calculates the optimal utilization capacity of the production facility. Lead times are short in the production process, and standstills, except those caused by technical defects, can be avoided. Within the value creation chain, the coordination of materials, information and goods is tailored exactly to demand. Stocks are kept to a minimum, but if materials needed for production fall below a certain level, the machine orders more. The same applies to finished products; the machine produces depending on incoming orders and general demand, thus reducing storage costs. 3) the decentralization of production. The machine is essentially self-organized. This includes a network of the manufacturing units. In addition to material planning, the handling of orders is also fully automated. 4) the individualization of production even down to a batch of one unit. The machine of the future will be able to respond, within certain limits, to individual customer requests. No adjustments to the machines by humans are required. As a result, changeover times are eliminated. The smart factory adds certain components or, in a context of optimum distribution throughout the entire process, adapts individual stages of production to correspond with customer requests.[56]

The term Industry 4.0 thus stands for the optimization of components involved in the production process (machines, operating resources, software, etc) owing to their independent communication with one another via sensors and networks.[57] This is supposed to reduce production costs, particularly in the area of staff planning, giving the company a better position in international competition.Well-known examples from the field of robotics and AI are the so-called 'smart factories', driverless cars, delivery drones or 3D printers, which, based on an individual template, can produce highly complex things without changes in the production process or human action in any form being necessary. Well-known service models are, for example, networking platforms like Facebook or Amazon Mechanical Turk, the economy-on-demand providers Uber and Airbnb, or sharing services, such as car sharing, Spotify and Netflix. Studies show that merely due to sharing services the turnover of the sector will grow twentyfold within the next ten years. Old industry made progress by using economies of scale in an environment of mass production, but the new information economy lives on networking effects, leading to more monopolies.[58]

Human Error and Use of AI

While the benefits of analytics are widely recognized, such as enhancing shopping experiences, optimizing train and truck routes, identifying extraterrestrial life, and forecasting diseases, organizations globally have been confronting the challenge of human errors creeping into their analytical endeavors, sometimes leading to catastrophic results. Human error in data processing has far-reaching consequences for organizations, from crashing spacecraft to sinking ships, transferring billions of dollars to unintended recipients, and causing deaths due to pharmaceutical overdose.[59] Human mistakes in data analysis can occur for a variety of reasons, including a lack of expertise, exhaustion or loss of focus, a lack of information, or the all-too-common biases in data interpretation. On the other hand, the most prevalent human errors are related to humans reading, processing, analyzing, and interpreting data. AI can successfully tackle human mistakes by parsing, analyzing, drilling down, and dissecting enormous amounts of data. It can also do high-level arithmetic, logical, and statistical functions on a human-led scale, whereas self-service analytics cannot. AI-driven analytics has numerous advantages, from giving actionable insights in minutes to removing errors or biases in self-service analytics. We may expect to see increased adoption of AI in analytics worldwide as more business executives look to AI for insights that fuel their businesses. There are five most common human errors observed, as discussed below, and that can be eliminated by using AI easily.[60]

Confirmation bias. If you're constantly on the lookout for a yellow car, you'll always spot it. In the corporate world, confirmation bias skews our approach to collecting, processing, and remembering information. Intuition often takes precedence over hard data, leading to the manipulation, exclusion, misrepresentation, or misinterpretation of facts to back up individual views. When data goes against these beliefs, it's frequently challenged and disregarded. Artificial intelligence avoids this method of cherry-picking data by examining past data for trends, patterns, and outliers, yielding reliable, bias-free conclusions.[61]Lockheed Martin,[62] one of the world's leading aerospace companies, uses historical project data, also called dark data, to manage its projects proactively. By analyzing and correlating numerous metrics, the company was able to pinpoint early and trailing signs of program development, forecast potential program setbacks, and enhance project insight by 3%.

Inability to break silos. The Silo Mentality, as described in the business dictionary, refers to a situation where specific departments or groups in a company are reluctant to share information with others within the same organization. Such an attitude can hinder overall productivity and negatively impact team morale. It may contribute to the decrease in productive company culture.[63]Too many organizations have trouble with data-related problems, such as keeping track of various sources of data, not being able to work together on data and

having data that is not accurate or that is hard to get to. Utilizing relational data modelling, AI can seamlessly bridge gaps by interfacing with and linking vast data sets from diverse databases, applications, or sources. For instance, several state governments in India collaborated with the National Green Tribunal on Project Elephant to investigate and prevent elephant fatalities on train tracks spanning multiple states. This initiative was sparked by an investigative piece in The Hindu newspaper, which compiled data from the railway and forest reserve departments to highlight the patterns, timings, and frequency of elephant deaths. AI-driven data analytics offers numerous advantages, such as delivering prompt actionable insights and eliminating errors or biases inherent in manual analytics. The transformative power of analytics is evident, influencing shopping behaviours, designing transport pathways, exploring extraterrestrial life, and even forecasting diseases. However, silos occur in various departments or business units in the organization, and AI could be employed in any of these business operations to break down silos.[64]

Downplaying losses.   Humans naturally dislike losses. Toyota minimized the issues related to defective brakes in their vehicles, leading to the removal of certain Toyota models from Consumer Reports' recommended list. BP downplayed the impact of the Gulf of Mexico oil spill by putting out polished ads apologizing for a 'minor spill,' until it received severe backlash from then-President Barack Obama, who said the company should have used its PR budget to clean up the spill instead.[65] Downplaying loss fosters tunnel vision and impairs leaders' ability to make good judgments. Moreover, this might be costly to the organization in the long run. Owing to the objective nature of artificial intelligence, it processes and evaluates data without bias, avoiding the human tendency to lean towards positive results. Hence, AI-driven analytics serves as an ideal partner for leaders who aim to base their decisions on complete data rather than a skewed perspective. AI's thirst for enormous volumes of training data will increase the relevance of data, altering how we must think about data protection.[66]

Inflated predictions. A limitation of human-led analytics is its potential for overly optimistic projections. Often, individuals may overstate the future financial needs of an organization, overpredict the impact of natural occurrences, or make assumptions about deficits or inflation based on prior experiences and assumptions. On the other hand, AI-led analytics tends to be more accurate because it makes predictions based on what is moving or stopping something and what is happening in the outside world. The US Navy uses AI and ML to plan preventive repairs for its ships and planes and to predict when parts will break down.[67] This enables sailors to spend more time focused on missions and less time on repairing aircraft when they fail.[68]

Inability to go beyond surface-level analytics. Companies that delve deep to understand the root causes of challenges often significantly surpass their rivals. By analyzing the sources of a problem, they can determine its genesis, propose effective solutions, and anticipate and prevent similar challenges in the future. Humans are not able to collect, analyze, and drill down through so many layers of data to find the root cause of a problem when there are too many data sources, structures, and silos.[69]AI-driven analytics can bypass these barriers by smoothly digging into numerous levels of data simultaneously. In addition, AI can also overlay several possible situations to come up with the most probable cause of a problem.[70]

Contribution of AI in Different Sectors

AI has become an influential force in various industries, businesses, and aspects of our daily lives. Its transformative potential is being recognized and harnessed across numerous sectors. Applications powered by AI have gained prominence in many fields, reflecting our shift towards a more digitalized world. Today, leveraging AI can significantly enhance efficiency and smooth operations across businesses. Numerous enterprises, organizations, and firms have already incorporated AI into their operations. In the following sections, we will delve into the impact of AI across diverse fields and business domains.

An automated information system (AIS).   An AIS is a combination of hardware, software, and equipment designed to manage information with minimal human intervention. This system can encompass computers, software, and telecommunication devices. The specific information an AIS manages varies based on its purpose. For instance, a library may use a Library Management System to assist staff in tracking and organizing books. If a book is overdue, the system will send an alert containing details like the borrower's name and contact number. Conversely, an accounting firm might employ a distinct AIS to gather and analyze financial data, generate and dispatch invoices, and compute taxes. Such systems also facilitate easier information dissemination. For example, a Library Management System could message the customer about the specific book and any fees charged.[71] There are general AIS types common across industries, and we will discuss a few below.

➢ **Management Information System (MIS):** An MIS assists an organization's leadership in overseeing operations. Through MIS, managers produce reports that provide insights into the company's operations, HR, sales, and more. Examples of such systems are HRM, sales management, and inventory management systems.

➢ **Transaction Processing System (TPS):** A Transaction Processing System (TPS) manages data related to business transactions like sales, expenses, inventory, and payroll. Its main function is to maintain and update transaction records for reports or further analysis in a Management Information System (MIS). Billing and payroll systems are examples of TPSs.

➢ **Office Automation System:** While MISs and TPSs are tailored to assist specific users or departments, Office Automation Systems facilitate processes across all levels. They can handle administrative tasks like setting up meetings and managing calendars, as well as managerial functions like creating reports and evaluating performance.

➢ **Expert System:** Expert systems are sophisticated AI applications that leverage artificial intelligence. In the healthcare sector, these medical expert systems can identify prevalent illnesses without a doctor's intervention.

Payroll, billing, inventory control, human resources (HR), and medical expert systems are all types of AISs. These systems are also integrated into our everyday lives beyond the workplace. They can instantly alert communities when a child goes missing. These notifications aren't just sent via text or email but are also broadcasted on TV, radio, and digital displays. AISs are also used by disaster management groups to let people know about floods, earthquakes, and other events that could affect them.[72] Even Siri, Alexa, and other AI-based systems are classified as AISs since they use all of the data; we enter daily to make recommendations. AISs are already embedded in our personal and professional lives. They assist people in making better, faster decisions, thereby saving time and, in some circumstances, lives. However, we must recognize some of the difficulties that AISs provide. One of the key issues is the security risk that these systems, like any digital device, pose. Hacking, data leaks, and various forms of cybercrime can afflict AIS users.[73] As such, AIS providers and users are encouraged to implement robust cybersecurity measures.[74] AIS benefits us:

➢ **Better decision-making:** With AISs, managers can make calculated and data-based decisions that benefit their whole organization.

➢ **Faster decision-making:** Besides making better decisions, people using AISs can also make decisions quickly. That is crucial, especially for time-critical events, such as ordering stocks before inventory runs out, spotting child abductors before they harm the victim, and evacuating residents from disaster-prone areas.

➢ **Efficiency:** Employing AISs reduces the need for allocating HR to mundane tasks. AISs can be left alone while employees perform high-level activities.

Travel and Transportation. AI has significantly impacted various industries, and the travel sector is no exception.[75] Today, the travel industry extensively uses AI-driven tools and solutions for everything from trip planning to the actual journey.[76] AI has emerged as a dominant trend in travel and transportation. It does more than just provide the quickest routes for drivers; it also facilitates remote travel arrangements.[77] Recognizing the power of AI, numerous travel firms have integrated it into their systems, capitalizing on the fact that people frequently use their smartphones for travel-related searches. In fact, a recent study revealed that 82% of individuals use their smartphones to explore local attractions and dining options. Take Google Maps, for instance, an application where many might not realize the extent of AI's role. It can scan roads by using an advanced algorithm to look for and suggest more competent routes and guide us about future traffic conditions in real-time, whether we are in a car, on a bus, train, or on foot.[78]

Manufacturing. AI greatly enhances the production industry by addressing internal challenges. Today, with AI, manufacturing facilities can seamlessly automate, streamline decisions, integrate, and orchestrate their operations more efficiently. Such technological advancements significantly influence manufacturing speed and quality. It's projected that AI could amplify production by 40% by 2035. One of the key advantages of AI is its ability to make decisions rooted in data, optimizing efficiency, increasing output, and reducing operational expenses. This not only simplifies scaling efforts but also refines product development. Manufacturers employing AI can monitor equipment health and proactively schedule maintenance. By leveraging machine learning for predictive maintenance, factories can decrease downtime and repair costs by up to 30%. Systems grounded in deep learning can enhance defect detection by nearly 90%, ensuring unparalleled product quality. AI provides a comprehensive view of factories, assembly lines, and storage areas. Such insights empower operators to identify quality issues, reduce waste, and tweak production processes. This capability enables manufacturers to boost their production rates by 20% and enhance quality by 35%.[79]

Agriculture. The journey of products like flour or rice from the farm to the grocery store involves numerous steps. Agriculture is a complex industry where getting things right can be challenging. AI and autonomous farming can significantly enhance agricultural efficiency by predicting customer demands, regional supply chain behaviours, and the necessary raw materials for specific yields. Such technology can also identify significant weather patterns that might impact crops, such as heavy rain or extreme heat. Additionally, AI can aid in other farming challenges, including optimizing fertilization, combating pests, and addressing diseases. These advancements can mitigate challenges posed by climate change, population growth, workforce shortages in agriculture, and food safety concerns. AI has revolutionized farming by simplifying the processes of growing, monitoring, harvesting, processing, and selling crops. Cutting-edge digital solutions are being developed to tackle key issues such as weed detection, crop yield forecasting, and quality assessment.[80]

Healthcare. According to a forecast by CB Insights, a staggering 86% of healthcare organizations are expected to adopt AI technologies soon. The integration of advanced AI in healthcare holds immense potential. From managing medical records, interpreting tests and X-rays, to providing virtual nursing and handling data entry, AI stands as a transformative force in medical settings. Industry professionals are optimistic about the combined power of AI and the Internet of Medical Things, predicting groundbreaking advancements in early disease detection and medical research. Consumer-facing AI apps, often backed by healthcare chatbots, are guiding individuals towards healthier living choices. One standout application of AI in healthcare is its capability in pathology.[81]AI and ML-driven systems assist pathologists in analyzing tissue samples, leading to more accurate diagnoses. Through the incorporation of AI in healthcare, the goal isn't just to enhance diagnostic precision but also to refine treatment methods for greater accuracy.[82]

AI-operated health care systems can handle most tasks previously handled by humans and they can do faster and cheaper way. This significant benefit has eased stakeholders, and related activities, especially hospital administrators, doctors, and patients. AI has continued to revive and reinvent itself. There are now modern ML solutions capable of acting, learning, understanding, and predicting related diseases and patients. This is a step further than the surgery-assisting robots and linking genetic codes previously driven by AI. However, AI development has some risks and challenges like, AI system errors put patients at risk of injuries. Again, the patient's data for AI reference puts the patient at risk of privacy invasion.[83] The benefits and advantages of AI in health care are as follows:

➤ As we know that most of the developing countries struggling to keep up with the fast-paced global technological advancements have limited or no access to standard healthcare facilities and systems. The population of such a country has a high risk of dying. From the report of WHO, between the world's richest and poorest nations limited or no healthcare accessibility is responsible for the 18.1-year gap in life expectancy.[84] These disadvantaged areas can enjoy an efficient healthcare ecosystem through AI innovations. AI-backed digital systems can facilitate patient diagnosis, treatment and medication in those areas.

➤ Today AI-powered mobile health apses are helping and used as the application of sensors, mobile apps, social media, and location-tracking technology to obtain data pertinent to wellness and disease diagnosis, prevention, and management to the users.[85,86]Those are low-priced and user-friendly. Mobile health technologies are evolving from evocative monitoring tools to digital diagnostics and therapeutics that synergize tracking with behavioural and other interventions to directly affect health outcomes.[87]

➤ AI can develop an easy information-sharing system. We can realize and utilize the potential of AI for precision diagnosis and medicine. ML and algorithms must be able to analyze large amounts of data quickly and purposefully. AI can locate particular patient data more effectively than conventional care and give doctors more time to concentrate on medications and treatments. It also helps doctors with quick and viable decision-making.[88]For example, a glucose broadcasting system enables citizens with diabetes to monitor their glucose levels in real-time and acquire reports to discuss and manage their advancement with physicians or support groups. Again, wearable device data can indicate the likelihood of contracting a particular disease.[89]Our day-to-day life is saturated with health data that was previously out of reach. Over the last decade, new devices and fitness technology companies are attempting to tap into this data, uncovering a treasure trove of useful information that, when applied correctly, has the potential to revolutionize the way we approach healthcare and chronic conditions like asthma, diabetes, etc.[90]

➤ Today, AI-driven medical equipments and tools now rely on people's data to assess the previous and present health issues of patients. And by comparing those disease details, healthcare professionals and doctors are positioned to diagnose more accurately. The database in several healthcare mobile apps has computed millions of symptoms and diagnoses. Those can predict the potential health issues an individual can encounter in the future.[91] For example, verily from Google is an application created to forecast hereditary and non-contagious genetic diseases.[92] With such useful health tools, health experts can correctly predict and prepare for possible

threats in the future by taking the right steps early stages. So, by using such tools, it is possible to better operational management, predictive analysis and decision-making.

➢   Today, due to AI algorithms, healthcare processes become faster and at a fraction of the original costs. AI has really changed the game in terms of speed and costs for the patient examination to diagnosis, and even appropriate medication. Such as AI can identify the biomarkers that suggest disease in our bodies. Moreover, AI algorithms have minimized the manual work involved in specifying these biomarkers. AI algorithms and ML are considered more cost-efficient compared to traditional healthcare methods.[93]Patients can take required trips to the laboratory, along with AI algorithms providing prediction and results which based on personal information. This is responsible for the increased implementation of AI across all types of healthcare area. According to a new survey of 500 U.S. health industry leaders from hospitals, health plans, life sciences and employers, on their attitudes and adoption of the technology. The result is significant, compared with 2018 findings, that, a nearly 88% increase in the number of respondents who said their organizations have a strategy in place and have implemented AI.[94]

➢   We know that most of the patients have a poor experience due to crowded and chaotic healthcare facilities. Utilizing AI can help patients quickly navigate and manage data, obtain reports, and be directed to where to go and whom to see, thereby avoiding the usual chaos and confusion in healthcare settings.[95] A recent study reveals that, according to 83% of patients, poor communication is the most unpleasant aspect of their experience. AI can provide information to patients round-the-clock. To provide accurate, up-to-date medical information, today's advanced AI healthcare apps or system asks questions, looks at the answers, and looks at symptoms and risk factors that are already known.

➢   AI advancement has taken a huge leap in robotic applications in health care. The same is the case for ML implementation in surgery. There are dedicated AI Surgical Systems that can execute the tiniest movements with maximum accuracy. This means we can do complex operations efficiently with reduced risks and side effects, blood loss, or pain. Again by use of AI post-surgery recovery can make faster and easier.[96] Today patients are subjected to Antibacterial Nano-robots which eliminate all infections in their blood before operations. Nowadays, AI-backed information on the patient's present situation is available to surgeons in real time. It helps the doctor about the patient's condition, especially before surgery when the patient is under general anesthesia.

➢   Advanced robots can assist both patients and medical staff. Such as exoskeleton robots can help paralyzed people regain their mobility with little or no help from caretakers. Today, smart AI-backed prostheses are fitted with sensors that serve as more immediate limbs than traditional models.[97] Service robots from ML implementation can handle daily tasks and keep the company of patients. There are dedicated companion and conversational robots that carry out necessary tests and checks like sugar levels, blood pressure, controlling temperature, and taking pills. More advanced robots developed to help depressed patients, babies, and old or week patients. With these capabilities, they can analyze the mood of the patients and help them feel more positive.

➢   Today, intelligent robots are launched into healthcare and patient home settings. As new algorithms are integrated into patient care processes, it will be essential for nurses to gain experience in interpreting multiple data results and integrating new information into nursing practice. AI-controlled health care Tools must benefit patient care. Ideally, they allow nurses to spend more time at the bedside and gain a better understanding of the patient's illness and needs.[98] However, tools must be easy to use, and output interpretation must be intuitive. Researchers around the globe are creating robots to help people drive, impact suicide rates, support clinical tele-health applications, and more.[99]

Customer Service and Call Centers.AI offers transformative benefits in the customer service realm, being extensively integrated into industries such as retail, finance, and insurance. Through AI-driven solutions, businesses can deliver prompt and tailored customer interactions. Not only does this technology enhance customer support, but it also elevates the job satisfaction and productivity of employees. In settings like call centers, AI accelerates the retrieval of pertinent data. Advanced AI tools enable the evolution of methods, helping to discern effective strategies from ineffective ones. Call center AI software can benefit our company by handling client interactions more efficiently.[100] So, AI can help customers/users to find their information easily and to help them by solving their problems smoothly to achieve higher customer satisfaction.AI can automate simple tasks, provide in-depth analysis, and also help agents achieve a faster response time, better first-call resolution, and happier customer service agents who have the tools to do their job better.[101]

Cybersecurity.   Cybersecurity is becoming a bigger problem all over the world. With everything being digitalized, organizations need help dealing with the security problems that are happening right now. Utilizing AI in defense significantly enhances security. This technology can proactively detect potential hackers and learn from current business vulnerabilities. It's crucial to bolster security to ensure the safe application of AI. By harnessing AI for defense, experts aim to reduce instances of fraud and hacking. With the advent of AI-powered

cloud security, businesses are better equipped against cyber threats, gaining an advantage over cybercriminals. However, it's worth noting that cybercriminals are also adapting, using advanced AI-driven ransomware and malware that can infiltrate and damage systems efficiently, putting everyone in jeopardy. Furthermore, there's an emerging threat of AI-driven industrial and political espionage which focuses on data acquisition. AI tools like ML and natural language processing help analysts react to threats more quickly and confidently. AI can help keep track of hardware failures. Some multinational companies already have a team of experts in cybersecurity, IT infrastructure, and budgets to build products for working with massive data and coming up with a good plan to deal with threats. In most security setups, the speed of the attack and sometimes the way it changes can make it hard to respond to threats in real-time.[102]

Construction. can open many new avenues in the construction industry. Advanced forms of AI are making related operations in simple and user-friendly ways. By using AI in this field, it is possible to reduce human effort and achieve efficiency. Moreover, AI is proficient in collecting and processing data and predicting outcomes.[103]AI technology can be advantageous at various stages of the project's design, construction, and post-completion. AL and ML are pushing the construction industry's potential to new heights at every engineering and construction stage, from design to preconstruction to construction to operations and asset management. AI can be used for project conception and design bidding, financing, transportation management, operation, equipment, and asset management. [104]

Figure 3: Cybersecurity vs information and network security[105] AI in the finance sector[106]

Software Development. In the field of software development, the world will surely see significant disruption from AI with new tools and libraries, enabling the generation of code which will use natural language. Moreover, technology ensures we can automate anything as we desire.[107]Using information from AI-based tools can lead to new ways of building software and using it to help a growing business. Most AI systems use technologies that work together. For example, speech synthesis and speech detection technologies are often used together. The size of software companies and the size of their software teams show that collaboration is an important part of making software.[108]

Finance. Today, financial institutions like banks, insurance, and hotels are using AI to provide improved and necessary information and recommendations to customers/users and help them make more thoughtful decisions. AI and Financial Experts believe AI and the finance industry are a great match. The most crucial factors driving the financial sectors are accuracy, real-time data reporting, and processing data in large volumes.[109]The technology is perfect for these tasks, which is why the financial industry is recognizing its speed and accuracy and using ML, adaptive intelligence, algorithm trading, automation, and chatbots in its financial processes. There are currently Robo advisers available through several financial investing sites. These advisers employ AI to create a unique and tailored profile for each investor based on their financial goals. Banks that use AI can greatly improve the client experience by providing 24/7 access to their accounts and financial advisory services. One of the most important business cases for artificial intelligence in banking is its capacity to detect and prevent fraud and cyberattacks. According to Insider Intelligence, consumers need secure accounts from banks and other financial institutions, especially with online payment fraud losses anticipated to reach $48 billion per year by 2023. AI can examine and identify abnormalities in patterns that humans would otherwise miss.[110]

Gaming. One of the biggest advantages of AI is in the gaming industry for making quick enhancements. AI is about creating more responsive, adaptive, and challenging games in gaming. From NPCs to path-finding, AI is revolutionizing the gaming experience.[111]AI has changed the gaming world by making games that respond to

players, learn from them in real-time, and be made quickly. AI used to be a hobby, but now it is a tool that many people find very useful. With AI, it is easy to make very complicated models. Regarding video games, the technology will help makers make huge online worlds for players to explore. What is more important is that developers can use the technology to model policy questions and scientific studies that happen in the real world. AI could be used to make game levels that are procedurally generated, which means that they are made as the person plays the game. This way, players do not have to play through the same levels repeatedly, which can help keep the game new and interesting. [112]

E-Commerce. Nowadays, we have seen an image of the same product on an e-commerce platform as we are searching for on some other e-commerce site. AI is the right answer to this. Organizations implement ML algorithms to develop stronger customer relationships. The ML algorithms can also help in customizing customers' experiences. Such advanced technology can also help organizations increase sales and earn more profit.[113]Today, Amazon has found the best utilization of AI. They become one of the most powerful e-commerce platforms. They are known to have implemented AI into every step of the customer's life cycle.[114] Amazon has built the whole business depending on AI with many AI subprojects.

Business. The rise of AI as an enabling technology for economic growth and social empowerment has compelled researchers to investigate existing difficulties and report on accompanying potential thoroughly. Businesses use AI to increase efficiencies, save time, and reduce costs. AI is increasingly becoming a valuable resource for businesses across industries as it advances.[115]If we run a business that works in the automobile industry, it is clear that the developments and possible entry into this area can be worthwhile. In this way, our company can become part of a visionary future for AI in the automobile industry, drawing ever closer. We can simultaneously take advantage of the benefits in various other branches.[116]We have the choice to provide relevant assistants and automation to support company vehicles. By doing this, we help our staff drive more easily and may appear more appealing to potential candidates. Future freight transportation for our company might also involve autonomous driving.

Energy Sector. In the energy sector, which is currently in flux due to, among other things, changing extraction methods, AI is rapidly being used in numerous sections of the energy industry. It is increasingly important in controlling networks, among other things, in this context. As a result, it contributes to automation and improvement. Furthermore, AI is being used to improve the efficiency of energy creation and to aid in the shift to renewable energy sources. In the energy sector, AI can also be used on the client side to collect important data for a more efficient consumption configuration. In this context, it also contributes to enhanced sustainability, a major driver for the energy revolution. AI is also used to meet the wants and needs of clients better. If our company is in the energy sector, we can use these chances to improve our operations and production. We may get a competitive edge by doing so. Machine learning and artificial intelligence have huge potential in general to manage the problem of energy supply and demand balance. Aside from the two key areas of trustworthy predictions and smart grids, many additional factors come into play for which significant gains are predicted, such as power theft prevention and detection and prediction of power outages.[117]

Automobile Industry. AI should play a bigger role in the car business over the next few years and decades. This will become clear, among other places, in the production of cars and the automation and help with driving. In the car production business, for example, there is a goal that AI could figure out whether or not all the steps are working or have worked as planned. If a broken part is installed, AI can help find it and fix the car. AI could help manufacturers keep evaluating their goods in this way. It would help with overall quality control and make things run more smoothly simultaneously. This is not possible in a reliable way, but this picture of the future is already in the works. On the other hand, AI is already helping drivers do their daily tasks more easily. This happens through the driver assistance system, which sounds an alarm when certain dangers are found or when the distance between the car and other cars or items gets too close. Again, AI allows some driving parts to be done directly by the car.[118]Today, it is found in some vehicles that there is an option to allow the vehicle to park itself using the steering assistant without additional help from the driver.
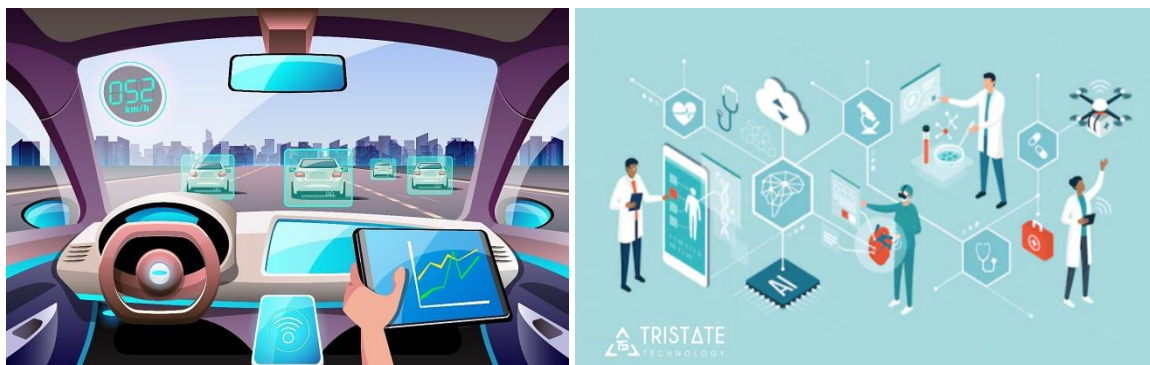
Figure 4: Benefit of AI in automobiles[119] and benefit of AI in healthcare[120]

Some models have similar ideas about how to deal with traffic jams. The AI sometimes takes the wheel in the most literal way. In cars, AI also includes cruise control and systems that help you stay in your lane. Cars of the future may be able to drive themselves. At the moment, AI-based, fully driverless driving is not quite possible, but it is a goal for the future. Here, the driver does not do any steering; instead, a system, for this reason, does it. Automated parking and traffic systems in everyday driving are the start of progress. There are different levels of technology when it comes to driving by itself.[121] Depending on the level, the driver can intervene or be prompted by the system. In the case of the highest automation tier, this is neither required nor possible, and the driver becomes a passenger. So, autonomous driving is conceivable for, but not limited to, passenger cars, public transportation, and freight transport. However, prototypes and tests for some of these ideas already exist.[122] Shortly, we will see more automation in automobiles. The legal framework is supposed to apply in the techno-loving country for various possible fields and become favourite, developed, and realized.

Discussing automotive machine learning initiatives without including self-driving automobile solutions is challenging. Automakers like Toyota and General Motors, as well as other major technology companies like Lift and Waymo, have spent billions of dollars developing self-driving cars. Autonomous buses and shuttles are already being used in cities and airports in many countries, driverless trucks are already delivering goods over large distances, and autonomous flying taxis will soon appear to be a reality. Moreover, there is a strong reason for the car industry's quick adoption of machine learning.[123] Many people wonder how driverless cars can recognize potential threats and react to the environment in real time. Self-driving cars use neural networks and specific algorithms, which have the power of autonomous vehicle perception. These neural networks enable driverless vehicles to orient themselves on the street and avoid collisions.[124] Today, the automotive industry is seeing increased competition, cost pressure, and volatility; Evan, a small disruption can make or break an enterprise's image. Including AI and machine learning capabilities can be a game-changer for the automotive industry. Automotive manufacturers can deploy AI technologies for designing and building new prototypes, improving supply chain efficiency, and enabling efficient maintenance of both factory equipment and vehicles on the road.[125] And the high time to adopt these AI technologies is now. Act on it before it is too late if you can leverage the same.

Telecommunication Industry. AI has already arrived and is widely used in the telecommunications industry. It is important in network administration, among other things, especially in network maintenance and governance. Experts believe that AI will be responsible for making redundant certain individuals who have previously performed this function in the future. AI can be especially useful in enhancing customer service in this sector. It can ensure that consumers do not have to wait as long for any company to respond to specific issues.[126] It can concurrently make various other processes more efficient and also ensure that errors in customer service are gradually avoided.[127] AI systems are trained by 'feeding' the algorithms with appropriate training data sets. For machines, data is the same as experience is for us humans. There should be as much of this as possible to achieve an optimal training goal. The best AI training data is therefore obtained from a large number of different people.[128]

Future Behavioural and Societal Change due AI

Modern AI, often referred to as 'narrow AI', predominantly utilizes data-trained models and frequently incorporates deep learning or machine learning techniques. This influence has been especially pronounced in recent years due to the surge in data collection and analysis facilitated by robust IoT connectivity, the increasing number of connected devices, and rapid advancements in computer processing. Companies are investing billions of dollars annually into AI products and services. Tech giants such as Google, Apple, Microsoft, and Amazon

are at the forefront, pouring billions into the development of these AI-driven offerings. Concurrently, universities are placing greater emphasis on AI within their curricula, and the military forces of developed nations are enhancing their tactical use of AI. Andrew Ng, the former leader of Google Brain and a top scientist at Baidu, observed that many industries experience periods he describes as "winter, winter, and an eternal spring." He suggests that we might currently be in the "endless spring" phase of AI.[129] Today, some sectors are at the start of their AI journey, whereas others are expert travellers. However, both have a long way to go. Whatever impact AI is having on our present-day lives is hard to overlook. Nobody can stop or slow the very fast journey of AI.Today, AI-enabled machines can perform specific jobs better and faster than humans and imitate human actions nicely. There are four types of AI. Such as Reactive machines AI is the most superficial level of AI. Reactive machines can do basic operations. They cannot form memories or use past experiences to make decisions like IBM's Deep Blue.[130]In contrast, with limited memory, AI can store existing data and create better output using the data like Tesla's self-driving cars. Again, theory of mind AI can connect with human thoughts and interpret them better, but these are still works in improvement or progress. On the other hand, self-aware AI will have independent intelligence and make its own decisions. These machines will be smarter than human minds, and it is coming soon and will make a new history of civilization.

AI has played a significant role in the manufacturing sector for decades. Since the 1960s and 1970s, AI has been integrated into robotic arms and other industrial robots. This demonstrates the industry's successful adoption of AI capabilities. Typically, these industrial robots collaborate with humans, performing specialized tasks such as assembly and stacking. Predictive analytics sensors also ensure that equipment operates efficiently. The transportation sector is on the brink of significant transformation due to AI. The technology is set to revolutionize our modes of travel, encompassing self-driving cars, AI-based trip planners, and intelligent traffic management systems. While self-driving cars still have room for improvement, there will come a day when we can travel seamlessly from one location to another without any concerns. The healthcare industry, although not always obvious, has also been profoundly impacted by AI. Today's AI systems can swiftly analyze vast amounts of data, leading to quicker and more accurate disease diagnoses, more efficient drug discoveries, and patient monitoring via virtual nursing assistants. This is the reality we're witnessing.

Figure 2: AI define humanity's future[131] and the emotional relationship between human and robots[132]

Today, AI in education will transform how people of all ages can learn. Currently, AI is using machine learning (ML), natural language processing, and facial recognition aids in digitizing textbooks, detecting plagiarism, and gauging student emotions to determine who is struggling or bored. AI tailors the learning experience to students' particular needs now and in the future. Journalism is also utilizing AI and will continue to profit from it. The Associated Press, for example, uses Automated Insights to generate thousands of earnings report stories per year. However, as generative AI writing tools like ChatGPT enter the market, concerns regarding its application in journalism arise. Most people fear receiving a robocall, but artificial intelligence in customer service may give the industry data-driven solutions that deliver important insights to both the customer and the supplier. Chatbots and virtual assistants are AI systems that enable the customer service business.

Even though Amazon has over 100,000 robots buzzing around in its warehouses, people still pick and pack. This will soon change, however. The New York Times quoted an expert named Mr. Lee as saying, "People want to get very big numbers. In the past, they had plans to reduce their workforce by 5 to 10% at a time. Now they are asking, "Why cannot 1% of the people we have do it?" More interestingly, the AI we have today is useless in two important ways: it cannot be creative, and it cannot feel love or kindness. It is sort of a "tool to boost human creativity." Those jobs that involve repetitive or regular tasks must teach new skills not to be left by the wayside. Amazon will even pay its workers to get training for jobs at other companies.

Professor Klara Nahrstedt of the University of Illinois' computer science department has emphasized the importance of substantial investment in education to prepare individuals for new job opportunities, especially as AI becomes increasingly specialized and intentional in its functionalities. She believes that in the near future, learning programming will be as essential as acquiring a new language. If we delay this learning process, it could become even more challenging. Although technological advancements might render certain jobs obsolete, history has shown that new employment opportunities will emerge. This transition can be likened to America's shift from an agrarian to an industrial economy during the Industrial Revolution, which had a significant impact and played a role in the "Great Depression." The disappearance of jobs can sometimes be more abrupt than many anticipate, but new opportunities inevitably arise.[133]If we understand what the technology is capable of and the domain very well, we may start to make connections and say, 'Maybe this is an AI problem, maybe that is an AI problem. It's wise to state, 'There's a specific problem I'd like to address'.

AI research is unfolding in various parts of the world, delving into intriguing areas. One such area is reinforcement learning, which operates based on rewards and punishments rather than relying on labelled data. Another area of interest is generative adversarial networks (GANs). These networks enable computer algorithms to create by setting two networks against each other, rather than merely assessing. The former is demonstrated by the prowess of Google DeepMind's AlphaGo Zero,[134] the latter by original image or audio generation based on learning about a subject like celebrities or a particular type of music. On a far grander scale, AI has the potential to have a significant impact on sustainability, climate change and environmental challenges. Cities will ideally become less congested, less polluted and more livable, thanks partly to the employment of smart sensors. We all know we may impose policies and norms once we foresee anything. For example, sensors on automobiles that convey data about traffic conditions could identify possible difficulties and optimize car flow. However, in the future, the road will play a significant role.

Today, it's evident that AI's dependence on vast amounts of data significantly impacts privacy. The incident with Cambridge Analytica on Facebook and concerns about Amazon's Alexa eavesdropping are prime examples of technology overstepping boundaries. Many critics argue that without proper regulations and self-imposed constraints, the situation will only deteriorate.In 2015, Apple CEO Tim Cook derided competitors Google and Meta for greed-driven data mining.[135] He stated that advancing AI through amassing massive human profiles is a sign of laziness rather than efficiency. To be truly intelligent, AI must respect human values, including privacy. If we do this wrong, the consequences will be severe.' AI is reserved for routine tasks rather than a cataclysmic transformation, such as the arrival of robot overlords. AI can benefit society if used wisely. However, as with most developing technologies, there is a significant risk that commercial and governmental use will negatively influence human rights. As a result, enormous volumes of data can be collected and used benignly, such as spam filters and recommendation engines, to forecast future behaviors. However, there is a significant risk that it will negatively influence personal privacy and the right to be free from discrimination.

In 2018, the internationally renowned AI scientist, Stuart Russell, stated, "There are still significant breakthroughs needed before we achieve human-level AI." He also emphasized that for AI to be comparable to humans, it must fully understand English. This highlights the present gap between humans and AI. Humans can interpret and translate machine language, but AI cannot do the same for human language.[136] However, if we reach a point where AI can understand our languages, the AI systems will be able to read and understand everything ever written. He added, 'Once we have that capability, you could query all of the human knowledge, and it would be able to synthesize and integrate and answer questions that no human being has ever been able to answer. Because, they haven't read and been able to put together and join the dots between things that have remained separate throughout history.'[137] John Laird, a longtime professor of engineering and computer science at the University of Michigan, stated that the objective of his study has always been to create what is known as cognitive architecture, which he believes to be inherent to an intelligence system. For instance, the human brain is more complex than a collection of uniform neurons. There is a true structure in terms of several elements, some connected to knowledge of how things are done in the outside world. It is referred to as procedural memory. Then there is knowledge based on general facts, a.k.a. semantic memory[138]and knowledge about previous experiences or personal facts, called episodic memory.

AI and Future Education

AI has the potential to be tremendously beneficial in the education industry. Many learning programs benefit from using technology in their conception and implementation. It can also be used to create games and software. It is possible to revamp and overhaul the entire educational system and teaching methodologies using Artificial

Intelligence. It starts with the issuance of certificates and degrees in schools and institutions. AI-based apps can help both institutions and students. You can influence the teaching and learning process by incorporating them into the educational field.[139]As a result, the procedure as a whole is benefits. It changes and adapts learning tasks to help all students become better students. AI makes sure that the needs of children with special needs are met. AI is used in education in many ways, from chatbots that help students 24/7 to personalized learning algorithms that change each student's needs. AI-powered tools are also used to do things like grade assignments and automatically give comments. AI is also being used to look at many data to find patterns and insights that can be used to help make new strategies and plans for education.[140]

 AI works in the backdrop whenever we open our Facebook, YouTube, and newsfeed, do Google searches, get help from chatgpt, even get a product recommendation from Amazon, or book a trip online. AI has penetrated the business, service sector, automobile, healthcare, and social media, and now it will be the next big thing in the field of education. As we know, education is the catalytic tool that has the strength to transform the future of a nation. The relationship and connection between education and society are frequently ambiguous and one-way, with education and skill expected to fit in with social, economic, political, and global trends. It should not be antagonistic to them and should not represent anything different. As a result, the relationship between education and socioeconomic structures, human resource development, and education position assist us in forming a forecast of future mid-level and higher education related to the 4IR. In this 4IR era, the aim and goal of mid-level and higher education are to ensure the quality of learning through teaching and practice, enable learners to gain useful and sustainable knowledge and skills through on-the-ground practice and exploratory research and sustain societies' development through service. In the 4IR era, mid-level and higher learning institutions should prioritize innovation, both evolutionary and revolutionary and deepen technology system restructuring by breaking down all barriers to innovation and modernization.[141]

The condition of education and training in the Fourth Industrial Revolution (4IR) is multifaceted and complex but also offers exciting opportunities that can revolutionize society and whole nations for better health and a superior state. AI powers the 4IR, changing the workplace from being unique based on jobs to unique based on people. 4IR is making sure that people and machines can work together again. This will close the gap between the arts and social sciences and between science and technology. We need a quick response from a middle-level or higher education school because 4IR technologies can help people or damage the environment.[142] This will necessarily require much more interdisciplinary teaching, on-ground practice, research and innovation.So along with 4IR, education 4.0 is a focused, purposeful and viable approach to learning and is transforming the future of education using advanced technology and automation.[143]To stay up with the times, traditional formal educational approaches must be revisited with a future perspective. Teachers and students/learners must be familiar with the abilities required by today's rapidly evolving technology and global society. As a result, students/learners should now be led rather than directed, and material should be made available rather than given to them. However, there should be ethical internet usage and optimal use of technical advantage for humanity. The purpose and goal of both general and vocational education should be to guarantee that students/learners have the knowledge and skills necessary to compete in the global workforce.[144]

Our education should have a long-term goal, and be based on what we learn. So, we need to develop outcome-based education modules to meet the accreditation needs of students and competency-based education modules to help students learn information and skills effectively. We need to build and improve the system to cut costs, be easy to use, and automate all middle- and higher-level schooling processes. Every education system and institute should have project management, reporting, and analytics tools so that we can make sure that future and modern education processes and procedures take care of things like scheduling, virtual classrooms, accreditation, strategic planning, modern learning, skill development, etc.[145]We should adopt a strategy and formulate such a useful plan that can ensure a preferable future for today's students/learners.[146] In keeping with the changing situation of today's competitive world and the induction of super technology in every aspect of life, education curriculum formulation and development has to be prepared with supreme care and giving intense importance to technology, IT, AI, IoT, ML, big data**,** cloud and edge computing, social media and other knowledge and skill.

By equipping today's workforce with the proper tools, we can contribute to the development of a society and nation that is more adaptable, multifaceted, and purposeful, in which everyone plays a significant role, thereby enhancing a model of education that is self-sustaining. We must recognize the transformative power of digital technology in education and be conscious of end-to-end mid-level and higher education digitization and automation to make our education smart and future-ready.[147] Our educational institutions and curriculum should be designed with smart tools so that they can ensure 24/7 virtual learning, 'made to order' learning and connect

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with department/faculty with interpersonal connection facilities easily. Because today students/learners should have all facility to prefer, admit, enrol, discuss, conduct assessments, and even examine online easily and spontaneously. Education 4.0 encompasses and ensures a few important aspects of learning and skill-developing issues. We can ensure those with some specific ways and means.[148] Those important learning and skill-developing aspects and means and ways have been described below in brief:

Ensure more individual/personalized learning: The individuality of every single student/learner and their own pace of learning are important at the age of 4IR and Education 4.0. Having a personalized way of teaching will have a greater impact on students to achieve their outcomes easily and effectively.[149] There are several tools accessible with AI, IoT, and Cloud computing that squeeze the entire teaching and skill development process as per the individual learner's demands with a unique learning pace. At the same time, the Department/Faculty will be able to readily identify and correct individual students' strengths and weaknesses, as well as opportunities and threats, and will be able to provide individualized feedback in real time.[150]

Ensure more remote learning opportunities: Nowadays, with the growing use of technologies in educational interventions, approaches to learning and teaching have evolved to take place in different environments with a variety of strategies and techniques.[151] The core of Education 4.0 is to make learning and skill development programs available anywhere, at any time, by using a set of e-learning tools and ensuring remote and self-paced learning for all learners. As we all know, blended learning is often (though perhaps overly simplistically) defined as a combination of face-to-face and online components. On the other hand, active learning is frequently described as an educational strategy involving students in higher-order thinking tasks that typically need collaboration with others. So, the Active Blended Learning (ABL) concept is a blend of both and is particularly effective in the present age of 4IR. The ABL concept, in which learners are actively involved in learning outside of classrooms, is gaining traction.[152] This way, learners end up mastering both practical and experiential learning and nowadays, it become popular.

Ensure optimum active learning system: Comparative studies often try to find ways to teach the same way in online, mixed, and face-to-face settings. However, the real benefits come from how educational materials, pedagogy, and learning time work together. The best-blended studies let students learn in ways impossible in other classes. Active learning is one of the best ways to have a good and satisfying school experience. It can lead to fewer students failing, better test scores, better problem-solving and critical thinking skills, more students coming to school, and happier students. [153] it can also reduce the accomplishment gap between disadvantaged and non-disadvantaged students. The move towards active learning makes classrooms look like real-world work and social settings that foster cross-disciplinary connections. As we have seen, students perceive that active classrooms promote creativity and innovation.[154] When learners participate in active learning environments, they tend to break their peers in more traditional classroom settings.[155]

Ensure availability of education tools: We know that Education 4.0 offers a clear route to students/learners by making tools and techniques available and handy in their learning environment. Students/learners will be able to choose the tools and techniques through which they want to acquire knowledge. For example, collaborative and engagement tools, flipped or blended learning, etc.[156] However, appropriate collaborative learning support is necessary for group learning in a flipped classroom setting, especially in the out-of-class learning phase. The flipped classroom can be a pathway into the disciplines that can be used in overcoming the disadvantages of the one-shot and other barriers to collaboration.[157]

Ensure project-based learning: In project-based learning (PBL), students work in groups to solve challenging problems that are authentic, curriculum-based, and often interdisciplinary.[158] Learners make decisions about how to approach a topic and which activities to pursue. They collect data from various sources and synthesize, analyze, and generate knowledge. PBL is made possible by technology. Students use word processors, spreadsheets, and databases to complete tasks such as outlining, composing essays, evaluating numerical data, and keeping track of material gathered. E-mail, electronic mailing lists, forums, and other online applications make it easier to communicate and collaborate with people beyond the classroom.[159] The Internet allows researchers to conduct studies in museums, libraries, and other remote physical sites. Students study in a fun and exciting way, thanks to Education 4.0's project-driven approach. It rejects theoretical knowledge and encourages students to gain time management skills, organizational skills, collaboration skills, and time management skills, all of which are essential for their future work.[160]

Ensure easy and accurate assessment: Predicting student performance is currently one of the most particular concerns for learning environments such as universities and schools, as it leads to the development of

effective mechanisms that can improve academic outcomes while avoiding destruction. AI can play a crucial part in education 4.0 by discovering new determinants in student performance and applying personalized learning, answering routine student inquiries, leveraging learning analytics, and predictive modelling.[161]A more practical way of assessment comes into place with Education 4.0.[162] There are both online and offline assessments and students get assessed on projects, assignments, and fieldwork. Again, to find the available vulnerabilities in any system, it is mandatory to conduct vulnerability assessments as scheduled tasks in a regular manner.

Ensure information/Data at the fingertips: There are greater insights into the students' learning journey with data analytics and reporting in Education 4.0.[163]Statistical research lets teachers discover where each student stands and help them improve. A balanced scorecard is the basis for the organization's or institution's social ties' causal graph. The structure unit of a university or school is used as an example. Getting numeric measurement data has been hard in middle school, high school, and college, especially in technical education, because the devices and tools needed are often too old, prone to mistakes, hard to use, or just too expensive.[164]It creates hindrance to those educations.

Figure 5: AI in Education[165]and Robots and AI are helping in education[166]

Remodeling of education curriculum: We must develop adequate techniques and procedures for our educational institutes to prepare our students following Education 4.0 to face future challenges. This must be in line with industry standards. Future-oriented issues should be given extra attention and emphasis. A skill-based curriculum is the rule of the day in this age of digitization and automation. Employers require competent workers and rely on colleges and educational institutions to train current employees.[167] In addition to information technology skills, Engineers should have expanded design skills that include interoperability, virtualization, decentralization, Real-time capability, service orientation, modularity, etc. for effective implementation of Industry 4.0. Therefore, Engineering Education 4.0 (EE 4.0), which produces engineers for Industry 4.0, must be modified to satisfy the demands of Industry 4.0, which emphasizes the integration of all engineering disciplines.[168]

 Building digital skills: One of the primary goals of Education 4.0 is to give students an understanding of disruptive technologies such as machine learning and the ability to apply this knowledge to real-world situations. As a result, both students and professors demand teaching and learning aids that make such issues more accessible. Educational institutions should focus on training their faculty to develop digital skills to develop fully capable pupils for their workplace. Soft skills, including problem-solving, social, and process skills, should be made indispensable.

Opt for digital tools for virtual learning environments (VLEs): This is becoming more popular worldwide as students and staff receive remote access for instruction via LMS. Learning and teaching, course content access, online chat, discussions, collaborations, peer teaching, and blended learning occurs during flexible hours. Artificial intelligence (AI), robotics, cloud computing, the Internet of Things (IoT), cyber-physical systems, big data, and other innovations are driving the 4IR. Thus, industries have leveraged these technologies to deliver solutions to humanity's expanding requirements; yet, for them to continue adapting their ecosystems to the digital world, competent personnel with knowledge and abilities in those areas are required.[169]

Fine-tuning of course delivery: Coordination between the faculty and the curriculum taught should exist. Faculty should be willing to use technological apps to help students improve their cognitive learning capacities.

They should adopt individualized adaptive learning approaches for a wiser learning approach to make the entire process enjoyable and exciting. A solid professional framework with cross-disciplinary career planning should be incorporated. This component will help Indian education prepare a workforce for Company 4.0. However, Education 4.0 is being proposed as a new framework to train professionals capable of creating knowledge through scientific research and experience, as well as sharing this knowledge with society and using it to face technological, social, political, and economic challenges.[170]

Prepare technology-built classrooms: University, college, and higher education institutions have begun implementing technology to produce graduates who will be successful in the cyber-physical systems used in all sectors of the economy. This entails revamping the learning process and creating a curriculum that makes extensive use of technology for the benefit of the students. This fourth industrial revolution in education is centred on cutting-edge, intelligent technology, robotics, and AI, impacting our daily lives. To recognize the creative, imaginative, and bright students, it is a new challenge to redefine education 4.0, and it is challenging to determine students' outcomes.[171] Once, Einstein said, 'Everybody is a genius but if you judge a fish by its ability to climb a tree, it will live its whole life believing that it is stupid.' AI is a reality; without appropriate knowledge, education and skill, we cannot continue with the present world. AI systems use traditional syllabi to create customized textbooks for certain subjects. As a result, textbooks are digitized and new learning interfaces are being created to help students and teachers of all academic grades and ages. One example of a useful AI interface is Netex Learning, which enables professors to create electronic curriculums and educational information across various devices. Netex includes online assistance programs, audio, and illustrative videos.[172]

Now, AI is helping students with independent study through more customizable teaching and studying support applications. The software can now go beyond simply reciting facts that need to be memorized for consistent tests by providing a catered experience that matches the students' level, console, and emotional state. Different learning styles and mindsets can be considered in real-time, improving results drastically and helping students succeed. As we know, education has no limits, and AI can help to eliminate boundaries. Technology brings drastic transitions by facilitating the learning of any course from anywhere worldwide and at any time. AI-powered education also equips students with fundamental IT skills. With more inventions, a wider range of courses will be available online. Moreover, with the help of AI, students will be learning from wherever they are.[173] As a recent example, the Chinese have been working on creating intelligent education. The Chinese government's ambitious plan would require huge amounts of research in AI to support by professionals trained in technology and engineering know-how. The Chinese government has set 2030 the deadline for integrating AI with Chinese infrastructure and development. In this regard, huge paces are already being made when educating the general mass using AI.[174]According to an estimate, China led the way, with over US$ 1 billion invested globally in 2022 in AI education.[175]

Impact of AI in the Era of 4IR

Now, AI has been around everywhere for a great deal of time. The benefit of AI is steadily improving our everyday life. The technology is being used for robots that are welcome at shopping centres or online search engines for offering suggestions.[176]Today, AI simulates human analysis in AI systems. The computer program can think and learn. Everything can be taken to be AI if it involves a program that does something that we usually think depends on human intelligence. Innovations in the AI space have led to several benefits across multiple industries.[177] Today, processes are effective and efficient, convenient technologies are extensively available, and forecasts are more accurate.AI and other technology experts are saying today, the rise of AI will make most people better off over the next decade. However, many are concerned about how AI advances will affect and what it means to be human, productive and exercise free will. The automation revolution will have a tremendous impact on the fundamentals of business and society and the innovation and productivity potential. Blockchain technology has the potential to impact most industries across the globe shortly[178]; heralding a new age of consumer trust and optimization. AI can improve data backup and disaster recovery planning and policy from an IT standpoint to ensure smooth company continuity. The elements for successful technology and IT leadership continue to evolve. However, a strong business strategy, vision, IT management, and a knowledgeable approach to risk, compliance, outsourcing, and AI remain as important as ever. [179]

Digital existence is enhancing human potential while upending long-standing human activity. More than half of the world's population now uses code-driven systems, which present extraordinary potential and challenges never seen before.[180]Will people be better off than they are now as algorithm-driven AI continues to spread? AI will impact the entire agricultural and food value chain, from farm to fork, both now and in the future. AI will influence next-generation automotive technologies, changing how cars, trucks, and power trains are designed

and produced.[181] AI will influence the tech developments of the global aviation and aerospace sectors. It will also influence space travel and communications, airport operations and management, air traffic control systems, and future trends in flight and aviation transport-related industries. AI will influence technology innovation transforming all parts of the construction and civil engineering sectors leading to improvements in cost, safety, efficiency and quality of construction.[182]AI will have an impact on smartphones, tablets, and wearable tech gadgets, as well as how people live, work, and consume services, prompting businesses to establish their methods for dealing with such use at the back end and capitalizing on it at the front end.[183]

The experts predicted networked AI would amplify human effectiveness but also threaten human autonomy, agency and capabilities.[184]Computers might be as smart as or smarter than humans when it comes to things like making complicated decisions, learning, reasoning, pattern recognition, visual acuity, speech recognition, and language translation. Smart systems in neighbourhoods, cars, buildings, utilities, farms, and business processes will save time, money, and lives and give people a chance to enjoy a more personalized future.[185]The use of AI in healthcare is hopeful, with applications such as diagnosing and treating patients and assisting senior citizens in living fuller and better lives. They were particularly enthused about AI's involvement in broad public-health programs based on vast amounts of data that may be collected in the future years on everything from personal genomes to nutrition.[186] AI would abet long-anticipated changes in formal and informal education systems.
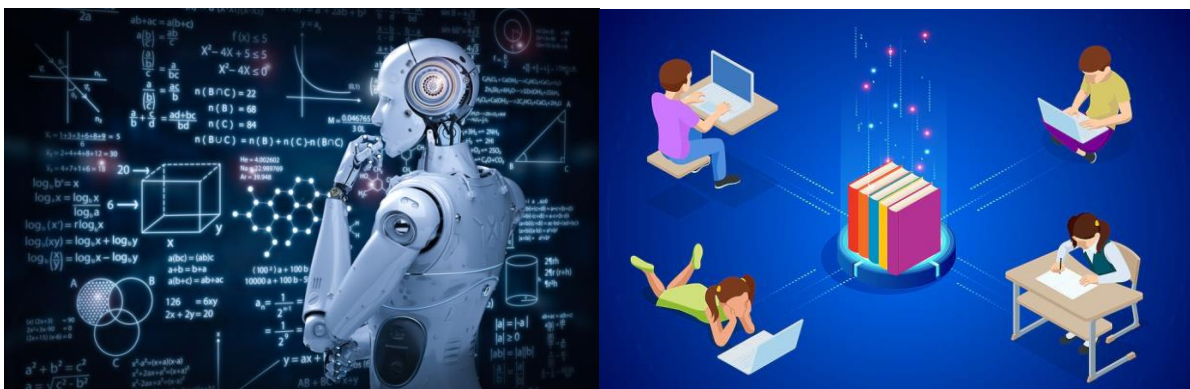
Figure 5: Future robotic teacher in the classroom[187] and No books and no physical library[188]

Looking around now, we can see that our society is changing due to the use of AI and IoT in daily operations. If we go to a healthcare facility, an AI-powered machine will check our pulse, and if we go to an internet store, we will see a recommended list customized by an AI tool. These are only a few examples of the benefits of AI in our daily lives. AI will provide a lot more in the future. With time, more industries, service sectors, and organizations will embrace this transformative technology to improve every human activity working process.[189] AI can help simplify and speed up processes in the community, society, country, and world by making the workplace more efficient, helping us make better decisions, or giving us direct help. AI can help by finding and fixing problems that people might not be able to see or fix on their own. However, some people do not see the benefits of AI because they think it will cause people to lose their jobs and become less smart. Speed, precision, efficiency, and scalability are the most important benefits of AI.

The 4IR will significantly transform industries, services and other sectors, so much of the work today will not exist in the next 25 years. We must understand the impact of these changes on all areas of our lives, including academic and learning institutions.[190]Currently, all graduates are confronted with a technologically transformed world in which AI, IoT, ML, Big Data, Cloud, and Edge Computing, and social media create diverse opportunities and challenges for conventional education systems. As students consider their post-diploma or post-graduation lives, formal academic and learning institutions ponder their fate, particularly regarding employment. Nearly all contemporary technologies propelled by AI are transforming the world, so social concepts such as 'post-work' are increasingly defining the present era. This period requires skills not identical to those required during the Third IR when information technology (IT) was the primary driver. Artificial intelligence is estimated to be a US\$ 15 trillion industry within the next seven years. Millions of unskilled and traditionally trained individuals will be laid off.[191]On the other hand, millions of jobs related to modern and hi-tech skills will be created in the next few years.[192]

**Future of Robotics and Robots**

An algorithm is a step-by-step procedure for solving a problem or accomplishing some end.' In the field of AI, algorithms are automated instructions that tell a computer what to do. The instructions are mathematically driven and can be as simple as 'if X, then Y' actions or encompass complex mathematical layers of instructions to execute a task or find an answer to a problem.[193] The algorithm manipulates data in a variety of ways, such as sorting, inserting, replacing, or searching for a data attribute. It solves problems when it carries out the instructions. ML can be supervised, unsupervised, semi-supervised, or reinforcement learning depending on the kind of data being input into the program and the type of outputs that can be expected.[194]When we hear someone talk about a machine that learns, the machine is executing a structured set of mathematical procedures. The machine learns how to correct itself based on data used to train the application or by iterating on data used by the application once deployed. How the machine learns to correct itself depends on the mathematical models selected for the task.[195]Data scientists and ML programmers are the team members who select and adjust the mathematical models used in applications.[196] In deep learning, a set of mathematical instructions such as an algorithm, which is called a *node*, works like a neuron to fire the algorithm, process it as instructed, and pass its information to another node in the computer. That algorithm is then used as input by another node in the neural network. Data move through the nodes in a direction specified by the algorithm. A deep learning model can contain billions of nodes embedded in many layers.

Future robotics and automation will serve as assistants, workmates, teachers, surgeons, drivers, operators, and explorers. As engineers, technologists, and scientists continue to develop and advance robotics, the capabilities of this technology will only increase further. Today, in many ways, robots are already an integral part of daily life. They might even assist us in expanding our horizons on our planet and beyond, helping billions of people live better lives.[197] Today, robots have become human friends and have been among us for quite some time and are used to separate humans from dull, automated, dangerous or dirty jobs or tasks in warehouses and factories at the workplace. Safety is perhaps one of the most important factors when we are talking about replacing humans with robots. Robots injuring or even worse, killing their human colleagues is becoming even bigger as the use of advanced AI increases or automation rises and many more factories are adopting automation. Forbes published an interesting story about the incident in which a semi-autonomous driving Tesla car[198] collided with a tractor-trailer in Florida and subsequently killed its driver in 2016.[199]Again in 2015 when an industrial robot killed a German factory employee and in 2017, another killed a Michigan worker. However, in the Future of Jobs Report, more than 80% of business executives said that they are accelerating plans to digitize work processes and deploy new technologies.[200]And 50% of employers expect to increase the speed of the automation of some roles in their companies. So, in the age of AI, the McKinsey Global Institute declared that workforce transitions in a time of automation estimate that as many as 375 million workers, or roughly 14% of the global labour force, may need to re-skill in digitization, automation and AI by 2030,[201] in their report, 'Jobs lost, jobs gained.'[202]

An up-skilling worker is the most popular course in advanced companies. For example, Amazon's 'Up-skilling 2025'[203] initiative has announced that it plans to spend US\$ 700 million to retrain a third of its workforce with automation skills or AI training. Again, 52% of industrial workers interviewed in the Digital Factories 2020 and 'Shaping the future of manufacturing'[204] report by PricewaterhouseCoopers (PwC)[205] believed their company lacks a true digital culture**.** They decided to get workers involved and trained with technologies at the earliest stages can double up with effective risk assessment and understanding of potential safety hazards. Safety and training can go hand-in-hand by ensuring each worker is trained to follow the safety protocol and avoid risks of on-site accidents and injuries, whatever their skill level. Training for the safe use of robots also goes beyond the technologies' installation. The national safety guidelines for the manufacturing industry are always changing and periodic training must be delivered to workers to ensure they can operate the machinery safely. The safety of robots must also be guaranteed over the long term for the betterment of human safety. MIT is exploring one way to achieve this [206] in collaboration with the automobile manufacturer BMW.[207]Using simulations to develop algorithms that help robots predict and respond to humans in close proximity, like, on a car production line. In addition, effective maintenance is crucial to the safe operation of robots.[208] So, the future of AI and robotics will provide several fascinating opportunities with high pay and promising career advancement. The chances for a new generation to have a rewarding job in the production and service industry can be increased further by formal education, certification, practical training, work experience, and skill development.

Currently, social robots are designed to interact in ways that make them human by responding to human interactions.[209] Sophia is an example of a social robot conceived as a companion for older adults that demonstrates the potential of technological advancements to improve how robots function.[210] In 2018, Sophia

was redesigned with mobility capabilities and is now the first robot to be given citizenship in a country (Saudi Arabia).[211] Miko is kind of robot that understand human emotion. Miko's got dozens of emotions (and a few tricks up its sleeve). Not just recognizing and calling you by name but responding to your mood and getting to know you better daily. Need a joke when you are down? A dance when you are bored? Miko's on it. Because it is not just the smartest little robot, you will ever meet. It is also your friend. Miko's constantly exploring for fun, prompting you to play, and encouraging you to challenge your brain. As comfortable initiating a conversation as starting a dance party, Miko's only missing a partner-in-crime.[212] PARO is an advanced interactive robot developed by AIST, a leading Japanese industrial automation pioneer. It allows the documented benefits of animal therapy to be administered to patients in environments such as hospitals and extended care facilities where live animals present treatment or logistical difficulties.[213]Professor Einstein is a robot that teaches science and general information.[214] ROBEAR is a nursing care robot.[215] Vortex is a programmable robot that teaches kids STEM.[216] Pillo is an AI-powered health companion.[217] Buddy is a home robot.[218]
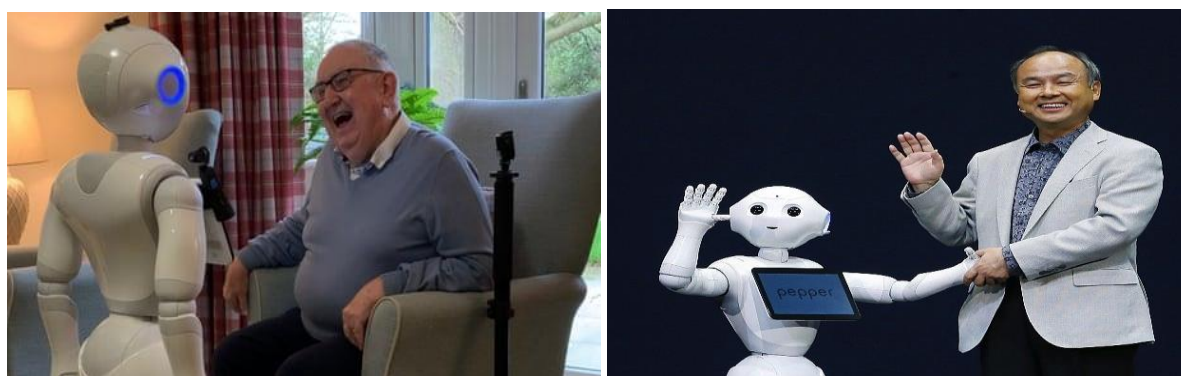
Figure 6: Example of few modern robots (Home care robot, Emotional robot)[219,220]

As robots learn to perform nursing functions, such as ambulation support, vital signs measurement, medication administration, and infectious disease protocols, the role of nurses in care delivery will change.[221] Research suggests that between 8% and 16% of nursing, time is spent on nonnursing activities and tasks that should be delegated to others.[222] Again an example of a robot collaboration is found at Duke University Pratt School of Engineering and School of Nursing. Interdisciplinary teams are working on developing the Tele-Robotic Intelligent Nursing Assistant (TRINA), a remote-controlled robot, to address healthcare workers who are at "high risk for infection due to routine interaction with patients, handling of contaminated materials, and challenges associated with safely removing protective gear."[223] TRINA is tested in the nursing simulation lab and currently performs about 60% of predefined nursing tasks; however, it is 20 times slower than a nurse. The nurse will become the information integrator, health coach, and deliverer of human caring, supported by AI technologies, not replaced by them.

In 2017, the McKinsey Global Institute (MGI) published the report "Jobs Lost, Jobs Gained: Workforce Transitions in a Time of Automation."[224] Although discussions of AI replacing human workers have taken place since the beginning of the technology, this report stirred great debate about the global impact of AI. MGI models predict that by 2030, nearly 75 million to 375 million workers worldwide will need to switch occupations due to AI technologies. However, the report also emphasizes that new roles and jobs will be created. American Economic Association researchers agree with the MGI predictions, finding that some tasks will be favourable for automation, but few jobs can be fully automated. They also predict that workers will train in new roles. [225]In 2011, computer scientist Andrew Ng proved that computers can learn what an object is without being told what it represents. His research used 10 million online videos of cats; the computer learned what a cat was over time. This breakthrough technology is used today in speech recognition systems. Recent Research predicts that global AI healthcare spending will equal US$ 36.1 billion by 2025.[226] China announced in 2017 its goal to become a global leader in AI by 2030. The US issued the executive order 'Maintaining American Leadership in AI' on February 11, 2019, directing all federal government agencies to implement strategic objectives aimed at accelerating AI research and development.[227]

The Impact of New and Advanced Technology on the Labour Market
Advanced technology is always affects both blue-collar and white-collar sectors. The faster the process of the division of labour and the more single working or process steps can be described in detail, the sooner employees can be replaced by intelligent algorithms. One third of current jobs requiring a bachelor's degree can be performed by machines or intelligent software in the future. Individual jobs will disappear completely, and new

types of jobs will come into being. It must be noted in this regard, however, that no jobs will be lost abruptly. Instead, a gradual transition will take place, which has already commenced and differs from industry to industry and from company to company.[228]

Advantages of Robotics and Intelligent Algorithms. Particularly in the industrial sectors in the Western high-labour cost countries, automation and use of production robots lead to considerable savings with regard to the cost of labour and products. While one production working hour costs the German automotive industry more than €40, the use of a robot costs between €5 and €8 per hour.[229] A production robot is thus cheaper than a worker in China is.[230] A further aspect is that a robot cannot become ill, have children or go on strike and is not entitled to annual leave. An autonomous computer system does not depend on external factors meaning that it works reliably and constantly, 24/7, and it can work in danger zones.[231] As a rule, its accuracy is greater than that of a human, and it cannot be distracted either by fatigue or by other external circumstances.[232] Work can be standardised and synchronized to a greater extent, resulting in an improvement in efficiency and a better control of performance and more transparency in the company.[233] In the decision-making process, autonomous systems can be guided by objective standards, so decisions can be made unemotionally, on the basis of facts. Productivity gains have so far always led to an improvement of living circumstances for everybody. The same applies for intelligent algorithms.[234]

The advantage for employees is that they have to do less manual or hard work; repetitive, monotonous work can be performed by autonomous systems. The same applies for typical back-office activities in the service sector: algorithms will collect data automatically, they will transfer data from purchasers' to sellers' systems, and they will find solutions for clients' problems. Once an interface between the sellers' and the purchasers' system has been set up, employees are no longer required to manually enter data into an IT system.[235] Employees might have more free time that they can use for creative activities or individual recreational activities. Robots and intelligent machines can have not only supporting, but even lifesaving functions. Examples are robots used in medical diagnostics, which have high accuracy, or for the assessment of dangerous objects using remote control and integrated camera systems. These make it possible, for example, to defuse a bomb without a human having to come close to it. The 'Robo Gas Inspector',[236] an inspection robot equipped with remote gas sensing technology, can inspect technical facilities even in hard-to-reach areas without putting humans at risk, for example, to detect leaks in above-ground and underground gas pipelines.

A Global Phenomenon. While the trends of automation and digitalization continue to develop in developed countries, the question arises as to whether this is also happening to the same extent in developing countries. According to a 2016 study by the World Economic Forum, technically highly equipped countries such as Switzerland, the Netherlands, Singapore, Qatar or the US are considered to be particularly well prepared for the fourth industrial revolution.[237] Since July 2016, the Netherlands is the first country that has a nationwide internet of things, allowing the connection of more intelligent technical devices than the inhabitants of the small country.[238] What is relevant for each country in this respect is the degree of its technological development and the technological skills of young people who will shape the future of the labour market. Young people in developing countries are optimistic with regard to their professional future. They have more confidence in their own ability than many young people in developed countries. Many developing countries, however, face the problem that only those employees who have already gained substantial IT knowledge show an interest in and a willingness to improve their technological skills.[239] A great advantage in a number of developing countries is that more women are having access to education. In the UAE, for example,most of the university graduates are female. Particularly in economic systems that were originally dominated by men, the opening up of labour markets was a great opportunity for highly qualified female professionals. Women are more likely to have better developed 'soft skills' which makes them an important talent pool – especially in developing countries.[240]

Low-labour-cost countries, such as China, India and Bangladesh, are still benefiting from their surplus of low-skilled workers, while Western companies are still outsourcing their production to these countries. If, however, these companies decide to produce in their countries of origin in the future, using production robots and only a few workers, the surplus of low-skilled workers might turn into a curse for these developing countries.[241] A good example of this problem is the clothing industry, in which clothing is still often produced by hand in low-labour-cost countries such as Bangladesh or Thailand, although the work could easily be done by machines because much of it is routine. The question is how to integrate the great number of unskilled production workers into a structurally difficult labour market that depends on foreign investment. Another problem for developing countries such as India, Thailand or China is the lack of social security systems. Possible mass unemployment could lead to human catastrophes and a wave of migration.[242] Accordingly, the same rule applies to developing countries as to developed countries: jobs with low or medium qualification requirements will be eliminated in

the end. The only difference is that in developing countries there will be more routine jobs with lower or medium qualification requirements. About 47 per cent of total US employment is at risk, whereas 70 per cent of total employment in Thailand or India is at risk.

In many sectors, the implementation of (partly) autonomous systems requires too much of an investment at present, compared to the existing labour costs.[243] In addition, companies operating in developing countries have to promote their appropriate systems in order to improve their productivity and attractiveness visà-vis their competitors and remain competitive in the long run. At the same time, (production) robots are becoming less expensive year by year. Replacing human manual labour with robots makes economic sense in low-labour-cost countries when the cost of human labour becomes 15 per cent higher than the cost of robotic labour. This will happen in countries such as Mexico by 2025, according to a study by the Boston Consulting Group. Chinese companies are already starting to build factories where robots will replace 90 per cent of human workers.[244] It must therefore be assumed that in most developing countries, markets for autonomous IT systems will be opened up with a delay of a few years. The driving force will most likely be international companies, which will integrate their common systems in all production facilities around the world. In future, companies will locate where they can most easily find suitable highly qualified employees for monitoring and generating AI. If developing countries thus can provide qualified staff in the technological sector, it can be assumed that developing countries will also be able to profit from technological change.[245]

Potential Losers due 4IR. For a long time, the BRIC countries (Brazil, Russia, India and China) were considered the beacon of hope for the global economy. Owing to an increased mining of raw materials and the outsourcing of numerous Western branches of industry to low-labour-cost countries, investors expect long-term yields. However, demand for raw materials is currently very low, so Brazil and Russia are becoming less attractive. With the technical development of production robots, many companies producing in lowlabour-cost countries will relocate their production sector to the countries where they originally came from.[246] The developing countries in Central and South America will also not profit from the trend of the fourth industrial revolution. It is to be feared that these countries – like the North African countries and Indonesia – are not equipped to face automation and digitalisation due to the lack of education of much of the population, lack of investment in a (digital) infrastructure and lack of legal framework.[247] Further complicating the matter is the rising birth rate in the North African and Arabic countries, which will lead to high rates of youth unemployment. For every older employee in Uganda, Mali or Nigeria, seven younger employees will enter the badly structured national labour market.[248] In these countries, only 40 per cent of the younger generation is in employment, and most of these jobs are low-paid jobs without social security in the third sector. It does not come as a surprise that many youths – especially those who are better educated – would like to leave their countries to migrate to Western developed countries. Legal frameworks, less corruption, more social security and a better infrastructure would be necessary to avoid the younger generation's migration wave. Additionally, better access to higher education and training opportunities – particularly for women – would be necessary to promote the competitiveness of these countries.[249]

Potential Winners due 4IR. The winners of the digital revolution are, on the other hand, likely to be the highly developed Asian countries with good education systems, such as Singapore, Hong Kong, Taiwan and South Korea.[250] These countries – together with the Scandinavian countries – have been undertaking research and working to find digital solutions for complex issues for a long time. The digital interconnection of people in these countries is also very far advanced. The share of the population at risk of unemployment is about six per cent in these countries.[251] Finally, Western developed countries will profit from the relocation of the companies' production sectors when robotic production becomes cheaper than human production in low-labour-cost countries. This will create new jobs in these countries and destroy many routine jobs in the low-labour-cost countries. Another positive trend can be seen for India and China, which are both considered very suitable candidates for participation in the digital revolution due to most of the population having a good command of English and IT skills. IT knowledge is taught in schools as a key qualification. It is, therefore, not surprising that Indian and Chinese professionals have more extensive computer knowledge than their French or English colleagues do.[252] Not only are salaries and wages lower in India, but also the number of betterqualified professionals is why, according to Forrester Research, 25,000 IT jobs are likely to be outsourced to India from the UK alone.[253] Like China, India is in the process of developing from simply being a low-labour-cost country into being a Western-orientated society whose population works mainly in the tertiary sector. As the most populated countries in the world, these two countries have a high level of consumer demand. Moreover, because of their rapidly growing cities, these developing countries need highly developed solutions in terms of logistics and environmental technologies, like the smart city, in order to increase the quality of life for city residents over the long term.

The digital world market leaders are based in Silicon Valley, California. In 2015, the top ten Silicon Valley startups created an annual turnover of approximately US$600bn with information and communication services.[254] Additionally, the eight leading digital platforms – Alphabet, Amazon, Facebook, etc – due to their exponential growth show a significantly higher capital market value than the leading industrial companies (eg, General Electric, Siemens or Honeywell).[255] The rise of AI in the service sector, especially the gig-economy, can be illustrated by the example of Uber, which saw an increase in its market value from zero to US$40bn in only six years. Even though more than 80 per cent of the robots sold each year are deployed in Japan, South Korea, the US and Germany[256] and enhance productivity in the production sector, the new business models in the service sector are the digital future. With economic growth in this sector, the US will be particularly resistant to future economic crises. It is therefore not surprising that innovative countries like Switzerland, Germany, the US or Japan are rated best in the Global Competitiveness Index by the World Economic Forum.[257] In summary, it can be said that the increase of automation and digitalization is a global concern that, due to the lack of financial possibilities in many developing countries, will initially be strongly focused on Western developed countries and Southeast Asia. These countries will be considered the winners of Industry 4.0 because of their technological head start and their creative service models.[258]

Necessary Skill Future Employees. Due to huge number of emerging multidisciplinary support alternatives due to AI and ML, the requirements for future employees will change. There will be hardly any need for employees who do simple and/or repetitive work. Already today, the number of factory workers is constantly decreasing, and humans are ever more becoming the control mechanism of the machine. The automotive industry, where many production steps are already fully automated, is the pioneer in this respect. The lower the demand for workers, the higher will be the companies' demand for highly qualified employees. According to common belief, better education helps.[259] Better education helps, however, only in certain circumstances. The additional qualification of an individual employee must be connected to the work in question. Additional qualifications as an accountant will be of little benefit for the individual employee, because – over time – there is a 98 per cent probability that the work of an accountant can be done by intelligent software.[260]

Creative people who are talented in mathematics and sciences are best qualified for the new labour market. Although not every future employee will be required to be an IT programmer, should have a fundamental grasp of analytical and technical matters. Employees should be able to form a unit with supporting machines and algorithms and to navigate the internet comfortably and move safely in social networks. To do this, it is necessary to know how the basic structures work. The employee should also, however, be able to examine machines and software critically.[261] There is an increasing demand for employees who can work in strategic and complex areas as well. It is not necessary only to oversee machines, but also to coordinate them. The interfaces between humans and machines and the overlaps in the area of responsibility among the more flexible humans must also be coordinated. There is thus likewise an increasing demand for future executive staff with social and interdisciplinary competence.[262] Employees must be able not only to communicate with other people, but also, if necessary, to lead them effectively and coordinate with them.[263]

In addition, creativity and flexibility are becoming increasingly important. In the future, critical and problem-orientated thinking will be expected of employees as the most important requirement.[264] This requires sound judgment. The expectations with respect to availability will be higher for future employees. Flexible working hours and standby duties will be the rule and no longer an exception in the labour market. Employees will be required to focus not only on one main practice area, but also to take on several multifaceted, sometimes highly complex tasks as necessary, and also to perform as part of a team. Employees are increasingly expected to have non-formal qualifications. These include, for example, the ability to act independently, to build networks, to organize themselves and their teams with a focus on targets, and to think abstractly. Special knowledge or a flair for high-quality craftsmanship will become less important, since this work is likely to be done by intelligent software or machine.54 Mere knowledge workers will no longer be required; the focus will rather be on how to find creative solutions to problems.[265] Deals will still be made between people in the future, even if the facts may be gathered beforehand by software.[266] One of the most important requirements, however, will be creativity. As one can see from the examples of Tesla, Uber or Airbnb, innovations are created not only by established market participants, but also by visionary startups making a name for themselves with disruptive ideas.[267]

Necessary Future Investment Pattern. Many investments will be necessary for companies to be able to ride the industrial wave 4.0. This applies not only to the IT sector, but equally to the development and procurement of new technical assistive machines. In addition, a multitude of (mostly external) service providers

will be necessary to assist in the reorganizations. Moreover, governments must very quickly make provisions for a broad coverage of broadband internet in several countries. In their investments, companies will focus more and more on sensor technology and IT services of any type in the years to come. In addition to newer electrical equipment of any type, these so-called equipment investments also include new production machines and their repair, installation and maintenance. In the area of processing and extractive industries, these investments are of vital importance because in the long run, costs for material and personnel can be reduced only with the aid of these investments. Without this cost reduction, these companies will no longer be able to compete.[268] Apart from this, building investments are vital. In addition to the classic extension and conversion of a company's own production facility and workplace, this primarily concerns fast internet across the board, without which efficient communication is not possible either among humans or between human and machine. In the course of digitalization, companies will change their focus and invest more in other areas. 71% of the CEOs of the worlds' biggest companies are sure that the next few years will be more important for the strategic orientation of their companies than the last 50 years.[269] Therefore, investments in technical devices and the focused use of AI and ML are necessary in all sectors.

Preparation of Future Workers with Required Skills and Knowledge. Many employees and trade unions are hostile towards intelligent IT systems, although AI is a phenomenon without which certain industries and services would be unthinkable. Many people, for instance, have got used to small robotic vacuum cleaners. In principle, there is no structural difference between this household aid and intelligent production system. Moreover, only 11 per cent of US employees assume that they will lose their jobs because of intelligent IT systems or production robots.[270] The biggest fear is of a plant closure as a consequence of mismanagement. The reservations of the (representatives of the) employees are primarily associated with the fear of massive job cutbacks. The machine costs money only once and pays for itself, whereas labour costs are a major, recurring expenditure for a company. The machine or the algorithm carries out its work with a precision and reliability that a human cannot achieve. Humans can thus be considered inferior to machines in a competitive situation. The situation is aggravated by science fiction blockbusters and single industrial accidents with robots that cast a poor light on the robot systems. It is the responsibility of governments and companies, however, to create general acceptance, and this will be possible after a certain time period; for example, 25 per cent of people can presently imagine being cared for by a robot when they are old.[271] Employers must proceed sensitively and gradually when introducing new systems. They should establish clear rules for handling the machines and specify relevant hierarchies, for example, that the machine has only an assistive and not a replacing function, and the power to make decisions still lies with the human being as before and not vice-versa. Employees should be involved in the development and the process of change at an early stage in order to grow accustomed to the new technology them.[272]

Adaptation of the education system is necessary In order to be able to meet the above-mentioned standards set for Industry 4.0, future employees must learn new key qualifications, but the educational system must also be adapted to these new framework conditions. There was agreement at the World Economic Forum 2016, for instance, that both schools and universities 'should not teach the world as it was, but as it will be'.[273] New qualification strategies for individual countries are thus needed. They must encourage students' interest in subjects such as mathematics, information technology, science and technology when they are still in school, and teachers with digital competence must teach students how to think critically when using new media and help them to achieve a fundamental grasp of new digital and information devices.[274] Furthermore, increased use should be made of the design thinking method in order to encourage creative minds already at schools and universities. This method designates an integrated degree program during which creative work at a company is accompanied by degree courses. Adaptability is one of the major challenges humans' faces, yet at the same time it can be a major strong point. The next generation of employees must learn to adapt quickly to the technical, social and digital change, because it is to be expected that even a 'fifth industrial revolution' will not be long in coming. Lifelong learning is the buzzword that applies not only to fully automated robots, but also to human beings! If an employee's field of work is automated, the employee must be able to reposition or to distance him or herself from the machine by individual skills.[275]

Besides tried and tested school subjects and degree courses, more new degree courses and occupations requiring vocational training based on imparting extensive skills in IT, communication and sciences must be created. This includes data processing occupations, in particular. Although previous degree courses such as classic information technology or business information technology include numerous elements of significant importance for Industry 4.0, they deal too superficially with some aspects owing to their great variety, whereas other aspects are superfluous for the intended work. For example, 'industrial cognitive science and automation bionics are suggested as innovative degree courses that deal mainly with researching and optimizing the

interaction between robot systems and employees. In addition to the area of robotics, extended degree courses in the area of big data will be necessary. Employers' demand for data artists and data scientists or big data developers is rapidly increasing. The main subjects for the professional field of data science include researching data of all types and their structures. Uniform education in this area is, however, still not available.[276] Governments are responsible not only for making education possible, but also for focusing young people's interests on technical and IT jobs at an early age. This will increase the number of graduates in the long run.[277]

Ultimately, neither the 'tried and tested' nor the 'new' degree courses may focus solely on imparting specific technical knowledge. The employees of the future must, for instance, be given an understanding of the possibilities of technical aids. This applies, however, not only to theoretical background, but also to practical applications and thus handling the technical aids. US investors do not expect the new generation of employees to be technical geniuses, but employees should always be willing to learn new skills.[278] A lifelong learning progress characterises the new labour market, which is changing rapidly because of technical development. The challenge for schools and universities is to teach the employees 'soft skills' that are becoming more important than ever, such as the ability to work in a team and to accept criticism, assertiveness, reliability, social and communicative skills and good time management. Learning 'soft skills' will prepare employees optimally for the future labour market: 'To Switch the Skills, Switch the Schools.'[279]

Future Job Structures. About 47% of total US employment is at risk, read the catch line in the report by Frey/Osborne in 2013.[280] Consistent with this is that according to a survey by Pew Research Center, 65 percent of US citizens expect that within 50 years a robot or an intelligent algorithm will be doing their work.[281] Experts hold vastly different opinions with regard to the dramatic impact of the changes in the job structures. Others claim that, thanks to digitalization and automatization, many employees whose jobs are at high risk will not be replaced completely, even if the technical advances would allow a replacement.[282] Not every specific occupation will be replaced by the work of machines in general, but it is certain that some individual occupational activities will be performed by machines. For example, the risk of being replaced by a robot is 87 per cent for a barkeeper. Already today, it is technically feasible that a robotic machine could mix drinks, send the clients' orders directly to the kitchen, receive complaints and accept the clients' money.[283] Nevertheless, the atmosphere in the bar or in the restaurants will no longer be the same. Because of the lack of acceptance by potential clients and the high acquisition costs, it is definite that 87 per cent of all barkeepers will not lose their jobs in the next few years.

Small and medium-sized companies, in particular, are likely to shy away from technical devices because of the high acquisition costs and the lack of highly qualified specialists who can handle the new systems.84 In view of the occupational work structure and the legal, technical, ethnical and social barriers, only nine to 12 per cent of total US and German employment will be at high risk of being completely replaced.85 Nonetheless, we can be confident that the performance of several occupational activities by machines will ultimately cost some jobs. Other studies expect that AI and robotics are not just job killers; the eliminated jobs will be compensated for, more or less, by newly created jobs.86 For example, the German government assumes that digitalization and automatization will create about 390,000 new jobs in the third sector over the next ten years in Germany.[284] What can be safely predicted is the continuous movement of employees into the third service sector. However, even in this service sector the transition will be gradual. For example, consider the following questions that might be put to service-sector employees.[285] Do you perform less repetitive routine activities? Do you create individual solutions or do you merely reproduce existing knowledge? Do you perform individual tasks that other colleagues cannot perform? Is your employer unable to buy your skills without problems from a cheaper external service provider?[286] Employees, who can answer these questions with yes, should not worry about their jobs being performed by intelligent algorithms. However, we have to recognize that no one does a job that is completely safe.[287] However, the potential digitalization of their jobs is likely to be reduced for employees with a PhD or a master's degree (only 18 per cent in total).[288]

Jobs will be Eliminated in Future. There are few categories or types of jobs or profession will be eliminated near future.

1. Mass Production, Repetitive Task, High Routine Professions or Jobs. In future, Jobs like accountant, court clerk or desk officer at fiscal authorities, unskilled or semi-skilled workers, admin, office jobs, etc. Owing to the high level of routine in their performance, these jobs will mainly be done independently by software and robots or computers. Almost every job where an employee sits in front of a computer screen and processes and interprets data is at high risk. According to a study by ING-Diba conducted in 2015, the probability of the relevant job being eliminated is 89%. As of 2022, for example, tax returns are supposed to be digitally processed in most Western countries.[289] The form will be completed online and analyzed by the computer. It is intended

that tax officers will no longer examine the tax returns of dependent employees, as has been common practice in the develop countries like, US, German, Japan, France, etc for quite some time. They will no longer have to check receipts, as is usual still today. Humans will only make random checks and process special cases individually. As a result, of the simplification of the tax returns, there is a 72% probability that the job of assistant tax consultant will be eliminated. Huge number of white colour job, office desk jobs, financial desk jobs, unskilled worker, etc will be eliminated soon.

2. Maximum Physical and Manual Jobs. In the future, simple work mostly carried out by mere physical strength will be increasingly, but never completely, performed by machines or robots or AI operated alternatives. The decisive criterion remains the level of routine.[290] The efficient use of a machine rather than a human employee is possible only if the process can be made independent and is repeated with certain regularity. Many supplier operations have thus been planning already for some time to eliminate many jobs in production and have the work performed by robots. Minimum salaries in the lower wage sector may also be a reason to use robots.[291] The affected employees could be transferred to other positions within the company. For example, they might perform distribution, IT and creative research tasks. It is acknowledged that even in low labour cost countries. Such as China, South Korea, etc, traditional factory workers are gradually being replaced by robots. Whether it will be possible to retrain traditional assembly line workers to be IT or AI or ML experts or account managers is a different matter.

3. Dismissal of Employees as a Result of Digitalization and Atomization. If retraining the employees is out of the question (eg, the employees working in those jobs will not be able to be trained for a highly qualified job because of their own lack of ability concerning digitalization) or if the technical reorganization will reduce the number of employees to such extent that not all employees can be retrained, collective redundancies in the fields of work listed above, by way of example, will be the inevitable consequence.[292] The ability to effect such collective redundancies may be constrained by labour law but the rules vary from country to country. For example, there is generally a high level of protection for employees in Europe because both employee representative bodies and labour authorities must be informed and consulted in advance. By contrast, the principle of 'hire and fire' applies in other countries such as the US or China. In these countries, no special reason for dismissal is required, but sometimes individual laws can be an obstacle to a dismissal without cause only in exceptional cases (eg, membership in a trade union or the Anti Discrimination Act in the US).

Jobs in demand. There are few categories or types of jobs or profession will raise demand near future.

1. IT Management, Science, Advance Technology like IT, IoT, AI, ML, Big Data, and Such Technical Professions. Media science and humanistic professions will initially benefit from the increase in investments and the associated growth in the area of Industry 4.0. The probability of jobs being eliminated in the area of the sciences (physics, biology, information technology and chemistry) is 10%. In addition to executive employees is 11%, the prospects are similarly good for physicians and nurse, which is due to the ageing develop countries population. In the next ten years, the IT, IoT, AI, ML, Data service sector will experience the greatest boom. Typically, high-paying occupations are corporate managers, physical, mathematical, and engineering professionals, life science and health professionals, in other words, typical jobs related to science, technology, engineering and mathematics (STEM) that can be found in parts of both manufacturing and services. These high-paying occupations will not be eliminated; on the contrary, the number of employees in those occupations will rise. Afterwards, the teaching, legal and advisory professions will participate in the gains caused by the numerous reorganizations and technical upgrades.

2. Teaching and Skills Development Professions. The sector 'teaching professions' covers not only the areas of school, university and vocational training, but in particular, possibilities of further and advanced training for young and adults. This professional group benefits from the need of companies to spend more money on the education of employees and the achievement of further key qualifications for new and existing employees. The number of young professionals with a university degree is already increasing day by day. The range of additional qualifications up to internationally acknowledged degrees is also increasing, so even the individual employee is under pressure to obtain additional degrees in order to stand out against well-educated colleagues. There is a general trend towards more education. More education leads to more jobs for teachers even if there are fewer attendance seminars, more webinars and more online workshops for Generation Y and Z.

3. Humanistic, Social and Environmental Science, Media Science, Artistics, On-line Professions. Creative professions have benefited in all respects in recent decades, and humans in these professions will not be replaced by machines in the future either. Whether they are superstars with their music, artists with their works

or authors and actors with their literary or cinematic works,[293] or simply humanities and media scholars, increasing demand is forecast for their professions. In the future, the end user will still demand creative entertainment options and graphically appealing presentations. Since there is no routine involved, these professions can hardly be performed by intelligent software. The same applies to the socio-scientific communicative sector or to professions with an emotional component. Communication with other people will always come directly from people. It is true that communication increasingly takes place in social networks, but they too must be maintained and technically equipped. This is the central challenge of Industry 4.0, as is the development of ever new, technically versed business models.

4.   Lawyer, Legal, Special Field. Legal profession remain since ancient time and it will continue. Even if the risk of being replaced by intelligent software or a machine is low for members of the legal profession, the technical development is taking place also in this sector. In addition to the financial and insurance sectors that are deemed technically well-equipped and in which financial services have already been assessed using computer simulations and analyses for years, intelligent software can also conquer the legal market and optimize work habits. Studies conclude that the legal profession is at risk to a lower degree than other jobs in the financial sector because of the personal relationships with clients and the creativity needed to draft new legislature and contract clauses. Nevertheless, this profession is not safe from Industry 4.0 either, and further technical development is necessary. An intelligent algorithm went through the European Court of Human Rights' decisions and found patterns in the text. Having learned from these cases, the algorithm was able to predict the outcome of other cases with 79% accuracy.[294] In addition to common online databases and automatic time recording, the acceleration of work with regard to reviewing contracts is a central topic. For example, reviewing contracts or entering contracts in a database is often a nuisance for lawyers and leads to high costs for the client. In order to reduce the lawyers' work and save money for clients, software developers and lawyers are working on intelligent systems for reviewing contracts, called optical character recognition (OCR). Such software allows patent, contract and other lawyers to perform a preliminary review of legal documents. The system can present the overall structure on the basis of language analyses without a lawyer having read the document. The software is also able to automatically create a graphic presentation of the data gained by it. As an alternative, software can automatically review specific clauses on the basis of rendered decisions. In problematic sections of text, the system submits the clause to the lawyer for individual review. Therefore, the lawyer must review only the problematic clauses, whereas the routine review of unproblematic clauses is carried out by the software.[295] It is also worth mentioning the EU Alternative and Online Dispute Resolution (ODR) Regulation by way of which online dispute resolution for online purchases is to be introduced. [296] This has already been common practice for years at eBay and PayPalthrough the system 'Modria'.[297] To this end, the complainant must fill out a complaint form, then receives a corresponding proposal for resolution from the system. In many sectors, fixed amounts for the provision of a certain service have been customary for a long time. Examples are finder's fees or fixed service fees at banks. However a fixed price for legal services is rare. In most countries, payment is rendered on the basis of an individually agreed hourly rate. In some countries, the lawyer is paid also on the basis of the value at issue. Within the framework of digital working, it has become common practice to negotiate fixed prices also in the legal services sector. Fixed prices are offered not only to companies that have a particular interest in financial certainty for their balance sheet reserves; this has already become prevalent also in the private sector.[298] That fixed prices can be specified is made possible by the ongoing digitalization. More and more legal work is carried out by algorithms; this applies, in particular, to routine work, such as reviewing an employment contract, registering a trademark or making divorce papers available.[299] Algorithms not only make the work easier for lawyers, but also allow them to offer fixed prices. It is therefore logical that according to a study conducted by Deloitte, 100,000 jobs in the English legal sector will be automated in the next 20 years.[300] Moreover, it can be observed that more and more companies are working with on fees. Private clients also want to have a better overview of the lawyers' fees, so more and more law firms are forced to offer fixed prices and to invest in digital innovations because of the pressure from their clients and increased competition.

5.   Doctors and Nursing Staff. In future, doctors and nursing staff are far from being replaced. However, in this sector too, technical possibilities can lead to staff reduction.[301] In some cases, machines are able to work faster, more accurately, and more efficiently than the best humans. It will no longer be possible to imagine hospitals without robots in the future. Their tasks will be, for example, to move people out of their wheel chairs or their beds or even help the doctors to perform surgery on people. Additionally, software technology based on artificial intelligence, called 'Watson Health', will help doctors to diagnose various illnesses by reconciling patient data with medical knowledge collected in a cloud. Finally, the demographic change, at least in Western Europe, will lead to an increase of jobs in this sector because the population is constantly ageing and modern medicine is one reason for this.

Inequality in the Future New Job Market.   The gap between rich and poor will continue to grow, which will inevitably lead to social unrest that will be a 'danger for the growth of the economy'. As a result, wage differences will become more obvious than ever, despite established minimum wages in many countries, such as the US, Germany, France or the UK. Owing to increasing digitalization and the streamlining of jobs that this entails, there will be fewer possibilities for well-paid work in the low- and medium-wage sectors. Many people will end up unemployed, whereas highly qualified, creative and ambitious professionals will increase their wealth. When one compares the distribution of wealth in the OECD countries in the years from 1985 to 2013, one sees that this trend has already begun. The agricultural sector can be seen as an example of this; change has begun and this will only increase. Thus, thanks to automatic irrigation systems, intelligent harvesting and transporting machines, the demand for foreign harvest hands and helpers is decreasing. By contrast, the need for technically versed employees who regularly check and repair the machines is increasing at large agricultural businesses. Mere physical strength will be needed less and less. The trend can be seen that high labour cost countries will rise even more. Their dependence on cheaper workers from abroad will also continue to decline. This will in turn result in an oversupply of cheap workers in the relevant low labour cost countries. A similar phenomenon can be discerned in the medium wage sector. In this sector, routine jobs will be eliminated, with the result that a huge number of employees will temporarily drift into unemployment. It is assumed that in the OECD countries alone, a total of approximately seven million jobs will be eliminated in the next five years. On the other hand, in the current situation, only approximately two million 'new' jobs will be created.[302] In addition to combating unemployment among young people, the integration of five million people into the 'New Labour Market 4.0' is the greatest challenge for governments, employee representatives and companies. The situation for LDC and developing countries will be more severe. General poverty level and inequality in the globe will be increase further in future.

Integration of Untrained and Unskilled Workers in the 'New' Job Market. The integration of untrained and unskilled workers will be a massive problem in the future, because in addition to the number of university graduates, the number of people without completed vocational training or school education will increase. Additionally, the number of immigrants in the Western and developed countries will rise further. Whereas many auxiliary jobs are now performed by untrained workers, students or trainees on the basis of marginal employment will reduced as the demand for these jobs will decline extremely in a technically modernized establishment. The integration of these workers into the new digital and robotic labour market is practically impossible. The number of workers who carry out the simplest helping or auxiliary or production jobs within the framework of their full-time work will also be reduced because of the introduction of robots and other AI operated tools/devices. For many people, the technical innovations will therefore result in a serious threat to their professional livelihood.

AI and Next Global Consequence

With every new use of AI comes the scary question of whether or not robots will put people out of work. The judges have yet to make up their minds. Some experts strongly disagree that AI will automate so many jobs that millions will be out of work. On the other hand, other experts see this as a serious issue. Social experts and people who think about AI thought that the organization of the workforce was changing and that AI was taking over jobs. It lets us build a market based on knowledge and use that to improve automation for a better way of life. It might be abstract, but we should be worried about AI and robots taking our jobs.[303] However, some experts speculated that algorithms are to blame for losing white-collar jobs like business analysts, hedge fund managers, and lawyers. Again, there is some disagreement on how the rise of AI will affect the workforce, but experts agree on several themes to look for.On the other hand, some experts feel that when AI is integrated into the working, it will create more jobs, at least in the medium term. Wilson believes the change to AI-based systems will cause the economy to add occupations to help transition. Some additional specialists AI will generate more riches than it consumes. However, it may be dispersed slowly. The changes will be felt subliminally and will not be visible. A tax accountant will not get a pink slip and meet the robot, who will now sit at her desk. The next time the tax accountant searches for a position, locating the same one will be more difficult. Few optimistic analysts predict that AI in the workplace will fragment long-standing processes, creating many new human occupations to combine those workflows and offer satisfaction and progress.The age of AI and 4IR is a transition, and it could take years or even decades for different parts of the workforce and almost every part of life to get used to it. So, these predictions are harder to make, but a few gloomy experts worry that once AI is everywhere, these new jobs and those already there may start to disappear. So, they wonder what will happen to those people in the long run. As we have seen in the past, there were ways to move from farming to making things to providing services. Now, that is not true. What will happen to most workers if robots take over all jobs? As we have seen, technology makes more sense from a business point of view. For

example, self-driving cars and AI concierges like Siri and Cortana could take away up to 8 million jobs in the US alone as these technologies get better. What about the rest of the world? When all these jobs start to disappear, we will have to ask ourselves, 'What makes us useful?'[304]How do we define productivity? We must face the ever-evolving reality and rethink the foundations upon which our civilization is built. What do we do that contributes to society and makes us valuable as individuals? Since the technology will not wait for us, we need to have this discussion ASAP. It is time for us to develop a moonshot mindset.[305] To build inclusive, decentralized intelligent digital networks 'imbued with empathy'[306] that help humans aggressively and ensure that technology meets social and ethical responsibilities.[307]We need some effective and new levels of regulatory and certification processes to ensure the best use of AI for the entire human race.[308]
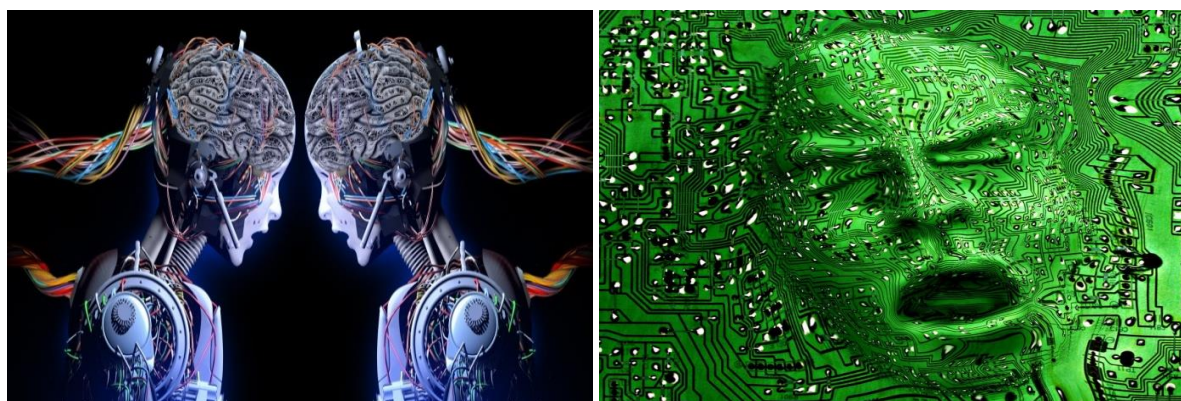
Figure 7: AI and the Singularity[309] and that may collapse the earth[310]

AI could be data-driven as well as knowledge-driven. The next-generation AI breakthrough is knowledge inference and its application to all contexts. Several significant concerns with machine learning in 5G and future networks may give rise to new areas of Research and extensions of present standards to support future networks.[311]So, if AI is going to be used by many people and get better, there needs to be a strong guarantee of security. Since AI will be used in transportation and health care in the coming years, it must be presented in a way that builds trust and understanding and protects human and civil rights.[312]Policies and protocols, on the other hand, should handle ethical, privacy, and security concerns. As a result, multinational communities should work together to push AI to progress in a way that benefits humanity. As AI becomes more incorporated into the workforce, it seems doubtful that all human employment will be eliminated. Instead, many experts believe that the workforce will become increasingly specialized. These professions will necessitate more of what automation cannot currently deliver, such as creativity, problem-solving, and qualitative skills. Essentially, there will always be a need for people in the industry, but their responsibilities may change as technology advances. Specific skill sets will be in higher demand, and many professions will require a more advanced, technical skill set. Thefuture still needs to be written and who knows whether robots are dangerous. What is for sure is that humans**,** being curious beings, will develop new advanced generations of robots**.** It happens so that people and robots go together in this life side by side, in some spheres of life, they are even interchangeable and who knows what this opposition between **"Humans and Robots"** will translate into. Robots and humans that live and prosper together or robots will realize they do not need that much.

Few Suggestions to Solve Inequality, Inequity and Unemployment Problem

The central follow-up question is how social security systems will compensate for the elimination of these jobs and who will ultimately pay the costs. The companies will share the costs in part by bearing the costs for retraining and by making severance payments in the event of dismissals. Many people will not be able to retrain for another position for physical or cognitive reasons. These people will become long-term unemployed and will have to be supported by the state. The high financial pressure on social welfare systems will be a central problem.[313] While some demand a revolution in the European social security systems by establishing an unconditional basic income for all people,[314]others reject this idea – sometimes designated as 'communistically outdated' – from the outset.145 It is said by proponents that the positive aspect of this idea is that money and prosperity for all will secure social peace, whereas unemployment caused by machines might ultimately turn into frustration or even civil disobedience. Another positive aspect of an unconditional basic income would be the deregulation of many legal aspects of labour and social laws (eg, unemployment benefits and protection against unfair dismissal).There are now discussions in Finland about starting a two-year test project regarding an unconditional basic income, since the economic crisis is persisting and the social security payments are high anyway.[315] For the first time, citizens of Switzerland were able to vote in a referendum concerning the

introduction of an unconditional basic income (approximately US$2,300 for adults and US$500 for minors) in June 2016. The Swiss citizens voted against an unconditional basic income, but it is said the majority of Europeans would vote for an unconditional basic income, if they had the choice.[316]The Swiss citizens voted against the introduction of an unconditional basic income because they believed that too many citizens would stop working immediately, and that would lead to greater financial problems.

In addition, the state, as lawmaker, is in a position to determine what jobs it wants to be performed exclusively by humans like caring for babies, schooling, shop/hotel per time jobs. The state could introduce a kind of 'human quota' in any sector and they could decide what social and charitable work it wants to support and to what extent and whether it intends to introduce a 'made by humans' label or a tax for the use of machines.[317] Another alternative is the introduction of social security funds into which the industries; like the oil industry in Alaska must pay or into which the operators of smart factories could pay in a few decades. Government subsidies for innovative startups in the founding phase are particularly suitable for this purpose. The modernization of the economy can be driven forward only by new ideas entering the market. Jobs can be created only if these ideas are not torpedoed by state bureaucracy or financial difficulties in the founding phase, because only then can the economy exploit its full potential for adaptation. It goes without saying that none of the envisaged proposals offer any guarantee that the issues discussed in this paper will be managed in an economically tenable and socially 'fair' manner. They are only ideas that the lawmakers must think about in the decades to come. The question arises as to how to assess AI or ML in the form of autonomous operating systems, production and auxiliary robots or self-driving cars from a labour law perspective. Whatever the case, we need to ensure just society, equity and judgment in the world.

Risks For the staff of a company, AI will entail short-term disadvantages. In the low and medium qualification sectors primarily, several million jobs worldwide are under threat, and it is not at all certain that they can be regrouped to other areas. There may not be employment opportunities in other sectors for these employees because they lack sufficient training. Owing to the introduction of ever more new machines and intelligent IT systems, humans will become increasingly irrelevant for work processes. This may like the feared shift into unemployment and the gap between rich and poor and which lead to social conflicts.[318] Even the most sophisticated system can make mistakes, whether these are inherent in the system itself or are caused by the performance of humans. Creative solutions from employee representatives, national lawmakers and companies are required in order to manage the problems that will arise. For instance, the Italian Sharing Economy Act is a potential way to solve the new labour market's problems. A threshold of €10,000 per year will be fixed with a lower taxation rate of 10%. On the other hand, such new legal frameworks will create new jurisprudential questions; for example, concerning the distinction between a platform and real business or the definition of certain criteria to distinguish between 'on-demand workers' and 'traditional workers' in the service sector.

Advanced technology create unemployment problem no doubt; however, at the same time, IT, AI or ML opens new opportunities for companies and individuals. Humans are adaptable and will create new jobs.[319] The use of intelligent IT or AI systems helps decrease the time required for the product or the service, and the associated costs as well. The time saved, especially for dangerous work, can be used by human beings for other work or for leisure. AI should thus result in a growth of prosperity. This applies especially to high-wage countries where it is possible to produce at lower cost owing to production robots. [320] Moreover, technical developments will lead to a situation in which older employees and employees with disabilities can be better integrated; while machines can perform dangerous work. Despite occasional gloomy forecasts, it can be expected that the greater part of jobs will be shifted to a different area of work. The new job models that will become common due to AI, digitalization and the global integration of workers will be a chance for the younger generation to have more free time and to create an individual working atmosphere. Even if some of these new jobs like crowd working or some sharing-economy jobs will mean a loss of tax revenue and social security and they will at least help to avoid unemployment.[321] Though in the past humans participated actively in production, they will now supervise it. In this sector, AI is to be considered an enhancement of the technical opportunities in fact. The humans who become superfluous will make greater use of their time to develop and perform innovative services. They can focus solely on their core competence; this has meant adapting to the environment and learning.[322]

As an alternative to the unconditional basic income, governments could introduce higher minimum social standards by revolutionizing the progressive tax systems, distributing subsidies or vouchers or offering rewards/prizes. Alternatively, the US economist Richard Freeman proposes that employees should buy the robots that replace their jobs or should invest in the development of new IT and AI or ML systems. The advantage these alternatives have over the unconditional basic income is that working is not rendered unattractive. As a substitute, the state could reduce the maximum working hours by law so that existing jobs

must be allocated to several employees. In this regard, a 30 or 35 hour week or a 4-day week could be considered.[323] An employment crisis can also be avoided by allowing working age populations to decline.[324] However, the introduction of a 35 hour week has not resulted in an increase of jobs either in France or in the German metalworking industry. The evidence is that reduced working hours prevent only a rise in unemployment, but do not contribute to the reduction of existing unemployment.[325]

II.   Conclusion

Today, AI robots are already very close to being real. Things that normally need human intelligence are now within the capabilities of machines. ML and deep learning are only two examples of AI techniques that can simplify any task. Data has the same value for computers as experience does for humans. There is a great deal we can do using AI to improve the quality of our service and the success of our company. If AI is deployed properly, it will allow us to maximize productivity across all departments, boost sales and customer happiness, and better use our resources. This is why AI is using every sector or business or organization. Some examples of these sectors include the automotive, healthcare, financial, automobile, manufacturing, production, energy, agriculture, military, telecommunication, cybersecurity, etc. The new era will be governed by different norms and necessitate a new type of economic analysis. In the middle of the 20th century was manufacturing economy dominated. The current economic frameworks must be updated to describe the next 50 years. Google Maps' usefulness to travellers is mostly due to AI. It has allowed us to create detailed road maps in a fraction of the time and it took just five years ago to distribute these maps to every part of the globe. Today, we may also rely on AI-powered apps to keep us safe and comfortable while riding bikes, strolling, or taking public transportation. AI has a bright future in the financial and banking sector; those sectors have been propelled by real-time data reporting, adoption, precision, and processing by using massive amounts of data. Such massive and complicated tasks can be accomplished by using AI technologies such as ML, algorithmic trading, adaptive intelligence, chatbots, and automation.

At present, self-driving cars use AI to make real-time decisions based on the data they gather from their sensors. So, AI-controlled self-driving cars are a sign that the future is getting closer to the concept of driverless cars and is no longer the stuff of science fiction. Recent studies say that by 2040, there will be about 33 million cars that can drive themselves. On the other hand, AI in healthcare is a broad and very popular term for the use of ML algorithms and software to imitate human cognition in the analysis, evaluation, calculation, presentation, and understanding of complex physical, mental, medical and healthcare data, and ready to go beyond human capabilities by giving new ways to pathology test analysis, diagnose, choose drugs, treat, surgery, or prevent any complicated disease. In particular, AI has the required talent of computer programs to draw close conclusions based only on the data they are given. Today, AI can solve many problems by intelligently searching through possible solutions. AI is an interdisciplinary science with multiple approaches, advancements in ML and deep learning, in particular, are creating a paradigm shift in virtually every sector of the tech and advanced industry. AI is the backbone of innovation in modern computing and unlocking value for individuals, organizations, companies or businesses.

Future dangers from AI may be very significant. AI, IoT, ML, and automation will reduce the need for human workers and the size of the global economy. AI in education is not about humanoid robots as a teacher to replace human teachers. However, it is about using computer intelligence to help teachers and students and improving and effective the education system. In the future, the education system will have many AI tools that will shape the educational experience. Again, who knows, maybe even robot-human emotional relations will be possible in the future. There were already several movies playing with that idea. However, there is a high degree of uncertainty regarding the conceivable technological development scenarios and their effects. So, substantial potential weaknesses and risks cannot be ignored. Economic analysis based on models suited to this new era has the potential to aid in the development of policies at both the global and national levels that can mitigate these negative effects. The big threat of AI is 'Singularity' in which AI machines take over and fundamentally alter human existence by making us dependent on them or eliminating us. This is another major threat to humanity on a global scale. Today many people believe that the end of humanity is possible if super-intelligent robots gain access to nuclear weapons or develop biological or chemical agents. Those devastating/horrifying tasks could be carried out at any time, either by super clever robots themselves or by some ignorant human acting out of anger, malice, or dictated by a stupid person. So, there should be appropriate procedures, rules and regulations for using advanced AI and robots. And such procedures and regulations should include ethical, privacy, and security concerns. Therefore, global coordination should guide AI development in a positive, gentle path.

There is no doubt that AI is a real game-changer in the healthcare field and automobile. It is improving almost every part of the business, from keeping private records safe to using robots to help with surgeries. Like the industrial revolution, progress in AI and similar technologies could be a major turning point in history. But, advancement and diversified use of AI could lead to the end of the manufacturing-export-led development model, which has helped many emerging market economies in the past. The worst-case situation is that most of the progress made in development and reducing poverty over the last 50 years will be lost. In the past, new technologies led to more shared wealth and equality between and within countries. But new hi-tech technologies may lead to more inequality on both fronts if policies aren't implemented to counteract them. There is still a need for humans in some capacities as AI grows more pervasive in the workplace. Again, creativity, problem-solving, and qualitative abilities all such task robots cannot replicate, and such capable and specialized humans will be in more demand in the future. There will always be some demand for skilled workers, though their specific functions may change as per the requirement of improved and advanced technology. There will be a shift in the kinds of talents and expertise that will be in demand and many of these positions will call for a higher level of technological proficiency. In the future white-collar and middle-class jobs will be more threatened by AI. But, nursing, physiotherapy, cooking, stewarding, mechanics, electrician, and other service or care-related occupations are expected to rise in demand. So we need to change and shape our curriculum, syllabus, study pattern, teaching style, skill development program, and whole education system to meet future challenges. Implementing AI will streamline work and create more job opportunities for skilled employees with high future salaries.

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