Review

The nexus between Artificial Intelligence and Sustainable Development Goals: A review

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Abstract: This article focuses on the link between Artificial Intelligence and Sustainable Development Goals and, more precisely, how the former can be applied to achieve the latter. The solution to SDG-related issues may be one goal of AI applicability. There have been suggestions that the current status of artificial intelligence (AI) might serve hundreds of millions of people in both rich and developing countries by helping to resolve problems related to all 17 UN Sustainable Development Goals. Examples include helping those who are blind or visually handicapped navigate their environment, detecting victims of sexual exploitation online, supporting relief operations in the event of a disaster, helping to detect diabetes early, and using image scanning to diagnose skin cancer. These are but a few examples of how AI works and how AI innovation can be advantageous. It also reviews how Artificial Intelligence can be applied to protect the environment, food production, the energy industry, and healthcare development.

Keywords: Artificial Intelligence; SDGs; technology; application; environment; energy

1. Introduction

Over the past few years, we have been inundated with headlines warning us that machines will control the world and Artificial Intelligence (AI) will take over our employment. But among the flood of gloomy information, we may also come across evidence of AI's beneficial effects, which aid in improving the state of the world. AI has the potential to be a very effective tool for a circular economy and more sustainable living in global efforts to achieve sustainability, particularly in reaching the UN Sustainable Development Goals (SDGs). In fact, the McKinsey Global Institute [1] has gathered over 160 examples of AI technology solutions that potentially have a positive non-commercial impact on society. These solutions include deep learning, computer vision, machine learning, natural language processing (NLP), and others.

One objective of AI applicability may be to resolve SDG-related problems. It has been suggested that the current state of artificial intelligence (AI) might aid in the resolution of cases pertaining to all 17 UN Sustainable Development Goals, ultimately helping hundreds of millions of people in both developed and developing nations. For example, assisting visually impaired persons in navigating their surroundings, identifying victims of online sexual exploitation, providing support for disaster relief efforts, or assisting in the early detection of diabetes and the use of image scanning to diagnose skin cancer. These are only a few instances of AI's effects, and adopting AI innovation can be beneficial.

In order to fulfill the 2030 UN agenda for sustainable development, the United Nations (UN) developed 17 Sustainable Development Goals (SDGs) in 2015. These goals consist of 169 objectives. These objectives cover an enormous spectrum, from

climate change to poverty. Many practitioners and scholars are interested in using Artificial Intelligence (AI) to accomplish the SDGs for social good [2]. However, studies have demonstrated that AI technology is a two-edged tool that may both support and obstruct the SDGs. Regarding the 169 targets listed for the 17 SDGs, Vinuesa et al. [3] investigated the enabling and inhibiting effects of AI and found that it was an inhibitor for 59 targets and an enabler for 134 targets (for certain targets, AI was both potentially an enabler and an inhibitor). Additionally, Gupta et al. [4] expanded on their research to include talks on how AI may affect the SDGs at the indicator level. The rationale of the study, accordingly, is to underline the nexus between AI and SDGs by demonstrating how the former can be critically helpful in achieving the latter.

2. Literature review

The 17 integrated priorities that make up the Sustainable Development Goals (SDGs) use social, economic, and environmental development aspects to determine worldwide quantifiable targets. By 2030, they are intended to serve as a global set of measurements and a framework for reference that the global community may use to inspire action and adoption. As a follow-up to the Millennium Development Goals, which laid the groundwork for international cooperation to end extreme poverty, the UN adopted these goals in 2015. This new paradigm makes a long-term change towards more sustainable growth possible. It promotes openness and facilitates international cooperation at the same time. It is a means of guiding decision-making, not an authoritative and practical manual in and of itself. Because of this, Member States and organisations are free to enact legislation and initiatives based on their own experience, skills, and available research findings.

The interconnection of the 17 global goals is their primary feature. It's probable that as poverty rises, hygienic practices will deteriorate and health problems will rise. Poverty also makes it harder to get an education and makes it more likely that violence will occur. Another illustration is how biodiversity is being impacted by climate change, which will exacerbate existing inequalities in society. Having said that, any effort made to further one of these objectives could benefit multiple others. The components of sustainability are interdependent and dependent on one another, much like the components of a human organism. The state of society has an impact on the economy, and society has an impact on how we care for the environment. The purpose of the goals is to demonstrate how civilisation, which is heavily dependent on the environment, cannot progress without having an impact on the economy.

However, there aren't enough of the 169 targets spread among the 17 goals to have a significant effect. They are intended to motivate countries and world leaders to devise practical measures that would bring about beneficial, long-lasting transformations. This is reflected in the 17 Global Partnership Goals, which call for stakeholder collaboration to improve outcomes and facilitate data sharing. To achieve the SDGs, a large number of professionals, entrepreneurs, technologists, and scholars contribute a great deal of knowledge, ideas, and cutting-edge technology every day. To make this knowledge and information useful, though, a great deal of work needs to be done in order to gather facts and expertise. This is the role of technology. More

precisely, machine learning (ML), big data, computer vision, artificial intelligence (AI), and other technological solutions can assist stakeholders in receiving more detailed instructions on how to take action to achieve the SDGs.

AI and ML, two of the newest technologies, will significantly influence our behaviour in the future. The global artificial intelligence (AI) industry is expected to reach $39.9 billion in 2019 and rise at a compound annual growth rate (CAGR) of 42.2% between 2020 and 2027, according to Grand View Research [5]. The adoption of AI and SDG targets will benefit from this rapid expansion, as it will further permeate a wide range of industries and sectors. In other words, AI will continue to play a role in achieving these objectives.

3. Methodology

"Is there published evidence of AI acting as an enabler or an inhibitor for this particular target?" was the question that needed to be addressed for selected SDGs. In order to achieve this, desktop research, drawing on prior research on the mapping of SDG interlinkages as well as Butler et al. [6] and Morgan [7], prescribed methodologies. To bolster the conclusions drawn on the relationships between AI and the different targets, a literature search was carried out, and the following information sources were deemed suitable for use as evidence: published work on real-world applications (it was ensured that the publications taken into account in the analysis were of sufficient quality, given the quality variation depending on the venue); published evidence on controlled/laboratory scenarios reports from government bodies or accredited organizations (like the UN); and documented commercial-stage applications.

4. Results and discussion

The digital technology of today is driving amazing developments at an incredible rate. AI innovation will allow people to use massive amounts of data to achieve ground-breaking advancements in fields like healthcare, agriculture, education, and transportation. Additionally, we are witnessing how AI-enhanced computing can help doctors eradicate medical mistakes, boost farmers' yields, customise student training, and identify researchers [8]. The relationship between artificial intelligence and climate change has gained significant attention in recent years. AI, for instance, can be used to control environmental alterations and their effects in a variety of economic contexts. A few potential uses include safer supply chains, weather forecasting, environmental control and regulation, and distributed electricity grids powered by renewable energy and artificial intelligence. PwC UK and Microsoft [9] research estimates that by 2030, the global economy might benefit from the application of AI in environmental technologies to the tune of USD$5.2 trillion, a 4.4% improvement over business as usual.

Furthermore, by using AI technology solutions, greenhouse gas (GHG) emissions might be reduced globally by 4% by 2030. This is comparable to 2.4 Gt CO_2, which is the same as the combined yearly emissions of Australia, Canada, and Japan. AI has the potential to create 38.2 million new jobs globally as part of this shift, increasing

competitiveness and opening up additional opportunities for qualified individuals. Some examples of the application of AI to the SDGs are discussed below.

The preservation of life on land and in the ocean is a target of the fourteenth and fifteenth SDGs. In these situations, automated procedures that gather biodiversity data through remote sensing can be developed using AI-powered technology [10]. Those involved in the species' behavior can use this data to recognise patterns and take appropriate action when they observe something out of the ordinary. As a result, artificial intelligence technology has a lot to offer in terms of environmental conservation. A better grasp of the particular behaviour patterns can improve the efficacy of protected area management. This is particularly beneficial for safeguarding water and its delicate ecosystems. However, the usage of technologies must be clear and under control. If not, AI might be used for environmental exploitation, which is something we definitely do not want [11].

AI is having a beneficial effect on the energy industry as well. It can be applied to lower energy usage and promote inexpensive, renewable energy. Smart power networks, for instance, have the ability to balance the demand for electricity from various renewable energy sources [12]. But we must use caution here as well. The need for ICT solutions is growing along with digital technology. Consequently, as ICT solutions are produced more often, more electricity is used, which is contrary to the intended objectives [13].

According to the McKinsey report, researchers at Stanford University and the University of Heidelberg developed an AI system for illness identification that uses visual assessment of natural images—like pictures of skin conditions—to evaluate whether or not they are malignant. It was discovered that the AI-based identification system performed better than licensed dermatologists [14]. Wearable technology that uses data from heart rate sensors to identify early signs of diabetes is another example of AI being used in healthcare. If these gadgets are able to be made inexpensive, they could benefit more than 400 million diabetics globally. Human error is a significant problem in the healthcare industry as well. Massive patient loads and incomplete medical data can result in deadly human error [15]. AI is more adept than most medical professionals at anticipating and detecting illness because it is immune to these causes. For instance, in one study, an AI model that combined deep learning and algorithms identified breast cancer more frequently than 11 pathologists. Another interesting use for AI is in the field of drug development.

One of the biggest AI advances in drug development occurred in 2007 when scientists gave a robot named Adam responsibility for yeast testing. Adam conducted extensive data searches in public libraries to develop theories on the functions of 19 genes in yeast, generating nine novel and accurate predictions. It was discovered by Eve, Adam's robot mate, that triclosan, a natural toothpaste ingredient, may eradicate parasites that cause malaria [16].

The United Nations estimates that a 70% increase in the world's food supply will be necessary to feed everyone by the year 2050. AI systems can be used to expedite the investigation of prospective solutions when time is of the essence [17]. The goal is to produce food in a more economical and intelligent manner. Approximately half of the food produced worldwide is wasted nowadays. With the use of artificial

intelligence, the TOMRA Sorting Solutions machine can classify food as "good" or "bad". If the algorithm has to examine a tomato, for instance, it may determine whether or not it is appropriate for a salad [18].

The Nutrition Early Warning System (NEWS), which classifies areas at increased risk of food shortages, droughts, and floods, as well as rising food prices and soil degradation, also uses big data and machine learning. It has already been used in Colombia to warn farmers of impending flooding and advise them to postpone the planting season [19]. The 170 farmers that followed the advice and skipped the planting season saved a significant amount of money on planting when the drought struck. Other use cases include using an AI approach to optimize food delivery networks in areas affected by natural disasters, or integrating data from various alternative sources, including geospatial data, social media data, telecommunications data, internet search data, and vaccine data, to better forecast patterns of virus and disease transmission [20].

Infrastructure-related improvements could provide public benefits in the domains of real estate, transportation, power, water and waste management, and urban planning. For example, real-time traffic camera data and Internet of Things sensors can be used to adjust traffic light systems to increase vehicle throughput. AI might also be utilised for condition monitoring of public transportation systems, like trains, and public infrastructure, like bridges, to identify potentially faulty components [21].

To improve society for all global citizens, it is imperative that issues of equality, diversity, and self-determination be addressed. Examples of these issues include minimizing or eliminating stigma related to race, sexual orientation, ethnicity, religion, and disability. Affectiva, a spin-out of the MIT Media Lab, and Autism Glass, a Stanford research project, are mentioned by McKinsey in their study. Their work uses artificial intelligence (AI) to automate emotion recognition and offer social cues to enable people on the autism spectrum to communicate in social contexts. Another illustration is the development of an alternative form of identity validation for those lacking traditional forms of identification, such as driver's licenses.

To make more substantial progress, governments, non-governmental organisations (NGOs), charitable organisations, technological companies, and groups that collect or generate vast amounts of data will need to take some proactive steps. There are two significant barriers that stand in the way of using AI innovation to achieve the UN SDGs: 1. The issue of getting useful information; and 2. The dearth of individuals with AI expertise to create, enhance, and use machines and algorithms. Furthermore, there would be a lot of dangers involved in using AI technology solutions. Authorities and other stakeholders may inadvertently harm the very people they are supposed to assist when they misuse their tools and methods or allow themselves to be unintentionally misused.

5. Conclusion—Limitations and the way forward

Even if we haven't developed super-intelligent machines yet, it's important to examine the legal, political, societal, financial, and regulatory challenges today in order to be ready to operate securely among them when the time comes. These issues are so complex and wide-ranging. Apart from planning for a world where super-

intelligent computers exist in the future, artificial intelligence in its current form can already be dangerous. Let's examine some of the main risks associated with AI.

One way AI can be dangerous is if it is trained to do something dangerous, like autonomous weaponry designed to kill. One could even reasonably anticipate that the global autonomous weapons competition will take the place of the nuclear arms race. "Artificial intelligence is the future, not only for Russia but for all of humanity," declared Vladimir Putin, the president of Russia. It presents not just great potential but also unpredictable hazards. The world will be ruled by whoever rises to the top in this domain. The hazards that autonomous weapons could pose to a person or nation that doesn't respect human life are a greater worry than the possibility that they could develop a "mind of their own".

Social media's self-powered algorithms make it immensely helpful for target marketing. They are incredibly perceptive about our thoughts, interests, and personalities. While investigations into the claims that Cambridge Analytica and other affiliates of the company used the data of 50 million Facebook users to try to sway the outcome of the Brexit referendum in the UK and the 2016 US presidential election are ongoing, if they are accurate, it illustrates how artificial intelligence (AI) can be used to manipulate society. Artificial intelligence (AI) has the ability to identify specific individuals and distribute propaganda, whether factual or fictional, in any format to those who have been identified by algorithms and personal data.

These days, it's feasible to monitor and examine a person's every action, both on the internet and during their regular activities. There are cameras almost everywhere, and facial recognition software can identify you. Indeed, it is precisely this kind of data that will drive China's social credit system, which is anticipated to assign a personal score to each of the country's 1.4 billion inhabitants in accordance with their behavioral patterns, including whether or not they jaywalk, whether or not they smoke in designated areas, and how much time they spend playing video games. Not only is it an infringement of privacy when Big Brother is watching you and using that information to make choices, but it may also easily escalate into societal oppression.

The efficacy and efficiency of AI-powered devices are something that people appreciate about them. However, if we are unclear about the objectives we set for AI systems, it might be hazardous if a computer isn't equipped with the same intentions as humans. An order to "get me to the airport as quickly as possible," for instance, can have disastrous results. A machine might fairly successfully accomplish its aim of delivering you to the airport as quickly as possible and do exactly what you asked, yet leave a path of accidents in its wake if it didn't explicitly state that we value human life and that the rules of the road must be observed.

It's highly likely that machines will use the information they can gather, track, and analyze about you against you. It's not difficult to see an insurance provider telling you that you are not covered because of the frequency of instances in which you were seen using your phone while on camera. Based on your "social credit score", a company may decide not to extend a job offer to you.

Misuse of any strong technology is possible. Artificial intelligence is being employed today for a variety of beneficial purposes, such as improving cancer diagnosis, developing novel cancer treatments, and improving vehicle safety. Sadly,

as artificial intelligence (AI) becomes more powerful, it will also be utilized for nefarious or hazardous ends. Given how quickly AI technology is developing, it is imperative that we begin discussing how to maximize AI's beneficial development while minimizing its potentially harmful effects.

Artificial Intelligence is not a solution to every human issue. But when combined with the SDGs, AI has the potential to be a useful tool and have a positive effect. To maximize the benefits, we must both promote the development of applications and their thoughtful, appropriate use at all levels. In this context, artificial intelligence (AI) seeks to progress the area and offer a powerful tool for addressing environmental, social, and political issues.

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