
AI FOR LIFE: TRENDS IN ARTIFICIAL INTELLIGENCE FOR ENVIRONMENTAL HEALTH AND SUSTAINABILITY

Arjunan Karupiah¹, Preetham Anton Alphonse Rozzario², Ridhu Varshini Jaganathan Kavitha³, Saranya Devi Chitra Sethuraman⁴, K B Rajesh⁵ and Habibur Rahman^{1*}

¹Department of Pharmaceutics, PSG College of Pharmacy, Peelamedu, Coimbatore -641004, Tamil Nadu, India

^{2,3,4,5}Department of Physics, Chikkanna Government Arts College, Tiruppur -641602, Tamil Nadu, India

¹dr.aj.mpharm.phd@gmail.com, ²preethamantonpharma@gmail.com, ³ridhujagan15@gmail.com,

⁴isaru10@outlook.com, ⁵rajeshkb@gmail.com and ^{*}habet1@gmail.com

ABSTRACT

Environmental health is the branch of public health that: focuses on the relationships between people and their environment; promotes human health and well-being; and fosters healthy and safe communities. Environmental health is a key part of any comprehensive public health system. Climate change is a global threat to humanity throughout world. The long-term changes in weather patterns and temperature has both direct and indirect impacts on lives worldwide. The branch of Artificial Intelligence (AI) which use machine system made up of complex algorithm which stimulate critical thinking and intelligence to perform cognitive function of humans such as making decision, reasoning, problem solving, reasoning, environmental interaction etc. In the present review we have focused the present and futuristics view of AI in environmental health and sustainability.

Keywords: Environment, environmental health, public health, health and safety, smoking, active and passive smoking, carbon monoxide, artificial intelligence

INTRODUCTION

Climate change is a global threat to humanity throughout world. The long-term changes in weather patterns and temperature have both direct and indirect impacts on lives worldwide [1]. It is anticipated that between 2030 and 2050, climate change will result in an additional 2,50,000 deaths annually [2]. Natural sources such as the sun's activity and massive volcanic eruptions are the source of direct effect. Man-made factors like burning fossil fuels especially coal and natural gas that releases greenhouse gases (GHG) are the major cause of indirect influence. The need for extensive responses to human-induced climate change has been emphasised time and time again by the Intergovernmental Panel on Climate Change (IPCC), both to prevent avoidable warming and to lessen the effects of warming that has already occurred [3]. The impact of global climate change is deep-rooted and involves warming temperatures, carbon-monoxide liberation, raising sea levels, intense heat waves, altered precipitation patterns, increasing frequency of extreme weather events etc [4].

Artificial Intelligence

The term "Artificial Intelligence" or "Machine Learning" coined by Sir Johan McCarthy in the year 1956 [5] which is broadly defined as, "The branch of computer science which use machine system [6] made up of complex algorithm [7] which stimulate critical thinking and intelligence to perform cognitive function of humans such as making decision, reasoning, problem solving, reasoning, environmental interaction etc [8]. This technology use data to perform various task [9]. The subfields of artificial intelligence are Natural Language Processing (NLP), Machine Learning (ML), Computer Vision (CV), Deep Learning (DL) [10] The history dated back to year 1940 exactly 1942 [11] where the term was coined by Johan McCarthy in the year 196 at Dartmouth College in the year 1956 [12]. The first AI integrated ELIZA program created in the years in between 1964 to 1966. The year 1884 is the starting era of Artificial intelligence on this date Sir Charles Babbage on this date created mechanical machine that execute human intelligence. The year 1965 to 1970 is a dark period and in the year 1970 and 1975 where the Artificial Intelligence gained some momentum [13] and AI become popular in the year 1980. The goal and objective of AI is to mimic human intelligence to and to work in a flexible and efficient manner [14].

The goal is to achieve Intelligence Automation (IA) through Artificial Intelligence (AI). The importance of the AI is to improve in making decision making, analyse different data and trending areas which help business to make important decisions [15]. The AI had deepened his routes to various areas (Figure 1) such as financial and banking sectors, Business, Personalized marketing, Healthcare, Cyber Security, Self-driven vehicles, Internet on Things, etc [16]. The advantage of AI is predominantly which automize (Bhbosale S. et.al)¹⁷ everything where the ratio of success is very high [18] which can work for long period and can give results in short time and can work in fuel and mining sectors can do various functions at a same time which reduce errors by human and the results are based on previously gathered information which give precise results. The disadvantage of AI which

cost more to repair and build and which results in unemployment and make human lazy due to automation and make human less interfering in day to day and make humans less creative, AI sometimes will malfunction and produce misappropriate results.

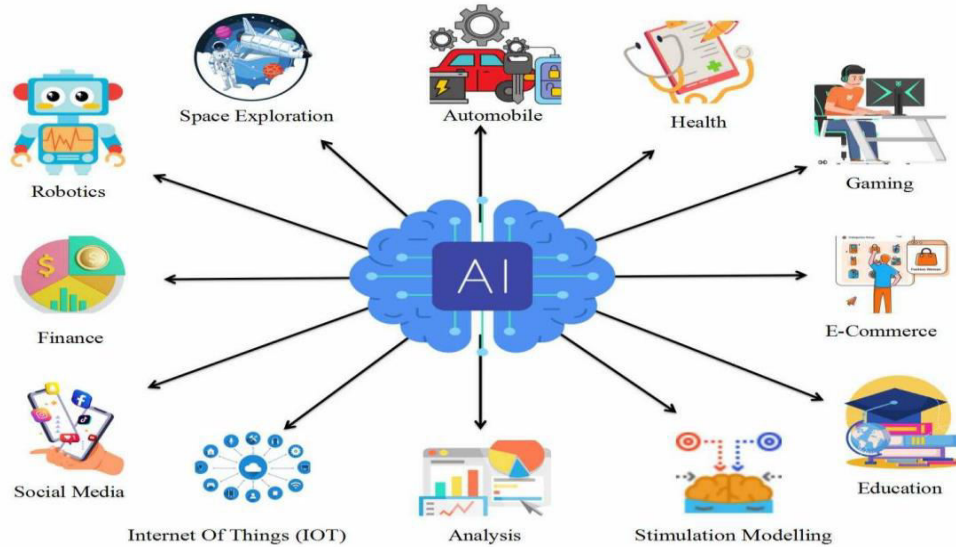


Figure 1 Applications of AI in various field

AI in Progress to save Environmental Health and Sustainability

The 21st century mentioned the importance of “Artificial Intelligence”, as a tool to tackle issues in sustainability and tackle issues in environmental sustainability such as transportation, biodiversity, water management and energy. The AI used to develop methods and model of sustainable production. The AI advancements in AI Algorithms, Big Data, Hardware have integrated to changes in our lives. Deep learning (DL) gives results in task such as medical diagnosis, image recognition and Natural Language Processing (NLP) [19]. This advancements in AI towards sustainable development make the planet very safe. AI constantly replacing humans with better efficiency and higher results and gradually replace homo sapiens and it will be incorporated into various form of SDG [20].

The term “Sustainable Development” is broadly defined as, “The paradigm of development which change AI life cycle products (implementation, idea generation, retuning, governance, training) and improve standard of life without interrupting the eco-system or causing challenges in environment such as water, air pollution and deforestation. The Sustainability of AI focused on infrastructures, power supply and sustainable data source as a method to reduce the footprint of carbon and has two branches such as, “Sustainability for AI”, & “AI for Sustainability”. The pillars of the sustainable developments are, “Environment, Economic & Social”. The Sustainable AI focus the system of AI rather than the application of AI. The schemes introduced by government to improve sustainable development of AI. The corporates provide reports in carbon emission for AI systems. The funding directed to the approach of AI in sustainability The AI deal with climate problems and environment and possible two tools are “Machine Learning Emissions Calculator” estimate carbon footprint using GPU through hardware type and the other tool is ‘Experiment-Impact Tracker’ Framework which track consumption of energy in a real time. The main approach is to reduce consumption of energy using the development of AI [21]

The statistics related to sustainable development in various fields are given below AI reduce 20% emission by reducing the amount of time vehicle spend stopped and manage traffic light in a excellent manner and google by 40% reduce consumption of energy by using AI to analyze the number of times a day where people use search engine and optimize its data centers. The streaming platforms, Netflix uses AI to reduce the consumption of bandwidth without losing controls in broadcast. IBM predict rainfall prediction results in 30% accuracy in the forecast prediction by utilizing AI. The usage of range of technologies such as big data, Artificial Intelligence AI and Internet of Things (IOT) are used in cities to be more sustainable, efficient.

AI plays a huge role in renewable energy sources by optimizing the performance of wind farms and reduce consumption of energy results in a more sustainable energy system. In agricultural field algorithm of AI inform farmers about waste usage, pest-management and crop production, these systems are effective in improving soil management and irrigation. The web-based system uses AI for wheat diagnose. The usage of AI in agriculture improves better yields in a growth of peanut in India In preserving the eco-system AI plays a big role in

preserving the flora and fauna by analyzing large amount of data which is used by AI researches to understand about the bio diversity and climatic change and predict which species are in risk using ultra fine image analysis here area mapped and monitored. The partnership between Nature Conservancy and the tech giant Microsoft to map ocean species using AI. MIT use AI and Microsoft to listen the interaction between species. The optimization of electronic component utilizes AI to handle complex calculation and large amount of data using algorithm making faster and efficient than traditional.

The urban system uses Hybrid AI in DesCartes program to make complex situation in smart city resulting in more accurate and efficient results.[22] The application of AI in agriculture through mobile based app discover disease in field enhance food production and agricultural output. The implication of AI in education management results in job replacement. The utilization of AI in buses reduce emissions by 50% by 2050 by identifying the efficient routes [23]

Climate change: Through sensors in vehicles connecting them to fog computing architectures on V21 network anomalies on streets are analysed. Abnormal road conditions are detected through machine learning algorithms comparing the roughness against a flat surface. AI based models are used in forecasting solid waste management because the ability to predict through AI is huge and accurate.

Water security and supply: The artificial neural network for estimating the flow and pressure controller which works using adaptive control is a major contribution of AI in the field of water supply. With help of AI, in medical education it has potential to improve water efficiency and also to provide medical image interpretations with excellent reliability [24]

Weather and disaster resilience: AI-powered climate change adaption solutions have the power to completely redefine how we approach and combat the problem. The AI-powered simulations can assist businesses in evaluating the opportunities and hazards associated with climate change, enabling them to better plan for the future and establish more sustainable business practises. The use of AI-powered models to simulate the impact of climate change on infrastructure is one of the most exciting applications of AI in climate change adaptation.

Area of field	Study findings	Inference	Reference
Improving Biodiversity Protection Through Artificial Intelligence	Analysis of Madagascar endemic tree diversity	More reliable than the full initial monitoring. Optimize dynamic conservation policies using RL and evaluate their biodiversity outcome through simulations.	Silvestro, D., et al., 2022 [25]
The Role of Artificial Intelligence In Achieving The Sustainable Development Goals	Electricity demand, replacing old jobs with ones requiring more skills, ccontrolled laboratory environments- limited datasets or using prototypes	SDGs -powerful lens - looking at internationally agreed goals on sustainable development	Vinuesa, R., et al., 2020 [26]
Artificial intelligence and automated monitoring for assisting conservation of marine ecosystems: A perspective	Application of artificial intelligence (AI) and automation in marine conservation	The marine conservation efforts can be transformed by establishing new methods of collecting and analyzing data, making informed decisions, and managing marine ecosystems, through the use of artificial intelligence and automation	Ditria, et al., 2022 [27]

The Current And Future Uses Of Machine Learning In Ecosystem Service Research	Machine learning techniques in data description (64%) & predictive modelling (44%)	AI models were focused on data collection, processing, assessment, and analysis in the areas of animal behavior detection, disease monitoring, growth estimation, and environment monitoring	Matthew Scowen, et al., 2021 [28]
Water Management- The role of AI in waste water management	Discussion of water management using the techniques of AI and IoT, statistical analysis of sample and discussion about intelligent techniques in water management	Artificial neural network mostly used AI methods in water management and federal network is the second most used AI method in water waste management	Krishnan SR et al., 2022 [29]
Filtration of air through AI methodologies	An AI mobile air purifier is designed to tackle air related problems at large scale.	This purifier detects humans and moves from one place to another place to provide them purified air.	Vashishtha P et al., 2020 [30]
Early warning systems through AI	The proposed model forecasts PM 2.5 - 1 hour ahead of time to provide an early health risk warning system.	Early warning systems at underground stations ensure sustainable environment.	Shahzeb Tariq et al., 2022 [31]
Air quality management through AI	The study estimates concentration of pollutants in air by using machine learning and deep learning techniques.	The underlying causes for air pollution was understood from the studies and smart strategies were used to reduce the air pollution levels effectively.	Neo EX et al., 2023 [32]

Carbon monoxide - A deadly gas: liberation and its impact on environmental health and sustainability

The incomplete combustion of fuels, hydrocarbons and by-product of tobacco smoking produce the colourless, odourless, tasteless and non - irritating gas known as carbon monoxide (CO) - “THE SILENT KILLER”. Although it is not a direct cause of climate change, carbon monoxide's presence influences the amount of greenhouse gases like carbon dioxide and methane (Adam Voiland et al., 2015) [33]. Despite being a very weak direct greenhouse gas, carbon monoxide (CO) has significant indirect effects on global warming. Because CO contributes to atmospheric chemical reactions that result in the production of ozone, a climate change gas [34] The amount of greenhouse gases in the atmosphere is impacted by the emission of carbon monoxide. This implies that rising sea and land temperatures alter ecosystems, storm activity, and result in other extreme weather phenomena. Hydroxyl (OH) radicals in the atmosphere are reduced in number by carbon monoxide's reaction with them. These OH radicals are the ones which enables the reduction of vital greenhouse gases like CH4. Thus, CO indirectly multiplies the global warming potential pf these gases.

Car exhaust fumes mostly consist of carbon monoxide, which is released into the atmosphere when we light cigarettes and even when we start the engines. The two biggest sources of carbon monoxide emissions are exhaust from vehicles and wildfires. Additional sources include charcoal heaters, which include barbecues, wood stoves, gas water heaters, gas stoves, fuel-fired heaters, fireplaces, and gas dryers, as well as internal combustion engines found in chainsaws and leaf blowers. (Department of Energy, Environment, Water and Climate Change) [35]

The most important factor influencing the relationship between smoking and the environment is arguably the effects of tobacco growth. It has been stated that the main cause of CO exposure is cigarette smoking. Numerous studies have reported comparatively high levels of COHb in smokers' blood, typically more than 2%, though it's possible that smokers' COHb levels are just a reflection of their level of inhalation [36]. It is estimated that there are about 530 million metric tons of carbon monoxide in the earth's atmosphere at any given time. Ten times this amount is produced annually by both natural and man-made sources. It is estimated that smoking cigarettes produces 0.6 million tons of CO annually worldwide. (HELMUT R. et al. [37])

Detection of carbon monoxide

Using IoT: An ongoing Internet of Things (IoT)-based method that is an affordable substitute for traditional air quality monitoring systems. Leveraging a mobile application, a cheap carbon monoxide detector may warn users of excessive levels of carbon monoxide via sounding and lighting alarms. An integrated system for a vehicle capable of detecting and sensing gases such as carbon monoxide was built using the creation of IoT prototype design and implantation for carbon monoxide detection using the WeMos D1 micro board programmed by Arduino IDE software. The changes in LED's colour showing an increase in the gas concentration. Additional features are included in the suggested system, such as a beeper that will sound on instantly as the gas concentration hits a dangerous level and an alert message that will be sent to the user [38].

Using Cyber-physical systems: Certain Metal Oxide Semiconductors MOS were found to be superior CO sensing materials. MOS can be used as micro- or nano-thin films, CO sensing based on MOS has attracted a lot of interest. Micro-machining, microelectromechanical systems (MEMS), and other techniques can be used to create mini or micro-structured devices using these films. The electrical characteristics of the sensing elements are impacted by the reduction and oxidation reactions between the CO gas and MOS-based chemo-resistive sensors. This alteration in the electrical characteristics aids in the CO detection process [39]

Using nanotechnology assisted sensors: Since the development of nanotechnology, the application of nanoporous and nanostructured materials has resulted from the significant influence of nanoscale features in chemical and gas sensing systems. Consequently, since the development of nanotechnology, materials that are both nanoporous and nanostructured have been used more and more in sensing systems. This trend has accelerated the growth of knowledge and aided in the creation of real products and applications that leverage nanosystems advancements. two types of CO sensors—electrochemical and semiconductor-based sensors provides an overview of how advancements in nanotechnology have enhanced these sensors' capacity to detect CO [37].

Forthcoming perspective - An optimistic outlook for future:

The scope of this article has a primary objective, that is to identify gaseous pollutants that are present in the environment, such as carbon monoxide, carbon dioxide, nitric oxide, sulphur dioxide, and CFCs (chlorofluorocarbons). Artificial Intelligence (AI) is a rapidly developing field of study that uses pollutant sensing probes, detectors or sensors and other tools for identification. These sensors are built into wearables like smart watches to provide the most straightforward and practical method of detection. This allows for the detection of both smoke (from cigarettes) and atmospheric gas pollutants. By using innovative products, people can be warned that they are in a polluted area with danger alarms. As a result, diseases brought on by a contaminated environment are avoided, improving human health.

AI driven smartwatch: CO is a hazardous gas which is likely to be found in elevated concentrations in atmosphere due to various reasons. It not only affects the environmental sustainability but also tremendously increases the mortality rate. Early warning alert people to safeguard themselves from inhaling the deadly gas. For easier access, convenience and smart mobility 'Sensors and Detectors' can be incorporated in wearables such as smartwatches so that people can reap benefit through Smart CO detection, which is under study.

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