

Harnessing the Power of Artificial Intelligence for Environmental Conservation

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(Source: AI World School)

Introduction

In this era of modern technology, environmental degradation is one of the, if not, the most pressing issue. That is why, harnessing modern technology towards climate is not only a necessity, but a vital imperative. Artificial intelligence (AI), with its huge potential has already shown its capabilities to change the world. In the same way, AI's capabilities in mitigating the hazardous impacts on the environment are enormous. Particularly in the fields of monitoring,

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predicting, analyzing, recommending, conserving the environment along with so many other potentials that are still to be navigated. These massive potential of AI can not only lead the way towards environmental conservation but also can ensure sustainable development. With some limitations, AI can significantly play a vital role in the field of climate change.

In this article, firstly, the specific areas where AI can contribute to the environment will be discussed. Secondly, the author will discuss how AI can contribute to sustainable development. Lastly, the challenges of AI in climate change will be discussed.

Environment Conservation and AI

AI has already shown its potential in the field of environment and with its massive capabilities, AI is doing wonders in environment conservation. There are many important sectors AI where is contributing massively for the preservation of the environment. Some of those are following:-

Climate Change: AI's machine learning algorithm can analyze huge data sets and can provide a complete analysis. Climate change is one of the most significant issues the world is facing. Since 1880, the temperature of the earth increases by 0.8% in every decade and the rate of warming is more than double since 1981.² Under these circumstances, AI can provide analyses of dataset of individual indicators such as temperature, greenhouse gas emission, ocean currents and so on. The AI-driven predictive modeling can further anticipate the future changes in the climate.³ These analyses and anticipations will not only provide a better understanding of the impacts of climate change but also will help the decision-makers to take certain policy decisions.

Monitoring the Environment: AI has made promising contributions in remote sensing and observation of the earth. The satellite images, sensors and other sources can provide detailed information about the earth. However, analyzing the huge amount of data is challenging. This is where AI can contribute; it can analyze huge volume of data in a short period of time. The Convolutional Neural Network (CNN) is an example for this which can extract the satellite images. With its convolutional layer, pooling layer, fully connected layer, it can process spatial

² "AI & Sustainability: Artificial Intelligence for Tackling Environmental Challenges," FDM Group, November 3, 2023, <https://www.fdmgroup.com/blog/ai-and-sustainability/>.

³ Abu Rayhan, "AI AND THE ENVIRONMENT: TOWARD SUSTAINABLE DEVELOPMENT AND CONSERVATION," 2023, doi:10.13140/RG.2.2.12024.42245.

data like images.⁴ Besides, real-time monitoring system has made a significant impact in this field which helps to provide early warnings.⁵ With this advanced technology, the air quality, water quality, temperature of a certain region can be easily analyzed. As a result, one can get detailed information about the region which can also help in undertaking policy decisions. For example, to monitor the level of air pollution in different cities, the European Space Agency is using AI which at the same time, is contributing to develop their policies.⁶ One of the initiatives led by the United National Environment Programme (UNEP) is the World Environment Situation Room (WESR) and under this, the International Methane Emissions Observatory (IMEO) monitors and mitigates methane emissions.⁷

Carbon and Greenhouse gas management: AI has the capability to manage and even reduce carbon and other greenhouse gases (GHG). The learning-bases AI can measure the GHG in the atmosphere, identify sources and can recommend what can be done to reduce them. IBM's Green Horizon Project in China is an example of it where it can predict the air pollution, track sources and can suggest what can be done to reduce that.⁸ The carbon capture and sequestration (CCS) system can capture the emission of carbon dioxide and store them underground, so that it does not get released in the environment and pollute it. At the same time, AI, with this CCS system, can process the condition of the captured materials. In this case, AI's machine learning model can analyze various factors and select the most effective one. Not only that, it can even monitor the underground storage sites of carbon, prevent leaks and ensure its long term effectiveness.⁹ The problem of the emission of carbon and other GHGs mostly come from the industrial sectors, such as metal, oil, gas, mining and other industries. AI can effectively decarbonize their operations. For example, Eugenie.ai is developed in California of the United States which is a

⁴ Lev Craig and Rahul Awati, "Convolutional Neural Network (CNN)," Enterprise AI, January 11, 2024, <https://www.techtarget.com/searchenterpriseai/definition/convolutional-neural-network#:~:text=CNNs%20use%20a%20series%20of,layers%20to%20recognize%20detailed%20patterns.>

⁵ Abu Rayhan, "AI AND THE ENVIRONMENT: TOWARD SUSTAINABLE DEVELOPMENT AND CONSERVATION," 2023.

⁶ AZoQuantum, "European Space Agency Shares Space Safety Programme Plans to Tackle Space Debris and Use AI to Boost Cyber-Resilience," November 1, 2023, <https://www.azoquantum.com/News.aspx?newsID=9892>.

⁷ "How Artificial Intelligence Is Helping Tackle Environmental Challenges," United Nations Environment Programme (UNEP), accessed March 20, 2024, <https://www.unep.org/news-and-stories/story/how-artificial-intelligence-helping-tackle-environmental-challenges>.

⁸ Robotix learning solutions private limited, "How AI Is Helping Humans Fight Climate Change | AIWS," AIWS, December 6, 2020, <https://aiworldschool.com/research/how-ai-is-helping-humans-fight-climate-change/>.

⁹ "AI & Sustainability: Artificial Intelligence for Tackling Environmental Challenges," FDM Group, November 3, 2023.

developed emission tracking platform. It combines the satellite images with data and help companies to track, trace and reduce their emissions by 20-30%.¹⁰ In the case of transportation, the AI-based vehicles, with their eco-driving algorithms, ride sharing service and so many other eco-friendly options can make a revolution in the automobile market.¹¹

Disaster Preparedness: The data collected from satellites, sensors and other sources can be used for preparedness of any natural disaster by the AI. According to the FDM Group, the number of natural disasters has increased by five times in the last 50 years.¹² Natural disasters such as hurricanes, wildfires, cyclones have increased drastically. Under these circumstances, AI technology with its advanced algorithms can analyze the historical data, compare it with the current condition and real-time data and can give a prediction about the incoming natural disasters. For example, “Dr. Joseph Cook, a glaciologist, is working in collaboration with Microsoft to understand how microscopic organisms are associated with the melting of the glaciers.”¹³ These early warnings can make the concerned authority take certain steps such as evacuating the place or other necessary steps to protect the lives of the human and other animals. The machine learning algorithm of AI is doing wonders in this field.

Wildlife Conservation: AI-powered cameras and sensors are playing a significant role in conserving wildlife, even in the most remote areas. The comprehensive monitoring system consists of camera trap image analysis, acoustic monitoring, GPS tracking, movement tracking. By this system, individual animals can be tracked along with their population sizes and their migration patterns.¹⁴ The images can give insights about the “elusive and endangered species”.

¹⁰ World Economic Forum, “8 ways AI is helping tackle climate change,” Gavi, the Vaccine Alliance, January 11, 2024, accessed March 20, 2024, https://www.gavi.org/vaccineswork/8-ways-ai-helping-tackle-climate-change?gad_source=1&gclid=CjwKCAjw48-vBhBbEiwAzqrZVMINCx1uuBXDjBtsrI--Pxr7wYdqaZ4J-WUyvy4KdHy4KG33lsjdRRoCwy8QAvD_BwE.

¹¹ Sarath Muralreedharan, “Artificial Intelligence and Environmental Sustainability,” EcoMENA, January 30, 2024, <https://www.ecomena.org/artificial-intelligence-environmental-sustainability/>.

¹² “AI & Sustainability: Artificial Intelligence for Tackling Environmental Challenges,” FDM Group, November 3, 2023.

¹³ Robotix learning solutions private limited, “How AI Is Helping Humans Fight Climate Change | AIWS,” AIWS, December 6, 2020.

¹⁴ Lev Craig and Rahul Awati, “Convolutional Neural Network (CNN),” Enterprise AI, January 11, 2024.

At the same time, the illegal trade networks can be identified by dint of this technology and with the facial recognition technology, even the traffickers can be identified.¹⁵

AI and Sustainable Development

AI is leading the way towards sustainable development by ensuring long term preservation of the environment. Renewable energy, waste management, agriculture, urban planning- are some of the areas that AI is making immense contributions towards sustainable development.

AI, in the case of waste management, has proved to be a smarter and more efficient option. The AI-proved waste management system and recycling algorithms have facilitated the process of waste collection and the sorting process. At the same time, the machine learning system is playing a huge role in the recycling process as it helps to separate between recyclable and non-recyclable wastes. For example, Greyparrot is a company that uses AI to recycle and process wastes.¹⁶ The huge storage of historical data along with its real-time inputs helps analyze the collection routes.¹⁷ According to the United States Environmental Protection Agency, 16% of global GHGs consist of methane and these wastes are sources of methane.¹⁸ Thus, it makes the way towards sustainable and resilient cities where certain factors like green spaces, infrastructure optimization are ensured. Along with waste management, usage of renewable energy, lesser consumption of fuel from vehicles, low carbon emissions- all these lead towards a city to become a smart one.¹⁹

AI has led the way towards the production of more sustainable energy. The renewable energy sources such as wind turbines, solar panels can work more efficiently with the help of AI. For example, in the cases of weather-driven energy productions, AI, with its real time inputs and analyzing capabilities, can predict the weather conditions which can help produce more clean energy. Thus, on one hand, it ensures clean energy and on the other hand, it becomes

¹⁵ CloudDevs, "The Role of AI in Environmental Conservation: Protecting Nature," December 30, 2023, <https://clouddevs.com/ai/environmental-conservation/>.

¹⁶ "TechCrunch Is Part of the Yahoo Family of Brands," February 7, 2024, <https://techcrunch.com/2024/02/07/greyparrot-bollegraaf/>.

¹⁷ "AI & Sustainability: Artificial Intelligence for Tackling Environmental Challenges," FDM Group, November 3, 2023.

¹⁸ World Economic Forum, "8 ways AI is helping tackle climate change," Gavi, the Vaccine Alliance, January 11, 2024, accessed March 20, 2024

¹⁹ Abu Rayhan, "AI AND THE ENVIRONMENT: TOWARD SUSTAINABLE DEVELOPMENT AND CONSERVATION," 2023.

economically more viable. With the capabilities in the field of renewable energy, AI is making a revolution. In buildings and commercial areas, AI can ensure energy efficiency in buildings and factories by controlling the heating, lighting, cooling processes.²⁰ In the electric grids, AI can contribute in energy consumption by handling power fluctuations.²¹ At the same time, it ensures lower carbon emissions which contribute massively in conserving the environment.

In the field of food production and agriculture, AI can lead to more sustainable and efficient agricultural practices. With the facility of real-time monitoring, AI can provide farmers the necessary data on soil conditions, weather conditions, crop health. As a result, farmers can grow crops more efficiently and also be aware of harming the environment. Pesticides can cause severe damage to the elements of the environment such as water, soil. By managing the pesticides, AI can ensure environmental sustainability. According to European Parliament, precision agriculture can lead a 20-30% decrease in the use of pesticides.²²

Conclusion

The potential of AI in environmental conservation is beyond imagination. It has already proved its capabilities in several fields including the disaster-prone areas, extreme weather areas and by provided early warning, it has saved thousands of lives. Although there are many challenges on quality of data, ethical considerations, biases, availability of data and so on, its capabilities the preservation of the environment is undeniable. But its availability is one of the main concerns. As many of the climate affected regions lack technological awareness, the limited access of AI is a challenging issue. With more availability and access, it can do wonders in this field.

²⁰ “AI & Sustainability: Artificial Intelligence for Tackling Environmental Challenges,” FDM Group, November 3, 2023.

²¹ Robotix learning solutions private limited, “How AI Is Helping Humans Fight Climate Change | AIWS,” AIWS, December 6, 2020.

²² CropLife Europe, “Digital & Precision Agriculture - CropLife Europe,” November 9, 2023, <https://croplifeeurope.eu/farmers-toolbox/digital-and-precision-agriculture/#:~:text=The%20Scientific%20Foresight%20Study%20published,area%20where%20pesticides%20are%20applied.>