POTENTIALS OF ARTIFICIAL INTELLIGENCE IN CLIMATE CHANGE MITIGATION AND ADAPTATION IN NIGERIA

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Abstract

All over the world over, climate change has become a burning issue and the consequences negatively impact public health. While Artificial Intelligence (AI) keeps on establishing itself in the current day-to-day lives, posing threats to our security and privacy, it also has potentials to solve complex technical problems such as climate change which has become a serious global threat requiring innovative solutions. Several studies on artificial intelligence and climate change, specifically on climate change mitigation, adaptation and prediction, were thoroughly reviewed. The goal of this article is to review the causes and effects of climate change in addition to reviewing the potentials of AI as an instrument for climate change mitigation, adaptation and prediction in order to inspire appropriate policymaking in Nigeria. This article therefore highlights the potentials of AI in tackling the scourge of climate change, advocating critical policy issues in Nigeria that may be associated with its use in reducing greenhouse-gas emissions.

Keywords: Artificial Intelligence, Climate Change, Mitigation, Adaptation, Policy.

Introduction

Climate change has become a serious issue of concern and its consequences negatively impact public health, globally. It is claimed that robots will soon take over the workforce and that artificial intelligence (AI) has the ability to launch an uncoordinated attack using machine learning. Despite the myriads of dangers AI poses, there still exist many of its beneficial potentials. AI can be described as a system of approaches aimed at advancing certain aspects of human or animal cognition using machines (Ryan, 2020). AI exists in various dimensions of which the most popular is machine learning. Machine learning is a technology that is used to make projections that functions best when using large amounts of data and computing capacity. The use of AI has evolved over the years, from using AI for recreational purposes such as photography and video, into more technical ones which include border surveillance, emergency and response protocols, precision agriculture and infrastructure inspections (Shakhatreh *et. al.,* 2019).

Climate change has become a global troubling question, and the moves towards addressing it involve both mitigation of carbon emissions and adaptation to its effects. Worldwide researches on global warming have led to the conclusion that increases in greenhouse gas emissions due to

anthropogenic activities and increasing industrialization have been the predominant causes of the bizarre increases in global temperature, developing as well technological frontiers to address climate change using AI (Dheeshjith *et. al.,* 2024; Deshmukh *et. al.,* 2024). This review not only explores the potentials of AI in tackling the scourge of climate change, advocating critical policy issues in Nigeria that may be associated with its use in reducing greenhouse-gas emissions, but also examines reports of researchers on the value of AI in fighting climate change in addition to how it can be used for mitigation and adaptation, advocating a more ambitious use in Nigeria.

Causes of Climate Crisis

Climate change is essentially caused by anthropogenic activities, involving many complicated elements which contribute to its aggravation. Fossil fuel combustion, deforestation, industrial activities, automobile transportation, and agricultural practices are significant sources of anthropogenic emission of greenhouse gases, including methane (CH_4), carbon dioxide (CO_2), and nitrous oxide (N_2O). These emissions create the greenhouse effect, causing warming of the atmosphere and resultant changes to the global climate system (Walleser, 2021).

Effects of Climate Crisis

Climate change has severe and long-term consequences for natural ecosystems and human communities. Rising global temperatures alter weather patterns leading to an increased intensity and frequency of severe weather manifestations such as storms, floods, droughts, and heat waves. The sea-level rises as a result of the melting ice caps and glaciers, threatening coastal cities and towns and increasing the danger of floods and erosions. Shifts in precipitation and temperature regimes undermine agricultural output, jeopardize food security, and worsen water shortages in many areas. The climate crisis has severe consequences for biodiversity, including habitat loss, species extinction, and disturbances to ecosystem functioning and services. Human health is also affected with higher risks of heat-related illnesses, vector-borne infections, respiratory problems, and hunger (Malliaraki, 2020).

Addressing climate change demands a thorough knowledge of its sources and consequences, as well as coordinated actions for the abatement of greenhouse gas emissions and a timely adaptation to changing climatic conditions. By recognizing the gravity of the situation and its far-reaching repercussions, concerted efforts should be taken implement practical solutions fighting, mitigating and adapting it in order to create a more sustainable future.

Reducing Emissions from Artificial Intelligence Itself

The present over-reliance of electricity on fossil fuels is one major way AI contributes to climate change. As such, it is imperative to examine ways by which emissions can be reduced from AI itself. The emissions of greenhouse gas from AI could be reduced in various ways. Firstly, by improving energy efficiency. AI-based companies should make the use of AI to be more energy-efficient, for instance, by enabling a reduction in the energy needed for cooling in data centres or using more efficient hardwares (Lacoste *et. al.*, 2019). Secondly, by cutting down on the amount of data used in training AI models (Toews, 2020). Moreover, it is better to cut down on the size of the AI models and not just data alone. Employing larger models in order to accomplish smaller progress, yields diminishing returns which stand implausible through the lens of climate change (Toews, 2020; Zheng, 2018).

Mitigating Climate Change Using Artificial Intelligence

Mitigating climate change implies reducing the stream, into the atmosphere, of heat-capturing greenhouse gases. The following are means by which greenhouse gases can be cut from their main sources.

- *More Efficient Use of energy*

AI applications can be used for more adept utilization of energy in the society such as the construction of more energy-efficient infrastructure. In addition, AI can be used for cleaner innovations which include design of improved materials for solar panels, deforestation monitoring, greener transportation and creation of low-carbon materials. Furthermore, AI can make energy supply more efficient through the allocation of fossil-free energies (Rolnick *et. al.*, 2022).

- *Climate Models*

Using AI for improving climate models is another mitigation measure (Rolnick *et. al.*, 2022). AI can provide with precision, information on climate change and its impacts which then can be used by governments, communities, companies and individuals to reduce the emission of greenhouse gases into the atmosphere.

- *Guiding Human Behaviour*

AI can be employed for the purpose of guiding human behaviour in a climate-friendly manner. AI can also be useful for governments in attaining sub-national, national and global climate change goals by making climate regulations and policies more operative and strategic (Coeckelbergh, 2021).

Artificial Intelligence for Adaptation

Adaptation, being a practice of adjusting to actuated or projected climate change, is typically locale- or sector-specific (Field *et. al.*, 2014). Below are some measures for the employment of AI in adapting to climate change.

- *Increased security, efficiency and use of energy*

The use of AI can increase the security of electric grids. Also, it could upgrade efficiency, thereby reducing the demand for energy (Rolnick *et. al.*, 2022).

- *Prevention and resilience boost*

AI could enhance the resilience of building designs, bridges, roads, and sea walls in addition to endearing improved water pollution prevention and disease spread (Victor, 2019; Rolnick *et. al.*, 2022).

- *Optimized weather forecasting*

With AI providing precise weather forecasts, there can better protection from extreme weather events. For example, AI can help predict the course, size and extent of hurricanes and storms in addition to the onsets of floods and droughts. Additionally, the provision of systems for agricultural forecast in good time may help adjustments in seeds, cropping methods, and planting times in order to cut down the deleterious effects of unfavourable weather scenarios (Rolnick *et. al.*, 2022).

AI Techniques in Climate Prediction

According to Dilshodjon 2024, Convolution Neural Networks (CNNs), Random Forests and Decision Trees (RFs-DTs), Generative Adversarial Networks (GANs), and Support Vector Machines (SVMs) are AI techniques proven to be particularly effective in climate change prediction, through analysis of spatial and temporal climate data, classification and regression tasks in climate science, detection of patterns that indicate changes in climate behavior, and generation of synthetic climate data that can augment existing datasets, respectively.

Applications of AI-driven climate predictions

Climate predictions driven by AI can be applied in extreme weather forecasting, carbon emission tracking, agricultural planning, and urban planning, using models that can analyze past weather patterns and current conditions through provision of early warnings, monitoring and predicting carbon emissions from various sources, informing agricultural decisions such as crop selection and irrigation planning in order to forecast seasonal weather patterns, aiding farmers in optimizing their yields, and designing buildings to withstand extreme weather, respectively (Dilshodjon, 2024).

Future of AI Use in Tackling Climate Change in Nigeria

With the growing awareness of the climate crisis, Nigeria will have to keep up with the rest of the world to achieve breakthroughs in AI-driven climate solutions. Research institutions, private sectors and the government, all must create concerted initiatives to build state-of-the-art AI researches in addition to developmental frame works in order to solve intricate climate issues. More significantly, the role of AI in the fight against climate change in Nigeria will be defined by the implementation of policies and rules that foster the expansion of AI-driven solutions. The government, across all levels, will have to enact regulatory frameworks to deploy AI technologies that combat the climate crisis. Basically, Nigeria can inspire the rest of Africa through enterprising advocacies to cut down greenhouse gasses emission.

Conclusion and Recommendations

Though climate change is a global phenomenon, its impact in Africa might be greater compared to other parts of the world due to the current lag in technology which results in relatively low shock tolerance of many African countries, Nigeria not being an exception. Hence, a coordinated effort is an urgent necessity for a sustainable policymaking on AI that would address the issues of climate change in Nigeria. No doubt, AI has its own disadvantages. However, its potentials can be harnessed to monitor and reduce greenhouse gas emissions, in addition to assisting in climate change prediction, mitigation, and adaptation in Nigeria. It is recommended that Nigeria should immediately emulate the developed countries of the world which have already tapped into AI for solutions to climate change crises.

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