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## THE BENEFITS OF ARTIFICIAL INTELLIGENCE TO ADDRESS THE CHALLENGES OF CLIMATE CHANGE

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### **Abstract:**

Climate change represents one of the serious challenges of modern times, with profound consequences for ecosystems, the economy and everyday life. In this context, Artificial Intelligence (AI) is increasingly recognized as a powerful tool used to recognize and manage complex climate processes. This paper explores concrete applications of AI in the fight against climate change, analyzing how these systems are used in energy, agriculture, risk management. Special attention is paid to ethical challenges such as bias, transparency and energy consumption, which accompany the application and development of AI technologies.

**Keywords:** Artificial Intelligence, Climate change, Energy efficiency, Sustainable development.

### **Introduction**

Climate change is one of the most significant challenges facing the world today. Its consequences manifested through rising temperatures, prolonged dry seasons, and more frequent extreme weather events affect ecosystem stability, resource availability, and human quality of life. In such a context, it is evident that traditional approaches to environmental protection are insufficient, necessitating the introduction of advanced technological solutions that enable faster and more effective responses to climate risks.

Artificial intelligence (AI) has recently been increasingly recognized as a key parameter in the fight against climate change. Based on its ability to process large amounts of data, recognize patterns and possibly predict upcoming events, AI is used in a wide range of sectors: including agriculture and animal husbandry, forestry to energy, natural resource

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management [1,2,3]. Climate change is one of the most important challenges facing the world today. Consequences manifested through rising temperatures, prolonged dry seasons, more frequent weather events, affect the stability of the ecosystem, the availability of resources and the quality of life of people. With such a context, it is clear that the traditional approaches that people have towards environmental protection are insufficient, so it is necessary to introduce more advanced technological solutions that will enable a faster and more efficient response to climate risks.

Artificial intelligence (AI) has recently been increasingly recognized as a key parameter in the fight against climate change. Based on its ability to process large amounts of data, recognize patterns and possibly predict upcoming events, AI is used in a wide range of sectors: from agriculture and animal husbandry, forestry to energy, natural resource management [1,2,3]. Smart irrigation systems, yield and plant disease prediction algorithms, monitoring of forest areas through satellite images, as well as existing models for forecasting production from renewable energy sources [4,5].

In addition to the many potentials offered by AI, it also faces several ethical and technical challenges, such as privacy protection, energy consumption of AI systems, and the availability of technologies.

This paper will analyze the basic challenges of climate change, concrete ways in which AI is used for adaptation and facilitation, ethical and technical challenges of implementation, as well as successful examples from practice that are widely used.

### **1. The role of Artificial Intelligence in the Fight Against Climate Change**

Climate changes require new, more efficient, technologically correct and advanced approaches for their mitigation and adaptation. Artificial intelligence with its properties of analyzing large amounts of data, recognizing patterns and predictive complex models, is becoming a very important tool. The application of AI is not limited to one sphere, but is used in a wide range of areas related to environmental protection, reducing gas emissions and increasing the environment's resistance to climate change.

One of the more important contributions of AI is in climate modeling and data analysis. When machine learning is used, it is possible to improve the accuracy of prediction of weather phenomena, temperature rise at the local and global level. Rolnick et al. [6] emphasize that AI offers the possibility of improving climate models that are integrated based on data obtained from satellites, meteorological stations and sensor networks, where the quality and speed of assessment of potential climate risks are significantly improved.

In the energy sector, AI is mainly used to optimize production from renewable sources, such as solar panels and wind farms. Accurate weather forecasts generated by the AI system enable more stable operation of networks and more efficient management of energy consumption, which is very crucial for reducing reliance on fossil fuels [6]. Similarly, in urban environments, AI contributes to smarter management of infrastructure and energy resources. Hamedani & Aslam [7] point to the role of AI in the development of "smart cities" that reduce gas emissions and optimize traffic, public lighting and air conditioning.

Coastal areas, which are vulnerable to the effects of sea level rise and weather extremes, represent another important field where AI can be applied. Adewale [8] uses AI algorithms for flood analysis and prediction that allows local communities to prepare in advance and plan adequate protection. They use a similar approach to monitor the degradation of mangrove forests. Rahmila et al. [9] emphasize that AI offers the property of spatial qualification of endangered areas, which contributes to the preservation of coastal ecosystems and the planning of potential interventions.

In addition to technical solutions, AI contributes to the improvement of research related to climate change. Kayusi et al. [10] state how important its role is in the processing of large scientific databases, trend synthesis and support. Their analysis indicates that AI already has applications in these scenarios. However, it is important to note that any use of AI must be carefully planned and with fair availability of technology and data privacy protections.

## **2. Ethics, challenges and limitations of the application of artificial intelligence**

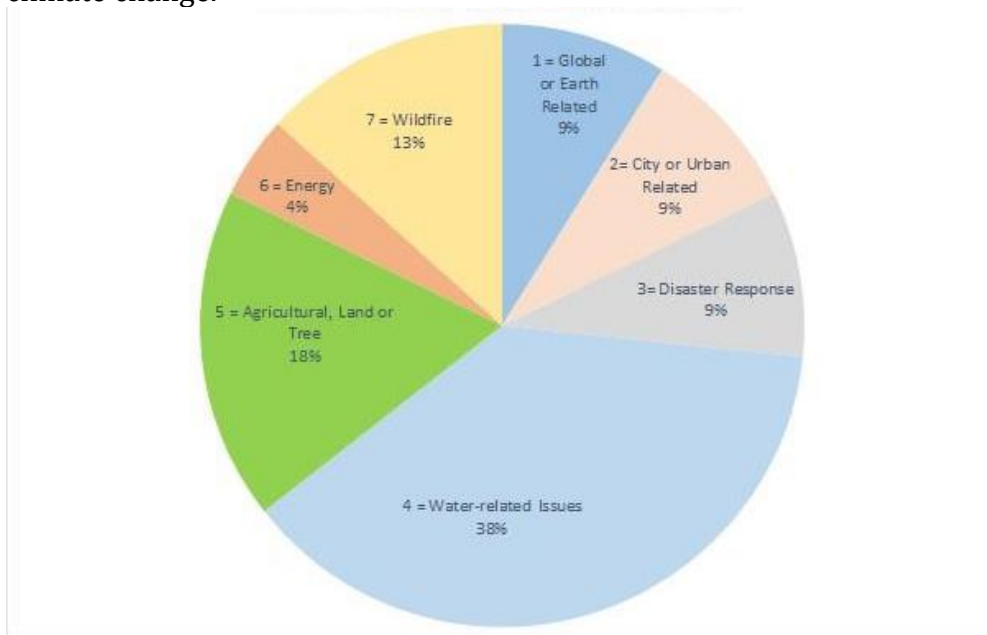
The rapid development of AI opens up very significant opportunities for adapting to climate change. In addition to the potential that AI offers, there is also much attention being paid to the ethical, legal and social challenges. The use of complex algorithms in a high-risk environment, such as ecosystem management and energy infrastructure, must be accompanied by appropriate norms of responsibility, fairness and transparency.

One of the key challenges is bias in algorithms and unequal access to technologies. Algorithms are trained so that if they come into contact with inadequate or locally unreliable data, they can result in decisions that will harm certain regions, especially developing countries. Cowles et al. [11] warn that AI systems often reproduce systemic inequalities and that their implementation without checking ethical criteria can exacerbate climate injustice.

In addition, there is a problem regarding the transparency and interpretability of the model. A large number of AI systems behave like "black boxes" where they do not show clear insight into decision-making. Without clear decision-making, verification and public control are difficult. Simoes et al. They emphasize the need to develop procedures that would be able to understand the decisions that models will make in climate management processes [12] An additional aspect that is also important is how AI technologies leave an imprint on ecology. Although AI is seen as a tool that contributes to environmental protection, testing large models (using an enormous amount of data) also requires a huge amount of energy. Shahi & Singh point out that the implementation of AI systems in the context of sustainability must be accompanied by an analysis of the impact on energy consumption and gas emissions. Otherwise, there is a risk that technology that was created to solve climate problems will be part of a new problem [13]. Also, there are shortcomings in the legal and institutional framework for regulating the use of AI in climate contexts. Filho et al. [14] indicate that most countries do not have developed procedures, standards for monitoring and evaluation that would be performed on AI systems. This lack can lead to misuse of technology and non-transparent management of risks that are most exposed to the consequences of the climate.

### 3. Examples of successful Application of Artificial Intelligence

AI in the context of climate change is no longer limited to experimental and theoretical parts. Numerous studies and concrete cases show that AI has practical applications, especially in areas that are essential for climate sustainability. Picture 1 shows the key points and sectors where AI technologies are already successfully used to mitigate the effects of climate change.



**Picture 1.** Key points of application of AI in climate change management [14]

A very important area of application of AI is the sector for renewable energy and energy efficiency. Cowles et al. [11] state that machine learning can be used to accurately forecast wind and solar energy production, which will contribute to a better balance of production and consumption in real time. In this way, energy systems become resistant to fluctuations in production, which will also reduce reliance on fossil fuels. Also, AI enables the optimization of energy consumption in buildings with the help of intelligent systems that manage cooling, heating, etc.

In the domain of climate change, Filho et al. [14] show how AI is applied in the detection of signs of droughts and floods, where data obtained from meteorological stations and satellite images are processed. Based

on these analyses, a pre-planned distribution of resources is carried out, irrigation is ensured and the community is informed about potential dangers.

In the field of climate-smart agriculture, Forooq et al. [15] show the application of deep learning algorithms where yields are improved under conditions of stress caused by climate change, which significantly contributes to food security in affected regions.

#### **4. Conclusion**

AI is increasingly recognized as a very powerful tool that contributes to the fight against climate change, not only in the domain of theory and research, but also in implementation in sectors such as agriculture, environmental protection, risk management, etc. The ability of AI to process large amounts of data, predict potential risks and optimize resources to make more effective decisions in conditions where climate challenges are most pronounced.

The development of AI solutions in industries that were less connected to digitalization, such as textile industries, also deserves attention. Modern AI systems enable much better management of supply chains, prediction of all possible consumption and reduction of waste in the production of garments. In this way, AI also contributes to the maintenance of the fashion and textile industry, making it compatible with environmental requirements and climate goals in the future.

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