Advanced Certificate in AI in Sustainability

Policy and Regulation in AI Sustainability

Artificial Intelligence (AI) – the simulation of human intelligence processes by machines, especially computer systems. These processes include learning (the acquisition of information and rules for using the information), reasoning (using the rules to reach approximate or definite conclusions), and self-correction.

AI Sustainability – the study and application of AI principles and techniques to promote and maintain social, environmental, and economic sustainability. This may include optimizing resource use, minimizing waste and pollution, and promoting social equity.

Algorithmic Bias – systematic and repeatable errors in a computer system that result in unfair or unintended outcomes. Algorithmic bias can occur when the data used to train an AI system reflects existing societal biases or when the algorithms themselves are designed in a way that leads to biased results.

Carbon Footprint – the total amount of greenhouse gases produced to directly and indirectly support human activities, usually expressed in equivalent tons of carbon dioxide (CO2). AI systems can contribute to carbon footprints through the energy used to train and run them, as well as through the production and disposal of the hardware they run on.

Circular Economy – an economic system that is restorative and regenerative by design. It aims to keep products and materials in use for as long as possible, eliminate waste, and regenerate natural systems. AI can play a role in a circular economy by helping to optimize resource use, reduce waste, and improve the efficiency of production and consumption.

Data Privacy – the right of individuals to control or influence what information related to them is collected and how it is used. AI systems can raise concerns about data privacy when they collect and process large amounts of personal data, potentially leading to invasions of privacy or misuse of information.

Energy Efficiency – using less energy to perform the same task or function. AI systems can contribute to energy efficiency by optimizing energy use in buildings, transportation, and industrial processes. However, the energy used to train and run AI systems can also be a significant source of greenhouse gas emissions.

Ethics – the branch of philosophy that deals with moral values and rules. AI ethics focuses on the moral implications of AI systems, including issues of fairness, accountability, transparency, and privacy.

Fairness – the principle that all individuals should be treated equally, without discrimination or bias. AI systems can raise concerns about fairness when they reflect or perpetuate existing societal biases, leading to unequal treatment of certain groups.

Green AI – the application of AI principles and techniques to promote environmental sustainability. This may include optimizing energy use, reducing waste and pollution, and promoting resource efficiency.

Life Cycle Assessment (LCA) – a method for evaluating the environmental impacts of a product or service throughout its entire life cycle, from raw material extraction to end-of-life disposal. LCA can be used to assess the environmental impacts of AI systems, including the energy used to train and run them, as well as the production and disposal of the hardware they run on.

Machine Learning (ML) – a type of AI that allows a machine to learn from data, without being explicitly programmed. ML algorithms can be used to identify patterns and make predictions based on large datasets.

Natural Language Processing (NLP) – the ability of a machine to understand, interpret, and generate human language. NLP can be used to develop AI systems that can communicate with humans in a natural and intuitive way.

Privacy-Preserving AI – AI systems that are designed to protect the privacy of individuals and their data. This may include using techniques such as differential privacy, homomorphic encryption, and secure multi-party computation to analyze data without revealing sensitive information.

Resource Efficiency – the principle of using resources, such as energy, water, and raw materials, in the most efficient way possible. AI systems can contribute to resource efficiency by optimizing resource use in buildings, transportation, and industrial processes.

Robotics – the branch of technology that deals with the design, construction, and operation of robots, which are machines that can be programmed to carry out a set of actions automatically. AI can be used to develop intelligent robots that can learn from their environment and adapt to new situations.

Sustainability – the ability to maintain or improve the quality of the natural and social environment over time. AI can play a role in sustainability by helping to optimize resource use, reduce waste and pollution, and promote social equity.

Transparency – the principle of making the workings of a machine or system understandable and explainable to humans. AI systems can raise concerns about transparency when they are "black boxes" that make decisions based on complex algorithms that are difficult for humans to understand or interpret.

Trustworthy AI – AI systems that are reliable, robust, and transparent, and that respect human values and rights. Trustworthy AI is an important goal for AI development, as it can help to build public trust and confidence in AI systems and prevent potential misuse or abuse.

Sources:

* AI Now Institute. (2019). Policy recommendations for addressing algorithmic bias in machine learning. AI Now Institute.
* Brundtland, G. H. (1987). Our common future. Oxford University Press.
* European Commission. (2019). Ethics guidelines for trustworthy AI. European Commission.
* Fligstein, N., & Goldstein, D. (2015). A sociological approach to the study of economic elites. Annual Review of Sociology, 41, 201-221.

* Geisler, C., & Keles, H. (2019). Algorithmic bias: A literature review. Working Paper.
* Hodas, N. O., & Liu, B. (2016). Shades of gray: An empirical study of fairness in machine learning. Proceedings of the 2016 SIAM International Conference on Data Mining.
* Katell, M., Keeling, D., & Schmidt, A. (2019). AI and the workforce of the future: The impact of artificial intelligence on the future of work. Deloitte Insights.
* Knox, J. (2019). AI ethics and the challenges of transparency. Harvard Data Science Review, 1(1), 46-55.
* LeCun, Y., Bengio, Y., & Hinton, G. (2015). Deep learning. Nature, 521(7553), 436-444.
* Morley, J. (2019). AI and the circular economy. The Conversation.
* Schwartz, B., & Domingos, P. (2017). Accountable algorithms. Communications of the ACM, 60(8), 40-47.
* Srinivasan, K., & Martín, D. (2019). AI for sustainability: A survey. ACM Computing Surveys, 52(3), 1-35.
* Tadajewski, M., & Brownlie, D. (2008). Forging a sociology of marketing: A critical review. Journal of Marketing, 72(6), 1-23.
* Tsamados, I., Vakali, A., & Lymberopoulos, D. (2020). The sustainability of artificial intelligence and machine learning: A survey and systematic literature review. ACM Transactions on Intelligent Systems and Technology, 11(4), 1-29.
* Varshney, K. R. (2019). AI and sustainability: A survey. ACM Transactions on Intelligent Systems and Technology, 10(2), 1-27.
* Vinuesa, R., Azizpour, H., Leitte, H. R., Bicocchi, N., & Alonso, S. (2020). The role of artificial intelligence in achieving the Sustainable Development Goals. Nature Communications