UNRAVELING EARTH'S COMPLEXITIES: ARTIFICIAL INTELLIGENCE IN GEOECOLOGY

K. Lewita [1, 2], T. Miller [2, 3]

[1] University of Szczecin
[2] Polish Society of Bioinformatics and Data Science BIODATA, Szczecin, Poland
[3] The Institute of Marine and Environmental Sciences, University of Szczecin

Abstract:

Artificial intelligence (AI) has the potential to revolutionize the field of geoecology by providing advanced tools for analyzing complex ecological and geological processes. This short communication discusses the integration of AI in geoecology, focusing on landform analysis, natural hazard prediction, ecosystem modeling, remote sensing, environmental monitoring, and sustainable resource management. By leveraging AI technologies, researchers and practitioners can gain valuable insights into geoecological interactions, informing decision-making and promoting environmental sustainability.

Keywords: Artificial intelligence, Geoecology

Introduction:

Geoecology is an interdisciplinary field that examines the interactions between geological processes and ecosystems, aiming to understand the complex dynamics that shape our environment. With the rapid advancement of AI, new opportunities have emerged for enhancing our understanding of geoecological processes and addressing environmental challenges. This communication explores the potential applications of AI in geoecology and their implications for environmental sustainability.

1. Landform Analysis:

AI-driven algorithms can analyze high-resolution topographic data to identify and classify various landforms, such as rivers, mountains, and valleys. By automating landform analysis, researchers can gain a better understanding of geomorphic processes, contributing to improved land management and conservation strategies.

2. Natural Hazard Prediction:

AI-powered predictive models can be used to forecast natural hazards, such as earthquakes, landslides, and floods, by analyzing diverse datasets and detecting patterns associated with these events. These models can help in the development of early warning systems and disaster risk reduction strategies, ultimately minimizing the impacts of natural hazards on human populations and ecosystems.

3. Ecosystem Modeling:

AI can support the development of complex ecosystem models that simulate the interactions between geological processes and ecological systems. By incorporating large-scale environmental and geological data, AI-driven models can provide insights into the drivers of ecosystem dynamics and inform management strategies aimed at maintaining ecosystem health and resilience.

4. Remote Sensing:

AI can enhance remote sensing applications in geoecology by automating the analysis of satellite and aerial imagery. AI-powered algorithms can extract valuable information from these images, such as vegetation cover, soil properties, and land use patterns, providing essential data for monitoring and managing geoecological processes.

5. Environmental Monitoring:

AI can support real-time environmental monitoring by analyzing data from various sensors, such as seismometers, weather stations, and air quality monitors. By processing large volumes of data in real-time, AI can detect anomalies and trends, informing timely interventions and adaptive management strategies.

6. Sustainable Resource Management:

AI can assist in sustainable resource management by optimizing the extraction and use of natural resources, such as minerals, water, and energy. AI-driven models can identify resource inefficiencies and provide recommendations for sustainable practices, ultimately promoting environmental conservation and economic development.

Conclusion:

Artificial intelligence has the potential to transform the field of geoecology by offering advanced tools for analyzing complex ecological and geological processes. By integrating AI technologies into geoecological research and practice, we can gain valuable insights into the interactions between geological processes and ecosystems, ultimately informing decision-making and promoting environmental sustainability.

REFERENCES

1. John E. Estes, Charlene Sailer & Larry R. Tinney (1986) Applications of artificial intelligence techniques to remote sensing, The Professional Geographer, 38:2, 133-141, DOI: 10.1111/j.0033-0124.1986.00133.x

2. Yassine Himeur, Bhagawat Rimal, Abhishek Tiwary, Abbes Amira. Using artificial intelligence and data fusion for environmental monitoring: A review and future perspectives. Information Fusion; Vol. 86–87 (2022):44-75. ISSN 1566-2535. https://doi.org/10.1016/j.inffus.2022.06.003

3. Xiaojun Xiang, Qiong Li, Shahnawaz Khan, Osamah Ibrahim Khalaf. Urban water resource management for sustainable environment planning using artificial intelligence techniques. Environmental Impact Assessment Review Vol. 86 (2021): 106515. ISSN 0195-9255. https://doi.org/10.1016/j.eiar.2020.106515

4. Dede, V., Turan, İ.D., Dengiz, O. *et al.* Effects of Periglacial Landforms on Soil Erosion Sensitivity Factors and Predicted by Artificial Intelligence Approach in Mount Cin, NE Turkey. *Eurasian Soil Sc.* 55, 1857–1870 (2022). https://doi.org/10.1134/S106422932260138X

5. Tan, L., Guo, J., Mohanarajah, S. *et al.* Can we detect trends in natural disaster management with artificial intelligence? A review of modeling practices. *Nat Hazards* 107, 2389–2417 (2021). https://doi.org/10.1007/s11069-020-04429-3

МАТЕМАТИЧНА МОДЕЛЬ ДЛЯ ВИМІРЮВАННЯ СТАБІЛІЗАЦІЙНОГО ВІДБОРУ НА МОРФОЛОГІЮ АНТАРКТИЧНОГО МОЛЮСКА *NACELLA CONCINNA* (STREBEL, 1908)

Ю.Г. Беспалов[1], А.Є. Березкіна[2], М.Ю. Шрестха [1], А.Ю. Утєвський [1]

[1] Харківський національний університет ім. В.Н. Каразіна
[2] Інститут рибного господарства НААНУ
y.bespalov@karazin.ua

Представлені результати математичного моделювання системних ознак впливу стабілізуючого відбору на морфологію антарктичних молюсків. Ці результати отримані з використанням дискретного моделювання динамічних систем. Згадані системні ознаки можуть бути використані як маркери впливу на гомеостаз екосистем глобальних кліматичних змін.

Ключові слова: дискретне моделювання динамічних систем, морфологія, антарктичні молюски, гомеостаз екосистем, глобальні кліматичні зміни.