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Popular Article

Transforming Aquatic Health Management: The Power of Artificial Intelligence

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Introduction

Aquatic ecosystem health and well-being are crucial for environmental preservation, sustainable fisheries and human welfare. There is a rising need for effective and efficient management solutions due to the problems that are being posed by pollution, climate change, and overexploitation. Artificial intelligence (AI) has become a potent tool in recent years, providing creative approaches for tracking, evaluating, and defending aquatic ecosystems. It is an area of computer science that tries to give robots the ability to learn to emulate the cognitive processes of living creatures and make decisions based on prior experiences. Machine learning, which is a branch of AI, mimics natural behavior. Studying algorithms and statistical models that computer systems employ to carry out certain tasks with little human assistance is one of the specialized scientific methodologies now used for AI research (Mustapha et al., 2021). The present article examines the diverse uses of AI and scrutinizes how it has the potential to revolutionize aquatic health management.

Keywords*:* AI, Aquatic Health, Data Collaboration, Smart Technology.

Enhanced Monitoring and Early Detection

The manual observation used in traditional monitoring of aquatic ecosystems may be time-consuming, labor-intensive and chances of human error. AI technologies, such as machine learning

and computer vision, have revolutionized monitoring capacities by enabling the automatic analysis of massive volumes of data gathered from sensors, satellites and underwater cameras. This makes it possible to continuously and in real-time monitor changes in ecosystem dynamics, biodiversity and also water quality parameters. Artificial intelligence (AI) systems can recognize minute variations in variables like temperature, pH, dissolved oxygen (DO) and nutrient concentrations, giving early notice of possible ecological disturbances or dangerous algal blooms. Future results can be predicted using AI algorithms that analyze based on previous data to find patterns and correlations that are difficult for humans to see or observe since AI offers the chance to resolve problems that are based on expertise and background knowledge to get pertinent information and make discoveries that previously depend on professional's experience. To provide high accuracy (99.99%) in prediction by removing external effects, research improvement is required to enhance statistical models and algorithms under AI and machine learning (Mustapha et al., 2021).

Predictive Modelling and Decision Support Systems

AI is essential for creating prediction models that mimic how aquatic systems will behave in certain conditions. The financial damage brought on by floods from excessive rainfall and improper water quality parameters, such as DO, pH, etc., may be avoided with proper meteorological and water environment forecasting. Even the smallest increase may significantly improve decision-making in weather prediction. By increasing accuracy and efficiency, AI and data mining close the gap between real-time guidance and prediction utilizing numerical models (Mustapha et al., 2021). Understanding the effects of numerous stressors, such as pollution, climate change, and habitat loss, on aquatic ecosystems is made easier with the use of these models. They support decision-makers and resource managers in their efforts to sustainably manage fisheries, marine protected areas, and water resources.

Disease Detection and Aquaculture Management

Maintaining the health and productivity of confined populations is a big concern for aquaculture, which involves culturing fish, shellfish and aquatic plants. In aquaculture settings, AI-based systems provide creative approaches to disease detection, early diagnosis and treatment monitoring. Machine learning algorithms can analyze vast datasets of fish behavior, physiological characteristics, and environmental circumstances to spot symptoms of stress, disease outbreaks, or poor water quality. Aquaculturists can quickly take preventative action, which minimizes financial

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losses and lowers the need for the addition of antibiotics or pesticides.

Ecological Restoration and Conservation

The support of AI technologies is crucial for conservation and ecological restoration projects. AI systems can detect important species, map habitats, and evaluate biodiversity trends by analyzing intricate ecological datasets. This information is essential and helps develop successful restoration methods and identify regions needing conservation efforts. Additionally, AI-based solutions support more effective conservation efforts by assisting in discovering and tracking endangered species, illicit fishing, and enforcing marine protected zones.

Data Integration and Collaboration

AI provide a way to combine data from many sources, including satellites, underwater drones, buoys, and citizen science projects. AI enables multidisciplinary cooperation and improves our knowledge of complicated aquatic ecosystems by combining and analyzing disparate datasets. Yang et al. (2021) suggested a method for establishing operational limitations in aquaculture utilizing multi-source data to give businesses, particularly service providers, assistance for safe operational planning and choices for both coastal and offshore fish farms. Furthermore, AI-powered platforms make it possible for multiple stakeholders, such as scientists, politicians, resource managers and local people, to share real-time data and insights. This encourages a more thorough and organized response to problems with aquatic health.

Conclusion

Artificial intelligence (AI) in aquatic health management has enormous potential for resolving the imperative environmental problems affecting the world's water bodies. AI provides scientists, decision-makers and stakeholders with insightful information and useful tools for sustainable management and conservation, from real-time monitoring and predictive modeling to disease identification and conservation initiatives. However, while using AI technology, it is crucial to take into account ethical issues, data quality and the necessity for human knowledge. We can ensure that our aquatic ecosystems have a healthier and more resilient future by utilizing AI's transformational potential.

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