Chapter 1
Introduction to ML and IoT for Water Management

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ABSTRACT

Planning, regulating, and sustainably using water supplies to meet various demands are all critical to managing water resources. A growing water shortage puts ecosystem health and mortal needs at risk, prompting creative solutions. The main objective is to investigate how ML, along with IoT synergies, optimise resource allocation, improve predictions for water distribution, improve quality surveillance, and identify leaks, ultimately promoting sustainability as well as informed decision-making. The study highlighted the significant potential of the ML-IoT fusion in transforming water management practises. This is accomplished by undertaking a thorough analysis of the current literature, which is supported by actual case studies. This investigation will ultimately shed light on the bright future of water resource management, wherein insights based on data as well as cutting-edge technology will pave the way for a more secure and sustainable water supply.

1. INTRODUCTION

Water management has been transformed by machine learning (ML), which provides data-driven solutions to handle the escalating problems in this crucial area. To enhance the management, distribution, and quality control of water resources, machine learning (ML) algorithms examine large datasets from several sources, such as sensors along with satellite data records (Sun & Scanlon, 2019). They enable distribution network optimization for increased efficiency, leak detection, and predictive modeling of

water demand. ML is essential for identifying toxins, keeping track of contaminants, as well as ensuring environmental requirements are followed (Kshirsagar et al., 2022). Moreover, it supports early warning infrastructures for floods, droughts, and floods, supporting authorities in making anticipatory choices to protect water resources and maintain sustainable management.

1.1 Background and Context

With the rising demand for clean water and the prospect of water shortages, efficient water use is a crucial worldwide concern. By allowing real-time data collection, analysis, and optimization of resources, "leveraging the power of machine learning (ML) and the Internet of things (IoT)" may transform water management (Fu et al., 2022). Water management includes planning, implementation, and regulation practices to sustainably use and distribute water resources. It is important to maintain ecosystems as it helps in an effective supply for many requirements, including drinking, agriculture, and industry. It combines human needs with environmental preservation, preserving the future, and is essential due to the developing water shortage (Fox, 2019).

The convergence of "ML and the Internet of Things (IoT)" has developed into an uprising force in today's society, especially in the crucial water management field. The responsible operation of water resources has evolved into a more urgent issue as the world's population continues to increase (Lowe et al., 2022). Combining the IoT's network of interlinked sensors and devices with ML, which can handle enormous volumes of data and extract insightful knowledge, offers a potent remedy for these issues (Fox, 2019).

Figure 1. Water resource management
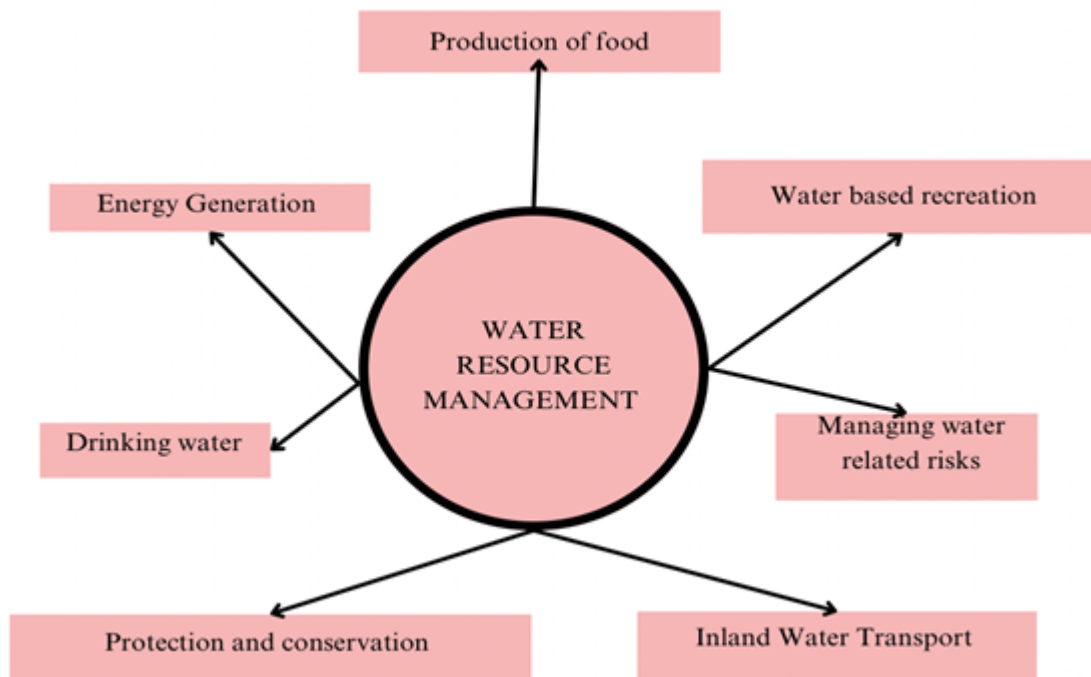
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