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Utilizing machine learning for short-term water demand forecast

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ABSTRACT

As technology continues to evolve, it has a profound impact on various aspects of our lives, including our water consumption. This becomes crucial as the GCC region is experiencing rapid social and economic transformation, leading to an increase in water demands and creating a gap between water supply and demand. This gap can be addressed by utilizing the new water demand forecast technologies that continue to evolve. With the advent of innovative technologies and methodologies, such as machine learning and artificial intelligence, there is a potential for significant improvement in the water management section. Having an accurate short-term water demand forecast is essential for preparing optimal and secure operational plans for water management. It allows for the precise determination of the required water reserve and the development of efficient plans for pumping stations and water production plants. There are multiple approaches to forecasting water demand depending on various factors such as network complexity, operational limitations, available data, forecast horizon, and the desired level of accuracy. This paper aims to bridge the gap between water supply and demand by introducing a reliable short-term water demand forecast method using machine learning (ML). The results obtained from a water utility in the United Arab Emirates (UAE) demonstrate the effectiveness of the proposed ML forecasting method, with a significant reduction in the mean absolute percentage error (MAPE) from 5.42% to 2.76% compared to the conventional forecasting method. Similarly, the root mean square error (RMSE) decreased from 11.14 million imperial gallons per day (MIGD) to 5.97 MIGD, and the total difference per year between actual and forecasted demand decreased from 2683 million imperial gallons (MIG) to 900 MIG. These findings highlight the importance of accurate demand forecasting in improving the efficiency and performance of water management systems.

Keywords: Demand forecast; Machine learning; Water demand; Technology; Sustainability; Water management

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