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An Hybrid Neural Network-Optimal Control Approach for Irrigation Scheduling Based on Satellite Data

Plantations face significant challenges due to water scarcity and prolonged periods of drought. Currently, irrigation management is mostly performed manually and relies heavily on the experience of farmers, who make adjustments based on the time of year. However, several factors influence irrigation needs, including air and soil humidity, temperature, and the amount of rainfall. Incorporating these variables into irrigation planning is crucial for optimising water use and ensuring efficient resource management, thereby supporting sustainability. Moreover, climate change has led to an increase in extreme weather events and atmospheric instability, making optimal water management even more difficult. In this work, we formulate an optimal control problem that recommends the amount of water to use for irrigation in a given time horizon. To support long-term decision making, we use variables given by a neural network to the optimal control problem. The neural network identifies and models new and complex causal relationships between atmospheric and soil variables from satellite data. Our approach allows for intelligent irrigation management that can anticipate periods of drought or extreme precipitation events.

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