SMARter: Soil Moisture Artificially Intelligent Regression in a Domestic Garden Environment to Conserve Water

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This project aims to demonstrate the potential to predict soil temperature through a machine-learning approach, within a South African domestic garden environment. The vision of the project is to preserve freshwater resources while maintaining appropriate irrigation conditions for plant health. A multimodal data collection system was created, with sensing signals including soil moisture and temperature, air humidity and temperature, wind speed, lighting condition, time, and the on/off status of a sprinkler system added as a control. The system collected the data in a domestic garden over a period of 6 months. Precipitation data was acquired from the nearest weather station. The data was then removed of anomalous values, smoothed, interpolated, synchronized, and normalized to prepare it for machine learning. The Wilcoxon signed-rank test was used to verify the data's capability as training data for machine learning algorithms. Models were created using Support Vector Regression, Random Forest, Neural Network, Lasso Regression and K Nearest Neighbours algorithms. The accuracies of these models were compared using Pearson's R values and Mean Squared Errors (MSEs). The Random Forest algorithm was found to be the most accurate, with an R-value of 0.84 and an MSE of 0.251. Support Vector Regression and Lasso Regression also produced comparable results. The accuracy of the Random Forest algorithm was deemed to be satisfactory for use in soil moisture prediction, achieving the aim of this study. This study will serve as an important groundwork for the future development of intelligent irrigation systems in South Africa.