利用機器學習方法預測農地土壤含水量

Using Machine-learning method to predict soil moisture content of farmland

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摘要

農田灌溉為台灣的主要用水標的，而灌溉需水量受到土壤特性和降雨型態等影響，本研究目的為利用過去或現在已知的氣象參數資訊預測未來土壤含水量變化，做為農田水資源管理的依據，藉以協助更精確地決定灌溉水量，如此一來不但能維持土壤的水分，還能節約用水。本研究場址選為位於臺中行政院農業委員會農業試驗所之農地，利用機器學習模式推估土壤含水量的變化，包含短期不同降雨事件下或在長期月尺度下之模擬。本研究選用各種不同時間尺度的氣象資訊輸入機器學習模式進行模擬，並根據結果討論何種時間長度的輸入資料選取能更準確地預測土壤含水量，考量影響土壤含水量的氣象參數(例如：降雨、氣溫等氣象參數)眾多，可能使模式複雜化而降低應用性，目前於模式中先輸入過去降雨和氣溫資訊以推估、模擬未來的土壤含水量。期望本研究之模擬結果能提供氣象資訊量完整時之土壤水分預測誤差範圍，以便在未來將模式應用在不同的場址及天氣條件時也能達到良好的預測結果，提供給更多農民或相關單位做灌溉決策的參考。

關鍵詞：土壤含水量、機器學習、模擬、降雨

Abstract

Farmland irrigation is the main water target in Taiwan, and the water demand for irrigation is affected by soil characteristics and rainfall patterns. The purpose of this study is to use past or present known meteorological parameter information to predict future changes in soil water content, as a basis for farmland water resources management. The predicted soil water content helps more accurately determine the

amount of irrigation water, which not only maintain soil moisture, but also save water. The research site was selected as the Taiwan Agricultural Research Institute in Taichung. The machine learning models were used to estimate changes in soil water content, including short-term simulations of different rainfall events or long-term monthly scales. In this study, various time scales of meteorological information were input into the machine learning model for simulation. According to the results, proper time scale of the input data is selected to predict soil water content more accurately. Considering that there are many meteorological parameters affecting soil water content which may complicate the model and reduce its applicability, currently only rainfall and temperature information in the past are input in the model to estimate and simulate the future soil moisture content. It is expected that the simulation results of this study provide the error range of soil moisture prediction when the meteorological information is complete, so that good prediction results can be achieved when the model is applied to different sites and weather conditions in the future. The contribution of the collective results would then provide a reference of making irrigation decisions to farmers or related parties.

Keywords : soil moisture content, machine learning, simulation, rainfall