注意力機制神經網路於地下水指標預測探討
Predicting Groundwater Level Index by Attention

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摘　要

台灣最近的一次乾旱自 109 年中延伸到 110 年 5 月，嚴重的影響到 110 年一期作的灌溉用水。依據中央氣象局氣候年報顯示，近三年來臺灣平均雨量分別為 108 年為 2197.2 毫米，109 年為 1742.4 毫米，110 年為 1997.4 毫米，均低於歷年氣候雨量平均值 2162.6 毫米，可見在氣候變遷的環境下，年平均雨量已經呈現下降現象。由於地下水為具備穩定水質與出水量，經常被作為各項用水的後備水源，在農業用水上，地下水也經常在地表水源不足時，被利用作為灌溉補充用水，然而從農業用水的時間特性來看，一期作灌溉期間，通常是在地表水資源缺乏的狀況，同時地下水位在一期作期間也呈下降的趨勢，在地表水不足且地下水位逐漸下降的狀況下，地下水是否仍具有補充灌溉的供水能力是值得探討的主題。本文以標準化地下水位指標作為評估指標，並且應用近幾年在人工智慧領域中備受矚目的注意力機制神經網路開發地下水位預測模型。本文在建構人工智慧地下水位模型前，先將地下水位轉換為標準地下水位指標，以旬為單位的標準地下水位指標作為訓練應用注意力機制神經網路模型的資料，進一步比較注意力機制神經網路、LSTM 及 GRU 模型在地下水指標上預測的優劣。初步結果顯示注意力機制神經網路預測結果與 LSTM 及 GRU 所獲得的結果更為準確。

關鍵詞：注意力機制神經網路，地下水位指標，人工智慧

Abstract

The most recent drought in Taiwan extended from mid time of 2020 to May, 2021, which severely affecting irrigation water of 2021 spring crop. According to the climate annual report of the Central Weather Bureau, the average rainfall in Taiwan in the past three years was 2197.2 mm of 2019, 1742.4 mm of 2020, and 1997.4 mm of 2021. They are all smaller than the average climatic rainfall of 2162.6 mm. Apparently, yearly precipitation was affected by climate change.

Since groundwater has stable water quality and quantity as well, it is often used as a supplementary water resource for various purposes. In agricultural water use, groundwater is often used as irrigation supplementary water when surface water sources are insufficient. However, from the perspective of the time characteristics of agricultural water use, during the

spring crop irrigation season, it is usually in the state of lack of surface water resources, and the groundwater level also shows a downward trend. However, groundwater as irrigation supplemental use was concerned during spring crop irrigation season. In this research, Standardized Groundwater level Index (SGI) was used as the index of groundwater resources. The purpose of this paper is to build a groundwater level prediction model by artificial intelligence. The first step of building the model is to convert the groundwater level into groundwater index, and then apply the Attention to develop the prediction model. Compare the pros and cons of Attention, LSTM and GRU models. Preliminary results show that the prediction results of Attention model were more accurate than the results obtained by LSTM and GRU.