



Desarrollo de estrategias de machine learning (ML) energéticamente eficientes para la gestión sostenible de Espacios Naturales Inteligentes (ENI), como reservas naturales y parques protegidos.

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Bridging data gaps in smart greenhouses: Outdoor-to-indoor mapping for synthetic climate forecasting

Abstract

In order to make reliable forecasts of greenhouse climate variables, it is often necessary to have a long history of indoor sensor data, but newly constructed facilities often lack such records. In contrast, multi-year outdoor weather series are usually available. This paper introduces a two-stage deep learning pipeline to address this data scarcity. First, outdoor-to-indoor mapping models are trained to translate outdoor measurements of temperature, humidity, and radiation into synthetic indoor series. Secondly, these synthetic indoor series are used to train prediction models, which are then compared with their counterparts trained with real indoor data. Experiments conducted on six greenhouses across four countries with six deep learning architectures demonstrate that synthetic indoor climate series, generated from weather records, can effectively substitute for missing sensor histories. This approach enables the rapid deployment of forecasting systems in data-limited greenhouses and provides a practical AIoT strategy to mitigate information gaps in precision agriculture.