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TITLE OF PROJECT: **Machine Learning modelling for predicting Crop Wate Stress Index(CWSI) and its sensitivity analysis**

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ABSTRACT (150-300 words):

Crop water stress index (CWSI) is a plant-based index used for quantifying crop water stress and is widely used for efficient irrigation scheduling. CWSI has possible values ranging from 0 to 1 with 0 corresponding to no stress condition and 1 showing fully stressed condition. In this study, we have used eight machine learning algorithms to predict the CWSI of wheat crop. Three input parameters, which are used for deriving CWSI, relative humidity (RH), air temperature (T_a), and canopy temperature (T_c), are used as the input parameters to the machine learning models. Crop experiments on wheat crop were conducted during December 2022 to April 2023 for which empirical CWSI values were derived. T c and RH are recorded using the weather station for every 15min interval. T c is recorded thrice a week using handheld infrared radiometer. The CWSI values are computed through empirical approach that involves baselines. A linear correlation between the temperature difference of the air and canopy and the vapor pressure deficit (VPD) was established for the lower CWSI baseline of wheat. The upper CWSI baselines was taken as 2°C. The predictive capabilities of MLP, SMOreg, M5P, RF, IBk, Random tree, Bagging and Kstar algorithms for CWSI were evaluated against empirical CWSI estimates and all models demonstrated satisfactory performance. The performance of MLP (MAE=0.013) was found most accurate among the eight machine learning algorithms. Different architectures of MLP models have been adapted for sensitivity analysis. Wherein 5-11-1, 4-9-1, and 3-7-1 architectures are used for 5, 4, and 3 input parameters, respectively. Upon analysis it was observed that the best prediction of CWSI comes from 4 input parameters: Tc, Ta, RH, Rn (R2= 0.769, MAE=0.034); followed by 5 input parameters: Tc, Ta, RH, Rn, U (R2= 0.739, MAE= 0.035); and 3 input parameters: Tc, Ta, RH (R2= 0.573, MAE=0.038). The results clearly demonstrate the importance of Rn over U.

KEYWORDS: Machine learning, CWSI, Sensitivity analysis, Crop stress, AI

CATEGORY: Hydraulics and water resources engineering