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Enhancing agricultural resilience: a novel approach for detecting and mitigating water stress in wheat crops under climate change impacts

Abstract:

Amidst the intensifying challenges of climate change, the agricultural sector faces a pressing demand for adaptation and innovation to safeguard food security and sustainability. This study presents a pioneering methodology tailored for the detection and alleviation of water stress in wheat crops, critical for sustaining agricultural productivity and ecosystem resilience amidst shifting climatic conditions. Utilizing cutting-edge machine learning techniques, including Naive Bayes (NB) and Random Forest (RF) as base learners, with K-Nearest Neighbors (KNN) serving as the meta-learner, in conjunction with image-based texture features, wheat canopy components, and PSII features, this approach achieves an impressive accuracy of 97.82% in early water stress detection, analyzing the chlorophyll fluorescence images of vegetative and reproductive stages of the Raj 3765 wheat variety. After detection, proactive interventions are advocated to mitigate losses and advocate sustainable agricultural practices. Furthermore, the research doesn't stop with the detection of water stress. Once stress is detected, it constructs an analytical model for losses caused by water stress. This model can successfully propose cost-effective controls to counter the losses incurred due to the presence or detection of water stress in wheat, offering practical and economically feasible solutions to address agricultural challenges caused due to climatic changes effectively.

Biography

Dr. Ankita Gupta, with a Ph.D. in Computer Science and Engineering, brings a wealth of academic and research expertise. Notable projects include "Image Enhancement of Latent Fingerprints to Investigate Crime Scenes" and the development of "BISRAC," a risk assessment model for Indian banks. Her current research focuses on integrating chlorophyll fluorescence imaging with machine learning for drought stress detection, contributing significantly to precision agriculture. Dr. Gupta has published extensively in reputable journals and conferences and holds several patents in IOT and healthcare technology. With over Five years of teaching experience and a track record of achievements in academia and the performing arts, she embodies versatility and excellence