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"Filling gaps and removing traps
for sustainable resource management"

Monsoon Crop Biomass Estimation Using Terrestrial Hyperspectral Imaging

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Abstract

India's majority (60%) of the population depend on the agriculture sector for their livelihood. With the agriculture facing major challenges, remote sensing can be an effective tool in monitoring crop production and estimating the yield. It can lead to better planning and policies to ensure food security. This study was conducted with the main objective of predicting the fresh matter biomass (FMB) using the spectral reflectance extracted from hyperspectral images. Three monsoon crops (lablab, maize and finger millet) were grown simultaneously in each of these two experiments rainfed (R) and drip irrigated (I) at University of Agricultural Sciences, Bengaluru, India. The images from full frame hyperspectral camera UHD-185 was used along with destructive biomass sampling to measure the FMB in t ha^{-1}. A total of 11 sampling dates in the monsoon season of 2016 to 2018 were sampled. The spectral data was used with random forest regression model to estimate the FMB in rainfed, irrigated experiments and generalised (data sets of R and I combined) condition. The prediction accuracies based on the relative error (rRMSEP) was found to be lower in generalised condition with 13.9 % for lablab ($R^2 = 0.53$), 18 % for finger millet ($R^2 = 0.46$) and 18.7 % for maize (R^2=0.53). Overall, the results show that the FMB prediction model is not specific to rainfed and irrigated experiments as it performed better in the generalised condition. In future, it must be tested to predict the FMB on a larger scale using the sensor on unmanned aerial vehicles.

Keywords: Biomass prediction, hyperspectral imaging, machine learning, multitemporal

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