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Mapping Weed Infestation in Maize Fields Using Sentinel-2 data

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Abstract:

Weed detection and management are time sensitive activities in maize farms. Early weed detection methods through Remote Sensing face challenges such as the similarities between weeds and dicotyledon crops like maize. This results in the frequent use of hyperspectral data. However, Sentinel-2 possesses an enhanced spectral configuration featuring 3 red edge bands known for their ability to discriminate vegetation at species level which presents a cost-effective opportunity for weed detection using multispectral data. This study explores the utility of Sentinel-2 in differentiating weeds from maize in the early growth stages of maize. 195 GPS points were recorded in 6 maize farms and categorised into 3 classes, namely, maize, weed and mixed. These points were overlaid on Sentinel-2 images acquired within 2 days of the field collection date, to guide the collection of spectral signatures. A Random Forest model was generated using spectral signatures and vegetation indices which were divided into a ration of 7:3 for training and testing. A separability test was conducted for spectral signatures using a 2-way Analysis of Variances test. The results revealed that there was high interclass variability particularly in the red-edge and the near infrared regions. Consequently, the classification matrix showed that weeds had high user's and producer's accuracy of 92,96% and 88,2% respectively. The results showed that the classification achieved an overall accuracy of 73.2%. Overall, the results indicate the utility of Sentinel-2 for early weed detection in maize farms and presents Sentinel-2 as a timely and cost-effective substitute to expensive hyperspectral data.

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