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Decision Tree Models Applied in Sugarcane Cultivation

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Extended Abstract

Interest in sugarcane production is increasing around the world due to its wide range of applications, including in nature, in the form of fodder, animal feed, as well as raw material for the production of alcohol and sugar. Furthermore, its waste has high economic value, as it can be transformed into fertilizers or renewable fuels (ethanol).

Among the largest sugarcane producers in the world, Brazil is the country with the largest production. According to the 3rd Survey of the 2023/24 Harvest, carried out by the Brazilian National Supply Company (CONAB), the weather conditions and investments in the sugar and ethanol sector in 2023 resulted in an increase in sugarcane production in the country, resulting in a growth of 10.9% compared to the previous cycle, producing 677.6 million tons, setting a new record in the state-owned company's historical series. The good expected result is influenced both by the better crop yield, estimated at 81,129 kilos per hectare, and by the larger area destined for the cultivation of the crop, estimated at approximately 8.35 million hectares.

Sugarcane being a long duration and widely spaced crop, which provides an environment conducive to the proliferation of weeds. Studies carried out around the world show that the proliferation of weeds in sugarcane crops can cause enormous losses, ranging from 20-90% [1] if they are not controlled. A survey in Ethiopia shows that weeds caused sugarcane yield losses ranging from 64 to 80% [2]. In Brazil, invasion of Brachiaria decumbens and Panicum were responsible for the loss of 40% of production [3].

To deal with the proliferation of weeds, and also avoid the use of herbicides applied across the entire field, one of the most recent techniques is to map the plantation, using unmanned aerial vehicles (drones) and then use classification models to identify the weeds, then spraying herbicides with precision, reducing production costs. In this survey we propose a decision tree model, to predict weed in the field, using four colour spectra as input (red, green, RE and NIR), which were obtained by a multispectral camera adapted to an unmanned aerial vehicle.

The total pixels observed in the image were N=127,853, of which only n=8801 (6.88%) were manually classified as soil, sugarcane or weeds, i.e, an output with three levels. The cross-validation method was used to build the model, with 70% of the data used for training and 30% for testing. The accuracy of the final model was 97.4%. Spraying herbicide only where weeds were detected, rather than the entire field, would reduce the use of herbicides by 57%.

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