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Precision Agriculture: Herbicide Reduction with AI Models

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Extended Abstract

Sugarcane cultivation has been concentrated in several countries due to its diversity of use, such as in fuel, sugar, as well as other areas. Among the 80 largest sugarcane producers, Brazil occupies the first place, representing 22% of world production in the 2020/2021 harvest. The modernization of agriculture, called agriculture 4.0, has allowed greater productivity, which are directly affected by the invasion of weeds. A survey presented by [1] shows that the invasion of Brachiaria decumbens and Panicum (weed varieties) were responsible for the loss of 40% of the sugarcane production.

Integrated weed management, which includes constant mapping in a crop and the appropriate choice of control strategies, can be achieved through a better understanding of the structure and production system in relation to the behaviour of weeds in the field, as well as the optimization of its control. The adoption of the soil mapping method in the regular network allows producers, who use the localized application of fertilizers and herbicides, to make agribusiness more competitive and efficient in agricultural management and in increasing productivity [2]. In a study carried out by [3] it was observed that with the application of targeted herbicide (punctually) in beet, corn, wheat and others cultivars, it was possible to obtain a reduction from 6 to 81% in applications directed to weeds of broad-leaved and a 20 to 79% reduction in applications targeting narrow-leaf weeds.

In this survey, we propose a supervised machine learning model, which was able to identify weed invasion in a sugarcane cultivar, using four colour spectra as input variables, being NIR, RE, R and G, which were obtained by a multispectral camera adapted to an unmanned aerial vehicle. The model used to predict weed infestation was Random Forest, which was validated using cross-validation techniques, such as the k-fold method. With the exact identification of the infestation, it was possible to carry out the management in the field with applications of herbicides precisely, thus avoiding the increase in the cost of production as well avoiding the use of herbicides in unnecessary places. Results of this survey shows that, without the precision agriculture techniques, spraying was carried out in 100% of the field; however, it was necessary to be applied in only 39.6% of the total cultivated area, based on the infestation level obtained by the model. Finally, the model was estimated using the randomForest package [4] of the R software, which presented an accuracy of 97%.

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