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# OCARP: Object Copy and Random Paste Image Augmentation for Semantic Segmentation of Crop and Weed

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# Abstract

Precision agricultural robots require efficient and accurate semantic segmentation models to pixel wise classify crop, weed, and soil in agricultural fields for weed removal. Maintaining significant performance in deep learning requires large amounts of data. Human's need to annotate each pixel in these datasets, which is an extremely tedious and labor-intensive task. Therefore, the data that can be used to train such models are small. Using less data can cause increased amounts of class imbalance, similarity, overlapping, and high density within classes in datasets. This can cause difficulties in discriminating between crop and weed. In multiple previous research conducted, it can be noticed that in many instances, crop plants are being predicted as weed and vice versa. In this research project, the author proposes a novel augmentation approach Object Copy and Random Paste (OCARP) data augmentation for semantic segmentation of crop and weed. OCARP augmentation extracts crop or weed object images and label annotations from the original training set, then pastes them randomly on original images and corresponding label annotations creating augmented images and annotations for training. This assists the network to learn more features of the class that has low amount of pixel data while also combating the class imbalance problem within the plant classes. OCARP augmentation applied models achieve 86.21% overall Dice Similarity Co-Efficient (DSC) on the test set of a carrot field dataset taken in Germany while showing increased performance on both crop and weed classes. The object class pasted achieves the highest performance increment. Using the predictions created by the OCARP augmentation applied models, it can be observed that most of the crop and weed plant pixels are correctly classified according to the ground truth available.


**Keywords** : OCARP, Crop and Weed, Semantic Segmentation, Image Augmentation, Deep Learning