| Project No. | Project Title | |
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| P-2022-050 | Object Detection in Autonomous Tractor | |
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## Abstract

Our project goal is to develop an algorithm for detecting, classifying, and localizing objects in an agricultural environment using computer vision technologies. The algorithm will detect five common objects in the farm area and will be used as an additional feature for an autonomous tractor that is been developed by Blue White Robotics company. Our main motivation is to build a safety system that will alert whether an object interferes in the tractor path, and it must stop.

Our algorithm uses a pre-trained network for classification, trained on a custom dataset. We considered different approaches for object detection and different methods in each approach. we chose to use a pre-trained CNN YOLOv5 model implemented with PyTorch. We performed four experiment days in three different crop types – clementine, avocado, and vineyard, collecting videos of the five objects in different operational scenarios and various combinations of the objects in a frame. Overall, we have collected over 900 images that were labeled and split into train, validation, and test sets.

The model showed good results according to the measures we have established – Precision, Recall, and mAP o.5:0.95. since our model will be used as a safety system, it is crucial to minimize the count of misses (False Negative). The model showed 4.37% of misses, which is unacceptable. Therefore, we extended the train set by manipulating the original images: changing the brightness and adding noise. we retrained the extended model with 1800 images. The model performance improved at all the measurements, and the misses rate decreased to 0.72%.

In conclusion, the results showed proof of concept to implement and use the feature as part of the complete autonomous system. Further testing in the field is required after implementation in order to show consistency and reliability.

**Keywords:** Computer Vision, Classification, Object Detection, YOLO, AgriTech