Project No.	Project Title	
2022-01-047	Automatic detection and tree-specific features extraction from UAV images in the thermal and visible range	
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Abstract

This study develops automatic tools for extracting tree-specific features from UAV images in the thermal and visible range.

Trees detection from thermal images was achieved through image processing methods developed in a preliminary study. In the current study, the methods were expanded for images from the visible range. The image was divided into soil and vegetation segments and then using morphological methods the trees were extracted as objects. Statistical properties were then extracted for each tree from the thermal, RGB and the HSV domains. Clustering based on the thermal properties was performed followed by examination of the relationships between the different ranges. Additionally, the effect of the tree detection for crops under nets was examined.

Data from different orchard types were tested, including an apple orchard which was partially covered by net and partially without net, almond and avocado orchards without net coverage. The apple orchard data included images from four different dates and covered an area of 20 dunams including 1166 trees. The images from the avocado and almond orchards covered respectively an area of 237 dunams including 4764 trees and 35 dunams including 3684 trees.

Algorithms for anomalies detection in the trees properties were developed using clustering methods based on variables derived using image processing tools from thermal imagery. For each cluster, the properties from the visible range in the green channel were examined in the RGB domain and from the hue channel in the HSV domain. The cluster models included K means & Fuzzy k means, both of which yielded very similar results when analyzing the entire orchard. The results of trees' anomalies classification revealed that the clustering process should be performed separately for each crop type. There is a correlation between the green channel and the temperature in the tree and therefore it is possible that the visible area can also be used to detect anomalies in the trees.

These results are a positive indication of the reliability of identifying anomalies and extracting characteristic features in UAV images in the thermal and visible ranges images. Features can be extracted for both crops covered with net and without nets using the thermal images. Future work will use these techniques to identify irrigation faults in drip systems. Additionally, we will focus on examining the model for additional data using labeled data by an expert to test the classification capabilities of the model.

Keywords: Thermal imaging, Tree identification, Anomaly detection, Clustering, Tree specific.