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RGB and Multispectral UAV image classification of agricultural fields using a machine learning algorithm

A common technique within image analysis is image classification which describes the process of reducing the information content of an image into few user-defined classes. With the emergence of unmanned aerial vehicles (UAVs), high spatial resolution (cm-level) images can be collected. This thesis aims at testing different methods for classifying UAV images from an agricultural crop site in the south of Skåne, Sweden. To classify the UAV images, the Random Forest algorithm was used. Random Forest (RF) is an ensemble classifier which consists of multiple classification-trees, where the results of each individual tree contributes a single vote for to which class each pixel or segment belongs to. To evaluate the results a few objectives are presented. First of all, two cameras (RGB and multispectral) were used to examine the effect of different wavelengths bands on classification accuracy. Furthermore, the effects of spatial resolution, segmentation and integration of additional data were tested. To evaluate these different strategies a few classification examples were tested; two general classification cases, a 5-class classification and 11-class classification, and one specialized case where the high resolution of the UAV was used to classify a crop field consisting of two crop types.

Both RGB and multispectral cameras performed well, reaching overall accuracies greater than 75% for all classification cases. Results from the general cases show little difference between RGB and multispectral cameras. However, in performing the specialized case classification, i.e., analyzing a field containing two spectrally similar classes, the multispectral camera outperformed the RGB. The pixel size has a big impact on resulting classification accuracy for both RGB and multispectral cameras (30% difference in accuracy ranging from 5 cm to 1 m pixel size), where higher accuracies are achieved at higher spatial resolutions. By integrating addition data sources in the pixel-by-pixel classification method, accuracies increase by a factor of >10%. The Mean – texture feature turns out to be the most important texture feature for both cameras. The highest accuracy, for both RGB and multispectral classification, was achieved by classifying groups of pixels into segments, reaching overall accuracy of >90%.

Overall, UAV image classification works well for agricultural farm mapping and is a good monitoring tool due to its quick deployment, ease of data collection and accurate results.

Keywords: Physical Geography and Ecosystem Analysis, UAV, classification, Random Forest, Geomatics, segmentation

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