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UAV image classification using a machine learning algorithm

In this thesis, the aim was to classify images captured by an unmanned aerial vehicle (UAV), or more commonly known as drones. The purpose of these images is to use them to classify the surface by using a technique called image classification, i.e. reducing the information content of an image into few user-defined classes (such as water, trees, grass, etc.).

To classify an image, some kind of algorithm has to be used for the computer to decide on which class each pixel should belong to. Here, the Random Forest algorithm was used, which classifies the image by creating many decision trees (hence the name Random Forest) and each of those trees decides on a single class for a given pixel. When all the trees have voted for their class, the class with the highest number of votes will be the final class denoted to that image pixel.

In this report, UAV images from agricultural crop fields in Sweden are used. Onboard the UAV were 2 cameras, one RGB and one multispectral camera. The main goal of this thesis is to examine how much better or worse multispectral cameras perform image classification than normal RGB cameras. Note that multispectral cameras collect information from the non-visible part of the electromagnetic spectrum (unlike RGB cameras), are more expensive and would therefore be expected to give better results. To test the difference between the two cameras, a few classification scenarios were set up, i.e. one general case (classifying each crop field as one class and separate between the fields) and one specialized case (try to classify/distinguish between two visible similar crop types which grow in the same field). Also, the effect of pixel size, grouping pixels together into segments and adding additional information is tested.

Both the RGB and multispectral camera performed well, reaching high classification accuracies in all test cases. For the general case, there was little difference between the RGB and multispectral cameras and in many cases the RGB performed better. In the specialize case, i.e. classifying a field containing two similar crop types, the multispectral camera outperformed the RGB and showed the significant of collecting extra information which the RGB could not do. The pixel size has a big impact on classification accuracy, where higher spatial resolution generates higher classification accuracies. The highest classification accuracy was achieved by applying segmentation, i.e. similar pixels are grouped together to from segments, reaching accuracy higher than 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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