Weed mapping – a vital component of site specific crop protection

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Weed mapping as a component of site specific crop protection allows for a reduced herbicide use and consequently for a more sustainable agricultural production. Site specific weed management requires information on the number and location of different weed species in the field.

Gathering this information requires high-resolution aerial images and automatic weed classification to generate field maps. Aerial images are taken with an unmanned aerial vehicle (UAV), with flights being carried out at a flight altitude of 5 m over a selected field. The altitude and camera parameters result in a ground resolution of 2.5 pix/mm, allowing the differentiation of single weed plants. Besides UAV imagery, ground-truth data is generated through manual weed counting and a second set of photographs taken at about 70 cm above ground.

The ground-truth set of images is visually examined and plants are annotated with ground truthing locations. Sub-images showing single weed plants are then extracted for model building and validation. The sub-image sets are divided into a calibration (train) and a validation (test) set. These sets will be used to train an image classifier using the “bag of visual words” (BoVW) concept. The image classifier can subsequently be used to analyse the UAV images.

With the BoVW models, the occurrences of soil, crop and weed species can be mapped on the field scenes. This detailed information on the distribution of different weed species could then be used to generate maps for site specific herbicide application of different herbicides. So far, these maps were only generated by using manual weed counting data. Automatic weed recognition would expedite this process significantly. Together with new application technologies, e.g. a direct injection system and weed density thresholds, this enables a more precise weed management.