

Abstract

Mapping Invasive *Rumex obtusifolius* in Grassland Using Unmanned Aerial Vehicle [†]

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Abstract: *Rumex obtusifolius* (*R. obtusifolius*) is one of the most common non-cultivated weed in European grasslands. Its broad-leaved and wide-spread nature make this weed competitive with the native pasture species reducing grass yield (van Evert et al. 2010), while its oxalic acid content makes this species poisonous for livestock if large doses are consumed (Hejduk and Doležal 2004). Therefore, early removal is preferred especially in organic dairy farms or conservation areas where mass spraying is prohibited. Remote sensing and airborne technologies offer fast and efficient support in environmental monitoring allowing early detection of invasive species, yet current studies mostly rely on object-based image analysis (OBIA) and proprietary software to perform weed classification that require substantial human inputs. In this work, an open source workflow for automatic weed detection using unmanned aerial vehicle (UAV) RGB-imagery of native grassland had been developed using deep learning techniques, based on a previously developed OBIA approach (Lam et al. 2019). During the study, DJI Phantom 3 and 4 Pro were used for data acquisition throughout the vegetation period in 2018 and early 2019 at a nature conservation area in North Rhine-Westphalia, Germany. Images were processed using OpenDroneMap to produce orthomosaics. OBIA methods were then performed using Python and QGIS to assist the data labelling process for training a convolutional neural network (CNN), which was later used as an image classifier. Preliminary results of the proposed workflow achieved an overall accuracy of 93.8% and had demonstrated the capability in mapping *R. obtusifolius* in datasets collected at various flight altitudes, camera settings and light conditions. This shows the potential of developing a repeatable and robust system for semi- or fully-automated early weed detection in grassland using UAV-imagery.

Keywords: weed mapping; image segmentation; neural network; UAV; RGB-imagery

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