Using UAVs and deep learning techniques to detect invasive species in forests and wetlands

*Sarah Kentsch[1,2], Maximo Larry Lopez Caceres[1], Yago Diez Donoso[1], Jens Gross[3]

1. Yamagata University, 2. United Graduate school of Agriculture Sciences (UGAS), 3. Leibniz University of Hannover

Nowadays, forests becoming more important since the climate change has high impact in forest ecosystems. Several studies showed the widespread shifts of tree species related to their geographic position. A special case of wide spreading trees are invasive species. Invasive tree species have a major impact on structure, properties and function of natural/seminatural ecosystems. Invasive trees disturb ecosystems, displace plant species and cause high economic and ecological costs. Those species can change the structure and diversity of ecosystems and influence the regeneration of plants, soil properties and can lead to a loss of communities and functions of ecosystems. Therefore, we want to precisely detect the location of invasive species in order to provide management possibilities.

The possibility for this detection is offered by conducting automatic field surveys. We used Unmanned Aerial Vehicles (UAVs), which have become an effective tool in several forestry application. These easy-to-use and cheap tools are able to gather images with a high resolution. Together with image orthomosaics and deep learning techniques in combination with transfer learning we researched the detection of invasive species.

In order to explore the practical use of deep learning tools for detection applications in forestry we chose two practical problems of interest in Japan and Germany. Our first study site is located in the Shonai plains in north-eastern Japan. It is a coastal forest composed of evergreen monoculture of pine trees which is invaded by black locust trees. Pine trees were planted to protect the villages from storms and wind erosions. Since the black pine is a deciduous tree it is able to weaken the function of the forest. The second study site is a wetland located Germany in the north of Hannover. Since 1933 blueberries are commercially planted but since a few decades they are invading into sensible ecosystems. In wetlands like the Lichtenmoor the plants can influence processes and the displacement of endangered species.

We will provide an effective tool to detect invasive species. Our approach is adaptable, easy and fast and can be applied in a large-scale and for long-term monitoring.

Keywords: detection, deep learning, invasive species, UAV

