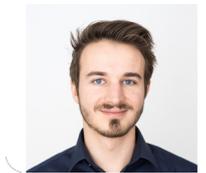# Detection of Invasive Neophytes using Novel Artificial Intelligence Algorithms

Students

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Introduction: Solidago gigantea is an invasive neophyte and a major threat to biodiversity. Our newly developed AI algorithms make it possible to detect Solidago gigantea coverage from simple RGB aerial drone imagery alone. As drone imagery becomes increasingly ubiquitous, techniques such as the proposed algorithms enable fast, cheap and accurate neophyte detection.

Approach: Our algorithms, trained with Solidago coverage labels are able to process orthomosaic images and output a coverage map. The software is generic, and hence can include additional layers, such as multispectral imagery and/or digital surface models, leading to even better results. In this work, several algorithms have been developed, including a custom deep convolutional neural network and an innovative semi-supervised clustering approach. The custom deep convolutional neural network is a fully convolutional architecture which gives a probability distribution output per pixel. As labels are often rare, the semi-supervised approach extracts features from superpixels and clusters them in an unsupervised fashion. The labels are only used to determine which unsupervised class belongs to which predefined class.

These results have been achieved on a single image from the Entensee in Kaltbrunn, Switzerland where Solidago gigantea is common. In order to generalize these results, aerial data and Solidago gigentea labels have been found for the whole canton of Zürich. Unfortunately, negative labels are not available, so the algorithms could not be applied. To solve this problem, new one-class Solidago detection algorithms have been developed.

Conclusion: The results, although preliminary, clearly indicate the high effectiveness of the proposed solution for identifying Solidago gigantea coverage. Since the algorithms perform well with RGB data alone, numerous potential applications may emerge.

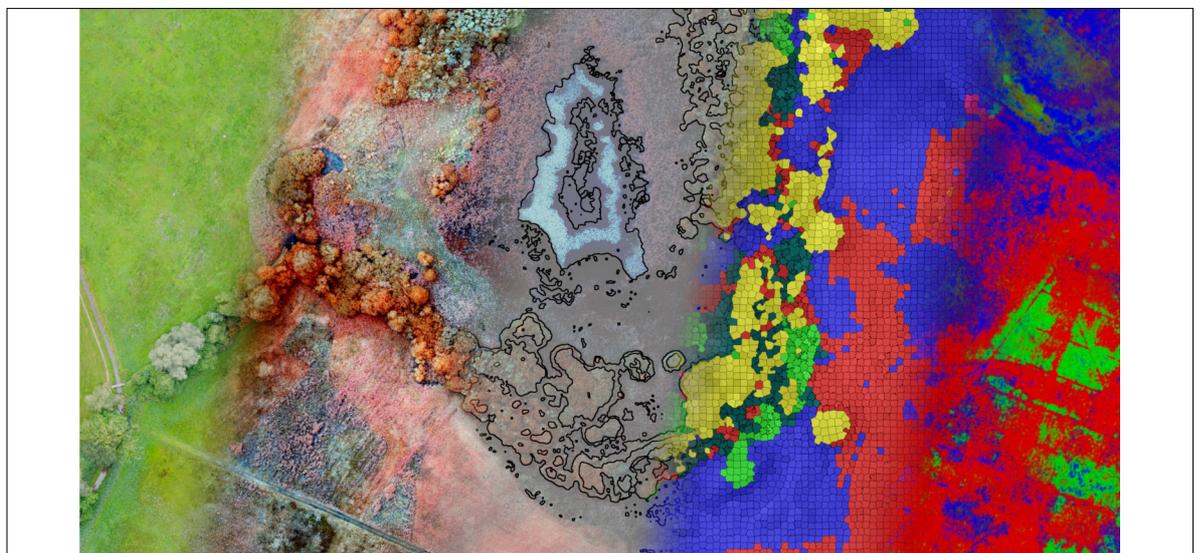**Superpixel clustering of the Entensee area.**
Own presentment

Receiver operating characteristic curve of the one-class PU-learning appraoch.
Own presentment
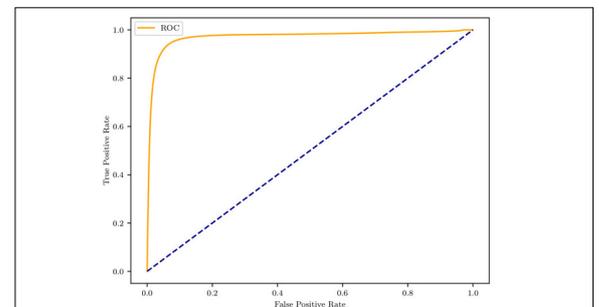
Composite image of RGB input, multispectral input, DSM input, unsupervised output and supervised output.
Own presentment

Examiner
Prof. Dr. Guido Schuster

Subject Area
Software and Systems, Spatial Development and Landscape Architecture

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