Joint Lab
Künstliche Intelligenz
& Data Science

Monitoring Biodiversity of Agroforestry Systems, using multisensor Earth-Observation Data and Deep Learning

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Background

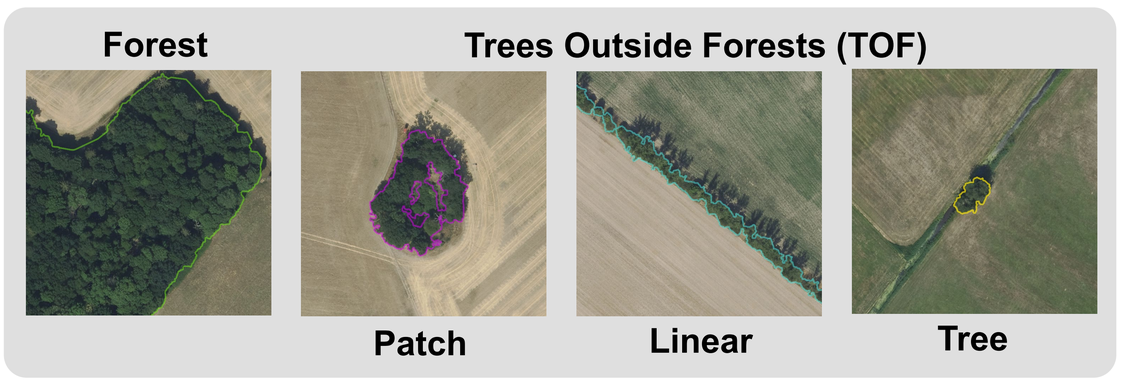
- Agroforestry is a land management system that **deliberately combines trees, crops, and/or livestock** within the same spatial and/or temporal domain [1].
- These either **ancient or modern** farming techniques, encompassing **small-scale farms to landscapes**.

Figure 1: A flock of sheep graze on a meadow orchard near Hohenebra in the Kyffhäuserkreis district of Thuringia by Tobias Nordhausen, CC BY 2.0

Figure 2: Short rotation alley cropping system with poplars near Sacro (Germany) in summer 2014" by Dirk Freese, CC BY-SA DE 4.0.

- **Supporting Biodiversity**: Connected woodland structures and a higher diversity of species provide a habitat for insects and animals.
- **Enhanced Microclimate**: Trees contribute to regulated microclimatic conditions by reducing temperatures and lowering evaporative demand.
- **Improved Soil Health: T**rees and shrubs can help to improve soil fertility and structure by fixing nitrogen, carbon sequestration, and reducing erosion.
- **Improved Water Quality:** Agroforestry systems can help to filter runoff water and reduce pollution.
- **Increased Income:** Farmers can sell a variety of products from agroforestry systems, such as crops, livestock products, timber, fruits, nuts, and fodder.
- **Climate Resilience**: Diminished wind speeds, reduced erosion and enhanced microclimatic conditions helps to reduce the effects of droughts and heavy rainfall

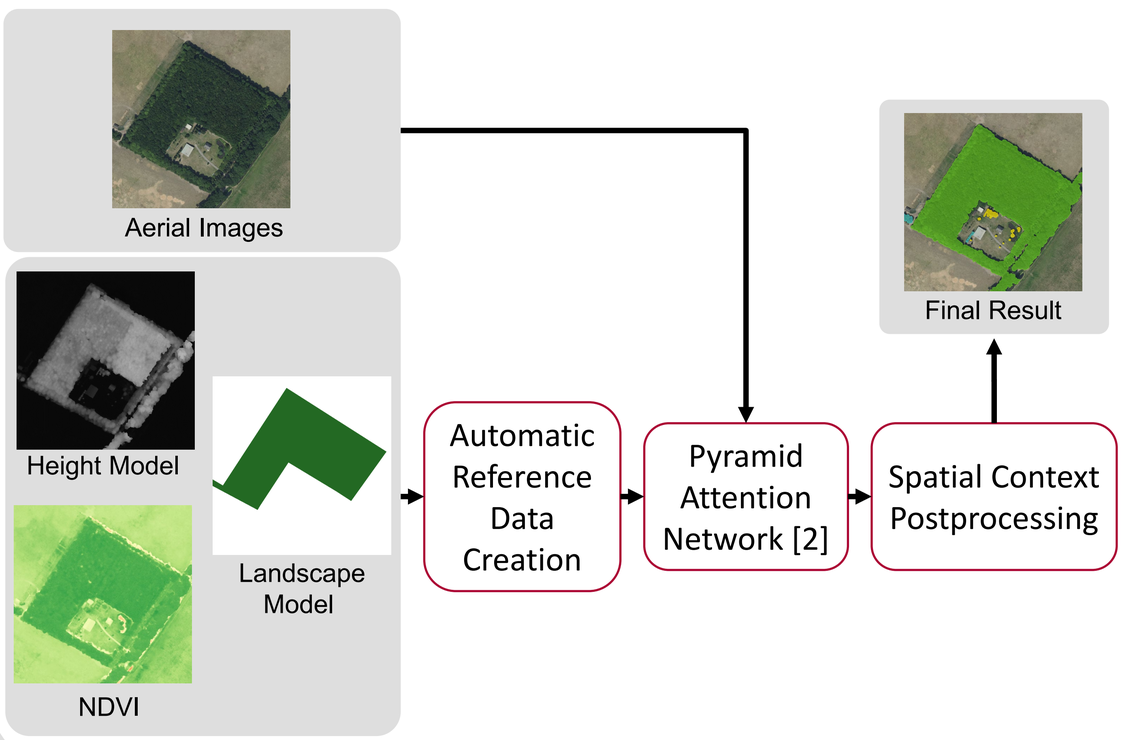
Mapping Trees Outside Forests



Motivation

- Classifying trees outside forests offers a simpler approach to assessing agroforestry, given its high complexity due to variations.
- Existing studies use thresholds based on height models, near-infrared and geometrical attributes

What capability have RGB aerial images to classify trees outside forest using semantic segmentation?



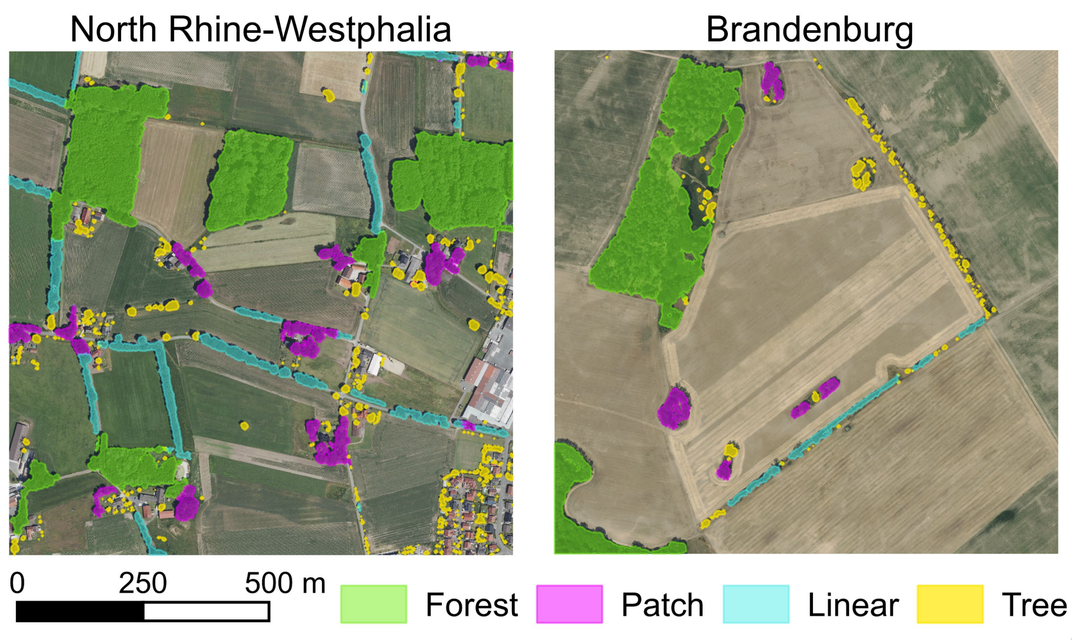


Figure 3: Results of the semantic segmentation of forest and trees outside forest classes.

Future Work

- Using aerial and satellite imagery **mapping trees outside forests on large scale** in Germany.
- Biodiversity was shown to be positively influenced by the heterogeneity of the landscape. The aim of this project is to **evaluate biodiversity at landscape level in Germany**.

References

(1) Food and Agriculture Organization of the United Nations (2013). Towards the Assessment of Trees outside Forests: A Thematic Report prepared in the Framework of the Global Forest Resources.

(2) Li, Hanchao; Xiong, Pengfei; an Jie; Wang, Lingxue (2018). Pyramid Attention Network for Semantic Segmentation.

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