Institut für Photogrammetrie und GeoInformation

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Domain adaptation for pixel-wise classification

Proposal for a Master thesis topic (EN)

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Accurate pixel-wise classification is essential for a wide range of remote sensing applications, including land use and land cover mapping, environmental monitoring, urban planning, disaster management, among others. While deep learning models have shown promising results for remote sensing applications, they depend heavily on extensive labeled data tailored to the target region of interest. However, acquiring high-quality labeled data across diverse geographic regions is a labor-intensive, costly, and time-consuming process. This challenge is further highly affected by variations in sensor characteristics and environmental conditions, which can produce significant shifts in data distribution both spatially and temporally, negatively affecting the model's ability to generalize well on new or unseen data. Domain adaptation emerges as a promising solution to address these challenges. By leveraging labeled data from a source domain and adapting it to perform well in a target domain (e.g., a new region with no labeled data), domain adaptation techniques aim to bridge the gap between data distributions (see Figure 1). This capability not only reduces the dependence on extensive labeled data but also enhances the generalization ability of classification models.

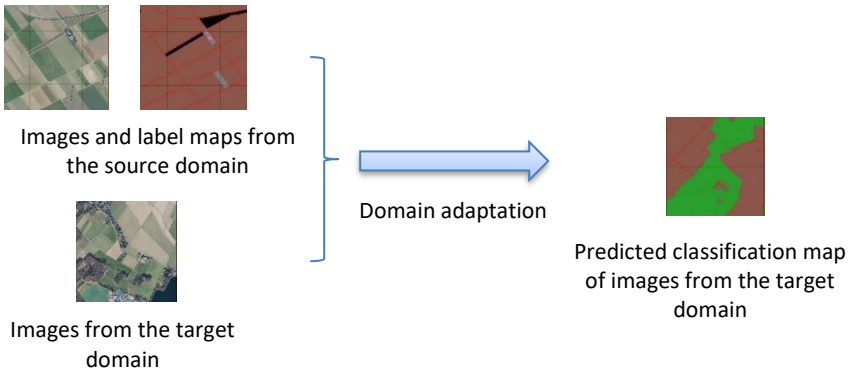

Figure 1: Domain adaptation scheme for pixel-wise classification

In the context of land cover classification, temporal domain adaptation holds significant potential to improve the scalability and applicability of deep learning models. By handling temporal shifts caused by seasonal dynamics, changes in vegetation, urban growth, or environmental disturbances, it becomes possible to create robust models capable of classify well on new data. The main aim of this thesis is to evaluate a domain adaptation method tailored to land cover classification, including temporal domain shifts. For this purpose, data from optical data will be used. Previous knowledge in the field of image analysis and deep learning is of great advantage.

A further requirement is good programming knowledge and experience with the usage of deep learning packages like tensorflow or pytorch.
This thesis will be supervised by Mabel Ortega M.Sc.

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