Semantic Segmentation Algorithms for Aerial Image Analysis and Classification

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Abstract. Our current field of work is pixelwise classification and labeling of multiple objects in images. At the moment we test our approaches for classifying different elements of facade images (e.g. windows and doors)[3]. These results can be used for building memory efficient large 3d city models. In this short abstract we want to show how these methods can be used for classifying aerial images pixelwise. The absence of an adequate database of labeled aerial images for training and testing our algorithm is a big problem for our current research.

1 Introduction

Learning object categories and recognizing their instances in arbitrary images is one of the most important tasks in Computer Vision. Due to the great success of current state-of-the-art approaches, which reach nearly human abilities on simple applications, research nowadays focuses on high-level tasks. In our work we analyze different techniques for pixelwise classification which is also known as *Semantic Segmentation*. This relative new area of research extends the idea of localizing an object in images and tries to estimate the object category label for each pixel. The main focus of our work is to study and improve state-of-the-art approaches to different aspects of *Semantic Segmentation*. In this context, we want to evaluate our algorithms in as many application areas as possible.

2 Base Algorithm

In the following we describe the basics outline of our approach. The abstract algorithm for testing is visualized in Figure 1. First an unsupervised segmentation [2] splits the image in homogeneous regions. For each region a set of features, describing color and structure [4], is computed. Afterwards these features are classified employing a classifier, e.g. Random Forests [1]. An exemplary result of these steps is shown in Figure 2. Additionally an optional global optimization step using a Markov Random Field can be used to incorporate context information.

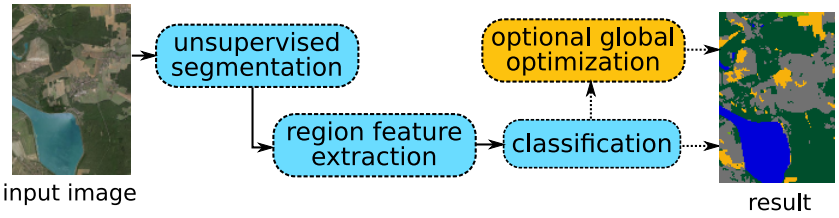
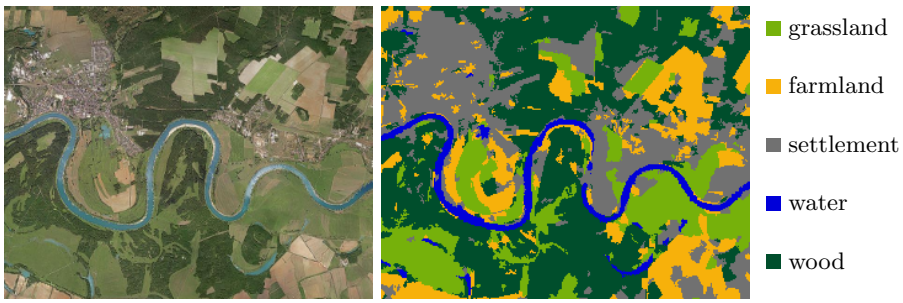


Fig. 1. Overview of semantic segmentation.



(a) input image (b) result image (c) legend

Fig. 2. Exemplary pixelwise classification result using our *semantic segmentation* approach; each color represents another class

3 Semantic Segmentation for Aerial Images

The above mentioned algorithm is applicable to different problems where it is necessary to locate distinct objects/classes pixelwise. Disbite the difficulty of aerial image classification using visual satellite images only, our algorithm seems even suitable for this specific application area. We tested our method on a very small self labeled database using only six weakly labeled images from Google maps (`http://maps.google.com/`). Hence labeling these images manually is very time-consuming, it would be very interesting to perform large scale evaluation on an already existing database.

References

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4. Fahad Shahbaz Khan, Joost van de Weijer, and M Vanrell. Top-down color attention for object recognition. In *IEEE Conference on Computer Vision (ICCV'09)*, 2009.