Technical Report – ISPRS 2D Semantic Labeling Benchmark (Vaihingen)

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In this work we use a simple object-based approach based on single scale mean-shift and spectral difference segmentation followed by object-based classification using the random forest algorithm and classification map regularization. The entire workflow is implemented using open-source software only.

Large-Scale Mean-shift Segmentation (LSMS) is used to create initial single scale partitioning of the RGBIR images using a range of different parameter sets. Preparation of the input data for LSMS includes winsorizing, log-transformation and scaling of each image tile.

In the following step, Spectral Difference Segmentation (SDS) is performed on the output of LSMS to aggregate object primitives for various thresholds of the maximal spectral difference parameter. Here, RGIR and nDSM data are used as inputs. Object based statistics are calculated, based on the RGIR and nDSM data, including mean, standard deviation and selected percentiles for each segment and input layer.

Furthermore, wavelet detail images are derived from the spectral input data. Object-based statistics are calculated in order to include texture information in subsequent classification.

Spatial information is included in terms of each segment's Shape Index, Compactness and Fractal Dimension. A subset of the image tiles (, where reference is available,) was used to train a Random Forest (RF) classifier based on the extracted features.

Training data is automatically generated based on stratified random point sampling from the reference data. A segment is selected for training, if it contains (at least) one of the sampled points and satisfies a minimum class overlap condition (e.g., overlap with a single class in the reference of above or equal to 80%).

A held-out subset of tiles is used for internal validation. Classification map regularization and sieving is performed in post-processing. From the set of available segmentation results, the final one is chosen based on (1) RF model performance in terms of Overall Accuracy (OA) on the held-out validation data set and (2) unsupervised segmentation evaluation based on area-weighted variance and spatial autocorrelation.

The results presented in this submission were selected with regard to RF performance (using strategy (1)).