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segmentation of multitemporal envisat asar and hj-1b optical data using an edge-aware region growing and merging algorithm

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In our previous research we showed already the benefit of object-based classification as well as SAR and optical data fusion for the purpose of urban land-cover mapping. Hence the focus of our current research lies on the development of object based methods for segmentation of multitemporal, multisensor satellite imagery. In this paper we demonstrate how the fusion of different segmentation approaches, namely edge detection, region growing and merging and thresholding, positively influences the outcome of urban land-cover mapping. The KTH-Segment tool now includes an edge-aware region growing and merging algorithm where the final merging is based on automatic homogeneity thresholding. Prior to the region growing and merging, a canny edge detection filter is separately applied to both SAR and optical data sources and a final binary surface of edge or no-edge is created through thresholding and majority voting on the input bands. This decision surface is then used to guide the region growing phase to only grow along edges or inside of homogenous areas. This enables to get segments better approximating the spectral composition of the edge areas and greatly reduces merging of areas of heterogeneous nature. The so created segments can then be merged in a later step, allowing a much better decision to which area the edge should be counted. The homogeneity is measured by a combination of change of mean and standard deviation. Besides this the algorithm is mainly guided by two parameters the desired minimum and maximum segment size in pixels. The threshold for the second merging step is derived as a fraction of the global average of the homogeneity criteria.

The advanced version of the algorithm has been tested on a dataset consisting of multitemporal ENVISAT ASAR scenes and one HJ-1B image acquired in 2009 over the Greater Beijing Area. The post-segmentation classification was performed using a SVM. Independent training and testing areas were selected for calibration and validation.

Preliminary results indicate a great improvement of the classification results by including edge detection into the region growing and merging algorithm. Especially important for the urban classification is the greatly improved classification of linear features such as roads and rivers. The higher quality segments also have a benefit to all other classes through a great reduction of mixed segments, i.e. segments that failed to represent only one object or one class of land cover.

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边缘引导的区域增长和合并算法用于分割多时相ENVISAT ASAR及HJ-1B光学数据

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在以前的研究中我们已经显示了基于对象分类以及雷达和光学数据融合在城市土地覆盖制图中的优势。因此，本研究着眼于构建和发展对于多时相、多源遥感卫星影像的面向对象分割算法。本文阐述了不同分割算法包括边缘检测、区域增长与合并、阈值算法等的融合对城市土地覆盖制图的积极作用。KTH分割工具包括了一个顾及边缘的区域增长和合并算法，其最终的合并是基于自动同质阈值。在区域增长和合并之前，首先将canny边缘检测过滤器单独应用到雷达和光学数据源上，并且通过阈值和多数投票法得到一个最终的二值边缘和非边缘表面。这个决策表层随后用于指导区域增长时态，以保证沿着边缘和同质区域内部进行增长，这也使得分割结果更加近似于边缘区域的光谱组成，且较好地抑制了异质区域的合并。分割后的结果可以在后续的步骤中进行合并，同时考虑到一个更完善的决策以计算区域的边缘。对于一致性通过综合度量其变化均值和标准差。该算法主要由两个参数进行调节，包括所需要的最小和最大分割像素大小。在第二个合并步骤中的阈值可由同质准则的全局平均的部分进行得到。

最新的算法版本已经在多时相ENVISAT ASAR数据和一个2009年北京地区的HJ-1B数据进行测试。分割后分割选用支持向量机进行分类，选择独立的训练和测试区域进行校正和验证。初步的结果显示，通过将边缘检测加入区域增长和合并算法，所获得的分类结果的精度有了很大提高，特别对于城市分类中的线性特征如道路和河流的分类具有重要意义。较高质量的分割结果同时也对其他类别具有较大好处，如分割对象不能代表只有一个对象或者是一个土地覆盖类别的情况。

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