



#### [Volume XL-3/W2](#)

Int. Arch. Photogramm. Remote Sens. Spatial Inf. Sci., XL-3/W2, 261-268, 2015  
www.int-arch-photogramm-remote-sens-spatial-inf-sci.net/XL-3-W2/261/2015/  
doi: 10.5194/isprsarchives-XL-3-W2-261-2015  
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## SEGMENTATION OF UAV-BASED IMAGES INCORPORATING 3D POINT CLOUD INFORMATION

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**Keywords:** Image segmentation, Building detection, UAV images, 3D point cloud, Texture, Region growing

**Abstract.** Numerous applications related to urban scene analysis demand automatic recognition of buildings and distinct sub-elements. For example, if LiDAR data is available, only 3D information could be leveraged for the segmentation. However, this poses several risks, for instance, the in-plane objects cannot be distinguished from their surroundings. On the other hand, if only image based segmentation is performed, the geometric features (e.g., normal orientation, planarity) are not readily available. This renders the task of detecting the distinct sub-elements of the building with similar radiometric characteristic infeasible. In this paper the individual sub-elements of buildings are recognized through sub-segmentation of the building using geometric and radiometric characteristics jointly. 3D points generated from Unmanned Aerial Vehicle (UAV) images are used for inferring the geometric characteristics of roofs and facades of the building. However, the image-based 3D points are noisy, error prone and often contain gaps. Hence the segmentation in 3D space is not appropriate. Therefore, we propose to perform segmentation in image space using geometric features from the 3D point cloud along with the radiometric features. The initial detection of buildings in 3D point cloud is followed by the segmentation in image space using the region growing approach by utilizing various radiometric and 3D point cloud features. The developed method was tested using two data sets obtained with UAV images with a ground resolution of around 1-2 cm. The developed method accurately segmented most of the building elements when compared to the plane-based segmentation using 3D point cloud alone.

[Conference Paper](#) (PDF, 1407 KB)

Citation: Vetrivel, A., Gerke, M., Kerle, N., and Vosselman, G.: SEGMENTATION OF UAV-BASED IMAGES INCORPORATING 3D POINT CLOUD INFORMATION, Int. Arch. Photogramm. Remote Sens. Spatial Inf. Sci., XL-3/W2, 261-268, doi:10.5194/isprsarchives-XL-3-W2-261-2015, 2015.

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