FIG WORKING WEEK 2017
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Automatic Extraction of Oblique Roofs for Buildings from Point Clouds Produced by High Resolution Color-Infrared Aerial Images

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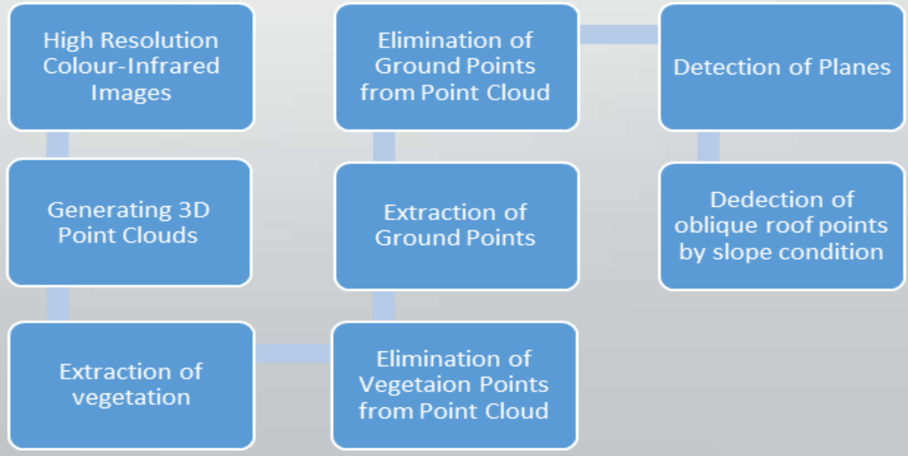
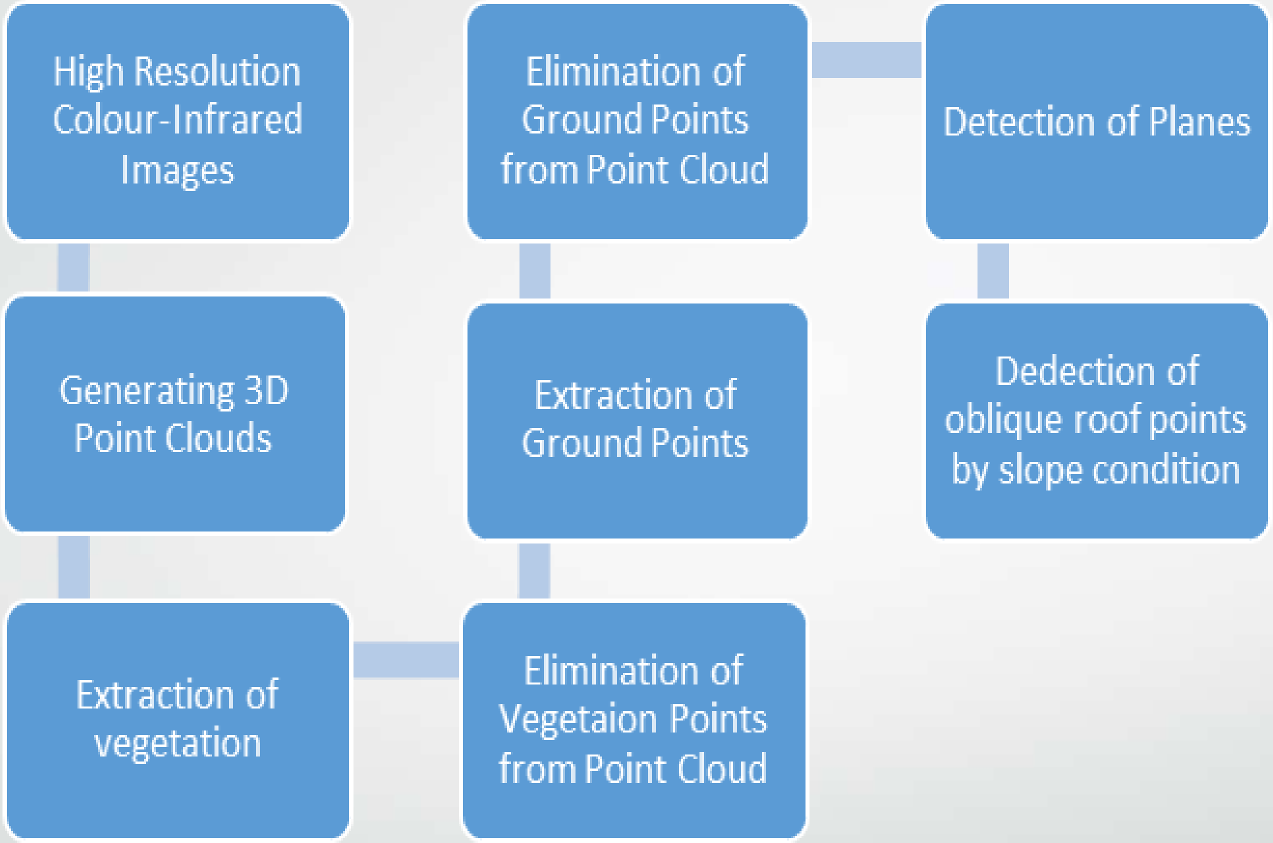
Automatic creation of the 3D city models and keeping up to date are important topics in many disciplines. Generating the 3D city models quickly and automatically depends on producing some of models' details (buildings, vegetation, roads etc.) and digital elevation model. This study presents an automatic detection technique for extraction of building oblique roof and vegetation from dense image matching point clouds by Semi Global Matching (SGM) algorithm applied on high resolution color-infrared (CIR) digital aerial images

STUDY AREA AND DATA

The high resolution (7680x13824-12 µm pixel-GSD 8 cm) colour-infrared images from Vaihingen-Data Set (ISPRS DGPF Project, consisting of historic buildings with roads and trees) were used for producing the coloured 3D point clouds by SGM. The size of study area images were nearly 280×210m.

The study basically consists of three steps; firstly, the vegetation points were detected by using NDVI mask from the infrared-coloured 3D point clouds. Then, the bare-earth points were extracted by Progressive TIN densification algorithm from the 3D point clouds that have been eliminated the vegetation points. As a final step, the oblique roof planes were obtained by Random Sample Consensus (RANSAC) from the latest point cloud without the vegetation and the bare-earth points.





Steps of the study

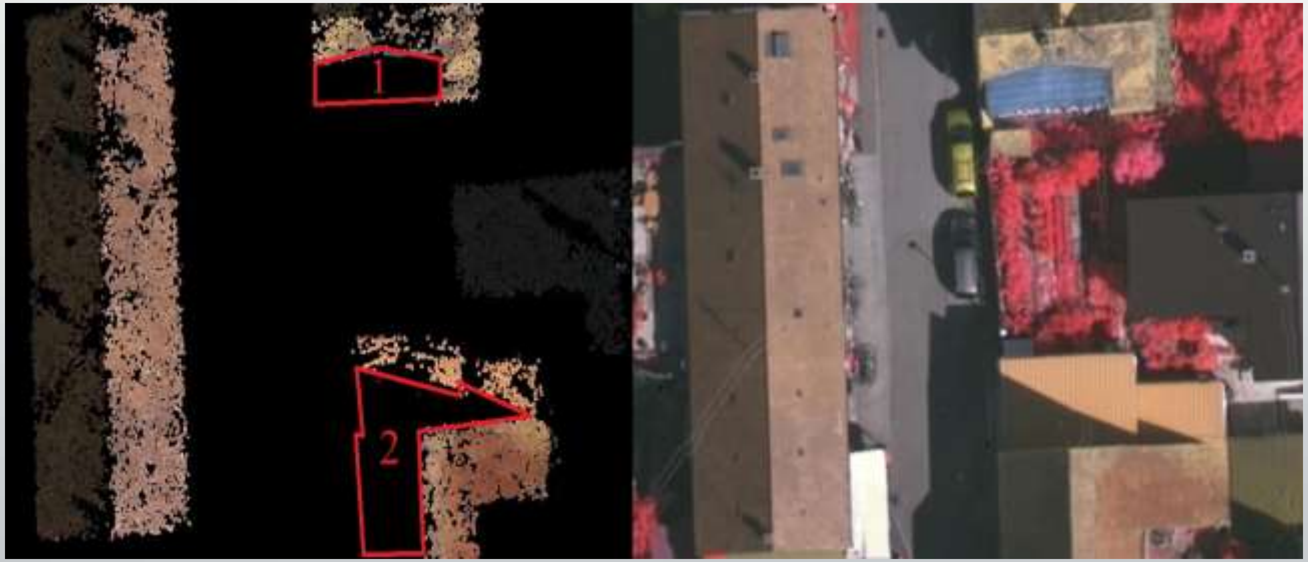
Generated 3D Points Cloud

Eliminated 3D points cloud from vegatation

Eliminated 3D points cloud from ground

Automatic extracted points of oblique roofs

There were some blanks on building's roof because of the unmatched pixels which were falling over shadows of dense building, shadows of high vegetation and the parts of plane without slope. Because of these conditions some of accuracy rates were low.



The blanks on roofs (1. The flat plane, 2. The falling over shadow of dense)

Only the oblique roof points were analyzed from points clouds that obtained from high resolution colour-infrared images, without lidar datas. The Correctness: 0.78, Completeness: 0.99 and Quality: 0.78 were calculated from layers of detail that generated automatically and layers of reference for the accuracy analysis.

The reference layer of details and the layer of details' points that detected automatically

It expected that, if the high resolution images can be taken in less shadow condition and more overlap, the blanks will degrease and the Correctness and Qualty rates will increase.

CONCLUSIONS

The 3D points cloud was produced by using the high resolution overlapped images as an alternative to laser scanning technology. The oblique roofs' points were extracted automatically with the Correctness: 0.78, Completeness: 0.99 and Quality: 0.78 rates.

Some gaps on oblique roof were observed because of shadow, vegetation and some of flat part of buildings. Extraction of all oblique and normal roof plane automatically are required for 3D city models. For future study, it was planned that extraction of all type of roofs automatically, creation of a prototype 3D city model with all roof's planes and generating the true orthophotos.