TRUE-ORTHOPHOTO GENERATION USING DATASET COLLECTED BY UAV PLATFORM

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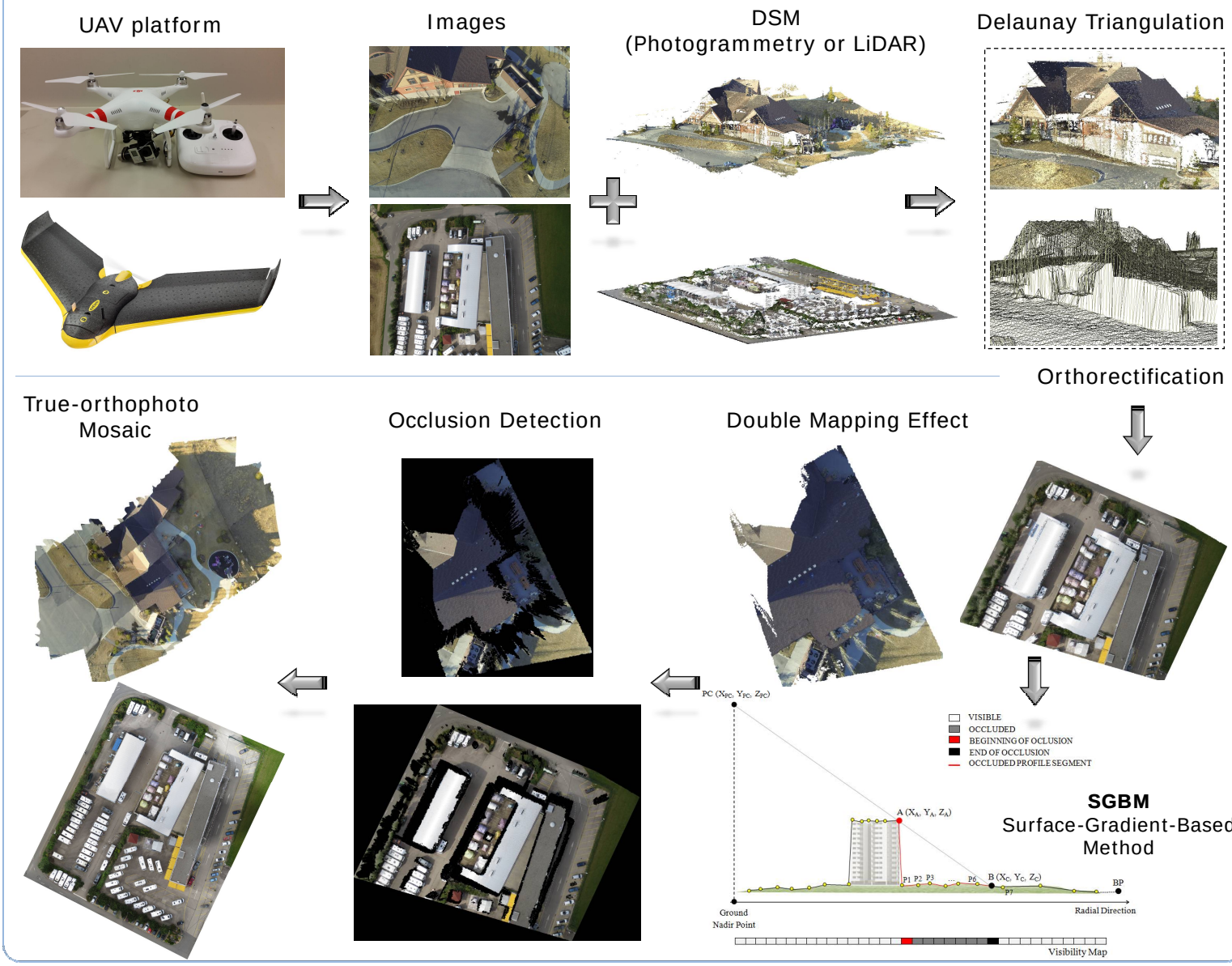
INTRODUCTION

Conventional Orthophoto: It is a product without a constant scale, due to the relief variation and camera attitude, that can be corrected by using a Digital Terrain Model (DTM) and parameters of the sensor – Interior and Exterior Orientation Parameters (IOP and EOP). However, after this correction, it still contains scale-variation caused by the objects above the ground; **True-Orthophoto**: Besides relief and sensor correction, in the true orthophoto generation, features above the surface are also considered using a Digital Surface Model (DSM) and this product is free from occlusions and has a constant scale. **Problem**: The use of a DSM in the orthorectification process causes an effect called double mapping. This effect represents both the corrected position of the object (building's roof) and also a duplicated portion ('ghost image'). This duplicated portion correspond to the occlusion area, which has no radiometric information about the real features on the ground level, such as streets. This problem increases by using a dataset collected by an UAV platform. **The Aim of this work** is to propose an alternative method for occlusion detection, the key-step for true orthophoto generation, using a triangulated irregular network (TIN), instead of a gridded-DSM or a Digital Building Model (DBM).

SURFACE-GRADIENT-BASED METHOD

The Surface-Gradient-Based Method was developed to automatically identify occlusion areas over a polyhedral surface, aiming the true-orthophoto generation. This polyhedral surface is formed by using a TIN (via Delaunay constrain) to represent its facets. This structure can be analysed by extracting profiles that represent the radial directions, which is the direction where the occlusions occur (as well as the displacements on the image) due to the perspective projections that the images are acquired. Since the profile segments are extracted, it is possible to estimate the surface gradients between adjacent facets. The gradients with large values indicate the height variation in the surface, and consequently, the presence of objects above the ground level (buildings, for example). Considering the profile analyzes starting at the ground nadir point, the negative gradients represents the beginning of an occlusion. The end of the occlusion is then obtained by projecting the point that correspond to the negative gradient onto the surface. This procedure identifies a set of occluded triangles. By the knowledge of these regions (triangles) it is possible the search for radiometric information in adjacent images by applying specific cost functions. The true-orthophoto mosaic is then generated.

DEVELOPMENT and RESULTS



CONCLUSIONS

The usage of true-orthophotos is important in several applications performed over urban areas, or areas containing objects with height variation related to the ground level. This objects cause occlusions on the image, which can hide important information (that vary regarding the application). The identification of occluded areas is the main step for true-orthophoto generation. This poster presents some results obtained from the Surface-Gradient-Based Method for occlusion detection, aiming the true-orthophoto mosaic generation. The images were obtained by an UAV platform (DJI Phantom and Sensefly Ebee RTK) and the parameters (IOP and EOP), together with the DSM, were obtained by photogrammetric procedures. The results show an occlusion detection with high completeness (larger than 90%) and true-orthophoto mosaics with a good alignment (error in a sub-pixel level ~ 1cm). The main advantages of the SGBM are: the possibility of using an irregular-spaced point cloud – without the necessity of an initial interpolation step; and the use of different point cloud density along the surface, which causes a reduction in the processing time (computational effort).

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