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AN AUTOMATIC PROCEDURE FOR COMBINING DIGITAL IMAGES AND LASER SCANNER DATA

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Abstract. Besides improving both the geometry and the visual quality of the model, the integration of close-range photogrammetry and terrestrial laser scanning techniques directs at filling gaps in laser scanner point clouds to avoid modeling errors, reconstructing more details in higher resolution and recovering simple structures with less geometric details. Thus, within this paper a flexible approach for the automatic combination of digital images and laser scanner data is presented. Our approach comprises two methods for data fusion. The first method starts by a marker-free registration of digital images based on a point-based environment model (PEM) of a scene which stores the 3D laser scanner point clouds associated with intensity and RGB values. The PEM allows the extraction of accurate control information for the direct computation of absolute camera orientations with redundant information by means of accurate space resection methods. In order to use the computed relations between the digital images and the laser scanner data, an extended Helmert (seven-parameter) transformation is introduced and its parameters are estimated. Precedent to that, in the second method, the local relative orientation parameters of the camera images are calculated by means of an optimized Structure and Motion (SaM) reconstruction method. Then, using the determined transformation parameters results in having absolute oriented images in relation to the laser scanner data. With the resulting absolute orientations we have employed robust dense image reconstruction algorithms to create oriented dense image point clouds, which are automatically combined with the laser scanner data to form a complete detailed representation of a scene. Examples of different data sets are shown and experimental results demonstrate the effectiveness of the presented procedures.

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