Volume XL-1/W1

Int. Arch. Photogramm. Remote Sens. Spatial Inf. Sci., XL-1/W1, 373-378, 2013
www.int-arch-photogramm-remote-sens-spatial-inf-sci.net/XL-1-W1/373/2013/
doi:10.5194/isprsarchives-XL-1-W1-373-2013

AUTOMATIC FEATURE-BASED POINT CLOUD REGISTRATION FOR A MOVING SENSOR PLATFORM

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Keywords: LIDAR, Point Cloud, Registration, Imagery, Dynamic, Close Range

Abstract. The automatic and accurate alignment of multiple point clouds is a basic requirement for an adequate digitization, reconstruction and interpretation of large 3D environments. Due to the recent technological advancements, modern devices are available which allow for simultaneously capturing intensity and range images with high update rates. Hence, such devices can even be used for dynamic scene analysis and for rapid mapping which is particularly required for environmental applications and disaster management, but unfortunately, they also reveal severe restrictions. Facing challenges with respect to noisy range measurements, a limited non-ambiguous range, a limited field of view and the occurrence of scene dynamics, the adequate alignment of captured point clouds has to satisfy additional constraints compared to the classical registration of terrestrial laser scanning (TLS) point clouds for describing static scenes. In this paper, we propose a new methodology for point cloud registration which considers such constraints while maintaining the fundamental properties of high accuracy and low computational effort without relying on a good initial alignment or human interaction. Exploiting 2D image features and 2D/2D correspondences, sparse point clouds of physically almost identical 3D points are derived. Subsequently, these point clouds are aligned with a fast procedure directly taking into account the reliability of the detected correspondences with respect to geometric and radiometric information. The proposed methodology is evaluated and its performance is demonstrated for data captured with a moving sensor platform which has been designed for monitoring from low altitudes. Due to the provided reliability and a fast processing scheme, the proposed methodology offers a high potential for dynamic scene capture and analysis.

Conference Paper (PDF, 3730 KB)

Citation: Weinmann, M., Dittrich, A., Hinz, S., and Jutzi, B.: AUTOMATIC FEATURE-BASED POINT CLOUD REGISTRATION FOR A MOVING SENSOR PLATFORM, Int. Arch. Photogramm. Remote Sens. Spatial Inf. Sci., XL-1/W1, 373-378, doi:10.5194/isprsarchives-XL-1-W1-373-2013, 2013.

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