From the Topical Issue Editor

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Welcome to the 3D Research topical issue, “3D Computer Vision.” The three-dimensional analysis of objects and scenes based on optical sensors has become highly relevant in recent years in various fields, such as robotics, surveillance, industrial metrology and quality inspection, land surveying, or remote sensing, to name only a few. This topical issue features articles covering a broad variety of methodical and application-related aspects of 3D Computer Vision.

A fairly classical photogrammetric problem is addressed in the work by Yao et al., namely the automatic registration of pairs of overlapping 3D point clouds acquired by terrestrial laser scanners. In addition to 3D points, the authors also rely on the reflectance images provided by the laser scanner to determine mutually corresponding parts of the scans using computer vision techniques. Werghi et al. regard the analysis of 3D face shapes and develop a concept called “spiral facets” to infer a compact representation of faces from point-based triangular meshes. They apply their method to landmark detection in the 3D data, extraction of frontal faces, and estimation of face orientation. The human body as a whole is examined by Shahjahan et al., who extract interesting, distinctive features from human motion patterns. Going beyond a 3D object reconstruction in metric terms, they analyze the motion patterns by neural methods that allow a classification of particular motion classes and a quantification of the regularity of the motion over time.

The contribution by Beuter et al. is set in the context of human–robot interaction and describes how 3D point cloud and reflectance data acquired from a mobile robotic platform by a time-of-flight sensor is analyzed in order to extract information about the static scene background, about autonomously moving objects such as persons or mobile robots, and about articulated parts, corresponding to movable objects in an articulated scene model. The obtained scene information is important in the context of

human-robot interaction for navigation as well as for tracking and detecting interaction partners. Hahn et al. specifically concentrate on the aspect of safe interaction between humans and industrial robots. Their framework relies on the simultaneous model-based estimation of 3D pose and instantaneous motion of the articulated human hand-forearm limb in image tuples acquired by a calibrated trinocular camera sensor. This information is essential to detect potentially hazardous interferences between the human and the industrial robot.

Alvarez Cedillo et al. further extend the range of methods: Instead of extracting model information from images, they discuss the inverse problem in a tutorial-like manner and describe the synthesis of complex objects – human hair – using the open-source 3D rendering software Blender.

I hope you will enjoy reading this interdisciplinary collection of papers describing recent progress in various fields of optical 3D data analysis.

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