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Editorial

Special Issue on Large-Scale 3D Modeling of Urban Indoor or Outdoor Scenes from Images and Range Scans

3D reconstruction and modeling of the physical world has progressed very far over the last few years, driven by advances in 3D imaging and sensing technology, intelligent algorithms, and an increased capability to process very large data sets. 3D acquisition technology provides us with datasets of various resolutions and accuracies in outdoor or indoor environments. High resolution quality images can be now acquired by consumer grade cameras and cell phones. 3D range data can be acquired from highly accurate terrestrial lidar sensors, less accurate but faster sensors mounted on moving vehicles, or fast and inexpensive RGBD sensors for indoor environments. Many new challenges need to be addressed in modeling and understanding these datasets. A major issue has to do with the need to process voluminous data sets. That means that algorithms that explore the big-data nature of the indoor/outdoor datasets are becoming important. Issues related to big data manifest themselves in two ways: very large data collections and very high resolution of each image or range scan. With this issue we would like to explore new avenues in 3D modeling from images and range data. Applications of these methods can be seen in historical preservation, urban planning, digital mapping, architecture, navigation, virtual reality, e-commerce, digital cinematography, computer games, just to name a few.

We received 45 submissions. Eleven were rejected without review because they were outside the scope of the issue, and one paper was withdrawn by the authors.

The Guest Editors handled 32 out of the 33 reviewed papers, while one paper was handled by the Editor-in-Chief due to conflict of interest. Twenty papers were accepted for publication and thirteen were rejected after review. All papers were peer-reviewed by at least two, in many cases three, reviewers. Two rounds of revisions were allowed. In cases of conflicts between the reviewers after the final revision, the Guest Editors reviewed and provided the final decision.

We would like to express our thanks to all the authors who submitted their work to our special issue. We would also like to thank our reviewers for the time they devoted and for their invaluable contribution to the issue. We also wish to thank the Editor-in-Chief, Professor Nikos Paragios and the editorial staff at the Computer Vision and Image Understanding Journal who have guided and supported us throughout the process of producing this special issue.

Below we list the accepted papers in rough categories.

Point Cloud 3D Modeling and Registration

"Efficient Edge-Aware Surface Mesh Reconstruction for Urban Scenes" describes an efficient approach for building compact, edge-preserving, view-centric triangle meshes from either dense or sparse depth data, with a focus on modeling architecture in large-scale urban scenes.

"Automatic large-scale three dimensional modeling using cooperative multiple robots" describes a planning and modeling system from laser data captured by multiple robots.

"Error-aware Construction and Rendering of Multi-scan Panoramas from Massive Point Clouds" starts from large-scale point clouds acquired by lidar sensors and produces a panorama-based compact reconstruction of the scene.

"Temporal City Modeling using Street Level Imagery" describes two methods for detecting changes in a city; by using street-level images and a 2D city map, or pairs of images collected at different times on similar locations.

"6DOF Decoupled Roto-Translation Alignment of Large-Scale Indoor Point Clouds" describes a system for the alignment of large-scale point clouds, by exploiting inherent characteristics of indoor spaces.

"Fine Scale Image Registration in Large-Scale Urban LIDAR Point Sets" introduces a method that registers color images to large-scale point clouds, by matching the given images with synthetic images produced from the point cloud.

RGB-D Processing

"Modelling large-scale indoor scenes with rigid fragments using RGB-D cameras" describes a real-time system for building large-scale models from hand-held depth cameras through a two-stage mapping process.

"A Generalised Framework for Saliency-Based Point Feature Detection" describes and evaluates (in large indoor and outdoor datasets) histogram-based salient point feature detector that can be applied to both images and 3D data.

"Large Scale and Long Standing Simultaneous Reconstruction and Segmentation" presents a method to simultaneously reconstruct and segment a scene from a sequence of depth images in real-time.

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1077-3142/

Structure from Motion / Stereo

"Large-Scale Outdoor 3D Reconstruction on a Mobile Device" presents an approach for reconstructing large-scale outdoor scenes through motion stereo at interactive frame rates on a modern mobile device.

"Efficient 3D Scene Abstraction Using Line Segments" presents a system that produces large-scale urban models from images, using 2D line segment matching, in which reconstruction is formulated as a graph-clustering problem.

"Efficient Tree-structured SfM by RANSAC Generalized Procrustes Analysis" describes a structure-from-motion method that uses generalized Procrustes analysis for solving the problem in unordered image datasets.

"Divide and Conquer: A Hierarchical Approach to Large-Scale Structure-from-Motion" presents an efficient hierarchical pipeline for solving structure from motion in large-scale datasets.

"Stereo reconstruction using top-down cues" unifies urban scene understanding and standard stereo, by detecting common arrangements of surface normals and semantic edges as well as walls, and collinear edges.

"Indoor Manhattan Spatial Layout Recovery from Monocular Videos via Line Matching" utilizes lines with invariant characteristics for structure from motion in indoor environments.

"Autocalibration for Structure from Motion" provides estimation of calibration parameters of images to be used in Structure from Motion pipelines and 3D reconstruction from image feature correspondences.

"Evaluations on Multi-scale Camera Networks for Precise and Geo-accurate Reconstructions from Aerial and Terrestrial Images with User Guidance" presents an automated processing pipeline (along with evaluation) for metric and geo-accurate 3D reconstructions supported by online user feedback.

"Video Registration in Egocentric Vision under Day and Night Illumination Changes" describes a registration method focused on improving feature matching between frames.

Semantic Labeling

"ASIST: Automatic Semantically Invariant Scene Transformation" starts from a large input point cloud and provides a unified formulation of semantic labeling and object replacement from a database of objects, by minimizing a single objective function.

"Efficient Architectural Structural Element Decomposition" decomposes 3D building models into architectural elements by incorporating symmetry and other cues.

The Guest Editors

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