Special issue on “Challenges, trends and solutions for 3-D imaging techniques”

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We are pleased to present Challenges, Trends and Solutions for 3-D Imaging Techniques Special Issue. The interest in 3-D imaging systems and applications has been growing at a fast pace. Applications ranging from entertainment to computer vision, including augmented reality and teleoperation systems are tending to increasingly rely on 3-D imaging technologies. The papers in this special issue span a wide range of problems arising in the development of algorithms for 3-D applications, technologies and services. Among the topics addressed are 3-D video transmission, quality assessment of 3-D content, virtual reality systems, production audit systems and 3-D reconstruction techniques. For this Special Issue we have received 13 submissions. Each one has undergone rigorous peer-review, and based on these reviews we have selected 7 papers for publication.

The first two papers are on frame-compatible interpolation techniques for 3-D video transmission. The first one of them, *Mode selective interpolation for stereoscopic 3D video in frame-compatible top-bottom packing*, by C. S. Won, proposes a frame-compatible top-and-bottom packing with a horizontal line offset. It exploits the horizontal parallax between the left and right viewpoints improving the quality of the reconstructed video when compared to conventional interpolation.

The second paper, *Analysis of frame-compatible subsampling structures for efficient 3DTV broadcast*, by R. Mohedano et al., deals with alternative subsampling schemes for 3-D frame-compatible broadcasting. It analyzes and compares different spatial multiplexing arrangements with the well known side-by-side (SbS) and top-and-bottom (TaB) formats. The authors propose, for progressive and interlaced video, schemes for frame-compatible packing that present higher objective quality for the reconstructed video than the SbS and TaB structures.

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The third and fourth manuscripts consider quality assessment of 3-D content. In the third one, entitled *Quality assessment of auto-stereoscopic rendering depending on positioning accuracy of multi-view capture systems' components*, M. Ali-Bey *et al.* address the problem of how to guarantee the 3-D rendering quality at the 3-D capture stage. They stipulate the global shooting/viewing geometrical parameters based on a quality assessment of auto-stereoscopic rendering. Two approaches are proposed to determine the positioning accuracy of the different components of the multi-view camera rig.

In the fourth paper, *A perceptual metric for stereoscopic image quality assessment based on the binocular energy*, R. Bensalma and C. Larabi propose a novel perceptually-based full reference metric for quality assessment of stereoscopic images. They built their metric modeling the 3-D perception based on the binocular fusion process of the human visual system, and compared the results with the metrics that try to assess 3-D contents either by using 2-D metrics or by exploiting the depth information.

In the contribution entitled *Tele-immersive environments for rehabilitation activities: an empirical study on proprioception*, K. McHenry *et al.* present a methodology to evaluate virtual reality spaces for rehabilitation activities. The experiments assessed the effectiveness of a 3-D virtual environment in gaining a notion of proprioception (the sense of how your own limbs are oriented in space) when performing a particular task. The focus of their research is on whether the real-time 3-D reconstructions used in tele-immersive systems are better or worse than conventional 2-D views.

To demonstrate proof of safety (without visual inspection) for production audit in aerospace industry, in *A new cost effective 3D measurement audit and model comparison system for verification tasks*, K. Vaiapury *et al.* developed a 3-D safety assessment model. The authors propose a software package combining several computer vision algorithms for important tasks: calibration, stereo measurement, 3-D model computation, and 3-D model fitting. The framework for 3-D measurement audit and model comparison uses the data provided by the stereo camera, as well as the semantic metadata knowledge (color, location and shape) available from the geometrical model. As the classification accuracy is dependent on the training data, the framework was tested with variety of data sets for measurement audit and model matching.

Depth map reconstruction is the topic of the last paper of this Special Issue. The paper *Reconstruction of coarse depth estimates using hierarchical image partitions*, by C. Dorea and R. Queiroz employs plane-fitting procedures to estimate the reconstructed maps. The proposed algorithm uses color-based hierarchical image partitions to delimit the set of regions over which depth map estimates may be refined while respecting the proposed color borders within the partitions. The experimental results demonstrate that the algorithm is capable of improving low quality (even corrupted) depth estimates.

We are particularly grateful to the reviewers of this Special Issue for their valuable reviews in a timely manner maintaining the high standards of MSSP. Finally, we would like to thank the authors who submitted their research manuscripts, promoting further research and inspiring new approaches to address the important technical challenges in the field. The guest editors in this Special Issue thank all those who contribute to expanding ongoing knowledge. We would also like to thank Prof. Zhiping Lin, Editor-in-Chief of MSSP, for the enthusiastic support of this Special Issue.