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# Focus Issue Introduction: 3D Image Acquisition and Display: Technology, Perception and Applications

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**Abstract:** This Feature Issue of *Optics Express* is organized in conjunction with the 2022 Optica conference on 3D Image Acquisition and Display: Technology, Perception and Applications which was held in hybrid format from 11 to 15, July 2022 as part of the Imaging and Applied Optics Congress and Optical Sensors and Sensing Congress 2022 in Vancouver, Canada. This Feature Issue presents 31 articles which cover the topics and scope of the 2022 3D Image Acquisition and Display conference. This Introduction provides a summary of these published articles that appear in this Feature Issue.



The Optica conference on "3D Image Acquisition and Display: Technology, Perception and Applications" was part of the Optica Imaging and Applied Optics Congress and Optical Sensors and Sensing Congress 2022 in Vancouver, Canada which was held virtually during 11-15, July 2022. This Optics Express feature issue on "3D Image Acquisition and Display: Technology, Perception and Applications" is organized in conjunction with this 2022 Optica 3D conference.

The scope and topics of this feature issue and the 2022 3D conference cover a broad array of research topics related to the 3D field in science, technology, and applications. These include 3D image collection, processing, and display technologies, perception, human factors, visual comfort of 3D displays, interdisciplinary 3D research, hardware, information collection and processing, and various applications for both active and passive 3D techniques. The 3D conference and the feature issue cover algorithms, devices, and systems for 3D imaging, 3D visualization, augmented reality displays, 3D displays, and biomedical applications. Additionally, 3D sensing and visualization, and task-specific design and applications of 3D acquisition and display are of particular interest. The conference participants were encouraged to submit their work as a journal article to this feature issue. Likewise, this feature issue was open to all original contributions in related areas of the 3D field. The goal of this feature issue is to publish outstanding contributions by leading researchers from a broad range of 3D.

We are thankful to the authors of this feature issue for their fine contributions, and the anonymous reviewers for their efforts and hard work. We regret that we could not accommodate all the submissions to this feature issue per the peer review guidelines of the Optics Express and Optica journals. We thank Ms. Carmelita Washington and other staff from the Optics Express Manuscript Office for their assistance and support during this process. We thank the Editor in


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Chief James Leger for giving us the opportunity to organize this feature issue. In the following, we present a summary of 31 articles that appear in the feature issue [1–31].

P. Lyu, and H. Hua report the Design of a statically foveated display based on perceptual-driven approach [1]. H.-L. Tsay, C.-H. Chang, and F.-Y. Lin report a Random-modulated pulse lidar using a gain-switched semiconductor laser with a delayed self-homodyne interferometer, [2]. S. A. Saleah, D. Seong, R. Eranga Wijesinghe, S. Han, S. Kim, M. Jeon, and J. Kim describe the Development of a deviated focusing-based optical coherence microscope with a variable depth of focus for high-resolution imaging [3].

L. Galdón, J. Garcia-Sucerquia, G. Saavedra, M. Martínez-Corral, and E. Sánchez-Ortiga, present the resolution limit in opto-digital systems [4]. Z. Yang, X. Sang, B. Yan, D. Chen, P. Wang, H. Wan, S. Chen, and J. Li report real-time light-field generation based on the visual hull for the 3D light-field display with free-viewpoint texture mapping [5]. J. Qu, H. Gao, R. Zhang, Y. Cao, W. Zhou, and H. Xie describe a high-flexibility and high-accuracy phase delay calibration method for MEMS-based fringe projection systems [6]. K. Usmani, T. O'Connor, P. Wani, and Bahram Javidi present a 3D object detection through fog and occlusion: passive integral imaging vs active (LiDAR) sensing [7].

R. Zhang, M. Duan, X. Fan, Y. Zheng, Z. Sun, J. Zheng, and Y. Jin discuss a deep learning-enabled anti-ambient light approach for fringe projection profilometry [8]. A. Matlock, J. Zhu, and Lei Tian report a multiple-scattering simulator-trained neural network for intensity diffraction tomography [9]. Y. He, X. Chen, X. Li, Z. Li, Y. Fan, J. Ding, Z. Yan, H. Liang, and J. Zhou discuss harnessing the plenoptic function for a directionally illuminated autostereoscopic display [10].

Y. Huang, G. Krishnan, T. O'Connor, R. Joshi, and B. Javidi propose an end-to-end integrated pipeline for underwater optical signal detection using 1D integral imaging capture with a convolutional neural network [11]. P. Wani, G. Krishnan, T. O'Connor, and B. Javidi, present an information theoretic performance evaluation of 3D integral imaging [12]. X. Shui, H. Zheng, X. Xia, F. Yang, W. Wang, and Y. Yu report on a diffraction model-informed neural network for unsupervised layer-based computer-generated holography [13].

S. Chen, B. Yan, X. Sang, D. Chen, P. Wang, Z. Yang, X. Guo, and C. Zhong present a fast virtual view synthesis for an 8 K 3D light-field display based on cutoff-NeRF and 3D voxel rendering [14]. Y. Lee, Y. Mao, and Z. Chen discuss a fast combined-frequency phase extraction for phase shifting profilometry [15]. P. Xia, S. Ri, T. Inoue, Y. Awatsuji, and O. Matoba discuss three-dimensional dynamic measurement of unstable temperature fields by multi-view single-shot phase-shifting digital holography [16].

L.-L. Tian, Y. Li, Z. Yin, L. Li, and F. Chu report a fast response electrically controlled liquid crystal lens array for high resolution 2D/3D switchable display [17]. T. Sasaki, E. N. Grossman, and J. R. Leger propose estimation of the 3D spatial location of non-line-of-sight objects using passive THz plenoptic measurements [18]. X. Liu, Y. Lou, J. Hu, J. Kou, and F. Wu discuss perspective clipping and fast rendering of light field images for holographic stereograms using RGBD data [19].

H. Speck, C. Munkelt, S. Heist, P. Kühmstedt, and G. Notni report an efficient freeform-based pattern projection system for 3D measurements [20]. H. Liang, D. Yao, and H. Shen, describe pseudo Wigner-Ville distribution for 3D white light scanning interferometric measurement [21].

J. Xiao, J. Jiang, J. Zhang, Y. Wang, and B. Wang present an acoustic-resolution-based spectroscopic photoacoustic endoscopy towards molecular imaging in deep tissues [22]. P. M. Douglass, T. O'Connor, and B. Javidi demonstrate automated sickle cell disease identification in human red blood cells using a lensless single random phase encoding biosensor and convolutional neural networks [23]. T. Kozacki, M. Chlipala, J. Martinez-Carranza, R. Kukołowicz, and M. Sajeev Idicula present an LED near-eye holographic display with a large non-paraxial hologram generation [24].

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L. Shi, C. Liu, D. He, X. Zhao, and J. Qiu discuss matching entropy based disparity estimation from light field [25]. D. Fox, A. Ahmadzada, C. T. Wang, S. Azenkot, M. Chu, R. Maduchi, and E. Cooper use augmented reality to cue obstacles for people with low vision [26]. J. Eastwood, G. Gayton, R. Leach, and S. Piano discuss improving the localization of features for the calibration of cameras using EfficientNets [27].

J. Zhao, Y. Wang, X. Huang, and S. Wu report spectroscopic localization of atomic sample plane for precise digital holography [28]. Y. Braun, and H. Guterman present light invariant photometric stereo [29]. Y. Sun, Z. Li, S. Wang, and W. Gao present depth-assisted calibration on learning-based factorization for a compressive light field display [30]. S. Goswami, P. Wani, G. Gupta, and B. Javidi report an assessment of lateral resolution of single random phase encoded lensless imaging systems [31].

Finally, we wish to dedicate this Feature Issue to those colleagues and friends in the 3D community that we lost recently. Dr. Byoungho Lee of Seoul National University (S. Korea), Dr. John Sheridan of University College Dublin (Ireland), Dr. Gabriel Popescu of University of Illinois in Urbana-Champaign (USA), and Dr. Jose M. Sotoca of Universitat Jaume I (Spain) were all lost before their time. Their contributions will continue to benefit the 3D community. *Non omnis moriar (Horace).*

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