International Forum on Computational Optical Measurement and its Education (COME 2019)

计算光学测量国际研讨会

18 June, Hall 1 in Yifu Building, Southeast University, Nanjing, China
2019 年 6 月 18 日 中国，南京，东南大学，逸夫科技馆第一会议厅

论坛资助:
国家自然科学基金
中央高校建设一流学科专项基金

Free ideas, free interaction and free tea break, WELCOME!

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Program 研讨会议程

Welcome Speech 8:30am-8:40am	**Prof. Da Feipeng**
Session I	
18 June 2019 8:40am-10:10am	**Chair: Wang Chenxing**
8:40am-9:05am **Camera array-based digital image correlation for high-resolution strain measurement** Prof. He Xiaoyuan, Southeast University, China	
9:05am-9:30am **3D video compression and streaming** Prof. Zhang Song, Purdue University, America	

9:30am-9:55am

A discussion on optical measurement data analysis strategies

Prof. Qian Kemao, Nanyang Technological University, Singapore

Tea break

9:55am-10:05am

Session II

18 June 2019 10:05am-11:45am **Chair: Qian Kemao**

10:05am-10:30am

High speed 3D surface imaging using fringe projection profilometry: 6 5 4 3 2 1μ

Prof. Zuo Chao, Nanjing University of Science and Technology, China

10:30am-10:55am

Digital Holography for 3D Deformation and Shape Measurement

Prof. Yan Hao, Shanghai Jiaotong University, China

10:55am-11:20am

Investigations on multi-modal hand biometric features

Prof. Wang Haixia, Zhejiang University of Technology, China

11:20am-11:45am

The 3D measurement and recognition base on active vision

Prof. Gai Shaoyan, Southeast University, China

Close Ceremony, 11:45-11:50

International Forum on Computational Optical Measurement and its Education

10:05am-10:30am

Camera array-based digital image correlation for high-resolution strain measurement

Prof. He Xiaoyuan, Southeast University, China

Abstract

Digital image correlation (DIC) is a well-known technique for non-contact, non-destructive, full-field deformation measurement in experimental solid mechanics. Although DIC has been widely used in science and engineering, the resolution of strain measurement with DIC is limited by imaging resolution and is much lower than that obtained with a strain gauge. To achieve a breakthrough in strain measurement using DIC, a camera array-based DIC method is proposed herein for high-resolution strain measurement. Twenty-five industrial cameras were assembled into a plane array, with each camera capturing a part of the specimen. A novel calibration-based image stitching method is proposed and was applied to these images and their corresponding displacement fields. The strain field was then calculated based on the stitched displacement fields. The use of the camera array greatly improved the measurement spatial resolution of DIC and made high-resolution strain measurement possible. Both static error analysis and four point-bending experiments were performed to demonstrate the feasibility and effectiveness of the proposed method, and a full-field strain resolution of 10 με was achieved.

About the Speaker

Xiaoyuan He received his BS degree from the Department of Applied Mechanics at Nanjing University of Science and Technology, China, in 1982, MS degree from the Department of Mathematics and Mechanics at Southeast University in Naning, China, in 1987, and PhD from the Institute of Mechanics at Southwest Jiaotong University, Chengdu, China, in 1994. Currently, he is a professor in the Department of Engineering Mechanics at Southeast University. His research

interests include 3D shape and deformation measurements by optical method and image processing techniques.

8:40am-9:05am

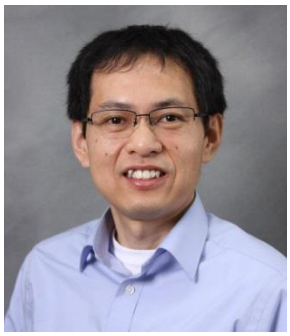
3D video compression and streaming

Prof. Zhang Song, Purdue University, American

Abstract

With 3D sensors being built into smartphones, 3D optical sensing techniques have penetrated into our daily lives. Yet one of the challenges that have not been fully addressed is the way to manage data. Our research explores novel means to store enormously large 3D geometric data by innovating geometry/video compression methods. In particular, we have developed novel methods that can convert 3D data to regular 2D counterparts, offering the opportunity to leverage mature 2D data compression platform, and achieving extremely high compression ratios without reinventing the whole data compression infrastructure. In this talk, I will present some of our recent work with special focus on real-time 3D video streaming.

About the Speaker



Dr Song Zhang is a professor of mechanical engineering at Purdue University. He received his Ph.D. degree in mechanical engineering from Stony Brook University in 2005. Dr. Zhang has published 118 journal articles; co-authored 7 book chapters; wrote one book; edited one book; and filed 12 patent applications (3 granted). 15 of his journal articles were selected as cover page highlights. His publications have been cited over 8,200 citations with an h-index of 43. He has won AIAA Best Paper Award, IEEE ROBIO Best Conference Paper Award, Best of SIGGRAPH Disney Emerging Technologies Award, the NSF CAREER award, Stony Brook University's "Forty under 40 Alumni Award", Early Career Faculty Research Excellence Awards from both Iowa State University and Purdue University. He is a fellow SPIE and OSA.

9:05am-9:30am

A discussion on optical measurement data analysis strategies

Prof. Qian Kemao, Nanyang Technological University, Singapore

Abstract

We are luckily witnessing the increasing importance and wider applications of computational optical measurement. In this paper, some strategies of optical measurement data analysis are discussed, including the optics-assisted simplified algorithms (OSA) in phase-shifting and Fourier transform for fringe analysis, windowed, optimal and tracking (WOT) in windowed Fourier transform (WFT) and digital image correlation (DIC), self-adaptation for empirical mode decomposition (EMD), and self-learning through optimization in convolutional neural networks (CNN). The competition and collaboration between computation and optics are interestingly seen.

About the Speaker

Dr Qian Kemao is an Associate Professor in the School of Computer Science and Engineering (SCSE) at Nanyang Technological University (NTU) in Singapore. He graduated from University of Science and Technology of China (USTC), where he got his BE, ME and PhD degrees. His research interests include optical metrology, image processing, parallel computing, and computer vision.

9:30am-9:55am

High speed 3D surface imaging using fringe projection profilometry: 6 5 4 3 2 1μ

Prof. Zuo Chao, Nanjing University of Science and Technology, China

Abstract

High speed 3D surface imaging has been long sought in a host of fields that include biomechanics, industrial inspection, solid mechanics, motion/deformation analysis, and vehicle impact testing. To achieve this goal, full field triangulation based active structured light illumination, also well known as fringe projection profilometry (FPP), has proven to be one of the most promising techniques. During the last decades, FPP has attracted immense research interest on the global level, and there is a clear trend towards improving its imaging speed to video rates and far beyond. This trend is being driven by the expanding application requirements for high-speed 3D sensing coupled with rapid advances in high-frame-rate image sensors and digital projection technology. However, due to the large number of projection patterns used for phase recovery and de-ambiguity of fringe orders, the maximum frame rate that can be achieved with current FPP 3D shape measurement techniques is still quite limited. To addresses this critical issue, our group developed several novel schemes to reduce the No. of patterns required per 3D reconstruction, and thus increase the measurement efficiency for FPP. Our techniques can be summarized as 6 5 4 3 2 1: 6: 3 + 3 PSP [2016 OLEN];5: Bi-freq PSP [2013 OLEN];4: 2+2 PSP [2012 OPEX];3: Comp. PSP [2016 OPEX];2: Comp. FTP [2015 AO];1: FTP;μ: μFTP [2018 OLEN]. In this talk, I will review these pattern schemes and demonstrate their potential applications. For more detailed information about these techniques, please refer to our recent review article: Phase shifting algorithms for fringe projection profilometry: A review, OLEN 109, 23-59.

About the Speaker

Dr Chao Zuo is a professor at the department of Electronic and Optical Engineering, Nanjing University of Science and Technology (NJUST). He received his B.S and PhD. from Nanjing University of Science and Technology in 2009 and 2014, respectively. He was a research assistant at Centre for Optical and Laser Engineering (COLE), Nanyang Technological University (NTU), Singapore, from 2012 to 2013. In 2014 and 2016, he was exceptionally promoted to associate professor and full professor of NJUST, respectively. Now he is the principal investigator of the Smart Computational Imaging Laboratory (SCILab: www.scilaboratory.com) at NJUST where the research interest focuses on computational bio-imaging, noninterferometic phase retrieval, digital holographic microscopy, optical information processing, and high-speed 3D optical sensing. He has authored over 100 peer-reviewed journals publications, including more than 50 papers

published in JCR Q1 journals, e.g. Opt Lett, Opt Express, with over 2,300 citations. He is an Associate Editor of IEEE Access (03/2019-), Microwave and Optical Technology Letters (03/2019-), Topical Editor of Acta Optica Sinica (06/2017-). He has been selected into the Natural Science Foundation of China (NSFC) for Excellent Young Scholars (the youngest awardee in the field of electronic information, 2017), Outstanding Youth Foundation of Jiangsu Province (the youngest awardee, 2017), the "Six Talent Peak" program, and "333 project" of Jiangsu Province, China. He received the first "National Excellent Doctoral Dissertation" of Optical Engineering Nomination Award, “Wang Daheng Optical Award” of Chinese Optical Society, the first "Youth Optical Technology Award" of Jiangsu Province, China etc. He is the principal investigator (PI) or CO-PI of 4 NSFCs, National Key Technologies R&D Program of China, and Key Technologies R&D Program of Jiangsu Province, with the total funding awarded over ¥ 13 million.

10:30am-10:55am

Digital Holography for 3D Deformation and Shape Measurement

Prof. Yan Hao, Shanghai Jiaotong University, China

Abstract

Digital holographic interferometry (DHI) has proven to have the capability to study qualitatively and quantitatively 3D deformations in solid and elastic materials, and biological samples amongst many other applications. However, in order to have a complete and accurate description of the object deformation, its surface shape (contour) must be found so that the amplitude and phase (direction of object motion) can be mapped on the object's surface. In this work, a 3D deformation and shape measurement technique with both large field of view and high accuracy integrated into a compact system is introduced. To achieve such goal, techniques of simultaneous 3D shape and deformation measurement, aperture synthesis based on pure phase images or speckle images, simultaneous 3D deformation measurement with a simple setup are studied.

About the Speaker

Dr Hao Yan is an Associate Professor in the School of Electronic Information and Electrical Engineering (SEIEE) at Shanghai Jiao Tong University (SJTU) in China. She received her Ph.D degree from Nanyang Technological University (NTU) in Singapore. She graduated from Tianjin University, where she got her BE and ME degrees. Her research interests include Digital Holography and Synthetic Molecular Communication towards Nano-Communication-Networks.

10:55am-11:20am

Investigations on multi-modal hand biometric features

Prof. Wang Haixia, Zhejiang University of Technology, China

Abstract

Biometrics based personal identification techniques are widely used in national security and consumption, among those applications, recognition system related with hand feature occupies about 70 percent market share. Single mode biometric recognition faces two critical challenges. The recognition rate drops under large scale population and the anti-counterfeiting capability of current automatic systems is usually low. Multi-modal hand features are thus of great interest. A multi-modal simultaneous hand feature measuring system is established based on interdisciplinary study in optical coherence tomography, spectral imaging, image and graphic processing, embedded system and so on. Hand recognition features including the fingerprint (both on surface and in vivo), palm print, palm vein, and anti-countering features including gland under skin, status of blood, degree of blood oxygen saturation, are investigated.

About the Speaker

Dr Haixia Wang received her B.S. and Ph.D. degree in Computer Engineering from Nanyang Technological University, Singapore, in 2007 and 2012, respectively. She is currently an associate professor in College of Computer Science & Technology, Zhejiang University of Technology, China. Her research interests include optical metrology, image processing, parallel computing, and 3D shape measurements. She has published more than 40 academic papers, in journals such as OL,

OE, SP, NC, etc. She has directed/participated in 9 projects including the youth project of National Natural Science Foundation of China, general projects of Zhejiang Natural Science Foundation, and was awarded the First Prize of Zhejiang Science and Technology Progress in 2019.

11:20am-11:45am

The 3D measurement and recognition base on active vision

Prof. Gai Shaoyan, Southeast University, China

The measurement of the geometric shape of the three-dimensional surface of an object is one of the basic problems in the fields of manufacturing, precision measurement, 3D printing, and optics. In recent years, our research group has focused on the three-dimensional measurement of the fringe projection method, which has greatly improved the performance of the measurement system. The group is the 3D measurement and recognition lab of southeast university, which is leading by Feipeng Da and consists of Shaoyan Gai and Chenxing Wang. This report introduces the research of the research group, including visual 3D modeling, point cloud processing, 3D face recognition, and etc.

About the Speaker

Dr Shaoyan Gai received his B.S. and Ph.D. degree in Automation Engineering from Southeast University, China, in 2004 and 2008, respectively. He is currently an associate professor in Schoolof Automation, Southeast University. His research interests include optical metrology, image processing, and 3D shape measurements. He has published an academic monograph and more than 20 academic papers, in journals such as Optics Express, Applied Optics, Optics and Lasers in Engineering, etc. He was awarded the second Prize of the Ministry of Education Science and Technology Progress Award.