

Special Issue on Compact and Efficient Feature Representation and Learning in Computer Vision

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1 SPECIAL ISSUE TITLE

Compact and Efficient Feature Representation and Learning in Computer Vision

2 GUEST EDITORS

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3 ABSTRACT AND MOTIVATION

Feature representation is at the core of many computer vision problems such as image classification, object detection and recognition, object tracking, image and video retrieval, image matching and many others. The rapidly developing field of feature representation is concerned

with questions surrounding how we can best seek meaningful and useful features that can support effective machine learning. In the past two decades we have witnessed remarkable progress in feature representation and learning, starting from Scale Invariant Feature Transform (SIFT) feature entering the scene and evolving to deep learning based features dominating the computer vision field today. For years, milestone handcrafted feature descriptors such as SIFT, Speeded Up Robust Features (SURF), Histogram of Oriented Gradients (HOG) and Local Binary Pattern (LBP) have dominated various domains of computer vision until the turning point in 2012 when Deep Convolutional Neural Networks (DCNN) achieved a record breaking image classification result. Handcrafted features are not data adaptive and usually labor intensive. DCNN is a hierarchical structure that attempts to learn representations of data with multiple levels of abstraction automatically. However, it is a common belief that existing DCNN based features often rely on computationally expensive deep models, which are very slow for numerous applications.

Nowadays, featuring exponentially increasing amount of images and videos, the emerging phenomenon of big dimensionality (millions of dimensions and above) renders the inadequacies of existing approaches, no matter traditional handcrafted features or recent deep learning based ones. There is thus a pressing need for new scalable and efficient approaches that can cope with this explosion of dimensionality. In addition, with the prevalence of social media networks and portable/mobile/wearable devices which have limited computational capabilities and storage space, the demands for sophisticated portable/mobile/wearable device applications in handling large-scale visual data is rising. In such applications, real time performance is of utmost importance to users, since no one is willing to spend any time waiting nowadays. Therefore, there is a growing need for feature descriptors that are fast to compute, memory efficient, and yet exhibiting good discriminability and robustness.

A number of attempting efforts, such as compact binary features, DCNN network quantization, simple

and efficient neural network architectures and big dimensionality oriented feature selection, have appeared in top conferences (including CVPR, ICCV, ECCV, NIPS and ICLR) and top journals (including TPAMI and IJCV). Nevertheless, there has been yet no special issue in major journals to systematically collect mature research and to boost future work in this area. The aim of this special issue is to fill this gap by stimulating researchers from the fields of computer vision, pattern recognition and machine learning to present high quality work and to provide a cross-fertilization ground for stimulating discussions on the next steps in this important research area.

This proposal is inspired by our workshop on Compact and Efficient Feature Representation and Learning in Computer Vision recently accepted by the ICCV 2017 conference. We will advertise this special issue (*e.g.* at the ICCV 2017 conference) and invite researchers from related fields (including authors of the workshop papers) to submit to the special issue. We expect to get many high quality submissions.

4 TOPICS OF INTEREST

The topics of interest include (but are not limited to) the following areas:

- Large-scale applications oriented new features
- Binary codes learning and its related applications
- DCNN features compression
- Efficient neural network design
- Compact and efficient feature selection
- Fast features that are suitable for wearable/mobile devices
- Big dimensionality oriented dimensionality reduction and feature selection
- Sparse modeling and its related applications
- Evaluations of current handcrafted descriptors and deep learning based features
- Other applications such as robotics and medical image analysis

5 PROPOSED DATES

- Paper Submission: December 15, 2017.
- First Notification: April 15, 2018.
- Revisions of Submissions: June 15, 2018.
- Final Decisions: August 15, 2018.
- Final manuscript due: September 15, 2018.

6 EXPECTED NUMBER OF SUBMISSIONS

We expect about 60 submissions from all around the world.

7 BIOGRAPHY OF GUEST EDITORS

7.1 Matti Pietikäinen

Matti Pietikäinen received his Doctor of Science in Technology degree from the University of Oulu, Finland. He is currently a professor and senior research advisor in the Machine Vision Group at the University of Oulu. From 1980 to 1981 and from 1984 to 1985, he visited the Computer Vision Laboratory at the University of Maryland. He has made pioneering contributions, *e.g.* to local binary pattern (LBP) methodology, texture-based image and video analysis, and facial image analysis. He has authored over 340 refereed papers. His papers have currently over 40,100 citations in Google Scholar (h-index 69), and eight of his papers have over 1,000 citations. Dr. Pietikäinen was Associate Editor of IEEE Transactions on Pattern Analysis and Machine Intelligence and Pattern Recognition, and currently serves as Associate Editor of Image and Vision Computing and IEEE Transactions on Forensics and Security journals. He was President of the Pattern Recognition Society of Finland from 1989 to 1992, and was named its Honorary Member in 2014. From 1989 to 2007 he served as Member of the Governing Board of International Association for Pattern Recognition (IAPR), and became one of the founding fellows of the IAPR in 1994. He is IEEE Fellow for contributions to texture and facial image analysis for machine vision. In 2014, his research on LBP-based face description was awarded the Koenderink Prize for Fundamental Contributions in Computer Vision.

7.2 Li Liu

Dr. Li Liu received the B.S. degree in communication engineering, the M.S. degree in photogrammetry and remote sensing and the Ph.D. degree in information and communication engineering from the National University of Defense Technology, China, in 2003, 2005 and 2012, respectively. She joined the faculty at the National University of Defense Technology in 2012, where she is currently an Associate Professor with the College of Information System and Management. During her PhD study, she spent more than two years as a Visiting Student at the University of Waterloo, Canada, from 2008 to 2010. From 2015 to 2016, she spent ten months visiting the Multimedia Laboratory at the Chinese University of Hong Kong. From 2016 to 2018, she is visiting Machine Vision Group at the University of Oulu, Finland. Dr. Liu was a cochair of International Workshops at ACCV2014, CVPR2016, and ICCV2017. She was a guest editor of the special issue RoLoD: Robust local descriptors for computer vision for the journal of Neurocomputing. Her papers have currently over 1000 citations in Google Scholar. Her current research interests include texture analysis, image classification, object detection and scene understanding. She has authored more than 30 papers in journals and conferences. She is a member of the IEEE.

7.3 Jie Chen

Dr. Jie Chen received the M.S. and Ph.D. degrees from Harbin Institute of Technology, China, in 2002 and 2007, respectively. Since September 2007, he has been a senior researcher in the Machine Vision Group at the University of Oulu, Finland. In 2012 and 2015, he visited the Computer Vision Laboratory at the University of Maryland and School of Electrical and Computer Engineering at the Duke University respectively. Dr. Chen was a cochair of International Workshops at ACCV2014, CVPR2016, and ICCV2017. He was a guest editor of the special issue RoLoD: Robust local descriptors for computer vision for the journal of Neurocomputing. His research interests include pattern recognition, computer vision, machine learning, dynamic texture, deep learning, medical image analysis and watermarking. Recently, he proposed a novel image descriptor based on Weber's law (IEEE TPAMI, 2010), which has about 621 citations according to Google Scholar. He has authored more than 50 papers in journals and conferences, and he is a member of the IEEE.

7.4 Guoying Zhao

Dr. Guoying Zhao received the Ph.D. degree in computer science from the Chinese Academy of Sciences, Beijing, China, in 2005. She is currently an Associate Professor with the Center for Machine Vision and Signal Analysis, University of Oulu, Finland, where she has been a senior researcher since 2005. In 2011, she was selected to the highly competitive Academy Research Fellow position. She has authored or co-authored more than 150 papers in journals and conferences. Her papers have currently over 5,600 citations in Google Scholar (h-index 33). She has served as area chairs for FG 2017 and WACV 2017 and is associate editor for Pattern Recognition and Image and Vision Computing Journals. She has lectured tutorials at ICPR 2006, ICCV 2009, and SCIA 2013, and authored/edited three books and six special issues in journals. Dr. Zhao was a cochair of nine International Workshops at ECCV, ICCV, CVPR and ACCV, and two special sessions at FG13 and FG15. She is IEEE Senior Member. Her current research interests include image and video descriptors, facial-expression and micro-expression recognition, gait analysis, dynamic-texture recognition, human motion analysis, and person identification. Her research has been reported by Finnish TV programs, newspapers and MIT Technology Review.

7.5 Xiaogang Wang

Dr. Xiaogang Wang received his B.S. in Electronic Engineering and Information Science from the Special Class of Gifted Young at the University of Science and Technology of China, M.S. degree in Information Engineering from the Chinese University of Hong Kong, and Ph.D. degree in Computer Science from Massachusetts Institute of Technology. He is an associate professor in

the Department of Electronic Engineering at the Chinese University of Hong Kong since 2009. He was the Area Chairs of CVPR 2017, ICCV 2011 and 2015, ECCV 2014 and 2016, ACCV 2014 and 2016. He received the Outstanding Young Researcher in Automatic Human Behaviour Analysis Award in 2011, Hong Kong RGC Early Career Award in 2012, and CUHK Young Researcher Award 2012. His research interests include deep learning and computer vision. His papers have currently over 11,500 citations in Google Scholar (h-index 61).

7.6 Rama Chellappa

Rama Chellappa (F'92) received the B.E. (Hons.) degree in electronics and communication engineering from the University of Madras, Chennai, India, in 1975, the M.E. (with Distinction) degree from the Indian Institute of Science, Bangalore, India, in 1977, and the M.S.E.E. and Ph.D. degrees in electrical engineering from Purdue University, West Lafayette, IN, USA, in 1978 and 1981, respectively. He was a Faculty Member with the Department of Electrical Engineering/Systems, University of Southern California (USC), from 1981 to 1991. Since 1991, he has been a Professor of electrical and computer engineering (ECE) and an affiliate Professor of computer science with the University of Maryland (UMD), College Park, MD, USA. He is also affiliated with the Center for Automation Research and the Institute for Advanced Computer Studies (Permanent Member) and is serving as the Chair of the ECE Department. In 2005, he was named a Minta Martin Professor of Engineering. He holds three patents. His current research interests include face recognition, clustering and video summarization, 3D modeling from video, image and video-based recognition of objects, events and activities, dictionary-based inference, compressive sensing, domain adaptation and hyper spectral processing.

Dr. Chellappa was the recipient of an NSF Presidential Young Investigator Award, four IBM Faculty Development Awards, an Excellence in Teaching Award from the School of Engineering at USC, and two paper awards from the International Association of Pattern Recognition (IAPR). He is a recipient of the K.S. Fu Prize from IAPR. He received the Society, Technical Achievement and Meritorious Service Awards from the IEEE Signal Processing Society. He was also the recipient of the Technical Achievement and Meritorious Service Awards from the IEEE Computer Society. At UMD, he was elected as a Distinguished Faculty Research Fellow and Distinguished Scholar-Teacher, received an Outstanding Innovator Award from the Office of Technology Commercialization, and received an Outstanding GEMSTONE Mentor Award from the Honors College. He received the Outstanding Faculty Research Award and the Poole and Kent Teaching Award for Senior Faculty from the College of Engineering. In 2010, he was recognized as an Outstanding ECE by Purdue University. He is a Fellow of IAPR, OSA and AAAS.

Prof. Chellappa served as the Editor-in-Chief of the IEEE transactions on Pattern Analysis and Machine Intelligence. He has served as a General and Technical Program Chair for several IEEE international and national conferences and workshops. He is a Golden Core Member of the IEEE Computer Society and served as a Distinguished Lecturer of the IEEE Signal Processing Society. Recently, he completed a two-year term as the President of the IEEE Biometrics Council. His papers have currently over 50,800 citations in Google Scholar (h-index 97).

8 SELECTED PUBLICATIONS OF GUEST EDITORS ON THE SPECIAL ISSUE TOPIC

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