PROCEEDINGS OF SPIE

Applications of Machine Learning

Michael E. Zelinski
Tarek M. Taha
Jonathan Howe
Abdul A. S. Awwal
Khan M. Iftekharuddin
Editors

13–14 August 2019
San Diego, California, United States

Sponsored and Published by
SPIE

Volume 11139

Proceedings of SPIE 0277-786X, V. 11139

SPIE is an international society advancing an interdisciplinary approach to the science and application of light.

Applications of Machine Learning, edited by Michael E. Zelinski, Tarek M. Taha, Jonathan Howe, Abdul A. S. Awwal, Khan M. Iftekharuddin, Proc. of SPIE Vol. 11139, 1113901
© 2019 SPIE · CCC code: 0277-786X/19/$21 · doi: 10.1117/12.2552821

The papers in this volume were part of the technical conference cited on the cover and title page. Papers were selected and subject to review by the editors and conference program committee. Some conference presentations may not be available for publication. Additional papers and presentation recordings may be available online in the SPIE Digital Library at SPIEDigitalLibrary.org.

The papers reflect the work and thoughts of the authors and are published herein as submitted. The publisher is not responsible for the validity of the information or for any outcomes resulting from reliance thereon.

Please use the following format to cite material from these proceedings:
Author(s), "Title of Paper," in *Applications of Machine Learning*, edited by Michael E. Zelinski, Tarek M. Taha, Jonathan Howe, Abdul A. S. Awwal, Khan M. Iftekharuddin, Proceedings of SPIE Vol. 11139 (SPIE, Bellingham, WA, 2019) Seven-digit Article CID Number.

ISSN: 0277-786X
ISSN: 1996-756X (electronic)

ISBN: 9781510629714
ISBN: 9781510629721 (electronic)

Published by
SPIE
P.O. Box 10, Bellingham, Washington 98227-0010 USA
Telephone +1 360 676 3290 (Pacific Time) · Fax +1 360 647 1445
SPIE.org
Copyright © 2019, Society of Photo-Optical Instrumentation Engineers.

Copying of material in this book for internal or personal use, or for the internal or personal use of specific clients, beyond the fair use provisions granted by the U.S. Copyright Law is authorized by SPIE subject to payment of copying fees. The Transactional Reporting Service base fee for this volume is $21.00 per article (or portion thereof), which should be paid directly to the Copyright Clearance Center (CCC), 222 Rosewood Drive, Danvers, MA 01923. Payment may also be made electronically through CCC Online at copyright.com. Other copying for republication, resale, advertising or promotion, or any form of systematic or multiple reproduction of any material in this book is prohibited except with permission in writing from the publisher. The CCC fee code is 0277-786X/19/$21.00.

Printed in the United States of America by Curran Associates, Inc., under license from SPIE.

Publication of record for individual papers is online in the SPIE Digital Library.

SPIE. DIGITAL LIBRARY
SPIEDigitalLibrary.org

Paper Numbering: *Proceedings of SPIE* follow an e-First publication model. A unique citation identifier (CID) number is assigned to each article at the time of publication. Utilization of CIDs allows articles to be fully citable as soon as they are published online, and connects the same identifier to all online and print versions of the publication. SPIE uses a seven-digit CID article numbering system structured as follows:

- The first five digits correspond to the SPIE volume number.
- The last two digits indicate publication order within the volume using a Base 36 numbering system employing both numerals and letters. These two-number sets start with 00, 01, 02, 03, 04, 05, 06, 07, 08, 09, 0A, 0B … 0Z, followed by 10-1Z, 20-2Z, etc. The CID Number appears on each page of the manuscript.

Contents

vii *Authors*
ix *Conference Committee*

MACHINE VISION AND MANUFACTURING

11139 04 **Machine learning prediction of defect types for electroluminescence images of photovoltaic panels** [11139-1]

11139 05 **Deep learning-based semantic segmentation for in-process monitoring in laser welding applications** [11139-2]

11139 06 **Image classification and control of microfluidic systems** [11139-3]

11139 07 **Deep learning for automated defect detection in high-reliability electronic parts** [11139-4]

ELECTRO-OPTICS, IMAGING, AND VIDEO PROCESSING

11139 08 **Sensor networks and artificial intelligence for real time motion analysis** [11139-5]

11139 09 **Semantic segmentation in egocentric video frames with deep learning for recognition of activities of daily living** [11139-6]

11139 0A **Image disambiguation with deep neural networks** [11139-7]

11139 0B **Restoration of turbulence-degraded images based on deep convolutional network** [11139-8]

COMPUTING HARDWARE FOR MACHINE LEARNING

11139 0C **Digital neuromorphic chips for deep learning inference: a comprehensive study** [11139-9]

11139 0D **Digit recognition based on programmable nanophotonic processor** [11139-10]

REMOTE SENSING

11139 0E **Reconstruct missing pixels of Landsat land surface temperature product using a CNN with partial convolution** [11139-11]

11139 0G **Conditional generative adversarial networks for data augmentation and adaptation in remotely sensed imagery** [11139-13]

11139 0H **Unsupervised feature learning in remote sensing** [11139-14]

11139 0I **Phenomenological versus random data augmentation for hyperspectral target detection** [11139-15]

11139 0J **Paired neural networks for hyperspectral target detection** [11139-16]

BIG DATA, SIMULATIONS, AND THEORY I

11139 0O **A deep learning framework for mesh relaxation in arbitrary Lagrangian-Eulerian simulations** [11139-21]

11139 0P **Trade-offs between inference and learning in image segmentation** [11139-22]

BIG DATA, SIMULATIONS, AND THEORY II

11139 0R **ML health monitor: taking the pulse of machine learning algorithms in production** [11139-24]

11139 0S **Simple generative model for assessing feature selection based on relevance, redundancy, and redundancy** [11139-25]

11139 0T **Nonlinear spectral preprocessing for small-brain machine learning** [11139-26]

MEDICAL IMAGING AND HEALTHCARE I

11139 0U **Glaucoma diagnosis using transfer learning methods** [11139-27]

11139 0V **Cross-domain diabetic retinopathy detection using deep learning** [11139-28]

11139 0W **Performance analysis of machine learning and deep learning architectures for malaria detection on cell images** [11139-29]

11139 0X **Histopathological image classification with deep convolutional neural networks** [11139-30]

MEDICAL IMAGING AND HEALTHCARE II

11139 0Y **Automated quantification of DNA damage via deep transfer learning based analysis of comet assay images** [11139-31]

11139 10 **Feasibility of sparse contact thermometry as a method for breast cancer detection** [11139-33]

11139 11 **Transfer learning approach to multiclass classification of child facial expressions** [11139-34]

POSTER SESSION

11139 13 **Support vector machine and convolutional neural network based approaches for defect detection in fused filament fabrication** [11139-36]

11139 14 **Crack detection of UAV concrete surface images** [11139-37]

11139 15 **Visual attentiveness recognition using probabilistic neural network** [11139-38]

11139 16 **Monitoring forest disturbance using change detection on synthetic aperture radar imagery** [11139-39]

11139 17 **Road network mapping from aerial images** [11139-40]

11139 18 **An efficient framework for monitoring tree cover in an area through aerial images** [11139-41]

11139 19 **Weed classification in grasslands using convolutional neural networks** [11139-42]

11139 1B **Nature of distracted driving in various physiological conditions** [11139-45]

Authors

Numbers in the index correspond to the last two digits of the seven-digit citation identifier (CID) article numbering system used in Proceedings of SPIE. The first five digits reflect the volume number. Base 36 numbering is employed for the last two digits and indicates the order of articles within the volume. Numbers start with 00, 01, 02, 03, 04, 05, 06, 07, 08, 09, 0A, 0B...0Z, followed by 10-1Z, 20-2Z, etc.

Abels, P., 05
Ali, Redha, 0W
Alom, Md. Zahangir, 0X
Alves dos Reis Benatto, Gisele, 04
Anderson, Dylan Z., 0J
Arko, Scott, 16
Asari, Vijayan K., 0X
Aslam, Dean, 1B
Aspiras, Theus, 0X
Bai, Xiangyu, 0B
Beigh, Kelly, 13
Bhansali, Shekhar, 0Y
Byrne, Arlo, 19
Calef, Matthew T., 16
Chartrand, Rick, 16
Chen, I-Chieh, 15
Chen, Maosi, 0E
Chen, Shih-Jui, 15
Chen, Yi-Chun, 15
Chen, Yuan, 0D
Chowdhury, Hasanur Rahman, 1B
Chu, Albert B., 06
Chu, Yihang, 1B
Compean Aguirre, Jorge L., 09
Cooke, Marcus, 0Y
Corr, Chelsea A., 0E
DeGuchy, Omar, 0A
Donahue, Emily A., 07
Dong, Liquan, 0B
Durieux, Alice M. S., 16
Forchhammer, Søren, 04
Forsyth, Steven, 0H
Gallagher, Brian, 0O
Gao, Wei, 0E
García Vázquez, Mireya S., 09
Ghanta, Sindhu, 0R
Giera, Brian, 06
Goldberg, Yakov, 0R
Goley, Steven, 0H
González, Francisco Javier, 10
González Leal, Raymundo, 10
Han, D., 14
Hansen, Mark F., 19
Hardie, Russell C., 0W
He, Chuan, 0B
Henderson, Keith, 0O
Ho, Alex, 0A
Hossain, Kabir, 04
Hossain, Mohammad Jobayer, 1B
Howe, Jonathan, 0G
Hu, Yu-Jian, 15
Huang, Yi, 0D
Iftekharuddin, Khan M., 11
Indovina, Mark, 0C
Jaimes Méndez, Juan C., 09
Jain, Arpan, 18
Jain, Suchit, 17, 18
Jiang, Ming, 0O
Kangas, Scott, 0H
Kaplan, Alan D., 06
Karbaschi, Mahsa, 0Y
Keisler, Ryan, 16
Khermosh, Lior, 0R
Knaak, C., 05
Kolter, G., 05
Kontgis, Caitlin, 16
Kröger, M., 05
Kudithipudi, Dhireesha, 0C
LaCasse, Charles F., 0I
Lakshminarayanan, Vasudevan, 0U, 0V
Lane, Hobson, 0T
Langroudi, Hamed F., 0C
Leduc, Jean-Pierre, 08
Lin, Yi-Jing, 15
Liu, Ming, 0B
Liu, Xiaohua, 0B
Loughnane, Gregory, 13
Maguire, Alister, 0O
Mandell, Noah, 0O
Mantel, Claire, 04
Marcia, Roummel F., 0A
Martinez, Cari, 07
Mishra, Prakamya, 17
Mittal, Rohan, 17, 18
Mitul, Abu, 1B
Montoya Obeso, Abraham, 09
Namuduri, Srikanth, 0Y
Narayanan, Barath Narayanan, 0W, 0Y, 13
Newell, Benjamin H., 0E
Nguyen, Du, 06
Nguyen, Quan, 0P
Pandit, Tej, 0C
Peng, Chia-Ju, 15
Porter, Reid, 0P
Potter, Kevin, 07
Poulsen, Peter, 04
Powar, Nilesh, 13
Pula, Kyle, 0G

Qin, Zhentao, 0D
Quach, Tu-Thach, 07
Rajesh Parikh, Harsh, 04
Ramírez Acosta, Alejandro A., 09
Reite, Aaron A., 0G, 0H
Roselli, Drew, 0R
Samad, Manar D., 11
Schulze, F., 05
Sengupta, Sourya, 0U, 0V
Sera, Dezso, 04
Shah, Harshil, 0R
Singh, Amitojdeep, 0U, 0V
Sinha, Aakash, 17, 18
Smith, Braden J., 0I, 0J
Smith, Lyndon N., 19
Smith, Matthew, 07
Smith, Melvyn L., 19
Spataru, Sergiu, 04
Steck, Zackery, 0H
Subramanian, Sriram, 0R
Sun, Zhibin, 0E
Sundararaman, Swaminathan, 0R
Taha, Tarek M., 0X
Talagala, Nisha, 0R
Theiler, James, 0S
Turner, Christian D., 07
Uddin, Nezam, 1B
Villebro, Frederik, 04
Von Stroh, Jonathan, 0H
Vuong, Luat T., 0T
Warren, Michael S., 16
Weinert, George, 0O
Wendlandt, Stefan, 04
Witherow, Megan A., 11
Zamorano Raya, José A., 09
Zelek, John, 0V
Zhang, Jinlei, 0D
Zhang, Wenhao, 19
Zhao, Yuejin, 0B
Zheng, Zhenrong, 0D
Zimmer, Beate, 0P
Zollweg, Joshua D., 0I, 0J

Conference Committee

Program Track Chair

Khan M. Iftekharuddin, Old Dominion University (United States)

Conference Chairs

Michael E. Zelinski, Lawrence Livermore National Laboratory (United States)
Tarek M. Taha, University of Dayton (United States)
Jonathan Howe, NVIDIA Corporation (United States)

Conference Co-chairs

Abdul A. S. Awwal, Lawrence Livermore National Laboratory (United States)
Khan M. Iftekharuddin, Old Dominion University (United States)

Conference Program Committee

Ghaleb M. Abdulla, Lawrence Livermore National Laboratory (United States)
Md. Zahangir Alom, University of Dayton (United States)
Brent D. Bartlett, BeamIO (United States)
Jason T. Casey, BeamIO (United States)
Sindhu Ghanta, ParallelM, Inc. (United States)
James Henrikson, Lawrence Livermore National Laboratory (United States)
Dhireesha Kudithipudi, Rochester Institute of Technology (United States)
Nathan Longbotham, Descartes Labs, Inc. (United States)
Uttam K. Majumder, Air Force Research Laboratory (United States)
Nathan Mundhenk, Lawrence Livermore National Laboratory (United States)
Karl Song-Jeng Ni, Google (United States)
Manar D. Samad, Tennessee State University (United States)
Shaohui Sun, Lyft, Inc. (United States)
Amanda K. Ziemann, Los Alamos National Laboratory (United States)

Session Chairs

Signal, Image, and Data Processing Plenary Session
Khan M. Iftekharuddin, Old Dominion University (United States)

1 Machine Vision and Manufacturing
Tarek M. Taha, University of Dayton (United States)

2 Electro-Optics, Imaging, and Video Processing
Nathan Mundhenk, Lawrence Livermore National Laboratory (United States)

3 Computing Hardware for Machine Learning
Tarek M. Taha, University of Dayton (United States)

4 Remote Sensing
Michael E. Zelinski, Lawrence Livermore National Laboratory (United States)

5 Big Data, Simulations, and Theory I
Jonathan Howe, NVIDIA Corporation (United States)

6 Big Data, Simulations, and Theory II
Jonathan Howe, NVIDIA Corporation (United States)

7 Medical Imaging and Healthcare I
Sindhu Ghanta, ParallelM, Inc. (United States)

8 Medical Imaging and Healthcare II
Sindhu Ghanta, ParallelM, Inc. (United States)