

PROCEEDINGS OF SPIE

***Next-Generation Robotics II;
and Machine Intelligence
and Bio-inspired Computation:
Theory and Applications IX***

**Dan Popa
Muthu B. J. Wijesundara
Misty Blowers**
Editors

**21–22 April 2015
Baltimore, Maryland, United States**

Sponsored and Published by
SPIE

Volume 9494

Proceedings of SPIE 0277-786X, V. 9494

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

Next-Generation Robotics II; and Machine Intelligence and Bio-inspired Computation: Theory and Applications IX,
edited by Dan Popa, Muthu B. J. Wijesundara, Misty Blowers, Proc. of SPIE Vol. 9494, 949401
© 2015 SPIE · CCC code: 0277-786X/15/\$18 · doi: 10.1117/12.2199012

Proc. of SPIE Vol. 9494 949401-1

The papers included 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. The papers published in these proceedings 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 this book:

Author(s), "Title of Paper," in *Next-Generation Robotics II; and Machine Intelligence and Bio-inspired Computation: Theory and Applications IX*, edited by Dan Popa, Muthu B. J. Wijesundara, Misty Blowers, Proceedings of SPIE Vol. 9494 (SPIE, Bellingham, WA, 2015) Article CID Number.

ISSN: 0277-786X

ISBN: 9781628416107

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 © 2015, 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 \$18.00 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/15/\$18.00.

Printed in the United States of America.

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

SPIE 
Digital Library

SPIDigitalLibrary.org

Paper Numbering: Proceedings of SPIE follow an e-First publication model, with papers published first online and then in print. Papers are published as they are submitted and meet publication criteria. A unique citation identifier (CID) number is assigned to each article at the time of the first 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, print, and electronic versions of the publication. SPIE uses a six-digit CID article numbering system in which:

- The first four 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. The complete citation is used on the first page, and an abbreviated version on subsequent pages.

Contents

v *Authors*
vii *Conference Committees*

Part A Sensors for Next-Generation Robotics II

SESSION 1	NEW SENSORS FOR ROBOTS
9494 03	EHD printing of PEDOT: PSS inks for fabricating pressure and strain sensor arrays on flexible substrates [9494-2]
9494 04	Multi-material additive manufacturing of robot components with integrated sensor arrays [9494-3]
9494 05	Micro-force sensing mobile microrobots [9494-4]
9494 07	Force estimation in a 2-DoF piezoelectric actuator by using the inverse-dynamics based unknown input observer technique [9494-26]
SESSION 2	ROBOTIC APPLICATIONS
9494 08	Sensor study for high speed autonomous operations [9494-6]
9494 09	Multi-modal sensor and HMI integration with applications in personal robotics [9494-7]
94940A	Robotic situational awareness of actions in human teaming [9494-8]
9494 0B	Performance evaluation and clinical applications of 3D plenoptic cameras [9494-9]
9494 0C	Surface EMG and intra-socket force measurement to control a prosthetic device [9494-10]
9494 0D	Resolving ranges of layered objects using ground vehicle LiDAR [9494-11]
9494 0E	Performances analysis of piezoelectric cantilever based energy harvester devoted to mesoscale intra-body robot [9494-28]
9494 0F	Untethered microscale flight: mechanisms and platforms for future aerial MEMS microrobots [9494-30]
SESSION 3	CONTROL
9494 0G	Automated actuation of multiple bubble microrobots using computer-generated holograms [9494-12]

- 9494 OH **An ontology to enable optimized task partitioning in human-robot collaboration for warehouse kitting operations** [9494-13]
- 9494 OI **Control of a powered prosthetic device via a pinch gesture interface** [9494-14]
- 9494 OK **Multi-mode vibration suppression in 2-DOF piezoelectric systems using zero placement input shaping technique** [9494-27]
- 9494 OL **Simultaneous suppression of badly damped vibrations and cross-couplings in a 2-DoF piezoelectric actuator by using feedforward standard H_∞ approach** [9494-29]

Part B Machine Intelligence and Bio-inspired Computation: Theory and Applications IX

SESSION 1 ADVANCES IN FUNDAMENTAL RESEARCH

- 9494 OM **Evolving spiking neural networks: a novel growth algorithm exhibits unintelligent design** [9494-16]
- 9494 ON **Experimental analysis of a Lotka-Volterra neural network for classification** [9494-17]
- 9494 OO **Collaborative mining and transfer learning for relational data** [9494-18]

SESSION 2 INNOVATIONS IN APPLIED RESEARCH

- 9494 OS **Bio-inspired approach for intelligent unattended ground sensors (Best Paper Award)** [9494-21]

SESSION 3 IMPROVED SITUATIONAL AWARENESS

- 9494 OU **Subset selection of training data for machine learning: a situational awareness system case study** [9494-23]
- 9494 OV **Realistic computer network simulation for network intrusion detection dataset generation** [9494-24]
- 9494 OW **Change detection in Arctic satellite imagery using clustering of sparse approximations (CoSA) over learned feature dictionaries** [9494-25]

Authors

Numbers in the index correspond to the last two digits of the six-digit citation identifier (CID) article numbering system used in Proceedings of SPIE. The first four 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.

Al Hamidi, Yasser, 0K
Alonzo, Rommel, 09
Altmann, Garrett L., 0W
Aylesworth, Marc, 0N
Banerjee, Ashis Gopal, 0H
Baptist, Joshua R., 03
Barnes, Andrew, 0H
Cappelleri, David J., 05
Cheng, Julian, 0G
Close, Ryan, 08, 0D
Cohen, Adam L., 04
Cox, Bryan, 04
Cremer, Sven, 09
Decker, Ryan, 0B
Del Giorno, Mark, 08
Eslami, Mohammed, 0O
Fan, Qihui, 0G
Galla, Matt, 04
Gowda, Sandesh, 09
Gupta, Satyandra K., 0H
Habineza, Didace, 0L
Haddab, Yassine, 07
Hennequin, Christophe, 0S
Hollinger, Jim, 0D
Hueber, Nicolas, 0S
Hussain, Syed A., 0F
Jing, Wuming, 05
Kaipa, Krishnanand N., 0H
Kim, Peter C. W., 0B
Krieger, Axel, 0B
Krueger, Paul S., 04
Kutscher, Brett, 0D
La Celle, Zachary, 08
Lacaze, Alberto, 08
Le Gorrec, Yann, 0L
Lee, Woo Ho, 03
Leonard, Simon, 0B
Levchuk, Georgiy, 0O
Liu, Jiashun, 0H
Mahdavi pour, Omid, 0F
Majumdar, Ratul, 0F
Mastromoro, Larry, 09
McKenzie, M., 0U
Mirza, Fahad, 09
Moeglin, Jean-Pierre, 0S
Moody, Daniela I., 0W
Murphy, Karl, 08
Nothnagle, Caleb, 03
Ohta, Aaron T., 0G

Opfermann, Justin, 0B
Paprotny, Igor, 0F
Patterson, Rita, 0C
Payer, Garrett, 0V
Perrot, Maxime, 0S
Pichler, Alexander, 0S
Popa, Dan O., 03, 09, 0C, 0I
Rabenorosoa, Kanty, 0E
Rahman, M. Arifur, 0G
Rakotondrabe, Micky, 07, 0E, 0K, 0L
Raymond, Pierre, 0S
Richer, Edmond, 04
Rowland, Joel C., 0W
Saari, Matt, 04
Sanford, Joseph D., 03, 0C, 0I
Schaffer, J. David, 0M
Schneider, Anne, 08
Shademan, Azad, 0B
Shah, Nadir, 0H
Shriyam, Shaurya, 0H
Stanton, Joseph, 0N
Sukhu, Christopher L., 0N
Tahmoush, David, 0A
Trenchant, Vincent, 07
Voisin, Philippe, 0S
Wallace, Kristi, 0I
Ward, Spencer, 0F
Wijesundara, Muthu B. J., 03
Wilson, Cathy J., 0W
Wong, S. C., 0U
Yetkin, Oguz, 0I

Conference Committees

Symposium Chair

Wolfgang Schade, Clausthal University of Technology and Fraunhofer Heinrich-Hertz Institute (Germany)

Symposium Co-chair

Ming C. Wu, University of California, Berkeley (United States)

Part A Sensors for Next-Generation Robotics II

Conference Chairs

Dan Popa, The University of Texas at Arlington (United States)
Muthu B. J. Wijesundara, The University of Texas at Arlington Research Institute (United States)

Conference Program Committee

Ashis G. Banerjee, GE Global Research (United States)
Ryan R. Close, U.S. Army RDECOM CERDEC NVESD (United States)
Yong-Lae Park, Carnegie Mellon University (United States)
Micky Rakotondrabe, FEMTO-ST (France)
Veronica J. Santos, University of California, Los Angeles (United States)

Session Chairs

- 1 New Sensors for Robots
 Muthu B. J. Wijesundara, The University of Texas at Arlington Research Institute (United States)
- 2 Robotic Applications
 Ryan R. Close, U.S. Army RDECOM CERDEC NVESD (United States)
- 3 Control
 Ashis Gopal Banerjee, GE Global Research (United States)

Part B Machine Intelligence and Bio-inspired Computation: Theory and Applications IX

Conference Chair

Misty Blowers, Air Force Research Laboratory (United States)

Conference Program Committee

Gus Anderson, MacAulay-Brown, Inc. (United States)

Georgiy M. Levchuk, Aptima, Inc. (United States)

John A. Marsh, State University of New York Institute of Technology
(United States)

Clare D. Thiem, Air Force Research Laboratory (United States)

Robinson Pino, U.S. Department of Energy (United States)

Daniel Stambovsky, Air Force Research Laboratory (United States)

Jonathan Williams, Air Force Research Laboratory (United States)

Bryant T. Wysocki, Air Force Research Laboratory (United States)