

# IEEE TRANSACTIONS ON NEURAL NETWORKS AND LEARNING SYSTEMS

IEEE TRANSACTIONS ON NEURAL NETWORKS AND LEARNING SYSTEMS is published by the IEEE Computational Intelligence Society. Members may subscribe to this TRANSACTIONS for \$29.00 per year. IEEE student members may subscribe for \$15.00 per year. Nonmembers may subscribe for \$2,990.00. For information on receiving this TRANSACTIONS, write to the IEEE Service Center at the address below. *Member copies of Transactions/Journals are for personal use only.* For more information about this TRANSACTIONS see <http://www.ieee-cis.org/pubs/tmnls>

## Editor-in-Chief

DERONG LIU (e-mail: [ieectmnls@gmail.com](mailto:ieectmnls@gmail.com))

School of Automation and Electrical Engineering, University of Science and Technology Beijing, Beijing 100083, China  
Dept. of Electrical and Computer Engineering, University of Illinois, Chicago, IL 60607 USA

## Associate Editors

MURAD ABU-KHALAF MIT, USA	PAU-CHOO (JULIA) CHUNG National Cheng Kung Univ., Taiwan	SHIWANG JI Old Dominion University, USA	ROBI POLIKAR Rowan Univ., USA	HUAJIN TANG Institute for Infocomm Research, Singapore
ADEL M. ALIMI University of Sfax, Tunisia	SERGIO CRUCES University of Seville, Spain	PREBEN KIDMOSE Aarhus University, Denmark	DANIL PROKHOROV Toyota Research Institute NA, USA	DACHENG TAO University of Technology Sydney, Australia
CHARLES ANDERSON Colorado State Univ., USA	QIONGHAI DAI Tsinghua University, China	RHEE MAN KIL Sungkyunkwan University, Korea	MANUEL ROVERI Politecnico di Milano, Italy	PETER TINO The University of Birmingham, U.K.
ALUZIO FAUSTO RIBEIRO ARAUJO Federal Univ. of Pernambuco, Brazil	STEVEN DAMELIN University of Michigan, USA	LI-WEI (LEO) KO National Chiao-Tung Univ., Taiwan	BJÖRN W. SCHULLER Technische Universität München, Germany	DIANHUI WANG La Trobe University, Australia
AHMAD TAHER AZAR Benha University, Egypt	DAOYI DONG Univ. of New South Wales, Australia	ROBERT LEGENSTEIN Graz Univ. of Technology, Austria	MADHUSUDANA SHASHANKA United Technologies Research Center, USA	MICHAEL J. WATTS Auckland Institute of Studies, New Zealand
BART BAESENS Catholic University of Leuven, Belgium	EL-SAYED EL-ALFY King Fahd Univ. of Petroleum & Minerals, Saudi Arabia	HONGYI LI Bohai University, China	CHUNHUA SHEN University of Adelaide Australia	QINGLAI WEI Chinese Academy of Sciences, China
GIORGIO BATTISTELLI University of Florence, Italy	DAVID ELIZONDO De Montfort University, U.K.	ZHIJUN LI Souch China Univ. of Technology, China	IGOR SKRJANC University of Ljubljana, Slovenia	STEFAN WERMTER University of Hamburg, Germany
EDUARDO BAYRO-CORROCHANO CINVESTAV Unidad Guadalajara, Mexico	MAURIZIO FILIPPONE Univ. of Glasgow, U.K.	JINLING LIANG Southeast University, China	YONGDUAN SONG Chongqing University, China	MARCO WIERING Univ. of Groningen, The Netherlands
SANDER BOHTE Centrum Wiskunde & Informatica, The Netherlands	YUN RAYMOND FU Northeastern University, USA	JUWEI LU The Canon USA Innovation Ctr., USA	STEFANO SQUARTINI Univ. Politecnica delle Marche, Italy	JONATHAN WU University of Windsor, Canada
PANTELIS BOUBOULIS University of Athens, Greece	GIORGIO GNECCO University of Genoa, Italy	WENLIAN LU Fudan University, China	CHANGYIN SUN Southeast University, China	SHENGLI XIE Guangdong University of Technology, China
ANTONIO DE PADUA BRAGA Federal Univ. of Minas Gerais, Brazil	JOHN (YANNIS) GOULERMAS University of Liverpool, U.K.	JIANCHENG LV Sichuan University, China	ANA MARIA MADUREIRA Polytechnic of Porto (ISEP/IPP), Portugal	DONG XU Nanyang Technological University, Singapore
CRISTIANO CERVELLERA Institute of Intelligent Systems for Automation, NRC, Italy	HAIBO HE Univ. of Rhode Island, USA	YEW-SOON ONG Nanyang Technological Univ., Singapore	SUNDARAM SURESH Nanyang Technological Univ., Singapore	HUAGUANG ZHANG Northeastern University, China
BADONG CHEN Xi'an Jiaotong Univ., China	TOM HESKES Radboud Univ. Nijmegen, The Netherlands	SEIICHI OZAWA Kobe Univ., Japan	AH-HWEE TAN Nanyang Technological Univ., Singapore	YUNONG ZHANG Sun Yat-sen University, China
CLIVE CHEONG TOOK University of Surrey, UK	XIAOLIN HU Tsinghua University, China	MASSIMO PANELLA Univ. of Rome "La Sapienza", Italy	YING TAN Peking University, China	DONGBIN ZHAO Chinese Academy of Sciences, China
YIU-MING CHEUNG Hong Kong Baptist University, Hong Kong	TINGWEN HUANG Texas A&M University at Qatar, Qatar	TOSHIIHISA TANAKA Tokyo Univ. Agriculture and Technology, Japan	ZHI-HUA ZHOU Nanjing University, China	JUN ZHAO Dalian University of Technology, China
HUNG-YUAN CHUNG National Central Univ., Taiwan	AMIR HUSSAIN University of Stirling, UK			WEI XING ZHENG University of Western Sydney, Australia

## IEEE Officers

HOWARD E. MICHEL, *President*  
BARRY L. SHOOP, *President-Elect*  
PARVIZ FAMOURI, *Secretary*  
JERRY L. HEDGINS, *Treasurer*  
ROBERTO DE MARCA, *Past President*

SAURABH SINHA, *Vice President, Educational Activities*  
SHEILA HEMAMI, *Vice President, Publication Services and Products*  
WAI-CHOONG WONG, *Vice President, Member and Geographic Activities*  
BRUCE P. KRAEMER, *President, Standards Association*  
VINCENZO PIURI, *Vice President, Technical Activities*  
JAMES A. JEFFRIES, *President, IEEE-USA*

KAZUHIRO KOSUGE, *Director, Division X*

## IEEE Executive Staff

DR. E. JAMES PRENDERGAST, *Executive Director & Chief Operating Officer*

THOMAS SIEGERT, *Business Administration*  
ELENA GERSTMANN, *Corporate Activities*  
DOUGLAS GORHAM, *Educational Activities*  
EILEEN LACH, *General Counsel & Corporate Compliance Officer*  
SHANNON JOHNSTON, *Human Resources*  
CHRIS BRANTLEY, *IEEE-USA*

DONNA HOURICAN, *Information Technology (acting)*  
PATRICK MAHONEY, *Marketing*  
CECELIA JANKOWSKI, *Member and Geographic Activities*  
ANTHONY DURNIAK, *Publications*  
KONSTANTINOS KARACHALIOS, *Standards Activities*  
MARY WARD-CALLAN, *Technical Activities*

## IEEE Periodicals

### Transactions/Journals Department

*Senior Director:* FRAN ZAPPULLA  
*Editorial Director:* DAWN MELLEY *Production Director:* PETER M. TUOHY  
*Managing Editor:* JEFFREY E. CICHOCKI *Journals Coordinator:* MICHAEL J. HELLERIGEL

IEEE TRANSACTIONS ON NEURAL NETWORKS AND LEARNING SYSTEMS (ISSN 2162-237X) is published monthly by The Institute of Electrical and Electronics Engineers, Inc. Responsibility for the contents rests upon the authors and not upon the IEEE, the Society/Council, or its members. **IEEE Corporate Office:** 3 Park Avenue, 17th Floor, New York, NY 10016-5997. **IEEE Operations Center:** 445 Hoes Lane, Piscataway, NJ 08854-4141. **NJ Telephone:** +1 732 981 0060. **Price/Publication Information:** Individual copies: IEEE Members \$20.00 (first copy only), nonmembers \$249.00 per copy. (Note: Postage and handling charge not included.) Member and nonmember subscription prices available upon request. **Copyright and Reprint Permissions:** Abstracting is permitted with credit to the source. Libraries are permitted to photocopy for private use of patrons, provided the per-copy fee of \$31.00 is paid through the Copyright Clearance Center, 222 Rosewood Drive, Danvers, MA 01923. For all other copying, reprint, or republication permission, write to Copyrights and Permissions Department, IEEE Publications Administration, 445 Hoes Lane, Piscataway, NJ 08854-4141. Copyright © 2015 by The IEEE, Inc. All rights reserved. Periodicals Postage Pending at New York, NY and at additional mailing offices. **Postmaster:** Send address changes to IEEE TRANSACTIONS ON NEURAL NETWORKS, IEEE, 445 Hoes Lane, Piscataway, NJ 08854-4141. GST Registration No. 125634188. CPC Sales Agreement #40013087. Return undeliverable Canada addresses to: Pitney Bowes IMEX, P.O. Box 4332, Stanton Rd., Toronto, ON M5W 3J4, Canada. IEEE prohibits discrimination, harassment and bullying. For more information visit <http://www.ieee.org/nondiscrimination> Printed in U.S.A.