Advances in Intelligent Systems and Computing

Volume 531

Series editor

Janusz Kacprzyk, Polish Academy of Sciences, Warsaw, Poland
e-mail: kacprzyk@ibspan.waw.pl

About this Series

The series "Advances in Intelligent Systems and Computing" contains publications on theory, applications, and design methods of Intelligent Systems and Intelligent Computing. Virtually all disciplines such as engineering, natural sciences, computer and information science, ICT, economics, business, e-commerce, environment, healthcare, life science are covered. The list of topics spans all the areas of modern intelligent systems and computing.

The publications within "Advances in Intelligent Systems and Computing" are primarily textbooks and proceedings of important conferences, symposia and congresses. They cover significant recent developments in the field, both of a foundational and applicable character. An important characteristic feature of the series is the short publication time and world-wide distribution. This permits a rapid and broad dissemination of research results.

Advisory Board

Chairman

Nikhil R. Pal, Indian Statistical Institute, Kolkata, India
e-mail: nikhil@isical.ac.in

Members

Rafael Bello Perez, Universidad Central "Marta Abreu" de Las Villas, Santa Clara, Cuba
e-mail: rbellop@uclv.edu.cu

Emilio S. Corchado, University of Salamanca, Salamanca, Spain
e-mail: escorchado@usal.es

Hani Hagras, University of Essex, Colchester, UK
e-mail: hani@essex.ac.uk

László T. Kóczy, Széchenyi István University, Győr, Hungary
e-mail: koczy@sze.hu

Vladik Kreinovich, University of Texas at El Paso, El Paso, USA
e-mail: vladik@utep.edu

Chin-Teng Lin, National Chiao Tung University, Hsinchu, Taiwan
e-mail: ctlin@mail.nctu.edu.tw

Jie Lu, University of Technology, Sydney, Australia
e-mail: Jie.Lu@uts.edu.au

Patricia Melin, Tijuana Institute of Technology, Tijuana, Mexico
e-mail: epmelin@hafsamx.org

Nadia Nedjah, State University of Rio de Janeiro, Rio de Janeiro, Brazil
e-mail: nadia@eng.uerj.br

Ngoc Thanh Nguyen, Wroclaw University of Technology, Wroclaw, Poland
e-mail: Ngoc-Thanh.Nguyen@pwr.edu.pl

Jun Wang, The Chinese University of Hong Kong, Shatin, Hong Kong
e-mail: jwang@mae.cuhk.edu.hk

More information about this series at http://www.springer.com/series/11156

Weidong Chen · Koh Hosoda
Emanuele Menegatti · Masahiro Shimizu
Hesheng Wang
Editors

Intelligent Autonomous Systems 14

Proceedings of the 14th International Conference IAS-14

Springer

Editors
Weidong Chen
Shanghai Jiao Tong University
Shanghai
China

Koh Hosoda
Osaka University
Osaka
Japan

Emanuele Menegatti
University of Padua
Padua
Italy

Masahiro Shimizu
Osaka University
Osaka
Japan

Hesheng Wang
Shanghai Jiao Tong University
Shanghai
China

ISSN 2194-5357 ISSN 2194-5365 (electronic)
Advances in Intelligent Systems and Computing
ISBN 978-3-319-48035-0 ISBN 978-3-319-48036-7 (eBook)
DOI 10.1007/978-3-319-48036-7

Library of Congress Control Number: 2016955328

© Springer International Publishing AG 2017
This work is subject to copyright. All rights are reserved by the Publisher, whether the whole or part of the material is concerned, specifically the rights of translation, reprinting, reuse of illustrations, recitation, broadcasting, reproduction on microfilms or in any other physical way, and transmission or information storage and retrieval, electronic adaptation, computer software, or by similar or dissimilar methodology now known or hereafter developed.
The use of general descriptive names, registered names, trademarks, service marks, etc. in this publication does not imply, even in the absence of a specific statement, that such names are exempt from the relevant protective laws and regulations and therefore free for general use.
The publisher, the authors and the editors are safe to assume that the advice and information in this book are believed to be true and accurate at the date of publication. Neither the publisher nor the authors or the editors give a warranty, express or implied, with respect to the material contained herein or for any errors or omissions that may have been made.

Printed on acid-free paper

This Springer imprint is published by Springer Nature
The registered company is Springer International Publishing AG
The registered company address is: Gewerbestrasse 11, 6330 Cham, Switzerland

Preface

For the first time, the International Conference on Intelligent Autonomous Systems (IAS) is held in China and organized by Shanghai Jiao Tong University. This year, the 14th IAS is held in Shanghai from July 3 to July 7, 2016 at Shanghai Jiao Tong University with the goal of bringing together researchers and engineers from around the world to present their latest research accomplishments, innovations, and visions in the field of robotics and artificial intelligence.

The theme of IAS-14 is "**Frontier of intelligent autonomous systems**," reflecting the ever growing interests in research, development, and applications in the dynamic and exciting areas of robotics.

After going through a rigorous peer-review process, totally, 85 papers have been selected for oral presentation. The scientific program consists of 24 technical sessions in 4 tracks, running over two days in comfortable slots of 20 min. The conference program is enriched by four plenary talks from Maarja Kruusmaa, Davide Scaramuzza, Jun Ota, Barry Trimmer, and one keynote talk by Dong Sun.

We are grateful for the assistance of the staff members and students of Shanghai Jiao Tong University. We would also thank all members of the organization committee for their help in organizing this event. Special thanks should be given to all the authors for contributing their research works, and all the participants for making the conference a memorable event.

We hope that these proceedings, and especially the participation in the IAS-14 Conference and its related events, will inspire new ideas, foster new research, and create new friendships which can grow into fruitful collaborations. IAS-14 promises to be a great event for all participants, with excellent technical and social programs.

Shanghai, China
June 2016

Weidong Chen
Masahiro Shimizu

Contents

Part I Embodied-Brain Systems Science

Clustering Latent Sensor Distribution on Body Map for Generating Body Schema 3
Tomohiro Mimura, Yoshinobu Hagiwara, Tadahiro Taniguchi and Tetsunari Inamura

Improvement of EMG Pattern Recognition by Eliminating Posture-Dependent Components 19
Akira Ishii, Toshiyuki Kondo and Shiro Yano

Quantification of Temporal Parameters for Tripedalism 31
Arito Yozu, Dai Owaki, Masashi Hamada, Takuya Sasaki, Qi An, Tetsuro Funato and Nobuhiko Haga

Proposal of a Stance Postural Control Model with Vestibular and Proprioceptive Somatosensory Sensory Input 39
Ping Jiang, Shouhei Shirafuji, Ryosuke Chiba, Kaoru Takakusaki and Jun Ota

Simultaneous Localization, Mapping and Self-body Shape Estimation by a Mobile Robot 53
Akira Taniguchi, Lv WanPeng, Tadahiro Taniguchi, Toshiaki Takano, Yoshinobu Hagiwara and Shiro Yano

Objective Measurement of Dynamic Balance Function by the Simultaneous Measurement of the Center of Gravity (COG) and Center of Pressure (COP) 69
Masahiko Mukaino, Fumihiro Matsuda, Ryoma Sassa, Kei Ohtsuka, Nobuhiro Kumazawa, Kazuhiro Tsuchiyama, Shigeo Tanabe and Eiichi Saitoh

Development of a Master–Slave Finger Exoskeleton Driven by Pneumatic Artificial Muscles 77
Takuya Urino, Shuhei Ikemoto and Koh Hosoda

Temporal Structure of Muscle Synergy of Human Stepping Leg During Sit-to-Walk Motion 91
Qi An, Hiroshi Yamakawa, Atsushi Yamashita and Hajime Asama

Part II Field Robot

Fast and Accurate Crop and Weed Identification with Summarized Train Sets for Precision Agriculture 105
Ciro Potena, Daniele Nardi and Alberto Pretto

Supervised Autonomy for Exploration and Mobile Manipulation in Rough Terrain 123
Max Schwarz, Sebastian Schüller, Christian Lenz, David Droeschel and Sven Behnke

Behavior-Based Collision Avoidance Using a Cylinder-Coordinate Octree 143
Daniel Schmidt, Fabian Göckel and Karsten Berns

An Integrated Robotic System for Autonomous Brake Bleeding in Rail Yards 157
Huan Tan, Shiraj Sen, Arpit Jain, Shuai Li, Viktor Holovashchenko, Ghulam Baloch, Omar Al Assad, Romano Patrick, Douglas Forman, Yonatan Gefen, Pramod Sharma, Frederick Wheeler, Charles Theurer and Balajee Kannan

Part III Flying Robot

I Believe I Can Fly—Gesture-Driven Quadrotor Control Based on a Fuzzy Control System 177
Leon Spohn, Marcus Bergen, Nicolai Benz, Denis Vonscheidt, Hans-Jörg Haubner and Marcus Strand

ROS-Gazebo Supported Platform for Tag-in-Loop Indoor Localization of Quadrocopter 185
Shuyuan Wang and Tianjiang Hu

The Project PRISMA: Post-Disaster Assessment with UAVs 199
Carmine Tommaso Recchiuto and Antonio Sgorbissa

An Automatic Collision Avoidance Approach to Assist Remotely Operated Quadrotors 213
Bruno Giovanini, Hugo A. Oliveira and Paulo F.F. Rosa

Part IV Hand

Shared Control with Flexible Obstacle Avoidance for Manipulator 229
Zhixuan Wei, Weidong Chen and Hesheng Wang

An RGB-D Visual Application for Error Detection in Robot Grasping Tasks 243
Ester Martinez-Martin, David Fischinger, Markus Vincze and Angel P. del Pobil

Sensorless In-Hand Caging Manipulation 255
Yusuke Maeda and Tomohiro Asamura

Development of New Cosmetic Gloves for Myoelectric Prosthetic Hand by Using Thermoplastic Styrene Elastomer 269
Yoshiko Yabuki, Kazumasa Tanahashi, Suguru Hoshikawa, Tatsuhiro Nakamura, Ryu Kato, Yinlai Jiang and Hiroshi Yokoi

Part V Human Robot Interaction

Cloud-Based Task Planning for Smart Robots 285
Elisa Tosello, Zhengjie Fan, Alejandro Gatto Castro and Enrico Pagello

Tracking Control of Human-Following Robot with Sonar Sensors 301
Wei Peng, Jingchuan Wang and Weidong Chen

Active Sensing for Human Activity Recognition by a Home Bio-monitoring Robot in a Home Living Environment 315
Keigo Nakahata, Enrique Dorronzoro, Nevrez Imamoglu, Masashi Sekine, Kahori Kita and Wenwei Yu

Part VI Legged Robot

An Underactuated Biped Robot Guided via Elastic Elements: EKF-Based Estimation of Ankle Mechanical Parameters 329
Roberto Bortoletto, Thomas Reilly, Enrico Pagello and Davide Piovesan

Higher Jumping of a Biped Musculoskeletal Robot with Foot Windlass Mechanism 343
Xiangxiao Liu, Yu Duan, Andre Rosendo, Shuhei Ikemoto and Koh Hosoda

A Motion Planning Architecture for Conveyance Tasks with a Quadruped Robot 357
Giulio Cerruti, Wei-Zhong Guo and Fulvio Mastrogiovanni

Part VII Localization and Path Planning

A Simple and Efficient Path Following Algorithm for Wheeled Mobile Robots 375
Goran Huskić, Sebastian Buck and Andreas Zell

Localization Issues for an Autonomous Robot Moving in a Potentially Adverse Environment 389
Antonio D'Angelo and Dante Degl'Innocenti

Vector-AMCL: Vector Based Adaptive Monte Carlo Localization for Indoor Maps 403
Richard Hanten, Sebastian Buck, Sebastian Otte and Andreas Zell

A Virtual Force Guidance Law for Trajectory Tracking and Path Following 417
Xun Wang, Jianwei Zhang, Daibing Zhang and Lincheng Shen

A 2D Voronoi-Based Random Tree for Path Planning in Complicated 3D Environments 433
Zheng Fang, Chengzhi Luan and Zhiming Sun

3D FieldLut Algorithm Based Indoor Localization for Planar Mobile Robots Using Kinect 447
Xiaoxiao Zhu, Qixin Cao and Wenshan Wang

A Feature-Based Mutual Information and Wavelet Method for Image Fusion 459
Yulong Liu, Yiping Chen, Cheng Wang and Ming Cheng

Part VIII Measurement

An Intelligent RGB-D Video System for Bus Passenger Counting 473
Daniele Liciotti, Annalisa Cenci, Emanuele Frontoni, Adriano Mancini and Primo Zingaretti

A Powerful and Cost-Efficient Human Perception System for Camera Networks and Mobile Robotics 485
Marco Carraro, Matteo Munaro and Emanuele Menegatti

Influence of Stimulus Color on Steady State Visual Evoked Potentials 499
Leeyee Chu, Jacobo Fernández-Vargas, Kahori Kita and Wenwei Yu

Accelerated Adaptive Local Scanning of Complicated Micro Objects for the PSD Scanning Microscopy: Methods and Implementation 511
Mehdi Rahimi and Yantao Shen

Part IX Medical Engineering

Development of a Robotic Thumb Rehabilitation System Using a Soft Pneumatic Actuator and a Pneumatic Artificial Muscles-Based Parallel Link Mechanism 525
Kouki Shiota, Tapio V. J. Tarvainen, Masashi Sekine, Kahori Kita and Wenwei Yu

An fMRI Study on Vibration Stimulation Synchronized Mirror Therapy 539
Kazuya Imai, Kahori Kita and Wenwei Yu

Robot Patient Imitating Paralysis Patients for Nursing Students to Learn Patient Transfer Skill 549
Chingszu Lin, Zhifeng Huang, Masako Kanai-Pak, Jukai Maeda, Yasuko Kitajima, Mitsuhiro Nakamura, Noriaki Kuwahara, Taiki Ogata and Jun Ota

Part X Multi-robot Systems

A Self-reconfigurable Robot M-Lattice 563
Shihe Tian, Zhen Yang, Zhuang Fu and Hui Zheng

Adaptive Synchronized Formation Control Considering Communication Constraints 573
Zhe Liu, Weidong Chen, Junguo Lu, Jingchuan Wang and Hesheng Wang

A Distributed Self-healing Algorithm for Global Optimal Movement Synchronization of Multi-robot Formation Network 587
Xiangyu Fu, Weidong Chen, Zhe Liu, Jingchuan Wang and Hesheng Wang

Consensus of Discrete-Time Linear Networked Multi-agent Systems Subject to Actuator Saturation 601
DU Boyang, Zhang Guoliang, XU Jun, Zeng Jing and Zhang Yong

Partitioning Strategies for Multi-robot Area Coverage with No Communication 615
Cristiano Nattero and Fulvio Mastrogiovanni

Max-Sum for Allocation of Changing Cost Tasks 629
James Parker, Alessandro Farinelli and Maria Gini

Part XI Robot Control

LuGre Model Based Hysteresis Compensation of a Piezo-Actuated Mechanism 645
Guangwei Wang and Qingsong Xu

Sample-Data Control of Optimal Tracking for a Class of Non-linear Systems via Discrete-Time State Dependent Riccati Equation 659
Fan Yang, Guoliang Zhang, Zhenan Pang and Lei Yuan

Real-Time Flight Test Track Filtering and Association Using Kalman Filter and QDA Classifier 675
Kundong Wang and Yao Ge

Simulation of Time Delay Compensation Controller for a Mobile Robot Using the SMC and Smith Predictor 687
Dong-Hyuk Lee, Jae-Hun Jung, Ha-Neul Yoon, Young-Sik Park and Jang-Myung Lee

Differential Wheeled Robot Navigation Based on the Smoothing A* Algorithm and Dead-Reckoning 695
Daowei Jiang and Liang Yuan

Adaptive Impedance Control for Docking of Space Robotic Arm Based on Its End Force/Torque Sensor 713
Gangfeng Liu, Changle Li, Caiwei Song, Liyi Li and Jie Zhao

A Robotic Hardware-in-the-Loop Simulation System for Flying Objects Contact in Space 725
Chenkun Qi, Xianchao Zhao, Feng Gao, Anye Ren and Yan Hu

Particle Filter on Episode for Learning Decision Making Rule 737
Ryuichi Ueda, Kotaro Mizuta, Hiroshi Yamakawa and Hiroyuki Okada

Part XII Robot Design

Efficient Measurement of Fibre Orientation for Mapping Carbon Fibre Parts with a Robotic System 757
Morris Antonello, Matteo Munaro and Emanuele Menegatti

A Honeycomb Artifacts Removal and Super Resolution Method for Fiber-Optic Images 771
Zhong Zheng, Bin Cai, Jieting Kou, Wei Liu and Zengfu Wang

Water-Surface Stability Analysis of a Miniature Surface Tension-Driven Water Strider Robot 781
Jihong Yan, Xinbin Zhang, Jie Zhao and Hegao Cai

Mechanism Allowing a Mobile Robot to Apply a Large Force to the Environment 795
Shouhei Shirafuji, Yuri Terada and Jun Ota

Part XIII Robot Learning

Self-improving Robot Action Management System with Probabilistic Graphical Model Based on Task Related Memories 811
Yuki Furuta, Yuto Inagaki, Kei Okada and Masayuki Inaba

View-Based Teaching/Playback with Photoelasticity for Force-Control Tasks 825
Yoshinori Nakagawa, Soichi Ishii and Yusuke Maeda

Discovering the Relationship Between the Morphology and the Internal Model in a Robot System by Means of Neural Networks 839
Angel J. Duran and Angel P. del Pobil

Part XIV Robot Navigation

Combining Feature-Based and Direct Methods for Semi-dense Real-Time Stereo Visual Odometry 855
Nicola Krombach, David Droeschel and Sven Behnke

Outdoor Robot Navigation Based on View-Based Global Localization and Local Navigation 869
Yohei Inoue, Jun Miura and Shuji Oishi

Using OpenStreetMap for Autonomous Mobile Robot Navigation 883
Patrick Fleischmann, Thomas Pfister, Moritz Oswald and Karsten Berns

A Lane Change Detection and Filtering Approach for Precise Longitudinal Position of On-Road Vehicles 897
Tianyi Li, Ming Yang, Xiaojun Xu, Xiang Zhou and Chunxiang Wang

Part XV Robot Vision

Synchronous Dataflow and Visual Programming for Prototyping Robotic Algorithms 911
Sebastian Buck, Richard Hanten, C. Robert Pech and Andreas Zell

Depth-Based Frontal View Generation for Pose Invariant Face Recognition with Consumer RGB-D Sensors 925
Giorgia Pitteri, Matteo Munaro and Emanuele Menegatti

Lighting- and Occlusion-Robust View-Based Teaching/Playback for Model-Free Robot Programming 939
Yusuke Maeda and Yoshito Saito

Part XVI Robotic Arm

Development of a Portable Compliant Dual Arm Robot 955
Zhifeng Huang, Chingszu Lin, Ping Jiang, Taiki Ogata and Jun Ota

Design, Analysis and Simulation of a Device for Measuring the Inertia Parameters of Rigid Bodies 965
Yu Liu, Song Huang, Li Jiang and Hong Liu

Development of a Myoelectric Hand Incorporating a Residual Thumb for Transmetacarpal Amputees 977
Yuta Murai, Suguru Hoshikawa, Shintaro Sakoda, Yoshiko Yabuki, Masahiro Ishihara, Tatsuhiro Nakamura, Takehiko Takagi, Shinichiro Takayama, Yinlai Jiang and Hiroshi Yokoi

Part XVII Robotics for ITER Remote Handling

Structural Design of Multi-joint Foldable Robot Manipulator for Remote Inspection in Experimental Advanced Superconducting Tokamak (EAST) 993
Baoyuan Wu, Weibin Guo, Yi Liu, Qiang Zhang, Ling Zhou, Qingquan Yan, Zhong Zheng and Zengfu Wang

The Design of Pipe Cutting Tools for Remote Handling in Maintenance Manipulator for Tokamak 1003
Xizhe Zang, Zhenkun Lin, Yixiang Liu, Yanhe Zhu and Jie Zhao

Optimal Trajectory Planning for Manipulators with Flexible Curved Links 1013
Liang Zhao, Hesheng Wang and Weidong Chen

Predictive Display for Telerobot Under Unstructured Environment 1027
Qing Wei, NaiLong Liu and Long Cui

Control System Design and Implementation of Flexible Multi-joint Snake-Like Robot for Inspecting Vessel 1037
Yi Liu, Qingquan Yan, Qiang Zhang, Weibin Guo, Odbal, Baoyuan Wu and Zengfu Wang

Research on the Tokamak Equipment CAsk (TECA) for Remote Handling in Experimental Advanced Superconducting Tokamak (EAST) 1049
Lifu Gao, Weibin Guo, Baoyuan Wu, Daqing Wang, Yuan Liu, Yi Liu, Qiang Zhang, Zengfu Wang and Liangbin Guo

3D SLAM for Scenes with Repetitive Texture Inside Tokamak Chamber 1061
Wei Liu, Zhong Zheng, Odbal, Bin Cai and Zengfu Wang

Design and Implementation of Wormlike Creeping Robot System Working at the Bottom of the Nuclear Fusion Vessel 1073
Qiang Zhang, Ling Zhou, Yi Liu and Zengfu Wang

Part XVIII Sensor Network

Indoor Positioning System Based on Distributed Camera Sensor Networks for Mobile Robot 1089
Yonghoon Ji, Atsushi Yamashita and Hajime Asama

Precise and Reliable Localization of Intelligent Vehicles for Safe Driving 1103
Liang Li, Ming Yang, Lindong Guo, Chunxiang Wang and Bing Wang

A Unified Controller for the Connectivity Maintenance of a Robotic Router Networks 1117
Li Xiangpeng, Huang Haibo, Yang Hao and Sun Dong

The Elderly's Falling Motion Recognition Based on Kinect and Wearable Sensors 1129
Pang Nana, Dong Min, Zhao Yue, Chen Xin and Bi Sheng

Online Adjusting Task Models for Ubiquitous Robotic Systems 1143
Wenshan Wang, Qixin Cao, Qiang Qiu and Gilbert Cheruiyot

Improved Skeleton Estimation by Means of Depth Data Fusion from Multiple Depth Cameras 1155
Marco Carraro, Matteo Munaro, Alina Roitberg and Emanuele Menegatti

Author Index 1169