

PROCEEDINGS OF SPIE

***International Symposium on  
Robotics, Artificial Intelligence,  
and Information Engineering  
(RAIIE 2022)***

**Johan Debayle**  
*Editor*

**15–17 July 2022**  
**Hohhot, China**

*Organized by*  
*Guangzhou Computer Society*

*Sponsored by*  
*AEIC Academic Exchange Information Center (China)*

*Published by*  
SPIE

**Volume 12454**

Proceedings of SPIE 0277-786X, V. 12454

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

International Symposium on Robotics, Artificial Intelligence, and Information Engineering (RAIIE 2022)  
edited by Johan Debayle, Proc. of SPIE Vol. 12454, 1245401  
© 2022 SPIE · 0277-786X · doi: 10.1117/12.2663198

Proc. of SPIE Vol. 12454 1245401-1

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 [SPIDigitalLibrary.org](http://SPIDigitalLibrary.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 *International Symposium on Robotics, Artificial Intelligence, and Information Engineering (RAIIE 2022)*, edited by Johan Debayle, Proc. of SPIE 12454, Seven-digit Article CID Number (DD/MM/YYYY); (DOI URL).

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

ISBN: 9781510660137  
ISBN: 9781510660144 (electronic)

Published by

**SPIE**

P.O. Box 10, Bellingham, Washington 98227-0010 USA

Telephone +1 360 676 3290 (Pacific Time)

[SPIE.org](http://SPIE.org)

Copyright © 2022 Society of Photo-Optical Instrumentation Engineers (SPIE).

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 fees. To obtain permission to use and share articles in this volume, visit Copyright Clearance Center at [copyright.com](http://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.

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**

[SPIDigitalLibrary.org](http://SPIDigitalLibrary.org)

---

**Paper Numbering:** A unique citation identifier (CID) number is assigned to each article in the Proceedings of SPIE 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

ix *Conference Committee*

---

## RESEARCH ON POWER GRID INFORMATION ENGINEERING AND SIMULATION SYSTEM

---

- 12454 02 **Application of oblique photogrammetry technology in 3D design of overhead transmission lines** [12454-18]
- 12454 03 **Simulation system design and application analysis of power intelligent emergency repair scene based on digital twin technology** [12454-59]
- 12454 04 **Research on art design of digital media interactive installation based on green design** [12454-79]
- 12454 05 **Evaluation of teachers' teaching quality based on analytic hierarchy and grey correlation projection** [12454-108]
- 12454 06 **Digital twin assisted automatic routing selection for electric elastic optical networks** [12454-96]
- 12454 07 **Research on detection and tracking technology of optoelectronic system based on deep neural network** [12454-107]
- 12454 08 **Design and simulation of a 4-DOF robot arm transportation system** [12454-74]
- 12454 09 **Intelligent service orchestration for EON-assisted power communication network** [12454-89]
- 12454 0A **Simple and effective multi-scale fusion strategy** [12454-52]
- 12454 0B **Robust point matching via spatial clustering and Gaussian mixture models** [12454-72]
- 12454 0C **Research on classifier design of Chinese abstracts of postgraduate dissertations in library collection** [12454-94]
- 12454 0D **Increment prediction for video anomaly detection** [12454-93]
- 12454 0E **Broadband photodetector based on CdS/Sb<sub>2</sub>Se<sub>3</sub> heterojunction** [12454-41]
- 12454 0F **Credit card fraud detection based on ensemble learning** [12454-103]
- 12454 0G **Research on the construction of university smart library under5G environment** [12454-106]

- 12454 OH **Parametric modeling of CNC machine tool geometric errors based on low-order fourier polynomials** [12454-9]
- 12454 OI **WOA-based fuzzy self-tuning PID evaporative source temperature control** [12454-19]
- 12454 OJ **Design of battery management system and estimation of state of charge** [12454-55]
- 12454 OK **Monte Carlo-based simulation study on the firing performance of mortar projectiles trigger mechanism** [12454-29]
- 12454 OL **Effects of processing parameters on the thermal behaviour of AISi10Mg during pulse-selective laser melting** [12454-47]
- 12454 OM **FPGA design for general control of the stepper motor based on the factory method pattern** [12454-23]
- 12454 ON **Design and application of intelligent manufacturing simulation system based on Unity3d** [12454-17]
- 12454 OO **Parameter identification based on capacitor pre-charge curve** [12454-12]
- 12454 OP **Design of test system for hydrogen oxygen fuel cell** [12454-49]
- 12454 OQ **Sensitivity analysis of influencing factors on assembly accuracy of casings with interference fit rabbet** [12454-35]
- 12454 OR **Analysis of the relationship between battery internal resistance and SOC** [12454-64]
- 12454 OS **Simulation analysis of root cutting process of corrugated cutter head** [12454-61]
- 12454 OT **Multi-response comprehensive evaluation of SLA parts based on entropy weight method and grey relational analysis method** [12454-40]
- 12454 OU **Structural optimization design of electromagnetic railgun** [12454-28]
- 12454 OV **Optimization modeling of anti breast cancer drug candidates based on data mining** [12454-2]
- 12454 OW **Fair recommendation by geometric interpretation and analysis of matrix factorization** [12454-80]
- 12454 OX **Exploring the influence of flue gas desulfurization influence factors on desulfurization efficiency** [12454-54]
- 12454 OY **Traffic sign detection based on improved YOLOv5** [12454-88]

## APPLICATION OF INTELLIGENT DEVICES AND ROBOTIC EQUIPMENT

---

- 12454 0Z **Robust UAV-assisted autonomous landing system and its key technology for USVs** [12454-69]
- 12454 10 **Research on robot optimal working space based on spiral theory** [12454-81]
- 12454 11 **Locomotion mode recognition method based on inertial measurement units in exoskeleton robot** [12454-95]
- 12454 12 **Research on a curling-like amphibious robot for ground and underwater torch relay of Beijing 2022 Winter Olympics** [12454-87]
- 12454 13 **Mutual information based radar target detection and delay estimation** [12454-92]
- 12454 14 **Optimization of the executive system of the picking robot based on fuzzy control algorithm** [12454-85]
- 12454 15 **Design of a modular inchworm-like crawling robot** [12454-75]
- 12454 16 **Structural design and mechanism verification of multi-tailed collaborative robotic fish** [12454-70]
- 12454 17 **Analysis of workspace of dual-arm robot in obstructed environment** [12454-77]
- 12454 18 **The leg structure design and motion analysis of connecting rod wheel leg hybrid mobile robot** [12454-102]
- 12454 19 **Reconstruction stack shape detection for robot palletizing** [12454-82]
- 12454 1A **Four DOF robot arm trajectory planning** [12454-101]
- 12454 1B **Path following control of underground mining articulated vehicle based on the quadratic optimization method** [12454-33]
- 12454 1C **Design of a device for dividing caked tobacco in front of the inlet of the conditioning cylinder** [12454-8]
- 12454 1D **Design of pipeline sorting device based on OpenMV** [12454-27]
- 12454 1E **Research on the technical design of an automatic UV film coating machine** [12454-5]
- 12454 1F **Analysis of the impact of vehicle toe-in angle on vehicle stability** [12454-21]
- 12454 1G **Design of structure and control system of automatic handling robot** [12454-111]
- 12454 1H **Technical changes and countermeasures of shift mechanism of fixed shaft transmission under low temperature** [12454-30]

- 12454 1I **Topology optimization design and research on a main tower of radar antenna based on finite element method** [12454-26]
- 12454 1J **Analysis of the influence of car front wheel kingpin caster angle on steering trajectory based on bicycle model** [12454-15]
- 12454 1K **Research on an innovative design method of modularized assembled indoor installation transportation device—Take GIS as an example** [12454-48]
- 12454 1L **Design of locking control system for vehicle charging port** [12454-60]
- 12454 1M **Tire-road friction model as a function of tire type and road condition** [12454-22]
- 12454 1N **Failure diagnosis of the transmission part of heavy-duty tracked vehicles based on big data** [12454-31]
- 12454 1O **Research on modular design method of stroller based on Kansei Engineering** [12454-7]
- 12454 1P **Design of solar conversion device for self-propelled trash cleaning boat** [12454-11]
- 12454 1Q **Numerical simulation of the real contact area of mechanical seal based on LabVIEW** [12454-6]
- 12454 1R **Optimization design of radar antenna array structure and study on its mechanical performance based on ANSYS** [12454-24]
- 12454 1S **Conceptual design of modular vehicle rescue robot based on bionics** [12454-32]
- 12454 1T **A joint scoring and classification for rehabilitation training poses based on convolutional neural networks** [12454-13]
- 12454 1U **School safety early warning system based on machine vision** [12454-4]

---

**ARTIFICIAL INTELLIGENCE ALGORITHMS AND INFORMATION PROCESSING APPLICATIONS**

---

- 12454 1V **Research and implementation of tax planning platform based on big data and artificial intelligence** [12454-10]
- 12454 1W **Design of distribution network fault Intelligent processing system based on artificial intelligence** [12454-3]
- 12454 1X **Construction of college network public physical education teaching resource platform system based on deep learning** [12454-116]
- 12454 1Y **Application of classifier based on DRNG algorithm** [12454-50]
- 12454 1Z **Seagull optimization algorithm combining Cauchy mutation and elite reverse learning** [12454-68]

- 12454 20 **Stroke prediction based on improved machine learning algorithm** [12454-90]
- 12454 21 **Obstacle avoidance and scene switching recognition for autonomous underwater vehicles based on convolutional neural networks** [12454-73]
- 12454 22 **A method of extracting height and coverage of Tetraena based on UAV images and 3D point cloud** [12454-100]
- 12454 23 **Neural network models for predicting trends in VTuber Industry on Bilibili** [12454-91]
- 12454 24 **Personal protective equipment detection based on computer vision** [12454-109]
- 12454 25 **Lightweight MobileNetV2 offline handwritten Chinese character recognition based on attention mechanism** [12454-83]
- 12454 26 **Lightweight helmet wear detection algorithm based on YOLOv3** [12454-53]
- 12454 27 **Lightweight 3D DenseNet with improved attention mechanism** [12454-65]
- 12454 28 **Research on path planning of mobile robot based on ROS and improved A\* algorithm** [12454-67]
- 12454 29 **Intelligent classification of digital text based on machine learning** [12454-58]
- 12454 2A **Super-resolution reconstruction of face images based on iterative upsampling and downsampling layers** [12454-71]
- 12454 2B **Research and application of artificial neural network prediction model in deep learning** [12454-97]
- 12454 2C **A SAR image ship detection method combined with anchor-free and attention module** [12454-56]
- 12454 2D **Design of parking guidance path in parking lot based on Dijkstra algorithm** [12454-66]
- 12454 2E **Artificial neural network combined with support vector machine for breast cancer prediction** [12454-86]
- 12454 2F **Research on multi-robot formation obstacle avoidance algorithm** [12454-62]
- 12454 2G **Research on knowledge graph technology and application scenarios** [12454-76]
- 12454 2H **Object tracking algorithm with multi-scale channel attention** [12454-84]
- 12454 2I **Knowledge distillation for end-to-end speech recognition based on Conformer model** [12454-110]
- 12454 2J **Design of multifunctional remote monitoring system for ward** [12454-112]

- 12454 2K **Design of voice recognition of intelligent household waste classification system** [12454-113]
- 12454 2L **Research on remaining life prediction of machine tool spindle bearing combining neural network and weighted average de-noising method** [12454-44]
- 12454 2M **Design of intelligent elevator control system** [12454-34]
- 12454 2N **NLP based artificial intelligence method for online semantic recognition of short and long text** [12454-14]
- 12454 2O **Recycled concrete bridge engineering based on artificial intelligence algorithm** [12454-20]
- 12454 2P **City's House pricing prediction based on machine learning algorithms** [12454-25]
- 12454 2Q **A meaningful path finding method without specific starting metabolite** [12454-1]
- 12454 2R **Reflections on the reform of curriculum ideological and political teaching mode in the era of artificial intelligence** [12454-114]
- 12454 2S **Recognition of urban pollution types based on BP neural network** [12454-98]
- 12454 2T **Artificial intelligence opportunities and challenges for enterprise management: a review and research hotspot** [12454-99]



# Conference Committee

## *Conference General Chair*

**Johan Debayle**, MINES Saint-Étienne (France)

## *Technical Program Committee Chair*

**Pinial Khan Butt**, Sindh Agriculture University (Pakistan)

## *Technical Program Committee*

**Johan Debayle**, Ecole Nationale Supérieure des Mines de Saint Etienne (France)

**Muhammad Nasir Khan**, The University of Lahore (Pakistan)

**Wei Wei**, Xi'an Jiaotong University (China)

**Mingwei Qin**, Southwest University of Science and Technology (China)

**Santhosh Krishna B V**, New Horizon College of Engineering (India)

**Ravi Panwar**, IIT Jabalpur (India)

