

PROCEEDINGS OF SPIE

# ***Third International Conference on Image Processing and Intelligent Control (IPIC 2023)***

**Zhihan Lv**  
**Badrul Hisham Bin Ahmad**  
*Editors*

**5–7 May 2023**  
**Kuala Lumpur, Malaysia**

*Organized by*  
Dalian Jiaotong University (China)

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

*Published by*  
SPIE

**Volume 12782**

Proceedings of SPIE 0277-786X, V. 12782

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

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 *Third International Conference on Image Processing and Intelligent Control (IPIIC 2023)*, edited by Zhihan Lv, Badrul Hisham Bin Ahmad, Proc. of SPIE 12782, Seven-digit Article CID Number (DD/MM/YYYY); (DOI URL).

ISSN: 0277-786X

ISSN: 1996-756X (electronic)

ISBN: 9781510668140

ISBN: 9781510668157 (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 © 2023 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

vii *Conference Committee*

## DIGITAL SIGNAL PROCESSING AND IMAGE FEATURE EXTRACTION

---

- 12782 02 **Image recognition and position technology based on super-pixel fuzzy C-means clustering in industrial assembly systems** [12782-47]
- 12782 03 **A method of extracting outer eye corners of terra cotta warriors based on point cloud data** [12782-12]
- 12782 04 **Research on UI design and optimization of digital media with artificial intelligence** [12782-16]
- 12782 05 **ORB feature extraction and feature matching based on geometric constraints** [12782-35]
- 12782 06 **Video description method with fusion of instance-aware temporal features** [12782-2]
- 12782 07 **A multi-modal information fusion-based method for repairing cracks in train hooks** [12782-25]
- 12782 08 **Research on optical detection technology for underwater archaeology** [12782-62]
- 12782 09 **Discharging state recognition method of intelligent ring network cabinet based on audio signal spectrum analysis** [12782-26]
- 12782 0A **Numerical analysis and calculation of urban landscape spatial pattern** [12782-33]
- 12782 0B **CNN-LSTM-VAE based time series trend prediction** [12782-32]
- 12782 0C **Three-dimensional digital intelligent patrol inspection system for substation based on digital twin technology** [12782-23]
- 12782 0D **Evaluation of design factors of an interactive interface of intangible cultural heritage APP based on user experience** [12782-5]
- 12782 0E **Chinese image description evaluation method based on target domain semantic constraints** [12782-19]
- 12782 0F **Improved SRGAN model** [12782-20]
- 12782 0G **Oilfield water injection surface monitoring system** [12782-4]
- 12782 0H **Sparse signal recovery for multispectral demosaicking using pseudo-panchromatic image** [12782-30]

12782 OI **Research on cotton and flax fiber identification based on multi-scale features of the texture and Gaussian process classification** [12782-58]

**INTELLIGENT ELECTROMECHANICAL MEASUREMENT AND CONTROL AND GENETIC ALGORITHM APPLICATION**

---

12782 OJ **A convolutional neural network approach for optimal steering control of self-driving cars** [12782-46]

12782 OK **Improved PSO-GA-based LSSVM flight conflict detection model** [12782-15]

12782 OL **3D target detection based on dynamic occlusion processing** [12782-10]

12782 OM **Vehicle pedestrian detection algorithm at ferry entrance based on improved YOLOX** [12782-43]

12782 ON **A neural network model for adversarial defense based on deep learning** [12782-11]

12782 OO **Underwater image color correction and adaptive contrast algorithm improvement based on fusion algorithm** [12782-36]

12782 OP **The design of lightweight vehicle detection model based on improved YOLOv5** [12782-38]

12782 OQ **Research and application of 3D simulation of truck formation based on Unreal Engine** [12782-52]

12782 OR **Infrared small target recognition in waterways based on YOLOv5 algorithm** [12782-60]

12782 OS **Research on ticket recognition platform based on deep learning algorithm** [12782-65]

12782 OT **A purely azimuth passive localization model and adjustment scheme for UAV formation** [12782-49]

12782 OU **Review of infrared object detection algorithms for low-light background** [12782-44]

12782 OV **Road pothole detection based on improved YOLOv7** [12782-6]

12782 OW **A control system for fine farming of apple trees** [12782-41]

12782 OX **A garbage sorting method using an adaptive deep neural network** [12782-59]

12782 OY **Research on the application of YOLOv5 in station interlocking test** [12782-64]

12782 OZ **YOLO-H: a lightweight object detection framework for helmet wearing detection** [12782-24]

12782 10 **Research on auxiliary decision-making for sea striking of naval aviation based on deep reinforcement learning** [12782-31]

---

**MACHINE VISION AND BEHAVIOR RECOGNITION DETECTION TECHNOLOGY**

---

12782 11 **Research on target recognition technology based on improved YOLOv5** [12782-27]

12782 12 **Analysis of binocular visual perception technology of underwater robot** [12782-40]

12782 13 **AU-Net: an image segmentation for complex scenes** [12782-42]

12782 14 **Application of SBAS-INSAR technology in surface subsidence monitoring in Yanghuopan mining area** [12782-3]

12782 15 **Human posture recognition based on lightweight OpenPose model** [12782-29]

12782 16 **Design of digital watermarking algorithm based on compression sensing** [12782-63]

12782 17 **A multi-scale branch convolutional neural network for denoising** [12782-28]

12782 18 **Adversarial training-based robust diagnosis method for lumbar disc herniation** [12782-54]

12782 19 **Deep learning-based crowd recognition for tourist attractions in different periods** [12782-48]

12782 1A **Exploration on the football player physical fitness video monitoring system based on information technology** [12782-17]

12782 1B **A simple and efficient deep learning-based framework for vegetable recognition** [12782-7]

12782 1C **Non-interactive GrabCut image segmentation method** [12782-9]

12782 1D **Intelligent wind farm state mixed sensing and intelligent warning system** [12782-37]

12782 1E **RSFNet: a method for remote sensing image semantic segmentation based on fully convolutional neural networks** [12782-18]

12782 1F **Research on video vibration measurement based on fast two-dimensional empirical mode decomposition and Hilbert transform** [12782-39]

12782 1G **Semantic segmentation of remote sensing image based on U-NET** [12782-57]

12782 1H **HAU-Net: hybrid attention U-NET for retinal blood vessels image segmentation** [12782-14]

12782 1I **Research on the improved apple classification method of AlexNet** [12782-8]

12782 1J      **Application of Videolog visualization technology in workover operation** [12782-56]