PROCEEDINGS OF SPIE

International Conference on Machine Vision and Deep Learning (MVDL 2025)

Chengzhong Xu Dickson K. W. Chiu Editors

11–13 April 2025 Hong Kong, China

Organized by
University of Macau (Macau, China)
The University of Hong Kong (Hong Kong, China)

Sponsored by Universiti Teknologi Malaysia (Malaysia)

Published by SPIE

Volume 13689

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 SPIEDigitalLibrary.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 Conference on Machine Vision and Deep Learning (MVDL 2025)*, edited by Chengzhong Xu, Dickson K. W. Chiu, Proc. of SPIE 13689, Seven-digit Article CID Number (DD/MM/YYYY); (DOI URL).

ISSN: 0277-786X

ISSN: 1996-756X (electronic)

ISBN: 9781510693241

ISBN: 9781510693258 (electronic)

Published by

SPIE

P.O. Box 10, Bellingham, Washington 98227-0010 USA Telephone +1 360 676 3290 (Pacific Time) SPIE.org

Copyright © 2025 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. 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.



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

INTERNATIONAL CONFERENCE ON MACHINE VISION AND DEEP LEARNING (MVDL 2025)

13689 02	Research on optimization of face recognition algorithm in smart campus driven by multimodal feature fusion: construction of hybrid model based on dynamic weight allocation [13689-1]
13689 03	Application of big data analysis in college students' career interest identification and planning models [13689-22]
13689 04	Research on supply chain optimization model based on data mining [13689-23]
13689 05	Big data-based risk assessment and decision-support model for sustainable development [13689-25]
13689 06	Research on AI-driven talent training system for cruise industry and its optimization path [13689-3]
13689 07	The application of machine learning in analyzing the musical emotional expressions of the Schumann couple $[13689\text{-}5]$
13689 08	Prediction model of urban drainage pipeline blockage based on deep learning [13689-34]
13689 09	Research on optimization decision of command control based on deep learning [13689-2]
13689 OA	The application of blockchain technology in anti-counterfeiting and traceability of testing reports [13689-16]
13689 OB	Research on the application of AI in blended teaching reform of Chinese and Western pastry culinary arts courses under the OBE framework [13689-8]
13689 OC	Research on AI decision support system for agricultural intelligentization and industrial upgrading under the background of rural revitalization [13689-11]
13689 OD	Privacy preserving trajectory data publishing algorithm based on multilayer spatial fuzzy subtraction clustering algorithm [13689-13]
13689 OE	Practice and exploration of Al image recognition algorithm in digital protection and feature extraction of intangible cultural heritage [13689-24]
13689 OF	Improvement of multiscale feature fusion of YOLO algorithm and its application in small target detection [13689-35]

13689 OG	Construction of a distributed English proficiency assessment framework based on federated learning [13689-36]
13689 OH	The application of deep reinforcement learning in flexible job shop scheduling [13689-38]
13689 01	Design of multitarget tracking and trajectory prediction algorithm in dynamic scenes [13689-39]
13689 OJ	Design of intelligent resource sharing and collaborative service system for digital libraries based on cloud computing [13689-7]
13689 OK	Adaptive convolutional time series evaluation for attack behavior postures [13689-21]
13689 OL	Research on intelligent question-answering system of ideological and political education based on natural language processing and knowledge map [13689-9]
13689 OM	Intelligent grasping and surgical assistant model of medical robot based on neural network and reinforcement learning [13689-12]
13689 ON	Research on emotional state identification and intervention strategies for preschool students using deep learning techniques [13689-26]
13689 00	Design of remote control and management mechanism of 5G power test terminal [13689-30]
13689 OP	5G power virtual private network test service management platform resource scheduling and optimization algorithm [13689-31]
13689 OQ	Enhanced security technologies for 5G power testing terminals [13689-32]
13689 OR	Adaptive shift of education teaching in colleges and universities based on generative artificial intelligence scene [13689-29]
13689 OS	Research on the application of virtual reality technology in college Chinese language teaching [13689-33]
13689 OT	Fault prediction and health status evaluation method of GIS equipment based on time series neural network [13689-10]
13689 OU	Strategic collaboration platform and alliance system interoperability network analysis model based on graph neural networks [13689-41]
13689 OV	Research on optimization of workshop material distribution path based on genetic algorithm [13689-40]
13689 OW	Rural tourism scene reconstruction and intelligent recommendation mechanism for AIGC [13689-15]
13689 OX	Prediction of the impact of agricultural insurance on production stability based on machine learning [13689-43]

13689 OY	Deep learning-driven intelligent production optimization and high-quality development strategies for manufacturing enterprises [13689-19]
13689 OZ	Machine learning-driven maze behavior analysis: a novel paradigm for learning and memory evaluation [13689-17]
13689 10	The research on lightweight reinforcement learning algorithm optimization for high-frequency trading data [13689-44]
13689 11	A study on the application and optimization of deep learning algorithms in soil erosion and secondary disaster early warning [13689-48]
13689 12	Design and implementation of an intelligent teaching system for cabin service training driven by artificial intelligence: a multimodal real-time feedback framework [13689-27]
13689 13	Research on data fusion mechanism of Internet of Things intelligent terminal for edge computing [13689-18]
13689 14	Application of deep learning in improving music literacy of college students [13689-20]
13689 15	Dynamic scheduling algorithm for container resources based on reinforcement learning [13689-4]
13689 16	Data encryption technology based on adversarial neural network [13689-6]
13689 17	Research on intelligent recognition of grammatical errors in college English writing based on natural language processing [13689-28]
13689 18	Research on the construction of integrated platform of books and education management information based on AI technology [13689-14]
13689 19	Research on automatic layout algorithm of indoor space based on computer vision [13689-37]
13689 1A	Optimization of mining equipment maintenance scheduling based on multiobjective genetic algorithm [13689-45]
13689 1B	Vehicle routing optimization based on heuristic algorithm [13689-47]
13689 1C	Multispectral fusion and lightweight CNN model framework for nondestructive detection of grain quality [13689-46]
13689 1D	Research on target recognition of tea and water delivery robot based on convolutional neural network [13689-49]
13689 1E	Research on electronic component detection algorithm based on machine vision [13689-42]