

**2025 2nd International  
Conference on Machine Learning,  
Pattern Recognition and  
Automation Engineering  
(MLPRAE 2025)**

**Jinan, China  
26-28 September 2025**



**IEEE Catalog Number: CFP251B0-POD  
ISBN: 978-1-6654-5743-9**

**Copyright © 2025 by the Institute of Electrical and Electronics Engineers, Inc.  
All Rights Reserved**

*Copyright and Reprint Permissions:* Abstracting is permitted with credit to the source. Libraries are permitted to photocopy beyond the limit of U.S. copyright law for private use of patrons those articles in this volume that carry a code at the bottom of the first page, provided the per-copy fee indicated in the code is paid through Copyright Clearance Center, 222 Rosewood Drive, Danvers, MA 01923.

For other copying, reprint or republication permission, write to IEEE Copyrights Manager, IEEE Service Center, 445 Hoes Lane, Piscataway, NJ 08854. All rights reserved.

***\*\*\* This is a print representation of what appears in the IEEE Digital Library. Some format issues inherent in the e-media version may also appear in this print version.***

|                         |                   |
|-------------------------|-------------------|
| IEEE Catalog Number:    | CFP251B0-POD      |
| ISBN (Print-On-Demand): | 978-1-6654-5743-9 |
| ISBN (Online):          | 978-1-6654-5742-2 |

**Additional Copies of This Publication Are Available From:**

Curran Associates, Inc  
57 Morehouse Lane  
Red Hook, NY 12571 USA  
Phone: (845) 758-0400  
Fax: (845) 758-2633  
E-mail: [curran@proceedings.com](mailto:curran@proceedings.com)  
Web: [www.proceedings.com](http://www.proceedings.com)

CURRAN ASSOCIATES INC.  
**proceedings**  
.com

## Table of Contents

|  |    |
|--|----|
| <b>Causal Graph-Enhanced Deep Learning for Robust Anomaly Detection in Network Intrusion Detection Systems</b>                           | 1  |
| Xiaoyan Yu   |    |
| <b>A Deep Reinforcement Learning Approach for Multi-UAV Collaborative Coverage with Adaptive Step Size and Dynamic Reward Mechanism</b>  | 7  |
| Qian Liu, Yong Zhang, Lu Jia   |    |
| <b>Dual-Peak Adjustment Enhanced Particle Swarm Optimization for EFJSP with Complex Labor Wage Structure</b>                             | 11 |
| Yanqiushi Yue  |    |
| <b>Fuzzy Aware Block Fusion Deeplabv3+ for High-Resolution Remote Sensing Images Segmentation</b>  | 16 |
| Jianjun Huang, Baopeng Xu, Yiting Zhang, Ximei Zhao, Xinyue Shi, Junru Liang   |    |
| <b>Synchronization control of delayed Markov Jumping Neural Networks under Hybrid Network Attacks</b>                                    | 20 |
| Wenhao Zhang, Hongqian Lu, Lei Qu  |    |
| <b>Research on Instance Segmentation and Extraction Technology for Operating Features of Metering Boxes Based on Improved Mask R-CNN</b> | 25 |
| Xiaoze Liu, Yu Cui, Wanxu Zhao, Tingting Zhang   |    |
| <b>Attention-MLP: A High-Performance and Interpretable QSAR Model for EGFR Inhibitors</b>  | 42 |
| Chenshu Qu   |    |
| <b>Review for Medical Image Segmentation: From U-Net and to Transformer</b>  | 47 |
| Jinming Ma, Chunmei Duan   |    |
| <b>A Multi-Strategy Multi-Agent Reinforcement Learning Method for Generating Safety-Critical Scenarios for Autonomous Driving</b>        | 56 |
| Yuxiang Hou, Hengpei Wang, Jianwei Xu, Yong Wang, Wenxiao Li   |    |
| <b>The Safety Verification of Autonomous Driving on Nested Game Algorithm</b>  | 60 |
| Hengpei Wang, Yuxiang Hou, Zhixin Zhao, Yong Wang, Wenxiao Li  |    |
| <b>Integrating Grid Partitioning with Genetic Algorithms for Negative Selection Detector Generation</b>                                  | 64 |
| Zhiyong Li, Xiang Wei, Li Yan, Chunyan Li  |    |
| <b>Deep Learning-Based Modelling of the Adsorption Mechanism and Dynamic Optimization of Lanthanum Adsorption Reactions</b>              | 68 |
| Yi Zhang, Xiangni Pan, Xinglei Li, Juguang Ren, Xiangbiao Yin  |    |
| <b>Research on the Construction of Smart Grid Data Optimization Management Scheme Based on Machine Learning</b>                          | 72 |
| Jianchen Hu, Yanlan Fu, Linmang Wang, Chuanpu Zhu, Zhengdong Lin, Fangyuan Fu, Jiwei Huang   |    |
| <b>A Bidirectional APF-RRT* Path Planning Algorithm with Multi-Strategy Adaptive Expansion</b>   | 77 |
| Guoliang Cheng, Jiuxiang Yan, Qian Li, Yongguo Zhao, Malgat Mazakov, Kaliyeva Kulyash  |    |

|  |     |
|--|-----|
| <b>Grasping Force Control of Underwater Manipulators Based on a Composite Strategy of External Force Loop and Active Disturbance Rejection</b> | 81  |
| Changlin Wang, Xuelin Wang, Xiaoyun Tang, Qian Li, Yue Wang, Zhumadil Baigunchekov   |     |
| <b>Large Language Models: Principles, Applications, and Cutting-edge Advances</b>  | 85  |
| Xuefei Bian, Yingchun Zhang  |     |
| <b>Underactuated Path Planning Based on Improved Bidirectional RRT*</b>  | 89  |
| Xingmin Wang, Jiliang Yuan, Qinggang Luo, Yang Wu, Aleksander Sladkowski, Qian Li  |     |
| <b>A CNN-Based Framework for Cross-Modal Literary Text-to-Image Synthesis</b>  | 93  |
| Yu Wu  |     |
| <b>The Robustness of Deep Learning Models to Adversarial Attacks in Lung X-ray Classification</b>  | 99  |
| Xuanyi Li, Yajie Pang, Yihong Li   |     |
| <b>ParallelFusionNet for Partial Differential Equations</b>  | 107 |
| Tangying Lv, Wenming Yin, Qingqing Zhang, Kuan Zhao, Shanliang Zhu   |     |
| <b>Warehouse Robot Path planning Based on Improved TD3 Algorithm</b>   | 111 |
| Deguo Yang, Minghui Zhao   |     |
| <b>Dynamic Perception Intelligent Street Lamp System Based on FPGA and Millimeter Wave Radar</b>   | 117 |
| Tianyu Xu, Yuxin Liu, Bin Meng, Ziyu Zhang, Yue Liu, Yanbo Zhang   |     |
| <b>Research on the Integrated Localization Algorithm of Ground Penetrating Radar Robot Based on Extended Kalman Filter</b>                     | 123 |
| Wujin Shen, Dongfei Cai, Xiaobin Sun, Bolun Zhao, Jingjie Wang, Yanbo Zhang  |     |
| <b>Domain-Enhanced SimCSE with Lexicon Injection for Semantic Representation of Technical Texts</b>  | 128 |
| Zhida Song, Xiaotong Guan, Naijun Zhao, Jingbo Zhao  |     |
| <b>Adversarially Robust Hybrid Sampling for Imbalanced Airworthiness Directive Assessment</b>  | 133 |
| Xiaotong Guan, Zhida Song, Li Zhang, Jingbo Zhao   |     |
| <b>RDPC: Region-based Density Peak Clustering</b>  | 138 |
| Huihui Chu, Lei Qu, Yue Guan, Wenke Zang   |     |
| <b>Dual-Channel Heterogeneous Graph Neural Network with Relation-Meta-Path Collaborative Interactions</b>                                      | 142 |
| Yimeng Chen, Lei Qu, Sami Mohammed Ahmed Ghanem, Wenke Zang  |     |
| <b>Research on Tibetan-Chinese Translation Method Based on Improved Transformer Model</b>  | 147 |
| Shuhui Li, Tao Wang, Ailing Ma, Xuegang Zhang, Yubo Wang, Siyi Li  |     |
| <b>HyDiabNet: A Hybrid Neural Network Architecture for Enhanced Multi-Class Diabetes Classification</b>  | 151 |
| Yue Wang   |     |
| <b>Health Prediction for Main Reducer Gears of New Energy Vehicles Based on a CNN-LSTM Fusion Model</b>  | 155 |
| Zhonghua Pang, Junhong Yang, Dongchen Qin  |     |
| <b>VLM3KG:A Hallucination Mitigation Method for Vision-Language Models based on Multimodal Knowledge Graph</b>                                 | 160 |
| Yuxia Shang  |     |

|  |     |
|--|-----|
| <b>A Service Mesh-Driven Continuous Delivery Strategy for Microservices with Intelligent Decision Models</b>                 | 170 |
| Wenya Zhang, Xin Ji, Hanyuan Li, Yifan Mao, Zhi Yang, Fang Peng, Junle Wang  |     |
| <b>Research on Classification Methods Based on Bayesian Optimization and Multiple Kernel Quantum Support Vector Machines</b> | 176 |
| Gaojie Wu  |     |
| <b>Semantic Reasoning Query Rewriting (SRQR): A Multi-Agent RAG to Answer Complex Queries</b>                                | 180 |
| Bo Wang, Gang Zhou, Xi Zhang, Kunpeng Yang   |     |
| <b>An Industrial Fence-Line Gas Classification Method Using Multi-Sensor Arrays and Deep Learning Algorithms*</b>            | 185 |
| Xiaozhen Ma, Qi Zhou, Sa Xiao, Jingquan Yao, Meiqi Wang  |     |
| <b>Author Index</b>  | 190 |