

2021 4th International Conference on Intelligent Autonomous Systems (ICoIAS 2021)

**Wuhan, China
14 – 16 May 2021**



**IEEE Catalog Number: CFP21O41-POD
ISBN: 978-1-6654-4196-4**

**Copyright © 2021 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:	CFP21O41-POD
ISBN (Print-On-Demand):	978-1-6654-4196-4
ISBN (Online):	978-1-6654-4195-7

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
Web: www.proceedings.com

CURRAN ASSOCIATES INC.
proceedings
.com

2021 4th International Conference on Intelligent Autonomous Systems (ICoIAS) **ICoIAS 2021**

Table of Contents

Preface *xiv*.....
Committees *xv*.....
Sponsors *xviii*.....

Target Detection

Incremental Learning of Object Detection with Output Merging of Compact Expert Detectors .1.....
*Nan Zhang (Huazhong University of Science and Technology, China),
Zhigang Sun (Huazhong University of Science and Technology, China),
Kai Zhang (Huazhong University of Science and Technology, China), and
Li Xiao (Huazhong University of Science and Technology, China)*

Research on Object Detection Network Based on Knowledge Distillation .8.....
*Hongbo Kuang (Wuhan University of Science and Technology, China) and
Ziwei Liu (Wuhan University of Science and Technology, China)*

Paper Dating Analysis Based on Paper Texture Image Feature .13.....
*Qi Lu (Wuhan University of Science and Technology, China), Ziqi Zhu
(Wuhan University of Science and Technology, China), Zhihao Li
(Institute of Forensic Science, China), and Zhe Lian (Institute of
Forensic Science, China)*

Knowledge Distillation for Object Detection Based on Mutual Information .18.....
*Liu Xi (Wuhan University of Science and Technology, China) and Ziqi
Zhu (Wuhan University of Science and Technology, China)*

Study on LiDAR Obstacle Detection for FSAC Racing Car Chiji .24.....
*Chao Deng (Wuhan University of Science and Technology, China), Gang
Liu (Wuhan University of Science and Technology, China), Anqi Jia
(Wuhan University of Science and Technology, China), Xiang Wen (Wuhan
University of Science and Technology, China), Kuan Ma (Wuhan
University of Science and Technology, China), and Baosheng Ying (Wuhan
University of Science and Technology, China)*

Research on Parallel Detection Technology of Remote Sensing Object Based on Deep Learning .29...
*Chengguang Zhang (Space Engineering University, China), Xuebo Zhang
(Space Engineering University, China), and Min Jiang (Space
Engineering University, China)*

Attention Model Based RNN for Automated Eye-Movement Event Detection .33.....
*Xiaopan Li (Wuhan University of Science and Technology, China),
 Huazhen Zhang (Wuhan University of Science and Technology, China),
 Shiqian Wu (Wuhan University of Science and Technology, China), and
 Hongping Fang (Wuhan University of Science and Technology, China)*

Research on Traffic Target Detection Method Based on Improved YOLOv3 .39.....
*Xinyu Zhang (Wuhan University of Science and Technology, China) and
 Sheng Ding (Wuhan University of Science and Technology, China)*

Image Segmentation

Underwater Sonar Image Segmentation Based on Deep Learning of Receptive Field Block and Search Attention Mechanism .44.....
Huipu Xu (Dalian Maritime University, China), Lin Zhang (Dalian Maritime University, China), Meng Joo Er (Dalian Maritime University, China), and Qiushi Yang (Dalian Maritime University, China)

Image Segmentation of Argon Blowing based on Improved Otsu Algorithm .49.....
Yukang Huang (Wuhan University of Science and Technology, China), Ling Xiong (Wuhan University of Science and Technology, China), Yang Liu (Wuhan University of Science and Technology, China), Pan Deng (Baosteel Central Research Institute(WISCO Limited Technology Center), China), and Binbin Dan (Wuhan University of Science and Technology, China)

A GUI-Based Automatic Sonar Image Segmentation System .55.....
Wenjie Lu (Dalian Maritime University, China), Huipu Xu (Dalian Maritime University, China), and Meng Joo Er (Dalian Maritime University, China)

Single Image Dehazing Method via Sky-Regions Segmentation and Dark Channel Prior .60.....
Pengfei Han (Xi'an University of Posts and Telecommunications, China), Weichao Yan (Xi'an University of Posts and Telecommunications, China), Dianwei Wang (Xi'an University of Posts and Telecommunications, China), Yongrui Qin (University of Huddersfield Huddersfield, UK), and Zhijie Xu (University of Huddersfield Huddersfield, UK)

Retinal Vessel Segmentation Based on Recurrent Convolutional Skip Connection U-Net .65.....
Han Hu (Wuhan University of Science and Technology, China) and Zhao Liu (Wuhan University of Science and Technology, China)

Unknown Object Segmentation Through Domain Adaptation .72.....
Yiting Chen (Wuhan University, China), Miao Li (Wuhan University, China), and Chenguang Yang (University of the West of England, United Kingdom)

Pneumothorax Segmentation in Routine Computed Tomography Based on Deep Neural Networks 78
Wenbin Wu (Tongji University, China), Guanjun Liu (Tongji University, China), Kaiyi Liang (Jiading District Central Hospital Affiliated to Shanghai University of Medicine and Health Sciences, China), and Hui Zhou (Jiading District Central Hospital Affiliated to Shanghai University of Medicine and Health Sciences, China)

An Improved Image Segmentation Model based on U-Net for Interventional Intravascular Robots .84.....

Yuhong Zheng (Dalian Maritime University, China), Meng Joo Er (Dalian Maritime University, China), Shiwei Shen (Dalian Maritime University, China), Wanghongbo Li (Shenzhen Institutes of Advanced Technology, Chinese Academy of Sciences, China), Yifa Li (Shenzhen Institutes of Advanced Technology, Chinese Academy of Sciences, China), Wenjing Du (Shenzhen Institutes of Advanced Technology, Chinese Academy of Sciences, China), Wenke Duan (Shenzhen Institutes of Advanced Technology, Chinese Academy of Sciences, China), and Olatunji Mumini Omisore (Shenzhen Institutes of Advanced Technology, Chinese Academy of Sciences, China)

Image Processing and Application

A Weighted Extrinsic Calibration of a Camera and a LRF .91.....

Shiheng Deng (Huazhong University of Science and Technology, China), Zhigang Sun (Huazhong University of Science and Technology, China), Kai Zhang (Huazhong University of Science and Technology, China), and Li Xiao (Huazhong University of Science and Technology, China)

Electric Vehicle Automatic Charging System Guided by 3D Vision and F/T Sensor .97.....

Bin Liu (Wuhan University of Science and Technology, China), Yunhan Lin (Wuhan University of Science and Technology, China), and Huasong Min (Wuhan University of Science and Technology, China)

Geometric Interpretation of Ellipse Projection and Disambiguating in Pose Estimation .103.....

Xin Li (National University of Defense Technology, China), Xiaoping Hu (National University of Defense Technology, China), Xiaofeng He (National University of Defense Technology, China), and Chen Fan (National University of Defense Technology, China)

Dynamic Texture Feature Extraction based on Multi-Scale Convolutional Autoencoder .108.....

Huimin Yi (Wuhan University of Science and Technology, China), Ziqi Zhu (Wuhan University of Science and Technology, China), and Yangwei Gu (Wuhan University of Science and Technology, China)

Low-Light Image Enhancement Based on Weighted Adaptive Guided Filter .113.....

Ruoyun Zeng (Wuhan University of Science and Technology, China), Hongping Fang (Wuhan University of Science and Technology, China), Shiqian Wu (Wuhan University of Science and Technology, China), and Jiaxin Wu (Wuhan University of Science and Technology, China)

Fast Three-Dimensional Reconstruction Using Composite Three-Frequency Heterodyne Method .118

Gaoxu Deng (Wuhan University of Science and Technology, China), Shiqian Wu (Wuhan University of Science and Technology, China), Bin Chen (Wuhan University of Science and Technology, China), Yucheng Liao (Wuhan University of Science and Technology, China), and Jie Li (Wuhan University of Science and Technology, China)

Super-Resolution Image Reconstruction Algorithm Based on Improved Information Distillation Network .123.....

Heng Wang (Wuhan University of Science and Technology, China), Dongfang Chen (Wuhan University of Science and Technology, China), and Xiaofeng Wang (Wuhan University of Science and Technology, China)

A Novel Information-Entropy-Based Feature Extraction Method for Transaction Fraud Detection .129.....
Dingkun Zhu (Tongji university, China), Chungang Yan (Tongji university, China), Mingjian Guang (Tongji university, China), and Yu Xie (Tongji university, China)

Intelligent Recognition Technology and Application

Research on Recognition Method of Zinc Dross in Hot Dip Galvanizing Pot Based on Image Feature .134.....
Chen Gang (Wuhan University of Science and Technology, China), Dan Binbin (Wuhan University of Science and Technology, China), Xiong Ling (Wuhan University of Science and Technology, China), and Chen Xiaoyan (School of telecom engineering Hubei Science and Technology College, China)

Automatic Detection and Recognition Method of Digital Instrument Representation .139.....
Jiale Liu (Wuhan University of Science and Technology, China), Huaiyu Wu (Wuhan University of Science and Technology, China), and Zhihuan Chen (Wuhan University of Science and Technology, China)

Learning Semantic Graph with Bayesian Networks for Action Recognition .144.....
Runjie Zhang (Wuhan University of Science and Technology, China) and Ziqi Zhu (Wuhan University of Science and Technology, China)

Medical Entity Recognition Based on BiLSTM with Knowledge Graph and Attention Mechanism .149
Qiaoling Wang (Wuhan University of Science and Technology, China), Yu Liu (Wuhan University of Science and Technology, China), Jinguang Gu (Wuhan University of Science and Technology, China), and Haidong Fu (Wuhan University of Science and Technology, China)

Detection and Identification of Sandwich Materials in Tobacco Packing Boxes Based on Three-Channel Two-Dimensional Convolutional Neural Network .158.....
Liang Yuan (Zhengzhou University of Light Industry, China), Yihao Li (Zhengzhou University of Light Industry, China), Yang Wang (Tobacco Henan Industrial Co. Ltd., China), Ailong Mao (Tobacco Henan Industrial Co. Ltd., China), and Kun Chen (Shanghai Institute of Spaceflight Control Technology, China)

Evolutionary Relationship Extraction of Emergencies Based on Two-Way GRU and Multi-Channel Self-Attention Mechanism .162.....
Shun Wang (Wuhan University of Science and Technology, China) and Ping Liang (Wuhan University of Science and Technology, China)

Dynamic Objects Recognizing and Masking for RGB-D SLAM .169.....
Xiangcheng Li (Wuhan University of Science and Technology, China), Huaiyu Wu (Wuhan University of Science and Technology, China), and Zhihuan Chen (Wuhan University of Science and Technology, China)

GNSS-Aided Visual-Inertial Odometry with Failure Mode Recognition .175.....
Qiguang Su (Chongqing University, China), Qian Tang (Chongqing University, China), Yi Li (Chongqing University, China), and Lianchao Liu (Chongqing University, China)

Intelligent Algorithm and Calculation

- G-RGAN: A Spatiotemporal Graph Generative Adversarial Model of Parking Data Recovery .181..
Weiwei Wu (Shenzhen Institute of Advanced Technology, China; University of Chinese Academy of Sciences, China) and Lei Peng (Shenzhen Institute of Advanced Technology, China)
- Spatial-Temporal Structures of Deep Learning Models for Traffic Flow Forecasting: A Survey .187..
Qingsong Luo (Shenzhen Institute of Advanced Technology, Chinese Academy of Sciences, China; University of Chinese Academy of Sciences, China) and Yimin Zhou (Shenzhen Institute of Advanced Technology, Chinese Academy of Sciences, China; University of Chinese Academy of Sciences, China)
- Application of Virtual Simulation Experiments for Undergraduate Networking Teaching .194.....
Wei Wang (Wuhan University of Science and Technology, China) and Xing Liu (Wuhan University of Science and Technology, China)
- Multi-Population Evolutionary Algorithm for Multimodal Multobjective Optimization .199.....
Kai Zhang (Wuhan University of Science and Technology, China), Fang Liu (Wuhan University of Science and Technology, China), Chaonan Shen (Wuhan University of Science and Technology, China), and Zhiwei Xu (Wuhan University of Science and Technology, China)
- Adaptive Niche Radius Fireworks Algorithm for Multi-Modal Function Optimization .205.....
Simiao Li (Wuhan University of science and technology, China) and Fang Liu (Wuhan University of science and technology, China)
- Analysis of Learning Behavior Indicators Based on Python .211.....
Yining Li (Wuhan University of Science and Technology, China), Wei Hu (Wuhan University of Science and Technology, China), Fang Liu (Wuhan University of Science and Technology, China), and Tianyi Liu (Wuhan University of Science and Technology, China)
- Parameter-Adaptive NLM Denoising Algorithm Based on Hessian Matrix .216.....
Chunping Zhao (Wuhan University of Science and Technology, China), Shiqian Wu (Wuhan University of Science and Technology, China), and Jiaxin Wu (Wuhan University of Science and Technology, China)
- Sentiment Analysis of MOOC Reviews Based On Capsule Network .222.....
Tianyi Liu (Wuhan University of Science and Technology, China), Wei Hu (Wuhan University of Science and Technology, China), Hong Guo (Wuhan University of Science and Technology, China), and Yining Li (Wuhan University of Science and Technology, China)
- Level Target Inject Net for IDs Representation in Recommendation System .228.....
Jing Tang (Tongji University, China), Hengda Bao (Department of BaiduMaps, BIDU, China), and Guanjun Liu (Tongji University, China)
- An Improvement of Density Peaks Clustering Algorithm Based on KNN and Gravitation .234.....
Jianyang Sun (Tongji University, China) and Guanjun Liu (Tongji University, China)
- Route-Optimization Based Storage Allocation Algorithm in Intelligent High-Bay Warehouses .240..
Qiubo Huang (Donghua University, China), Yuxiang Ye (Donghua University, China), Zhenwei Zhu (Shanghai Enfon Robotics Co., Ltd, China), and Ting Lu (Donghua University, China)

Ensemble Method for Credit Card Fraud Detection .246.....	
	<i>Rui Wang (Tongji University, China) and Guanjun Liu (Tongji University, China)</i>
Bi-Directional Chains of Neural Nets for Multi-Target Regression .253.....	
	<i>Vishwa Mohan Singh (MIT World Peace University, India), Sneha Rao (MIT World Peace University, India), and Jaysree Ghorpade-Aher (MIT World Peace University, India)</i>

Tracking Control and System

Design and Optimization of Actuator for Soft Bionic Finger .260.....	
	<i>Xinjie Wang (Zhengzhou University of Light Industry, China), Yan Cheng (Zhengzhou University of Light Industry, China), Huadong Zheng (Zhengzhou University of Light Industry, China), Yihao Li (Zhengzhou University of Light Industry, China), and Caidong Wang (Zhengzhou University of Light Industry, China)</i>
Fault-Tolerant Time-Varying Formation Tracking Control for Unmanned Aerial Vehicle Swarm Systems with Switching Topologies and a Leader of Unknown Control Input .265.....	
	<i>Xiaojing Wu (Hebei University of Science and Technology, China), Yating Jin (Hebei University of Science and Technology, China), and Ran Zhen (Hebei University of Science and Technology, China)</i>
A Novel Maximum Energy Extraction and Tracking Strategy for Wave Energy .271.....	
	<i>Bohua Wang (Dalian Maritime University, China), Meng Joo Er (Dalian Maritime University, China), Zhongkun Li (Dalian Maritime University, China), and Shaobao Li (Yanshan University, China)</i>
Trajectory Tracking Control of a Mobile Manipulator Mounted on an Unmanned Surface Vehicle .277.....	
	<i>Ting Pan (Dalian Maritime University, China), Meng Joo Er (Dalian Maritime University, China), Yuqing Chen (Dalian Maritime University, China), and Zhongkun Li (Dalian Maritime University, China)</i>
Long-Term Visual Tracking of an Unmanned Surface Vehicle in Complex Environment Based on Adaptive Multi-Feature Fusion with Correlation Filtering .283.....	
	<i>Meng Joo Er (Dalian Maritime University, China), Shiwei Shen (Dalian Maritime University, China), Yuhong Zheng (Dalian Maritime University, China), and Xun Ji (Dalian Maritime University, China)</i>
Game Theoretical Reinforcement Learning for Robust H^∞ Tracking Control of Discrete-Time Linear Systems with Unknown Dynamics .290.....	
	<i>Hao Wu (Yanshan University, China), Shaobao Li (Yanshan University, China), Petar Durdevic (Aalborg University, Denmark), and Zhenyu Yang (Aalborg University, Denmark)</i>
S-Plane-Based Trajectory Tracking Control of Underactuated Ship .296.....	
	<i>Qiushi Yang (Dalian Maritime University, China), Huipu Xu (Dalian Maritime University, China), and Meng Joo Er (Dalian Maritime University, China)</i>

Course Control Strategy for Unmanned Surface Vehicle Based on Mode Switching .302.....
Dongdong Mu (Dalian Maritime University, China), Guofeng Wang (Dalian Maritime University, China), Yunsheng Fan (Dalian Maritime University, China), Yong Wang (Dalian Maritime University, China), Yanli Liu (Dalian Maritime University, China), and Xuguo Jiao (University of Technology Qingdao, China)

Control Theory and Control System

ADRC Course Control for USV Based on Fuzzy Self-Tuning .307.....
Yunsheng Fan (Dalian Maritime University, China), Lei Liu (Dalian Maritime University, China), and Yu Yang (Dalian Maritime University, China)

Precise Landing Control of UAV Based on Binocular Visual SLAM .312.....
Tianxiao Cui (Dalian Maritime University, China), Chen Guo (Dalian Maritime University, China), Yi Liu (Dalian Maritime University, China), and Zeyu Tian (Dalian Maritime University, China)

Leader-Follower Formation Control of Unmanned Surface Vehicles Using Non-Singular Terminal Sliding Mode Strategy .318.....
Zhongkun Li (Dalian Maritime University, China), Meng Joo Er (Dalian Maritime University, China), Bohua Wang (Dalian Maritime University, China), and Ying Zhao (Dalian Maritime University, China)

Four Position Synthesis of Spherical 4R Mechanism Based on Solution Region .324.....
Zhen Zhang (Zhengzhou University of Light Industry, China), Quanwei Zong (Zhengzhou University of Light Industry, China), Hua Lu (Zhengzhou University of Light Industry, China), and Qiongpei Xia (Zhengzhou University of Light Industry, China)

A Novel Composite Controller Design for Manipulator with Flexible Component under Time-Varying Uncertainties and Disturbances .330.....
Baolei Wang (Ningbo Institute of Material Technology and Engineering Chinese Academy of Sciences, University of Chinese Academy of Sciences, China), Chi Zhang (Ningbo Institute of Material Technology and Engineering Chinese Academy of Sciences, China), Qingwei Jia (Institute of Intelligence Control Wildsc (Ningbo) Intelligent Technology Co. Ltd, China), and Zhaohui Shi (National Quality Supervision and Inspection Center of Pneumatic Products, China)

Design and Control of a Cable-Driven Series Elastic Actuator for Exoskeleton .335.....
Letian Ai (Wuhan University, China), Xikai Men (Wuhan University, China), Tianlin Zhou (Wuhan University, China), Xiaohui Xiao (Wuhan University, China), and Zhao Guo (Wuhan University, China)

Comparison of Anti-Interference Ability between MPC and Robust Control .340.....
Yun-Sheng Hu (Wuhan University of Science and Technology, China) and Yin-Tao Zhu (Wuhan University of Science and Technology, China)

Unmanned System and Navigation System

- GPS/INS Integrated Navigation with LSTM Neural Network .345.....
Yaohua Liu (University of Science and Technology of China; Chinese Academy of Sciences), Qingsong Luo (Shenzhen Institute of Advanced Technology, Chinese Academy of Sciences), Wei Liang (University of Science and Technology of China; Chinese Academy of Sciences), and Yimin Zhou (Shenzhen Institute of Advanced Technology, Chinese Academy of Sciences)
- A New Model for Sea-Rail Intermodal Transportation Network System Planning Considering the Arctic Route .351.....
Peixiu Han (Dalian Maritime University, China), Zhuo Sun (Dalian Maritime University, China), Kaili Liu (Dalian Maritime University, China), and Bin Li (BMW Brilliance Auto co. Ltd, China)
- UAV Path Planning Based on an Improved Ant Colony Algorithm .357.....
Huan Liu (National University of Defense Technology, China), Ning Zhang (95402 army, China), and Qiang Li (National University of Defense Technology, China)
- Research on UAV Task Assignment Based on Hybrid Particle Swarm Algorithm .361.....
Yeding Li (Nanchang Hangkong University, China) and Dai Jiyang (Nanchang Hangkong University, China)
- Research on Mission Planning of Multiple AUVs based on Hybrid Strategy .366.....
Shaokun Yan (Jiangsu Automation Research Institute, China), Jihua Xu (Jiangsu Automation Research Institute, China), Ping Zhang (Jiangsu Automation Research Institute, China), and Linan Song (Jiangsu Automation Research Institute, China)
- Application of the Adaptive Double-Layer Ant Colony Algorithm in UAV Trajectory Planning .371
Chu Wang (Nanjing University of Aeronautics & Astronautics, China), Ying Nan (Nanjing University of Aeronautics & Astronautics, China), Shaoliang Zhang (Nanjing University of Aeronautics & Astronautics, China), and Liang Jiang (Nanjing University of Aeronautics & Astronautics, China)
- Hybrid Adaptive Path Planning for a USV under Complex Marine Environment .378.....
Meng Joo Er (Dalian Maritime University Dalian, China), Chengzhong Li (Dalian Maritime University Dalian, China), and Qianying Li (Dalian Maritime University Dalian, China)

Intelligent Robot Design and Development

- Research of Fuzzy PID Control for Lower Limb Wearable Exoskeleton Robot .385.....
Kun You He (Zhengzhou University of Light Industry, China) and Lumin Chen (Zhengzhou University of Light Industry, China)
- Steering Dynamics Analysis of the Intestinal Microrobot .390.....
Minglu Chi (Henan Institute of Technology, China), Yuanli Wang (Henan Institute of Technology, China), Rongsheng Liu (Henan Institute of Technology, China), and Xiaoyan Qian (Henan Institute of Technology, China)

Reverse Thrust Adsorption Characteristics of a Wall Climbing Robot .396.....	396
<i>Minglu Chi (Henan Institute of Technology, China), Ruihua Ren (Henan Institute of Technology, China), Yaqin Qiu (Henan Institute of Technology, China), Qian Xing (Henan Institute of Technology, China), Liping Ren (Guangxi University, China), and Xiaoyan Qian (Henan Institute of Technology, China)</i>	
Design and Simulation of Pipe Outer Wall Robot Based on Omnidirectional Wheel .402.....	402
<i>Xirui Duan Mu (Zhengzhou University of Light Industry, China), Lumin Chen (Zhengzhou University of Light Industry, China), and Huadong Zheng (Zhengzhou University of Light Industry, China)</i>	
Design of Vascular Interventional Surgical Robot with Network Time Delay Analysis for Master-Slave Teleoperation .406.....	406
<i>Yifa Li (Beijing University of Posts and Telecommunications, China), Weimin Wang (Beijing University of Posts and Telecommunications, China), Wenke Duan (Shenzhen Institutes of Advanced Technology, Chinese Academy of Sciences, China), Olatunji Mumini Omisore (Shenzhen Institutes of Advanced Technology, Chinese Academy of Sciences, China), Toluwanimi Akinyemi (Shenzhen Institutes of Advanced Technology, Chinese Academy of Sciences, China), Wenjing Du (Shenzhen Institutes of Advanced Technology, Chinese Academy of Sciences, China), and Yuhong Zheng (Shenzhen Institutes of Advanced Technology, Chinese Academy of Sciences, China)</i>	
Optimization of Spraying Distance and Coating Thickness of Spraying Robot .413.....	413
<i>Lin Zhang (Nanjing Tech University, China) and Guangming Zhang (Nanjing Tech University, China)</i>	
Fast Jump Point Search Based Path Planning for Mobile Robots .418.....	418
<i>Yucong Tong (Wuhan University of science and technology, China), Huaiyu Wu (Wuhan University of science and technology, China), Xiujuan Zhen (Wuhan University of science and technology, China), Yang Chen (Wuhan University of science and technology, China), and Zhihuan Chen (Wuhan University of science and technology, China)</i>	
Research on Multi-Robot Cooperative Task Assignment Based on Cooperative Game .424.....	424
<i>Man Li (Wuhan University of Science and Technology, China), Huaiyu Wu (Wuhan University of Science and Technology, China), and Lin Chen (Wuhan University of Science and Technology, China)</i>	
Author Index 431	431