2022 12th International Conference on CYBER Technology in Automation, Control, and Intelligent Systems (CYBER 2022)

Baishan, China
27-31 July 2022

Pages 1-640

IEEE Catalog Number: CFP22CYB-POD
ISBN: 978-1-6654-7268-5

Copyright © 2022 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:	CFP22CYB-POD
ISBN (Print-On-Demand):	978-1-6654-7268-5
ISBN (Online):	978-1-6654-7267-8
ISSN:	2379-7711

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

Table of Contents

ThA1: Best Paper Session I

Modeling and Hybrid Compliant Control for a 2-DOF Robotic Leg With a New Biarticular Actuation 1
Abdonoor Kalibala, Abdelfatah Mohamed, Shinjiro Umezu, Samy Assal

Active Disturbance Rejection Controller via Dynamic Weighted Mutant Pigeon-Inspired Optimization for UAV Close Formation Flight 7
Guangsong Yuan, Haibin Duan, Yongbin Sun, Chen Wei

The Region-based Virtual Fixtures Control for Invasive Avoidance in Hands-on Robot-assisted Mandibular Angle Split Osteotomy 13
Huanyu Tian, Zhe Han, Dongsheng Xie, Xingguang Duan, Xi Fu, Feng Niu

Robust Platoon Control of Industrial Heavy-Load Autonomous Vehicles 19
ZHE LIU, XIANG LI, Hesheng Wang

Development of a Redundant Humanoid Lower Limb With Whole-Foot Tactile Perception 25
Funing Hou, Jixiao Liu, Dicai Chen, Kuo Liu, Shijie Guo

Human Inspired Robot Learning to Search Objects in Cluttered Environment Using Maximum Information-based Method 31
Zhihao Li, Shuaishuai Zheng, Zhipeng Dong, Miao Li, Fei Chen

ThPo1: Poster Session 1

Autonomous Cognition and Personalized Service Selection Based on Emotion-Space-Time Information for Home Service Robot 37
Fei Lu, Ying Yuan, Yuhong Liu, Guohui Tian, Hao Wu

Modeling and control of a soft-rigid hybrid robotic glove for hand rehabilitation and assistance 43
Yongkang Jiang

Mobility Analysis and Simulation of Metamorphic Detection Robot with Metamorphic Bevel Gear 49
Yuan Bingbing, Wang Hongguang, Yuan Hui

An Intelligent Piano Playing Algorithm Applied to The Humanoid Robot 55
Guang Gao, LING ZHONG, Pu Zhang, Zhiyong Huang, Ruilong Du, Yuehua Li, Jason Gu

Hybrid Controller and Switching Strategy of Ice-underwater Amphibious Robot based on Dynamic Model Observer 61
Xinyu LIU, Yang LU, Chuanlong XIN, Dongxu TAN, Shuo LI

Balance Control for Lower Limb Exoskeleton based on the Center of Mass 67
Ligang Liu, Wanxin Chen, Mengze Li, Jiawei Zhao, Bi Zhang, Xingang Zhao

A Robust and Flexible Geometry calibration Method for Phase Measuring Deflectometry 72
Xinggang Fan, Tianle Ma, Geng Wang, Jiaxian Liu, Chao Li

Image-Based Visual Servoing under Field of View Constraints for Robot Manipulators 77
Guoyu Zuo, Yan Liu, Gao Huang, Daoxiong Gong

An Efficient Color and Geometric Feature Fusion Module for 6D Object Pose Estimation 83
Jiangeng Li, Hong Liu, Gao Huang, Guoyu Zuo

Particle Swarm Optimization of a Liquid State Machine for Epilepsy and Seizure EEG Signal Classification 89
Qingfeng Gong, Wenli Zhou, Zhuoyu Li, Kaiqiang Wen, Zhoujun Sheng

An Optimized Physical Reservoir Computing Through Genetic Algorithm 94
Kaiqiang Wen, Wenli Zhou, Qingfeng Gong, Zhuang Yan, Chengzhu Li, Zhoujun Sheng, Zhuoyu Li

AGV State Monitoring Based on Global and First-person View Fusion in Digital Workshops 99
Sichao Zhang, Wei Liang, Gengyu Li, Xudong Yuan, Haibo An, Yinlong Zhang

Gait tracking control of biped robot based on adaptive gait switching algorithm 105
Jianjun Yu, Ruiqi LI, Daoxiong Gong, Yixin Liu, Peng Liu

Research on CT Image Super-resolution Reconstruction with Multi-branch Fusion Network 111
Zhipeng Ren, Jianping Zhao, Chunyi Chen, Peng Wang, Shutong Zhang

Design and Development of Foldable Domestic Rescue Capsule 117
Ziqiang Zhang, Shangkun Yang, Jun Li, Chunqi Liu

Design and Optimization of Electric Vehicle Power Battery Box 123
Qiang Wu, Fangzheng Wu, Lanying Xu, Wenjun Jie, Renzhong Han

Iterative learning control for conformable fractional order system with time delay 129
Yugang Wang, Mingwen Yao, Cong Sun, Fengyu Zhou

DFT-Based Digital Signal Processing Algorithm Design for Eddy Current Testing Instrument 134
Shuangyin Wang, Bo Tang, Qianfei Yang, Shaobin Shen, Ge Lin, Songhua Huang

Mobile Robot Path Planning Method Based on an Improved A* Algorithm 140
Ning Wang, Ting Wang, Zhihui Zhang, Shiliang Shao, Yihan Jiang, Yawei Li

Design of prostate puncture system guided by 3D MRI and TRUS images 144
Dong Liu, Long Wang, Yu Du, De Yang, Xue Wang, Ming Cong

A Camera Movement Guidance Method based on Multi-Object Tracking 150
Puchun Liu, Botao Li, Sheng Bi, Muye Li, Chenxi Zheng

Simulation Analysis of Contact Stress of Cycloidal-Pin Gear Transmission 156
Lanying Xu, Guoshan Ye, Qiang Wu, Sicheng Feng

Simulation analysis of temperature field and stress-strain in form grinding of cycloidal gear 162
Lanying Xu, Sichen Feng, Guoshan Ye, Qiang Wu

Development of an Economical 3D Sensor for Weld Seam Tracking in Robotic Welding 168
Heping Chen, Henry Okeke, Biao Zhang

Design of Humanoid Robotic Hand Based on Link Underactuation 174
Pu Zhang, Da-ming NIE, Yun LIU, Shi-qiang ZHU, Jason GU, Rui-long DU

Optimization Method of Black Start Path for Offshore Wind Farm Considering Operating State of Turbines 179
Haitao Jiang, Chenggen Xu, Yuanming Zeng, Hongyu Yang, Kaiyuan Huang

Research on Black Start Coordinated Control Technology of Offshore Wind Power, Diesel, and Storage Combined System 185
Chao Yuan, Hongyu Yang, Yanan Liu, Yiming Tang, Kaiyuan Huang

Network Security Analysis Method for Power System 191
Liang Gu, Yi An, Xin Zhou

ThB2: Perception and Recognition I

Unsupervised Domain Adaptive Object Detection Based on Frequency Domain Adjustment and Pixel-Level Feature Fusion 196
Yanlong Xu, Huijie Fan, Hao Pan, Lianquan Wu, Yandong Tang

A High-efficient Training Strategy for Deep Q-learning Network Used in Robot Active Object Detection 202
Shaopeng Liu, Guohui Tian

Sparse representation guided low-rank restoration for noisy image recognition 207
ZhenYu Li, Xi'ai Chen, Jiaxin Liu, Chenyu Zhang, Yong Li, Zhi Han

An Automatic Hand Rehabilitation Assessment System: Implementation and Experiments 213
Yifan Wang, Long Cheng

Study of Control Method of a Rope-Driven Coordinative Towing Robot System 219
Xiaoyan LI

Elderly walking model and micro Doppler feature extraction with millimeter wave radar 225
Xinchun Zhao, Jun Zhang, Yu Wang

ThB3: Measurement and Prediction I

A Novel Lightweight Architecture of Deep Convolutional Neural Networks 230
Baichen Liu, Xi'ai Chen, Zhi Han, Huidi Jia, Yandong Tang

Prediction of the Contrast between Target and Background based on an Improved Support Vector Machine 236
Junbo Liao, Hongxue Yuan, Huiru Zhong, Heng Li, Xin Cai, Jian Li, Yuliang Zhao

Analysis and Simulation of Influence of Attitude Error on Strapdown Seeker Angle Rate Extraction 242
Zhiman Liu, Yifei Wang

Robotic Visual Inspection and Positioning Method for Flexible Wire Coating Operation 247
Chenglong Rao, Yifeng Song, Hongguang Wang, Junpeng Wang, Fengren Jing

Research on Intraoperative Cornea-Instrument-Robot Interaction for Autonomous Cornea Suturing 253
Xiaojing Feng, Xiaodong Zhang, Xiaojun Shi, Li Li

Kinematic Parameter Calibration Method of Light Weight Robots Based on Sequence Quadratic Programming Algorithm 259
Kang Min, Fenglei Ni, Xin Shu, Zhu Ji, Hong Liu

ThB4: Robot Planning and Control I

An Intelligent Robot Motion Planning Method and Application via LPPO in Unknown Environment 265
Lingli Yu, Jiawei Luo, Kaijun Zhou

A Novel Thrust Allocation Method for Underwater Robots 271
Xinhui Zheng, Cong Wang, Xuejiao Yang, Qiyan Tian, Qifeng Zhang, Baoqi Zhai

Structure Design and Trajectory Planning Of Meal-assistance Robot 277
Chao Wang, Keyi Wang, Jinghang Li, Xingyuan Wang, Yanjie Chen

Research on vision based outdoor blind guiding robot 283
Yanchen Guo, Lina Hao, Yingli Wu

Obstacle Detection and Path Planning for Intelligent Overhead Cranes Using Dual 3D LiDARs in a Brewing Environment 289
TongLei Jiang, Guoliang Liu, Qinghui Zhang, Zheng Zeng, Sujun Cheng, Jianhua Zhang, Yuhang Zhang

ThPo2: Poster Session 2

Evaluation and Comparison of Gmapping and Karto SLAM Systems 295
Shengshu Liu, Yixing Lei, Xin Dong

Design of a Multi-connection Pneumatic Artificial Muscle 301
Shixin Zhang, Daoxiong Gong, Jianjun Yu

EMG-based Assessment of Shank Muscle Fatigue During Dynamic Exercise 307
Huiqi Niu, Lizhong Zhu, Tao Cheng, Xu Zhong, Jiwei Li, Bi Zhang, Xingang Zhao

6DoF-ICTC: A Deep Image Feature Extraction Network Combining Transformers and CNNs for 6DoF Pose Estimation 313
Liming Zhang, Xin Zhou, Baixian Zhu, Can Wang, Xinyu Wu

ENFW: an Industrial Firewall for Edge Computing 320
Guo Wu, Youdong Chen, Guohua Zhang

Study on the Master-slave Control System of the Fracture Reduction Surgery 326
Minghe Liu, Hao Sun, Jian Li, Yinglun Tan, Bokai Xuan, Xin Guo, Yuexuan Xu, Tianyi Ma, Qingsong Ding

Option-based Multi-Agent Exploration 332
Xuwei Song, Lipeng Wan, Zeyang Liu, Xingyu Chen, Xuguang Lan

Research on Variable Stiffness of a Human-Inspired Rigid-soft Finger Driven by Enhanced IPMC actuators 338
Man Wang, Xiaojun Zhang, Minglu Zhang, Manhong Li, Sujun Yu

Research on demonstration task segmentation method based on multi-mode information 343
Wei Zhang, Tieze Cao, Anbin Sun, Xiaochuan Gan, Jingjing Fan, Lina Hao, Hongtai Cheng

An Improved Dynamic Window Approach for Mobile Robot Dynamic Path Planning 348
Hongwei Qin, Shiliang Shao, Ting Wang, Yawei Li, Ning Wang, Yao Chen

Coordinate Embedding Transformer Model for Optical Music Recognition on Monophonic Scores 354
Changhai Zha, Zhiyong Huang, Shiqiang Zhu, Jiakai Zhu, LING ZHONG, Ruilong Du, Jason Gu

Preliminary exploration on the construction and application of knowledge graph for security control strategy 359
Wen Bo, Zhang Junhao, Han Qingqing

Research and Application of Standardization for Ship Energy Efficiency Intelligent Management Systems 365
Heng Li, Wei Liu, Shuhuan Feng

Countermeasures for cramps in passive training of hand function rehabilitation robot 371
Ben Wang, Kexin Zuo, Yangwei Wang

Prediction of spraying process parameters based on BP neural network 376
Danyang Yu, Chengzhi Su, Dongxing Yang, Haifeng Bao

A Cooperative Gene Regulatory Network Target Entrapping in GNSS-denied Environments 382
Ze Shi, Zhun Fan, Peili Ma, Juncao Hong, Wenji Li, Guijie Zhu, Huaxing Huang, Yuwei Cai, Zhaohui Dong, Xiaomin Zhu

Research on Denoising Method of Point Cloud based on Multi-frame Fusion 388
Enguo Wang, Mengxiang Cai, Chengzhi Su, Xiaochen Zhang

Research on Point Cloud Precision Registration Method Combined with Color Grid Projection 394
Enguo Wang, Mengxiang Cai, Chengzhi Su, Xiaocheng Zhang

Inverse kinematic solution method for a 6-DOF manipulator based on mayfly algorithm 400
Zhenyu Liu, Qin Zhang, Hui Chai, Jiamin Guo

Digital Twin-Driven Task Replanning Method for Robot-Environment Physical Interaction 407
Xin Li, Bin He, Zhipeng Wang, Yanmin Zhou, Gang Li

A Novel Multi-Stream Informer Used for Lower Extremity Joint Angle Estimation 413
Xin Zhou, Liming Zhang, Jiaqing Liu, Jiancong Ye, Can Wang, Xin yu Wu

Multi-robot cooperative patrol path planning method under road network constraints 420
Xiaotian Fan, Yang Chen, Fei Shu

Automatic Pavement Crack Detection Based on YOLOv5-AH 426
Zhaohui Dong, Guijie Zhu, Zhun Fan, Jiacheng Liu, Huanlin Li, Yuwei Cai, Huaxing Huang, Ze Shi, Weibo Ning, Liu Wang

Design of An Ankle-Foot System with Uneven Terrain Adaptability 432
Fangyan Shen, Ruilong Du, Daming Nie, Zhiyong Huang, Jiangren Tian, Jason Gu

Design and Implementation of a Control System for Wrist Offset Wheel Hub Polishing Robot 438
Zhu Kui, Zhao Jun, Liu Heng, Xia Yi

A FOPID-IGPC Control Method for Bulb Tubular Turbine Generator Unit 446
Aimin An, Yongan Wen, Rongxin Wang

A Method for Identifying Spatial Distribution Parameter Fields of Composite Materials Based on Modal Functions 452
Li Fan, Xiongzi Li, Zhongxue Gan

An Attention Based Chinese Sign Language Recognition Method Using sEMG Signal 457
Zhen Zeng, Fei Wang

Prediction of Battery Capacity Based on Deep Residual Network 462
Yankui Wang, Wenhao Yao, Min Dong, Yixuan Li, Longxing Zhu, Sheng Bi

ThC2: Perception and Recognition II

SIP-YOLOv5: A Road Negative Obstacle Detection Network Based on Improved YOLOv5 and Prediction Box Correction Algorithm 468
Fan Zhang, Hanwei Peng, Lingli Yu

SlowFast GCN Network for Quantification of Parkinsonian Gait Using 2D Videos 474
Qingyi Zeng, Peipei Liu, Ying Bai, Huan Yu, Xiaoyi Sun, Jianda Han, Jialing Wu, Ningbo Yu

ECG Feature Wave Recognition Based on Adaptive Wavelet Thresholding Algorithm 480
Meichun Wang, Peng Su, Qiang Guo, Peili Wang, Sikai Wang, Qinran Zhang

The Performance Of A Novel P300 Brain-Computer Interface Paradigm With Electrical And Vibration Modes 486
Chenxi Chu

A Novel Hand Gesture Recognition Method Using sEMG-Based PSODE-BPNN 492
Ling-Long Li, Guangzhong Cao, Yuepeng Zhang, Jiang-Cheng Chen

A Comparison of Modality-Matched and Modality-Missed-Matched Sensory Feedback by Brain Mapping and Practical Trials 498
Saeed Bahrami Moqadam, Ahmad saleh Asheghabadi, Farzaneh Norouzi, Nikki Akraminejad, Behruz Shiee Zadeh Yazdi, Jing Xu

ThC3: Measurement and Prediction II

SRODNet: Pavement Crack Detection Based on Deep Convolutional Neural Network and Shadow Removal 504
Yide Zhang, Zhihong Li, Zilong Sun, Guoliang Liu, Yichao Cao

A Kind of Nonlinear Disturbance Observer for Robotic Manipulator 509
Feilong Zhang, Bi Zhang, Xingang Zhao

A Robot Coordinate Measurement System Based on Pull Wire Sensor and Its Parameter Identification Method 514
Shuang Gao, Kaiwei Ma, Yang Gao, Xin Shen, Mingxing Yang, Fengyu Xu

Overview of Underwater Image Enhancement and Restoration Methods 520
Cheng Chenyu, Zhang Huiying, Li Gang

Calibration of the Pseudo-rigid-body Model for a Multi-section Magnetic Catheter Robot 526
Daojing Lin, Niandong Jiao, Zhidong Wang, Lianqing Liu

A Novel Motor Imagery EEG Classification Model Using Frequency-Temporal-Spatial□ Convolutional Neural Network with Channel Attention 531
Hong-Jie Liang, Ling-Long Li, Guangzhong Cao, Jiang-Cheng Chen

ThC4: Robot Planning and Control II

3D Eye-to-Hand Coordination for Uninstructed Robot Grasp Planning 537
Peidong Liang, Chengxi Huang, Zhendong Fan, Chentao Zhang, Ruizhe Zhang, Lijun Zhao

Path Planning Research for Outdoor Mobile Robot 543
Yujing Dong, Shuang Liu, Changzheng Zhang, Qigao Zhou

Automatic Generation Of Stability Matrix For Assembly Sequence Planning 548
Trong Thien Vu, Zengxi Pan, Stephen Van Duin

ZMP Preview Control of Lower Limb Exoskeleton Robot Based on 3D Linear Inverted Pendulum 554
Zhiwei Zhu

Ordered Boundary Extraction Algorithm of 3D Point Cloud for Guiding Robot Spraying 558
Shiqi Ding, Chengzhi Su, Hao Qin, Zhen Xu, Enguo Wang

Manipulation Planning for an Mobile Manipulator with Positioning Error 564
Yuhao Meng, Tao Wang, Yujing Chen, Yunjiang Lou

A Multiphysics Nanorobotic Manipulation System 570
Wenqi Zhang, Donglei Chen, Chaojian Hou, Kun Wang, Qingwei Li, Lixin Dong

FrA1: Best Paper Session II

Fast AFM probes switching method via Integrated dual-probes 574
Kaixuan Wang, Tie Yang, Jialin Shi, Peng Yu, Chanmin Su, Lianqing Liu

Robot Manipulation Skill Learning Based on Dynamic Movement Primitive 579
Yunfeng Bai, Fengming Li, Man Zhao, Wei Wang, Yibin Li, Rui Song

Classification of Individual Finger Motions Using Single-Site Mechanomyography by Optimized Long Short-Time Memory 585
Ahmad saleh Asheghabadi, Saeed Bahrami Moqadam, Jing Xu

An Active Power Allocation Optimization Strategy for Wind Farm Frequency Response Considering Fatigue Loads 591
Yongheng Mao, Bingtuan Gao

Cable Assembly based on Robot Manipulation and Control 597
Xiaobin Zhang, Congjian Li, Ning Xi

Technology and Application of Medical Bidirectional Transport Robot 603
Guangwei Zhang, Feng Jiang, Changshan Li

FrPo3: Poster Session 3

14 Degree IPMC Flexible Manipulator for Grasping 609
Xiaojun Zhang, Sujun Yu, Minglu Zhang, Manhong Li, Man Wang

Dynamic Parameter Identification of Six-axis Industrial Robot Based on Improved Genetic Algorithm 614
Yan Li, Dawei Ni, Chengyu Wei, Zengpeng Lu, Zhenguo Zhang, Keping Liu

Deep Residual Network for Image Super-Resolution Reconstruction 620
Bozhen Zhang, cheng gao

Design and Driving Rod Group Analysis of a Lower Limb Assisted Exoskeleton 624
Lingyan Zhao, Youan Tang, Xiaojun Wang, Zhiguang Guan

Experimental Design of Self-Tracking Camera Gimbal Robot Based on OpenCV 630
Di Zhao, Yuhong Du, Zhenyu Ding, Bo Yuan, Yuxiang Wang

Bionic robotic fish mechanical structure optimization design and performance analysis 636
Qunhong Tian, Lixin Zhang, Acan Jiang, Hongbo Ma, Yunxia Wang

A Crack Prediction Method Based on Improved Grey System Model 641
Zhe Liu, Sile Ma, Xiangyuan Jiang

Research on adaptive crawling of underwater hexapod robot on complex ground 647
Yingzhe Sun, Qifeng Zhang, Qingfeng Yao, Aiqun Zhang

Position Control of Traction Upper Limb Rehabilitation Robot Based on Fuzzy Sliding Mode Method 654
Wenxiang Zhang, Linsen Xu, Xingcan Liang, Yan Zhang, Wenjun Yan, Jian Zhou

Research on wall transition control of double-body negative pressure wall-climbing robot N/A
Wenjun Yan, Linsen Xu, Jinfu Liu, Jian Zhou, Shuang Zhou, Wenxiang Zhang

Robot Confrontation Based on Policy-Space Response Oracles 666
Mingxi Hu, Siyu Xia, Chenheng Zhang, Xian Guo

Motion Planning Combines Human Motion Prediction for Human-Robot Cooperation 672
HeJing Ling, Guoliang Liu, Liujuan Zhu, Bin Huang, Fei Lu, Hao Wu, Guohui Tian, Ze Ji

An Effective Training Strategy for Upper-limb Rehabilitation Robots Based on Visual-haptic Feedback Using Potential Field 678
Guang Feng, Jiaji Zhang, Guohong Chai, Maoqin Li, Guokun Zuo, Lei Yang

A light knee exoskeleton for assisted ramp walking 682
Shaocong Chen, Shouqi Wei, Chunjie Chen, Zhuo Wang, Yao Liu, Xin Ye, Lingxing Chen, Xinyu Wu

RPAS: A Refined Positioning and Analysis System Based on Aerial Platform for Swimming Scenes 688
Shijie Zhang, Zhongquan Liu, Hao Wang, Fan Sang, Jiaxin Li, Yuxuan Guo, Xuan Pei, Jianglong Zhang, Tao Tang, Taogang Hou

A New Dynamic Routing Network for Monocular Depth Estimation 694
Zhehao Luo, Sijin Luo, Guoyuan Liang, Xin yu Wu

Learning Rat-Like Behavioral Interaction Using a Small-Scale Robotic Rat 701
Zihang Gao, Guanglu Jia, Hongzhao Xie, Xiaowen Guo, Toshio Fukuda, Qing Shi

Cortical reorganization pattern of stroke patients under upper limb multi-joint linkage task 707
Qitong Chu, Congcong Huo, Tengyu Zhang, Xuemin Zhang, Gongcheng Xu, Shengcui Cheng, Huiyuan Li, Ping Xie, Xin Guo

Research Status of Bathing Aids for the Elderly 712
Jianyi Zhang, Xinyang Zhao, Lifang Ma, Jian Li

Multi-kernel-size Convolutional Supervised Autoencoders for Tactile Gesture Recognition 718
Chaoxiang Ye, Xiaoyu Li, Binhua Huang, Yuanzhe Su, Tingting Mi, Zhenning Zhou, Zhengkun Yi, Xinyu Wu

False Data Injection Attack Detection Method Based on Residual Distribution of State Estimation 724
Lei Zhu, He Huang, Song Gao, Jun Han, Chao Cai

A Method of Cell Counting Based on Computer Vision 729
Shihong Ding, Huanyu Zhao, Zhi Han, Yandong Tang

LiDAR Point-Cloud Odometer Based Mobile Robot Routine Tracking in Orchards 735
Quan Qiu, Xuefeng Li

Experimental study of a human-computer evaluation model based on the performance of surface electromyographic massage pillows 740
Jianyi Zhang, Wei Li, Shan Du, Xinyang Zhao, Haolin Sui

Low-carbon design of leafy vegetable production system based on life cycle analysis and digital model 744
Guohua Gao, Xinyue Du, Zihua Zhang, Wenyue Liu, Shiyue Pan

Detection of Human Action Intention by Electromyography(EMG) 750
Wenbo Yuan, Kehan Zou, Yafei Zhao, Ning Xi

Electric Vehicle Regulation Technology Based on Deep Reinforcement Learning 755
Zhujian Ou, Xiaolong Xiao, Hang Yu, Jianhua Yuan, Xiaowei Miao, Dongdong Huang

A Simulation Based Investigation Considering Carbon Emissions in Shanghai 759
Peng Chen, Mingxing Guo, Chen Fu, Su Wang, Li Lan, Yuetong Huang

FrB2: Sensing and Recognition I

Development of the Flexible Tactile Sensor for Safe Human-Robot Interaction 764
Xinkai Xia, Huanzhou Ma, Fan Zhang, Kun Yang, Shengbo Sang

A Vision-Based Target Localization System for the Meal Assistance Robot 769
Xueyi Zhao, Diansheng Chen, Guo Xiang, Chenghang Pan

Digital Twin-based Cement Rotary Kiln Simulation Training System 775
Zhuo Chao, Xiaohong Wang, Hongliang Yu, Shizeng Lu

Dynamic and flexible personal space model and parameter generation method for socially-aware robot navigation 780
Zhe Zhao, Xianyu Qi, Yufei Zhao, Ziwei Liao, Wei Wang, Xiangdong Yang

FOD Detection Using a Multi-channel Information Fusion Method 785
Yichao Cao, Guoliang Liu, Guangyu Hui, Xiaobo Guo, Liujuan Zhu, Zhikun Zhu, Yide Zhang, Fei Lu, Guohui Tian

Semantic Segmentation of FOD Using an Improved Deeplab V3+ Model 791
Zhikun Zhu, Guoliang Liu, Guangyu Hui, Xiaobo Guo, Yichao Cao, Hao Wu, Tiantian Liu, Guohui Tian

FrB3: Medical Robot I

Photonic hook through a microlens with a tip deposited at the bottom 797
Tianyao Zhang, Haibo Yu, Xiaoduo Wang, Hao Luo, Lianqing Liu

A Novel Unpowered Mechanical Robot with Vibrotactile Feedback for Upper Limb Coordination Rehabilitation 801
Yuxuan Lin, Han Xu, Dong Xu, Xu Zhang, Yibing Li, Xiaolong Li

A Foot-based Wearable Assist Mechanism Based on Tensegrity Structure 807
Jianwei Sun, Zhenyu Wang

Research on exoskeleton structure design of hand function rehabilitation robot 812
Kexin Zuo, Ben Wang, Yangwei Wang

Research on lower limb rehabilitation training device based on gravity balance 817
Zhen Zhang, TaiSheng Zhang, Yanpeng Kan, Manman Xu

Kinematics Modeling and Simulation of a Flexble Surgical Robotic Instrument with a Multi-joint Wirst 821
Xingshuai Li, Qinjian Zhang, Haiyuan Li, Baoguo Liu, Qingqing He

FrB4: Optimization and Control I

The improved approach for calculating residual error rates in SIS communication 827
Xiufang Zhou, Aidong Xu, Bingjun Yan, Yue Sun

A Dimensional Parameter Optimization Method of Manipulator to Improve Manipulability 834
Zhi Li, Haoqin Gong, Yuanhai Huang, Diansheng Chen

A Novel Method to Solve the Inverse Kinematics for Continuum Robots Accelerated by PID Theory 840
Yihua Fang, Samuel Hill, Weiming Ba, Xin Dong

Design and Implementation of a Highly Compatible Intelligent Video Analysis Framework 845
Lanfang Dong, Yongsheng Chen, Yuhang Zhang

A Comprehensive Dynamic Hysteresis Inverse Compensator for Pneumatic Artificial Muscles 851
Ying Zhang, Qiang Cheng, Haoze Gao, Wenlin Chen

A Neural-Driven Musculoskeletal Model for Continuous Estimation of Hand and Wrist Movements 856
Shizhuo Yue, Jianmin Li, Lizhi Pan

FrPo4: Poster Session 4

DCNN-based virtual synchronous generator control to improve frequency stability of PV-ESS station 861
Wei Zeng, Junjie Xiong, Zongqiang Qi, Xiaobo Dou

Data processing technology of distribution station area combined with convolutional neural network 866
Kexin Zhang, Xiaobo Dou, Hang Yu, Yongming Hu

Photovoltaic and energy storage control of partially observable distribution network based on deep reinforcement learning 871
Qiangsheng Bu, Pengpeng Lv, Kexin Zhang, Xiaobo Dou, Fei Luo, Xufeng Zhou

Research on Human Features Semantic Segmentation Based on Laser Point Cloud 876
Tianyi Ma, Bokai Xuan, Jian Li, Yuexuan Xu, Minghe Liu, Qingsong Ding, Jianwen Wang, Hao Sun

Improved YOLOv5-based Method for Recognition of Insulator String Pins 882
Jingbo Du, Jiang Yong

Three Dimensional Path Planning of Snake-Arm Robot Based on Improved Ant Colony Algorithm 888
Jiang Yong, Xu Chen

Economic Analysis of Waste Heat Utilization in Data Center under Different Business Models 893
Wei Fang, Tianhen chen, Jiaqi Li, Chenglei Sun, Fangyuan Pan, yi ding

Research on OpenCV-based method for monitoring the amount of intestinal coating accumulation 899
Qingsong Ding, Yuexuan Xu, Tianyi Ma, Minghe Liu, Qiang Li, Hao Sun

A 3D Reconstruction Technology of Indoor Scene based on Image Sequence 906
Songna Zhang, Tong Jia, Wenhao Li, Xiaojun Sun

SA-Unet A Phase Unwrapping method based on DCNN 912
Feng Liang, Tong Jia, Kang Zeng

Design of a FF HSE Message Analysis Tool Based on Wireshark 918
Shuwei Ding, Lin He, Yuanbei Gu, Weihua Bao

Posture Estimation of Articulated Robot Based on Multi-cylinder Segmentation 922
Kuicheng Chen, Hongtai Cheng

Global Semantic Information-based Text Detection and Recognition Networker 929
Jiazheng Tian, Qi Hu

Trajectory Planning of Quadrotors Flight like Binary Star 935
Xuan Zhang, Guangyu Zhang, Liying Yang, Yanchun Chang, Zhaoxiong Huang, Miao Sun, Yuqing He

A TB-CSP Motor Imagery EEG Recognition Method for Neural-controlled Manipulator System 941
Wei Mu, Pengchao Wang, Junkongshuai Wang, Tao Fang, Xueze Zhang, Aiping Wang, Lusheng Liu, Lan Niu, Jianxiong Bin, Jing Zhang, Lihua Zhang, Xiaoyang Kang

Motion Analysis and Simulation Verification of Novel Quadruped Robot 946
Zhongjin Ju, Ke Wei, Yundou Xu, Jiantao Yao, Yongsheng Zhao

Electrochemical impedance behavior of implantable neural interface following the change of equivalent circuit element 952
Jing Zhang, Lusheng Liu, Aiping Wang, Junkongshuai Wang, Tao Fang, Lan Niu, Jianxiong Bin, Pengchao Wang, Wei Mu, Lihua Zhang, Xiaoyang Kang

Route Control of Four-rotor UAV based on Brain-Computer Interface in Virtual Reality 958
Lan Niu, Jianxiong Bin, Junkongshuai Wang, Gege Zhan, Haifeng Jiang, Zhiyan Dong, Lihua Zhang, Xiaoyang Kang

Research on Haptic Feedback Control System of Bionic Pulse Diagnosis Equipment 963
Zhongzhi Ji, Yang Wang, Yulin Huang, Xing Zhu, Fanyu Wang, Jingjing Luo

Exploring Humanoid Robot Face Preference Using Brain Functional Connectivity and Graph Neural Network 969
Pengchao Wang, Wei Mu, Gege Zhan, Aiping Wang, Zuoting Song, Tao Fang, Xueze Zhang, Junkongshuai Wang, Lan Niu, Jianxiong Bin, Lihua Zhang, Jie Jia, Xiaoyang Kang

A Remotely Driven Finger Rehabilitation Robot for Passive and Active Rehabilitation 973
Hongbo Wang, Jiazheng Du, Yongshun Zhang, Yu Tian, Dagan Zhang, Yuansheng Ning, Jianye Niu

Research on Variable Workspace of Continuum Robot for Organ Protection and Multi-arm Cooperation 978
Fuhao Wang, Hongbo Wang, Jingjing Luo, Xiaoyang Kang, Xueze Zhang, Jiawei Wang, Qiqi Pan

A three-finger dexterous hand with suction cups integrated on fingertips 983
Yuanbo Liu, Wenjie Lu, Diansheng Chen, Weidong Guo

An Acupoint Detection Approach for Robotic Upper Limb Acupuncture Therapy 989
Bin Cai, Peiyang Sun, Meng Li, Erkang Cheng, Zhiyong Sun, Bo Song

Remainder particles detection method for spaceborne electronic equipment
Junyu Shi, Zhishuai Jiang, Zengshuai Qiu, Yuliang Zhao

The effect of tailored-made home-based exercise program on the training adherence of old patients underwent total hip and knee arthroplasty: A Randomized Controlled Pilot Study 993
Rongke Lv, Kangping Song, Peihui Wu, Yangfan Xu, Yangnag Lin, Yuling Wang

Regression prediction of key action indicators of shooting based on machine learning method
Xiaoai Wang, Jian Li, Shengfan Wang, Meilun Jiang, Wenyan Zhang, Yuliang Zhao

FrC2: Sensing and Recognition II

Microarray Image Segmentation Based on Level Set and Regridding 999
MD Shahriar Haque, Nishith Ranjan Biswas, Daria Hussain Antora, Mubeen Afzal, Lu Bibo

A Parkinson's Bradykinesia Recognition System Based on Deep Learning Method 1005
Lina Tong, Daisong Liu, Mingjia Zhang, Liang Peng

A POMDP-based Robot-Human Trust Model for Human-Robot Collaboration 1009
Pallavi Tilloo, Jesse Parron, Omar Obidat, Michelle Zhu, Weitian Wang

Body Alcohol Level Detection Based on Measurements of Human Balancing 1015
Jiaming Chen, Ning Xi, Song Wang, Yuqing TIAN, Wenbo Yuan

Towards Real-Time Synchronization of mBot's Motion with Musical Songs 1020
Wayne Jason LI, Yuqing TIAN, Chun KWOK, Ning XI

Scheduling Optimization of Automatic Biochemical Analyzer based on Particle Swarm Optimization 1028
Mingyue Zhao, Mingxing Lin, Wenjing Fan, Qinghua Xie, Bo Wang

FrC3: Medical Robot II

Design and Development of Unmanned Combat Game Platform 1032
Lina Hao, Zhe Li, Shuai Wang, Chenling Hao

Design and kinematics analysis of tibial orthopedic external fixation robot based on bone external fixation technology 1038
Yuliang Lai, Li Zhang, Jian Li, Lin Liu, Shihui Xie, Peng Su

Modeling and Validation of Safe Space in the Operating Area of Minimally Invasive Thyroid Surgery Robot 1044
Chao Yue, Peng Su, Jiang Li, Qinran Zhang, Baoguo Liu, Qinjian Zhang

Human-in-the-loop Optimization for Adaptive Assist-as-Needed Rehabilitation 1050
Ning Li, Yang Yang, Tie Yang, Wenyuan Chen, Yihan Wang, Peng Yu, Wenxue Wang, Ning Xi, Lianqing Liu

A Robotic Platform for Digitalized Pulse Information Collection 1055
Xing Zhu, Zhongzhi Ji, Fanyu Wang, Peng Zhou, Jingjing Luo

Mental Health Problems of Older Adults During the COVID-19 Pandemic: Effects, Recommendations and Healthcare Robot-Mediated Therapy 1061
Xisheng Lin, Tianyu Jiang, Na Wang, Shengjie Li, Wei Chen, Huiyan An, Qian Ren, Tao Xie, Changshui Weng

A light-driven swimming micro-fish based on photo-responsive hydrogel 1066
Zhen Wang, Xiaowen Wang, Wenguang Yang

Human-Computer Interaction Technology for Upper Limb Rehabilitation Based on Gesture Recognition Control 1072
Xuedong Zhu, Mingxing Lin, Yubo Liu, Wenjing Fan, Chaoguo Shi

FrC4: Optimization and Control II

Fuzzy Control of a Two-wheel Driven Spherical Robot Moving on the Surface of Water 1077
Anqing Hu, Bingtuan Gao, Huan Wang

Telerobotic Operations Using Network Address Translation (NAT) Traversal 1083
Xinyu Liu, Chun Ho So, Burak Kizilkaya, Yuxuan Xue, Guodong Zhao, Ning Xi

Fastening Operation Analysis and Optimization with Desktop Robot 1089
Li Cheng, Xin Cong, Chaohai Xu, Ze Huang

Adaptive backstepping sliding mode control of lower limb exoskeleton robot based on combined double power reaching law 1095
WenXin Xu, Guangzhong Cao, Yuepeng Zhang, Jiangcheng Chen, Dongpo Tan, Ziqin Ling

MorphoSys Bridges Morphogenesis in Swarms of Cells and Robots 1101
Yongliang Yang, Mengyun Pan, Long Cui, Lianqing Liu

Research on Robot-Assisted Bathing Based on Impedance Iterative Learning Sliding Mode Control Algorithm 1106
Yuexuan Xu, Xin Guo, Bokai Xuan, Tianyi Ma, Minghe Liu, Qingsong Ding, Yinglun Tan, Jian LI, Hao Sun

SaA2: Mobile Robotics I

Adaptive PID Trajectory Tracking Algorithm Using Q-Learning for Mobile Robots 1112
Xiaoliang Fan, Jin Sui, Naifeng He, Bi Zhang, Chunguang Bu, Junbo Yang, Lele Cui

Design of Two-Stage Passive Compliant of Wall-Climbing Robot with High Curvature Self-Adaptation 1118
Zhenyu Yang, Yifeng Song, Hongguang Wang, Yong Chang, Fengren Jing, Zhenchu Deng

Configuration Synthesis of Leg Mechanism of Quadruped Robot of Deployable Mechanism 1124
Boxuan Zhang, Zehao Yuan

DogGet: A Legged Manipulation System in Human Environments 1130
Linghan Meng, Cong Wang, Shengguo Cui, Qifeng Zhang, Baoqi Zhai

SaA3: Robots and Learning

Development of a Robot for 500-kV EHV Power Transmission Lines Faulty Insulator Detection 1136
Tianyu Zhang, Hongguang Wang, Xin'an Pan, Peng Lv, Lijuan Guo, Yifeng Song

Cause Analysis of Bolt Seizure Failure and Experimental Study On Influencing Factors 1142
Xiaoyu Liu, Aixuan Zhang, Zhongwei Zhang, Kai Liu, Xinggao Zhu, Weiliang Chen

Research on Built-in power supply technology of AUV based on the wave energy 1146
Fengmei Jing, Song Wang, Xiongbo Zheng, Mingze Ji, Yunlei Mei

Research status of phantom limb pain: based on CiteSpace analysis 1154
hongmei liu, zengyong li, yubo fan, weiyan ren, huiqin luan

SaA4: SLAM and Navigation

Image Feature Matching Based on Spatial Constraints and Inertial Assistance for AGV Navigation in Digital Workshops 1160
Shijie Sun, Li Chen, Wei Liang, Yinlong Zhang

A Robust Seabed Terrain Contour Aid Navigation Method Facing the Smooth Terrain 1166
Wenjun Zhang, Dong Ma, Jingxuan Gao, Teng Ma, Yueyang Ben

An Unmanned Vehicle Inspection System for Airport Runways 1171
Liujuan Zhu, Guoliang Liu, Guangyu Hui, Xiaobo Guo, Yichao Cao, Bin Huang, Guohui Tian

Collaborative Visual Inertial SLAM with KNN Map Matching 1177
Boyang Liu, Guoliang Liu, Zihao Zhang, Dongning Hao, Hongyu Lu, Yazhou Meng, Xiang Lu

A Robust and Efficient LiDAR-Inertial-Visual Fused Simultaneous Localization and Mapping System with Loop Closure 1182
Kangcheng Liu

SaB2: Mobile Robotics II

Map Creation of Indoor mobile Robot Based on Multi-sensor Fusion with Gradually Increasing Accuracy 1188
Zhanghai Luo, Zhengyong Feng

A Kinetic Simulation Mechanism of Torque-Free Satellites Based on A Mobile Parallel Manipulator 1194
Hao Chi, Yu Liu, Shuli Liang, Ken Chen, Jiwen Zhang

Human-like Walking of Biped Robot with Foot Rotation Using Passive Metatarsophalangeal Joint 1200
Xiaolin Dai, Yixiang Liu, Xinyu Liu, Xizhe Zang, Rui Song, Yibin Li

Event_based_Motion_Planning_and_Control_for_Mobile_Manipulator 1206
Jiajie Ye, Ma Ye, Siyu Wang, Kwok Chun, Qingyang Wang, Ning Xi

Development of a Crawling Robot for Large Steel Structure Welding 1212
Xiaoteng WANG, Gang CHEN

SaB3: Mechanism and Control

Research on Structure Design and Control of Plane 3-DOF Cable Driven Virtual Microgravity Training System 1218
Feng Xue, Lixun Zhang, Chao Wang, Zhenhan Wang, Yuhe Fan

Design of Programmable Droplet Manipulation Platform Based on Magnetic Control 1224
Xianmiao Zhang, Jie Liu, Jiying Liu, Yuzhe Wang, Mian Zhang, Hongbiao Xiang

Semi-Supervised Confidence-Level-based Contrastive Discrimination for Class-Imbalanced Semantic Segmentation 1230
Kangcheng Liu

A Review of Formation Control Methods for MAUV Systems 1236
Bofeng Fu, Gang Wang, Qiang Zhao, Yingjie Song

The mechanical properties and surface morphology of axillary crutches 1242
hongmei liu, jiwei duan, zhongjun mo, yiqing luan, huiqin luan

SaB4: Industrial Robotics and Applications

Mechanical Design of a Crawler Hydraulic Sludge Cleaning Robot 1247
Zhilin Yang, Haitao Fang, Yongqiang Wang, Wei Feng, Kai He

Mechanical Analysis of Superheater Pipe Detection Robot 1253
Lei Zhang, Jianping Hou, Kaiqi Shi, Wentao Huang, Fengyu Yang

Hybrid Dynamic Modeling for an Underwater Rigid-Soft Snake Robot 1258
Junhao Zhang, Yinglong Chen, Yongjun Gong

Analysis and Calculation of Strength and Rigidity for Industrial Grinding Robot 1264
Manman Xu, Zhitao Zhang, Long Shao, Zhen Zhang, Chuqing Cao

SaC2: Machine Learning and Applications

Multiple UAVs Target Allocation via Stochastic Dominant Learning Pigeon-inspired Optimization in Beyond-visual-range Air Combat 1269
Yangqi Lei, Mengzhen Huo, Yimin Deng, Haibin Duan

Research of Evaluation Method of Cleaning Performance for Cleaning Robots Based on Machine Learning 1275
Huang Qing

A Teleoperated Manipulator Control System Based on Surface Electromyography Using Deep Learning 1281
Zhiping Lai, Xueze Zhang, Junkongshuai Wang, Wei Mu, Aiping Wang, Lan Niu, Lihua Zhang, Hongbo Wang, Xiaoyang Kang

Initial value selection strategy of glide trajectory based on Legendre pseudospectral method 1287
Chuantao Ye, Zhiqin Liu, Jun Huang

SaC3: Intelligent Sensing and Control

Development and Construction of a Simulation Platform for a New R-ROV 1293
Xuejiao Yang, Qifeng Zhang, Cong Wang, Xiaomeng Liu, Yunxiu Zhang, Dehao Li

Virtual Human-Machine Interaction Force Algorithm in Astronaut Virtual Training 1299
Lingjie Lin, Lan Wang, Ying Chang, Lixun Zhang, Feng Xue

Meal target detection based on improved YoloV3 algorithm 1305
WenTao Huang, Lan Wang, Yan Li

SaC4: Internet of Things

Dynamic SLAM Algorithm Fusing Semantic Information and Geometric Constraints 1311
Dongyi Zhou, Yong Chang, Kunlong Hong, Yifeng Song

A wearable remote real-time monitoring system for transmission line operation monitoring 1317
Qinshu Chen, Dawei Tang, Xiaolong Liang, Yong Tang, Kai Dou, Xinyu Liu, Wenmiao Li, Yagang Li, Diansheng Chen

Usage of Colloidal AFM Probe for Research in Effects of Water Layer Evaporation on Interfacial Adhesion between Cellulose Surfaces 1323
Junyuan Geng, Hao Zhang, Xianghe Meng, Haibo Gao, Weibin Rong, Hui Xie

Research on DMP-based gait generation and control method for prosthetic limbs 1329
Meiqi Liu, Bokai Xuan, Yifei Liu, Yanli Geng