Conference Program

IRCE

The 3rd International Conference on Intelligent Robotics and Control Engineering (IRCE 2020)

With Workshops of

The 4th International Conference on Measurement Instrumentation and Electronics (ICMIE 2020)

The 3rd International Conference on Robotics and Computer Vision (ICRCV 2020)

The 5th International Conference on Robotics and Vision (ICRV 2020)

10- 12 August, 2020

British Summer Time (BST)
UTC + 1

IRCE

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Welcome Address

We are pleased to welcome you to 2020 The 3rd International Conference on Intelligent Robotics and Control Engineering (IRCE 2020), with workshops of The 5th International Conference on Robotics and Vision (ICRV 2020), The 4th International Conference on Measurement Instrumentation and Electronics (ICMIE 2020) and The 3rd International Conference on Robotics and Computer Vision (ICRCV 2020), which is held during 10-12 August, 2020 online via ZOOM the application.

Here on behalf of the Organizing Committees, we would like to convey our appreciation of your participations during this unprecedented time.

Since COVID_19 broke out, the whole world is suffering from a tough time, therefore, we would like wo deliver our great thanks to the committee members who give significant support to the conference, to attendees who make effort to present in the conference and to all stuff who are working hard to run the conference as usual or even better.

We hope this event would provide unique opportunity to have fruitful discussions about Intelligent Robotics, Automations and Control Engineering, and best practices that address Artificial Intelligence. Meanwhile, we aim to foster interdisciplinary and international collaboration opportunities, and strengthen domestic and international recognition in pure and applied research for the participants.

Let us enjoy IRCE 2020!

IRCE Committees

Committees

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Sheng-Ta Hsieh, Oriental Institute of Technology, Taiwan

Bin Xue, National University of Defense Technology, China

A. M. Harsha S. Abeykoon, Asian Institute of Technology, Thailand

Feng Yang, Northwestern Polytechnical University, China

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Conference Notice

UTC + 1

- The conference is arranged based on **British Summer Time (BST)**.
- Please carefully check your presentation time, and join the conference 15 minutes in advance.

Internet

- Stable WIFI or Wired network.
- Equipment be with enough battery or connected with chargers.
- If your Internet is not good, please send us presentation videos within 10 Minutes as back-up.

ZOOM

- Download the APP ZOOM on zoom.us or www.zoom.com.cn (China only).
- Learn to use ZOOM via : http://irce.org/zoom.html
- **ROOM A ID: 309643622**
- **ROOM B ID: 799767040**

Names in ZOOM

- Authors, please rename like Session **Number+Paper ID+Name** as you join the room. E.g.: S1+RC1001+Mindy Yu.
- For KN or SC, please rename like **KN/SC+ Name**. E.g.: KN+Mindy Yu/SC+Mindy Yu

Presentation

- Stay online during Keynote & Invited speeches and your own sessions.
- English only during the conference.
- Certificates & receipts will be emailed to you after the conference

Skills

- Turn on your Audio and start your Video.
- Use headsets/Earphones to enhance the audio effect and avoid the speaker echo or howling.
- Stay in a quite place without noise.
- Join **TEST DAY** on **August 10.**

British Summer Time (BST)
UTC + 1

Conference Overview

Monday, 10 August 2020 - TEST DAY		
Time	ROOM A ID: 309643622	ROOM B ID: 799767040
13:00-14:00	Keynote & Invited Speakers	Session 1 & Session 2
14:30-15:00	Session 3	Session 4

Tuesday, 11 August 2020	
Time	ROOM A ID: 309643622
9:30-9:35	Opening Remarks
9:35-10:20	Keynote Speech Ⅰ
10:25-11:10	Invited Speaker Ⅰ
11:15-12:00	Keynote Speech Ⅱ
12:00-13:30	Lunch Break
13:30-14:15	Keynote Speech Ⅲ
14:20-14:45	Keynote Speech Ⅳ

Wednesday, 12 August 2020		
Time	ROOM A ID: 309643622	ROOM B ID: 799767040
9:30-11:15	Session 1	Session 2
11:15-13:00	Lunch Break	
13:00-14:45	Session 3	Session 4

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Test Day Plan-Monday, 10 August 2020

Time	ROOM A ID: 309643622	ROOM B ID: 799767040
13:00-14:00	**Keynote & Invited Speakers**	**Session 1 & Session 2** RC1007, RC1011, RC1010, RC1019, RC1020, RC1008, RC1012, RC1005, RC1017, RC1022, RC11003, RC11007, RC1004
14:30-15:00	**Session 3** RC1003, RC1016, RC11004, RC1001, RC1009, RC1021	**Session 4** E2001, E2004, E2005, E2006, IC2001, IC2003, E2009

Time	Keynote & Invited Speekers Test Schedule ROOM A ID: 309643622
13:00-13:10	**Prof. Shane Xie**, University of Leeds, UK
13:10-13:20	**Prof. Richard Mitchell**, University of Reading, UK
13:20-13:30	**Prof. Zhengtao Ding,** The University of Manchester, UK
13:30-13:40	**Prof. Jan Peters**, Technical University (TU) of Darmstadt, Germany
13:40-13:50	**Prof. Chun-Yi Su**, Concordia University, Canada

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Speeches Day Plan-Tuesday, 11 August 2020

Time		Keynote & Invited Speeches ROOM A ID: 309643622
9:30-9:35	Opening Remarks	**Prof. Shane Xie**, University of Leeds, UK
9:35-10:20	Keynote Speech Ⅰ	**Prof. Jan Peters**, Technical University (TU) of Darmstadt, Germany
10:25-10:50	Invited Speaker Ⅰ	**Prof. Richard Mitchell**, University of Reading, UK
10:55-11:40	Keynote Speech Ⅱ	**Prof. Shane Xie**, University of Leeds, UK
11:40-13:30	Lunch Break	
13:30-14:15	Keynote Speech Ⅲ	**Prof. Zhengtao Ding,** The University of Manchester, UK
14:20-15:05	Keynote Speech Ⅳ	**Prof. Chun-Yi Su**, Concordia University, Canada

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Sessions Day Plan-Wednesday, 12 August 2020

Time	ROOM A ID: 309643622	ROOM B ID: 799767040
9:30-11:15	**Session 1** Robot and Unmanned Intelligent System	**Session 2** Intelligent Algorithm and Engineering Application
11:00-13:00	Lunch Break	
13:00-14:45	**Session 3** Computer Vision and Image Processing	**Session 4** Modern Electronics and Measurement Technology

British Summer Time (BST)
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Tuesday, 11 August 2020
9:35-10:20

Keynote Speech I

Machine Learning of Robot Motor Skills

Abstract: Autonomous robots that can assist humans in situations of daily life have been a long standing vision of robotics, artificial intelligence, and cognitive sciences. A first step towards this goal is to create robots that can learn tasks triggered by environmental context or higher level instruction. However, learning techniques have yet to live up to this promise as only few methods manage to scale to high-dimensional manipulator or humanoid robots. In this talk, we investigate a general framework suitable for learning motor skills in robotics which is based on the principles behind many analytical robotics approaches. It involves generating a representation of motor skills by parameterized motor primitive policies acting as building blocks of movement generation, and a learned task execution module that transforms these movements into motor commands. We discuss learning on three different levels of abstraction, i.e., learning for accurate control is needed to execute, learning of motor primitives is needed to acquire simple movements, and learning of the task-dependent „hyperparameters“ of these motor primitives allows learning complex tasks. We discuss task-appropriate learning approaches for imitation learning, model learning and reinforcement learning for robots with many degrees of freedom. Empirical evaluations on a several robot systems illustrate the effectiveness and applicability to learning control on an anthropomorphic robot arm. These robot motor skills range from toy examples (e.g., paddling a ball, ball-in-a-cup) to playing robot table tennis against a human being and manipulation of various objects.

Prof. Jan Peters

Technical University (TU) of Darmstadt, Germany
IEEE Fellow

Keynote Speech I

British Summer Time (BST)
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Tuesday, 11 August 2020
9:35-10:20

Prof. Jan Peters

Technical University (TU) of Darmstadt, Germany
IEEE Fellow

Biograph: Jan Peters is a full professor (W3) for Intelligent Autonomous Systems at the Computer Science Department of the Technische Universitaet Darmstadt and at the same time a senior research scientist and group leader at the Max-Planck Institute for Intelligent Systems, where he heads the interdepartmental Robot Learning Group. Jan Peters has received the Dick Volz Best 2007 US PhD Thesis Runner-Up Award, the Robotics: Science & Systems - Early Career Spotlight, the INNS Young Investigator Award, and the IEEE Robotics & Automation Society's Early Career Award as well as numerous best paper awards. In 2015, he received an ERC Starting Grant and in 2019, he was appointed as an IEEE Fellow. Despite being a faculty member at TU Darmstadt only since 2011, Jan Peters has already nurtured a series of outstanding young researchers into successful careers. These include new faculty members at leading universities in the USA, Japan, UK, Germany and Holland, postdoctoral scholars at top computer science departments (including MIT, CMU, and Berkeley) and young leaders at top AI companies (including Amazon, Google and Facebook).
Jan Peters has studied Computer Science, Electrical, Mechanical and Control Engineering at TU Munich and FernUni Hagen in Germany, at the National University of Singapore (NUS) and the University of Southern California (USC). He has received four Master's degrees in these disciplines as well as a Computer Science PhD from USC. Jan Peters has performed research in Germany at DLR, TU Munich and the Max Planck Institute for Biological Cybernetics (in addition to the institutions above), in Japan at the Advanced Telecommunication Research Center (ATR), at USC and at both NUS and Siemens Advanced Engineering in Singapore.

British Summer Time (BST)
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Tuesday, 11 August 2020
10:55-11:40

Keynote Speech II

Innovative Robotic Technology for the Future of Healthcare

Abstract: Stroke and neurological diseases have significant impact on our society, this talk will discuss the key societal challenges, robotic technologies for delivering effective care and opportunities for the healthcare industry. The keynote will cover the recent development of robotics for stroke rehabilitation, the research gaps and the need for new technologies in neuroscience, robotics and artificial intelligence. The talk will introduce a EPSRC-funded project on intelligent reconfigurable exoskeletons tailored to meet patients' needs, deliver effective diagnosis and personalised treatment, and monitored remotely by rehabilitation therapists. The talk will also briefly introduce the Leeds Centre for Assistive/Rehabilitation Robotics and our work on ankle robot, gait exoskeleton, gait upper limb bilaterial robot, neuromuscular and brain computer interfaces. The focus is on the technologies for those whose strength and coordination have been affected by amputation, stroke, spinal cord injury, cerebral palsy and ageing.

Prof. Shane Xie

University of Leeds, UK
IPENZ Fellow

Keynote Speech II

British Summer Time (BST)
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Tuesday, 11 August 2020
10:55-11:40

Prof. Shane Xie

University of Leeds, UK
IPENZ Fellow

Biograph: Prof Shane (Sheng Q) Xie, Ph.D., FIPENZ, is the Chair of Robotics and Autonomous Systems and Director of the Rehabilitation Robotics Lab at the University of Leeds, and he was the Director of the Rehabilitation and Medical Robotics Centre at the University of Auckland, New Zealand (NZ, 2002-2016). He has >28 years of research experience in healthcare robotics and exoskeletons. He has published > 400 refereed papers and 8 books in rehabilitation exoskeleton design and control, neuromuscular modelling, and advanced human-robot interaction. He has supervised >15 postdocs, 62 PhDs and 80 MEs in his team with funding of >£27M from five countries since 2003. His team has invented three award-winning rehabilitation exoskeletons. He is an expert in control of exoskeletons, i.e. impedance control, adaptive control, sliding mode control, and iterative learning control strategies. He has received many distinguished awards including the New Zealand Science Challenge Award, the David Bensted Fellowship Award, and the AMP Invention Award. He is an elected Fellow of the Institute of Professional Engineers of New Zealand and the Technical Editor for IEEE/ASME Transaction on Mechatronics.

British Summer Time (BST)
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Tuesday, 11 August 2020
13:30-14:15

Keynote Speech III

Network Empowered Distributed Algorithms

Abstract: Along with the rapid development of network-connected systems, coordination and cooperation among the subsystems/agents have become increasingly important and powerful in many control applications, in particular, in the areas relating to distributed learning, optimisation, decision making and control. Recently, distributed algorithms, which aim at making decisions in local level, and achieving certain global objective through network communications, have been developed based multi-agent systems. This talk will review some latest activities carried out in the speaker's group in University of Manchester, including formation control of mobile robots, machine learning via network consensus, distributed optimisation and game theory using algorithms based on local interactions. The presentation will focus on distributed algorithms, and motivations to the algorithm design from a control perspective.

Prof. Zhengtao Ding

The University of Manchester, UK

Keynote Speech III

British Summer Time (BST)
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Tuesday, 11 August 2020
13:30-14:15

Prof. Zhengtao Ding

The University of Manchester, UK

Biograph: Zhengtao Ding received B.Eng. degree from Tsinghua University, Beijing, China, and M.Sc. degree in systems and control, and the Ph.D. degree in control systems from the University of Manchester Institute of Science and Technology, Manchester, U.K. After working as a Lecturer with Ngee Ann Polytechnic, Singapore, for ten years, he joined the University of Manchester in 2003, where he is currently Professor of Control Systems with the Dept of Electrical and Electronic Engineering. He serves a member of the school/department leadership team, and Deputy Head of Control, Communication and Signal Processing Division in the university. He is the author of the book: Nonlinear and Adaptive Control Systems (IET, 2013) and has published over 260 research articles. His research interests include nonlinear and adaptive control theory and their applications, more recently network-based control, distributed optimization and distributed machine learning, with applications to power systems and robotics. Prof. Ding has served as an Associate Editor for the IEEE Transactions on Automatic Control, IEEE Control Systems Letters, and several other journals. He is a member of IEEE Technical Committee on Nonlinear Systems and Control, IEEE Technical Committee on Intelligent Control, and IFAC Technical Committee on Adaptive and Learning Systems.

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British Summer Time (BST)
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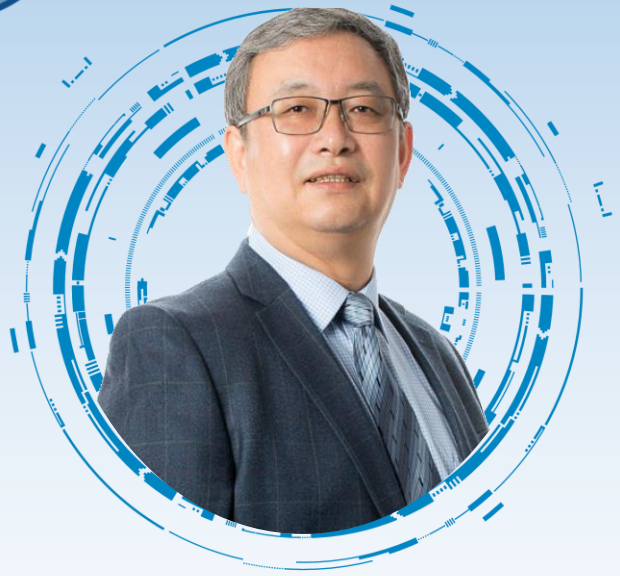
Tuesday, 11 August 2020
14:20-15:05

Keynote Speech IV

Robust Control of Underactuated Mechanical Systems

Abstract: In recent years, there has been great theoretical and practical interest in controlling underactuated mechanical systems. These systems are defined as underactuated because they have more joints than control actuators. Much of this interest is a consequence of the importance of such systems in application. For example, underactuation may arise in free-flying space robots, underwater vehicles without base actuators, legged robots with passive joints, redundant robots with flexible components, and in many other practical applications. Furthermore, when one or more joints of a standard manipulator fail, it becomes an underactuated mechanism and needs a special control algorithm to continue operation; thus the development of a control technique for underactuated systems will increase the reliability and fault-tolerance of current and future robots. Interest in studying underactuated mechanical systems is also motivated by their role as a class of strongly nonlinear systems where complex internal dynamics, nonholonomic behavior, and lack of feedback linearizability are often exhibited. Traditional nonlinear control methods are insufficient in these cases and new approaches must be developed.
In this presentation, an entirely new method is discussed. A robust nonlinear control law is proposed for underactuated mechanical systems in the presence of parameter uncertainties. The development is based on variable structure theory. The main advantage of the presented scheme is that the uncertainty bounds, needed to design the control law and to prove globally asymptotic stability, depend only on the upper bounds of the inertia parameters. These upper bounds can easily be computed making a control law possible for complex underactuated systems. Finally, the real-time application of this algorithm to a specific underactuated robot, Pendubot, is included to demonstrate the control performance.



Prof. Chun-Yi Su

Concordia University, Canada

Keynote Speech IV

British Summer Time (BST)
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Tuesday, 11 August 2020
14:20-15:05

Prof. Chun-Yi Su

Concordia University, Canada

Biograph: Dr. Su received his B.E. degree in control engineering from Shaanxi Institute of Mechanical Engineering (now Xi'an University of Technology) in 1982, his M.S. and Ph.D. degrees in control engineering from South China University of Technology, China, in 1987 and 1990, respectively. His Ph.D. study was jointly directed at Hong Kong Polytechnic (now The Hong Kong Polytechnic University), Hong Kong.

After long stint at the University of Victoria (1991-1998, Canada), he joined the Concordia University (Canada) in 1998, where he is currently Concordia Research Chair in Control and Professor of Mechanical Engineering. He has also held several short-time visiting positions in Japan, Singapore, China and New Zealand.

Dr. Su's research covers control theory and its applications to various mechanical systems. His current main research interests are in control techniques for smart material based actuators, robotic and mechatronic systems, vehicle suspension and vibration, and nonlinear control systems. He is the author or co-author of over 180 publications, which have appeared in journals, as book chapters and in conference proceedings.

Dr. Su is an Associate Editor of IEEE Transactions on Control Systems Technology, IEEE Transactions on Automatic Control, and Journal of Control Theory & Applications. He is on the Editorial Advisory Board of Mechatronics and on the Editorial Board of International Journal of Intelligent Systems Technologies and Applications. He has served on the technical program committee of numerous conferences in the area of control and automation. He has served as committee chairs of a number of these conferences, including the Program Chair of IEEE CCA07.

British Summer Time (BST)
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10:25-10:50

Invited Speech 1

Machine

Abstract:

Prof. Richard Mitchell

University of Reading, UK

Invited Speech I

British Summer Time (BST)
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Tuesday, 11 August 2020
10:25-10:50

Prof. Richard Mitchell

University of Reading, UK

Biograph: Richard Mitchell is Professor of Cybernetics and a University Teaching Fellow at the University of Reading, which he first attended as an undergraduate reading Cybernetics & Control Engineering, prior to his PhD, entitled 'Multimicroprocessor Control of Processes with Pure Time Delay', before becoming a lecturer. He has held many offices at Reading, including Head of Department of Cybernetics, Director of Teaching and Learning and then Senior Tutor in the School of Systems Engineering, and is currently Director of Technology Enhanced Learning in the School of Mathematical, Physical and Computational Sciences at Reading. He is the lead educator for the successful open online course on FutureLearn entitled “Begin Robotics”. He programmed the "seven dwarf" robots in Cybernetics which were forerunners of the ERIC robot which features in "Begin Robotics". His interests include artificial intelligence, control, robotics, Gaia and online learning.

Sessions 1

British Summer Time (BST)
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Wednesday, 12 August 2020
9:30-11:15

Time	ID	ROOM A ID: 309643622 Robot and Unmanned Intelligent System Session Chair:
9:30-9:45	RC1007	The Challenges and Opportunities of Artificial Intelligence in Implementing Trustworthy Robotics and Autonomous Systems **Dr. Hongmei He**, John Gray, Angelo Cangelosi, Qinggang Meng, Martin Mcgginity, Jorn Mehnen Cranfield University, UK
9:45-10:00	RC1011	Apply PSO Algorithm With Searching Space Improvements On A 5 Degrees Of Freedom Robot Thanh-Trung Nguyen, **Assist. Prof. Ngoc-Tam Bui**, Watanabe Dai, N.L. Tao, V.T. Nguyen, V.H Nguyen Hanoi University of Science and Technology, Vietnam
10:00-10:15	RC1010	Can the Movements of Robots Convey Emotions to People? The Robots Communicate with Human and Express Emotions Through Different Actions **Dr. Yue Yuan**, Chih-Fu Wu, Kai-Chieh Lin, Jin Niu Tatung University, Taiwan
10:15-10:30	RC1019	Trajectory Tracking of a Nonholonomic Mobile Robot using Optimal Cascade Sliding Mode Controller **Ms. Medha Chatterjee**, Omar Hanif, Nihar Deshpande, Alexandru Stancu The University of Manchester, UK
10:30-10:45	RC1020	Educational robot Kiddo learns to draw to enhance interactive handwriting scenario for primary school children Tahmina Akter Mispa, **Asst. Prof. Noushad Sojib** North East University, Bangladesh
10:45-11:00	RC1008	Simulation of Autonomous UAV Navigation with Collision Avoidance and Space Awareness **Mr. Jian Li**, Hongmei He, Ashutosh Tiwari Cranfield University, UK
11:00-11:15	RC1012	Industrial implementation and performance evaluation of LSD-SLAM and map filtering algorithms for obstacles avoidance in a cooperative fleet of unmanned aerial vehicles Luca Messina, **Mr. Silvio Mazzaro**, Angelo Emanuele Fiorilla, Alessandro Massa, Walter Matta Vitrociset - a Leonardo Company, Italy

Sessions 2

British Summer Time (BST)
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Wednesday, 12 August 2020
9:30-11:00

Time	ID	ROOM B ID: 799767040 Intelligent Algorithm and Engineering Application Session Chair:
9:30-9:45	RC1005	Too Close to Comfort? A New Approach of Designing a Soft Cable-driven Exoskeleton for Lifting Tasks Under Ergonomic Aspects **Mrs. Christina M. Harbauer**, Martin Fleischer, Thao Nguyen, Fabian Bos, Klaus Bengler Technical University of Munich, Chair of Ergonomics, Germany
9:45-10:00	RC1017	10.52 GOPS Systolic Cores Fuzzy Logic System for Cognitive Dysfunction Self-Awareness Using FPGA **Mr. Hossam Omar Ahmed** American College of the Middle East (ACM), Kuwait
10:00-10:15	RC1022	Prevention of Ant Mills in Pheromone based Swarm Algorithms **Mr. Ahmad Reza Cheraghi**, Jochen Peters, Kalman Graffi Heinrich Heine University, Germany
10:15-10:30	RC11003	Research on the Computer Synchronization of the Fault-Tolerant System **Ms. Ying Wang**, Zhengqi, Jia Min Zhang Xi'an Aeronautics Computing Technique Research Institute, AVIC, China
10:30-10:45	RC11007	Remaining Useful Life Prognostics for the Rolling Bearing Based on a Hybrid Data-driven Method **Mr. Yingang Wang**, Runxia Guo, Guihang Liu Civil Aviation University of China, China
10:45-11:00	RC1004	Application of Surface Reconstruction for Car Undercarriage Inspection **Mr. Martin Dörfler**, Tomáš Pivoňka, Karel Košnar, Libor Přeučil CTU in Prague, Czech Republic

Sessions 3

British Summer Time (BST)
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13:00-14:30

Time	ID	ROOM A ID: 309643622 Computer Vision and Image Processing Session Chair:
13:00-13:15	RC1003	Generation, Classification and Segmentation of Point Clouds in Logistic Context with PointNet++ and DGCNN **Mr. Keng Chai**, Jonas Stenzel, Jana Jost Fraunhofer Institute for Material Flow and Logistics, Germany
13:15-13:30	RC1016	Texture Gradient and Deep Features Fusion-Based Image Scene Geometry Identification System Using Extreme Learning Machine **Mr. Altaf Khan**, Alexander Chefranov, Hasan Demirel Eastern Mediterranean University, Turkey
13:30-13:45	RC11004	Research on Detection and Tracking of Moving Vehicles in Complex Environment Based on Real-time Surveillance Video **Mr. Zhen-jie Zhong**, Qi Wang Intelligent Information Processing Lab. Yanbian University Yanji, China
13:45-14:00	RC1001	Parameters selection for Blurred Image Matching **Mr. Yann Pierre Donon**, Alexander Kupriyanov, Rustam Paringer Samara National Research University, CERN, IPSI RAS
14:00-14:15	RC1009	Multi-Level Feature Fusion Mechanism for Single Image Super-Resolution **Mr. Jiawen Lyn** Trinity College Dublin, Germany
14:15-14:30	RC1021	Swarm-Sim: A 2D & 3D Simulation Core for Swarm Agents **Mr. Ahmad Reza Cheraghi**, Karol Actun, Sahdia Shahzad, Kalman Graffi Heinrich Heine University, Germany

Sessions 4

British Summer Time (BST)
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Wednesday, 12 August 2020
13:00-14:45

Time	ID	ROOM B ID: 799767040 Modern Electronics and Measurement Technology Session Chair:
13:00-13:15	E2001	Monte Carlo method to uncertainty evaluation of the relative dielectric constant and loss tangent measured by split-cavity resonator technique **Dr. Fei Zhao**, Jing Pei, Qi Tang, Chengxiang Wang, Jinsong Kan China Electronics Standardization Institute, China
13:15-13:30	E2004	Research and Application of A Data Processing Method on Outliers in Unmanned Aerial Vehicle (UAV) Tracking Measurement **Asst. Eng. Kunkun Li**, Rui Cao, Xiaoyu Qi, Xin Zhou, Yaxiong Hu Northwest Institute of Nuclear Technology, China
13:30-13:45	E2005	Study on the Technology of Ultra-high Sensitive Wide-band Magnetic-feedback Inductive Magnetic Sensor Yong Liu, Wenbin Li, Jinrong Zhou, Rui Pan, **Mr. Huan Zheng**, Bing Xiang, Rui Xu Wuhan Maritime Communication Research Institute, China
13:45-14:00	E2006	Glucose Analyzer Based on Self-Made Biosensor for High-Performance Glucose Detection **Mr. Qiang Tan**, Cuimei Bo, Jun Li, Yiqing Wang, Xiaorong Wang, Shubo Jiang Nanjing Tech University, Nanjing, China
14:00-14:15	IC2001	Stereo Visual Inertial Mapping Algorithm for Autonomous Mobile Robot Mi Zhang, **Mr. Songshan Han**, Shihan Wang, Xing Liu, Mengyu Hu, Jiayang Zhao Zhejiang Sineva Intelligent Technology Co.,Ltd , China
14:15-14:30	IC2003	An Improved Intelligent Scissors Algorithm for the segmentation of vessels segments in coronary angiography imaging **Ms. Yue Li**, HangYi Pan, LuRong Jiang, JiJun Tong, Yuqiang Shen Zhejiang Sci-Tech University, China
14:30-14:45	E2009	An ISFET Sensor Based on In2O3 Nanoribbon for pH Detection of Micro Solutions **Mr. Chuanjian Wu**, Yiqing Wang, and Min Yang Nanjing Tech University, China

British Summer Time (BST)
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Wednesday, 12 August 2020
9:30-11:15

Sessions 1

RC1007

The Challenges and Opportunities of Artificial Intelligence in Implementing Trustworthy Robotics and Autonomous Systems

Dr. Hongmei He, John Gray, Angelo Cangelosi, Qinggang Meng, Martin Mcgginity, Jorn Mehnen
Cranfield University, UK

Abstract: Trust is essential in designing autonomous and semi-autonomous Robots and Autonomous Systems (RAS), because of the “No trust, no use" concept. RAS should provide high quality services, with four key properties that make them trustworthy: they must be (i) robust with regards to any system health related issues, (ii) safe for any matters in their surrounding environments, (iii) secure against any threats from cyber spaces, and (iv) trusted for human-machine interaction. This article thoroughly analyses the challenges in implementing the trustworthy RAS in respects of the four properties, and addresses the power of AI in improving the trustworthiness of RAS. While we focus on the benefits that AI brings to human, we should realize the potential risks that could be caused by AI. This article introduces for the first time the set of key aspects of human-centered AI for RAS, which can serve as a cornerstone for implementing trustworthy RAS by design in the future.

RC1011

The Challenges and Opportunities of Artificial Intelligence in Implementing Trustworthy Robotics and Autonomous Systems Apply PSO Algorithm With Searching Space Improvements On A 5 Degrees Of Freedom Robot

Thanh-Trung Nguyen, **Assist. Prof. Ngoc-Tam Bui**, Watanabe Dai, N.L. Tao, V.T. Nguyen, V.H Nguyen
Hanoi University of Science and Technology, Vietnam

Abstract: In this research, Particle Swarm Optimization (PSO) algorithm has been applied to solve the Inverse Kinematic (IK) problem for redundant serial manipulator robots. The new point of the study is to consider the continuity of the joints’ variable. By noting this problem, the process of solving the Inverse Kinematic problem for the robots by the optimal algorithm has been significantly improved in terms of accuracy, execution time, and standard deviation (STD) as well as the number of iterations needed. The algorithm has been applied to solve the Inverse Kinematic problem on the 5-Degree of Freedom 5R robot model. The results show that just using the PSO algorithm with the above search domain limit has improved the quality of IK process.

RC1010

Can the Movements of Robots Convey Emotions to People? The Robots Communicate with Human and Express Emotions Through Different Actions

Dr. Yue Yuan, Chih-Fu Wu, Kai-Chieh Lin, Jin Niu
Tatung University, Taiwan

Abstract: The service robots as a fast-growing industry in today's society, have gained the attention of all the countries. The research of service robots has gradually shifted from functional to perceptual. During the human robot interaction, in addition to the voice interaction, movements are also an important factor in expressing information and conveying emotions. Through observation, this study collected the actions from three industry fields which have a total of 22 experts and staffs, and also analyzed and classified these movements. Finally, it established the robotic actions of animation for testing and using the three kinds of vocabulary of the robot personality traits (F1. "active factor", F2. "helpful factor", F3. "dominant interaction factor") as the evaluation criteria of perception , explored the user cognition to the different personality traits of robots. The results show that the robot movements have the greatest impact on the first type of F1「active factor」, while the industry category only affects the third type of F3「dominant interaction factor」. In the case of different industry categories, the impact of F1「active factor」 is also different. For overall preference, every action will increase users' preference. However, in terms of acceptance, "actions with information transfer functions" can increase users' acceptance, but "auxiliary Action" will not improve them. The results of this study can propose action design guidelines for personalized service robots for different industries.

RC1019

Trajectory Tracking of a Nonholonomic Mobile Robot using Optimal Cascade Sliding Mode Controller

Ms. Medha Chatterjee, Omar Hanif, Nihar Deshpande
The University of Manchester, UK

Abstract: The trajectory tracking for a non-holonomic mobile robot is addressed in this paper. Cascade control is implemented with a Sliding Mode Controller for the outer loop and a Proportional-Integral-Derivative controller governing the inner loop. Linear Quadratic Regulator is further applied to the outer loop to optimize the controller's effort. The model is further analyzed based on various output performances such as trajectory tracking, reference tracking of linear and angular velocities, sliding surfaces of the controller, and its robustness. A comparative analysis with and without an optimal approach has been illustrated. Simulations are carried out on a virtual robotic simulator in LabVIEW.

RC1020

Educational robot Kiddo learns to draw to enhance interactive handwriting scenario for primary school children

Tahmina Akter Mispa, **Asst. Prof. Noushad Sojib**
North East University, Bangladesh

Abstract: Handwriting and drawing skills play a significant role in early childhood education. Recent studies suggest that robots used in education are social robots where most of them don't write directly as the way humans do by holding a pen and moving it over a paper or on a board and use an indirect medium such as touch screen as the shared environment which creates a noticeable barrier in natural interaction. In this work, we develop a new robot named Kiddo that sits on a desk, has an animatronic face, can write with a whiteboard marker, and provides a shared environment where the robot and child can write simultaneously. The robot can write shapes by maneuvering its hand just like we humans do which creates a vivid image of the child interacting with it. We used deep learning to train the robot to recognize 100 shapes collected from the National curriculum Bengali, English, and Mathematics textbook of Bangladesh. We created handwriting datasets for the robot to draw these shapes. The robot also learns new shapes from children's demonstrations and for that, we developed an artificial intelligence system that takes an image and generates necessary segments where the robot can draw each segment without lifting the pen. In our experiment, three kids participated and they drew 18 known and 4 new shapes on the shared whiteboard and the robot were also able to recognize and draw the known shapes and learn to draw the new shapes from the children's demonstration in both simulation and in real.

RC1008

Simulation of Autonomous UAV Navigation with Collision Avoidance and Space Awareness

Mr. Jian Li, Hongmei He, Ashutosh Tiwari
Cranfield University, UK

Abstract: This research developed a safe navigation system of an autonomous UAV within a comprehensive simulation framework. The navigation system can find a collision-free trajectory to a randomly assigned 3D target position without any prior map information. It contains four main components: mapping, localisation, cognition and control, where the cognition system makes execution command based on the perceived position information about obstacles and the UAV itself from mapping and localisation system respectively. The control system is responsible for executing the input command made from the cognition system. Three case studies for real-life scenarios, such as restricted area avoidance, static obstacle avoidance and dynamic obstacles, are conducted. The experiments demonstrate that the UAV is capable of determining a collision-free trajectory under all three cases of environments. All simulated components are designed to match their real-world counterparts' dynamics and properties. Ideally, the simulated navigation framework can be transferred to a real UAV without any changes. As the navigation system of a drone is implemented in a modular way, it is easier to test and validate to ensure the system's performance. Moreover, the system has good readability, maintainability and extendability. Hence, the simulation framework provides a good platform for future robotic research.

Sessions 1

RC1012

Industrial implementation and performance evaluation of LSD-SLAM and map filtering algorithms for obstacles avoidance in a cooperative fleet of unmanned aerial vehicles

Luca Messina, **Mr. Silvio Mazzaro**, Angelo Emanuele Fiorilla, Alessandro Massa, Walter Matta
Vitrociset - a Leonardo Company, Italy

Abstract: In this paper we present an industrial implementation and performance evaluation of the problem of obstacles detection by drones using autonomous navigation systems. The software module that has been developed as well as the tests conducted are part of a large industrial R&D Vitrociset project called SWARM: an AI-Enabled Command and Control (C&C) system, able to execute and review ISR missions for mini/micro cooperative fleets of heterogeneous UAVs. The presented software module, that is currently under test, has been developed to recognize obstacles and drive correctly the drones, using images acquired by low cost RGB video cameras, whose features of lightness and reduced size allow them to be installed on mini/micro UAVs. Moreover, this setup does not require special calibration and pre-configuration processes like the ones necessary for example using stereo video camera systems. The real-time recognition of obstacles in the surrounding environment has been obtained and evaluated through the implementation, performance evaluation and tests of the LSD-SLAM and map filtering algorithms; the core of the study has been realized starting from the integration of these algorithms with a simulated drone in a synthetic environment. The areas of interest have been identified through the filtering of a computer generated map: the module was then integrated into the SWARM project platform, allowing the control of a single drone's movement and making it ready for use in a cooperative fleet environment.

British Summer Time (BST)
UTC + 1
Wednesday, 12 August 2020
9:30-11:15

Sessions 2

RC1005

Too Close to Comfort? A New Approach of Designing a Soft Cable-driven Exoskeleton for Lifting Tasks Under Ergonomic Aspects

Mrs. Christina M. Harbauer, Martin Fleischer, Thao Nguyen, Fabian Bos, Klaus Bengler
Technical University of Munich, Chair of Ergonomics, Germany

Abstract: To this point, available exoskeletons for industrial applications still lack a broad acceptance by the users on the shop floor, allegedly due to discomfort and restraining of movements. Exoskeletons are in close physical interaction with the user. For an everyday use at work, the kinematic chain of the human and the exoskeleton have to meet the needs of every possible user in terms of high usability and a positive user experience. Focusing on aspects like users' wearing comfort, reduction of interaction forces and an easy set-up, a new concept for an exoskeleton that supports the elbow movement during lifting tasks was developed. To avoid misalignments between the exoskeleton and the human as well as allow a full range of movement, a soft cable-driven structure was chosen. In an iterative design process, a basic structure made of a rather stiff fabric with elastic inlays was developed. The cut is meant to suit a wide range of anthropometric measures while ensuring a tight fit for a good transfer of forces. Using soft materials and cables poses a challenge for calculating, simulating and measuring the force distribution not only in the exoskeleton, but also in the human tissue and bones. Therefore, a suitable model of the kinematic human-machine-chain was developed and a method for testing the new concept. Since an ergonomic design and the users' needs were of high priority in the design process, the robustness and the maximum load capacity of the system are initially left out of this concept.
In this paper, the design of the soft fabric-based structure will be presented as well as the kinematic design of the cable train and the implementation thereof.

RC1017

10.52 GOPS Systolic Cores Fuzzy Logic System for Cognitive Dysfunction Self-Awareness Using FPGA

Mr. Hossam Omar Ahmed
American College of the Middle East (ACM), Kuwait

Abstract: It is inevitable to ignore the remarkable ecofriendly transformation impact that could be obtained by applying Sustainable Computing (SC) to a wide range of conventional applications in the near future. The reliability of the decision-making process in these transformed applications could be enhanced by the integration and collaboration of many algorithms and techniques like Cognitive Computing (CC), Approximate Computing (AC), and the reconfigurable hardware platforms with the SC, especially for scenarios with a high degree of uncertainties. In this paper, a systolic Fuzzy Logic System (FLS) processing cores has been proposed to provide a generic Cognitive Dysfunction Self-Awareness (CDSA) solution that assists the power management control of an electronic system based on its vital extracted parameters. The proposed processing unit architecture has been designed using VHDL, and the targeted FPGA chip was the Intel
Cyclone V 5CGXFC9D6F27C7. The proposed systolic-cores FLS CDSA processing core achieved a computational processing speed of 10.52 GOPS. The maximum operating frequency of the proposed CDSA unit is 500.75 MHz while draining only 13.25 mW as a core dynamic thermal power dissipation loss and dissipates about 15.10 mW as an I/O thermal power dissipation loss.

RC1022

Prevention of Ant Mills in Pheromone based Swarm Algorithms

Mr. Ahmad Reza Cheraghi, Jochen Peters, Kalman Graffi
Heinrich Heine University, Germany

Abstract: Technical developments are often motivated by concepts from nature. The ant algorithm is such a concept. This algorithm takes on the idea of using the environment as a data store in order to contact to other participants (robots or ants). Copying this concept, however, the same problems occur, like real ants have. Especially with the army ant, which is characterized by their uniform behavior, ants mills appear. Gadget by a wide pheromone trail an ant on a random circle intensifies this trail for each round. Other ants that run in these the circular trail, they additionally reinforce it until ant mill is formed and the whole colony starved to death. Nature solves this problem with a new breed at a new location. In an implementation as mars robots or molecular machines a new breed is not possible. We have developed a closer look at this ant mill problem. We also found the ant algorithm interesting in terms of molecular machines where a wireless link is not an option for communication. In our simulation the ants build randomly ant mills and highly frequented routes to already depleted sources of food. Both cases are characterized by a high density of ants. Therefore, we have added a part to the algorithm which triggers an escape behaviour, if 3 or more ants are standing near to each other. We measured a significantly better food supply than without this modification and were able to reduce ant mills.

RC11003

Research on the Computer Synchronization of the Fault-Tolerant System

Ms. Ying Wang, Zhengqi, Jia Min Zhang
Xi'an Aeronautics Computing Technique Research Institute, AVIC, China

Abstract: With the development of the control system, computers are applied more and more in it. The application of the quad-redundancy (similarity redundancy) computer is more extensive, in the time tightly-coupled control system, the synchronization among computers (namely channels) is the key to successful control. Synchronization is to narrow the time differences caused by errors in hardware among channels within the range of system requirements, which makes each channel achieve time consistency. Through the in-depth analysis and research of the system and computer, the corresponding synchronous supporting interface circuit is designed as the foundation of software synchronization, which ultimately completes the synchronization. The method of realizing synchronization adopts "single-handshake" and "twi-handshake". Finally, through the experiment verification, it is determined that the system adopts the "twi-handshake" synchronization method as the synchronization strategy of the quadruplex-redundancy computer. The method has been fully verified in subsequent system test experiments, and has met the expected design requirements. The "twi-handshake" synchronization method, as a synchronized method among computers, can be applied to a wider range of systems.

British Summer Time (BST)
UTC + 1
Wednesday, 12 August 2020
9:30-11:15

Sessions 2

RC11007

Remaining Useful Life Prognostics for the Rolling Bearing Based on a Hybrid Data-driven Method

Mr. Yingang Wang, Runxia Guo, Guihang Liu
Civil Aviation University of China, China

Abstract: Rolling bearing is the core part of rotating mechanical equipment, so developing an effective remaining useful life (RUL) prognostics method and alarming the impending fault for rolling bearing are of necessity to guarantee the reliable operation of mechanical equipment and schedule maintenance. The relevance vector machine (RVM) is one of substantially used methods for RUL prognostics of rolling bearing. However, the accuracy generated by RVM drops rapidly in the long-term prognostics. To remedy this existing shortcoming of RVM, a novel hybrid method combining grey model (GM), complete ensemble empirical mode decomposition (CEEMD) and RVM is put forward. In the hybrid prognostics framework, the GM is applied to gain a 'raw' prediction result based on a trained model and produce an original error sequence. Subsequently, a new smoother error sequence reconstructed by CEEMD method is used to train RVM model, by which the future prediction error applied to correct the raw prediction results of GM is projected. Ultimately, the online learning technique is used to implement dynamic updating of the 'old' hybrid model, so that the RUL of rolling bearing throughout the run-to-failure dataset could be accurately predicted. The experimental results demonstrate the satisfactory prognostics performance.

RC1004

Application of Surface Reconstruction for Car Undercarriage Inspection

Mr. Martin Dörfler, Tomáš Pivoňka, Karel Košnar, Libor Přeučil
CTU in Prague, Czech Republic

Abstract: The method for camera-based 3D reconstruction of car undercarriages is proposed in this paper. It is designed for a special scanner, which is placed under a road level and scans undercarriages of passing cars. The scanner uses mirrors to increase a distance from a camera and to capture a stereo image only by one camera. The 3D models of individual parts of an undercarriage are reconstructed by a correlation-based block-matching algorithm. Afterward, these models are stitched together based-on visual-odometry. The method was successfully tested on real car undercarriages.

RC1003

Generation, Classification and Segmentation of Point Clouds in Logistic Context with PointNet++ and DGCNN

Keng Chai, **Mr. Jonas Stenzel**, Jana Jost
Fraunhofer Institute for Material Flow and Logistics, Germany

Abstract: Many possible use-cases for deep-learning-based 3D object recognition in logistic environments have been proposed [1]. Nonetheless, the applicability of this technology in a logistic context has yet to be explored. Additionally, no dataset regarding point clouds in a logistic setting yet exists. Therefore, this paper investigates the generation of point clouds for logistics and the use of deep learning for classification and segmentation of the generated datasets. First, we generate different datasets regarding logistics with a virtual sensor. Afterwards, two state-of-the-art networks are evaluated and compared: PointNet++ and DGCN [2] [3]. Three different tasks are considered: The classification of logistic objects under the closed-world as well as the open-set assumption is assessed. Finally, the segmentation of logistic scenes is evaluated. Additionally, since simple surfaces can be removed reliably by traditional means, the effect of removing these as pre-processing step is evaluated as well. Both networks are able to reliably classify logistic objects with and without floor, even in the presence of unknown classes. However, while the segmentation performs well on average, some negative outliers do exist. Using transfer learning by pretraining the network with point clouds presenting the complete shape leads to a better performance.

RC1016

Texture Gradient and Deep Features Fusion-Based Image Scene Geometry Identification System Using Extreme Learning Machine

Mr. Altaf Khan, Alexander Chefranov, Hasan Demirel
Eastern Mediterranean University, Turkey

Abstract: It is an important aspect that image scene geometry can be used to reconstruct the 3D information of a single image and it beneficial for computer vision applications, such as 3D TV, video categorization. For the sake of this fact, the system needs to know the geometry type of input image. A novel architecture for the image scene geometry recognition based on the feature-level fusion of convolutional neural network (CNN) features and low-level texture gradient features is presented. Texture gradient features are used to capture the depth order of scene geometry. In this method, the serial feature fusion strategy is utilized for the fusion of the two different features set. The main benefit of using low-level features set are; it's simple to extract, has rich information of image scene geometry, and computationally less expensive. Next, we design a new scene dataset on the base of image scene geometry which can be used to evaluate the new research techniques. The experimental results exhibit that combination of deep CNN features and texture gradient features into a single vector can achieve even higher accuracy than applying CNN alone. Additionally, by utilizing the extreme learning machine (ELM) as a classifier, the proposed system achieves 86.29% recognition accuracy on the 12000 images dataset in the limited time that is superior to other baseline methods.

Sessions 3

RC11004

Research on Detection and Tracking of Moving Vehicles in Complex Environment Based on Real-time Surveillance Video

Mr. Zhen-jie Zhong, Qi Wang
Intelligent Information Processing Lab. Yanbian University Yanji, China

Abstract: Aiming at the moving target detection and tracking in the real-time video with the PTZ camera, this paper proposes a method of motion detection and tracking.First build the background with the improved mean method, then detect the moving target using background subtraction, next assign a Blob block structure to each moving target, after analyzing the next frame in the immediate area, detect and identify vehicles, finally record the target vehicle's motion trajectory and motion feature information.Each Blob block is numbered. By searching and establishing a CamShift tracking sequence nearby, the Blob block, which is the feature information of the tracking target, is updated in time to speed up the tracking speed and accuracy.A good tracking effect is obtained by the above methods. It can establish recognition area and capture video related data information for real-time monitoring equipment.

RC1001

Parameters selection for Blurred Image Matching

Mr. Yann Pierre Donon, Alexander Kupriyanov, Rustam Paringer
Samara National Research University, CERN, IPSI RAS

Abstract: Blurred Image Matching (BIM) is a feature comparison method based on image pre-processing and blobs detection. BIM is designed to perform comparison on images presenting a strong level of noise. The method’s published results display excellent robustness, speed, and unique features when compared to existing methods, leading to its implementation in the industry. This article investigates the process BIM is based on, and offers precision over its parameters, in order to optimize their selection. The article investigates the technique’s performances when using various blurring and thresholding parameters, resulting in an improvement of the method’s performances.

British Summer Time (BST)
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Wednesday, 12 August 2020
13:00-14:45

Sessions 3

RC1009

Multi-Level Feature Fusion Mechanism for Single Image Super-Resolution

Mr. Jiawen Lyn
Trinity College Dublin, Germany

Abstract: Convolution neural network (CNN) has been widely used in Single Image Super Resolution (SISR). As the network deepens, the learning ability of the network becomes more and more powerful. However, most SISR methods based on CNN do not make full use of the hierarchical features and the learning ability of the network. These features cannot be extracted directly by subsequent layers, so the previous layer hierarchical information has little impact on the output and performance of subsequent layers relatively poor. To solve the above problem, a novel Multi-Level Feature Fusion network (MLRN) is proposed, which can make full use of global intermediate features. I also introduce Feature Skip Fusion Block (FSFblock) as a basic module. Each block can be extracted directly to the raw multi-scale feature and fusion multi-level feature, then learn spatial correlation. The correlation among the features of the holistic approach leads to a continuous global memory of information mechanism. Experiments on public datasets show that the method MLRN can be implemented, which has a favorable performance than most of the current methods.

RC1021

Swarm-Sim: A 2D & 3D Simulation Core for Swarm Agents

Mr. Ahmad Reza Cheraghi, Karol Actun, Sahdia Shahzad, Kalman Graffi
Heinrich Heine University, Germany

Abstract: Real Robots are very expensive. Working with them and developing algorithm that should be scalable takes time and needs passion. Especially, when it comes to swarm robotics. A swarm is a set of agents that can handle actions together more efficiently than when they are on its own. Thus, scalability is vital. Evaluation tools help to simulate robots and to prepare scenarios and solutions in a fast and quick way without purchasing expensive equipments. This paper presents the simulator core swarm-sim. With swarm-sim it is possible to write scenarios and solutions for agents swarms. This simulator is completely written in python and its code is open-source. It provides a GUI and visualization that works in 2D and 3D environment. It is easy to learn and allows a basic ground for testing and evaluation. Thus, with this simulator scenarios and solutions for moving like a flock, spreading pheromones like ants, building geometrical formation blocks or many more and makes swarm-sim a unique and easy simulation tool.

British Summer Time (BST)
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13:00-14:45

Sessions 4

E2001

Monte Carlo method to uncertainty evaluation of the relative dielectric constant and loss tangent measured by split-cavity resonator technique

Dr. Fei Zhao, Jing Pei, Qi Tang, Chengxiang Wang, Jinsong Kan
China Electronics Standardization Institute, China

Abstract: According to the mathematical model of the split-cylinder resonator method, it is impossible to establish a simple equation between the intermediate variables and the relative dielectric constant or the loss tangent. Instead, the measured relative dielectric constant and the loss tangent must be calculated numerically by iterative programming. When evaluating uncertainty according to the Guide to the Expression of Uncertainty in Measurement (GUM), it is impossible to obtain the sensitivity coefficient of each intermediate. Therefore, the reliability of uncertainty evaluation is greatly reduced. ISO/TS15530 states that the most effective method for estimating uncertainty is computer simulation, and more specifically, a Monte Carlo simulation. In this study, Three typical samples with different relative dielectric constant and loss tangent were measured, respectively. The probability density function of each intermediate variable was given, according to which the Monte Carlo simulations were performed by MATLAB programming. Moreover, some of the simulation results are compared with those of the previous literature, and the results show that the measurement uncertainty evaluated by the GUM method was slightly larger, indicating that it was a little bit conservative to assume that each intermediate variable is completely uncorrelated in the GUM method.

E2004

Research and Application of A Data Processing Method on Outliers in Unmanned Aerial Vehicle (UAV) Tracking Measurement

Asst. Eng. Kunkun Li, Rui Cao, Xiaoyu Qi, Xin Zhou, Yaxiong Hu
Northwest Institute of Nuclear Technology, China

Abstract: In unmanned aerial vehicle (UAV) flight test, some complex outliers often appear in tracking measurements due to various factors stemming from environment, instrumentations, and even operators. This seriously affects the reliability of applications and analysis. This paper aims at the problem of outliers elimination to measurement data and proposes a joint data processing method comprising grouped data extraction, data trend modeling, and outliers detection. In the context of accuracy assessment test for measurement and control equipment (MCE), an approach using the measurement parameter for UAV flight is designed to estimate the time system deviation between MCEs, as well as to validate the effect of the proposed joint method. Finally, a simulation is implemented and results show the effectiveness and feasibility of the joint method to outliers elimination and time deviation estimation.

Sessions 4

E2005

Study on the Technology of Ultra-high Sensitive Wide-band Magnetic-feedback Inductive Magnetic Sensor

Yong Liu, Wenbin Li, Jinrong Zhou, Rui Pan, **Mr. Huan Zheng**, Bing Xiang, Rui Xu
Wuhan Maritime Communication Research Institute, China

Abstract: It analyses the composition and principle of high-sensitive wide-band magnetic-feedback inductive magnetic sensor to fulfil the demand of high-sensitive wide-band magnetic sensor in geological exploration. It studies main factors to the performance of wide-band magnetic sensor, such as turns of coils, core material features, and amplifier noise, specifies section-wise coil winding, the type and dimension of core material, and designs low-noise high-impedance LF chopping amplifier channel and composite amplifier with HF amplifier channel. The noise of magnetic sensor at 1 Hz is better than 10-4nT/Hz1/2, at 100Hz-1kHz band the noise floor is close to SQUID which can reach 10-6nT/Hz1/2. The magnetic sensor works at wide frequency band (0.0001Hz-10kHz) and ultra-low noise, which can meet the requirements of both AMT and CSAMT.

E2006

Glucose Analyzer Based on Self-Made Biosensor for High-Performance Glucose Detection

Mr. Qiang Tan, Cuimei Bo, Jun Li, Yiqing Wang, Xiaorong Wang, Shubo Jiang
Nanjing Tech University, Nanjing, China

Abstract: The concentration analyzer with high precision and wide range is the core device for monitoring the fermentation process. In this work, we designed and proposed a lowcost three-electrode glucose analyzer based on a self-made screen-printed enzyme biosensor chip, which has a Prussian blue (PB) nanocubic structure and leads to high sensitivity of 117.31 μAmM-1cm-2. The hardware design of the glucose analyzer can be divided into five critical parts, including digital, signal treatment system, power supply, motor-driven and the host computer. The signal treatment system is used to collect, convert and amplify the weak current signal generated by the biosensor. The digital circuit of the central processing unit of the analyzer is designed using the STM32F407ZET6. Besides, an external analog-to-digital converter is used to achieve high precision A/D conversion. The stability of the potentiostat is ensured by designing the precision power supply, hardware filtering, and algorithm filtering. The experimental results show that the glucose analyzer has a wide linear detection range from 1g/L to 120g/L and the coefficient of variation at 1g/L is 0.038, which exhibits excellent performance in stability and detection accuracy. The analyzer can be applied in the future for in-situ measurement of glucose concentration for its wide-range and high-precision detection capabilities.

Sessions 4

IC2001

Stereo Visual Inertial Mapping Algorithm for Autonomous Mobile Robot

Mi Zhang , **Mr. Songshan Han**, Shihan Wang , Xing Liu , Mengyu Hu , Jiayang Zhao
Zhejiang Sineva Intelligent Technology Co.,Ltd , China

Abstract: Simultaneous Localization and Mapping (SLAM) is a fundamental problem for autonomous mobile robots (AMRs). AMRs are widely used in automated warehousing, factory material transfer systems, flexible assembly systems, and other intelligent transportation sites. The visual Inertial Odometry (VIO) which consists of the camera and inertial-measurement-unit (IMU), is a popular approach to achieve accurate 6-DOF state estimation. However, such locally accurate VIO is prone to drift and cannot provide a global consistent map. The prerequisite for re-localizing the robot and ensuring precise autonomous navigation is an accurate and global consistent map of its environment. In this study, we propose a stereo visual-inertial mapping system. The front-end is a robust stereo VIO based on a tightly-coupled sliding window optimization. The core of the back-end is the global Bundle-Adjustment (BA) which is a nonlinear optimization, in which IMU is also added as a time-domain constraint. Meanwhile, stereo-camera-IMU extrinsic calibration is performed in BA to improve mapping accuracy. The selection principles of keyframes and map points are also designed according to the AMRs application characteristics. Further, the forward and backward Perspective-n-Point (PNP) method is also adopted to avoid the loop-detection mismatch. The performance of the system was validated and compared against other state-of-the-art algorithms. The findings revealed the effectiveness and robustness of this stereo visual-inertial mapping algorithm.

IC2003

An Improved Intelligent Scissors Algorithm for the segmentation of vessels segments in coronary angiography imaging

Ms. Yue Li, HangYi Pan, LuRong Jiang, JiJun Tong, Yuqiang Shen
Zhejiang Sci-Tech University, China

Abstract: Interactive segmentation is widely used to precisely segment the parts of interest in medical images. Among them, the intelligent scissors algorithm is an efficient interactive segmentation algorithm, but it has poor performance in processing images with a high similarity between foreground and background. And it is easily affected by the strong edge, which leads to more seed points and longer time to segment the interested vessel segments in the coronary angiography images. In order to improve the segmentation efficiency, we redesign the cost function, using Canny operator, Scharr operator, to replace the Laplace operator in the traditional algorithm. Moreover, gradient magnitude adjustment function and histogram adjustment function are introduced to improve the segmentation effect. Experiment results show that the improved algorithm can shorten the segmentation time and improve the segmentation efficiency without the loss of performance compared with the traditional algorithm.

Sessions 4

IC2009

An ISFET Sensor Based on In2O3 Nanoribbon for pH Detection of Micro Solutions

Mr. Chuanjian Wu, Yiqing Wang, and Min Yang
Nanjing Tech University, China

Abstract: In this paper, an ISFET sensor based on In2O3 nanoribbon is developed for pH detection of micro solutions. A double channel ISFET is designed which includes the In2O3 nanoribbon top channel and silicon substrate bottom channel so as to realize the pH detection of the micro solutions. Through experiments, the sensitivity of the sensor is 70 mV/pH in the range of pH 6 to pH 10, which exceeds the Nernst limit of 59.2 mV/pH (300 K) at room temperature. Taking the detection of cTnI as an example, the pH sensor can be used to detect the concentration of biomarkers.

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