The 13th International Conference on Intelligent Robotics and Applications

ICIRA 2020

Program Guide

5th to 7th November 2020

Kuala Lumpur, Malaysia

SCHEDULE AT A GLANCE

Malaysia time is used in the schedule.

5 Nov 2020 (Thursday)

9.00am - 9.30am	Opening speech
9.30am - 10.30am	Keynote speech 1 (Professor Yuanqing Li)
10.30am - 11.00am	Refreshment Break
11.00am - 12.30pm	Oral session (2 parallel sessions)
12.30pm - 2.00pm	Lunch Break
2.00pm - 2.45pm	Invited talk 1 (Associate Prof. Tan Chee Pin)
2.45pm - 3.15pm	Refreshment Break
3.15pm - 4.45pm	Oral Session (2 parallel sessions)

6 Nov 2020 (Friday)

9.30am - 10.30am	Keynote speech 2 (Professor Aiguo Song)
10.30am - 11.00am	Refreshment Break
11.00am - 12.40pm	Spotlight session (2 parallel sessions)
12.40pm - 2.00pm	Lunch Break
2.00pm - 2.45pm	Invited talk 2 (Associate Prof. Jeffrey Too Chuan Tan)
2.45pm - 3.15pm	Refreshment Break
3.15pm - 5.15pm	Spotlight session (2 parallel sessions)

7 Nov 2020 (Saturday)

9.30am - 10.30am	Keynote speech 3 (Professor Xinjun Liu)
10.30am - 11.00am	Refreshment Break
11.00am - 12.40pm	Spotlight session (2 parallel sessions)
12.40pm - 2.00pm	Lunch Break
2.00pm - 2.45pm	Invited talk 3 (Associate Prof. Sian Lun Lau)
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WELCOME MESSAGE FROM GENERAL CO-CHAIRS

Welcome to the 13th International Conference on Intelligent Robotics and Applications, the first Virtual ICIRA.

For every great show, there is a great team behind it. The ICIRA Organizing Committee consists of an amazing team of experts from the industry and academia, along with the hundreds of volunteers who put the conference together. They collaborated in presenting you an excellent program with top quality research papers, great keynotes, and invited talks.

Over the past 13 years, ICIRA has grown from a conference with just a laser focus on robotics, to a conference that covers the whole eco system with topics like machine learning/AI, IP, embedded systems and software, security and autonomous systems. ICIRA is a unique event that brings together the entire intelligent system ecosystem from academic and industrial researchers to designers, developers, vendors, and educators. Going forward, I see great momentum for ICIRA to continue to grow.

I hope you all enjoy Virtual ICIRA this week. Attend a presentation on a topic you don't know. Interact with live text chats or leave a message for the speakers to answer any questions or simply to introduce yourself. Attend our virtual networking events and connect with old friends or make some new ones, even in the virtual setting.

We are going through a special time in history due to the COVID-19 pandemic. It is more important than ever to work as one big global community among the robotic community, ML/AI community, security community, autonomous system community, etc. By working together, collaborating, sharing and exchanging ideas, great new ideas will come and all of us can contribute to our global society in a bigger way.

Please keep yourself and your family safe. Enjoy the #13th ICIRA!

Sincerely,

ICIRA 2020 General Chairs

Chee Seng Chan (University of Malaya, Malaysia)

Hong Liu (Harbin Institute of Technology, China)

Xiangyang Zhu (Shanghai Jiao Tong Univ., China)

TECHNICAL PROGRAM CO-CHAIRS' OVERVIEW

On behalf of the Technical Program Committee, we welcome you to the 2020 International Conference on Intelligent Robotics and Applications (ICIRA 2020) which was supposed to be held physically in Kuala Lumpur, Malaysia. But due to COVID-19 pandemic and the restrictions in traveling, ICIRA 2020 will be held virtually this year. The conference has successfully attracted papers on all aspects of robotics including automation, mechatronics, robotic vision, human-robot interaction, robot design, and emerging robotic applications.

2020 has been a very challenging year for conference organization, in spite of this, we are still receiving encouraging submission that make this conference a successful event. This year, we received 66 submissions from authors of various countries. For fair review of these submissions, ICIRA Technical Program Co-Chairs have invited 101 reviewers. We are pleased to let you know that the quality of the submissions was outstanding, and around 20% of the total regular submissions are accepted as Oral presentation while 45% are accepted as Spotlight presentation. Special sessions are organized which address recent hot topics in robotics and Computational Intelligence areas.

To introduce and discuss the state-of-the-art robotics technologies, we prepared 10 regular paper presentations, 2 special session presentations, 3 keynote speeches, and 3 invited talks. We would like to express our appreciation to the keynote speakers, invited talk speakers, reviewers, session chairs and all authors for their contributions to ICIRA 2020.

We hope that you will enjoy the technical program of ICIRA 2020 and stay safe.

Sincerely,

ICIRA 2020 Technical Program Co-Chairs:

Chern Hong Lim (Monash University, Malaysia)

Xinjun Liu (Tsinghua University, China)

Lianqing Liu (Chinese Academy of Sciences, China)

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KEYNOTE SPEECHES

Keynote Speech 1

Multimodal BCIs and Their Clinical Applications

Professor Yuanqing Li

South China University of Technology, China

Time & Place: 0930 – 1030, 5th November 2020 (Thursday)

Chair: Honghai Liu, Portsmouth University, UK

Abstract

Despite rapid advances in the study of brain-computer interfaces (BCIs) in recent decades, two fundamental challenges, namely, improvement of target detection performance and multi-dimensional control, continue to be major barriers for further development and applications. In this paper, we review the recent progress in multimodal BCIs (also called hybrid BCIs), which may provide potential solutions for addressing these challenges. In particular, improved target detection can be achieved by developing multimodal BCIs that utilize multiple brain patterns, multimodal signals or multisensory stimuli. Furthermore, multi-dimensional object control can be accomplished by generating multiple control signals from different brain patterns or signal modalities. Here, we highlight several representative multimodal BCI systems by analyzing their paradigm designs, detection/control methods, and experimental results. Furthermore, we report several initial clinical applications of these multimodal BCI systems including awareness evaluation/detection, assisting diagnosis in patients with disorder of consciousness (DOC). As an evolving research area, the study of multimodal BCIs is increasingly requiring more synergetic efforts from multiple disciplines for the exploration of the underlying brain mechanisms, the design of new effective paradigms and means of neurofeedback, and the expansion of the clinical applications of these systems.

Speaker's Biography

Yuanqing Li received the B.S. degree in applied mathematics from Wuhan University, Wuhan, China, in 1988, the M.S. degree in applied mathematics from South China Normal University, Guangzhou, China, in 1994, and the Ph.D. degree in control theory and applications from the South China University of Technology, Guangzhou, in 1997. Since 1997, he has been with the South China University of Technology, where he became a Full Professor in 2004. From 2002 to 2004, he was with the Laboratory for Advanced Brain Signal Processing, RIKEN Brain Science Institute, Japan, as a Researcher. From 2004 to 2008, he was with the Laboratory for Neural Signal Processing, Institute for Infocomm Research, Singapore, as a Research Scientist. He was elevated to IEEE Fellow for his contributions to brain signal analysis and BCIs in 2016. He won the State Natural Science Awards (second prize), China, 2009, Changjiang Professorship, Ministry of Education, China, 2012, Distinguished Young Scholar Award, National Natural Science Foundation of China (NSFC), 2008, and

many more. His research interests include blind signal processing, sparse representation, machine learning, brain–computer interface, EEG, and fMRI data analysis. He has published more than 100 journal papers and 2 edited books since 1994, of which 80 were published in high level journals including Brain, Cerebral Cortex, NeuroImage, Human Brain Mapping, Journal of Neural Engineering, Neural Computation, Proceedings of the IEEE, IEEE Signal Processing Magazine, and 8 various IEEE transactions, e.g., IEEE Trans. Information Theory and IEEE Trans. PAMI. He also has more than 30 publications in conferences including NIPS and WCCI. He has been serving as AE of several journals such as IEEE Trans. on Fuzzy Systems and IEEE Trans. on Human-Machine Systems.

Keynote Speech 2

Force Sensing, Feedback and Control for Teleoperation Robot

Professor Aiguo Song

Southeast University, China

Time & Place: 0930 – 1030, 6th November 2020 (Friday)

Chair: Naoyuki Kubota, Tokyo Metropolitan University, Japan

Abstract

Teleoperation robot is currently the frontier and hot-point of the robotics research. The telerobot combines the human intelligence with robot viability in unknown environments, so that it is able to perform the complex tasks or pre-unknown tasks in unknown or dangerous environments. Force sensing, feedback and control are core techniques of the teleoperation robot. In this presentation, we review the history of the teleoperation robot, and illustrate the architecture of the teleoperation robot system. Teleoperation robot with force feedback allows humans to perform complex tasks in a remote or inaccessible environment, while providing force feedback to the human operator. The incorporation of real-time force feedback as well as visual information in the teleoperation control loop can lead to significant improvements in task performance, feeling of presence. Then we discuss its three key techniques, that is force sensing, force feedback, and force control strategy under time delay. At last, we briefly introduce the development of teleoperation robot system with force sensing and feedback, and its typical applications at Southeast University during the past decade.

Speaker's Biography

Aiguo Song is the chief professor of Southeast University, winner of National Outstanding Youth Fund, National Outstanding Scientific and Technological Worker, and winner of China Youth Science and Technology Award. He has been selected into the National "Ten Thousand Talents Plan". He is the member of the Discipline Evaluation Group of Instrument Science and Technology of Academic Degree Committee of the State Council, chair of Jiangsu Instrumentation Society, chair of IEEE Nanjing Section Robotics and Automation Society Chapter, and IEEE senior member. From June 2004 to December 2019, he was the dean of the School of Instrument Science and Engineering, Southeast University, P. R. China. He is currently the chairman of the College of Electrical, Instrument and Automation Engineering, the executive president of the Institute of Space Science and Technology, Director of Robot Sensor and Control Laboratory, Southeast University. Prof. Song has been engaged in the research of robot sensing and control technology, space robot, nuclear detection robot, power inspection robot and rehabilitation/medical robot since 1993. As the project leader, he has completed more than 50 important projects, including national key R & D projects, National 863 high-tech projects, national 973 projects, key projects of National Natural Science Foundation of China, and

Space Exploration Research projects. As the first person, he has won the second prize of National Technology Invention Award, two of the first prize of Technology Invention Award of Ministry of Education, two of the first prize of science and technology progress award of Jiangsu Province, and three gold awards of Geneva International Invention. He has published more than 280 peer reviewed journal papers, and 180+ papers have been indexed by SCIE, and SCI cited time is 2000+. He has gotten more than 80 authorized patents and 5 national technique standards for special robots.

Keynote Speech 3

Mechanism design and application of robots.

Professor Xinjun Liu

Tsinghua University, China

Time & Place: 0930 – 1030, 7th November 2020 (Saturday)

Chair: Chee Seng Chan, University of Malaya, Malaysia

Abstract

Both constructing and behavior of natural life are the combination of serial and parallel. The design of a machine especially a robot should follow this law. The key issue for a serial-parallel robot is about the parallel mechanism. This lecture first introduces three open problems, i.e. type synthesis, performance evaluation and dimension optimization, and their research proposals of a parallel mechanism. Then, two types of parallel mechanisms are presented for the applications in the pick-and-place manipulation and machining of complex surface and large structures.

Speaker's Biography

Dr. Xinjun Liu is a full professor with tenure in Department of Mechanical Engineering at Tsinghua University, Beijing, China. He is now the Chair of IFToMM China-Beijing, the Winner of National Outstanding Youth Fund of China, the "Cheung Kong" Chair Professo. Prof. Liu received his Ph.D. degree in Mechanical Design and Theory from Yanshan University, Qinhuangdao, China, in 1999, the M.S. and B.S. degrees in Machine Design and Manufacture and Mechanics from Northeast Heavy Machinery Institute in 1994 and 1995, respectively. He was a Visiting Researcher at Seoul National University, Seoul, Korea in 2002-2003. He was the Alexander von Humboldt (AvH) Research Fellow at University of Stuttgart in Germany from 2004 to 2005. He was the visiting professor with Prof. Ilian Bonev in Department of Automated Manufacturing Engineering at École de technologie supérieure, Canada from July to August, 2006. He was the visiting professor with Prof. Dr. Reimund Neugebauer at Fraunhofer Institute for Machine Tools and Forming Technology, Germany, in August of 2007. Prof. Liu has published over 170 papers in refereed journals and refereed conference proceedings, 82 authorized patents, and two books. His research interests include parallel mechanisms, parallel kinematic machines, machining robots, moving robots, and roboticized equipments. He is now the associate editor of international journal "Mechanism and Machine Theory" and the director of Beijing Key Lab of Precision/Ultra-precision Manufacturing Equipments and Control.

INVITED TALKS

Invited Talk 1

State estimation and its application in intelligent robotics

Assoc. Professor Tan Chee Pin

Monash University, Malaysia

Time & Place: 1400 – 1445, 5th November 2020 (Thursday)

Chair: Chern Hong Lim, Monash University, Malaysia

Abstract

Intelligent robotics requires significant amounts of information which are obtained through sensors. These information could be used to glean hidden knowledge of a system, diagnose the condition of a system, or to make decisions on the next course of action. However, it is not always straightforward to obtain sensor information. Sensors could be expensive, or inaccurate, infeasible to be installed, or might not even be able to measure a desired variable. An attractive solution to address this issue is state estimation, which processes available sensor information based on a mathematical model of the system to produce an estimate of variables in the system. However, in state estimation, there are challenges such as inaccuracies and noise in the sensor information as well as the model. In this talk, we will introduce the concept of state estimation, as well as some of the latest developments in the field that can accurately estimate states despite the presence of the inaccuracies and noises. We will demonstrate the potential of state estimation in a soft robotic system, where we successfully achieved proprioception and exteroception (estimate internal and external variables) using convenient and inexpensive sensors.

Speaker's Biography

Tan Chee Pin received the B.Eng. degree (Hons.) and the Ph.D. degree from Leicester University, Leicester, U.K., in 1998 and 2002, respectively. He is now an Associate Professor at the School of Engineering, Monash University Malaysia. His research interests are in the theoretical development of robust state estimation and fault diagnosis schemes, and in applying them to areas such as soft robotics, mechanical ventilation, and smart cities. He has authored more than 100 internationally peer-reviewed research articles, including a book on fault reconstruction. He serves as a member of the IEEE Control Systems Society Conference Editorial Board, and also as Associate Editor of the Journal of Franklin Institute, and IET Collaborative Intelligent Manufacturing. In recognition of his research achievements, he has also been invited to give keynote and plenary talks at several international conferences – both in the academic and industrial communities.

Invited Talk 2

Learning AI (Artificial Intelligence) by Building Service Robots

Assoc. Professor Jeffrey Too Chuan Tan

Tamagawa University, Japan

Time & Place: 1400 – 1445, 6th November 2020 (Friday)

Chair: Weng Kin Lai, Tunku Abdul Rahman University College, Malaysia

Abstract

Learning AI (Artificial Intelligence) for beginners can be quite intimidated especially when one lacks of any computer science background. However, AI is flourishing various industries outside of its own technical domain, making AI literacy soon to be a requirement in many workplaces. The situation becomes more embarrassing when current AI education is mainly focusing on generating AI experts for the theoretical development or complex applications of AI, rather than making AI can be learned by young schoolchildren.

The RoboCup@Home Education initiative was started with a simple intention to facilitate technically complex service robot development by novice teams and even schoolchildren. The service robot development involves many practical AI applications solving real-world problems in various domains including human-robot interaction, navigation and mapping in dynamic environments, computer vision, object recognition and manipulation, and robot intelligence. Under the education initiative, a novel AI learning approach was formulated after several cycles of the organization of workshop based service robot challenge with team-centered competition design. Not only a learning framework was created, the workshop contents had generated teaching materials, and the competition design had provided yardstick for learning assessment.

The AI learning approach by service robot development is currently being further developed into a more formal education system, together with compatible hardware, software and courseware, with the aim to provide practical basic AI education for non-technical beginners and young schoolchildren.

Speaker's Biography

Jeffrey Too Chuan TAN received Bachelor of Mechanical Engineering (Hons.) and Master of Mechanical Engineering from Universiti Tenaga Nasional, Malaysia in 2003 and 2007, respectively. He received Doctor of Engineering in Precision Engineering from The University of Tokyo, Japan in 2010. He was a Project Researcher at National Institute of Informatics, Japan from 2011, developing a new simulator for human-robot interaction. From 2014, he worked as a Project Assistant Professor at Institute of Industrial Science, The University of Tokyo, Japan in advanced mobility development. In 2017, he was invited under the Tianjin City Thousand Talents Program (Young Professionals) and worked as an

Associate Professor at Nankai University, China. From the same time, he is also a Visiting Researcher at Tamagawa University, Japan, to foster international collaboration. His areas of research including service robotics and human-robot interaction, cloud robotics, and advanced mobility.

He was a Principle Investigator of over 20 research projects funded by National Natural Science Foundation of China (NSFC), Japan Society for the Promotion of Science (JSPS), IEEE and RoboCup Federation. He has published over 100 research papers in technical journals and academic conferences. He was a recipient of FANUC FA Robot Foundation Best Paper Award (2011), MAZAK Foundation Advanced Manufacturing Systems Best Paper Award (2011), and Japanese Society for Artificial Intelligence (JSAI) Award (2013, 2014). He was also a winner of RoboCup @Home leagues (Japan Open 2013-2019, China Open 2018-2019, RoboCup Asia-Pacific 2017, RoboCup Asia-Pacific Tianjin 2019, and international RoboCup 2019). In 2015, he founded the RoboCup @Home Education initiative to promote learning of practical AI and robotics development. Under the initiative outreach programs, he has conducted over 40 introductory talks & demos and over 20 hands-on workshops globally to promote a new form of AI-focused Robotics Education.

Invited Talk 3

30 years Ubiquitous Computing: Where do we go from here?

Assoc. Professor Sian Lun Lau

Sunway University, Malaysia

Time & Place: 1400 – 1445, 7th November 2020 (Saturday)

Chair: Matthew Teow, Sunway University, Malaysia

Abstract

It has been an exciting 30 years journey since Mark Weiser put forward the vision of Ubiquitous Computing (Ubicomp) in 1990. He inspired many researchers to build and pursue a world where computing may appear anytime and anywhere without users being conscious about its existence. Since then, research and technology have made tremendous progress towards a world with "computers" that are increasing intuitive, smart and invisible. This talk shares the different eras and work in Ubicomp over 30 years and discuss how much have been achieved. More importantly, where will the achievements, failures and experience lead us in years to come towards the vision of Ubiquitous Robots?

Speaker's Biography

Assoc. Prof. Dr. Sian Lun Lau received his Dr.-Ing. and MSc in Electrical Communication Engineering from the University of Kassel, Germany. He also holds a BEng with Hons in Electronic and Telecommunications Engineering from Universiti Malaysia Sarawak (UNIMAS). During his nine years (2004 – 2013) as a researcher at the Chair for Communication Technology (ComTec) at the University of Kassel, he has worked and managed various German National- and EU-funded research projects. Among them are EU IST-MobiLife, ITEA S4ALL, BMBF MATRIX and EU-SEAM4US.

He joined Sunway University, Malaysia in February 2013. He is currently an Associate Professor at the Department of Computing and Information Systems and holds the responsibility as the Head of Department. Since 2015, he is also the Associate Dean for the School of Science and Technology. He continues active research and has published over 60 publications in conferences, workshops, book chapters as well as journals.

He is currently a senior member of the Institute of Electrical and Electronics Engineers (IEEE) and serves as an executive committee member in the IEEE Computer Society Malaysia Chapter since 2017. His research interests include ubiquitous computing, sustainable smart city, context-awareness and applied machine learning.

ACKNOWLEDGEMENT

The ICIRA 2020 Organizing Committee wishes to thank the following organizations for the contribution and support to the conference:

IEEE Computational Intelligence Society MALAYSIA CHAPTER

Springer

Malaysia Convention & Exhibition Bureau

MALAYSIA CONVENTION & EXHIBITION BUREAU

ICIRA 2020
TECHNICAL PROGRAM

Session RA-01

Robotic Vision, Recognition and Reconstruction

Type: Regular Session (Oral) Venue: Airmeet Parallel Session hall 1

Date: November 5, 2020 (Thursday) Time: 11:00am – 12:30pm (Malaysia Time)

Chair:

Mei Kuan Lim, Monash University Malaysia (Malaysia)

RA-01.1 @ 11:00am

(19) 6D Pose Estimation for Texture-less Industrial parts in the Crowd

Zhenhua Xiong (Shanghai Jiao Tong University, China)
Dexin Zhou (Shanghai Jiao Tong University, China)
Chao Liu (Shanghai Jiao Tong University, China)
Ziqi Chai (Shanghai Jiao Tong University, China)
Peng Li (Faw JieFang Group Co., LTD., China)

Abstract: Recovering the 6D object pose of industrial part is a common but challeng-ing problem in many robotic applications. In this paper, an accurate 6D pose estimation approach is proposed for texture-less industrial part in the crowd. The proposed method consists of three stages: object detection, pose hy-potheses generation, and pose refinement. Firstly, the bounding boxes of ob-ject instances in an RGB image are detected by a convolution neural net-work. The training dataset is automatically synthesized using an efficient im-age rendering method. Then, highlight detection and removal are employed to eliminate noise edges. The coarse pose hypotheses are generated using an edge-based fast directional chamfer matching algorithm. After that, the accu-rate 6D poses are obtained by applying a non-linear optimization to these pose hypotheses. A re-weighted least-squares loss function is utilized to sup-press outlier noise in optimization. Finally, an edge direction consistency score is used to evaluate these obtained poses and eliminate outliers. The proposed method only relies on single RGB image to recover the 6D object pose in the crowd. Experimental results of texture-less industrial parts show the accuracy and robustness of the proposed method.

RA-01.2 @ 11:30am

(26) A Self-Correction Based Algorithm for Single-Shot Camera Calibration

Shuangfei Yu (Guangdong University of Technology, China)
Tao Zhang (Guangdong University of Technology, China)
Jie Hong (Australian National University, China)
Zhi Yang (Guangdong University of Technology, China)
Yisheng Guan (Guangdong University of Technology, China)

Abstract: Camera calibration is a fundamental task in photogrammetry and computer vision. In view of the requirements in live camera characteristics, we present a novel calibration approach to obtain all the camera optimal parameters and the distortion rectification by using only a single image. The existing automatic calibration approaches inspired by the vanishing point theory or the homography matrix are not capable of entirely deal with the internal, external and the len distortion parameters simultaneously. Compared to the previous works, our approach solves the problem by applying the linear features extracted from the image and thus improves the accuracy and efficiency. Results of experiments in different scenes demonstrate the comparable performance to the traditional methods.

RA-01.3 @ 12:00pm

(30) An Automated View Planning Method of Robot 3D Measurement

Yang Yilin (Shanghai University, China)
Zhang Lin (Shanghai University, China)
Wu Zeping (Shanghai University, China)
Zhang Xu (Shanghai University, China)

Abstract: Precision measurement of large-scale workpiece is one of the most difficult problems in industrial measurement. In order to select suitable viewpoints to obtain precise measurement data, a lot of research has been done in the past decades. This paper proposes an automated view planning method of robot 3D measurement for large-scale workpiece. A viewpoint constraint model is used for landmarks inspection. The viewpoints are generated based on the visual cone theory and checked for validity. A cost function for robot motion is designed based on path length minimization, after what the optimal viewpoint can be determined. The simulated annealing algorithm is used to calculate the optimal sequence for robot to pass through all optimal viewpoints with the shortest total distance. Experimental result shows that the view planning method proposed in this paper increases the automation and efficiency of the whole system.

Session RA-02

Robot Design, development and control/Mobile Robots and intelligent autonomous system

Type: Regular Session (Oral) Venue: Airmeet Parallel Session hall 2
Date: November 5, 2020 (Thursday) Time: 11:00am – 12:30pm (Malaysia Time)

Chairs:
Yuen Peng Loh, Multimedia University (Malaysia)

RA-02.1 @ 11:00am

(29) Leveraging Blockchain for Spoof-Resilient Robot Networks

Tauhidul Alam (Louisiana State University Shreveport, Louisiana)
Jarrett Taylor (Louisiana State University Shreveport, Louisiana)
Jonathan Taylor (Louisiana State University Shreveport, Louisiana)
Shahriar Badsha (University of Nevada, Reno)
Abdur Rahman Bin Shahid (Concord University, West Virginia)
A.S.M. Kayes (La Trobe University, Australia)

Abstract: Autonomous robots, such as unmanned aerial or ground robots, are vulnerable to cyber attacks since they use sensor data heavily for their path planning and control. Furthermore, consensus is critical for resilient coordination and communication of robots in multi-robot networks against a specific adversarial attack called the spoofing attack, where robots can be compromised by an adversary. Therefore, we leverage Blockchain in a network of robots to coordinate their path planning and present a consensus method utilizing their transferred Blockchain data to detect compromised robots. Our simulation results corroborate the fact that the proposed method enhances the resilience of a robot network by detecting its spoofed client robots or compromised server at a significant rate during the spoofing attack.

RA-02.2 @ 11:30am

(37) ImPL-VIO: An Improved Monocular Visual-Inertial Odometry Using Point and Line Features

Haoqi Cheng (Harbin Institute of Technology, China)
Hong Wang (Harbin Institute of Technology, China)

Abstract: Most of visual-inertial navigation systems (VINS) that use only point features usually work well in regular environment, but decay in low textured scenes. Meanwhile, those systems rarely construct environmental map with structural information. In this paper, an improved tightly-coupled monocular visual-inertial odometry (ImPL-VIO) is developed. The whole system is composed of point and line feature tracking, inertial measurements processing, pose estimator and loop closure detection. For the better use of monocular line observations in the sliding window based pose estimator, an improved line triangulation algorithm is proposed after a detailed analysis of error sources. In addition, we, for the first time, employ the closest point (CP) representation for spatial lines to optimization-based VINS system, and derive the corresponding Jacobians analytically. Finally, simulation and real-world experiments are conducted to validate the proposed system.

RA-02.3 @ 12:00pm

(63) Rapid Actuation for Soft Pneumatic Actuators Using Dynamic Instability Mechanism

Xinyu Guo (Shanghai Jiao Tong University, China)
Wenbo Li (Shanghai Jiao Tong University, China)
Wenming Zhang (Shanghai Jiao Tong University, China)

Abstract: The response speed of soft pneumatic actuators is usually limited by the intrinsic material and unstressed stable form. This paper describes a design strategy for improving the response speed of pneumatic actuators by employing the dynamic instability mechanism of the actuator. An adjustable elastic cord is incorporated into the pneumatic actuator to form the snapping pneumatic actuator (SPA). Fur-thermore, the bottom layer of the pneumatic actuator is accompanied by a higher elasticity modulus to improve the recovery performance of SPA. In the inflation and deflation processes, the torque reversal triggering occurs due to the instability of SPA, releasing the elastic energy stored in elastic cord quickly. The dynamic instability mechanism of SPA improves the response speed and amplifies the per-formance of SPA. Theoretical modeling and experiments are implemented to re-veal the fast response characteristics of SPA. Experimental results show that the maximum inflation bending angular velocity of SPA reaches 41.88 rad/s, the maximum deflation bending angular velocity is 36.65 rad/s. The saltation that oc-curs multiple times due to the application of pre-loading force increases the max-imum response speed of SPA by more than 9 times.

Session RP-01

Robotic Vision, Recognition and Reconstruction

Type: Regular Session (Oral) Venue: Airmeet Parallel Session hall 1

Date: November 5, 2020 (Thursday) Time: 3:15pm – 4:45pm (Malaysia Time)

Chairs:

Dalin Zhou, University of Portsmouth (UK)

RP-01.1 @ 3:15pm

(46) Research on point cloud processing algorithm applied to robot safety detection

Nianfeng Wang (South China University of Technology, China)
Jingxin Lin (South China University of Technology, China)
Kaifan Zhong (South China University of Technology, China)
Xianmin Zhang (South China University of Technology, China)

Abstract: In this paper, a method of point cloud recognition and segmentation based on neural network is introduced. This method will be applied to the specific industrial scene to detect whether there are sudden obstacles around the robot during the working process. This method is mainly divided into two parts. The first part is to design an efficient neural network structure, which achieves modification from state of art methods. The second part is to generate the corresponding neural network point cloud training data set for the specific scene. A simulation model is used to generate scene point cloud, and a large number of data are generated randomly. Simulation results verify the effectiveness and practicability of this method.

RP-01.2 @ 3:45pm

(47) A Brief Simulation Method for Coded Structured Light Based 3D Reconstruction

Nianfeng Wang (South China University of Technology, China)
Weiyong Xie (South China University of Technology, China)
Kaifan Zhong (South China University of Technology, China)
Xianmin Zhang (South China University of Technology, China)

Abstract: Coded structured light based 3D reconstruction is one of the most reliable methods to recover a scene. The errors in the reconstruction are mainly caused by indirect illumination. So it is necessary to suppress the effect of indirect illumination to improve the reconstruction accuracy. In this paper, a simulation method of coded structured light based 3D reconstruction is presented. A simulated point cloud with high accuracy is generated for the noise reduction for the actual point cloud. A down-sampling method based on edge detection is also proposed to improve the efficiency of loading and transporting a point cloud. The experiment results verify the performance of simulation and down-sampling.

RP-01.3 @ 4.15pm

(16) The point position and normal detection system and its application

Jin Yun (ShangHai University, China)
Li Chen (Huazhong University of Science and Technology, China)
Zhang Xu (ShangHai University, China)

Abstract: Mixed reflection objects have the characteristics of specular reflection and diffuse reflection, so it is difficult to reconstruct and the accuracy is low. In order to solve such problems, a point and normal detection system is proposed. In this paper, an industrial camera, a point laser and a holographic film are used to form a point position and normal sensor, and based on this, the incident light and reflected light of the sampling point on the surface of the mixture are calculated and the normal information of the sampling point is obtained. The reconstruction of objects through Zernike polynomials have highly accuracy. Compared with the traditional method of reconstructing mixed reflection objects, the experimental results show that the point position and normal detection system has high reconstruction accuracy and robust. It can reconstruct both specular reflection and mixed reflection objects with easy operation, and diffuse reflection can achieve scanning modeling. The accuracy of the model can reach micron level.

Session RP-02

Robot Design, development and control/Mobile Robots and intelligent autonomous system

Type: Regular Session (Oral) Venue: Airmeet Parallel Session hall 2
Date: November 5, 2020 (Thursday) Time: 3:15pm – 4:45pm (Malaysia Time)

Chairs:
Sim Ying Ong, University of Malaya (Malaysia)

RP-02.1 @ 3:15pm

(22) Simulation of Human Upright Standing Push-Recovery Based on OpenSim

Ting Xiao (Wuhan University of Technology, China)
Biwei Tang (Wuhan University of Technology, China)
Muye Pang (Wuhan University of Technology, China)
Kui Xiang (Wuhan University of Technology, China)

Abstract: Investigating the human standing balance mechanisms under push-recovery task is of great importance to the study of biped robot balance control. Under human push-recovery mission, the passive stiffness, stretch reflex and short-range stiff-ness control mechanisms of human ankle joint are the main components in the internal mechanism of human body. To this end, this paper dedicates to evaluating the roles of the three aforementioned mechanisms during human upright standing push-recovery mission. Firstly, based on the simulation platform OpenSim4.0, this paper chooses a simplified lower-limb musculoskeletal model as the research object. Subsequently, this paper completes the design of the passive stiffness, stretch reflex and passive stiffness controller, and completes the static standing test and upright push-recovery simulation of the selected musculoskeletal model. Finally, in order to verify the effectiveness of the simulation, this paper uses electromyography, force plate and dynamic capture system to collect the relevant data of the human upright push-recovery. The experimental and simulation results re-veal that the selected musculoskeletal model can basically simulate the process of human upright push-recovery under the joint actions of the three mechanisms noted above, which, to some degree, can reflect the effectiveness of the established method. Thus, the established method may provide some insights on the balance control of the bipedal robot.

RP-02.2@ 3:45pm

(20) Variable Impedance Control of Manipulator based on DQN

Yongjin Hou (Huazhong University of Science and Tecnology, China)
Hao Xu (Huazhong University of Science and Tecnology, China)
Jia-Wei Luo (Huazhong University of Science and Tecnology, China)
Yanpu Lei (Huazhong University of Science and Tecnology, China)
Jinyu Xu (Huazhong University of Science and Tecnology, China)
Hai-Tao Zhang (Huazhong University of Science and Tecnology, China)

Abstract: For traditional constant impedance control, the robot suffers from constant stiffness, poor flexibility, large wear and high energy consumption in the process of movement. To address these problems, a variable impedance control method based on reinforcement learning (RL) algorithm DQN (Deep Q Network) is proposed in this paper. Our method can optimize the reference trajectory and gain schedule simultaneously according to the completion of the task and the complexity of the surroundings. Simulation experiments show that, compared with the constant impedance control, the proposed algorithm can adjust the impedance in real time

while the manipulator is executing the task, which implies a better compliance, less wear and less control energy.

RP-02.3 @ 4:15pm

(44) Determination of Singularity Occurrence and Characteristic Analysis of Dual 6-DOF Manipulator Using Manipulability and Manipulability Ellipsoid

Jong-Hak Lee (Pusan National University, South Korea)
Jin-Uk bang (Pusan National University, South Korea)
Jang-Myung Lee (Pusan National University, South Korea)

Abstract: In this paper, we judge whether the singularity occurs among the path of dual 6-DOF manipulator using manipulability and analyze the characteristics in the velocity space of the straight path and alternative path what avoids the singularity using manipulability ellipsoid. To do this, we solved the inverse kinematics of the manipulator and made simulator in MATLAB. In this simulator, the path can be set in advance and change of manipulability and manipulability ellipsoid can be observed. This allows better path to be deter-mined in advance before following it. Experiments has confirmed that singularity occurs in straight path and eigenvalue in the direction of yaw is zero. In addition, the alternative path is identified as an improved path due to the large eigenvalue in the direction of pitch and yaw. Since this result can be used as an indicator for evaluating the agent's state, we intend to apply to reinforcement learning and research to create a singularity avoidance path by the robot itself.

Session RA-03
Automation
Type: Regular Session (Spotlight) Venue: Airmeet Parallel Session hall 1
Date: November 6, 2020 (Friday) Time: 11:00am – 12:40pm (Malaysia Time)

Chair:
Chern Hong Lim, Monash University Malaysia (Malaysia)

RA-03.1 @ 11:00am
(13) An Improved Calibration Method of EMG-driven Musculoskeletal Model for Estimating Wrist Joint Angles
Jiamin Zhao (Shanghai Jiao Tong University, China)
Yang Yu (Shanghai Jiao Tong University, China)
Xinjun Sheng (Shanghai Jiao Tong University, China)
Xiangyang Zhu (Jiao Tong University, China)

Abstract: Lumped-parameter musculoskeletal model based on surface electromyography (EMG) promises to estimate multiple degrees-of-freedom (DoFs) wrist kinematics and might be potentially applied in the real-time control of powered upper limb prostheses. In this study, we proposed a new parameter calibration method based on the lumped-parameter musculoskeletal model. Compared with the existing calibration method in the lumped-parameter musculoskeletal model, this paradigm used an improved method of calculating estimated joint angles in optimization and a reduced training dataset (data from only single-DoF movements) to optimize model parameters. Surface EMG signals were then mapped into the kinematics of the wrist joint using the optimized musculoskeletal model. In the experiments, wrist joint angles and surface EMG signals were simultaneously acquired from able-bodied subjects while performing 3 movements, including flexion/extension (Flex/Ext) only, pronation/supination (Pro/Sup) only, and 2-DoF movements. The offline tracking performance of the proposed method was comparable to that of the existing calibration method with averaged r=0.883 and NRMSE=0.218. Moreover, the results demonstrated significant superiority of the proposed method over the existing method with less amount of data for parameter tuning, providing a promising direction for predicting multi-DoF limb motions with only single-DoF information.

RA-03.2 @ 11:20am
(21) Deep learning for plant disease identification from disease region images
Aliyu Abdu (Universiti Teknologi Malaysia, Malaysia)
Musa Mokji (Universiti Teknologi Malaysia, Malaysia)
Usman Ullah Sheikh (Universiti Teknologi Malaysia, Malaysia)

Abstract: This paper proposes a deep learning (DL) plant disease identification approach at leaf surface level using image data of pathologically segmented disease region or region of interest (ROI). The DL model is an exceptional technique used in automatic plant disease identification that employs a series of convolutions for feature representation of the visible disease region, mainly characterized as the combination of the chlorotic, necrotic, and blurred (fuzzy) lesions. The majority of current DL model approaches apply whole leaf image data for which studies have shown its consequential tendencies of leading to irrelevant feature representations of the ROI. The effects of which are redundant feature learning and low classification performance. Consequently, some state-of-the-art deep learning methods practice

using the segmented ROI image data, which does not necessarily follow the pathological disease inference. This study proposes an extended ROI (EROI) algorithm using pathological inference of the disease symptom to generate the segmented image data for improved feature representation in DL models. The segmentation algorithm is developed using soft computing techniques of color thresholding that follows an individual symptom color feature that resulted in the incorporation of all lesions. The results from three different pre-trained DL models AlexNet, ResNet, and VGG were used to ascertain the efficacy of the approach. The advantage of the proposed method is using EROI image data based on pathological disease analogy to implement state-of-the-art DL models to identify plant diseases. This work finds application in decision support systems for the automation of plant disease identification and other resource management practices in the field of precision agriculture.

RA-03.3 @ 11:40am
(41) An Adaptive Seam-tracking System with Posture Estimation for Welding
Zhi Yang (Guangdong University of Technology, China)
Shuangfei Yu (Guangdong University of Technology, China)
Tao Zhang (Guangdong University of Technology, China)
Yisheng Guan (Guangdong University of Technology, China)

Abstract: In order to adapt to the conditions of uncertain working positions and complex shapes of workpieces in the field of welding, a robotic seam tracking system with welding posture estimation is proposed in this paper. During welding, the target coordinate system of the welding torch is established in real time at each welding position, and the rotation angles are obtained to change the welding posture of the robot. In order to improve the accuracy and robustness of welding seam tracking, gaussian kernel correlation filter is used to track the weld feature in real time. Compared with morphological methods, this method can quickly and accurately find the position of the weld from the noise image. Finally, experiments results show that this method can be used to calculate the welding posture, which meet the welding requirements of complex environment.

RA-03.4 @ 12:00pm
(17) Non-invasive Measurement of Pulse Rate Variability Signals by a PVDF Pulse Sensor
Dun Hu (University of Science and Technology of China, China)
Na Zhou (The Fourth Affiliated Hospital of Anhui Medical University, China)
Chenlei Xie (University of Science and Technology of China, China)
Lifu Gao (Institute of Intelligent Machines, HFIPS, Chinese Academy of Sciences, China)

Abstract: Pulse rate variability (PRV) is a small change in the heart beat cycle that can be obtained from the pulse signal. PRV has important application value in clinical diagnosis, disease monitoring, and prevention. PRV can be conveniently extracted from the fingertip pulse signal obtained by a photoplethysmography (PPG) pulse sensor. However, this method requires clamping the fingertip during the measurement, which is uncomfortable for the monitored person and is not conducive to continuous PRV detection in family monitoring or in a specific environment, such as driving. Thus, in this paper, we propose a pulse sensor with a soft polyvinylidene fluoride (PVDF) piezoelectric film. The non-invasive pulse signals can be collected by lightly pressing the fingertip on the sensor. In the experiment, two PVDF pulse sensors were used to collect the pulse waves from the left wrist and left forefinger;

simultaneously, an infrared PPG pulse sensor measures the pulse wave of the right forefinger. The pulse waves measured by the three methods were further filtered to extract PRV signals and compare the differences. The results show that the PRV signal obtained by the PVDF sensor pressing measurement method has good consistency with the PRV signal obtained by PPG measurement, and the PVDF pulse sensor can be conveniently applied in wearable devices and portable medical devices to obtain the PRV.

Session RA-04

Robotic Vision, Recognition and Reconstruction

Type: Regular Session (Spotlight) Venue: Airmeet Parallel Session hall 2

Date: November 6, 2020 (Friday) Time: 11:00am – 12:40pm (Malaysia Time)

Chairs:

David Chuah Joon Huang, University of Malaya (Malaysia)

RA-04.1 @ 11:00am

(25) Multi-scale crack detection based on Keypoint detection and minimal path technique

Nianfeng Wang (South China University of Technology, China)
Hao Zhu (South China University of Technology, China)
Xianmin Zhang (South China University of Technology, China)

Abstract: In this paper, a method for the detection of multi-scale cracks based on computer vision is introduced. This crack detection method is divided into two parts to extract crack features from the images. In the first part, the original image is mapped to different scale Spaces and the pixels with strong ridge characteristic are detected with a Hessian-matrix in these scales Spaces. Then the detection results in different scales are superimposed. Finally, an evaluation index is designed to select the Keypoints detected in the previous step. In the second part, the cracks are detected based on a modified Fast Marching Mothed which is improved into an iterative algorithm with self-terminating capability. The Keypoints detected and selected in the first part are used as endpoints for the crack detection. Then the burrs are removed from the detection results. The experimental results show that under different lighting and road conditions, the crack feature can be extracted stably by this method.

RA-04.2 @ 11:20am

(48) Human Gait Analysis Method Based on Kinect Sensor

Nianfeng Wang (South China University of Technology, China)
Guifeng Lin (South China University of Technology, China)
Xianmin Zhang (South China University of Technology, China)

Abstract: In this paper, a new method for human gait analysis based on the Kinect Sensor is introduced. Such method based on Kinect sensor can be divided into three steps: data acquisition, pre-processing and gait parameter calculation. First, a GUI (Graphical User Interface) was designed to control the Kinect sensor and get its raw data we need. In the pre-processing, abnormal frames are removed first. Afterwards, the influence of Kinect's installation error is eliminated by coordinate system transformation. What's more, the noise is eliminated by using moving average filtering and median filtering. Finally, gait parameters are obtained by the designed algorithm which composed of gait cycle detection, gait parameter calculation, and gait phase extraction. The validity of the gait analysis method based on Kinect v2 was verified by experiments.

RA-04.3 @ 11:40am
(49) A method for welding track correction based on emulational laser and trajectory
Nianfeng Wang (South China University of Technology, China)
Jialin Yang (South China University of Technology, China)
Kaifan Zhong (South China University of Technology, China)
Xianmin Zhang (South China University of Technology, China)

Abstract: In this paper, a method for welding track correction based on emulational laser and trajectory are introduced. The proposed method is divided into two parts: seam tracking and trajectory correction. In the seam tracking method, by using the prior information of emulational laser stripes which are generated by the simulation software and affine transformation of emulational laser stripes, the real seam point can be detected. And then the trajectory correction method mainly consists of three steps: pre-processing, coarse matching and presice matching by using Iterative Closest Point Matching(ICP). For various conditions and workpieces, the corresponding experiments are conducted in this paper. Experimental results demonstrate that the method can meet the requirement of the internal seams tracking of workpiece and accuracy of welding track correction.

RA-04.4 @ 12:00pm
(58) A Novel Edge Detection and Localization Method of Depalletizing Robot
Weihong Liu (School of Mechanical Engineering and Automation, Beihang University, China)
Yang Gao (Zhejiang Cainiao Supply Chain Management Co.,Ltd, China)
Yong Wang (Zhejiang Cainiao Supply Chain Management Co.,Ltd, China)
Zhe Liu (Robotics Institution, Beihang University, China)
Diansheng Chen (Robotics Institution, Beihang University; Beijing Advanced Innovation Center for Biomedical Engineering, China)

Abstract: The application of intelligent robots to perform the depalletizing task is a common requirement in warehouse automation. To solve the problem of identification and localization caused by the disorderly stacking of boxes in pallet, and to eliminate the interference of the reflective material contained in the stacks, this paper proposes an edge extraction algorithm that combines 3D and 2D data. The algorithm firstly obtains the plane position data through three-dimensional point cloud, secondly uses an edge detection algorithm to extract edges in the two-dimensional image. Finally, an optimal segmentation strategy is performed, which is based on the results of point cloud segmentation, edge extraction, and the size information of boxes. Therefore, we can determine the position of each box in the space accurately. Compared with algorithms that only use 2D and 3D data, our method can effectively filter interference. The accuracy rate is close to 100%, which meets the requirements of industrial applications.

Session RP-03

Robotic Design, Development and Control

Type: Regular Session (Spotlight) Venue: Airmeet Parallel Session hall 1
Date: November 6, 2020 (Friday) Time: 3:15pm – 4:55pm (Malaysia Time)

Chairs:
Hermawan Nugroho, University of Nottingham Malaysia (Malaysia)

RP-03.1 @ 3:15pm

(12) Kinematic Calibration for Industrial Robot Using a Telescoping Ballbar

Zeming Wu (Shanghai Jiao Tong University, China)
Peng Guo (Shanghai Jiao Tong University, China)
Yang Zhang (Shanghai Jiao Tong University, China)
Limin Zhu (Shanghai Jiao Tong University, China)

Abstract: Industrial robots are increasingly used in many applications where the positioning accuracy is of great importance. Kinematic calibration is an effective method to improve the positioning accuracy of industrial robots. In this paper, a new kinematic calibration method is proposed for six-axis serial industrial robots based on a single telescoping ballbar. The end of the robot to be calibrated is moved to a set of specific poses, and the actual distance between the tool center point (TCP) of the industrial robot and a fixed point in the world frame is measured by a telescoping ballbar. Through fitting the distance residual errors, the robot calibration problem is transformed into a nonlinear least-squares optimization problem. The optimization problem is solved using the Levenberg-Marquardt algorithm to derive the actual kinematic parameter errors of the robot. A simulation study demonstrates that the proposed method can effectively identify the kinematic parameter errors and the average position errors are reduced from 19.368mm to 0.073mm after calibration.

RP-03.2 @ 3:35pm

(24) Design and development of sEMG-Controlled prosthetic hand with temperature and pressure sensory feedback

Chenxi Li (South China University of Technology, China)
Nianfeng Wang (South China University of Technology, China)

Abstract: In this paper we deal with the design and development of a prosthetic hand using sEMG control, temperature and pressure sensors. Through the acquisition of the sEMG produced by the movement of the flexor digitorum superficialis, the prosthetic hand controlled the contraction and relaxation of the prosthetic hand. At the same time, the prosthetic hand can automatically detect the pressure and temperature of objects being held. It can pass the real-time pressure and temperature of the object held by the prosthetic hand to users, who can independently control the force, perceive the temperature of the object, and heat the surface of the prosthetic hand to the same temperature as the body by using the heating films. The prosthetic hand can provide better satisfaction to users and promote the humanistic care of disabled people. At present, the prosthetic hand has achieved the functions below: the acquisition of the sEMG; movement control of finger opening and closing; the acquisition of pressure and temperature of the object being held; pressure and temperature perception in prosthetic hand users; thermostatic control of prosthetic hand surface.

RP-03.3 @ 3:55pm

(28) Two-wheel balancing robot foot plate control using Series Elastic Actuator

Yeong-keun Kwon (Pusan National University, South Korea)
Jin-uk Bang (Pusan National University, South Korea)
Jang-myung Lee (Pusan National University, South Korea)

Abstract: In this paper we deal with the design and development of a prosthetic hand using sEMG control, temperature and pressure sensors. Through the acquisition of the sEMG produced by the movement of the flexor digitorum superficialis, the prosthetic hand controlled the contraction and relaxation of the prosthetic hand. At the same time, the prosthetic hand can automatically detect the pressure and temperature of objects being held. It can pass the real-time pressure and temperature of the object held by the prosthetic hand to users, who can independently control the force, perceive the temperature of the object, and heat the surface of the prosthetic hand to the same temperature as the body by using the heating films. The prosthetic hand can provide better satisfaction to users and promote the humanistic care of disabled people. At present, the prosthetic hand has achieved the functions below: the acquisition of the sEMG; movement control of finger opening and closing; the acquisition of pressure and temperature of the object being held; pressure and temperature perception in prosthetic hand users; thermostatic control of prosthetic hand surface.

RP-03.4 @ 4:15pm

(39) Design of USV for Search & Rescue in Shallow Water

Chew Min Kang (University of Nottingham Malaysia, Malaysia)
Loh Chow Yeh (University of Nottingham Malaysia, Malaysia)
Sam Yap Ren Jie (University of Nottingham Malaysia, Malaysia)
Tan Jing Pei (University of Nottingham Malaysia, Malaysia)
Hermawan Nugroho (University of Nottingham Malaysia, Malaysia)

Abstract: Growing interests in Unmanned Surface Vehicle (USV) for Search and Rescue missions associated with both oceans and shallow waters have raised the attention of researchers in relevant field. These disaster robotic boats can contribute to the successful rate of search mission. Currently there are no standards structure of the boat considering its speed, stability and load capacity. In this project, we pro-pose a modified single chine twin hull catamaran design for the USV. Adaptation of PID control system integrating with the robotics algorithms is applied to pro-vide light speed manoeuvrability and stability. The USV is equipped with an arti-ficial intelligence module to seek and pinpoint the location of victims while utilis-ing the localization system that allows the USV to reach targeted location without reference value from disturbances. Designing such prototype requires a reliable main structure and control systems. Synthesis of these systems and technology proves a successful deployment of the USV. Results show that more practical capabilities are encouraged.

RP-03.5 @ 4:35pm

(42) 4-leg landing platform with sensing for reliable rough landing of multi-copters

Dong-hun Cheon (Pusan National University, South Korea)
Ji-wook Choi (Pusan National University, South Korea)
Jang-myung Lee (Pusan National University, South Korea)

Abstract: In this paper we propose a landing system in which multi-copters can make stable landings even in rough terrain. In order to utilize multi-copters in various environments, it is necessary to develop a landing platform that can be landed in rough terrain. The 4-leg landing platform of 2-link structure was analyzed kinematically and produced through 3D modeling. The landing platform detects contact with the ground through the Force Sensor upon landing and estimates the slope angle with the IMU (Inertial Measurement Unit) sensor. Using the formula proposed in this paper, maintain horizontality by controlling the angle value of each leg joint. We presented a rough environment and tested the proposed landing platform to verify its effectiveness.

RP-03.6 @ 4:55pm

(36) Kinematics analysis of a new spatial 3-DOF parallel Mechanism

Yang Chao (Beijing University of Posts and Telecommunications, China)
Li Duanling (Beijing University of Posts and Telecommunications, China)
Jia Pu (Beijing University of Posts and Telecommunications, China)

Abstract: Growing interests in Unmanned Surface Vehicle (USV) for Search and Rescue missions associated with both oceans and shallow waters have raised the attention of researchers in relevant field. These disaster robotic boats can contribute to the successful rate of search mission. Currently there are no standards structure of the boat considering its speed, stability and load capacity. In this project, we pro-pose a modified single chine twin hull catamaran design for the USV. Adaptation of PID control system integrating with the robotics algorithms is applied to pro-vide light speed manoeuvrability and stability. The USV is equipped with an arti-ficial intelligence module to seek and pinpoint the location of victims while utilis-ing the localization system that allows the USV to reach targeted location without reference value from disturbances. Designing such prototype requires a reliable main structure and control systems. Synthesis of these systems and technology proves a successful deployment of the USV. Results show that more practical capabilities are encouraged.

Session RP-04
Human-Robot Interaction
Type: Regular Session (Spotlight) Venue: Airmeet Parallel Session hall 2
Date: November 6, 2020 (Friday) Time: 3:15pm – 4:55pm (Malaysia Time)

Chairs:
Wai Lam Hoo, University of Malaya (Malaysia)

RP-04.1 @ 3:15pm
(34) Variational Augmented the Heuristic Funnel-transitions Model for Dexterous Robot Manipulation
Jiancong Huang (Guangdong University of Technology, China)
Hongmin Wu (Guangdong Institute of Intelligent Manufacturing, China)
Yisheng Guan (Guangdong University of Technology, China)

Abstract: Learning from demonstrations is a heuristic technique that can only obtain the intentional dynamics of robot manipulation, which may fail to the task with unexpected anomalies. In this paper, we present a method for enhancing the diversity of multimodal signals collected from few-shot demonstrations using Variational Auto-encoders (VAEs), which can provide sufficient observations for clustering many funnel representations of the complex and multi-step task with anomalies. Then a funnel-base reinforcement learning is applied to obtain the policy from the synthetic funnel-transition model. Experimental verifications are based on an open-source force/torque dataset and our previous kitting experiment setup that equips with a well-constructed framework for multimodal signal collection, anomaly detector, and classifier. The baseline is used traditional funnel policy learning (without use augmented signals), the result shows significant improvement on the success rate from 70% to 90% on performing the kitting experiments after combined with the VAEs augmented signals to compute the funnel-transitions model. To the best of our knowledge, our scheme is the first attempt for improving robot manipulation by few demonstrations, which not only can respond to the normal manipulation but also can well adapt to the unexpected abnormal out of the demonstration. Our method can be extended to the environment that not only difficult to collect sufficient transitions online but having unpredictable anomaly. For example learning long-horizon household skills.

RP-04.2 @ 3:35pm
(38) A Guided Evaluation Method for Robot Dynamic Manipulation
Xuguang Lan (Xi'an Jiaotong University, China)
Chuzhen Feng (Xi'an Jiaotong University, China)
Wanli Peng (Xi'an Jiaotong University, China)
Zhuo Liang (China Academy of Launch Vehicle Technology, China)
Haoyu Wang (Xi'an Jiaotong University, China)

Abstract: It is challenging for reinforcement learning (RL) to solve the dynamic goal tasks of robot in sparse reward setting. Dynamic Hindsight Experience Replay (DHER) is a method to solve such problems. However, the learned policy DHER is easy to degrade, and the success rate is low, especially in complex environment. In order to help agents learn purposefully in dynamic goal tasks, avoid blind exploration, and improve the stability and robustness of policy,

we propose a guided evaluation method named GEDHER, which assists the agent to learn under the guidance of evaluated expert demonstrations based on the DHER. In addition, We add the Gaussian noise in action sampling to balance the exploration and exploitation, preventing from falling into local optimal policy. Experiment results show that our method outperforms original DHER method in terms of both stability and success rate.

RP-04.3 @ 3:55pm
(55) sEMG Feature Optimization Strategy for Finger Grip Force Estimation
Changcheng Wu (Nanjing University of Aeronautics and Astronautics, China)
Qingqing Cao (Nanjing Institute of Industry Technology, China)
Fei Fei (Nanjing University of Aeronautics and Astronautics, China)
Dehua Yang (Nanjing University of Aeronautics and Astronautics, China)
Baoguo Xu (Southeast University, China)
Hong Zeng (Southeast University, China)
Aiguo Song (Southeast University, China)

Abstract: Finger Grip force estimation based on sEMG plays an important role in dex-terous control of a prosthetic hand. In order to obtain higher estimation ac-curacy, one of the commonly used methods is to extract more features from sEMG and input them into the regression model. This practice results in a large amount of computation and is not suitable for practical use in low cost commercial prosthetic hand. In this paper, a sEMG feature optimization strategy for thumb-index finger grip force estimation is proposed with the purpose that using less features to achieve higher estimation accuracy. Four time-domain features are extracted from raw sEMG signals which captured from four muscle surfaces of the subject's forearm. GRNN is employed to realize the estimation of the finger grip force. RMS and MAE are adopted to validate the performance of estimation. The effects of different feature sets on the estimation performance are evaluated by ANOVA. And the Tukey HSD testing is conducted to optimal the feature set. The results show that sEMG features have a significant influence on the grip force estimation re-sults. The optimal feature combination is VZ, which provides an accuracy of 1.13N RMS and 0.85N MAE.

RP-04.4 @ 4:15pm
(57) Master-Slave Control f of a Bio-inspired Biped Climbing Robot
LEI Ting (Electric Power Research Institute of Guangdong Power Grid Co.,Ltd., Guangdong Diankeyuan Energy Technology Co.,Ltd, China)
WEI Hai-bin (Guangdong University ofTechnology, China)
ZHONG Yu (Guangdong University ofTechnology, China)
ZHONG Li-qiang(Electric Power Research Institute of Guangdong Power Grid Co.,Ltd., Guangdong Diankeyuan Energy Technology Co.,Ltd, China)
ZHANG Xiao-ye(Electric Power Research Institute of Guangdong Power Grid Co.,Ltd., Guangdong Diankeyuan Energy Technology Co.,Ltd, China)

Abstract: Biped climbing robot is able not only to climb a variety of media, but also to grasp and manipulate objects, it just like a " mobile " manipulator, and it has great application prospect in high-rise tasks in agriculture, forestry and architecture. Motivated by these potential applications, a climbing robot (Climbot) was proposed in this paper, and a modular master robot which is isomorphic to the climbing robot is designed. Then, a master-slave robot system with joint-to-joint mapping strategy is developed, which is combined with the Climbot and

master robot. In this system, the master robot can control the slave robot intuitively, and experiments of climbing poles are conducted to verify the feasibility and efficiency of the proposed master-slave robot system.

RP-04.5 @ 4:35pm

(54) A Learning Approach for Optimizing Robot Behavior Selection Algorithm

Basile Tousside (Bochum University of Applied Sciences, Germany)
Janis Mohr (Bochum University of Applied Sciences, Germany)
Marco Schmidt (Bochum University of Applied Sciences, Germany)
Joerg Frochte (Bochum University of Applied Sciences, Germany)

Abstract: Algorithms are the heart of each robotics system. A specific class of algorithm embedded in robotics systems is the so-called behavior - or action - selection algorithm. These algorithms select an action a robot should take, when performing a specific task. The action selection is determined by the parameters of the algorithm. However, manually choosing a proper configuration within the high-dimensional parameter space of the behavior selection algorithm is a non-trivial and demanding task. In this paper, we show how this problem can be addressed with supervised learning techniques. Our method starts by learning the algorithm behavior from the parameter space according to environment features, then bootstrap itself into a more robust framework capable of self-adjusting robot parameters in real-time. We demonstrate our concept on a set of examples, including simulations and real world experiments.

Session RA-05

Automation

Type: Regular Session (Spotlight) Venue: Airmeet Parallel Session hall 1
Date: November 7, 2020 (Saturday) Time: 11:00am – 12:40pm (Malaysia Time)

Chair:
Ven Jyn Kok, Universiti Kebangsaan Malaysia (Malaysia)

RA-05.1 @ 11:00am

(9) Towards Safe and Socially Compliant Map-less Navigation by Leveraging Prior Demonstrations

Shiqing Wei (Shanghai Jiao Tong University, China)
Xuelei Chen (Shanghai Jiao Tong University, China)
Xiaoyuan Zhang (Shanghai Jiao Tong University, China)
Chenkun Qi (Shanghai Jiao Tong University, China)

Abstract: This paper presents a learning-based approach for safe and socially compliant map-less navigation in dynamic environments. Our approach maps directly 2D-laser range findings and other measurements to motion commands, and a combination of imitation learning and reinforcement learning is deployed. We show that, by leveraging prior demonstrations, the training time for RL can be reduced by 60% and its performance is greatly improved. We use Constrained Policy Optimization (CPO) and specially designed rewards so that a safe and socially compliant behavior is achieved. Experiment results prove that the obtained navigation policy is capable of generalizing to unseen dynamic scenarios.

RA-05.2 @ 11:20am

(27) Task-Oriented Collision Avoidance in Fixed-Base Multi-Manipulator Systems

Jia-Wei Luo (Huazhong University of Science and Tecnology, China)
Jinyu Xu (Huazhong University of Science and Tecnology, China)
Yongjin Hou (Huazhong University of Science and Tecnology, China)
Hao Xu (Huazhong University of Science and Tecnology, China)
Yue Wu (Huazhong University of Science and Tecnology, China)
Hai-Tao Zhang (Huazhong University of Science and Tecnology, China)

Abstract: Collision avoidance implies that extra motion in joint space must be taken, which might exert unexpected influences on the execution of the desired end-effector tasks. In this paper, a novel framework for generating collision-free trajectories while respecting task priorities is proposed. Firstly, a data-driven approach is applied to learn an efficient representation of the distance decision function of the system. The function is then working as the collision avoidance constraints in the inverse kinematics (IK) solver, which avoids the collision between manipulators. To eliminate undesired influences of the extra motion for collision avoidance on the execution of tasks, task constraints are proposed to control the task priorities, offering the system with the ability to trade-off between collision avoidance and task execution. Furthermore, the overall framework is formulated as a QP (quadratic programming), therein guarantees a real time performance. Numerical simulations are conducted to demonstrate the effectiveness and efficiency of the presented method.

RA-05.3 @ 11:40am
(43) A Miniature Robot with Changeable Multiple Locomotion Modes
Wenju Ye (Guangdong University of Technology, China)
Jingheng Chen (Guangdong University of Technology, China)
Yisheng Guan (Guangdong University of Technology, China)
Haifei Zhu (Guangdong University of Technology, China)

Abstract: High mobility is always a very important feature of mobile robots, highly depending on locomotion modes. Integrating multiple locomotion modes will provide robot with better mobility and higher adaptability to a variety of terrain. Therefore, how to integrate multiple locomotion modes in one robot has been an interesting and important issue. In this paper, a miniature robot with at least three locomotion modes: wriggling like a caterpillar, winding like a snake and biped walking, is presented. The study describes how such a non-wheeled mobile robot can possess different locomotion modes, and moreover, how the transition between them can be implemented. The feasibility and effectiveness of the different modes, as well as transition among them are illustrated with some simple experiments.

RA-05.4 @ 12:00pm
(45) Problem of robotic precision cutting of the geometrically complex shape from an irregular honeycomb grid
Maksim Kubrikov (Reshetnev Siberian State University of Science and Technology, Russia)
Mikhail Saramud (Siberian Federal University, Russia)
Margarita Karaseva (Siberian Federal University, Russia)

Abstract: The article considers solving the problem of precision cutting of honeycomb blocks. The urgency of using arbitrary shapes application cutting from honey-comb blocks made of modern composite materials is substantiated. The problem is to obtain a cut of the given shape from honeycomb blocks. The complexity of this problem is in the irregular pattern of honeycomb blocks and the presence of double edges, which forces an operator to scan each block before cutting. It is necessary to take into account such restrictions as the place and angle of the cut and size of the knife, its angle when cutting and the geometry of cells. For this problem solving, a robotic complex has been developed. It includes a device for scanning the geometry of a honeycomb block, software for cutting automation and a cutting device itself. The software takes into account all restrictions on the choice of the location and angle of the operating mechanism. It helps to obtain the highest quality cut and a cut shape with the best strength characteristics. An actuating device has been developed and implemented for both scanning and cutting of honeycomb blocks directly. The necessary tests were carried out on real aluminium honeycomb blocks. Some technical solutions are used in the cutting de-vice to improve the quality of cutting honeycomb blocks. The tests have shown the effectiveness of the proposed complex. Robotic planar cutting made it possible to obtain precise cutting with a high degree of repeatability.

RA-05.5 @ 12:20pm

(62) Research on Key Technology of Logistics Sorting Robot

Hongwei Xiang (BeiHang University, China)
Yong Wang (Zhejiang Cainiao Supply Chain Management Co.,Ltd, China)
Yang Gao (Zhejiang Cainiao Supply Chain Management Co.,Ltd, China)
Zhe Liu (Robotics Institution, Beihang University, China)
Diansheng Chen (Robotics Institution, Beihang University; Beijing Advanced Innovation Center for Biomedical Engineering, China)

Abstract: It is an important direction to reduce the cost and improve the efficiency in the field of logistics to use automatic equipment such as mechanical arm to complete logistics sorting efficiently and accurately. This paper introduces a kind of mechanical arm sorting system. It improves two technologies──instance segmentation and poses estimation by using instance seg-mentation technology based on deep learning and calculating the point cloud vector of the depth camera. By using the Rapid-exploration Random Tree-Connect method (RRT-Connect) and Probabilistic Roadmap Method (PRM) algorithm, it can complete motion planning and select sucker to absorb and hold objects according to commodity size and weight. It is proved that the model recognition rate of the training system is high, the working efficiency of the system is 500 pieces/h, and the success rate of grasping is more than 99%.

Session RA-06

Advanced Measurement and machine Vision System

Type: Regular Session (Spotlight) Venue: Airmeet Parallel Session hall 2
Date: November 7, 2020 (Saturday) Time: 11:00am – 12:40pm (Malaysia Time)

Chairs:
Yiqi Tew, Tunku Abdul Rahman University College (Malaysia)

RA-06.1 @ 11:00am

(15) An Efficient Calibration Method for 3D Nonlinear and Nonorthogonal Scanning Probe in Cylindrical CMM

Kangyu Yang (Shanghai Jiao Tong University, China)
Xu Zhang (HUST-Wuxi Research Institute, China)
Jinbo Li (HUST-Wuxi Research Institute, China)
Limin Zhu (Shanghai Jiao Tong University, China)

Abstract: In terms of the measurement accuracy of traditional CMM, a three-dimensional (3D) probe plays a great part in machine performance. However, there is few models and calibrations for 3D nonlinear and nonorthogonal scanning probe to have been published in cylindrical coordinate measuring machine (Cylindrical CMM). In this paper, a proper nonlinear model on the 3D probe is established which is based on Taylor series expansion. Moreover, an efficient calibration method is proposed to compensate not only 3D deformation of the probe but also radius of the probe tip. A high-accuracy sphere is selected as an artefact and several practical and feasible scanning paths are designed. During the calibration, optimization of the third-order model benefits from the second-order model for providing the approximate coefficient magnitudes. The proposed calibration method was experimentally carried out on an assembled four-axis CMM. Although both of the two models can reach a micron level, a compensation of the third-order model is more accurate. The correctness of the model and the efficiency of the calibration method were successfully demonstrated by probing another high-accuracy ball and the uncertainty was also analyzed.

RA-06.2 @ 11:20am

(18) A matching algorithm for featureless sparse point cloud registration

Wu Zeping (Shanghai University, China)
Yang Yilin(Shanghai University, China)
Zhang Xu(Shanghai University, China)
Zhang Lin (HUST-Wuxi Reasearch Institute, China)

Abstract: Be confronted with the challenges of effiency and accuracy, point cloud registration, as a universal technique adopted in vision system, has always been used for large-dimension workpieces measurement. In this paper, we present a matching algorithm for determining the transformation relation between local point cloud and global point cloud with corresponding points unknown. First, multilinked lists of distance for point clouds are constructed with k-D tree. Then, a closed-traversal matching algorithm is proposed, which uses subgraph isomorphism to fid possible matching results. The possible results still need further verifiation by recursive to get a credible matching result. In the end, a method is designed to solve and verify the transformation matrix by singular value decomposition. The performance of the algorithm is evaluated with the actual data obtained from vision measuring system. The experiments show that the algorithm is of high performance and effiency and can be applied to practical problems of point cloud registration.

RA-06.3 @ 11:40am

(32) Iterative Phase Correction Method and its application

Li Chen (Huazhong University ofScience and Technology, China)
Jin Yun (Shanghai University, China)
Zhang Xu (Shanghai University, China)
Zhao Huan (Shanghai University, China)

Abstract: To solve the issue of phase recovery from low-quality fringe images (caused by noise, non-linear intensity and surface reflectivity changes), an iterative phase correction method is proposed. The high precision phase solution is achieved by projecting the wrapped phase into the phase shift fringe image space and performing iterative filtering. In general, compared with conventional methods, the proposed iterative phase correction method has three main advantages: 1) suppresses the influence of noise without interference from surface reflectivity; 2) effectively improve the phase accuracy, thereby improving the 3D measurement accuracy; 3) effectively recover the phase information of surfaces with very low or very high reflectivity without additional projection of phase shift fringe images. The effectiveness of the proposed iterative phase correction method is verified by the simulation and experiments. The proposed method applied to binocular structured light can significantly improve the measurement accuracy and greatly improve the measurement effect on objects with drastically changes in reflectivity. Under the calibration accuracy in the paper, the root mean square (RMS) deviations of measurement results of binocular structured light can reach 0.0094 mm.

Session SP-01

Soft Actuators

Type: Special Session
Venue: Airmeet Parallel Session hall 1
Date: November 7, 2020 (Saturday)
Time: 3:15pm – 5:15pm (Malaysia Time)

Chairs:
Zicai Zhu, Xi'an Jiaotong University (China)
Wenming ZHang, Shanghai Jiaotong University (China)
Liwu Liu, Harbin Institute of Technology (China)
Ying Hu, Hefei University of Technology (China)

SP-01.1 @ 3:15pm

(33) Control of a Series Elastic Actuator based on Sigmoid-proportional-retarded (SPR) with Online Gravity Compensation

Feng Jiang (Shanghai Jiaotong university, China)
Jiexin Zhang (Shanghai Jiaotong university, China)
Bo Zhang (Shanghai Jiaotong university, China)

Abstract: In this paper, a rotary series elastic actuator (SEA) based on torsion spring is designed. A novel position control law (Sigmoid-proportional-retarded) with online gravity compensation (OGC) is presented in order to reduce the residual vibration of the link and shorten the response time. Moreover, the stability of SPR control law is proved by the Lyapunov method. Some comparative experiments were implemented. It is concluded that SPR control based on OGC can reach the target position accurately and quickly. Meanwhile, the results show that the method is also effective in eliminating residual vibration.

SP-01.2 @ 3:45pm

(64) A Flexible Mechanical Arm based on Miura-ori

Meng Yu (Beijing University of Chemical Technology, China)
Xiu Zhang (Beijing University of Chemical Technology, China)
Weimin Yang (Beijing University of Chemical Technology, China)
Yuan Yu (Beijing University of Chemical Technology, China)
Yumei Ding (Beijing University of Chemical Technology, China)
Zhiwei Jiao (Beijing University of Chemical Technology, China)

Abstract: In this paper, a flexible mechanical arm（FMA）based on Miura origami structure is designed and its driving performance is studied. Through inflating or pumping air passage of the FMA, the relationship between the air pressure and the bending angle of the FMA is obtained; Through the inflation or extraction of the three air passages of the FMA， the relationship between the air pressure and the elongation or compression of the robotic arm is obtained. The results show that the FMA is flexible and can realize the bending, elongation and compression of the FMA in the two situations of inflation and extraction.

Session SP-02

Recent Trends in Computational Intelligence

Type: Special Session | Venue: Airmeet Parallel Session hall 2
Date: November 7, 2020 (Saturday) | Time: 3:15pm – 5:15pm (Malaysia Time)

Chairs:
Kam Meng Goh, Tunku Abdul Rahman University College (Malaysia)
Chern Hong Lim, Monash University Malaysia (Malaysia)

SP-02.1 @ 3:15pm

(23) Progressive Attentional Learning for Underwater Image Super-Resolution

Xuelei Chen (Shanghai Jiao Tong University, China)
Shiqing Wei (Shanghai Jiao Tong University, China)
Chao Yi (Shanghai Jiao Tong University, China)
Lingwei Quan (Shanghai Jiao Tong University, China)
Cunyue Lu (Shanghai Jiao Tong University, China)

Abstract: Visual perception plays an important role when underwater robots carry out missions under the sea. However, the quality of images captured by visual sensors is often affected by underwater environment conditions. Image super-resolution is an effective way to enhance the resolution of underwater images. In this paper, we propose a novel method for underwater image super-resolution. The proposed method uses CNNs with channel-wise attention to learn a mapping from low-resolution images to high-resolution images. And a progressive training strategy is used to deal with large scaling factors (eg. 4x and 8x) of super-resolution. We name our method as Progressive Attentional Learning (PAL). Experiments on a recently published underwater image super-resolution dataset, USR-248, show the superiority of our method over other state-of-the-art methods.

SP-02.2 @ 3:45pm

(35) Movie Genre Filtering for automated parental control

Zuo Jun Yong (Universiti Malaya, Malaysia)
Wai Lam Hoo (Universiti Malaya, Malaysia)

Abstract: With cloud robotics, particularly robotic vision available within a household, human are able to live a convenient and safer life in an ambient assisted living environment. Recent advances in computational intelligence including neural network improves the computational capability of the robotic vision to better understand the environment. Recently, internet hoaxes that affected the social community greatly have raised strong awareness among public in parental control and the content that the youngster can view. Therefore, this paper focuses on filtering movies or videos that is not suitable for youngster by attempting to identify movie genre. Movie genre classification is has been investigated in recent years, but there exist noise in normal videos referred as generic frames, as mentioned in [1], that makes differenciating movies with similar frame difficult. A filtering approach is proposed in this paper in order to identify generic frames within the video and discard them from genre classification process, in order to improve genre classification performance. Experiment shows that the filtering approach are able to improve action genre class, but have difficulties and improving other genre classes.

SP-02.3 @ 4:15pm

(51) Bridging Explainable Machine Vision in CAD Systems for Lung Cancer Detection

Nusaiba Alwarasneh (Monash University Malaysia, Malaysia)
Yuen Shan Serene Chow (Monash University Malaysia, Malaysia)
Sarah Teh Mei Yan (Monash University Malaysia, Malaysia)
Chern Hong Lim (Monash University Malaysia, Malaysia)

Abstract: Computer-aided diagnosis (CAD) systems have grown increasingly popular with aiding physicians in diagnosing lung cancer through medical images in recent years. However, the reasoning behind the state-of-the-art black-box learning and prediction models has become obscured and this resultant lack of transparency has presented a problem whereby physicians are unable to trust the results of these systems. This motivated us to improve the conventional CAD with a more robust and interpretable algorithms to produce a system that achieves high accuracy and explainable diagnoses of lung cancer. The proposed approach uses a novel image processing pipeline to segment nodules from lung CT scan images, and then classifies the nodule using both 2D and 3D Alexnet models that have been trained on lung nodule data from the LIDC-IDRI dataset. The explainability aspect is approached from two angles: 1) LIME that produces a visual explanation of the diagnosis, and 2) a rule-based system that produces a text-based explanation of the diagnosis. Overall, the proposed algorithm has achieved better performance and advance the practicality of CAD systems.

SP-02.4 @ 4:45pm

(52) Extending Egocentric Vision into Vehicles: Malaysian Dash-Cam dataset Nusaiba

Mahamat Moussa (Monash University Malaysia, Malaysia)
Chern Hong Lim (Monash University Malaysia, Malaysia)
Koksheik Wong (Monash University Malaysia, Malaysia)

Abstract: Egocentric Vision (EV) has become one of the emerging areas in computer vision recently. It is a process of recording the activity of a person by a wearable camera installed on the head of that person to gain an exclusive viewpoint. This field has gained more attention recently due to the intense availability of wearable cameras commercially and the recent success of Deep Learning (DL). Such attention has resulted in publishing more EV datasets. In this paper, we argue that the concept of egocentric vision is similar to recording road activities by a portable camera installed on the Dashboard of a vehicle (commonly known as DashCam) to gain an exclusive viewpoint. We attempt to extend the EV concept into vehicles and show how the two viewpoints are similar. To support this argument, we collect and annotate the first Malaysian DashCam dataset, which consists of 228 video clips about road activities classified into ten categories. We used this dataset to train a DL model on top of VGG16 model -a DL model that pre-trained on ImageNet-, to perform an initial experiment (activity classification), which reveals some limitations of this work such as small dataset size and less distribution of examples among categories. From this work, we learn that such a dataset may help discover valuable statistical knowledge about road most frequent behaviors that cause accidents and that we may leverage DL to understand such behaviors to save human life.