Co-organizers:

Date: 16 December 2022 (Friday)
Time: 09:00 - 17:00 (HKT GMT+8)
Format: In-person at INNO^2 & Online via ZOOM
Venue: INNO^2, 2/F, Building 17W, Hong Kong Science Park
Co- Organisers: Hong Kong Science and Technology Parks Corporation
Hong Kong Centre for Logistics Robotics Limited
The Chinese University of Hong Kong

RUNDOWN

08:45 – 09:00	**Online and On-site registration Starts**
09:00 – 09:05	**Welcoming Remarks by Mr. Albert Wong** *Chief Executive Officer, Hong Kong Science & Technology Parks Corporation*
09:05 – 09:20	**Opening Remarks by Prof. Yunhui Liu** *Director, Hong Kong Centre for Logistics Robotics Limited* *Choh-Ming Li Professor of Mechanical and Automation Engineering, The Chinese University of Hong Kong*
09:20 – 09:50	**Topic: Pre-Training for Robotics** **By Prof. Pieter Abbeel** *IEEE Fellow* *Professor, Department of Electrical Engineering and Computer Sciences, University of California, Berkeley*
09:50 – 10:20	**Topic: Unmanned Aerial System Applications in Smart Sustainable Built Environment: Towards AI Based Automated Inspection and Information Management** **By Prof. Xi Chen** *Research Assistant Professor, Department of Mechanical and Automation Engineering, The Chinese University of Hong Kong*
10:20 – 10:30	**Break I**

Co-organizers:

HKSTP 20 PROPELLING SUCCESS YEARS

HONG KONG CENTRE FOR LOGISTICS ROBOTICS 香港物流機械人研究中心

香港中文大學 The Chinese University of Hong Kong

Thought-leadership Series:

Symposium on Innovative Robotics Technologies and Applications

10:30 – 11:00	**Topic: Dynamic Loco-Manipulation for Logistics** **By Prof. Koushil Sreenath** *Associate Professor, Department of Mechanical Engineering, University of California, Berkeley*
11:00 – 11:30	**Topic: Morphing Drones and Adaptive Control** **By Prof. Mark Mueller** *Assistant Professor, Department of Mechanical Engineering, University of California, Berkeley*
11:30 – 12:00	**Topic: Making Simple Suction Cup Grippers Smarter** **By Prof. Hannah Stuart** *Assistant Professor, Department of Mechanical Engineering, University of California, Berkeley*
12:00 – 13:30	**Lunch Break**
13:30 – 14:00	**Topic: Human Robot Interaction** **By Prof. Masayoshi Tomizuka** *IEEE Fellow* *Co-Director, Hong Kong Centre for Logistics Robotics Limited* *Cheryl and John Neerhout, Jr. Distinguished Professor, Department of Mechanical Engineering, University of California, Berkeley*
14:00 – 14:20	**Topic: Wearable Robotic Exoskeleton for Load Transportation** **By Prof. Wei Hsin Liao** *ASME Fellow, IOP Fellow* *Professor and Chairman, Department of Mechanical and Automation Engineering, The Chinese University of Hong Kong*
14:20 – 14:50	**Topic: Introduction to Cainiao Logistics Technology Solutions in Automation** **By Dr. Zihao Wang** *Senior Algorithm Expert, Cainiao Logistic Technology* *Team leader of algorithm solutions for Automation (RCS&WES), Digital Supply Chain and Network Planning*
14:50 – 15:20	**Topic: Technology Empowers Intralogistics Automation** **By Dr. Mu Fang** *CTO of VisionNav Robotics*

Co-organizers:

HKSTP 20 PROPELLING SUCCESS YEARS

HONG KONG CENTRE FOR LOGISTICS ROBOTICS 香港物流機械人研究中心

香港中文大學 The Chinese University of Hong Kong

Thought-leadership Series:

Symposium on Innovative Robotics Technologies and Applications

15:20 – 15:30	**Break II**
15:30 – 16:00	**Topic: Intelligent RGB-D Perception for Robotic Bin Picking in Logistics Scenarios** **By Prof. Qi Dou** *Assistant Professor, Department of Computer Science and Engineering, The Chinese University of Hong Kong* **Dr. Xiaojie Gao** *Senior Engineer, Hong Kong Centre for Logistics Robotics Limited*
16:00 – 16:20	**Topic: Mobile Manipulation in Industry: From Autonomous to Collaborative** **By Prof. Fei Chen** *Assistant Professor, Department of Mechanical and Automation Engineering, The Chinese University of Hong Kong*
16:20 – 16:40	**Topic: Personal Air Cleaning for Reducing Infection Risks of Logistics Workers** **By Prof. Chun Chen** *Associate Professor, Department of Mechanical and Automation Engineering, The Chinese University of Hong Kong*
16:40 – 16:50	**Closing Remarks by Prof. Masayoshi TOMIZUKA** *IEEE Fellow* *Co-Director, Hong Kong Centre for Logistics Robotics Limited* *Cheryl and John Neerhout, Jr. Distinguished Professor, Department of Mechanical Engineering, University of California, Berkeley*

Thought-leadership Series:

Symposium on Innovative Robotics Technologies and Applications

ABSTRACTS & SPEAKER PROFILES

Director Profile

Prof. Yunhui Liu

Director, Hong Kong Centre for Logistics Robotics Limited

Choh-Ming Li Professor of Mechanical and Automation Engineering, The Chinese University of Hong Kong

Biography

Yun-Hui Liu received his Ph.D. degree in Applied Mathematics and Information Physics from the University of Tokyo. After working at the Electrotechnical Laboratory of Japan as a Research Scientist, he joined The Chinese University of Hong Kong (CUHK) in 1995 and is currently Choh-Ming Li Professor of Mechanical and Automation Engineering and the Director of the T Stone Robotics Institute. He also serves as the Director/CEO of Hong Kong Centre for Logistics Robotics sponsored by the InnoHK programme of the HKSAR government. He is an adjunct professor at the State Key Lab of Robotics Technology and System, Harbin Institute of Technology, China. He has published more than 500 papers in refereed journals and refereed conference proceedings and was listed in the Highly Cited Authors (Engineering) by Thomson Reuters in 2013. His research interests include visual servoing, logistics robotics, medical robotics, multi-fingered grasping, mobile robots, and machine intelligence. Dr. Liu has received numerous research awards from international journals and international conferences in robotics and automation and government agencies. He was the Editor-in-Chief of Robotics and Biomimetics and served as an Associate Editor of the IEEE TRANSACTION ON ROBOTICS AND AUTOMATION and General Chair of the 2006 IEEE/RSJ International Conference on Intelligent Robots and Systems. He is an IEEE Fellow.

Co-organizers:

HKSTP 20 PROPELLING SUCCESS YEARS

HONG KONG CENTRE FOR LOGISTICS ROBOTICS 香港物流機械人研究中心

香港中文大學 The Chinese University of Hong Kong

Thought-leadership Series:

Symposium on Innovative Robotics Technologies and Applications

Topic: Pre-Training for Robotics

By Prof. Pieter Abbeel

IEEE Fellow

Professor, Department of Electrical Engineering and Computer Sciences, University of California, Berkeley

Abstract

Pre-training on large data-sets has enabled major breakthroughs in natural language processing and computer vision. In this talk I will discuss our work towards achieving a similar breakthrough in robotics.

Speaker biography

Prof. Pieter ABBEEL

IEEE Fellow
Professor
Department of Electrical Engineering and Computer Sciences,
University of California, Berkeley

Professor Pieter Abbeel is Director of the Berkeley Robot Learning Lab and Co-Director of the Berkeley Artificial Intelligence (BAIR) Lab. Abbeel's research strives to build ever more intelligent systems, which has his lab push the frontiers of deep reinforcement learning, deep unsupervised learning, especially as it pertains to robotics. Abbeel's Intro to AI class has been taken by over 100K students through edX, and his Deep Unsupervised Learning materials are standard references for AI researchers. Abbeel has founded several companies, including Gradescope (AI to help instructors with grading homework, projects and exams) and Covariant (AI for robotic automation of warehouses and factories). He advises many AI and robotics start-ups, and is a frequently sought after speaker worldwide for C-suite sessions on AI future and strategy. Abbeel has received many awards and honors, including ACM Prize, IEEE Fellow, PECASE, NSF-CAREER, ONR-YIP, AFOSR-YIP, Darpa-YFA, TR35, and 10+ best paper awards/finalists. His work is frequently featured in the press, including the New York Times, Wall Street Journal, BBC, Rolling Stone, Wired, and Tech Review.

Co-organizers:
HKSTP 20 PROPELLING SUCCESS YEARS
HONG KONG CENTRE FOR LOGISTICS ROBOTICS 香港物流機械人研究中心
香港中文大學 The Chinese University of Hong Kong

Thought-leadership Series:

Symposium on Innovative Robotics Technologies and Applications

Topic: Unmanned Aerial System Applications in Smart Sustainable Built Environment: Towards AI Based Automated Inspection and Information Management

By Prof. Xi Chen

Research Assistant Professor, Department of Mechanical and Automation Engineering, The Chinese University of Hong Kong

Abstract

A smart sustainable city is an innovative city that uses ICTs (Information and Communication Technologies) and other means to improve quality of life, efficiency of urban operation and services, and competitiveness, while ensuring that it meets the needs of present and future generations with respect to economic, social, environmental as well as cultural aspects (by UNECE). To achieve smart sustainable built environment, the government of HKSAR has published the Smart City Blueprint and multiple initiatives under “Smart Mobility”, “Smart Living”, “Smart Environment”, “Smart People”, “Smart Government” and “Smart Economy”. Each of the above area is based on the integration of ICTs, where Unmanned Aerial Systems (UAVs) can play a major role given their flexibilities in performing difficult tasks as well as the support of high-resolution imagery and other sensors to cover large remote areas in a relatively low cost. Potential UAV applications in smart cities include but not limited to traffic, environmental, civil infrastructure and building inspection, monitoring and management. Especially, UAV based inspection can be integrated with Building Information Modelling (BIM) and Geographic Information Systems (GIS) for data collection, processing and management towards advanced digital solutions such as Digital-Twin combined with IoT (Internet of Things) technologies. This presentation will show the pathway of UAV applications in smart built environment with a focus on AI based autonomous inspection and management of as-built building information. The UAV motion planning and localization, AI based data processing, 3D scene reconstruction and integration with BIM/GIS platforms will be introduced with preliminary findings from our research team.

Thought-leadership Series:

Symposium on Innovative Robotics Technologies and Applications

Speaker biography

Prof. Xi CHEN
Research Assistant Professor,
Department of Mechanical and Automation Engineering
The Chinese University of Hong Kong

Dr. Chen has over 10-year experience in sustainable building technology related to the urban energy systems, renewable application in buildings and built environment modelling, and has been involved in multiple funding applications including ARC, NSFC, RGC and consultancy projects with the local government and industry. He published over 40 papers in peer-reviewed international journals and coauthored a book in green building and renewable application areas. He has also been awarded the DECRA Fellow in the Australian Research Council and Fulbright Scholar in the Lawrence Berkeley National Laboratory with a total funding support over 6.5M HK$. In addition, he services as the editorial board member of Buildings, Energies and Advances in Applied Energy.

Co-organizers:

HKSTP 20 PROPELLING SUCCESS YEARS

HONG KONG CENTRE FOR LOGISTICS ROBOTICS 香港物流機械人研究中心

香港中文大學 The Chinese University of Hong Kong

Thought-leadership Series:

Symposium on Innovative Robotics Technologies and Applications

Topic: Dynamic Loco-Manipulation for Logistics

By Prof. Koushil Sreenath

Associate Professor, Department of Mechanical Engineering, University of California, Berkeley

Abstract

In this talk I will summarize our recent results on combining locomotion and manipulation (loco-manipulation) using legged robots. We will see how bipedal and quadrupedal robots can be used for manipulating a ball and a payload. I will present results demonstrating loco-manipulation to collaboratively transport payloads, shoot and block soccer balls, and also show how a single policy can be designed to work on multiple quadrupedal robots. I will also illustrate projects related to service and logistics robotic applications.

Speaker biography

Prof. Koushil SREENATH

Associate Professor
Department of Mechanical Engineering,
University of California, Berkeley

Koushil Sreenath is an Associate Professor of Mechanical Engineering, at UC Berkeley. He received a Ph.D. degree in Electrical Engineering and Computer Science from the University of Michigan at Ann Arbor, MI. His research interest lies at the intersection of dynamic robotics and nonlinear control. He received the NSF CAREER, Hellman Fellow, and Best Paper Award at the Robotics: Science and Systems (RSS).

Co-organizers:
HKSTP 20 PROPELLING SUCCESS YEARS
HONG KONG CENTRE FOR LOGISTICS ROBOTICS 香港物流機械人研究中心
香港中文大學 The Chinese University of Hong Kong

Thought-leadership Series:

Symposium on Innovative Robotics Technologies and Applications

Topic: Morphing Drones and Adaptive Control

By Prof. Mark Mueller

Assistant Professor, Department of Mechanical Engineering, University of California, Berkeley

Abstract

Drones, or aerial robots, are capable of impressive autonomy. Compared to other robots, they are capable of moving faster, and reaching almost any 3D position. However, they also have several disadvantages, including that they are severely energy constrained, and struggling to deal with variation in physical parameters. This talk will present some work we've done on overcoming these limitations. We will describe a morphing quadcopter, that is capable of operating at low speeds like a normal quadcopter, keeping the high agility and small size. At higher speeds, the vehicle can tilt its rotors forward, to reduce the drag area and maintain efficiency. This tilting is achieved through a novel, unactuated mechanism, so that the vehicle retains the mechanical simplicity of a quadcopter. The second part of the talk will look at a learning-based adaptive control strategy that is capable of controlling a drone under hugely varying physical conditions. This is motivated by the problem of carrying different payloads, where it may be impossible for the vehicle to know, in advance, the physical characteristics of the payloads. We demonstrate that the controller is capable of controlling vehicles whose mass vary by a factor of 4.5x.

Speaker biography

Prof. Mark MUELLER

Assistant Professor
Department of Mechanical Engineering,
University of California, Berkeley

Mark W. Mueller joined the Mechanical Engineering Department at Berkeley in August 2016. He received a bachelors degree from the University of Pretoria, and a masters from the ETH Zurich in 2011, both in Mechanical Engineering. He completed his PhD studies at the Institute for Dynamic Systems and Control at the ETH Zurich at the end of 2015. Before joining Berkeley, he spent some time with Verity Studios. Mark received the 2016 George Giralt PhD award for the best robotics-related PhD thesis defended during the year 2015 at a European PhD-awarding institution; the 2011 Jacob Ackeret prize from the Swiss Association of Aeronautical Sciences for his Masters Thesis; and an award for the best final year project for his bachelors thesis in 2008.

Co-organizers:

HKSTP 20 PROPELLING SUCCESS YEARS

HONG KONG CENTRE FOR LOGISTICS ROBOTICS 香港物流機械人研究中心

香港中文大學 The Chinese University of Hong Kong

Thought-leadership Series:

Symposium on Innovative Robotics Technologies and Applications

Topic: Making Simple Suction Cup Grippers Smarter

By Prof. Hannah Stuart

Assistant Professor, Department of Mechanical Engineering, University of California, Berkeley

Abstract

Suction cup grippers provide a useful and common solution for pick-and-place logistics tasks. However, small bumps, pits, or irregularities on object surfaces quickly cause gripping failures. We aim to apply suction cups to grip onto a wide variety of objects without failure. I will present our invention, the smart suction cup, that uses inexpensive and simple pressure transducers to estimate internal flow rates of the cup. Even as an early prototype, this resilient design has been used for many thousands of grasping cycles without electromechanical failure. The enabled flow measurements allow us to perform adaptive haptic control strategies to improve grasping performance and reduce grasp failures on a range of objects. I will present our most recent strategies and outcomes of this work.

Speaker biography

Prof. Hannah STUART

Assistant Professor
Department of Mechanical Engineering,
University of California, Berkeley

Dr. Hannah Stuart is the Don M Cunningham Assistant Professor in the Department of Mechanical Engineering at the University of California at Berkeley. She received her BS in Mechanical Engineering at the George Washington University in 2011, and her MS and PhD in Mechanical Engineering at Stanford University in 2013 and 2018, respectively. Her research focuses on understanding the mechanics of physical interaction in order to better design systems for dexterous manipulation. Applications range from remote robotics to industrial tasks. Recent awards include the NASA Early Career Faculty grant, Hellman Fellows Fund grant, Johnson & Johnson Women in STEM2D grant. She is also a member of the Hong Kong Center for Logistics Robotics.

Co-organizers:

HKSTP 20 PROPELLING SUCCESS YEARS

HONG KONG CENTRE FOR LOGISTICS ROBOTICS 香港物流機械人研究中心

香港中文大學 The Chinese University of Hong Kong

Thought-leadership Series:

Symposium on Innovative Robotics Technologies and Applications

Topic: Human Robot Interaction

By Prof. Masayoshi Tomizuka

IEEE Fellow

Co-Director, Hong Kong Centre for Logistics Robotics Limited

Cheryl and John Neerhout, Jr. Distinguished Professor, Department of Mechanical Engineering, University of California, Berkeley

Abstract

Human robot interactions (HRI) and human robot collaborations (HRC) take place in many of modern engineering systems. In automation and robotization of assembly systems, the use of safe and highly-dexterous collaborative robots (co-robots) with humans may introduce flexibility. If we introduce autonomous (robot) vehicles to the traffic they must cooperate with manually driven vehicles for safely sharing the road. In problems involving collaborative robots and/or automated vehicles, it is necessary to understand how interactions/collaborations may take place and how we plan the trajectory and motion of the robots/autonomous vehicles to assure safety. This talk will introduce recent research on HRI and HRC conducted at the Mechanical Systems Control (MSC) laboratory of the University of California.

Speaker biography

Prof. Masayoshi TOMIZUKA

IEEE Fellow
Co-Director
Hong Kong Centre for Logistics Robotics Limited
Cheryl and John Neerhout,
Professor, Department of Mechanical Engineering
University of California, Berkeley

Masayoshi Tomizuka received his Ph. D. degree in Mechanical Engineering from the Massachusetts Institute of Technology in February 1974. In 1974, he joined the faculty of the Department of Mechanical Engineering at the University of California at Berkeley, where he currently holds the Cheryl and John Neerhout, Jr., Distinguished Professorship Chair and serves as Associate Dean for the Faculty in the College of Engineering. His current research interests are control theory, merging model based control and machine learning, mechatronic systems such as intelligent robots and autonomous vehicles. He served as Program Director of the Dynamic Systems and Control Program of the National Science Foundation (2002-2004). He has supervised about 135 Ph. D. students to completion.

He is the recipient of the Charles Russ Richards Memorial Award (ASME, 1997), the Rufus Oldenburger Medal (ASME, 2002), the John R. Ragazzini Award (AACC, 2006), the Richard Bellman Control Heritage Award (AACC, 2018) and the Nichols Medal (IFAC, 2020). He is an honorary member of ASME, Life Fellow of IEEE and is a member of the United State National Academy of Engineering.

Co-organizers:
HKSTP 20 PROPELLING SUCCESS YEARS
HONG KONG CENTRE FOR LOGISTICS ROBOTICS 香港物流機械人研究中心
香港中文大學 The Chinese University of Hong Kong

Thought-leadership Series:

Symposium on Innovative Robotics Technologies and Applications

Topic: Wearable Robotic Exoskeleton for Load Transportation

By Prof. Wei Hsin Liao

ASME Fellow, IOP Fellow

Professor and Chairman, Department of Mechanical and Automation Engineering, The Chinese University of Hong Kong

Abstract

Industrial back-support exoskeletons help workers in reducing the chance of developing lower back pain by alleviating the stress on their spine during lowering and lifting tasks. This is achieved by providing an interaction torque on the upper body, assisting the user in lowering and lifting objects. We have developed two active back support exoskeletons. To evaluate the assistance effectiveness of different exoskeleton actuation configurations for optimal design of the active back-support exoskeletons, different actuation systems are applied for the two developing exoskeletons. One is equipped with two cable-driven series-parallel elastic actuation (CSPEA) units placed behind the wearer's back and another design is equipped with conventional stiff actuation (CSA) units aligned to the wearer's hip joints. Till now, the following works have been done for the development of effective back-support exoskeletons: 1) A flexible back-support exoskeleton with CSPEA units for both symmetric and asymmetric bending assistance is designed and fabricated; 2)The second generation of the back-support exoskeleton with CSA units is designed and fabricated; 3) The performances of the two exoskeletons are experimentally evaluated; 4) New controller and variable stiffness actuator are proposed for further prototype improvement. Key results will be presented in this talk.

Speaker biography

Prof. Wei-Hsin LIAO

ASME Fellow, IOP Fellow
Professor and Chairman
Department of Mechanical and Automation Engineering,

Wei-Hsin Liao received his Ph.D. in Mechanical Engineering from The Pennsylvania State University, University Park, USA. Since August 1997, Dr. Liao has been with The Chinese University of Hong Kong, where he is currently Department Chairman and Choh-Ming Li Professor of Mechanical and Automation Engineering. His research has led to publications of over 300 technical papers in international journals and conference proceedings, 21 patents in US, China, Hong Kong, Taiwan, Japan, and Korea. Four of his journal papers received awards from American Society of Mechanical Engineers (ASME), and Institution of Mechanical Engineers (IMechE). As the Chair of Joint Chapter of Robotics, Automation and Control Systems Society (RACS), IEEE Hong Kong Section, Dr. Liao received 2012 Chapter of the Year Award from the IEEE Robotics and Automation Society. He is the

recipient of the 2020 ASME Adaptive Structures and Material Systems Award and the 2018 SPIE SSM Lifetime Achievement Award, to recognize his outstanding contributions to the advancement of smart structures and materials. Dr. Liao currently serves as an Associate Editor for Journal of Intelligent Material Systems and Structures, and on the Executive Editorial Board of Smart Materials and Structures. Dr. Liao is a Fellow of ASME, HKIE, and IOP.

Co-organizers:

HKSTP 20 PROPELLING SUCCESS YEARS

HONG KONG CENTRE FOR LOGISTICS ROBOTICS 香港物流機械人研究中心

香港中文大學 The Chinese University of Hong Kong

Thought-leadership Series:

Symposium on Innovative Robotics Technologies and Applications

Topic: Introduction to Cainiao Logistics Technology Solutions in Automation

By Dr. Zihao Wang

Senior Algorithm Expert, Cainiao Logistic Technology

Team leader of algorithm solutions for Automation (RCS&WES), Digital Supply Chain and Network Planning

Abstract

Cainiao Network is a global smart logistics company and the logistics arm of Alibaba Group. Cainiao provides logistics technology infrastructure services, such as Automation, IoT and Digital Technology, both for Alibaba group and its business customers.

Over the past 5 years, Cainiao has made great progress in applying Automation solutions in Cainiao e-commerce warehouses. Cainiao's most representative logistics infrastructure solutions include Goods-to-Person Automated Guided Vehicle ('AGV') Picking System, Dense Storage System, Auto Sorting System. The application of relevant devices and logistic robots, such as AGV, Shuttle, AS/RS and related robot control systems, can significantly improve the efficiency of logistics and order fulfillment. These applications can ensure high-performance logistics operations with relatively little manpower intervention in the context of restricted human activities and low work efficiency during the epidemic.

Speaker biography

Dr. Zihao WANG

Senior Algorithm Expert of
Cainiao Logistic Technology
Team leader of algorithm solutions for
Automation(RCS&WES)
Digital Supply Chain and Network Planning

Dr. Zihao Wang is the Senior Algorithm Expert of Cainiao Logistic Technology, he leads the team of algorithm solutions, with responsibility for algorithm researches and its application for Automation (RCS&WES), Digital Supply Chain and Network Planning.

After joining Cainiao Network in 2016, he led the data science team in the area of sales forecast and logistic data service. He also participated in designing logistic network and operational scheduling system for Cainiao Network since 2019 in both domestic and global areas. In 2022, he led the algorithm team of Automation redesigned and released a brand new commercial version of Cainiao RCS(robot control system) , which is capable of integrating robots of different brands for the optimal combination and providing efficient decisions with advanced job scheduling and MAPF(multi agent path finding) algorithms. This core AI engine has been applied in many

logistic warehouses and help Cainiao and its customers quickly adapt to ever-changing logistic business environment.

Zihao Wang received his bachelor and doctoral degrees of Control Science and Engineering in 2011 and 2016 from the ZJU(Zhejiang University), and was invited as visiting scholar for supply chain research in IPS Waseda University and University of Alberta in 2012 and 2014.

Co-organizers:

HKSTP 20 PROPELLING SUCCESS YEARS

HONG KONG CENTRE FOR LOGISTICS ROBOTICS 香港物流機械人研究中心

香港中文大學 The Chinese University of Hong Kong

Thought-leadership Series:

Symposium on Innovative Robotics Technologies and Applications

Topic: Technology Empowers Intralogistics Automation

By Dr. Mu Fang

CTO of VisionNav Robotics

Abstract

Automated industrial vehicles such as AGVs and AMRs are widely used in material handling processes, while improving the safety and standardization of warehousing processes. The difficulty lies in how to deal with the uncertainties of the warehouse environment, such as undulating pavements, dense access spaces, and a wide range of material specifications. This presentation will cover some of the work we are deploying in smart forklift AGVs, including 3D SLAM in life-long environments, machine learning and environmental awareness, and visual servos. The AGVs are already working in hundreds of facilities around the world, which can flexibly handle materials and provide complex scenario applications according to various workshops.

Speaker biography

Dr. Mu FANG

CTO

VisionNav Robotics

Mu Fang, co-founder and CTO of VisionNav Robotics. As a mobile robotics expert, Dr. Fang has been working on mobile robotics, automation control technology and machine vision for over 15 years. In the past 10 years, Dr. Fang has participated in the "Intelligent Robotics" key project of the Ministry of Science and Technology of China and the Enterprise Support Program (ESS) of the Hong Kong Innovation and Technology Commission, and has been awarded the "Shenzhen Young Innovative Entrepreneurial Talent" and the Hong Kong Business Award. She has led the development of over 20 new products and technologies for autonomous industrial vehicles and 50 patents for key technologies and product designs.

Co-organizers:
HKSTP 20 PROPELLING SUCCESS YEARS
HONG KONG CENTRE FOR LOGISTICS ROBOTICS 香港物流機械人研究中心
香港中文大學 The Chinese University of Hong Kong

Thought-leadership Series:

Symposium on Innovative Robotics Technologies and Applications

Topic: Intelligent RGB-D Perception for Robotic Bin Picking in Logistics Scenarios

By Prof. Qi Dou

Assistant Professor, Department of Computer Science and Engineering, The Chinese University of Hong Kong

AND

Dr. Xiaojie Gao

Senior Engineer, Hong Kong Centre for Logistics Robotics Limited

Abstract

Visual perception of target objects is the prerequisite for precise robotic manipulations in logistics scenes. In this talk, we will introduce two currently-targeted logistics scenarios in our project, i.e., AutoStore and industrial bin picking. Specifically, we will overview the existing challenges in the two scenarios and present our technical contributions of AI algorithms to process the associated 2D&3D visual data, including object instance segmentation, 6D object pose estimation, suction/grasp location generation, object packing planning, etc., with which we can enable the robots to accomplish desired picking/packing operations towards supporting the logistics tasks. Last, we will show some videos captured from extensive laboratory tests, which pave the way for our future real-world deployments and applications.

Speakers' biography

Prof. Qi Dou is an Assistant Professor with the Department of Computer Science and Engineering, and co-affiliated with T Stone Robotics Institute, at The Chinese University of Hong Kong. Her research interest lies in artificial intelligence and image-based robotic perception with applications in interdisciplinary fields such as medical image diagnosis and interventions. She has published over 80 papers in top-tier conferences in robotics, vision and learning including ICRA, IROS, CVPR, ICCV, NeurIPS, ICLR, and high-impact journals with a dozen of ESI Highly Cited Articles. Prof. Dou and her team have won the IEEE ICRA Best Paper Award in Medical Robotics in 2021, IEEE EMBS Best Paper Award in Trans. on Biomedical Engineering 2nd Place in 2021, Hong Kong Institute of Science Young Scientist Award in 2018, CUHK Engineering Faculty Outstanding Thesis Award in 2018, Best Paper Award of Medical Image Analysis-MICCAI in 2017, etc. Before joining CUHK faculty, Dr. Dou spent wonderful years as a postdoctoral research associate at

Prof. Qi DOU
Assistant Professor
Department of Computer Science and Engineering,
The Chinese University of Hong Kong

the Department of Computing at Imperial College London. She received her Ph.D. degree in Computer Science & Engineering at CUHK in 2018, and Bachelor's degree at Beihang University in 2014.

Dr. Xiaojie GAO
Senior Engineer
Hong Kong Centre for Logistics Robotics Limited

Dr. Xiaojie GAO is a senior engineer at Hong Kong Centre for Logistics Robotics, and an honorary Postdoc Fellow at The Chinese University of Hong Kong. His research interest lies in intelligent visual perception algorithms with applications in logistics robotics. He has published papers in top-tier conferences in robotics, including ICRA, IROS, and high-impact journals. He received his Ph.D. degree in Computer Science & Engineering at CUHK in 2021, and his Master's and Bachelor's degrees at Beihang University in 2017 and 2014.

Co-organizers:

HKSTP 20 PROPELLING SUCCESS YEARS

HONG KONG CENTRE FOR LOGISTICS ROBOTICS 香港物流機械人研究中心

香港中文大學 The Chinese University of Hong Kong

Thought-leadership Series:

Symposium on Innovative Robotics Technologies and Applications

Topic: Mobile Manipulation in Industry: From Autonomous to Collaborative

By Prof. Fei Chen

Assistant Professor, Department of Mechanical and Automation Engineering, The Chinese University of Hong Kong

Abstract

Modern industry demands the heavy usage of robotic mobile manipulators with high autonomy and intelligence to work ether independently or collaboratively with human workers. For this purpose, the robot should be able to accomplish various manipulation tasks without prior knowledge of the status of objects and human workers in a highly unstructured and dynamic environment. Therefore, it is important for the mobile manipulation robots to achieve human level capability in terms of perception of environment, planning and learning of manipulation skills adaptively and intelligently. In this talk, we will cover various topics and issues along the direction to develop collaborative mobile manipulation robots the team has been achieved in the past years and demonstrate various setup of autonomous mobile manipulator for various flexible manufacturing and logistical scenarios.

Speaker biography

Prof. Fei CHEN

Assistant Professor
Department of Mechanical and Automation Engineering,
The Chinese University of Hong Kong

Fei Chen is currently an Assistant Professor with the Department of Mechanical and Automation Engineering at the Chinese University of Hong Kong (CUHK). He was the head of Active Perception and Robot Interactive Learning (APRIL) laboratory with department of Advanced Robotics at Italian Institute of Technology, before joining CUHK in 2020. He has served as PI of several EU and Italian projects, e.g., FP7 EUROC AutoMAP, H2020 Chist-Era Learn-Real, VINUM, Learn-Assist, and team leader of several international robot challenges. His research interests lie in robot learning and control for various types of mobile manipulation robots. He has authored/co-authored about 80 journal and conference articles and has received several conference best paper awards.

Co-organizers:
HKSTP 20 PROPELLING SUCCESS YEARS
HONG KONG CENTRE FOR LOGISTICS ROBOTICS 香港物流機械人研究中心
香港中文大學 The Chinese University of Hong Kong

Thought-leadership Series:

Symposium on Innovative Robotics Technologies and Applications

Topic: Personal Air Cleaning for Reducing Infection Risks of Logistics Workers

By Prof. Chun Chen

Associate Professor, Department of Mechanical and Automation Engineering, The Chinese University of Hong Kong

Abstract

The pandemic of COVID-19 has caused over 6.5 million deaths around the world. The spread of infections has caused series problems to the logistics industry in China as the infected logistics workers and the close contact fellow workers would be in quarantine, which would result in manpower shortage and significant economic loss. Therefore, we aim to use our high-performance nanofiber-based filtration technology to develop high-efficiency face masks and portable air cleaners for use in logistics industry to reduce the workers' exposure to virus-containing particles and infection risks. First, we designed and fabricated the high-performance PAN nanofiber filters using the electrospinning technique and our minimized pressure drop fabrication method. The filters were used as face masks and their filtration performance was better than surgical masks while the air permeability was higher than N95 masks. Therefore, our masks are more suitable for logistics workers who are doing heavy-duty work. We also developed a prototype portable batter-based air cleaner based on the high-performance air filters. The clean air delivery rate (CADR) of the air cleaner can reach 262 m3/h, which is sufficiently high for near-person air cleaning to reduce the infection risks of logistics workers in warehouses and containers where stationary air cleaning is impossible.

Speaker biography

Prof. Chun CHEN

Assistant Professor
Department of Mechanical and Automation Engineering,
The Chinese University of Hong Kong

Dr. Chun Chen is an Associate Professor in the Department of Mechanical and Automation Engineering at the Chinese University of Hong Kong. He received his B.Eng. and M.Eng. degrees from the Department of Building Science at Tsinghua University in 2009 and 2012, respectively. He received his Ph.D. degree from the School of Mechanical Engineering at Purdue University in 2015. After his graduate study, he worked as a Visiting Assistant Professor at Purdue University, and then joined the Chinese University of Hong Kong in 2016. Dr. Chen's research interests include aerosol dynamics, indoor air quality, aircraft cabin environment, airborne infectious diseases transmission, and radiative cooling, which has led to over 50 journal publications. Dr. Chen is a member of the International Society of Indoor Air Quality and Climate (ISIAQ) and the American Society of Heating, Refrigerating and Air-conditioning Engineers (ASHRAE).