Conference Program

2026 15th International Conference on Information and Electronics Engineering

(ICIEE 2026)

2026 4th International Conference on Mechatronics, Control and Robotics

(ICMCR 2026)

March 20 to 22, 2026

Tokyo, Japan

Co-sponsors

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Welcome Message

On behalf of the Organizing and Technical Program Committees, it is my great pleasure to welcome all participants to the 2026 15th International Conference on Information and Electronics Engineering (ICIEE 2026), and the 2026 4th International Conference on Mechatronics, Control and Robotics (ICMCR 2026), to be held in Tokyo, Japan, March 20–22, 2026.

ICIEE and ICMCR have established themselves as premier international forum for the exchange of ideas and advances in information, electronics engineering, mechatronics, control, and robotics. These conferences bring together leading researchers, practitioners, industry experts, and students from around the globe to share cutting-edge research, explore emerging technologies, and foster collaborative innovation.

Over the next three days, we will engage in stimulating keynote talks, invited sessions, technical presentations, and scholarly discussions across topics spanning intelligent control, machine learning applications, autonomous systems, advanced manufacturing, information processing, electronic systems design, and communication technologies, among other areas. This diversity reflects the breadth and dynamism of our fields and highlights their critical role in addressing real-world challenges.

I sincerely thank all participants, authors, reviewers, session chairs, and volunteers whose efforts have made this event possible. ICIEE & ICMCR 2026 is not just a conference it is a catalyst for collaboration, discovery, and progress. I hope this gathering will inspire new connections, spark transformative ideas, and contribute meaningfully to the future of our disciplines.

Welcome to Tokyo and to ICIEE & ICMCR 2026!

Conference Chair
Prof. Genci Capi
Hosei University, Japan

Useful Information

Conference Venue

TKP Tokyo Station Conference Center

➢**Address:**
〒103-0028
東京都 中央区 八重洲 1-8-16 新槇町ビル 1～3 階・8 階・10～12 階（事務所：11 階）

Time Zone:
➢ UTC/GMT+9

March Climate & Weather Averages in Tokyo:
➢ High Temp: 19°C ➢ Low Temp: 12°C

Bank and Foreign Exchange:
➢ The Currency is Japanese Yen here

Emergency Number in Japan:
➢ 110

Important Notes
- ✧ Please take care of your belongings during the conference. The conference organizer does not assume any responsibility for the loss of personal belongings of the participants.
- ✧ Please wear delegate badge during the conference. There will be NO access for people without a badge. Never discard your badge at will.
- ✧ Accommodation is not provided. Early reservation is suggested to be made for delegates.
- ✧ Please show the badge and meal coupons during lunch and dinner.
- ✧ Don't stay too late in the city and don't be alone in the remote area. Be aware of the strangers who offer you service, signature of charity, etc., at scenic spots. More Tourist Information and Security tips are available online.

Virtual Meeting Software

ZOOM Download: https://zoom.us/

ZOOM Using Instruction and silde template: www.icmcr.org/kits.zip

- ZOOM online conference room will be open 30 mins before scheduled time.
- It's suggested to use headset with microphone or earphone with microphone.
- Please choose right room to join in while test and presentation session.
- Prepare the PPT file of your presentation on your laptop in advance.
- Duration of Each Presentation: 15 Minutes in total including 12 Minutes Presentation and 3 Minutes Q&A.
- The regular oral presentation time arrangement is for reference only. In case any absence or some presentations are less than 15 minutes, please enter the room before session starts.

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Delegate: Delegate-Name	Delegate-John Smith
Keynote Speaker: Keynote-Name	Keynote-John Smith
Committee Member: Committee-Name	Committee-John Smith

Keynote Speeches

Speech 1

March 21, 2026, Saturday, 09:05-09:45, GMT+9
Onsite Room: Conference Room 2A
Zoom ID: 822 2622 9974 Password: 032022

Prof. Graziano Chesi

Fellow of the IEEE, AAIA and AIIA

The University of Hong Kong, China

Speech Title: Response Peak of Structured Polytopic Systems via LMIs

Abstract: A fundamental and challenging problem in systems analysis and control consists of determining the response peak of a dynamical system. This talk addresses the problem of determining the response peak of a linear system whose system matrices are rational functions of an uncertainty vector constrained into a convex bounded polytope. The uncertainty can be time invariant, bounded rate time varying or arbitrarily time varying. The input of the system can be any signal obtainable as the impulse response of a linear time invariant (LTI) system. An approach is proposed for obtaining upper bounds of the sought peak by solving convex optimization problems with linear matrix inequality (LMI) constraints based on the construction of a structured polynomial Lyapunov function in the state and in the uncertainty. A priori and a posteriori conditions for establishing optimality of the obtained upper bounds are also provided. Some numerical examples illustrate the use and potentialities of the proposed approach.

Bio: Graziano Chesi is a full professor at the Department of Electrical and Electronic Engineering of the University of Hong Kong. He received the Laurea in Information Engineering from the University of Florence and the PhD in Systems Engineering from the University of Bologna. He served as associate editor for various journals, including Automatica, the European Journal of Control, the IEEE Control Systems Letters, the IEEE Transactions on Automatic Control, the IEEE Transactions on Computational Biology and Bioinformatics, and Systems and Control Letters. He founded the Technical Committee on Systems with Uncertainty of the IEEE Control Systems Society. He also served as chair of the Best Student Paper Award Committees of the IEEE Conference on Decision and Control and the IEEE Multi-Conference on Systems and Control. He authored the books "Homogeneous Polynomial Forms for Robustness Analysis of Uncertain Systems" (Springer, 2009), "Domain of Attraction: Analysis and Control via SOS Programming" (Springer, 2011) and "LMI-Based Robustness Analysis in Uncertain Systems" (Now Publishers, 2024). He is a Fellow of the IEEE, AAIA and AIIA.

Speech 2

March 21, 2026, Saturday, 09:45-10:25, GMT+9
Onsite Room: Conference Room 2A
Zoom ID: 822 2622 9974 Password: 032022

Prof. Genci Capi

Hosei University, Japan

Speech Title: Non-Invasive Brain–Robot Interfaces: Recent Advances in Neural Decoding and Intelligent Control

Abstract: Brain–robot interface (BRI) technologies integrate neuroscience, robotics, and artificial intelligence to enable direct communication between the human brain and external systems. Recent progress in non-invasive neural sensing and machine learning has significantly accelerated the practical deployment of these systems, opening new opportunities in healthcare, rehabilitation, assistive robotics, and human–machine interaction.

This talk presents recent research advances from our laboratory on non-invasive BRI systems based on electroencephalography (EEG). We focus on improving neural decoding accuracy and system robustness while maintaining usability across diverse user populations. In particular, we introduce learning frameworks that leverage contrastive learning to extract discriminative representations and generate visual features directly from EEG signals.

Furthermore, we demonstrate real-time robotic control driven by brain signals, highlighting approaches that support intuitive and adaptive human–robot collaboration. These developments illustrate the growing potential of non-invasive brain–robot interfaces to improve human capabilities, enable natural interaction with intelligent systems, and contribute to the next generation of neuro-robotic technologies.

Bio: Genci Capi received the Ph.D. degree from Yamagata University, in 2002. He was a Researcher at the Department of Computational Neurobiology, ATR Institute from 2002 to 2004. In 2004, he joined the Department of System Management, Fukuoka Institute of Technology, as an Assistant Professor, and in 2006, he was promoted to Associate Professor. He was a Professor in the Department of Electrical and Electronic Systems Engineering, at the University of Toyama up to March 2016. Now he is a Professor in the Department of Mechanical Engineering, Hosei University. His research interests include intelligent robots, BMI, multi-robot systems, humanoid robots, learning and evolution.

Speech 3

March 21, 2026, Saturday, 10:45-11:25, GMT+9
Onsite Room: Conference Room 2A
Zoom ID: 822 2622 9974 Password: 032022

Prof. Xiaoqing Wen

IEEE Fellow, World`s Top 2% Scientist

Kyushu Institute of Technology, Japan

Speech Title: Power-Aware LSI Testing: Present and Future

Abstract: With low power consumption becoming a key requirement for advanced LSI designs, the gap between functional power and test power has kept growing to such an extent that power-aware testing has now become a must. The foundation of power-aware testing is a complete understanding of the global impact of switching activity on peak and average power as well as the local impact of switching activity on IR-drop-induced delay increase along data and clock paths. This talk presents a holistic view on various aspects of power-aware testing, aimed at helping researchers and engineers to develop more sophisticated and complete solutions for controlling LSI test power.

Bio: Xiaoqing WEN received the B.E. degree from Tsinghua University, China, in 1986, the M.E. degree from Hiroshima University, Japan, in 1990, and the Ph.D. degree from Osaka University, Japan, in 1993. He was an Assistant Professor at Akita University, Japan, from1993 to 1997, and a Visiting Researcher at the University of Wisconsin–Madison, USA, from Oct. 1995 to Mar. 1996. He joined SynTest Technologies Inc., USA, in 1998, and served as its Vice President and Chief Technology Officer until 2003. He joined Kyushu Institute of Technology, Japan, in 2003, where he is currently a Professor with the Department of Computer Science and Networks. He is a Co-Founder and Co-Chair of Technical Activity Committee on Power-Aware Testing under Test Technology Technical Council (TTTC) of IEEE Computer Society. He has served as Associate Editors for IEEE Trans. on Computer-Aided Design of Integrated Circuits and Systems (TCAD), IEEE Trans. on Very Large Scale Integration Systems (TVLSI), and Journal of Electronic Testing: Theory and Applications (JETTA). He co-authored and co-edited the widely adopted VLSI test textbook “VLSI Test Principles and Architectures: Design for Testability” in 2006 and the first comprehansive book on power-aware VLSI testing “Power-Aware Testing and Test Strategies for Low Power Devices” in 2009. His research interests include design, test, and diagnosis of VLSI circuits. He has published more than 356 papers and holds 43 U.S. patents & 14 Japan patents. He received the 2008 Society Best Paper Award from IEICE-ISS. He is a Fellow of IEEE and a World’s Top 2% Scientist for his career-long impact.
(https://www.vlab.cse.kyutech.ac.jp/~wen/index.htm).

Speech 4

March 21, 2026, Saturday, 11:25-12:05, GMT+9
Onsite Room: Conference Room 2A
Zoom ID: 822 2622 9974 Password: 032022

Prof. Alvaro Rocha

World's Top 1% Scientist by Stanford University (USA) and Elsevier (2023 & 2024)

University of Lisbon, Portugal

Speech Title: AI Applications in Software Engineering: Transforming the Future

Abstract: Artificial Intelligence (AI) is driving a paradigm shift in software engineering, transforming how software systems are conceived, developed, tested, deployed, and managed by moving from traditional human-centric development to AI-augmented and agentic ecosystems. This keynote explores the impact of Large Language Models and intelligent automation across the entire software development lifecycle, including automated requirements engineering through natural language processing, AI-assisted system design and architecture optimization, and enhanced CI/CD pipelines supported by predictive analytics and intelligent deployment strategies. It also discusses AI-driven code generation, automated refactoring, and context-aware development support, which significantly improve productivity, software quality, and technical debt management, alongside advances in AI-enabled quality assurance through automated test generation, predictive bug detection, and optimized regression testing. Furthermore, the keynote examines the role of AI in software project management, risk forecasting, and decision support, enabling proactive and data-driven project execution, while addressing emerging frontiers such as neuro-symbolic AI, explainable AI, bias mitigation, and ethical governance to ensure trustworthy and responsible software systems. Finally, the presentation highlights the democratization of software creation through human-AI collaboration, outlining future opportunities and challenges in shaping sustainable, transparent, and innovative AI-powered software engineering practices.

Bio: Álvaro Rocha is World's Top 1% Scientist by Stanford University (USA) and Elsevier (2023 & 2024), World's Top 0.05% Scientist by ScholarGPS (2023), and World's Top 1% Scientist by ResearchGate for the domains of Information Science, Information Systems and Business Informatics (2023 & 2024). He is a Professor of Information Systems at the University of Lisbon – ISEG and Honorary Professor at the Amity University, researcher at the ADVANCE (the ISEG Centre for Advanced Research in Management), and a collaborator researcher at the CINTESIS (Center for Research in Health Technologies and Information Systems). His main research interests are maturity models, management information systems, quality of information systems, intelligent information systems, cybersecurity, e-government, e-health, and information technology in education. He is also ViceChair of the IEEE Portugal Section Systems, Man, and Cybernetics Society Chapter, and Founder and Editor-in-Chief of two Scopus and SCIMago journals: JISEM - Journal of Information Systems Engineering & Management; and RISTI - Revista Ibérica de Sistemas e Tecnologias de Informação / Iberian Journal of Information Systems and Technologies. Additionally, he is the Scientific Manager of the Information Systems Engineering & Management book series at Springer-Nature, the world's leading publisher of publications in Science, Technology and Health. Moreover, he has served as ViceChair of Experts for the European Commission's Horizon 2020 Program, and as an Expert at the COST - intergovernmental framework for European Cooperation in Science and Technology, at the European Commission's Horizon Europe Program, at the Government of Italy's Ministry of Universities and Research, at the Government of Latvia's Ministry of Finance, at the Government of Mexico's National Council of Science and Technology, at the Government of Polish's National Science Centre, at the Government of Cyprus's Research and Innovation Foundation, and at the Government of Slovak's Research Agency.

Álvaro Rocha has 393 publications indexed in the Scopus database, with an H-Index of 29 and 3,527 citations. In Google Scholar, he has an H5-Index of 42 and 8,242 citations. He has 221 publications indexed in the Web of Science (Core Collection), with an H-Index of 22 and 2,051 citations. On ResearchGate, he has an H-Index of 34 and 5,696 citations and he is among the top 2% of researchers worldwide across all research fields and among the top 1% in his specific research areas: Information Science, Information Systems, and Business Informatics.

Speech 5

March 21, 2026, Saturday, 13:30-14:10, GMT+9
Onsite Room: Conference Room 2A
Zoom ID: 822 2622 9974 Password: 032022

Prof. Hajime Asama

Fellow of IEEE, JSME, RSJ and SICE

The University of Tokyo, Japan

Speech Title: Robot Technology for Disaster Response and its Societal Dissemination

Abstract: Recently, the frequency and the severity of the disaster are increasing due to global warming and aging of the social infrastructures. In the disaster sites, there are difficulty and danger in tasks and environment for human workers, and it is necessary to utilize the robot technology for disaster response.
In this talk, the robot technologies which have been developed and utilized for the disaster response including decommissioning of the Fukushima Daiichi Nuclear Power Station are introduced, and new challenges for disaster response robot technology and issues on its societal dissemination, which are demanded for disaster prevention and disaster response in the future, are discussed.

Bio: Hajime Asama is Emeritus Professor of the University of Tokyo. He received M. S. in 1984, and Dr. Eng. in 1989 from UTokyo. He worked at RIKEN, Japan from 1986 to 200, became a professor with the Research into Artifacts, Center for Engineering (RACE) of UTokyo in 2002, a professor of the School of Engineering of Utokyo from 2009 to 2024, and the Director of RACE from 2019 to 2023. Currently, he is a project professor at Tokyo College, UTokyo.
He received the JSME Award (Technical Achievement) in 2018, etc. He was an AdCom Member of the IEEE Robotics and Automation Society (2007-2009), the Vice President of RSJ (2011-2012), a Council Member of the Science Council of Japan (2017-2023), the President of IFAC (2020-2023), the Vice President of JSME (2023). He is a fellow of IEEE, JSME, RSJ and SICE.
His main interests are research and development of service robotics, distributed autonomous robotic systems, and embodied brain science, as well as social acceptance of the robot technologies.

Invited Speeches

Speech 1

March 22, 2026, Sunday, 15:35-15:55, GMT+9
Zoom ID: 822 2622 9974 Password: 032022

Prof. Arbnor Pajaziti

University of Prishtina, Kosovo

Speech Title: Supervised and Reinforcement Learning for Grid-Based Robotic Path Planning Using Structured Navigation Data

Abstract: Autonomous navigation in structured environments remains a core challenge in robotics, requiring accurate path planning, efficient control, and robust obstacle avoidance. This paper presents a hybrid learning framework that integrates supervised learning with Reinforcement Learning (RL) to enhance navigation in discrete environments. The framework is trained and evaluated using a robot path-planning dataset generated in a 5×5 grid world with random obstacles. It first learns navigation policies from expert demonstrations, then refines them through autonomous exploration. A supervised module predicts optimal immediate actions by processing spatial features, while an RL module optimizes long-term navigation efficiency and safety. Experimental results demonstrate that this hybrid approach significantly improves action prediction accuracy, reduces the number of navigation steps, and increases obstacle-avoidance success rates compared to pure supervised or RL baselines. The findings indicate that hybrid learning is a promising strategy for developing intelligent, resource-efficient autonomous systems for applications in mobile robotics and human-robot interaction.

Bio: Prof. Dr. Arbnor Pajaziti received the B.Sc. degree in Mechanical Engineering from the University of Prishtina, Kosovo, the M.Sc. degree from the University of Zagreb, Croatia, and the Ph.D. degree in Robotics and Intelligent Control from the Vienna University of Technology, Austria. He has been a Professor at the Faculty of Mechanical Engineering, University of Prishtina “Hasan Prishtina,” since 2010, where he also serves as Head of the Department of Mechatronics.
He has extensive research experience in robotics, mechatronics, artificial intelligence, and intelligent control systems, including neural networks, fuzzy logic, and evolutionary algorithms. Prof. Pajaziti has led several national and international research projects in robotics and has authored numerous scientific publications and textbooks in engineering and technology.
His current research interests include mobile robotics, autonomous systems, intelligent motion control, and AI-driven robotic applications.

Speech 2

March 22, 2026, Sunday, 13:30-13:50, GMT+9
Zoom ID: 822 2622 9974 Password: 032022

Prof. Yunxiang Wang

University of Electronic Science and Technology of China, China

Speech Title: Heterodyne Interference Signal Processing in Coherent Single-photon Detection System

Abstract: Single-photon detectors are critical devices in the fields of quantum key distribution (QKD) and quantum computing. However, existing single-photon detectors cannot achieve both high detection efficiency and room-temperature operation, which restricts their practicality and versatility. Coherent detection plays a crucial role in ultra-weak signal detection, and it can significantly improve the detection sensitivity and operate at room-temperature. In traditional coherent detection systems, threshold decision method is widely employed to demodulate the signal, but it is difficult to reach the single-photon-level sensitivity. Here we demonstrate an interference signal processing method for a heterodyne single-photon detection system operating in the 1550 nm wavelength band. A heterodyne detection system was constructed. Gaussian-shaped optical pulses with 49-ns pulse width and 2.4-MHz repetition rate were generated by frequency shifting and intensity modulating of the signal laser. The laser pulses were subsequently attenuated to the single-photon level and then interfered with a local laser. The interfered optical signal was converted into an electrical signal using a high-efficiency photodetector, yielding the heterodyne interference signal. First, the signal was decomposed into Intrinsic Mode Functions (IMFs) with different frequency bands using variational mode decomposition (VMD). Then, continuous wavelet transform (CWT) was applied to each IMF individually. Finally, the photon arrival time was determined through cross-correlation analysis and phase analysis. Key parameters were optimized towards high detection efficiency and low dark counts. Processing results show that this single-photon detection system can achieve a detection efficiency exceeding 92% and dark counts lower than 300 cps. It indicates that the proposed method exhibits powerful single-photon detection capabilities, enabling high-efficiency room-temperature operation.

Bio: Dr. Yunxiang Wang received the B.S. degree in electronic science and technology from University of Electronic Science and Technology of China (UESTC), Chengdu, China, in 2003, and the Ph.D. degree in optical engineering from Tsinghua University, Beijing, China, in 2008. He has been a visiting scholar at School of Electrical & Electronic Engineering, Nanyang Technological University in Singapore from 2018 to 2019. He is currently an Associate Professor with School of Optoelectronic Science and Engineering, UESTC. His research interests include coherent optical detection, optical interference signal processing, solid state laser technology, nonlinear optics, laser noise reduction and narrow linewidth laser devices. He has published more than 50 academic papers in Optics Letters, Optics Express, Physical Review Applied and other journals. He engages with scholarly journals as editorial board member, including Journal of Applied Optics, Laser Technology, etc. He holds more than 20 patents in the fields of optical phase locking, interference signal processing, optical detection and laser technology. He is PI for more than 10 research projects, including fundings from National Natural Science Foundation of China, Sichuan Science and Technology Program, etc.

Speech 3

March 22, 2026, Sunday, 13:50-14:10, GMT+9
Zoom ID: 822 2622 9974 Password: 032022

Prof. Branimir Jaksic

University of Pristina in Kosovska Mitrovica, Serbia

Speech Title: Experimental Analysis of the Influences of Lighting in a Virtual TV Studio on Image Compression using Canny Recognition Method

Abstract: The paper analyzes the influence of front and back lighting in a virtual TV studio on image compression and behavior of Canny edge detection. The experiment analyses 21 combinations of lighting and three compression methods, JPEG, JPEG2000 and SPIHT. Analysis uses MSE and Canny map for estimating the loss of image structure through wide range of BPP values. JPEG2000 achieves the smallest MSE values and the most stable structure in different lighting condi-tions. JPEG shows the biggest degradation at low bitrates, while SPIHT stands in the middle. The best results are with 800 lux front and 800 lux back light. Weak and unbalanced lighting increases the degradation of edges after compres-sion. Introduced LSC metric clearly shows the amount of deviation that the edges have in the absence of good lighting. Results confirm that the quality of compres-sion depends on the source of light and algorithm. The conclusions reached assist with optimizing light and source of compression in virtual studio and other sys-tems for image processing.

Bio: Dr. Branimir Jaksic is a full professor at the Department of Electronics and Telecommunications, Faculty of Technical Sciences, University of Pristina in Kosovska Mitrovica, Serbia
Undergraduate and master studies were completed at the Faculty of Technical Sciences in Kosovska Mitrovica within the field of electronics and telecommunications. Doctoral studies were completed at the Faculty of Electronics, University of Niš, Department of Telecommunications.
An academic career has progressed continuously since 2010, from assistant to assistant professor and associate professor, with promotion to full professor in 2025.
Research activities focus on telecommunications and signal processing. More than 100 papers have been published in international scientific journals and conference proceedings, with over 600 citations.
Dr. Jaksic has developed a significant body of work regarding the optimization of digital image and video quality. His expertise centers on the intersection of physical environments and digital processing, including: advanced video compression, visual Optimization, edge detection & recognition.
Dr. Jaksic actively participates in reviewing papers for international journals with an impact factor. He is the author and co-author of several university textbooks, monographs and laboratory manuals. He participated in a large number of national and international projects. Particular expertise is in the development of study programs, digital platforms, smart classrooms, and modernization of teaching processes. He completed numerous study visits at universities and research institutions throughout Europe.

Speech 4

March 22, 2026, Sunday, 15:55-16:15, GMT+9
Zoom ID: 822 2622 9974 Password: 032022

Prof. Weiwei Jiang

Beijing University of Posts and Telecommunications, China

Speech Title: Satellite Network Optimization with Artificial Intelligence Techniques

Abstract: Facing the large scale, high dynamics, and wide coverage challenges in modern satellite networks, we propose a series of network optimization methods for network routing, satellite handover and satellite edge computing. For network routing, we propose a topology-aware graph reinforcement learning (GRL) model that natively captures orbital dynamics by explicitly modeling the time-varying topological relationships among satellites. This enables fully distributed, foresighted forwarding decisions at each node, significantly reducing end-to-end delay compared to conventional DRL baselines. For network handover, we introduce a dynamic preference adaptation mechanism that replaces static weighting with real-time, user- and context-aware decision-making, thereby overcoming the inherent bias in traditional user-centric strategies and achieving a higher user satisfaction and fewer handovers. Finally, for satellite edge computing, we first propose the MSCRA algorithm, an energy-aware multi-satellite collaboration framework, which jointly optimizes task offloading and resource allocation under strict power constraints. Then, we propose HMADRL, a hierarchical multi-agent DRL framework that decouples offloading and resource allocation to eliminate cross-domain optimization bottlenecks while effectively handling hybrid action spaces. With these schemes, we achieve a lower average task processing delay and a better load balance.

Bio: Dr. Weiwei Jiang received the B.Sc. and Ph.D. degrees from the Department of Electronic Engineering, Tsinghua University, Beijing, China, in 2013 and 2018, respectively. He is currently an assistant professor with the School of Information and Communication Engineering, Beijing University of Posts and Telecommunications, and Key Laboratory of Universal Wireless Communications, Ministry of Education. His current research interests include artificial intelligence, machine learning, big data, wireless communication and edge computing. He has published more than 70 academic papers in IEEE Trans and other journals, with more than 5000 citations in Google Scholar. He is one of 2023, 2024 and 2025 Stanford's List of World's Top 2% Scientists.

In addition to his research endeavors, Dr. Weiwei Jiang actively engages with scholarly journals as an Editor, including Information Fusion, Future Generation Computer Systems, Engineering Reports, Data Science and Management, Journal of Computational and Cognitive Engineering, and Indonesian Journal of Electrical Engineering and Computer Science, INGENIERIA E INVESTIGACION, International Journal of Intelligent Transportation Systems Research, EAI Endorsed Transactions on AI and Robotics, EAI Endorsed Transactions on Industrial Networks and Intelligent Systems. He is also the Guest Editor for many journals, including IEEE Transactions on Consumer Electronics, IEEE Communications Standards Magazine, IEEE Transactions on Industrial Cyber-Physical Systems, ACM Transactions on Autonomous and Adaptive Systems, Digital Communications and Networks, Information Fusion, Neural Computing and Applications, International Journal of Intelligent Systems, etc.

Speech 5

March 22, 2026, Sunday, 09:20-09:40, GMT+9
Zoom ID: 822 2622 9974 Password: 032022

Prof. Subarna Shakya

Tribhuvan University, Nepal

Speech Title: The Impact of Artificial Intelligence on Digital Government Services

Abstract: Artificial Intelligence (AI) is reshaping digital government services by improving efficiency, transparency, and citizen engagement. Governments are integrating AI technologies such as machine learning, natural language processing, and predictive analytics to automate administrative tasks, enhance decision-making, and deliver personalized public services. Applications including AI-powered chatbots, fraud detection systems, smart data analytics, and predictive planning tools are transforming traditional e-government models into intelligent governance systems. This invited talk examines the opportunities and challenges associated with AI adoption in the public sector. While AI enhances service quality, operational efficiency, and data-driven policy development, it also raises important concerns related to privacy, cybersecurity, algorithmic bias, and ethical accountability. The invited talk highlight best practices for responsible AI implementation and propose strategic approaches to building transparent, inclusive, and citizen-centered digital governments capable of sustaining innovation and public trust.

Bio: Prof. Dr. Subarna Shakya holds Ph.D. in Computer Engineering from Lviv Polytechnic National University, Ukraine. He is Professor of Computer Engineering at Department of Electronics and Computer Engineering, Pulchowk Campus, Institute of Engineering, Tribhuvan University and also Visiting Professor in Brown University, Rhode Island, USA. He is also director of IT Innovation Center, Tribhuvan University. He served as Executive Director at National Information technology Center, Government of Nepal and also head of Department of Electronics and Computer Engineering, Director of Center for Information Technology and Chairman of Electronics and Computer Engineering Subject Committee, Institute of Engineering, Tribhuvan University. He has also served as coordinator of Erasmus Mundus program from TU. He has delivered over 40 Keynotes and invited speeches at international conferences and workshops. He has published over 200 scientific/technical articles and 5 books. He has been serving as an Editor/Guest Editor for over 15 international journals. He is the expert member of Board of studies in South Asian University, India.
He is the Life Member of Indian society for mathematical modeling and Computer Simulation, IIT, Kanpur, India, Senior Member of IEEE and also member of ACM.
He was awarded by Nepal Education Leadership awards 2017, 18 Dec 2017 and outstanding contribution to education, 17 Dec 2018 by World CSR Day and World Sustainability. He was awarded 100 most dedicated professors, 4th July, 2019 and also awarded best professor in Computer Engineering studies, 10th Dec 2019 by World education congress. He is Chief Editor of journal of artificial Intelligence and capsule Networks (AICN). He has served as Chairman, technical committee chairman and committee member in many International conferences such as Springer and IEEE related to Computer Science and ICT as chairman. He is keen interest in research and development of ICT, e-government system, Information security for e-Government system, multimedia system, Computer Systems simulation and modeling, Cloud computing & Security, Energy Efficiency in cloud computing, Information system, computer architecture and software engineering.

Speech 6

March 22, 2026, Sunday, 09:00-09:20, GMT+9
Zoom ID: 822 2622 9974 Password: 032022

Assoc. Prof. Ting Zou

Memorial University of Newfoundland, Canada

Speech Title: Toward generalist manipulation: learning interaction forces without sensors or vision

Abstract: In this talk, I will present our recent progress toward learning-based interaction force estimation without relying on dedicated force sensors or external vision systems. Motivated by teleoperation and healthcare robotics applications, where sterilization, cost, and hardware complexity pose practical constraints, our research investigates sensorless force estimation through data-driven modeling and transformer-based architectures. Two challenges have been identified: (1) mapping the motions of the haptic device to slave robots with different architectures efficiently, and (2) sensing the interaction force accurately and cost-effectively for haptic feedback without introducing sterilization concerns. To this end, we first address efficient inverse kinematics for six-axis general manipulators using a novel neural network combining classification and regression. Furthermore, we explore the feasibility and effectiveness of the transformer architectures for interaction force estimation, even in the absence of critical dynamic variables such as joint acceleration. Building on this foundation, we further introduce our Interaction Force Transformer, a more powerful architecture overcomes the limitations, such as real-time feasibility, in the pilot study. Together, these developments represent a step toward generalist manipulation systems that can reason about contact implicitly, reducing reliance on specialized hardware while enhancing scalability and robustness.

Bio: Ting Zou received the B.Sc. degree in electrical engineering and the M.Sc. degree in automatic control engineering from Xi'an Jiaotong University, Xi'an, China, and the Ph.D. degree in robotics and mechatronics from McGill University, Montreal, QC, Canada. Afterward, she joined the Centre for Intelligent Machines of McGill University as a Postdoctoral fellow, working on the optimum design of the next-generation multi-speed transmissions for electric vehicles and nonlinear motion control of autonomous tracked vehicles for mining drilling operations. She is currently an Associate Professor with the Department of Mechanical and Mechatronics Engineering, Memorial University of Newfoundland, St. John's, NL, Canada. Her current research interests include mechanism design and control of biologically inspired robots, advanced human–robot interaction, machine learning for robotic applications, soft robots, and MEMS. Dr. Zou is a senior Member of the IEEE, and member of ASME, Canadian Society for Mechanical Engineers, and Canadian Committee for the Theory of Machines and Mechanisms.

Speech 7

March 21, 2026, Saturday, 14:20-14:40, GMT+9
Onsite Room: Conference Room 2B

Assoc. Prof. Ajit Salunke

Don Bosco College of Engineering, India

Speech Title: Intelligent Mechatronic Systems for Physical Property-Based Quality Grading of Agricultural Edible Nuts: Integrating Machine Vision and IoT

Abstract: Quality grading of agricultural edible nuts is a critical post-harvest operation that directly influences market value, processing efficiency, and consumer acceptance. In many developing countries, grading of arecanuts, cashew nuts, hazelnuts etc. is still predominantly performed through manual inspection or surface appearance-based methods, which are labor-intensive, subjective, and incapable of reliably assessing internal quality attributes. Moreover, commonly used color-based machine vision systems are highly sensitive to lighting conditions and fail to capture intrinsic quality characteristics such as moisture-related structural integrity. These limitations highlight the need for an objective, scalable, and non-destructive grading approach based on fundamental physical properties.

This work presents an intelligent mechatronic system for physical property–based quality grading of agricultural edible nuts through the integration of machine vision, Internet of Things (IoT), and microcontroller-based actuation. The proposed system utilizes measurable physical parameters, namely true density, bulk density, and porosity, as primary indicators of kernel quality. These properties are known to correlate strongly with internal attributes such as moisture content, maturity, firmness, and processing suitability across a wide range of edible nuts.

A dual-level grading architecture is implemented to enhance efficiency and throughput. At the first level, IoT-enabled bulk density measurement is used for batch-level preliminary screening. A precision load cell integrated with a microcontroller and cloud platform enables real-time data acquisition, remote monitoring, and batch classification. Batches that satisfy predefined quality thresholds proceed to the second level, where individual kernel assessment is performed. At this stage, kernel mass is measured using a load cell, while kernel volume is estimated in real time using a dual-camera machine vision system. Image segmentation techniques are employed to accurately handle irregular kernel geometries, enabling precise volume computation without physical contact.

True density is calculated from the measured mass and estimated volume, and grading decisions are made autonomously based on threshold values. Actuators controlled by embedded controllers physically segregate kernels into accept and reject categories, thereby completing the sensing–decision–action loop characteristic of intelligent mechatronic systems.

The system is experimentally validated using unboiled arecanut kernels as a representative case study, owing to their irregular shape, wide size variation, and economic importance. Validation results demonstrate a volume estimation accuracy of 97.33% using the segmentation-based image processing method, with overall grading accuracy ranging between 95% and 99%. Statistical analyses, including paired t-tests, regression analysis, and Bland–Altman plots, confirm strong agreement between automated measurements and conventional reference methods, as well as size-independent performance.

The proposed approach overcomes key limitations of manual and color-based grading systems by enabling objective assessment of internal quality attributes, reducing dependence on skilled labor, and ensuring consistent, repeatable grading outcomes. Owing to the universal relationship between physical properties and quality, the framework is readily extendable to other edible nuts such as cashews, almonds, walnuts, hazelnuts, and pistachios with appropriate calibration.

Overall, this work establishes a robust and scalable foundation for intelligent, physical property–based quality grading in post-harvest nut processing, offering significant potential for industrial adoption and digital transformation in agricultural value chains.

Bio: Dr. Ajit Salunke is an Associate Professor in Mechanical Engineering at Don Bosco College of

Engineering (DBCE), Fatorda, Goa, India. He has served as HOD for 10 years and as Officiating Principal for a year. He holds a PhD from Visvesvaraya Technological University (VTU), Belagavi, India, along with an M.Tech in Computer Integrated Manufacturing and Bachelor's degree in Mechanical Engineering. His current research interests include physical property-based quality grading and process optimization of agricultural edible nuts, machine vision, and IoT-based data monitoring and control systems.

With over 26 years of professional experience, Dr. Salunke has organized more than 100 workshops/ seminars/ invited talks on robotics, additive manufacturing, virtual instrumentation, computer-aided engineering analysis, and smart technologies for Industry 4.0. He has published several research papers in peer-reviewed international

journals and reputed conferences, including the ICMCR 2025 held at the National University of Singapore.

A Fellow of the Institution of Engineers (India) and Life Member of ISTE, NIPM, AMIEE, and VIBHA, Dr. Salunke received the CSI TechNext "Best HOD of the Year" Award (2017) at IIT Mumbai. He contributes as a resource person for Vidnyan Dhara program of the Directorate of Higher Education - Government of Goa, and Science Film Festival of India.

Speech 8

March 21, 2026, Saturday, 16:45-17:05, GMT+9
Onsite Room: Conference Room 2B

Assoc. Prof. Kei Fujisawa

Yokohama National University, Japan

Speech Title: Online Regime-Transition Monitoring of Erosion in Nuclear Power Plants Using Kalman Filtering

Abstract: High-speed liquid jet impacts can cause erosion in industrial components such as piping in nuclear power plants. Recent studies indicate that the liquid jet impact force on a target varies with transitions between erosion stages, yet robust identification of these transitions from noisy force signals remains challenging. In the present study, impact force signals were monitored using a force sensor attached to an aluminum specimen under high-speed liquid jet impingement and analyzed using an online regime-transition monitoring framework based on a state-space approach. A local linear trend Kalman filter was employed with a two-dimensional state consisting of the force level and its rate of change. Erosion regime transitions were detected by combining velocity-based rise criteria with statistical significance and a minimum level increase with two-dimensional kernel density estimation. The proposed framework offers an interpretable and robust tool for erosion-stage transition monitoring based on mechatronic sensing and state-space signal processing.

Bio: Kei Fujisawa is a researcher specializing in data-driven condition monitoring, state-space modeling, and statistical signal processing for safety-critical industrial systems. His recent work addresses erosion caused by high-speed liquid jet impacts in industrial components such as nuclear power plant piping. Using force-sensor measurements under jet impingement, he develops an interpretable online regime-transition monitoring framework based on a state-space approach, employing a local linear trend Kalman filter with a two-dimensional state and transition detection using velocity-based criteria and two-dimensional kernel density estimation. At the conference, he will present deployment-oriented results on online erosion monitoring using Kalman filtering.

Speech 9

March 21, 2026, Saturday, 16:25-16:45, GMT+9
Onsite Room: Conference Room 2C

Assoc. Prof. Shuqiong Wu

University of Osaka, Japan

Speech Title: Dual-task–based Software as a Medical Device for Detecting Early-Stage Cognitive Impairment

Abstract: Cognitive impairment has emerged as a major challenge in aging societies worldwide. Dementia, a common form of cognitive impairment, begins with subtle symptoms and progressively leads to loss of independence, with no curative treatment currently available. However, early detection during the Mild Cognitive Impairment (MCI) stage, an intermediate state between normal cognition and dementia, enables timely intervention that can slow disease progression. Existing diagnostic tools, such as MRI and PET-CT, are costly and unsuitable for frequent monitoring, while paper-based screening tests (e.g., MMSE) suffer from practice effects that limit their effectiveness for continuous assessment. To overcome these limitations, we propose a dual-task-based assessment system combining a motor task (gait) and a cognitive task (calculation). Individuals with MCI exhibit increased gait instability under dual-task conditions due to elevated cognitive load. By analyzing multimodal performance data acquired during dual-task assessment, the proposed system achieves more accurate early-stage cognitive impairment detection than conventional paper-based tests, demonstrating its potential as a practical software-based medical assessment tool.

Bio: Shuqiong Wu was born in Shanxi, China, in 1985. She received her B.E. and M.E. degrees from Beihang University, Beijing, China, in 2008 and 2011, respectively. She obtained her Ph.D. degree in Computational Intelligence and Systems Science from the Institute of Science Tokyo, Tokyo, Japan, in 2015. From 2015 to 2020, she was a research fellow at the Graduate School of Informatics, Kyoto University. From 2020 to 2025, she served as an assistant professor at SANKEN (The Institute of Scientific and Industrial Research), the University of Osaka. She is currently an associate professor at the Graduate School of Engineering Science, the University of Osaka. Her current research topics include dualtask-based cognitive impairment detection, cognitive status monitoring, medical image reconstruction, and contactless biometric sensing. Her research interests include biomedical signal processing, image processing, three-dimensional reconstruction, pattern recognition, and machine learning.

Speech 10

March 21, 2026, Saturday, 14:40-15:00, GMT+9
Onsite Room: Conference Room 2B

Assoc. Prof. Sunilkumar S. Honnungar

SDM College of Engineering & Technology (SDMCET), India

Speech Title: Optimization of Post-Harvest Processing Parameters for Intelligent Quality Grading of Edible Nuts

Abstract: Post-harvest processing plays a decisive role in determining the physical quality, storability, and market value of edible nuts. Among the various processing stages, drying is particularly critical, as it directly influences moisture content, bulk density, true density, and porosity—key physical properties used in objective quality grading. Improper selection of drying parameters often leads to quality degradation, non-uniform kernels, case hardening, and unreliable grading outcomes. This underscores the necessity of systematic optimization of processing parameters to support intelligent, physical property–based grading systems.

This talk focuses on the optimization of drying process parameters for edible nuts using a statistically guided approach, with particular emphasis on enabling reliable downstream grading using intelligent mechatronic systems. The study considers drying temperature, airflow velocity, and processing time as primary control variables influencing kernel moisture loss and associated physical properties. These parameters are optimized to achieve target moisture levels that correspond to acceptable density and porosity thresholds required for automated quality classification.

A response surface methodology (RSM)–based optimization framework is employed to quantify the individual and interaction effects of the selected process variables. A central composite rotatable design is used to generate experimental data under controlled drying conditions. Regression modelling and analysis of variance (ANOVA) are applied to identify statistically significant factors and to establish predictive relationships between process parameters and moisture loss. Model adequacy is verified through goodness-of-fit metrics, lack-of-fit analysis, coefficient of determination, and validation experiments.

The optimization objective is defined in accordance with recommended kernel moisture limits for safe storage and processing suitability, while simultaneously avoiding excessive thermal stress that could compromise kernel structure. Multiple feasible solutions satisfying the target moisture loss are identified, and an optimal operating point is selected based on moderate temperature and airflow conditions to minimize case hardening and energy consumption. Confirmation experiments demonstrate close agreement between predicted and experimental results, validating the robustness of the optimization model.

The significance of this optimization-driven approach lies in its direct coupling with intelligent mechatronic grading systems. Optimized drying conditions ensure that kernels entering automated grading devices exhibit consistent physical characteristics, thereby improving the accuracy and reliability of bulk density– and true density–based classification. The optimized parameters also enable the establishment of clear, data-driven density thresholds used by IoT-enabled grading devices for batch-level screening and individual kernel segregation.

By integrating process optimization with intelligent sensing and actuation, the work bridges the gap between post-harvest processing and automated quality assessment. While the study is experimentally validated using unboiled arecanut kernels, the methodology is generic and transferable to other edible nuts such as cashew, almond, walnut, and pistachio through appropriate calibration.

In conclusion, this talk emphasizes that optimization of processing parameters not only enhances product quality and uniformity but also strengthens the performance of mechatronic grading systems, supporting scalable automation, reduced wastage, and data-driven decision-making in modern nut processing industries.

Bio: Dr. Sunilkumar S. Honnungar is an accomplished academic leader and researcher with 23+ years of experience spanning mechanical engineering education, advanced manufacturing research, and strategic industry–academia collaboration. He currently serves as Associate Professor of Mechanical Engineering and Training & Placement Officer at SDM College of Engineering & Technology (SDMCET), Dharwad, India.

His core expertise covers thermal error minimization in CNC machine tools, feed-drive system thermal behavior, CFD-based analysis of precision manufacturing equipment, advanced and bio-compatible materials, automated quality assessment using image processing, and sustainable manufacturing and clean energy integration. Through his work, he has contributed significantly to improving precision, reliability, and sustainability in modern manufacturing systems.

Dr. Honnungar has a strong international research footprint, with 13 international journal publications and multiple international and national conference papers in reputed venues such as African Journal of Food, Agriculture, Nutrition and Development, Materials Today: Proceedings, AIP Conference Proceedings, International Journal of Scientific & Technology Research, IRJET, and Applied Engineering Research. He has also published on topics including thermal behaviour of ball-screw systems, thermal error minimization in CNC machine tools, CFD simulation of spark ignition engines, bio-compatible implants, and work-cell based manufacturing systems.

He has guided three PhD scholars (part-time, VTU Belagavi) in the domains of automated quality grading of areca nuts, welding of dissimilar metals, and bio-compatible material characterization, with one thesis already submitted and others in advanced stages. In addition, he has mentored numerous undergraduate and postgraduate projects aligned with industrial problems and advanced simulation-based research in mechanical and manufacturing engineering.

Dr. Honnungar's leadership extends to international academic platforms; he has served as Session Chair at the 3rd International Conference on Mechatronics, Controls & Robotics (ICMCR 2025) scheduled from 14–16 February 2025 at the National University of Singapore (NUS), Singapore. This role reflects his recognition as an expert in advanced engineering systems and his active engagement with the global research community.

At the institutional and professional level, he has coordinated and led several major conferences such as the National Conference on Global Emerging Technologies (Electric Mobility, Industry 4.0, Sustainability, 2024) and the PRIME series (Progress and Research Trends in Mechanical Engineering, 2016/2019/2022), along with TEQIP, AICTE and ISTE-sponsored FDPs and STTPs on topics including computational analysis, pedagogy, and advanced manufacturing. He has also been instrumental in designing and executing training and placement strategies that enhance graduate employability.

His contributions have been recognized through multiple awards, including the S.R. Gollapudi Award for Dynamic & Service-Oriented Leadership and Academic Excellence in Industrial Engineering (IIIE, Mumbai, 2019), a Special Award from IIIE for bridging academia and industry (2017), the Catalyze Tech Innovation Challenge Award (Global Center of Excellence in Affordable & Clean Energy, IIT Dharwad & SELCO Foundation, 2022), and the Best Co ordinator Award from the LEAD (Deshpande Foundation, 2013). He currently serves as Managing Committee Member, SAE India – Bangalore Section (2025–2026) and Board of Studies Member, Indian Institution of Industrial Engineering (IIIE, Mumbai, 2024–2026).

Speech 11

March 21, 2026, Saturday, 14:20-14:40, GMT+9
Onsite Room: Conference Room 2C

Asst. Researcher Kuo-Chin Jong

National Institutes of Applied Research, Taiwan

Speech Title: Patent Landscape Analysis of eVTOL Technologies

Abstract: The rapid development of electric vertical takeoff and landing (eVTOL) aircraft has led to concentrated innovation around specific technical modules. Using a contour-based patent mapping approach, this study identifies clusters of eVTOL-related patents across core categories: flight control, electric propulsion, battery systems, thermal management (radiators), supply systems, fuselage and power assemblies, and pilot input/flight path control. Among these, flight control and electric propulsion emerge as contested domains where most players converge, while thermal management and supply systems appear as relatively underexplored areas, indicating potential blue-ocean opportunities.

Bio: Dr. Kuo-Chin Jong received his Ph.D. degree in Photonics and Optoelectronics from National Taiwan University, Taipei, Taiwan, in 2010. He is currently an Assistant Researcher at the Science & Technology Policy Research and Information Center, National Institutes of Applied Research, Taipei, Taiwan.
His research focuses on patent landscape analysis, innovation strategy, and emerging technology policy. In particular, he is interested in developing purpose-driven innovation models and applying them to strategic foresight, enabling policymakers and industry leaders to better understand the evolving dynamics of advanced technologies such as electric vertical takeoff and landing (eVTOL) aircraft. Dr. Jong actively integrates patent analytics with innovation frameworks to provide actionable insights that bridge science, technology, and policy.

Speech 12

March 21, 2026, Saturday, 16:45-17:05, GMT+9
Onsite Room: Conference Room 2C

Asst. Prof. John Carlo Torres

National University–Lipa, Philippines

Speech Title: Robotics Education as the Foundation of the Philippine Robotics Ecosystem

Abstract: Robotics education plays a critical role in shaping national innovation capacity, workforce readiness, and technological sustainability. This talk presents a strategic academic perspective on how robotics education serves as the foundation of the emerging Philippine robotics ecosystem. It discusses the alignment of curriculum design, faculty development, laboratory infrastructure, and industry-academe-government collaboration in building a sustainable robotics pipeline. The presentation highlights current initiatives, challenges, and opportunities in integrating mechatronics, control systems, artificial intelligence, and automation into engineering and computing programs. Data-driven educational strategies, institutional partnerships, and policy-driven frameworks are examined as key enablers of ecosystem growth. Case studies from Philippine higher education institutions and national programs are presented to illustrate effective practices and impact. The talk concludes with future directions toward strengthening robotics research, innovation, and talent development to position the Philippines competitively within the global robotics landscape.

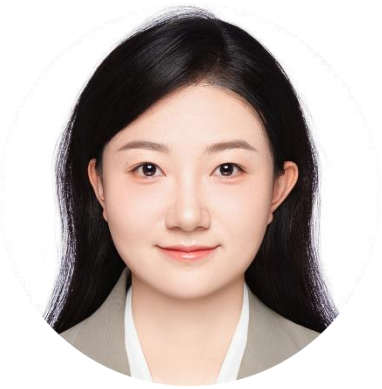
Bio: Engr. John Carlo Torres, CCpE, is an Assistant Professor at National University–Lipa, Philippines, and is currently pursuing his Doctor in Information Technology (DIT) at National University, Philippines. He earned his Bachelor of Science in Computer Engineering from Batangas State University – The National Engineering University and his Master of Science in Information Technology from Lyceum of the Philippines University – Batangas.

He has more than three years of professional IT industry experience as an administrator and consultant, and over four years in academia as professor. His expertise covers artificial intelligence, machine learning, computer vision, embedded systems, robotics, and automotive technologies.

Engr. Torres has published and presented several research papers in areas such as convolutional neural networks, autonomous vehicle systems, AI-driven solutions, and industry–academia collaboration. An internationally invited speaker, mentor, and robotics coach, he delivers seminars and workshops on embedded systems, programming logic, machine learning, and automotive technologies, inspiring emerging engineers to innovate in mechatronics, control, and robotics.

Speech 13

March 22, 2026, Sunday, 09:40-10:00, GMT+9
Zoom ID: 822 2622 9974 Password: 032022



Dr. Yuxiang Zhang

National University of Singapore, Singapore

Speech Title: Physics-Informed Safe Learning-Based Optimized Control for Safety-Critical Systems

Abstract: This talk presents a unified framework for physics-informed and safe learning-based optimized control for safety-critical systems. We first introduce a Physics-Informed Neural Networks (PINNs)-based adaptive optimized control approach that integrates system physics with online data during the learning process. By embedding the learned PINNs model into a continuous-time Hamilton–Jacobi–Bellman framework, the method enables adaptive dynamic programming with improved modeling accuracy, robustness, and learning efficiency compared to purely data-driven approaches. To address safety enforcement, the resilient safe optimized backstepping framework is developed using Barrier Lyapunov Functions and constrained learning mechanisms. By introducing adaptive performance boundaries under input saturation, the method guarantees state constraint satisfaction while maintaining optimized control performance. Together, these works advance reliable and safe learning-enabled control for complex nonlinear safety-critical systems.

Bio: Yuxiang Zhang received the B.S. and Ph.D. degrees in automotive engineering from Jilin University, Changchun, China, in 2016 and 2022, respectively. Since 2021, she has been a joint Ph.D. Student and a Research Fellow with the Department of Electrical and Computer Engineering, National University of Singapore, Singapore. Her current research interests include learning- based and model-based optimization methods for intelligent planning and control. Dr. Zhang has been an awardee of the Eric and Wendy Schmidt AI in Science Postdoctoral Fellowship with the Department of Electrical and Computer Engineering, National University of Singapore, since 2025.

Agenda Overview

Day 1, March 20, 2026, Friday, Japan Standard Time, GMT+9

Onsite Sign-in		
Time	**Event**	**Venue**
13:30-17:00	Onsite Sign-in	Meeting Room 2E
14:00-15:00	Tutorial	Conference Room 2C

Online Pretest Session		
Time	**Presenters**	**ZOOM Information**
10:30-17:00	Keynote Speakers, Session Chairs, Committee Members	Zoom ID: 822 2622 9974 Password: 032022
	Online Session 1: Invited Speech, Invited Speech, Invited Speech, TJ009, TJ105, TJ053, TJ033-A, TJ032, TJ1023	
	Online Session 2: Invited Speech, Invited Speech, TJ004, TJ051, TJ1029-A, TJ1007, TJ025	
	Online Session 3: Invited Speech, Invited Speech, TJ015, TJ052, TJ018, TJ030, TJ003, TJ020, TJ1027	

Tutorial

March 20, 2026, Friday, 13:30-14:10, GMT+9
Onsite Room: Conference Room 2C

AI Augmented by Memristors

Prof. J. Joshua Yang

IEEE Fellow
University of Southern California, USA

Tutorial Introduction: The rapid scaling of artificial intelligence (AI) has exposed fundamental challenges in energy efficiency and processing throughput that are difficult to overcome with conventional von Neumann architectures. Memristors—nanoscale resistive devices with nonvolatile, analog, and history-dependent behavior—offer a promising pathway to augment AI systems directly at the hardware level. This tutorial introduces AI augmented by memristors, drawing on recent advances in memristive materials, devices, and computing architectures.

The tutorial begins with a concise introduction to memristors, highlighting their physical mechanisms, programmability, and robustness under aggressive scaling and harsh operating conditions. It then examines memristor-based machine learning hardware accelerators, with an emphasis on in-memory computing architectures that perform vector–matrix multiplication directly within memristive arrays, substantially reducing data movement and improving energy efficiency and throughput for deep learning workloads.

Moving beyond static weight storage, the tutorial focuses on neuromorphic computing enabled by the intrinsic dynamical properties of memristors, including nonlinearity, stochasticity, and diffusion dynamics. These properties enable native implementations of synaptic plasticity, temporal information processing, and close integration with sensors, supporting brain-inspired and time-dependent AI paradigms that are difficult to realize efficiently using purely digital hardware.

By bridging devices, circuits, and algorithms, this tutorial presents a unified perspective on how memristors can both accelerate existing AI workloads and enable new neuromorphic computing paradigms, pointing toward scalable, energy-efficient, and adaptive AI hardware for the post-Moore era.

Bio: Dr. J. Joshua Yang is the Arthur B. Freeman Chair professor of Electrical and Computer Engineering in the Ming Hsieh Department of Electrical and Computer Engineering. He joined USC in 2020, coming from the faculty of the University of Massachusetts, Amherst. Specializing in post-CMOS hardware for neuromorphic computing, machine learning, and artificial intelligence, he has published many groundbreaking research papers in these domains. His innovative work has led to the granting of over 120 US patents. He is the Associate Editor of Science Advances on neuromorphic topics and the Founding Chair of the IEEE Neuromorphic Computing Technical Committee (2021). He serves as the director of an Air Force-funded Center of Excellence on Neuromorphic Computing at USC. Recognized as a Clarivate Highly Cited Researcher and listed among the Top Best Scientists in the Electronics and Electrical Engineering category by Research.com, he was elected Fellow of the IEEE (2022) and of the National Academy of Inventors (NAI) (2023), for his contributions to resistive switching materials and devices for nonvolatile memory and neuromorphic computing.

Day 2, March 21, 2026, Saturday, Japan Standard Time, GMT+9

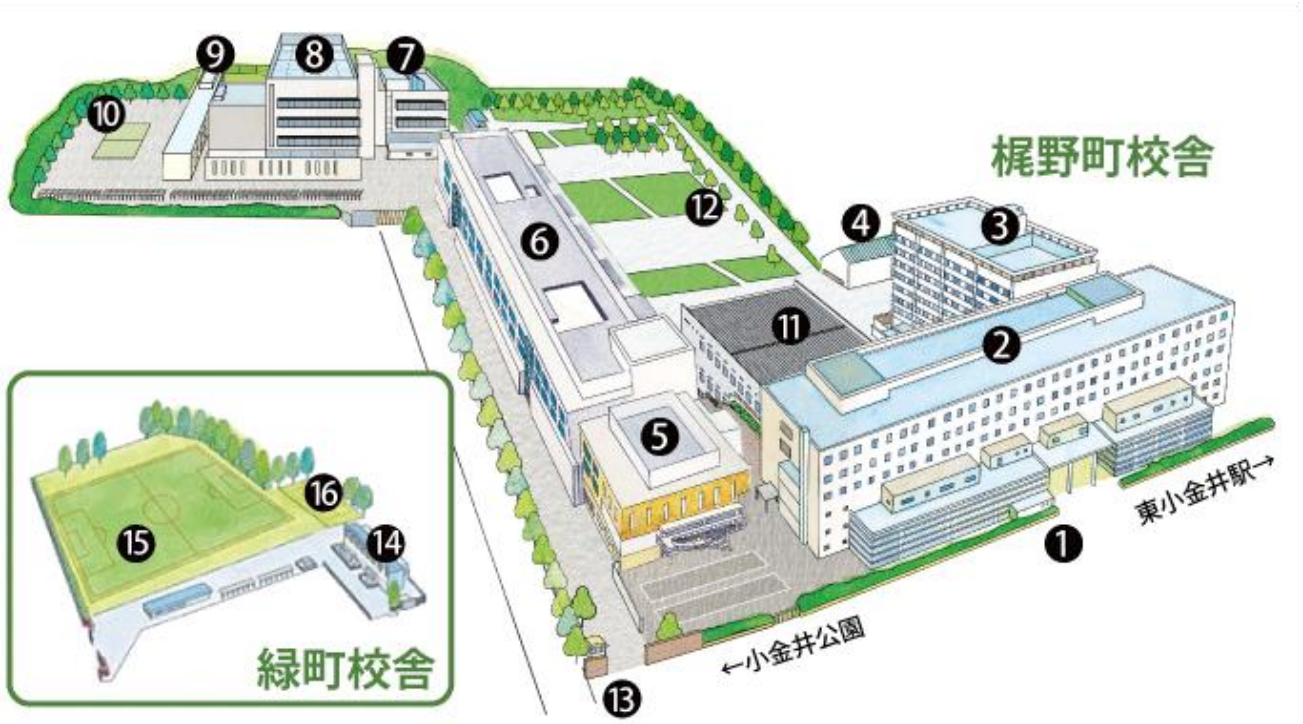
Time	Schedule
Onsite Room: Conference Room 2A **Zoom ID:** 822 2622 9974 **Password:** 032022 **Host: Prof. Saleh Mobayen, National Yunlin University of Science and Technology, Taiwan**	
09:00-09:05	**Welcome Message** **Prof. Genci Capi** **Hosei University, Japan**
09:05-09:45	**Keynote Speech 1** **Speech Title: Response Peak of Structured Polytopic Systems via LMIs** **Prof. Graziano Chesi** Fellow of the IEEE, AAIA and AIIA **The University of Hong Kong, China**
09:45-10:25	**Keynote Speech 2** **Speech Title: Non-Invasive Brain–Robot Interfaces: Recent Advances in Neural Decoding and Intelligent Control** **Prof. Genci Capi** **Hosei University, Japan**
10:25-10:45	**Group Photo&Coffee Break**
10:45-11:25	**Keynote Speech 3** **Speech Title: Power-Aware LSI Testing: Present and Future** **Prof. Xiaoqing Wen** IEEE Fellow, World`s Top 2% Scientist **Kyushu Institute of Technology, Japan**
11:25-12:05	**Keynote Speech 4** **Speech Title: AI Applications in Software Engineering: Transforming the Future** **Prof. Alvaro Rocha** World's Top 1% Scientist by Stanford University (USA) and Elsevier (2023 & 2024) **University of Lisbon, Portugal**
12:05-13:30	**Lunch**

13:30-14:10	**Keynote Speech 5** **Speech Title: Robot Technology for Disaster Response and its Societal Dissemination** **Prof. Hajime Asama** Fellow of IEEE, JSME, RSJ and SICE **The University of Tokyo, Japan**	
14:20-16:30	**Onsite Session 1: High Precision Image and Signal Feature Analysis Method Based on Multi-Source Information Fusion** Session Chair: Asst. Prof. John Carlo Torres, National University–Lipa, Philippines Invited Speech, Invited Speech, TJ017, TJ1010, TJ029-A, TJ1002, TJ013, TJ026	**Onsite Room: Conference Room 2B**
14:20-16:10	**Onsite Session 2: Intelligent Collaborative Control Algorithm and Multi-Agent System Application** Session Chair: Prof. Graziano Chesi, The University of Hong Kong, China Invited Speech, TJ055, TJ201-A, TJ006-A, TJ014, TJ038, TJ035	**Onsite Room: Conference Room 2C**
16:10-16:45	**Coffee Break**	
16:45-18:35	**Onsite Session 3: Intelligent Fault Diagnosis Aand Health Status Assessment Method Based on Multi-Source Signal Fusion** Session Chair: Assoc. Prof. Kei Fujisawa, Yokohama National University, Japan Invited Speech, TJ005, TJ102-A, TJ1011, TJ007, TJ031, TJ103-A	**Onsite Room: Conference Room 2B**
16:25-18:35	**Onsite Session 4: Design, Development and Scenario Application of Autonomous Perception Intelligent Robot System** Session Chair: Assoc. Prof. Shuqiong Wu, University of Osaka, Japan Invited Speech, Invited Speech, TJ011, TJ104, TJ039, TJ019, TJ1022, TJ1024	**Onsite Room: Conference Room 2C**
19:00-20:00	**Dinner**	

Day 3, March 22, 2026, Sunday, Japan Standard Time, GMT+9

Time	Schedule	
10:00-11:30	**Lab Vist - Assistive Robotics Laboratory** Lab Website: https://assistrobotics.ws.hosei.ac.jp/	**Meet promptly at 10:00 AM at the main gate of the Koganei Campus, Hosei University (Map on page 32), for departure.**
09:00-11:30	**Online Session 1: Theory and Application of Adaptive Intelligent Control for Complex Systems** Session Chair: Assoc. Prof. Ting Zou, Memorial University of Newfoundland, Canada Invited Speech, Invited Speech, Invited Speech, TJ009, TJ105, TJ053, TJ033-A, TJ032, TJ1023	**Zoom ID:** 822 2622 9974 **Password:** 032022
11:30-13:30	**Break Time**	
13:30-15:25	**Online Session 2: Multimodal Machine Vision and Object Detection Methods in Complex Scenes** Session Chair: Prof. Yunxiang Wang, University of Electronic Science and Technology of China, China Invited Speech, Invited Speech, TJ004, TJ051, TJ1029-A, TJ1007, TJ025	**Zoom ID:** 822 2622 9974 **Password:** 032022
15:25-15:35	**Break Time**	
15:35-18:00	**Online Session 3: Intelligent System Motion Control and Obstacle Avoidance Path Planning** Session Chair: Prof. Arbnor Pajaziti, University of Prishtina, Kosovo Invited Speech, Invited Speech, TJ015, TJ052, TJ018, TJ030, TJ003, TJ020, TJ1027	**Zoom ID:** 822 2622 9974 **Password:** 032022

Campus Map - Koganei Campus, Hosei University



1. Main Gate
2. West Wing (HOSEI Museum Satellite Koganei [1F])
3. South Building (Library [1F])
4. Common Experiment Preparation Room Building
5. Administration Building (Faculty offices, Career Center, Cafeteria, Student Counseling Center, Clinic)
6. North Wing
7. Ion Beam Engineering Laboratory
8. East Wing (Cafeteria [B1F], Gymnasium [2F])
9. Club Rooms Building
10. Multipurpose Ground
11. Central Wing
12. Courtyard
13. Keyakimon Gate
14. Micro/Nanotechnology Research Center
15. Soccer field
16. Tennis court

For detailed information, please visit:
https://www.en.hosei.ac.jp/LUC2HOSEI/cdata/luc2hosei_15293_jaen.html

Onsite Session 1: High Precision Image and Signal Feature Analysis Method Based on Multi-Source Information Fusion

Time: 14:20-16:30, March 21, 2026, Saturday, Japan Standard Time, GMT+9
Onsite Room: Conference Room 2B
Session Chair: Asst. Prof. John Carlo Torres, National University–Lipa, Philippines

Invited Speech

14:20-14:40

Title: Intelligent Mechatronic Systems for Physical Property-Based Quality Grading of Agricultural Edible Nuts: Integrating Machine Vision and IoT
Invited Speaker: Ajit Salunke, Don Bosco College of Engineering, India

Abstract: Quality grading of agricultural edible nuts is a critical post-harvest operation that directly influences market value, processing efficiency, and consumer acceptance. In many developing countries, grading of arecanuts, cashew nuts, hazelnuts etc. is still predominantly performed through manual inspection or surface appearance-based methods, which are labor-intensive, subjective, and incapable of reliably assessing internal quality attributes. Moreover, commonly used color-based machine vision systems are highly sensitive to lighting conditions and fail to capture intrinsic quality characteristics such as moisture-related structural integrity. These limitations highlight the need for an objective, scalable, and non-destructive grading approach based on fundamental physical properties.

This work presents an intelligent mechatronic system for physical property–based quality grading of agricultural edible nuts through the integration of machine vision, Internet of Things (IoT), and microcontroller-based actuation. The proposed system utilizes measurable physical parameters, namely true density, bulk density, and porosity, as primary indicators of kernel quality. These properties are known to correlate strongly with internal attributes such as moisture content, maturity, firmness, and processing suitability across a wide range of edible nuts.

A dual-level grading architecture is implemented to enhance efficiency and throughput. At the first level, IoT-enabled bulk density measurement is used for batch-level preliminary screening. A precision load cell integrated with a microcontroller and cloud platform enables real-time data acquisition, remote monitoring, and batch classification. Batches that satisfy predefined quality thresholds proceed to the second level, where individual kernel assessment is performed. At this stage, kernel mass is measured using a load cell, while kernel volume is estimated in real time using a dual-camera machine vision system. Image segmentation techniques are employed to accurately handle irregular kernel geometries, enabling precise volume computation without physical contact.

True density is calculated from the measured mass and estimated volume, and grading decisions are made autonomously based on threshold values. Actuators controlled by embedded controllers physically segregate kernels into accept and reject categories, thereby completing the sensing–decision–action loop characteristic of intelligent mechatronic systems.

The system is experimentally validated using unboiled arecanut kernels as a representative case study, owing to their irregular shape, wide size variation, and economic importance. Validation results demonstrate a volume estimation accuracy of 97.33% using the segmentation-based image processing method, with overall grading accuracy ranging between 95% and 99%. Statistical analyses, including paired t-tests, regression analysis, and Bland–Altman plots, confirm strong agreement between automated measurements and conventional reference methods, as well as size-independent performance.

The proposed approach overcomes key limitations of manual and color-based grading systems by enabling objective assessment of internal quality attributes, reducing dependence on skilled labor, and ensuring consistent, repeatable grading outcomes. Owing to the universal relationship between physical properties and quality, the framework is readily extendable to other edible nuts

such as cashews, almonds, walnuts, hazelnuts, and pistachios with appropriate calibration.
Overall, this work establishes a robust and scalable foundation for intelligent, physical property–based quality grading in post-harvest nut processing, offering significant potential for industrial adoption and digital transformation in agricultural value chains.

Invited Speech

14:40-15:00

Title: Optimization of Post-Harvest Processing Parameters for Intelligent Quality Grading of Edible Nuts

Invited Speaker: Sunilkumar S. Honnungar, SDM College of Engineering & Technology (SDMCET), India

Abstract: Post-harvest processing plays a decisive role in determining the physical quality, storability, and market value of edible nuts. Among the various processing stages, drying is particularly critical, as it directly influences moisture content, bulk density, true density, and porosity—key physical properties used in objective quality grading. Improper selection of drying parameters often leads to quality degradation, non-uniform kernels, case hardening, and unreliable grading outcomes. This underscores the necessity of systematic optimization of processing parameters to support intelligent, physical property–based grading systems.
This talk focuses on the optimization of drying process parameters for edible nuts using a statistically guided approach, with particular emphasis on enabling reliable downstream grading using intelligent mechatronic systems. The study considers drying temperature, airflow velocity, and processing time as primary control variables influencing kernel moisture loss and associated physical properties. These parameters are optimized to achieve target moisture levels that correspond to acceptable density and porosity thresholds required for automated quality classification.
A response surface methodology (RSM)–based optimization framework is employed to quantify the individual and interaction effects of the selected process variables. A central composite rotatable design is used to generate experimental data under controlled drying conditions. Regression modelling and analysis of variance (ANOVA) are applied to identify statistically significant factors and to establish predictive relationships between process parameters and moisture loss. Model adequacy is verified through goodness-of-fit metrics, lack-of-fit analysis, coefficient of determination, and validation experiments.
The optimization objective is defined in accordance with recommended kernel moisture limits for safe storage and processing suitability, while simultaneously avoiding excessive thermal stress that could compromise kernel structure. Multiple feasible solutions satisfying the target moisture loss are identified, and an optimal operating point is selected based on moderate temperature and airflow conditions to minimize case hardening and energy consumption. Confirmation experiments demonstrate close agreement between predicted and experimental results, validating the robustness of the optimization model.
The significance of this optimization-driven approach lies in its direct coupling with intelligent mechatronic grading systems. Optimized drying conditions ensure that kernels entering automated grading devices exhibit consistent physical characteristics, thereby improving the accuracy and reliability of bulk density– and true density–based classification. The optimized parameters also enable the establishment of clear, data-driven density thresholds used by IoT-enabled grading devices for batch-level screening and individual kernel segregation.
By integrating process optimization with intelligent sensing and actuation, the work bridges the gap between post-harvest processing and automated quality assessment. While the study is experimentally validated using unboiled arecanut kernels, the methodology is generic and transferable to other edible nuts such as cashew, almond, walnut, and pistachio through appropriate calibration.
In conclusion, this talk emphasizes that optimization of processing parameters not only enhances product quality and uniformity but also strengthens the performance of mechatronic grading systems, supporting scalable automation, reduced wastage, and data-driven decision-making in modern nut processing industries.

TJ017

15:00-15:15

Title: Proposal of a 3D position estimation method by region-based matching of stereo images using a two-pass scan clustering method
Authors: Kazuma Kato, Hideki Toda
Presenter: Kazuma Kato, University of Toyama, Japan

Abstract: Stereo matching is essential for obstacle detection and understanding road conditions in autonomous driving; however, matching between stereo images can be computationally expensive and sensitive to brightness changes. In this study, we perform stereo matching using regional features to reduce the matching load, and we propose an image segmentation method that mitigates the influence of brightness changes. We present results on three stereo image pairs with complex backgrounds, showing that the proposed approach can detect corresponding points robustly in the presence of shadows and gloss, while suggesting efficient processing with reduced computational cost. As future work, we will further discuss improvements to the algorithm and its applications.

TJ1010

15:15-15:30

Title: Multiscale Decomposition of Nonlinear PM2.5 Air-Quality Signals Using Ensemble Empirical Mode Decomposition and Fast Fourier Transform Integration
Authors: Panasun Ngamsirijit, Weerapat Virotjanakul, Watcharin Satjamukda, Chayut Preewan, Phum Supakkarnchana, Boonpanat Siripharksophon, and Thepwinphan Theppitak
Presenter: Weerapat Virotjanakul, Vajiravudh College, Thailand

Abstract: Fine-particulate pollution (PM2.5) remains a major challenge for sustaining urban and industrial systems in tropical megacities. This study develops a hybrid data driven framework integrating Ensemble Empirical Mode Decomposition (EEMD) with Fast Fourier Transform (FFT) to analyse nonlinear and non-stationary PM2.5 signals from ten stations in Bangkok (2015–2024). The EEMD results show that high frequency IMFs (IMF1–IMF3) capture approximately 42% of total energy, reflecting short term anthropogenic variability. FFT and Hilbert spectra reveal dominant 7, 30, and 365 day cycles associated with traffic activity, monsoonal patterns, and annual emission regimes. A two-sample t-test ($p < 0.05$) indicates a 17.6% reduction in mean PM2.5 and a 23% decline in variance after 2020, suggesting reduced anthropogenic volatility following emission-control and mobility transition policies. The findings demonstrate that the EEMD–FFT hybrid approach effectively decodes multiscale air quality behaviour and provides a robust analytical basis for risk-adaptive environmental management in emerging tropical cities.

TJ029-A

15:30-15:45

Title: Millisecond delay gesture recognition technology based on transmitted muscle sound signal
Authors: Meiyan Zhang, Boqi Zhao, Guohua Ding
Presenter: Meiyan Zhang, Harbin Institute of Technology, China

Abstract: Gesture recognition tasks are a key focus in the field of human-computer interaction. Although traditional electromyographic signal (EMG) and myoacoustic signal (MMG) methods have shown high recognition accuracy, both have limitations such as signal acquisition being susceptible to interference and insufficient physiological interpretability. To address these issues, this study presents an innovative transtransmitted myovoice (tMMG) gesture recognition framework that classifies gestures by detecting changes in forearm pressure. We developed a wearable acoustic armband with an integrated micro-vibration source and microphone array, using 3D printing technology to achieve a lightweight design. The device captures modulated vibration signals triggered by muscle contractions in real time and, in combination with feature extraction algorithms, efficiently distinguishes the resting state of the muscle. Experimental results show that the system's recognition accuracy for 10 gestures is over 98% (20ms window length), and it has a faster recognition speed while maintaining comparable accuracy to the EMG/MMG method, especially for non-stationary

signal detection. This work establishes a novel and practical technical path for the recognition of interpretable musculoskeletal movements, with significant application value in the fields of medical rehabilitation and virtual reality.

TJ1002

15:45-16:00

Title: Defense via Patch and Image Resizing in Vision Transformers
Authors: Nian-Hong Wu, Yean-Ru Chen
Presenter: Nian-Hong Wu, Department of Electrical Engineering, National Cheng Kung University, Taiwan

Abstract: Because Vision Transformers (ViTs) are vulnerable to adversarial examples, we propose a simple and cost-efficient defense method, independent of model architecture, that operates as a preprocessing step, with the core technique being multi-scale resizing. We first propose two basic strategies: an image resizing mechanism, which resizes the entire input image to a scale different from the original (1.0×); and a patch resizing mechanism, which downsamples the content while preserving the central region of each ViT patch. Furthermore, we consider a hybrid mechanism that sequentially applies patch resizing and image resizing. We evaluate the defense on 1,000 ImageNet validation images attacked by PatchOut, across three ViT backbones (FocalNet, Twins, and DaViT). Experimental results show that resizing reduces the attack success rate (ASR), with larger deviations from 1.0× or smaller patches yielding stronger defenses. Moreover, the hybrid approach demonstrates the best robustness: reducing the average ASR from 83.60% to 37.35% on FocalNet, from 52.30% to 18.50% on Twins, and from 72.10% to 22.20% on DaViT. Our results indicate that scale operations at both image and patch levels provide a practical, cost-efficient and effective defense for ViTs, which can enhance existing methods without requiring retraining or architectural modifications.

TJ013

16:00-16:15

Title: Leaf-Based Health Assessment Using CNN for NPK Deficiency Detection and IoT for Soil Analysis
Authors: Alice Lacorte, John Carlo Garcia Torres, Marvin Atanacio, John Michael Reyes, Kyla Jamito, Patrick Eva, Psalm Andal, Chester Andaya
Presenter: Alice M. Lacorte, National University, Philippines

Abstract: This study presents a hybrid system for precision nutrient management in bitter gourd (Momordica charantia), integrating convolutional neural network (CNN)–based leafimage analysis with Internet of Things (IoT)–enabled soil sensing for nitrogen (N), phosphorus (P), and potassium (K) deficiency detection. A dataset of 1,200 expert-validated leaf images was used to train and evaluate InceptionV3 and ResNet50 models, with ResNet50 achieving superior performance (F1-score up to 1.00) under a 70-20-10 training-validation-testing split. Parallel soil analysis employed NPK, pH, and moisture sensors calibrated against laboratory assays. Results demonstrate that CNN classification accurately identifies visual nutrient deficiencies, while IoT data provides real-time soil context. Integrating both modalities enhances diagnostic reliability, reduces misclassification, and enables data-driven fertilization recommendations. The combined approach supports precise, costeffective, and sustainable nutrient management, mitigating risks of under- or over-application. This study underscores the potential of AI–IoT hybrid systems in advancing site-specific agriculture and improving crop yield and environmental stewardship.

TJ026

16:15-16:30

Title: Safe Navigation using Neural Radiance Fields via Reachable Sets
Authors: Omanshu Thapliyal, Malarvizhi Sankaranarayanasamy, Ravigopal Vennelakanti
Presenter: Omanshu Thapliyal, Big Data Analytics & Solutions Lab, Hitachi America Ltd.

Abstract: Safe navigation in cluttered environments is an important challenge for autonomous systems. Robots navigating through obstacle ridden scenarios need to be able to navigate safely in the presence of obstacles, goals, and ego objects

of varying geometries. In this work, reachable set representations of the robot's real-time capabilities in the state space can be utilized to capture safe navigation requirements. While neural radiance fields (NeRFs) are utilized to compute, store, and manipulate the volumetric representations of the obstacles, or ego vehicle, as needed. Constrained optimal control is employed to represent the resulting path planning problem, involving linear matrix inequality constraints. We present simulation results for path planning in the presence of numerous obstacles in two different scenarios. Safe navigation is demonstrated through using reachable sets in the corresponding constrained optimal control problems.

Onsite Session 2: Intelligent Collaborative Control Algorithm and Multi-Agent System Application

Time: 14:20-16:10, March 21, 2026, Saturday, Japan Standard Time, GMT+9
Onsite Room: Conference Room 2C
Session Chair: Prof. Graziano Chesi, The University of Hong Kong, China

Invited Speech

14:20-14:40

Title: Patent Landscape Analysis of eVTOL Technologies
Invited Speaker: Kuo-Chin Jong, National Institutes of Applied Research, Taiwan

Abstract: The rapid development of electric vertical takeoff and landing (eVTOL) aircraft has led to concentrated innovation around specific technical modules. Using a contour-based patent mapping approach, this study identifies clusters of eVTOL-related patents across core categories: flight control, electric propulsion, battery systems, thermal management (radiators), supply systems, fuselage and power assemblies, and pilot input/flight path control. Among these, flight control and electric propulsion emerge as contested domains where most players converge, while thermal management and supply systems appear as relatively underexplored areas, indicating potential blue-ocean opportunities.
A cross-company comparison highlights distinct strategic emphases. Beta Technologies shows strong activity in battery systems and flight control, positioning itself around energy management and operational reliability. Archer exhibits dense clusters in electric propulsion and flight path control, reflecting its focus on scalable airframe and thrust management. Denso concentrates on thermal management and supply systems, consistent with its background in automotive electronics and energy distribution. Honda demonstrates balanced contributions across propulsion, battery, and radiator modules, integrating its dual expertise in mobility and powertrains. Boeing emphasizes patents in flight control and fuselage assemblies, aligning with its aerospace heritage in safety and structural design. Joby Aviation presents one of the broadest portfolios, spanning flight control, propulsion, and fuselage integration, suggesting a comprehensive approach to eVTOL system development.
This comparative analysis illustrates how patent clustering can illuminate the technological battlegrounds and neglected spaces in eVTOL innovation. The contour-based mapping method provides a systematic lens for identifying convergence and divergence among industry leaders, offering actionable insights for mechatronics, control systems, and robotics communities.

TJ055

14:40-14:55

Title: Overhead Perching Strategy on Arbitrary Branches for Nano UAVs
Authors: Abner Asignacion Jr, Saad Hussain, Tomoyuki Matsuda and Satoshi Suzuki
Presenter: Abner Asignacion, Chiba University, Japan

Abstract: Energy efficiency remains one of the primary limitations of nano unmanned aerial vehicles (UAVs), particularly in confined or forested environments where persistent observation is required. Perching enables aerial robots to transition from energy-intensive flight to passive resting states. However, existing perching mechanisms often increase payload mass, shift the center of mass (COM) for underbody perching, and are limited to specific branch geometries or orientations. This paper presents a flexible and lightweight overhead perching mechanism designed for nano UAVs that enables stable attachment to branches of arbitrary diameter, structure, and orientation. The mechanism is fabricated from thermoplastic polyurethane (TPU) and designed to bend unidirectionally toward the perching surface, mimicking an octopus-like wrapping motion. The system design enables safe perching and unperching across multiple branches. Experiments using a Crazyflie Brushless platform demonstrate simultaneous perching on three

distinct branches with varying sizes and orientations. Results validate geometric adaptability, repeatable branch-to-branch transitions, and structural compliance under nano-scale payload constraints.

TJ201-A

14:55-15:10

Title: Applications of Mechatronics Technology in Taiwan's Smart Agriculture and Regional Industrial Development
Author: Ya-Yun Liao
Presenter: Ya-Yun Liao, National Institutes of Applied Research, Taiwan

Abstract: Taiwan has actively promoted smart agriculture to address global warming, labor shortages, and an aging population. Mechatronics technology serves as the core driving force, enabling the transition from traditional, experience-based farming to precise, knowledge-intensive, and innovative production systems.
The mechatronics framework integrates three dimensions. Sensing and Monitoring employ IoT platforms with LoRa networks and advanced techniques, such as Electrochemical Impedance Spectroscopy (EIS), for accurate detection of crop water stress. Intelligent Execution incorporates unmanned aerial vehicles, automated machinery, and human–machine assistive devices. Examples include electric leafy vegetable harvesters, which achieve 3–6 times higher efficiency, and the “Iron Farmer” wearable exoskeletons, which reduce muscle force consumption by 27.7–52.7%. Intelligent Decision-Making applies AI-based pest and disease warning systems (80% accuracy), precision irrigation systems that save over 25% of water, and digital twin applications for knowledge-based farm management.
Significant achievements have been realized across sectors. In crop production, the edamame industry reduced labor demand by 30% and production costs by 50%. Pineapple hyperspectral detection achieved 80–93% accuracy in quality inspection. In facility cultivation, mushroom packaging efficiency improved 15-fold, while an AR-based flower management system increased operational efficiency by 50%.
To overcome high equipment costs and a shortage of interdisciplinary talent, Taiwan established 11 smart agriculture alliances, promoted public–private partnerships, and advanced domestic technologies through edge computing and integrated data platforms. These efforts demonstrate how mechatronics enhances agricultural efficiency, safety, and sustainability while strengthening Taiwan’s global competitiveness.

TJ006-A

15:10-15:25

Title: On robust global output stabilization of nonlinear systems via feasibility quantification
Author: Graziano Chesi
Presenter: Graziano Chesi, The University of Hong Kong, China

Abstract: It is well-known that a wide variety of physical systems can be modelled as nonlinear systems, i.e., dynamical systems consisting of input, state and output vectors, where the updating law of the state (time derivative or value at next time instant) and the expression of the output are nonlinear functions of the input and state. A key problem in nonlinear systems is global output stabilization, i.e., the design of feedback controllers that provide a suitable input for the system based on its current output in order to make the closed-loop system globally asymptotically stable. This problem is challenging due to various reasons. One of these reasons is that global asymptotical stability is not equivalent to having the eigenvalue of a matrix in a certain region of the complex plane contrary to the case of linear systems. Another reason is that the direct search of pairs of Lyapunov functions and stabilizing controllers leads to nonconvex optimization problems that are difficult to solve. A further reason is that dual stability results for nonlinear systems may not fully guarantee global asymptotical stability or may not allow to design controllers with desired structure. A last reason is that uncertainties may be present in the mathematical model of the nonlinear system. This abstract aims at proposing a

novel strategy for addressing this problem for polynomial nonlinear systems polynomially affected by uncertainties. This strategy consists of the following steps. First, an augmented state is introduced, whose additional variables are exploited for considering the uncertainty and for parameterizing the sought controller. Second, a Lyapunov inequality proving global asymptotical stability is constructed by introducing a polynomially dependent polynomial Lyapunov function candidate and a polynomial feasibility quantifier. Third, the Lyapunov function, the feasibility quantifier, and the sought controller are determined by maximizing the feasibility quantifier subject to the Lyapunov inequality by exploiting linear matrix inequality (LMI) optimization.

TJ014

15:25-15:40

Title: Robust Stabilization for Nonlinear Networked Control Systems with Intelligent Estimator
Authors: Amin Zarei, Yashar Mousavi, Saeed Tavakoli, Pritesh Narayan, Saleh Mobayen
Presenter: Pawel Skruch, AGH University of Krakow, Poland

Abstract: This research explores a novel, simple, and robust control method for nonlinear networked control systems (NCSs) with unknown uncertainties in the strict-feedback form. A mathematical strategy is developed to control the output of NCSs by creating a stable error dynamic in a general form. This approach generates a list of formulas based on the state equations of nonlinear NCSs and derivatives of the system error. By calculating the N-th derivative according to the final state equation, a robust control command is introduced to strongly mitigate the lumped uncertainties. Additionally, an intelligent estimator is employed to approximate the nonlinear functions in this methodology using fuzzy logic systems (FLSs). The Lyapunov stability of the method is proven, and the effectiveness of this robust control approach is evaluated through an illustrative example in MATLAB software.

TJ038

15:40-15:55

Title: Switching Control Strategies for a Pneumatic Isolation Table with a Single Servo Valve and Multiple On--Off Valves
Authors: Tsuru Tsutsumi, Masakazu Koike
Presenter: Tsuru Tsutsumi, Peking University, China

Abstract: With rapid advances in semiconductor lithography, ultra-precision machining, and gravitational-wave observation, demand is rising for ultra-low-frequency vibration isolation capable of nanometer–picometer positioning. We study a cost-effective pneumatic isolation table architecture that combines a single high-response servo valve with multiple low-cost on--off valves to time-share airflow among chambers. The plant becomes an underactuated switched linear system (SLS) in which the controller must choose both the continuous input magnitude and the discrete valve allocation. Using a 14th-order discrete model (vertical, roll, pitch, and pneumatic states) and a fixed state-feedback gain designed for cyclic switching, we compare three policies: cyclic switching, Lyapunov-based greedy switching (Min-Switching), and finite control set model predictive control (FCS--MPC) with a switching penalty. For cyclic switching with a fixed order, stability is guaranteed as shown in prior work; the other two are evaluated numerically under the same model and gain. Results show Min-Switching greatly accelerates transient regulation by focusing control on the most effective chamber, while FCS--MPC achieves a better trade-off between regulation accuracy and solenoid-valve wear by suppressing high-frequency switching.

TJ035

15:55-16:10

Title: A Standalone EMG-Based Upper-Arm Assistive Device
Authors: Genci Capi, Genti Progri
Presenter: Genci Capi, Hosei University, Japan

Abstract: With the rapid aging of society, assistive technologies that support upper-limb motion have become increasingly important for maintaining

independence in daily life. This study proposes a standalone upper-arm assistive system that recognizes user motion intention from surface electromyography (sEMG) signals and provides real-time mechanical assistance. sEMG signals acquired using a wearable sensor are processed and classified into six motion classes based on load conditions (1 kg and
3 kg) and motion states (static, flexion, extension) using a convolutional neural network (CNN). The trained model is deployed on a Raspberry Pi 5, enabling real-time inference and motor control without reliance on external computers. In addition,
a lightweight assistive device with a high-torque motor is designed to reduce muscular load during arm motion. Experimental results demonstrate a maximum classification accuracy of 87.4%, a response time reduction of up to 12% through signal trimming, and a reduction in muscle activity of up to 34.6% under assisted conditions. These results confirm the feasibility of a fully standalone, wearable upper-arm assistive system for practical use.

Onsite Session 3: Intelligent Fault Diagnosis and Health Status Assessment Method Based on Multi-Source Signal Fusion

Time: 16:45-18:35, March 21, 2026, Saturday, Japan Standard Time, GMT+9
Onsite Room: Conference Room 2B
Session Chair: Assoc. Prof. Kei Fujisawa, Yokohama National University, Japan

Invited Speech

16:45-17:05

Title: Online Regime-Transition Monitoring of Erosion in Nuclear Power Plants Using Kalman Filtering
Invited Speaker: Kei Fujisawa, Yokohama National University, Japan

Abstract: High-speed liquid jet impacts can cause erosion in industrial components such as piping in nuclear power plants. Recent studies indicate that the liquid jet impact force on a target varies with transitions between erosion stages, yet robust identification of these transitions from noisy force signals remains challenging. In the present study, impact force signals were monitored using a force sensor attached to an aluminum specimen under high-speed liquid jet impingement and analyzed using an online regime-transition monitoring framework based on a state-space approach. A local linear trend Kalman filter was employed with a two-dimensional state consisting of the force level and its rate of change. Erosion regime transitions were detected by combining velocity-based rise criteria with statistical significance and a minimum level increase with two-dimensional kernel density estimation. The proposed framework offers an interpretable and robust tool for erosion-stage transition monitoring based on mechatronic sensing and state-space signal processing.

TJ005

17:05-17:20

Title: Effect of Vibration Sampling Frequency on Autoencoder-Based Anomaly Detection in Pressurized Pump Systems
Author: Yusuke Hara
Presenter: Yusuke Hara, National Institute of Advanced Industrial Science and Technology (AIST), Japan

Abstract: Pressurized pumps are used in chemical plants and related facilities. Moreover, traditional condition-monitoring methods used in these chemical facilities often rely on predefined thresholds. In this study, a high-performance anomaly detection method is developed using a dense autoencoder, and time-dependent data were collected from three accelerometer sensors attached to a pressurized pump. Since the data used do not require fault labeling, the proposed method is simple and has low computational cost. To assess the ability of the proposed anomaly detection method, strong and weak impacts were applied to the pressurized pump. As a result, the accuracy of the proposed method significantly influenced sampling frequency. By selecting an appropriate frequency, the normal and abnormal states could be distinguished. The anomaly detection performance improved as the data acquisition frequency increased. In this study, the difference in anomaly values between strong and weak impacts exceeded 20 times at the highest sampling frequency (25.4 kHz).

TJ102-A

17:20-17:35

Title: AI-Based Edge Computing Module for Health Diagnosis of Industrial Equipment
Authors: I-Hua Ting, Hsu-Lun Lin, Ying-Hsiu Hung, Wei-Hsiang Zhan, Jeng-Dao Lee
Presenter: I-Hua Ting, National Formosa University, Taiwan

Abstract: With the rapid development of smart manufacturing and Industry 4.0, health monitoring and fault diagnosis of industrial equipment have become critical issues for industrial upgrading and production stability. Traditional maintenance approaches largely rely on periodic inspections or reactive repairs after failures, which are insufficient for timely detection of equipment conditions and often lead to unexpected downtime and high maintenance costs. This study

proposes a health monitoring and fault diagnosis system for industrial equipment based on deep learning, adopting a “standard dataset validation–real-world application” research framework to ensure model performance and verify its practical applicability across different industrial scenarios. The study first employed the Case Western Reserve University Bearing Data Center (CWRU) vibration dataset for model training, validation, and hyperparameter optimization. Several time-series models were utilized, including Long Short-Term Memory (LSTM), Bidirectional Long Short-Term Memory (Bi-LSTM), and Temporal Convolutional Network (TCN), to ensure stability and accuracy under standardized data conditions. After establishing the model’s performance, it was further applied to the water circulation cooling system of a Wire Electrical Discharge Machining (WEDM) machine. Vibration sensors were installed to collect real operational data, which were then used for retraining and testing in order to evaluate the model’s generalization capability and fault detection performance in real industrial environments. The experimental results demonstrated that the proposed model successfully identified different operating states and potential anomalies within the cooling system and exhibited real-time diagnostic capability. In addition, this study developed a web-based real-time diagnostic platform built on the Flask framework, integrated with a MySQL database and the Modbus communication protocol. The platform supports real-time condition monitoring, historical data retrieval, anomaly feedback, and model switching functions, while providing a visualization interface to present equipment health indicators. This design enables the system to be practically applied in maintenance decision-making within production lines. Overall, the outcomes of this study highlight three major contributions: first, the deep learning models maintained high diagnostic accuracy across both standardized public datasets and real industrial environments; second, the system features modularity and flexible deployment, enabling rapid integration with different types of industrial equipment; and third, the proposed approach demonstrates strong cross-domain applicability, with potential extensions to diverse scenarios such as smart manufacturing, predictive maintenance, and industrial automation. In summary, this study not only provides a feasible solution for anomaly diagnosis but also contributes to the intelligent transformation of traditional manufacturing equipment, enhancing production stability and reducing maintenance costs. The proposed approach therefore offers substantial contributions to the advancement of the smart manufacturing industry.

TJ1011

17:35-17:50

Title: A Multiscale EEMD-Based Seismic Index Framework for Characterizing Long- and High-Frequency Ground Motion Across Japan Prefectures

Authors: Panasun Ngamsirijit, Chartsiri Pornpiriyaniyom, Pattarapol Audsorn, Pattaradit Bongsadadt, Natthaset Meepien, Photchara weerapotjananan and Thepwinphan Theppitak.

Presenter: Chartsiri Pornpiriyaniyom, Vajiravudh College, Thailand

Abstract: This study presents a compact multiscale framework for characterizing regional ground-motion behavior using non-synchronous, event-based seismic records. Earthquake waveforms from ten prefectures in the Kanto region (2011–2021, JMA) were decomposed using Ensemble Empirical Mode Decomposition (EEMD) to obtain Intrinsic Mode Functions (IMFs) that separate high-frequency radiation from long-period basin response. Four quantitative indicators were developed: two long-period measures (LBRI-D, LBRI-M) derived from IMF6–8 and two high-frequency measures (HFRI-D, HFRI-M) derived from IMF1–2. The results reveal clear contrasts among basin-core, basin-edge, and rock-dominated regions: Tokyo, Eastern Saitama, and Central Chiba show pronounced long-period resonance, while Ibaraki and Gunma exhibit dominant high-frequency radiation. These findings demonstrate that meaningful regional signatures can be extracted even from heterogeneous, non-synchronous datasets. The proposed LBRI–HFRI system thus provides a lightweight, data-efficient tool for preliminary seismic zonation in large metropolitan basins and

shows strong potential for extension to other geological environments worldwide.

Title: Fault-Tolerant Control of MAGLEV Systems via Neural-Tuned Second-Order Sliding Modes
Authors: Amin Najafi, Maryam Tymori, Saleh Mobayen, Zahra Mokhtare, Abolfazl Jalilvand
Presenter: Pritesh Narayan, Australian University, Kuwait

TJ007

17:50-18:05

Abstract: Magnetic levitation systems are a well-established solution for minimizing energy losses due to mechanical friction in translational and rotational platforms. These systems use coil current to generate a magnetic field that interacts with a fixed ferromagnetic structure, suspending a moving body at a stable airgap. However, reliable levitation requires overcoming inherent nonlinearities, parametric uncertainties, and external disturbances from nearby electromagnetic sources. This study analyzes a simplified third-order nonlinear model of a magnetic levitation system and develops a generalized sub-optimal secondorder sliding mode controller (2-SMC). The controller ensures fast, monotonic convergence of the levitated body to the desired airgap from rest and robustly maintains it over time. Unlike conventional fault-tolerant strategies relying on auxiliary estimators or reconfiguration logic, the proposed approach inherently handles actuator faults by embedding an efficiency degradation parameter. This is achieved via an actuator effectiveness coefficient in the system dynamics and controller design, maintaining stability and performance during partial failure or saturation. To improve performance, a neural network approach tunes the control coefficients. A feedforward neural network, trained on simulation data, optimizes sliding mode parameters, adapting dynamically to uncertainties and disturbances. Compared to the baseline 2-SMC, this method shows enhanced convergence speed and reduced chattering under varying conditions. Simulations validate both approaches' effectiveness in managing uncertainties and degradation, with the neural-tuned version exhibiting superior robustness in faults. The control input's bounded switching, akin to PWM signals, suits real-time power electronic implementation. The strategy's robustness and fault accommodation position it as a strong candidate for high-precision, safety-critical applications.

Title: Magnetic Indoor Localization through CNN Regression and Rotation Invariance
Authors: Helge Rosé, Konstantin Klipp, Tom Koubek, Bernd Schäufele, Ilja Radusch
Presenter: Tom Eric Koubek, Fraunhofer FOKUS, Germany

TJ031

18:05-18:20

Abstract: Indoor positioning is an essential technology for a wide range of applications in GNSS-denied environments, including indoor navigation and IoT systems. Combining convolutional neural networks (CNNs) and magnetic field-based features offers a low-cost, infrastructure-free solution for precise positioning.
While magnetic fingerprints are a promising approach for indoor positioning, models trained on raw 3D magnetometer data are highly sensitive to device orientation. We address this by using two rotation invariant features derived from the 3D magnetic field: the norm (Mn) and the projection onto the gravity axis (Mg). We train a lightweight 7-layer dilated CNN (MagNetS/XL) on magnetic sequences to directly regress (x, y) positions. Using the MagPie dataset (three buildings, handheld trajectories), we systematically evaluate fixed and random rotations of test and/or train data. Raw 3D inputs (Mx,My,Mz) exhibit isotropic error increases under fixed 90◦ rotations and further degrade with growing random rotations. In contrast, 2D (Mn,Mg) inputs maintain rotation invariant accuracy and surpass the 3D inputs once rotation exceeds building-specific thresholds for three reference buildings: 0◦ for Loomis (large), 5◦ for Talbot (medium), and 6◦ for CSL (small). MagNetXL achieves or exceeds state-of-the-art accuracy on the MagPie dataset, and MagNetS delivers similar performance

with roughly one third of the parameters, favoring mobile deployment. These results show that the robustness gained from rotation invariant inputs outweighs the loss of input dimensionality in realistic usage, allowing mapping and localization without orientation alignment or added infrastructure.

TJ103-A

18:20-18:35

Title: API-Driven Digital Twin Development for Automated Robotic Production Line

Authors: Li-Xuan Chen, Tzu-Hao Hsiao, Han-Wei Wang, Shan-Xi Yang, Jeng-Dao Lee

Presenter: Li-Xuan Chen, National Formosa University, Taiwan

Abstract: With the rapid trend of smart manufacturing, traditional production line tuning still relies on trial-and-error with physical equipment, resulting in low efficiency, equipment wear, and potential safety risks.The proposed method is demonstrated through an automated robotic production line, where a C# and Python API framework is integrated with PLC control, industrial communication protocols (e.g., Modbus TCP), and higher-level monitoring platforms to ensure real-time interaction between the virtual and physical systems. System verification covers representative operations such as loading/unloading, conveyor control, and screw fastening. Results indicate that the proposed method can effectively reduce tuning time by approximately half, minimize errors and risks caused by manual trial-and-error, and improve process verification efficiency prior to deployment. The findings highlight the broad industrial potential of digital twin technology, including smart factory deployment, remote validation, rapid production line replication, and heterogeneous equipment integration. By leveraging a kinematics- and control-enabled virtual machine, the proposed system enhances the accuracy and reliability of production deployment while providing concrete value for automated tuning and intelligent decision-making in future manufacturing environments.

Onsite Session 4: Design, Development and Scenario Application of Autonomous Perception Intelligent Robot System

Time: 16:25-18:50, March 21, 2026, Saturday, Japan Standard Time, GMT+9
Onsite Room: Conference Room 2C
Session Chair: Assoc. Prof. Shuqiong Wu, University of Osaka, Japan

Invited Speech

16:25-16:45

Title: Dual-task–based Software as a Medical Device for Detecting Early-Stage Cognitive Impairment
Invited Speaker: Shuqiong Wu, University of Osaka, Japan

Abstract: Cognitive impairment has emerged as a major challenge in aging societies worldwide. Dementia, a common form of cognitive impairment, begins with subtle symptoms and progressively leads to loss of independence, with no curative treatment currently available. However, early detection during the Mild Cognitive Impairment (MCI) stage, an intermediate state between normal cognition and dementia, enables timely intervention that can slow disease progression. Existing diagnostic tools, such as MRI and PET-CT, are costly and unsuitable for frequent monitoring, while paper-based screening tests (e.g., MMSE) suffer from practice effects that limit their effectiveness for continuous assessment. To overcome these limitations, we propose a dual-task-based assessment system combining a motor task (gait) and a cognitive task (calculation). Individuals with MCI exhibit increased gait instability under dual-task conditions due to elevated cognitive load. By analyzing multimodal performance data acquired during dual-task assessment, the proposed system achieves more accurate early-stage cognitive impairment detection than conventional paper-based tests, demonstrating its potential as a practical software-based medical assessment tool.

Invited Speech

16:45-17:05

Title: Robotics Education as the Foundation of the Philippine Robotics Ecosystem
Invited Speaker: John Carlo Torres, National University–Lipa, Philippines

Abstract: Robotics education plays a critical role in shaping national innovation capacity, workforce readiness, and technological sustainability. This talk presents a strategic academic perspective on how robotics education serves as the foundation of the emerging Philippine robotics ecosystem. It discusses the alignment of curriculum design, faculty development, laboratory infrastructure, and industry-academe-government collaboration in building a sustainable robotics pipeline. The presentation highlights current initiatives, challenges, and opportunities in integrating mechatronics, control systems, artificial intelligence, and automation into engineering and computing programs. Data-driven educational strategies, institutional partnerships, and policy-driven frameworks are examined as key enablers of ecosystem growth. Case studies from Philippine higher education institutions and national programs are presented to illustrate effective practices and impact. The talk concludes with future directions toward strengthening robotics research, innovation, and talent development to position the Philippines competitively within the global robotics landscape.

TJ011

17:05-17:20

Title: Development and Balancing Control of a Unicycle Robot Using Omnidirectional Wheel
Authors: Phankon Pinkham, Manukid Parnichkun
Presenter: Phankon Pinkham, Asian Institute of Technology, Thailand

Abstract: Mobile robots are being studied by many researchers in fields such

as automotive, logistics, and robotics. Moreover, they are used in areas like transportation, healthcare, and personal assistance because they can move flexibly, fast, and accurately. Unicycle robots are one of the mobile robots that have unique characteristics, including designing, constructing, moving, and controlling. The unicycle robot uses one wheel for moving forward and backward and needs one reaction wheel to make itself stay upright while it is moving. In this paper, researchers design new mechanisms for the unicycle robot wheel to be appropriate for them to move in any direction that combines the pitch wheel and roller wheel into one wheel; the wheel is called an omnidirectional wheel. The control system uses an STM32 as the main controller that operates to work with the driver motor, IMU sensor, and encoder sensor. The LQR controller is applied to control the unicycle robot. Experimental results compare simulation and actual experiment to show time, angle, speed, and torque.

TJ104

17:20-17:35

Title: Design of an AI-Assisted Robotic Arm Workstation for Elderly Care
Authors: Yu-Rou Tu, Shan-Xi Yang, Tsai-Yen Wei, Ying-Hsiu Hung, Yu-Chiao Tu, Shin-Chi Lai, Jeng-Dao Lee
Presenter: Yu-Rou Tu, National Formosa University, Taiwan

Abstract: As Taiwan officially enters a super-aged society in 2025, the shortage of long-term care personnel is becoming increasingly severe. How to improve care efficiency through smart technology has become an urgent issue. This study proposes an "Intelligent Long-Term Care Service Collaborative Robotic Arm System" that integrates voice recognition, AI agents, robotic arm collaboration, smart image tracking, and real-time communication platforms to assist caregivers in resident scheduling, health monitoring, identity recognition, needs communication, and interactive games. The system enables voice control through wearable devices and uses the Chat Generative Pre-trained Transformer Application Programming Interface (ChatGPT API) to convert and interpret commands. A robotic arm then performs data acquisition, reminders, and assistive operations. At the same time, Node-RED and the LINE platform provide real-time information feedback. Practical application scenarios demonstrate that this system can effectively reduce the workload of caregivers, enhance resident safety and interaction experiences, and has the potential to be expanded to smart wards, warehouse logistics, and smart agriculture environments.

TJ039

17:35-17:50

Title: Multi Layer Multi Sensor Autonomous Mobile Inspection Robot for Mining Sites in Oman
Authors: D Satyanarayana, Abdullah Said Al Kalbani, Madan Kumar Sharma, Gopal Rathinam, Nadir Kamal Idries, Alaya Hamyar Al Azzani, Hiya Mohammed Al Risi, Shama Khalid Al jabri
Presenter: Degala Satyanarayana, University of Buraimi, Oman

Abstract: Mining sites are considered dangerous places that could severely hurt mining workers. For instance, the erosion of mining environments may cause unsafe conditions that threaten human lives. Therefore, it is essential to conduct an inspection of mining site prior to the arrival of employees to work. In this paper, we design a customized mobile robot that performs inspection of the site and ensures safety of workers in mining sites specifically made for mountainous terrains such as Oman. We propose a multi-layer mobile robot equipped with sensors to conduct inspection for Omani mining sites. The robot can perform various tasks under harsh conditions in mining sites, like mountainous areas and rocky soils that experience high heat. The simulation of proposed methodology is implemented with the sensors monitoring of environmental factors as well as worker safety.

TJ103-A

17:50-18:05

Title: API-Driven Digital Twin Development for Automated Robotic Production Line
Authors: Li-Xuan Chen, Tzu-Hao Hsiao, Han-Wei Wang, Shan-Xi Yang, Jeng-Dao Lee
Presenter: Li-Xuan Chen, National Formosa University, Taiwan

Abstract: With the rapid trend of smart manufacturing, traditional production line tuning still relies on trial-and-error with physical equipment, resulting in low efficiency, equipment wear, and potential safety risks.The proposed method is demonstrated through an automated robotic production line, where a C# and Python API framework is integrated with PLC control, industrial communication protocols (e.g., Modbus TCP), and higher-level monitoring platforms to ensure real-time interaction between the virtual and physical systems. System verification covers representative operations such as loading/unloading, conveyor control, and screw fastening. Results indicate that the proposed method can effectively reduce tuning time by approximately half, minimize errors and risks caused by manual trial-and-error, and improve process verification efficiency prior to deployment. The findings highlight the broad industrial potential of digital twin technology, including smart factory deployment, remote validation, rapid production line replication, and heterogeneous equipment integration. By leveraging a kinematics- and control-enabled virtual machine, the proposed system enhances the accuracy and reliability of production deployment while providing concrete value for automated tuning and intelligent decision-making in future manufacturing environments.

TJ019

18:05-18:20

Title: GA-Optimized Fractional-Order Sliding Mode Control for Robust Tracking of Flying Robots
Authors: Hamid Ghadiri, Saeed Saeedvand, Masoud Hajimani, Mohammad Javad Golchin, Gozar Ali Hazareh, Saleh Mobayen
Presenter: Saeed Saeedvand, National Taiwan Normal University, Taiwan

Abstract: This paper proposes a novel fractional-order terminal sliding mode controller (FOTSMC) for quadrotor systems, designed to achieve singularity-free and robust simultaneous tracking of position and attitude under bounded uncertainties and disturbances. By integrating fractional-order dynamics with a nonsingular terminal sliding surface, the controller ensures precise trajectory tracking with smooth, low-effort control signals while significantly reducing chattering. Key parameters are optimized using genetic algorithms to enhance robustness and convergence speed, yielding superior performance over conventional integer-order SMC. A Lyapunov-based analysis rigorously establishes finite-time stability of the designed sliding surfaces in the presence of model uncertainties and external disturbances, confirming the controller's high tracking accuracy and strong disturbance rejection capability.

TJ1022

18:20-18:35

Title: Noise-Based Terrain Generation and Machine Learning Algorithms in Unity
Authors: Liviu Cristian Miclea, Ștefan Țicuș, Marius Misaros, Dan Ioan Gota, Ovidiu Petru Stan, Szilárd Enyedi
Presenter: Liviu-Cristian Miclea, Technical University of Cluj-Napoca, Romania

Abstract: The development of expansive terrains or vast game worlds that incorporate a diverse range of environments is a complex task for designers, often requiring significant time and resource investment. Addressing these challenges, a terrain generator was developed within Unity, leveraging the platform's advanced capabilities and user-friendly graphical interface. This generator combines a Perlin noise-based approach with machine learning

algorithms to produce detailed and varied terrain surfaces efficiently. Unity was selected for its real-time 3D development features and flexibility, which streamlines both the creation and visualization of terrains. A proprietary implementation of Perlin noise forms the foundation of this generator, chosen for its computational efficiency and ability to produce smooth, natural-looking terrain features with minimal hardware strain. This approach ensures rapid generation of diverse terrain textures, essential for large-scale environments. Additionally, the integration of machine learning algorithms enhances the generator's adaptability, allowing it to generate terrains that align with specific design goals or mimic real-world landscapes. By combining the deterministic benefits of Perlin noise with the adaptive capabilities of machine learning, the system provides an efficient and scalable solution for generating complex terrains suitable for modern game worlds.

TJ1024

18:35-18:50

Title: Depth Estimation Using Defocus Modeling and Camera Calibration for Tilted Optics Using Color Filter Aperture
Authors: Aoi Fukino, Hiroshi Ikeoka and Takayuki Hamamoto
Presenter: Aoi Fukino, Fukuyama University, Japan

Abstract: This study focuses on the Depth-from-Defocus (DfD) method using tilted optics, which enables depth estimation over a wider depth range compared to conventional DfD methods with non-tilted optics. By incorporating a color filter aperture into the optics, we can resolve the front-back defocus ambiguity—where the same defocus size corresponds to two different depths—allowing for unique depth determination. However, conventional methods have relied on empirical formulas to describe the relationship between defocus amount, y-coordinate in the image coordinate system, and depth, which lack a theoretical foundation in optics. Consequently, it was difficult to predict the estimation accuracy and range based on camera parameters, such as effective aperture and tilt angle, without first capturing numerous images and performing model fitting to optimize the coefficients. In this research, we construct a defocus model based on geometric optics and derive a relationship between defocus amount, y-coordinate, and depth using camera parameters. This approach enables the design of depth estimation systems without the need for prior empirical model fitting. We then perform camera calibration to identify the camera parameters for real-world applications. Finally, we demonstrate the effectiveness of the proposed model through depth estimation experiments in real-world environment.

Online Session 1: Theory and Application of Adaptive Intelligent Control for Complex Systems

Time: 09:00-11:30, March 22, 2026, Sunday, Japan Standard Time, GMT+9
Zoom ID: 822 2622 9974 **Password:** 032022
Session Chair: Assoc. Prof. Ting Zou, Memorial University of Newfoundland, Canada

Invited Speech

09:00-09:20

Title: Toward generalist manipulation: learning interaction forces without sensors or vision
Invited Speaker: Ting Zou, Memorial University of Newfoundland, Canada

Abstract: In this talk, I will present our recent progress toward learning-based interaction force estimation without relying on dedicated force sensors or external vision systems. Motivated by teleoperation and healthcare robotics applications, where sterilization, cost, and hardware complexity pose practical constraints, our research investigates sensorless force estimation through data-driven modeling and transformer-based architectures. Two challenges have been identified: (1) mapping the motions of the haptic device to slave robots with different architectures efficiently, and (2) sensing the interaction force accurately and cost-effectively for haptic feedback without introducing sterilization concerns. To this end, we first address efficient inverse kinematics for six-axis general manipulators using a novel neural network combining classification and regression. Furthermore, we explore the feasibility and effectiveness of the transformer architectures for interaction force estimation, even in the absence of critical dynamic variables such as joint acceleration. Building on this foundation, we further introduce our Interaction Force Transformer, a more powerful architecture overcomes the limitations, such as real-time feasibility, in the pilot study. Together, these developments represent a step toward generalist manipulation systems that can reason about contact implicitly, reducing reliance on specialized hardware while enhancing scalability and robustness.

Invited Speech

09:20-09:40

Title: The Impact of Artificial Intelligence on Digital Government Services
Invited Speaker: Subarna Shakya, Tribhuvan University, Nepal

Abstract: Artificial Intelligence (AI) is reshaping digital government services by improving efficiency, transparency, and citizen engagement. Governments are integrating AI technologies such as machine learning, natural language processing, and predictive analytics to automate administrative tasks, enhance decision-making, and deliver personalized public services. Applications including AI-powered chatbots, fraud detection systems, smart data analytics, and predictive planning tools are transforming traditional e-government models into intelligent governance systems. This invited talk examines the opportunities and challenges associated with AI adoption in the public sector. While AI enhances service quality, operational efficiency, and data-driven policy development, it also raises important concerns related to privacy, cybersecurity, algorithmic bias, and ethical accountability. The invited talk highlight best practices for responsible AI implementation and propose strategic approaches to building transparent, inclusive, and citizen-centered digital governments capable of sustaining innovation and public trust.

Invited Speech

09:40-10:00

Title: Physics-Informed Safe Learning-Based Optimized Control for Safety-Critical Systems
Invited Speaker: Yuxiang Zhang, National University of Singapore, Singapore

Abstract: This talk presents a unified framework for physics-informed and safe learning-based optimized control for safety-critical systems. We first introduce a Physics-Informed Neural Networks (PINNs)-based adaptive optimized control approach that integrates system physics with online data during the learning

process. By embedding the learned PINNs model into a continuous-time Hamilton–Jacobi–Bellman framework, the method enables adaptive dynamic programming with improved modeling accuracy, robustness, and learning efficiency compared to purely data-driven approaches. To address safety enforcement, the resilient safe optimized backstepping framework is developed using Barrier Lyapunov Functions and constrained learning mechanisms. By introducing adaptive performance boundaries under input saturation, the method guarantees state constraint satisfaction while maintaining optimized control performance. Together, these works advance reliable and safe learning-enabled control for complex nonlinear safety-critical systems.

TJ009

10:00-10:15

Title: Design and Precision-Control of a 5-DOF Robotic Arm for Teleoperated Installation of Protective Rebar Caps Using a Hexapod Robot
Authors: Jeremi Chavez, Miguel Lara, Joel Figueroa, Ayrton Nieves, José Becerra, Camila Sulen
Presenter: Jeremi Chavez, Universidad Peruana de Ciencias Aplicadas, Peru

Abstract: This work presents the design, integration, and experimental validation of a teleoperated system for installing safety caps on exposed steel rebars in construction environments. The proposed platform combines a hexapod robot capable of maintaining body stability on uneven terrain with a 5-degree-of-freedom robotic manipulator optimized for axial insertion tasks. The methodology integrates kinematic modeling, required torque estimation, and motion planning to ensure precise alignment and safe interaction with the metal rebar under remote operation. Experimental tests, conducted under construction-like conditions, evaluated torque sufficiency, angular tracking performance, body stability, and insertion success rate. The results show that the available torque at the shoulder joint exceeds the required load with a safety factor greater than 1.9, the manipulator achieves stable tracking without overshoot, and the hexapod maintains pitch and roll angles within ±1.5° during the maneuver. The system achieved a 100% success rate in ten consecutive trials, demonstrating its reliability and its potential to reduce worker exposure to hazardous manual tasks in construction.

TJ105

10:15-10:30

Title: Co-Design of Dynamic Decoupling and Robust Control for High-Speed Magnetic Bearing SystemsAuthors: ZHANG Panpan, HE Yajue, CAI Sijie, SHEN Zhihuang, SHEN Aoda, HUANG Junfeng
Presenter: ZHANG Panpan, Jimei University, China

Abstract: To address the degraded performance of conventional decoupling approaches induced by dominant gyroscopic cross-coupling phenomena in high-speed active magnetic bearing-supported flexible rotor systems, an eigenstructure assignment-based dynamic decoupling methodology was developed. Based on the fully decoupled model, an H∞ control synthesis was implemented and validated through comprehensive experimental testing on a dedicated high-speed test rig. Experimental results confirm that the proposed decoupling methodology effectively mitigates gyroscopic cross-coupling under extreme operating conditions. The designed H∞ controller not only maintains stability margins at elevated rotational speeds but also demonstrates exceptional robustness, superior disturbance attenuation characteristics, and enhanced synchronous vibration attenuation performance across the entire operational range.

TJ053

10:30-10:45

Title: Research of FastSLAM based on Butterfly Optimization Algorithm with Hybrid Strategies
Authors: Shuai Yuan, Jiarui Liu, Haoyan Li, Zhaoqing Zhang
Presenter: Jiarui Liu, Shenyang University of Architecture, China

Abstract: To address the issue where the classical Fast SLAM algorithm utilizes

a motion model as the proposal distribution, leading to a deviation of particle distribution from the actual posterior probability distribution, this paper proposes an improved FastSLAM algorithm combined with a hybrid-strategy based Butterfly Optimization Algorithm. First of all, the STC (Sine-Tent-Cosine) chaotic mapping is introduced into the initialization stage of the Butterfly Optimization Algorithm to enhance population diversity. In the next place, an adaptive inertia weight strategy is introduced in the global search phase to balance the global exploration and local exploitation capabilities of the algorithm. In order to prevent the algorithm from falling into local optima, an improved strategy based on Cauchy mutation and lens opposition-based learning(OBL) is introduced. Finally, the improved Butterfly Optimization Algorithm is utilized to handle the prediction step of FastSLAM, which optimizes the particle poses and generates the new proposal distribution. Simulation results demonstrate that the proposed algorithm effectively enhances the accuracy of mobile robot localization and mapping, providing an efficient solution for FastSLAM research.

TJ033-A

10:45-11:00

Title: Pre-Programmable Multi-Stage Stiffness Modulation Using Gallium-Embedded Structures for Soft Robotic Applications
Authors: Sungjin Kim, Jaeuk Lee, Yong-Lae Park
Presenter: Sungjin Kim, Seoul National University, Republic of Korea

Abstract: Variable stiffness structures have gained considerable interest in soft robotics, enabling adaptability in the compliant state and load-bearing capability in the rigid state. However, most existing stiffness modulation approaches are limited to binary transitions or narrow ranges of continuous modulation, restricting their applicability to systems with diverse mechanical requirements. In this paper, we present a pre-rogrammable, multi-stage stiffness modulation method that combines gallium injection with phase change in elastomer structures containing embedded cavities. Two cavity architectures are investigated: submillimeter-scale porous silicone structures fabricated through sugar templating, and millimeter-scale channel structures produced by 3D printing. The structures are evaluated in terms of stiffness sensitivity to gallium volume, achievable modulation range, and repeatability under both cyclic use and disturbed gallium distributions. The porous structures allow fine stiffness adjustment (0.6~1.0 N/mm at 0.6 mL gallium) with high repeatability, while the channel-based designs achieve a larger maximum stiffness range (up to 15.2 N/mm) but with reduced robustness under external impact. Finally, integration into a PneuNet-type soft bending actuator demonstrates task-specific stiffness adaptation without mechanical redesign or structural replacement. Together, these results establish gallium-embedded cavity architecture as a promising route for multi-stage stiffness modulation, advancing mechanical versatility in soft robotic applications.

TJ032

11:00-11:15

Title: Edge-Based Real-Time Anomaly Detection System for a KUKA KRC4 Industrial Robot
Authors: Mehmet Talha Bozan, Ekin Güçlüel, Hamza Gözükara, Tahsin Sümer, Dilek Tukel, Ekrem Yiğit Tuluk, Sümeyye Şüheda Bingöl, Yusuf Aydın, Tuna Çakar
Presenter: Mehmet Talha Bozan, MEF University, Türkiye

Abstract: This paper presents a real time anomaly detection framework implemented at the network edge for industrial robot safety. The setup uses a Raspberry Pi 5 with a Raspberry Pi AI Kit (Hailo-8) connected to a KUKA KRC4 controller (via the KukaVarProxy interface) to continuously monitor 36 key operational variables of the robot arm, such as joint positions, torques, motor currents, temperatures, etc. It also uses a thermal camera feed to check the temperature of the object(s) held by the gripper of the robot. Firstly, an initial base logic identifies the anomalies (e.g., overheating or excessive load) in real time, using carefully set thresholds. Then alerts operators within the web dashboard. We take action data from robot to demonstrating the system in a workplace

setting with simulated actions There is no cloud connectivity needed for our edge based design and the system does not interfere with the robot's certified control systems as a result. Our research sets the foundation for predictive maintenance and safety as more data becomes available. The work can be expanded to include deep learning models for future works.

TJ1023

11:15-11:30

Title: Design and Performance Evaluation of a Cloud-Integrated Real-Time Mobile Interactive System

Authors: Dan Ioan Gota, Adrian Minai, Marius Misaros, Szilard Enyedi, Ovidiu Petru Stan, Liviu Miclea

Presenter: Gota Dan, Tehnical University of Cluj-Napoca, Romania

Abstract: This paper discusses the design, implementation, and performance assessment of a real-time mobile interactive system created for embedded iOS platforms. The application uses the Unity engine and follows a modular client-cloud architecture. It integrates a lightweight NoSQL backend through Firebase Realtime Database in order to support persistent state management and real-time data synchronization. The system was developed using an iterative engineering process. This included early interface prototyping, architectural modelling, and breaking down the software into components. The main application logic was written in C# using event-driven methods to ensure responsive interaction within mobile hardware limits. Real-time score submission and retrieval happen asynchronously through cloud services, which allows for low-latency data access and filtering based on geolocation information. We evaluated performance on several mobile iOS devices, measuring frame rate stability, how responsive the inputs were, and cloud synchronization de-lay. Real-time system performance was above 55 FPS, input response times under 100 ms. Leaderboard updates took less than 300 ms during typical net-work conditions. These results confirm that the proposed architecture works well for real-time mobile applications that need quick user interaction and scalable cloud data management. The architecture and development offer a re-usable framework for interactive simulation and real-time mobile applications. This framework could be useful in areas like training systems, educational platforms, and user-focused embedded software solutions.

Online Session 2: Multimodal Machine Vision and Object Detection Methods in Complex Scenes

Time: 13:30-15:25, March 22, 2026, Sunday, Japan Standard Time, GMT+9
Zoom ID: 822 2622 9974 **Password:** 032022
Session Chair: Prof. Yunxiang Wang, University of Electronic Science and Technology of China, China

Invited Speech

13:30-13:50

Title: Heterodyne Interference Signal Processing in Coherent Single-photon Detection System
Invited Speech: Yunxiang Wang, University of Electronic Science and Technology of China, China

Abstract: Single-photon detectors are critical devices in the fields of quantum key distribution (QKD) and quantum computing. However, existing single-photon detectors cannot achieve both high detection efficiency and room-temperature operation, which restricts their practicality and versatility. Coherent detection plays a crucial role in ultra-weak signal detection, and it can significantly improve the detection sensitivity and operate at room-temperature. In traditional coherent detection systems, threshold decision method is widely employed to demodulate the signal, but it is difficult to reach the single-photon-level sensitivity. Here we demonstrate an interference signal processing method for a heterodyne single-photon detection system operating in the 1550 nm wavelength band. A heterodyne detection system was constructed. Gaussian-shaped optical pulses with 49-ns pulse width and 2.4-MHz repetition rate were generated by frequency shifting and intensity modulating of the signal laser. The laser pulses were subsequently attenuated to the single-photon level and then interfered with a local laser. The interfered optical signal was converted into an electrical signal using a high-efficiency photodetector, yielding the heterodyne interference signal. First, the signal was decomposed into Intrinsic Mode Functions (IMFs) with different frequency bands using variational mode decomposition (VMD). Then, continuous wavelet transform (CWT) was applied to each IMF individually. Finally, the photon arrival time was determined through cross-correlation analysis and phase analysis. Key parameters were optimized towards high detection efficiency and low dark counts. Processing results show that this single-photon detection system can achieve a detection efficiency exceeding 92% and dark counts lower than 300 cps. It indicates that the proposed method exhibits powerful single-photon detection capabilities, enabling high-efficiency room-temperature operation.

Invited Speech

13:50-14:10

Title: Experimental Analysis of the Influences of Lighting in a Virtual TV Studio on Image Compression using Canny Recognition Method
Authors: Dimitrije Djordjevic, Branimir Jaksic, Djoko Bandjur, Jelena Todorovic, Vladimir Maksimovic
Presenter: Branimir Jaksic, University of Pristina in Kosovska Mitrovica, Serbia

Abstract: The paper analyzes the influence of front and back lighting in a virtual TV studio on image compression and behavior of Canny edge detection. The experiment analyses 21 combinations of lighting and three compression methods, JPEG, JPEG2000 and SPIHT. Analysis uses MSE and Canny map for estimating the loss of image structure through wide range of BPP values. JPEG2000 achieves the smallest MSE values and the most stable structure in different lighting condi-tions. JPEG shows the biggest degradation at low bitrates, while SPIHT stands in the middle. The best results are with 800 lux front and 800 lux back light. Weak and unbalanced lighting increases the degradation of edges after compres-sion. Introduced LSC metric clearly shows the amount of deviation that the edges have in the absence of good lighting. Results confirm that the

quality of compres-sion depends on the source of light and algorithm. The conclusions reached assist with optimizing light and source of compression in virtual studio and other sys-tems for image processing.

TJ004

14:10-14:25

Title: A Non-Contact Volume Measurement System using a RGB-D Camera
Authors: JAE HONG SHIM, JIN SEONG SON
Presenter: Jae Hong Shim, Tech University of Korea, Republic of Korea

Abstract: In recent years, the demand for three-dimensional (3D) scanners for shape reconstruction and volume measurement has grown significantly in the fields of manufacturing and quality inspection. However, most commercial 3D scanners rely on expensive equipment or complex robotic systems, making them cost-prohibitive and difficult to access for general users. To address these limitations, this study proposes the design and implementation of a low-cost 3D scanning system that integrates an RGB-D camera with a two degree of freedom(DOF) rotational structure. The proposed system consists of an RGB-D camera mounted on a servo motor enabling horizontal rotation and a turntable that rotates the target object. These two components operate independently, allowing the system to capture point cloud data from multiple perspectives and minimize occluded areas. The acquired point clouds from multiple viewpoints are aligned and post-processed to reconstruct the complete 3D geometry of the object. A volume estimation algorithm is then applied to automatically calculate the object's volume. Experimental results show that despite its simple mechanical configuration, the proposed system achieves accurate shape reconstruction and consistent volume measurement.

TJ051

14:25-14:40

Title: Point Cloud Classification and Segmentation Network based on Dynamic Surface Adaptive Convolution
Authors: Feng Zhang, Wenhai Gan, Shuai Yuan, Haolei Han
Presenter: Wenhai Gan, Shenyang Jianzhu University, China

Abstract: A point cloud classification and segmentation network is proposed which focused on uneven distribution density and complex, diverse detailed features of point clouds scenarios in real-world• First, a Dynamic Surface Representation (DSR) method is constructed to address traditional KNN's inability to adapt to density variations in complex point clouds. It builds a surface structure with explicit shape expression in the point cloud's adaptive neighborhood, enriching shape information and laying the foundation for precise local feature extraction. Second, a Dynamic Surface Adaptive Convolution (DSAconv) is proposed to boost the net-work's adaptability to complex scenarios, dynamically assembling convolution kernels from Weight Bank weight matrices by leveraging DSR-derived surface structure information, enabling effective capture of fine-grained local geometric features. Finally, a point residual mechanism is introduced to optimize DSAconv's Score Prediction Network (ScoreNet): residual connections extend network depth, enhancing ScoreNet's information extraction ability. Experiments on ModelNet40 and ShapeNet datasets demonstrate that the proposed network can improve Overall Accuracy (OA) and mean Intersection over Union (mIoU) compared with most state-of-the-art networks and verify its effectiveness.

TJ1029-A

14:40-14:55

Title: Dielectric-Based Reconfigurable PT-Symmetric Passive Sensors for Structural Health Monitoring
Authors: Ke Bi*, Yunjian Guo
Presenter: Ke Bi, Beijing University of Posts and Telecommunications, China

Abstract: Passive wireless structural health monitoring is often limited by short interrogation distance and insufficient sensitivity. Here we develop a reconfigurable passive wireless sensing platform that integrates an embedded parallel-plate capacitive transducer—formed by a functional dielectric layer and integrated electrodes—with a tunable parity–time (PT)-symmetric reader to

enhance interrogation contrast and extend the usable coupling distance beyond conventional L readout. The transducer is co-designed with an inductor to form an LC resonant unit whose resonance shifts under strain-induced micro-deformation, providing a compact and mechanically robust sensing element without discrete metal layers. Different from prior PT-symmetric sensing demonstrations operating at a fixed working point, we introduce a reconfigurable operating-state strategy that enables range-selective amplification, allowing the reader gain–loss balance and coupling topology to be programmed to a targeted sensing window for early-stage, minute strain/pressure perturbations in safety-critical components. By configuring the reader initial state and tuning the coupled system to the exact PT-symmetric phase, we achieve controllable frequency splitting with two resolvable resonance signatures, improving readout robustness to coupling variations and enhancing the usable interrogation range. At a 15 mm coil separation, the platform delivers up to 22.92 MHz/% strain sensitivity, a gauge factor of 10.8, and a 0–0.9375% operating strain range.

TJ1007

14:55-15:10

Title: Capacity Channel Analysis of FSO Links over Gamma–Chi-Square Turbulence Model
Authors: Jelena Todorovic, Branimir Jaksic, Mihailo Jovanovic, Vladimir Maksimovic, Dimitrije Djordjevic
Presenter: Jelena Todorovic, University of Pristina in Kosovska Mitrovica, Serbia

Abstract: In this paper, the channel capacity of a Free Space Optical (FSO) system modeled by a newly developed Gamma–Chi-square distribution is considered. Using the Gamma–Gamma model and the Chi-square model, a new Gamma–Chi-square model is proposed, formed as a combination of the Gamma and Chi-square (Ri-cian) models, which accurately represent large-scale and small-scale turbulence eddies. For the proposed model, the FSO channel capacity is determined using the Optimum Rate Adaptation with Constant Power (ORA) and Optimum Power and Rate Adaptation (OPRA) algorithms. The optical signal is analyzed under the impact of atmospheric turbulence and pointing errors. The results for the channel capacity are given in analytical form, while numerical results are presented graph-ically for various relevant parameters that affect signal quality, such as turbulence strength, FSO link length, K-factor, Signal-to-Noise Ratio (SNR), and others. The sensitivity of the model to changes in these parameters was also analyzed, in order to verify its applicability under real conditions and to enable a reliable comparison with existing channel models. The presented analysis helps to better understand the system's limitations and provides a basis for optimizing future FSO solutions.

TJ025

15:10-15:25

Title: Unexploded Ordnance Detection Using a Bespoke Uninhabited Aerial System Equipped with Magnetometer Sensors and Virtual Reality Interface
Authors: Benjamin Watkinson, Kaya Kuru, Darren Ansell, David Jones, Alex Thomas Morrison, John Michael Pinder, Ridha Hamila, Claire Tinker-Mill, Robert William Walsh
Presenter: Benjamin Watkinson, University of Lancashire, United Kingdom

Abstract: Unexploded ordnance (UXO) remain a serious and enduring danger to both human and animal populations in post-conflict regions, while simultaneously obstructing economic recovery by limiting agricultural activity and infrastructure development. Traditional methods for locating and clearing them rely heavily on human or animal involvement, exposing them to substantial risk and requiring significant time and labour. To overcome these limitations, this study introduces a smallscale, customised uninhabited aerial system (UAS) developed to automate these tasks, offering a safer and more efficient approach to support and accelerate humanitarian demining operations. The proposed system, termed UASvrUXO, incorporates advanced magnetometer sensors and intelligent automated capabilities and is integrated with a virtual reality (VR) interface through a human-in-the-loop (HITL) framework. Its effectiveness was validated

through extensive field trials conducted in both the UK and Cambodia. Results from open-field test sites confirm the practicality and efficacy of the proposed technologies and methods for the reliable detection of these explosives.

Online Session 3: Intelligent System Motion Control and Obstacle Avoidance Path Planning

Time: 15:35-18:00, March 22, 2026, Sunday, Japan Standard Time, GMT+9
Zoom ID: 822 2622 9974 **Password:** 032022
Session Chair: Prof. Arbnor Pajaziti, University of Prishtina, Kosovo

Invited Speech

15:35-15:55

Title: Supervised and Reinforcement Learning for Grid-Based Robotic Path Planning Using Structured Navigation Data
Invited Speaker: Arbnor Pajaziti, University of Prishtina, Kosovo

Abstract: Autonomous navigation in structured environments remains a core challenge in robotics, requiring accurate path planning, efficient control, and robust obstacle avoidance. This paper presents a hybrid learning framework that integrates supervised learning with Reinforcement Learning (RL) to enhance navigation in discrete environments. The framework is trained and evaluated using a robot path-planning dataset generated in a 5×5 grid world with random obstacles. It first learns navigation policies from expert demonstrations, then refines them through autonomous exploration. A supervised module predicts optimal immediate actions by processing spatial features, while an RL module optimizes long-term navigation efficiency and safety. Experimental results demonstrate that this hybrid approach significantly improves action prediction accuracy, reduces the number of navigation steps, and increases obstacle-avoidance success rates compared to pure supervised or RL baselines. The findings indicate that hybrid learning is a promising strategy for developing intelligent, resource-efficient autonomous systems for applications in mobile robotics and human-robot interaction.

Invited Speech

15:55-16:15

Title: Satellite Network Optimization with Artificial Intelligence Techniques
Invited Speaker: Weiwei Jiang, Beijing University of Posts and Telecommunications, China

Abstract: Facing the large scale, high dynamics, and wide coverage challenges in modern satellite networks, we propose a series of network optimization methods for network routing, satellite handover and satellite edge computing. For network routing, we propose a topology-aware graph reinforcement learning (GRL) model that natively captures orbital dynamics by explicitly modeling the time-varying topological relationships among satellites. This enables fully distributed, foresighted forwarding decisions at each node, significantly reducing end-to-end delay compared to conventional DRL baselines. For network handover, we introduce a dynamic preference adaptation mechanism that replaces static weighting with real-time, user- and context-aware decision-making, thereby overcoming the inherent bias in traditional user-centric strategies and achieving a higher user satisfaction and fewer handovers. Finally, for satellite edge computing, we first propose the MSCRA algorithm, an energy-aware multi-satellite collaboration framework, which jointly optimizes task offloading and resource allocation under strict power constraints. Then, we propose HMADRL, a hierarchical multi-agent DRL framework that decouples offloading and resource allocation to eliminate cross-domain optimization bottlenecks while effectively handling hybrid action spaces. With these schemes, we achieve a lower average task processing

delay and a better load balance.

Title: Tracked unmanned ground vehicle navigation based on A* algorithm
Authors: Wen Wang, Liying Zhang, Yacong Hu, Wenjing Wang, Siyang Wen, Ying Wu
Presenter: Wang Wen, Xi'an University of Posts and Telecommunications, China

TJ015

16:15-16:30

Abstract: Efficient path planning is crucial for tracked unmanned ground vehicles (T-UGVs) in complex environments, such as PV installation sites. However, traditional A* algorithms often yield unsmooth paths and ignore the unique steering characteristics of tracked platforms. This study proposes an improved A* algorithm that refines the evaluation function by incorporating a central steering cost model and a dynamic heuristic weighting scheme. Additionally, a redundant point removal technique and fourth-order Bézier curves are employed to smooth the trajectory. Simulation results demonstrate that the proposed method reduces search time by 66% to 98% and significantly improves path quality compared to traditional A*, Dijkstra, and ACO algorithms. The resulting paths are more kinematically feasible and stable for T-UGVs.

Title: A TD3 approach based on Two-Sided Evolutionary Fusion for Robotic Arm path planning
Authors: Feng Zhang, Haiyan Liu, Shuai Yuan, Chengjie Fan
Presenter: Haiyan Liu, Shenyang University of Architecture, China

TJ052

16:30-16:45

Abstract: A Two Side Evolutionary Fusion-Twin Delayed Deep Deterministic Policy Gradient (TEA-TD3) method is proposed focused on low planning efficiency along with long and tortuous paths for robotic arm path planning. Firstly, TEA-TD3 utilizes the Improved Cross-Entropy Method (ICEM) to alternately optimize the actor network and the critic network of TD3, thereby obtaining a better critic policy and improving the overall convergence speed. Secondly, hybrid distribution evolutionary perturbation mechanism and elite individual recycling mechanism are proposed. These mechanisms balance the scope of initialization perturbations for the actor network population and reintroduce the best critic network individual from the previous generation into the current population, thereby enhancing the overall explorative capability and stability of the method. Finally, the robotic arm conducts path planning experiments in the Robot Operating System (ROS)-Gazebo simulator. The experimental results demonstrate that the proposed method outperforms the ICEM-TD3 and TD3 methods in terms of success rate, average path length, average distance to the target, and average steps to completion.

Title: Energy Efficient Navigation of Autonomous Mobile Robots Using Euler Spiral Based Trajectories
Authors: Tran Viet Thanh, Enock William Nshama, Naoki Uchiyama
Presenter: Tran Viet Thanh, Toyohashi University of Technology, Japan

TJ018

16:45-17:00

Abstract: This paper presents a new approach to energy-efficiently navigate an autonomous mobile robot in a structured environment, based on Euler spirals and jerk limited acceleration profiles. Euler spirals, also known as clothoids, are curves that have curvature proportional to the curve length. The approach was

evaluated using an novel energy consumption model of the robot, which identification and verification were conduct using dynamics model of each motor of the real robot. The constant curvature and other smoothening strategies were compared and Euler spirals were found the most energy-efficient. The results show that the proposed approach can reduce the energy consumption of the robot by 28.2% compared to the constant curvature approach.

TJ030

17:00-17:15

Title: Research on trajectory planning of 6-DOF robot based on cubic B-spline
Authors: Qidi Tan, Junxi Bi, Zhian Xue, Wenqiang Xu
Presenter: Qidi Tan, Inner Mongolia University of Technology, China

Abstract: This paper investigates trajectory planning for a six-degree-of-freedom(6-DOF) robotic manipulator with the objective of satisfying kinematic constraints while ensuring path-tracking accuracy and high-order smoothness. A trajectory planning framework based on cubic B-spline interpolation in the joint space is developed. Leveraging the local support property of B-spline curves, additional control points are introduced to enable local freedom adjustments. Simulations of the 6-DOF manipulator model are conducted in MATLAB, yielding profiles of joint angles, velocities, and accelerations. The results demonstrate that the proposed B-spline-based approach effectively generates smooth and kinematically feasible trajectories for robotic manipulation tasks.

TJ003

17:15-17:30

Title: Autonomous Surface Vessels Path Following and Static Obstacle Collision Avoidance Using Deep Reinforcement Learning
Authors: Nam Hoang Tran, Hung Duc Nguyen, Peter King, Minh Tran
Presenter: Nam H. Tran, University of Tasmania, Australia

Abstract: Autonomous Surface Vessels (ASVs) require reliable path following and collision avoidance for safe maritime operations, particularly in cluttered or uncertain environments. This paper proposes a Deep Reinforcement Learning (DRL) framework that integrates a 3-DOF dynamic ship model with a simulated LiDAR sensor to enable realistic perception and manoeuvring. Two algorithms, Proximal Policy Optimization (PPO) and Soft Actor-Critic (SAC), are trained and evaluated in randomized scenarios with static obstacles. The framework employs a continuous rudder control action space and a multi-objective reward function with a weighting coefficient to balance path following and obstacle avoidance. Extensive experiments across 1000 test episodes show that SAC consistently outperforms PPO, achieving over 90% success rates, smoother trajectories, and better robustness to varied obstacle layouts. The weighting coefficient is shown to significantly influence agent behaviour, with lambda value of 0.5 providing the best trade-off between safety and efficiency. These results demonstrate the effectiveness of entropy-regularised off-policy methods for ASV navigation and highlight design considerations for future real-world deployment.

TJ020

17:30-17:45

Title: Effects of Trajectory Geometry and Temporal Lookahead on MPC-Based Trajectory Tracking in Autonomous Vehicles
Authors: Adam Hamadi, Faris Shahab, Nader Meskin, Uvais Qidawi, John-John Cabibihan

Presenter: Adam Hamadi, Qatar University, Qatar

Abstract: Nonlinear model predictive control (MPC) tracking performance depends not only on controller design but also on the reference trajectory geometry and its temporal alignment. This paper presents a controlled comparison of cubic Hermite spline and B´ezier curve references for nonlinear MPC-based tracking of an Ackermann-steered vehicle under identical controller settings in Gazebo. Tracking accuracy is evaluated using root-mean-square error (RMSE) in lateral position, speed, and heading.
Across repeated laps, the B´ezier reference improves tracking rela-tive to the Hermite spline baseline, including a 38.8% reduction in velocity RMSE, while heading accuracy remains comparable. We further investigate temporal alignment by sweeping a lookahead parameter on the B´ezier reference and find that zero lookahead yields the best lateral tracking under nominal conditions, whereas positive lookahead generally increases lateral error. These results highlight the influence of trajectory representation and timing onMPC tracking and indicate limited benefit of positive temporal lookahead in disturbance-free simulation.

TJ1027

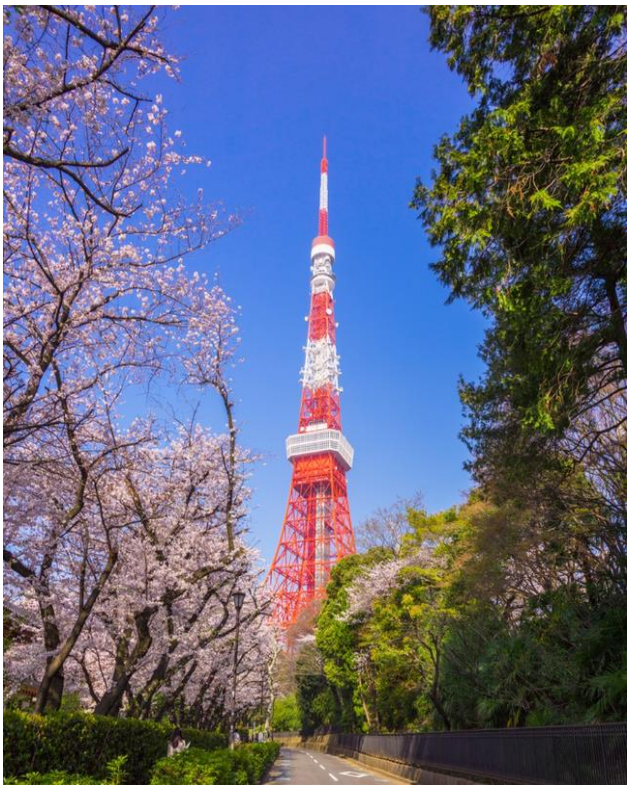
17:45-18:00

Title: A Hybrid Deep Learning for Automated Pneumonia Detection using Chest X-ray Images

Authors: Claudine Mae L. Leysa, Jirah P. Tupas, Ivan Jay P. Palec, Jocelle May Q. Pragados, Kharen Mhae L. Arendaje
Presenter: Claudine Mae L. Leysa, West Visayas State University-Pototan Campus, Philippines

Abstract: Pneumonia remains a critical global health challenge, particularly in resource-constrained regions where radiological expertise is limited. While deep learning has demonstrated significant potential in medical imaging, singular architectures often struggle to simultaneously achieve high-sensitivity detection, precise localization, and accurate severity classification. This study introduces a novel three-stage hybrid AI pipeline integrating a Convolutional Neural Network (CNN), a Region-based CNN (R-CNN), and an Artificial Neural Network (ANN) designed to provide a comprehensive diagnostic tool for chest X-ray analysis. The proposed model employs a modular approach wherein CNN is utilized for initial feature extraction and binary detection of pneumonia, R-CNN is employed for the precise regional localization of pulmonary opacities, and ANN is used for the downstream differential classification between bacterial and viral pneumonia. The model was trained and tested on a dataset of 5,856 chest X-ray images categorized into Normal, Bacterial, and Viral classes. The hybrid architecture achieved a state-of-the-art accuracy of 98.4%. Pilot testing was conducted at two healthcare hubs in Iloilo, Philippines, demonstrating the system's efficacy in realworld clinical settings. The findings indicate that this hybrid strategy significantly improves diagnostic precision and offers a scalable solution to alleviate clinical workloads in overburdened healthcare systems.

Tokyo



Tokyo (東京, Tōkyō) is Japan's capital and the world's most populous metropolis. It is also one of Japan's 47 prefectures, consisting of 23 central city wards and multiple cities, towns and villages west of the city center. The Izu and Ogasawara Islands are also part of Tokyo.

Prior to 1868, Tokyo was known as Edo. Previously a small castle town, Edo became Japan's political center in 1603 when Tokugawa Ieyasu established his feudal government there. A few decades later, Edo had grown into one of the world's largest cities. With the Meiji Restoration of 1868, the emperor and capital moved from Kyoto to Edo, which was renamed Tokyo ("Eastern Capital"). Large parts of Tokyo were destroyed in the Great Kanto Earthquake of 1923 and the air raids of 1945.

Today, Tokyo offers a seemingly unlimited choice of shopping, entertainment, culture and dining to its visitors. The city's history can be appreciated in districts such as Asakusa and in many excellent museums, historic temples and gardens. Contrary to common perception, Tokyo also offers a number of attractive green spaces in the city center and within relatively short train rides at its outskirts.

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Memo