ICAROB 2025

PROCEEDINGS OF THE 2025 INTERNATIONAL CONFERENCE ON ARTIFICIAL LIFE AND ROBOTICS

February 13 to 16, 2025
J:COM HorutoHall, Oita, Japan
30th AROB International Meeting Series

Editor-in-Chief
Masanori Sugisaka
Editors: Yingmin Jia, Takao Ito, Ju-Jang Lee
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(ICAROB2025)

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HISTORY

The International Conference on Artificial Life and Robotics (ICAROB) resulted from the AROB-symposium (International Symposium on Artificial Life and Robotics) whose first edition was held in 1996 and the eighteenth and last edition in 2013. The AROB symposium was annually organized by Oita University and ALife Robotics Corporation Ltd., under the sponsorship of the Science and Technology Policy Bureau, the Ministry of Education, Science, Sports, and Culture (Monbusho), presently, the Ministry of Education, Culture, Sports, Science, and Technology (Monkasho), Japanese Government, Japan Society for the Promotion of Science (JSPS), the Commemorative Organization for the Japan World Exposition ('70), Air Force Office of Scientific Research, Asian Office of Aerospace Research and Development (AFOSR/AOARD), USA. I would like to express my sincere thanks to not only Monkasho (annually fund support from 1996 to 2013) but also JSPS, the Commemorative Organization for the Japan World Exposition ('70), and various other Japanese companies for their repeated support. The old symposium (this symposium has been held every year at B-Con Plaza, Beppu, Oita, Japan except in Oita, Japan (AROB 5th ’00) and in Tokyo, Japan (AROB 6th ’01).) was organized by the International Organizing Committee of AROB and was co-operated by the Santa Fe

Institute (USA), RSJ, IEEJ, ICASE (Now ICROS) (Korea), CAAI (P. R. China), ISCIE, IEICE, IEEE (Japan Council), JARA, and SICE. The old AROB-symposium expanded much by absorbing much new knowledge and technologies into it. This history and character of the former AROB symposiums are passed on the current ICAROB conference and to these journals, Journal of Robotics, Networking and Artificial Life (JRNAL)(vol1-8) & Journal of Robotics, Networking and Artificial Life (JRNAL)(vol9-) & Journal of Advances in Artificial Life Robotics (JAALR). From now on, ALife Robotics Corporation Ltd. is in charge of management of both the conference and the journals. The future of the ICAROB is brilliant from a point of view of yielding new technologies to human society in the 21st century. We also expect to establish an international research institute on Artificial Life and Robotics in the future with the help of Japanese Government and ICAROB. This conference invites you all.

AIMS AND SCOPE

The objective of this conference is the development of new technologies for artificial life and robotics which have been recently born in Japan and are expected to be applied in various fields. This conference presents original technical papers and authoritative state-of-the-art reviews on the development of new technologies concerning robotics, networking and artificial life and, especially computer-based simulation and hardware for the twenty-first century. This conference covers a broad multidisciplinary field, including areas such as:

Artificial intelligence & complexity
Artificial living
Artificial mind research
Artificial nervous systems for robots
Artificial sciences
Bipedal robot
Brain science and computing
Chaos
Cognitive science
Computational Molecular biology
Computer graphics
Data mining
Disasters robotics
DNA computing
Empirical research on network and MOT
Environment navigation and localization
Evolutionary computations
Facial expression analysis, music recommendation and augmented reality
Foundation of computation and its application
Fuzzy control
Genetic algorithms
Human-welfare robotics
Image processing
Insect-like aero vehicles
Intelligence in biological systems
Intelligent control
Management of technology
Medical surgical robot
Micro-machines
Multi-agent systems
Nano-biology
Nano-robotics
Networking
Neural circuits
Neuro-computer
Neuromorphic Systems
Neuroscience
Pattern recognition
Quantum computing

Reinforcement learning system & genetic programing
Robotics
Software development support method
System cybernetics
Unmanned underwater vehicles
Unmanned Aerial Systems Technologies
Unmanned Aerial Systems designing, controls and navigation
Unmanned Aero vehicles
Virtual reality
Visualization
Hardware-oriented submissions are particularly welcome. This conference will discuss new results in the field of artificial life and robotics

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Accepted papers will be published in the proceeding of The 2025 International Conference on Artificial Life and Robotics (ICAROB2025) by ALife Robotics Corp. Ltd. Copyright belongs to ALife Robotics Corp. Ltd. Some of high-quality papers in the proceeding will be requested to re-submit their papers for the consideration of publication in Journal of Robotics, Networking and Artificial Life (JRNAL)(vol1-8) & Journal of Robotics, Networking and Artificial Life (JRNAL)(vol9-) & Journal of Advances in Artificial Life Robotics(JAALR) under agreement of both Editor-in- Chief Dr. Masanori Sugisaka and 3 reviewers. All correspondence related to the conference should be addressed to ICAROB Office.

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MESSAGES

Masanori Sugisaka
General Chair
(President, ALife Robotics Corp., Ltd, Japan)

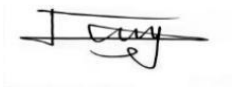
Masanori Sugisaka

Masanori Sugisaka

General Chair of ICAROB

It is my great honor to invite you all to The 2025 International Conference on Artificial Life and Robotics (ICAROB 2025) to be held at J:COM HorutoHall, Oita, Japan, 2025. This Conference is changed as the old symposium from the first (1996) to the Eighteenth (2013) annually which were organized by Oita University and ALife Robotics Corporation Ltd. under the sponsorship of the Science and Technology Policy Bureau, the Ministry of Education, Science, Sports, and Culture (Monbusho), presently, the Ministry of Education, Culture, Sports, Science, and Technology (Monkasho), Japanese Government, Japan Society for the Promotion of Science (JSPS), The Commemorative Organization for the Japan World Exposition (’70), Air Force Office of Scientific Research, Asian Office of Aerospace Research and Development (AFOSR/AOARD), USA. I would like to express my sincere thanks to not only Monkasho (annually fund support from 1996 to 2013) but also JSPS, the Commemorative Organization for the Japan World Exposition (’70), Japanese companies for their repeated support.
The old symposium was organized by International Organizing Committee of AROB and was co-operated by the Santa Fe Institute (USA), RSJ, IEEJ, ICASE (Now ICROS) (Korea), CAAI (P. R. China), ISCIE, IEICE, IEEE (Japan Council), JARA, and SICE. The old AROB symposium was growing up by absorbing many new knowledge and technologies into it. This history and character was inherited also from ICAROB2014(The 2014 International Conference on Artificial Life and Robotics, included a series of ICAROB proceedings indexed by SCOPUS and CPCI-Web of Science now. From now on, ALife Robotics Corporation Ltd. is in charge of management. This year we have The 2025 International Conference on Artificial Life and Robotics (ICAROB2025) (30th AROB Anniversary). The future of The ICAROB is brilliant from a point of view of yielding new technologies to human society in 21st century. I have founded Robot Artificial Life Society in 2017/12/07 together with Professor at Hiroshima University Takao Ito and Professor at University of Miyazaki Makoto Sakamoto. I hope that fruitful discussions and exchange of ideas between researchers during Conference (ICAROB2025) will yield new merged technologies for happiness of human beings and, hence, will facilitate the establishment of an international joint research institute on Artificial Life and Robotics in future.

Yingmin Jia
Co-General Chair
(Professor, Beihang University, P.R. China)



Yingmin Jia

Co-General Chair of ICAROB

It is my great pleasure to invite you to The 2025 International Conference on Artificial Life and Robotics (ICAROB 2025), will be held at J:COM Horuto Hall, Oita, JAPAN, from February 13 to 16, your understanding and support will be the strongest driving force for us to organize the meeting well.

ICAROB develops from the AROB that was created in 1996 by Prof. Masanori Sugisaka and will celebrate her 30th Anniversary in 2025. So far many important results have been presented at the past meetings and have a profound impact on artificial life and robotics. Doubtless, it is really one of the most famous international conferences in the field of artificial intelligence and attract wide interests among scientist, researchers, and engineers around the world, and effectively promotes the unprecedented popularity of artificial intelligence. Especially, we feel very happy for Prof. Sugisaka's good health and would like to express our sincerest congratulations to him.

For a successful meeting, many people have contributed their great efforts to the ICAROB. Here, I would like to express my special thanks to all authors and speakers, and the meeting organizing team for their excellent works. Looking forward to seeing you at the ICAROB2025.

Takao Ito
Co-General Chair
(Professor Hiroshima University, Japan)

Takao Ito

Co-General Chair of ICAROB

It is my great honor and pleasure to invite you all to the 2025 International Conference on Artificial Life and Robotics (ICAROB 2025).

The ICAROB has its long history. First launched in 1996 as ISAROB, this former organization of ICAROB, was developed under the strong leadership and yeoman efforts of the President—the internationally famous Professor Masanori Sugisaka, who is widely acknowledged as the father of our AROB conference. Our conference has brought together many research scholars, faculty members, and graduate students from all over the world, and published numerous manuscripts in high-quality proceedings as well as highly reputed journals every year.

Over the years, dramatic improvements have been made in the field of artificial life and its applications. The ICAROB has provided a foundation for unifying the exchange of scientific information on the studies of man-made systems that exhibit the behavioral characteristics of natural living systems, including software, hardware, and wetware. Our conference shapes the development of artificial life, extending our empirical research beyond the territory circumscribed by life-as-we-know-it and into the domain of life-as-it-could–be. It will provide us a good place to present our new research results, innovative ideas, and valuable information about artificial intelligence, complex systems theories, robotics, and management of technology.

The conference site is Horuto Hall, one of the most famous international convention centers in Oita City, Japan. You can find many fantastic scenic spots and splendid historical places in Oita City. Please enjoy your stay!

I eagerly look forward to personally meeting you during the ICAROB 2025 and to sharing a most pleasant, interesting, and fruitful conference with you. Do come and make this conference a fruitful, productive as well as enjoyable event!

Ju-Jang Lee
Co-General Chair
(Honorary professor, KAIST)

Ju-Jang Lee

Co-General Chair of ICAROB

The First International Conference on Artificial Life and Robotics (ICAROB) was held in Oita City, Oita, Japan from Jan. 11th to 13th, 2014. This year's Conference will be held amidst the high expectation of the increasingly important role of the new interdisciplinary paradigm of science and engineering represented by the field of artificial life and robotics that continuously attracts wide interests among scientist, researchers, and engineers around the globe.
Distinguished researchers and technologists from around the world are looking forward to attending and meeting at ICAROB. ICAROB is becoming the annual excellent forum that represents a unique opportunity for the academic and industrial communities to meet and assess the latest developments in this fast-growing artificial life and robotics field. ICAROB enables them to address new challenges, share solutions, discuss research directions for the future, exchange views and ideas, view the results of applied research, present and discuss the latest development of new technologies and relevant applications.
In addition, ICAROB offers the opportunity of hearing the opinions of well-known leading experts in the field through the keynote sessions, provides the bases for regional and international collaborative research, and enables to foresee the future evolution of new scientific paradigms and theories contributed by the field of artificial life and robotics and associated research area. The twenty-first century will become the century of artificial life and intelligent machines in support of humankind and ICAROB is contributing through wide technical topics of interest that support this direction.
It is a great honor for me as a Co-General Chair of the 12th ICAROB 2025 to welcome everyone to this important event. Also, I would like to extend my special thanks to all authors and speakers for contributing their research works, the participants, and the organizing team of the 12th ICAROB.
I'm looking forward to meeting you at the 12th ICAROB at J:COM HorutoHall in Oita city and wishing you all the best.

GENERAL SESSION TOPICS

GS1 Machine Learning & Autonomous Driving (5)	GS2 Image Processing I (4)
GS3 Image Processing II (4)	GS4 Robotics (5)
GS5 Applications I (6)	GS6 Applications II (5)

ORGANIZED SESSION TOPICS

OS1 Human-Machine Interface (7)	OS2 Computer and Information Engineering (3)
OS3 Robot Path Planning (6)	OS4 Robot Images and Motion (3)
OS5 Intelligent Life and Cybersecurity (7)	OS6 Intelligent Algorithm Application (7)
OS7 Intelligent Robotics and Systems (6)	OS8 Intelligent Systems and Applications (8)
OS9 Pattern Recognition and Control I (7)	OS10 Pattern Recognition and Control II (7)
OS11 Industrial Artificial Intelligence Robotics (7)	OS12 Advances in Field Robotics and Their Applications (9)
OS13 Research Towards the Renewable Energy and the Sustainable Development Goals (SDG's) / Part A (5)	OS14 Research Towards Renewable Energy and the Sustainable Development Goals (SDG's)/ Part B (4)
OS15 Robotic Manipulation (5)	OS16 Natural Computing (3)
OS17 Artificial Intelligence for Embedded Systems and Robotics (10)	OS18 Robotics in Biophilic-Designed Space Toward Co-existence of Humans, Robots, and Plants (4)
OS19 Intelligent Control (4)	OS20 Applications (6)
OS21 Applications of Information Technology for Better Living (5)	OS22 Navigation and Tracking (3)
OS23 Mathematical Informatics (10)	OS24 New Media Interactions (3)
OS25 Robotic and Communications (6)	OS26 Navigating the Digital Frontier: Innovations in the Age of Industry Revolution 4.0 (11)
OS27 Industrial Revolution (4)	

TIME TABLE (2/13)

Local time in Japan

2/13(Thu.) 17:30-19:30	Welcome Party (Oita Century Hotel)
2/16(Sun) 15:00-16:00	Farewell Party

TIME TABLE (2/14)

2/14(Fri.)	**Room 403**	**Room 404**	**Room 405**	**Room 406** **Remote Session** (ZOOM ID: 835 1207 4893)	**Room 407** **Remote Session** (ZOOM ID: 810 2039 1137)
9:40-	Registration (407)				
10:00-11:15	OS7 Intelligent Robotics and Systems (6) Chair: Kuo-Hsien Hsia will be ended before 11:30	OS19 Intelligent Control (4) Chair: Yingmin Jia	GS6 Applications II (5) Chair: Marion Oswald	OS14 Research Towards Renewable Energy and the Sustainable Development Goals (SDG's)/ Part B (4) Chair: Firas Basim	
11:15-11:30	Coffee Break				
11:30-12:00	Chair: Marion Oswald (Room 302. 303) Opening Ceremony				OS25-1 Robotic and Communications (2) Chair: Mastaneh Moayef
12:00-13:00	Lunch				
13:00-14:00	Chair: Takao Ito (Room 302, 303) Plenary Speech PS2 Firas Basim Ismail (Universiti Tenaga Nasional (UNITEN), Malaysia)				OS25-2 Robotic and Communications (4) Chair: Mastaneh Mokayef
14:00-14:30	Coffee break				
14:30-15:45	OS5-1 Intelligent Life and Cybersecurity (5) Chair: I-Hsien Liu	OS8-1 Intelligent Systems and Applications (5) Chair: Chun-Liang Liu	OS17-1 Artificial Intelligence for Embedded Systems and Robotics (5) Chair: Hakaru Tamukoh	OS6-1 Intelligent Algorithm Application (5) Chair: Peng Wang	OS9-1 Pattern Recognition and Control I (5) Chair: Sun Haozhe
15:45-16:00	Coffee break				
16:00-17:15	OS5-2 Intelligent Life and Cybersecurity (2) Chair: I-Hsien Liu will be ended before 16:30	OS8-2 Intelligent Systems and Applications (3) will be ended before 16:45	OS17-2 Artificial Intelligence for Embedded Systems and Robotics (5) Chair: Hakaru Tamukoh	OS6-2 Intelligent Algorithm Application (2) Chair: Peng Wang will be ended before 16:30	OS9-2 Pattern Recognition and Control I (2) Chair: Sun Haozhe will be ended before 16:30

TIME TABLE (2/15)

2/15(Sat.)	Room 403	Room 404	Room 405	Room 406 Remote Session (ZOOM ID: 835 1207 4893)
9:40-	Registration (407)			
10:00-11:15	GS4 Robotics (4) Chair: will be ended before 11:00	OS18 Robotics in Biophilic-Designed Space Toward Co-existence of Humans, Robots, and Plants (4) Chair: Yuichiro Tanaka	GS5 Applications I (5) Chair: Tsutomu Ito	OS1-1 Human-Machine Interface (5) Chair: Norrima Mokhtar
11:15-11:30	Coffee break			
11:30-12:15	GS3 Image Processing II (3) Chair: Kuo-Hsien Hsia	OS16 Natural Computing (3) Chair: Marion Oswald	OS22 Navigation and Tracking (3) Chair: Chan Gook Park	OS1-2 Human-Machine Interface (3) Chair: Norrima Mokhtar
12:15-13:00	Lunch			
13:00-14:00	Chair: Eiji Hayshi (Room 302, 303) Plenary Speech PS3 Norrima Mokhtar (Universiti Malaya, Malysia)			OS26-1 Navigating the Digital Frontier: Innovations in the Age of Industry Revolution 4.0 (5) Chair: Wei Hong Lim will be ended before 14:15
14:00-14:20	Coffee break			
14:20-15:20	Chair: Amane Takei (Room 302, 303) Plenary Speech PS1 Shinobu Yoshimura (The University of Tokyo, Japan)			OS26-2 Navigating the Digital Frontier: Innovations in the Age of Industry Revolution 4.0 (4) Chair: Wei Hong Lim
15:20-15:40	Coffee break			
15:40-16:55	GS1 Machine Learning & Autonomous Driving (4) Chair: Obada Al aama will be ended before 16:40	OS11-1 Industrial Artificial Intelligence Robotics (5) Chair: Eiji Hayashi	OS15 Robotic Manipulation (5) Chair: Kensuke Harada	OS26-3 Navigating the Digital Frontier: Innovations in the Age of Industry Revolution 4.0 (3) Chair: Wei Hong Lim
16:55-17:05				
17:05-18:05	GS2 Image Processing I (4) Chair: Amane Takei	OS11-2 Industrial Artificial Intelligence Robotics (2) Chair: Eiji Hayashi will be ended before 17:35	OS24 New Media Interactions (3) Chair: R.P.C. Janaka Rajapakse Remote Session (ZOOM ID: 841 9902 1154)	OS2 Computer and Information Engineering (3) Chair: Norrima Mokhtar will be ended before 17:50
18:30-20:30	Banquet (Tokiwa Kaikan)			

TIME TABLE (2/16)

2/16(Sun.)	Room 403	Room 404	Room 405 Remote Session (ZOOM ID: 841 9902 1154)	Room 406 Remote Session (ZOOM ID: 835 1207 4893)	Room 407 Remote Session (ZOOM ID: 810 2039 1137)
9:40-	Registration (407)				
10:00-11:15	OS12-1 Advances in Field Robotics and Their Applications (5) Chair: Shinsuke Yasukawa	OS21 Applications of Information Technology for Better Living (5) Chair: Tetsuro Katayama	OS10-1 Pattern Recognition and Control II (5) Chair Zhai Hongshuo	OS13 Research Towards the Renewable Energy and the Sustainable Development Goals (SDG's) / Part A (5) Chair Ammar A.M. Al Talib	OS27 Industrial Revolution (4) Chair: Hazry Desa will be ended before 11:00
11:15-11:30	Coffee Break				
11:30-12:00	OS12-2 Advances in Field Robotics and Their Applications (2) Chair: Shinsuke Yasukawa	OS23-1 Mathematical Informatics (2) Chair: Takao Ito	OS10-2 Pattern Recognition and Control II (2) Chair Zhai Hongshuo	OS4 Robot Images and Motion (3) Chair: Miao Zhang Will be ended before 12:15	
12:00-13:00	Lunch				
13:00-15:00	OS12-3 Advances in Field Robotics and Their Applications (2) Chair: Shinsuke Yasukawa will be ended before 13:30	OS23-2 Mathematical Informatics (8) Chair: Takao Ito	OS20 Applications (8) Chair: Kasthuri Subaramaniam	OS3 Robot Path Planning (6) Chair: Shengwei Liu will be ended before 14:30	
15:00-16:00	Farewell Party				

The 2025 International Conference on ARTIFICIAL LIFE AND ROBOTICS (ICAROB2025)

February 13 (Thursday)

17:30-19:30 Welcome Party (Oita Century Hotel)

February 14 (Friday)

Room 302, 303

11:30-12:00 Opening Ceremony

Chair: Marion Oswald (Vienna University of Technology, Austria)

Welcome Addresses

1. General Chairman of ICAROB	Masanori Sugisaka (ALife Robotics Co., Ltd., Japan)
2. Co-General Chairman of ICAROB	Yingmin Jia (Beihang University, China)
3. Co-General Chairman of ICAROB	TaKao Ito (Hiroshima University, Japan)
4. Co General Chairman of ICAROB	Ju-Jang Lee (Honorary professor, KAIST)
5. Vice General Chair of ICAROB	Norrima Mokhtar (University of Malaya, Malaysia)
6. Vice General Chair of ICAROB	Katia Passerini (Seton Hall University, USA)

February 15 (Saturday)

Banquet: Tokiwa Kaikan

18:30-20:30

Chair: Takao Ito (Hiroshima University, Japan)

Welcome Addresses

Prof. Yingmin Jia (Beihang University, P.R. China)

Dr. Norrima Mokhtar (University of Malaya, Malaysia)

TECHNICAL PAPER INDEX

February 14 (Friday)

9:40-Registration

Room 302, 303

11:30-12:00 Opening Ceremony

Chair: Marion Oswald (Vienna University of Technology, Austria)

13:00-14:00

Plenary Speech PS2

Chair: Takao Ito (Hiroshima University, Japan)

PS2 *Toward 2035: Renewable Energy Innovations Transforming Our Future*
Firas Basim Ismail (Universiti Tenaga Nasional (UNITEN), Malaysia)

Room 403

10:00-11:30 OS7- Intelligent Robotics and Systems (6)

Chair: Kuo-Hsien Hsia (National Yunlin University of Science and Technology, Taiwan)

Co-Chair: Jia-Ming Hsiao (National Yunlin University of Science and Technology, Taiwan)

OS7-1 *Fuzzy-Controlled Multi-Valve Pneumatic Soprano Recorder Auto-Playing and Score Recognition System*
Chun-Chieh Wang*, Chung-Wen Hung, Kuo-Hsien Hsia, Chian C. Ho, Ying-Yuan Yao
(National Yunlin University of Science and Technology, Taiwan)

OS7-2 *Development of agricultural robots based on ROS*
Jr-Hung Guo*, Kuo-Hsien Hsia (National Yunlin University of Science and Technology, Taiwan)

OS7-3 *The ROS-based web information center of small manipulator*
Yue-Jie Wang, Jia-Ming Hsiao*, Shao-Yi Hsiao
(National Yunlin University of Science & Technology, Taiwan)

OS7-4 *Image-assisted Assembly and Disassembly Process Using TM Six-Axis Collaborative Robotic Arm*
Kuo-Hsien Hsia, Yi- Yan Liao, Ching-Yuan Pan
(National Yunlin University of Science & Technology, Taiwan)

OS7-5 *Quality Inspection of PVC Shoe Chopsticks: A Research Study*
Shu-Li Pai, Kuo-Hsien Hsia, Chian-Cheng Ho
(National Yunlin University of Science and Technology, Taiwan)

OS7-6 *Obstructing PLC Operations through Modbus Command Manipulation*
Nai-Yu Chen, Cheng-Ying He, Jung-Shain Li, Chu-Sing Yang, I-Hsien Liu
(National Cheng Kung University, Taiwan)

14:30-15:45 OS5-1 Intelligent Life and Cybersecurity (5)
Chair: I-Hsien Liu (National Cheng Kung University, Taiwan)
Co-Chair: Chu-Fen Li (National Formosa University, Taiwan)
Co-Chair: Cheng-Han Lin (Fooyin University, Taiwan)

OS5-1 *A Diamond Model Approach to Analyzing GhostSec's Intrusion Paths*
Cheng-Ying He, Nai-Yu Chen, Jung-Shain Li, I-Hsien Liu
(National Cheng Kung University, Taiwan)

OS5-2 *A Bandwidth-Aware Routing Mechanism to Control Hadoop Shuffle Traffic over Software-Defined Networking*
Ming-Syuan Wu (National Kaohsiung University of Science and Technology, Taiwan)
Cheng-Han Lin (Fooyin University, Taiwan)
Wen-Shyang Hwang
(National Kaohsiung University of Science and Technology, Taiwan)
Ce-Kuen Shieh, Mao-Syun Lin (National Cheng Kung University, Taiwan)

OS5-3 *AI Sentencing System: Homicide Case Study in Taiwan*
Shih-Chin Lin, Cheng-Tsung Yeh, Chen-Yu Lai, Chih-Yun Chang, Chi-Ju Fu
(Ming Chuan University, Taiwan)

OS5-4 *Inferring ICS Topology and Behavior through Network Traffic Analysis*
Chien-Wen Tseng, Jung-Shain Li, I-Hsien Liu
(National Cheng Kung University, Taiwan)
Chu-Fen Li (National Formosa University, Taiwan)

OS5-5 *Using fuzzy control routing for dynamic load balancing over Software-Defined Networks*
Wen-Shyang Hwang, Ming-Syuan Wu, Sian-Fong Huang
(National Kaohsiung University of Science and Technology, Taiwan)
Cheng-Han Lin (Fooyin University, Taiwan),
Yan-Jing Wu (Shih Chien University, Taiwan)
Ming-Hua Cheng (Tzu-Hui Institute of Technology, Taiwan)

16:00-16:30 OS5-2 Intelligent Life and Cybersecurity (2)
Chair: I-Hsien Liu (National Cheng Kung University, Taiwan)
Co-Chair: Chu-Fen Li (National Formosa University, Taiwan)
Co-Chair: Cheng-Han Lin (Fooyin University, Taiwan)

OS5-6 *The Application of AI in the Real Estate Industry: Business Model Innovation Perspective*
Li-Min Chuang, Chih-Hung Chen (Chang Jung Christian University, Taiwan)

OS5-7 *The Impact of AI-Powered Health Monitoring on the Quality of Life and Social Participation of the Elderly: Technology Acceptance Model Perspective*
Li-Min Chuang, Zong-Sheng Li (Chang Jung Christian University, Taiwan)

Room 404

10:00-11:00 OS19 Intelligent Control (4)

Chair: Yingmin Jia (Beihang University, P.R.China)

Co-Chair: Weicun Zhang (University of Science and Technology Beijing, P.R.China)

OS19-1 *Practical Linearization Control of Nonholonomic Unicycles*
Lixia Yan, Yingmin Jia (Beihang University (BUAA), P.R.China)

OS19-2 *Task-Space Tracking Control for Dual-arm Free-floating Space Manipulators with Disturbances and Uncertainties*
Qian Sun, Yingmin Jia (Beihang University (BUAA), P.R.China)

OS19-3 *Manipulability Optimization for Redundant Dual-Arm Robots at the Acceleration Level*
Yang Zhang, Yingmin Jia (Beihang University (BUAA), P.R.China

OS19-4 *Flocking Control for Multiple Convex Polygonal Agents with Obstacle Avoidance*
Yaxin Li, Yingmin Jia (Beihang University (BUAA), Beijing P.R.China)

14:30-15:45 OS8-1 Intelligent Systems and Applications (5)

Chair: Chun-Liang Liu (National Yunlin University of Science and Technology, Taiwan)

Co-Chair: Yuting Hsiao (National Yunlin University of Science and Technology, Taiwan)

OS8-1 *MCU Ultrasonic oscillator driver with digital frequency sweep function*
Chung-Wen Hung, Chun-Chieh Wang, Yu-Hsing Su
(National Yunlin University of Science and Technology, Taiwan)

OS8-2 *Design and development of foot pressure sensing massage stick*
Yuting Hsiao, Dengchuan Cai, Chung-Wen Hung
(National Yunlin University of Science and Technology, Taiwan)

OS8-3 *Effects on physiological indicators of foot massage using a pressure sensing massage stick*
Dengchuan Cai, Yuting Hsiao, Chung-Wen Hung
(National Yunlin University of Science and Technology, Taiwan)

OS8-4 *Study on Maximum Power Point Tracking Technology for Solar Power Systems Using Power Variation to Adjust Step Response*
Chun-Liang Liu, Chung-Wen Hung, Yi-Feng Luo, Guan-Jhu Chen, Cheng-Sin Hu
(National Yunlin University of Science and Technology, Taiwan)

OS8-5 *Bearing faulty prediction based on knowledge distillation*
Chun-Liang Liu, Zheng-Jie Liao, Chung-Wen Hung
(National Yunlin University of Science and Technology, Taiwan)

16:00-16:45 OS8-2 Intelligent Systems and Applications (3)
Chair: Chun-Liang Liu (National Yunlin University of Science and Technology, Taiwan)
Co-Chair: Yuting Hsiao (National Yunlin University of Science and Technology, Taiwan)

OS8-6 *Accurate Brain Age Prediction Through Advanced Preprocessing and 3D DenseNet-50 Modeling*
Ting-An Chang, Chiang-Ming Yeh, Chun-Liang Liu
(National Yunlin University of Science and Technology, Yunlin, Taiwan)

OS8-7 *Intelligent agricultural landscape identification system*
Ching Ju Chen[1], Yu-Cheng Chen[1], Jing-Yao Lin[1], Rung-Tsung Chen[2], Candera Wijaya[3]
([1]National Yunlin University of Science and Technology, Taiwan) ([2]Taiwan Biodiversity Research Institute, Taiwan) ([3]Agricultural Engineering Research Center, Taiwan)

OS8-8 *Leveraging AIoT Visual Analytics for Optimizing Agricultural Sustainability and Efficiency*
Hsueh-Yen Shih[1], Xi-Wei Lin[2], Zhao-Sheng Chen[2], Ying-Cheng Chen[3], Ching-Ju Chen[2]
([1]Agricultural Engineering Research Center, Taiwan) ([2]National Yunlin University of Science and Technology, Taiwan) ([3]Tainan District Agricultural Research and Extension Station, Taiwan)

Room 405
10:00-11:15 GS6 Applications II (5)
Chair: Marion Oswald (TU Vienna, Austria)

GS6-1 *Signal Decomposition and Noise Reduction in Single-Channel EEG: A Morphological Component Analysis (MCA) Approach*
Kosei Shibata[1], Yide Yang[1], Rena Kato[1], (Kyushu Institute of Technology, Japan),
Hendry Ferreira Chame[2], Laurent Bougrain[2] (Université de Lorraine, CNRS, LORIA, France),
Tomohiro Shibata[1], Hiroaki Wagatsuma[1](Kyushu Institute of Technology, Japan)

GS6-2 *Variable Selection Methods for Multivariate Time Series Data Using Multivariate Granger Causality*
Keita Ohmori[1,2], Toshiki Saitoh[1], Akiko Fujimoto[1], Eiji Miyano[1]
([1]Kyushu Institute of Technology, [2]SUMCO, Japan

GS6-3 *A Support System for a Visually Impaired Person Finding Bus Route Numbers Employing MY VISION*
Daichi Nanaura, Seiji Ishikawa, Yui Tanjo (Kyushu Institute of Technology, Japan)

GS6-4 *Human Pose Estimation from Egocentric Videos*
Shunya Egashira, Yui Tanjo (Kyushu Institute of Technology, Japan)

GS6-5 *Analyzing Eye-Tracking Data to Detect Joint Attention in Hexgame Experiments*
Yide Yang[1], Rena Kato[1], Kosei Shibata[1] (Kyushu Institute of Technology, Japan),
Hendry Ferreira Chame[2], Laurent Bougrain[2] (Université de Lorraine, France),
Hiroaki Wagatsuma[1](Kyushu Institute of Technology, Japan)

14:30-15:45 OS17-1 Artificial Intelligence for Embedded Systems and Robotics (5)
Chair: Hakaru Tamukoh (Kyushu Institute of Technology, Japan)
Co-Chair: Yuma Yoshimoto (National Institute of Technology, Kitakyushu College, Japan),
Co-Chair: Dinda Pramanta (Kyushu Institute of Information Sciences, Japan)

OS17-1 *Optimizing Object Placement for Human Support Robots Using a Two-dimensional Irregular Packing Algorithm for Efficient Tray Storage*
Natee Buttawong, Kosei Isomoto, Kosei Yamao, Ninnart Fuengfusin, Hakaru Tamukoh (Kyushu Institute of Technology, Japan)

OS17-2 *Classification of Human Activity by Event-based Vision Sensors using Echo State Networks*
Rohan Saini, Aryan Rakheja, Ryuta Toyoda, Yuichiro Tanaka, Hakaru Tamukoh
(Kyushu Institute of Technology, Japan)

OS17-3 *Integrating Advanced Speech Recognition and Human Attribute Detection for Enhanced Receptionist Task in RoboCup@Home*
Koshun Arimura, Yuga Yano, Takuya Kawabata, Hakaru Tamukoh
(Kyushu Institute of Technology, Japan)

OS17-4 *Classification of Human Activity by Spiking Neural Networks using Event-based Vision Sensors*
Aryan Rakheja, Rohan Saini, Ryuta Toyoda, Yuichiro Tanaka, Hakaru Tamukoh
(Kyushu Institute of Technology, Japan)

OS17-5 *Robotic Grasping of Common Objects: Focusing on Edge Detection for Improved Handling*
Tomoya Shiba, Hakaru Tamukoh (Kyushu Institute of Technology, Japan)

16:00-17:15 OS17-2 Artificial Intelligence for Embedded Systems and Robotics (5)
Chair: Hakaru Tamukoh (Kyushu Institute of Technology, Japan)
Co-Chair: Yuma Yoshimoto (National Institute of Technology, Kitakyushu College, Japan),
Co-Chair: Dinda Pramanta (Kyushu Institute of Information Sciences, Japan)

OS17-6 *Proposal of a Grasp Verification Method Utilizing Background Subtraction and Depth Information*
Ryo Terashima, Yuga Yano, Koshun Arimura, Hakaru Tamukoh
(Kyushu Institute of Technology, Japan)

OS17-7 *Grasp Point Estimation Using Object Recognition Models with Simulator-Generated Datasets Including Pose Information*
Ryoga Maruno, Tomoya Shiba, Naoki Yamaguchi, Hakaru Tamukoh
(Kyushu Institute of Technology, Japan)

OS17-8 *A feasibility study of generative AI applications using EV-3 Robots at the Kyushu Institute of Information Sciences*
Dinda Pramanta[1], Hakaru Tamukoh[2]
([1]Kyushu Institute of Information Sciences, [2]Kyushu Institute of Technology, Japan)

OS17-9 *Development of a Collaborative System Between A Drone and A Home Service Robot for Enhanced Operational Efficiency*
Haruki Miura, Rion Yohu, Yuma Yoshimoto
(National Institute of Technology, Kitakyushu College, Japan)

OS17-10 *Efficient Object Detection with Color-Based Point Prompts for Densely Packed Scenarios in WRS FCSC 2024*
Naoki Yamaguchi[1], Tomoya Shiba[1], Hakaru Tamukoh[1]
([1]Kyushu Institute of Technology, Japan)

Room 406

10:00-11:00 OS14 Research Towards Renewable Energy and the Sustainable Development Goals (SDG's)/ Part B (4)

Chair: Firas Basim Ismail (University Tenaga National (UNITEN), Malaysia)
Co-Chair: Takao Ito (Hiroshima University, Japan)

OS14-1 *Empowering Decentralized Microgrids with A Blockchain-Based Peer-To-Peer Energy Trading Platform*
Firas Basim Ismail[1], Chetenraj Singh[1], Ammar A. Al-Talib[2], Nizar F.O. Al-Muhsen[1]
([1] UNITEN, Malaysia), ([2] UCSI University, Malaysia)

OS14-2 *Performance of Kenaf Fibre Reinforced Epoxy Biocomposite for High Voltage Insulator Applications*
Kang Rui Tan[1], Cik Suhana Bt. Hasan[1], Nor Fazilah Abdullah[1], Farah Adilah Jamaludin[1], Meng Choung Chiong[1], Eryana Hussin[1] ([1]UCSI University, Malaysia)

OS14-3 *Detection of Bullet Holes for Target Board in Malaysia Military (ATM) Shooting Exam Application*
Jilian.H.Wai Yin, Idayu M. Tahir, Ammar A.M. Al Talib, Osama Mohamed Magzoub
(UCSI University, Malaysia)

OS14-4 *Mobile App Development for Monitoring Goat Activities*
Samy M. Elmasri, Idayu M. Tahir, Ammar A.M. Al Talib
(UCSI University, Malaysia)

14:30-15:45 OS6-1 Intelligent Algorithm Application (5)

Chair: Peng Wang (Tianjin University of Science and Technology, China)
Co-Chair: Miao Zhang (Tianjin University of Science and Technology, China)

OS6-1 *Reliability Analysis and Optimization of Distribution Network with Distributed Generation*
Peng Wang, Mengyuan Hu, (Tianjin University of Science and Technology, China)

OS6-2 *Research on Improved PPLCNet Classification Network Based on CBAM Attention Model*
Peng Wang, Shengfeng Wang, Qikun Wang, Yuting Zhou
(Tianjin University of Science and Technology, China)

OS6-3 *Optimizing Microgrid Power Dispatch with Integrated Ground Source Heat Pumps Using Cellular Automata*
Peng Wang, Shunqi Yang (Tianjin University of Science and Technology, China)

OS6-4 *Indoor Personnel Thermal Comfort Monitoring System Based on Mobile Robots*
Peng Wang, Zihang Zhou (Tianjin University of Science and Technology, China)

OS6-5 *Market Trading Strategy of Integrated Energy Park from the Perspective of Non-cooperative Game*
Peng Wang, Siyi Wang, Liangyu Wang, Chengkai Miao
(Tianjin University of Science and Technology, China)

16:00-16:30 OS6-2 Intelligent Algorithm Application (2)
Chair: Peng Wang (Tianjin University of Science and Technology, China)
Co-Chair: Miao Zhang (Tianjin University of Science and Technology, China)

OS6-6 *Research on the Sensitivity of Thermal Comfort Using Sensitivity Algorithms Based on Variance and Stochastic Expansion*
Peng Wang, Yuting Zhou, Liangyu Wang, Chengkai Miao, Qikun Wang

OS6-7 *Deep Learning Based Infant and Child Monitoring System*
Peng Wang, Jiale Jia (Tianjin University of Science and Technology, China)

Room 407
11:30-12:00 OS25-1 Robotic and Communications (2)
Chair: Mastaneh Mokayef (UCSI University, Malaysia)
Co-Chair: Takao Ito (Hiroshima University, Japan)

OS25-1 *Exploring Techniques To Mitigate Interference In Drone Communication Systems*
Ahmed Alsaeed Rashad[1], Mastaneh Mokayef[1]*, M.K.A Ahamed Khan[1], MHD Amen Summakieh[1], Kim Soon Chong[1], Abdul Qayyum[2], Moona Mazher[3], Sanjoy Kumar Debnath[4], Chin Hong Wong[5, 6], Chua Huang Shen[7]
([1]UCSI University, Malaysia), ([2] Imperial College London, UK),
([3]University College London, UK), ([4]Chitkara University Institute of Engineering and Technology, India), ([5] Fuzhou University, China)
([6] Maynooth University, Ireland), ([7] UOW University Malaysia)

OS25-2 *An Automated Tracking System for Locating Impact Points on a Table Tennis Surface Using Ping Pong Balls*
Lee Wai Kit[1], Mastaneh Mokayef[1] *, MHD Amen Summakieh[1], M.K.A Ahamed Khan[1], Miad Mokayef[1], Sew Sun Tiang[1], Wei Hong Lim[1], Abdul Qayyum[2], Moona Mazher[3], Sanjoy Kumar Debnath[4]
([1] UCSI University, Malaysia), ([2] Imperial College London, UK), ([3] University College London, UK), ([4] Chitkara University, India)

13:00-14:00 OS25-2 Robotic and Communications (4)
Chair: Mastaneh Mokayef (UCSI University, Malaysia)
Co-Chair: Takao Ito (Hiroshima University, Japan)

OS25-3 *An Innovative Deep Learning Technique to Identify Potato Illness*
Abdul Majid Soomro[1] *, Muhammad Haseeb Asghar[2], Sanjoy Kumar Debnath[3], Susama Bagchi[3], and Awad Bin Naeem[2], M.K. A. Ahamed Khan[4], Mastaneh Mokayef[4] ([1] National University of Modern Languages, Pakistan), ([2] National College of Business Administration & Economics, Pakistan), ([3] Chitkara University, India), ([4]UCSI University, Malaysia)

OS25-4 *A Wearable Walking Support System Design And Simulation*
Omar Ayaman Yehiya[1], M. K. A. Ahamed Khan[1] *, Mastaneh Mokayef [1], Ridzuan A[1], Abdul Qayyum[2], Moona Mazher [3], Susama Bagchi[4], Sanjoy Kumar Debnath[4]
([1]UCSI University, Malaysia), ([2] Imperial College, London, UK), ([3]University College London, UK), ([4]Chitkara University, India)

OS25-5 *A Floor Tiling Robotic System*
Hue Chau Jieng[1], M. K. A. Ahamed Khan[1] *, Mastaneh Mokayef [1], Ridzuan A[1], Abdul Qayyum[2], Moona Mazher [3]. Susama Bagchi[4], Sanjoy Kumar Debnath[4]
([1]UCSI University, Malaysia), ([2] Imperial College, London, UK), ([3] University College London, UK), ([4]Chitkara University, India)

OS25-6 *Evaluation of Heart Disease Risk Using Deep Learning Technique with Image Enhancement*
Abdul Majid Soomro[1] *, Asad Abbas[2], Susama Bagchi[3], Sanjoy Kumar Debnath[3], Awad Bin Naeem[2], M. K. A. Ahamed Khan[4], Mastaneh Mokayef[4]
([1]National University of Modern Languages, Pakistan), ([2]National College of Business Administration & Economics, Pakistan), ([3]Chitkara University, India), ([4] UCSI University, Malaysia)

14:30-15:45 OS9-1 Pattern Recognition and Control I (5)

Chair: Sun Haozhe (Tianjin University of Science and Technology, China)

Co-Chair: Li Fangyan (Tianjin University of Science and Technology, China)

OS9-1 *A Study on Surface Defect Detection Algorithm of Strip Steel Based on YOLOv8n*
Haozhe Sun[1], Fengzhi Dai[1], Junjin Chen[2]
([1]Tianjin University of Science and Technology, [2]SMC (Beijing) Manufacturing Co., LTD., China)

OS9-2 *Prediction of Winter Wheat Growth Trends Based on NDVI Vegetation Index*
Lu Kang, Jiahao Xie, Chunli Li, Haoran Gong, Fengzhi Dai
(Tianjin University of Science and Technology, China)

OS9-3 *A Study on Artemia Culture System and Its Application*
Wanying Zhang, Yicheng Wu, Ziting Zhang,Yumei Huang
(Tianjin University of Science and Technology, China)

OS9-4 *Machine Vision-Based Chamfer Detection for Metal Parts*
Shangying Han[1], Kaili Guo[1], Yanzi Kong[1], Yanliang Gong[1], Junjin Chen[2], Ce Bian[3], Mengfan Zhang[3]
([1]Tianjin University of Science and Technology, [2]SMC (Beijing) Manufacturing Co., LTD., [3] Tianjin Tianke Intelligent Manufacture Technology Co., LTD., China)

OS9-5 *Deep Guard Dog - AI-Based Night Intrusion Detection Mobile Phone Software*
Keming Chen, Jiaxin Wang (Tianjin University of Science and Technology, China)

16:00-16:30 OS9-2 Pattern Recognition and Control I (2)

Chair: Sun Haozhe (Tianjin University of Science and Technology, China)

Co-Chair: Li Fangyan (Tianjin University of Science and Technology, China)

OS9-6 *Development of an Amphibious Surface Garbage Collection Robot and Its Applications*
Yu Su, Xin Wang, Long Shen, Zhenxing Liu, Xinrui Zhao, Xin Lin, Mengchen Huo, Yawen Qiao, Yan Zhang (Tianjin University of Science and Technology, China)

OS9-7 *Design of an Intelligent Orbital Inspection Robot Based on Machine Vision and Ultrasonic Guided Waves*
Xingwang Feng, Suqing Duan (Tianjin University of Science and Technology, China)

February 15 (Saturday)

9:40-Registration

Room 302, 303

13:00-14:00

Plenary Speech PS3

Chair: Eiji Hayashi (Kyusyu Institute of Technology, Japan)

PS3 *Integration of Human – Device Interface: Transforming the Future of Interaction*

Norrima Mokhtar (Universiti Malaya, Malysia)

14:20-15:20

Plenary Speech PS1

Chair: Amane Takei (University of Miyazaki, Japan)

PS1 *High-fidelity Multi-agent Simulations for Social Systems*

Shinobu Yoshimura (The University of Tokyo)

Room 403
10:00-11:00 GS4 Robotics (4)
Chair:

GS4-1 *Obstacle-Aware Autonomous Flipper Control Method Based on Terrain Geometry*
Kotaro Kanazawa, Noritaka Sato, Yoshifumi Morita
(Nagoya Institute of Technology, Japan)

GS4-2 *An Adaptive Control Method for a Knee-Joint Prosthetic Leg Toward Dynamic Stability and Gait Optimization*
Ge Yiqian[1], Purevdorj Choisuren[1], Shintaro Kasai[1], Hiroaki Wagatsuma[1]
([1]Kyushu Institute of Technology, Japan)

GS4-3 *A Gait Analysis with Multibody Dynamics Toward Energy-Efficient Active Knee Prostheses*
Purevdorj Choisuren[1], Ge Yiqian[1], Shintaro Kasai[1], Batbaatar Dondogjamts[2], Erdenesuren Naranbaatar[2] and Hiroaki Wagatsuma[1]
([1]Kyushu Institute of Technology, Japan; [2]Mongolian University of Science and Technology, Mongolia)

GS4-4 *Suppressing of Multi-Axial Vibration Caused in Carried Objects by Robot Using a Heuristic Algorithm Based on Evaluation of Actual Machine Information*
Yusuke Ueno[1], Hiroki Noguchi[1], Fumitoshi Shimono[1], Hiroshi Tachiya[2]
([1]Komatsu University, Japan) ([2]Kanazawa University, Japan)

11:30-12:15 GS3 Image Processing II (3)

Chair: Kuo-Hsien Hsia (National Yunlin University of Science and Technology, Taiwan)

GS3-1 *Shape-Preserving Embedding Technique for Binary Classification of Video Image of the Solar Surface*
Iori Tamura, Akiko Fujimoto, Soichiro Kondo, Reiri Noguchi
(Kyushu Institute of Technology, Japan)

GS3-2 *Seated Posture Estimation Based on Monocular Camera Images*
Hitoshi Shimomae, Tsubasa Esumi, Noriko Takemura (Kyushu Institute of Technology, Japan)

GS3-3 *Identification of lung nodules based on combining multi-slice CT images and clinical information*
Yuto Nishitaki, Tohru Kamiya (Kyushu Institute of Technology, Japan)
Shoji Kido (Osaka University, Japan)

15:40-16:40 GS1 Machine Learning & Autonomous Driving (4)

Chair: Obada Al aama (Kyushu Institute of Technology, Japan)

GS1-1 *Automatic classification of respiratory sounds by improving the loss function of ResNet*
Ryusei Oshima[1], Tohru Kamiya[1], Shoji Kido[2]
([1]Kyushu Institute of Technology, Japan), ([2]Osaka University, Japan)

GS1-2 *Classification of Heat Transfer Coefficient Using Deep Learning with Information from Boiling Images*
Fuga Mitsuyama, Ren Umeno, Tomohide Yabuki, Tohru Kamiya
(Kyushu Institute of Technology, Japan)

GS1-3 *A Data Format Integration of Open-Street-Map and Lanelet2 Toward the Ontology Framework for Safety Autonomous Driving systems*
Obada Al aama[1], Takahiro Koga[1], Tomoki Taniguchi[1], Davaanyam Jargal[1], Junya Oishi[2], Shigeru Nemoto[2], Wataru Mizushina[2], Kazuki Hirao[2], Hakaru Tamukoh[1], Hiroaki Wagatsuma[1]
([1]Kyushu Institute of Technology, Japan, [2]Aisan Technology Co., Ltd., Japan)

GS1-4 *Developing a Sound-Based Method to Synchronize Multiple Videos Recorded by Multiple Sound Sources*
Davaanyam Jargal, Rena Kato, Tomoki Taniguchi, Kosei Shibata, Takahiro Koga, Obada Al aama, Hakaru Tamukoh and Hiroaki Wagatsuma (Kyushu Institute of Technology, Japan)

17:05-18:05 GS2 Image Processing I (4)

Chair: Amane Takei (University of Miyazaki, Japan)

GS2-1 *Recognition of Plastic Bottles Region Using Improved DeepLab v3+*
Yusuke Murata, Tohru Kamiya (Kyushu Institute of Technology, Japan)

GS2-2 *Non-Invasive Classification of EGFR Mutation from Thoracic CT Images Using Radiomics Features and LightGBM*
Reo Takahashi[1], Tohru Kamiya[1], Takashi Terasawa[2], Takatoshi Aoki[2]
([1]Kyushu Institute of Technology, Japan)
([2]University of Occupational and Environmental Health, Japan)

GS2-3 *Detection of Lung Nodules from Temporal Subtraction CT Image Using Elastic Net-Based Features Selection*
Natsuho Baba, Tohru Kamiya (Kyushu Institute of Technology, Japan)
Takashi Terasawa, Takatoshi Aoki (University of Occupational Health)

GS2-4 *Detection of Lung Nodules from CT Image Based on Ensemble Learning*
Natsuho Baba, Tohru Kamiya (Kyushu Institute of Technology, Japan)
Takashi Terasawa, Takatoshi Aoki (University of Occupational Health)

Room 404

10:00-11:00 OS18 Robotics in Biophilic-Designed Space Toward Co-existence of Humans, Robots, and Plants (4)

Chair: Yuichiro Tanaka (Kyushu Institute of Technology, Japan)
Co-Chair: Naoto Ishizuka (Kyushu Institute of Technology, Japan)
Co-Chair: Tomomi Sudo (Kyushu Institute of Technology, Japan)
Co-Chair: Hakaru Tamukoh (Kyushu Institute of Technology, Japan)

OS18-1 *Application of AI Robot Technology for Biophilic Design*
Kairi Manabe, Ryo Miyazono, Keitaro Ito, Tomomi Sudo, Naoto Ishizuka, Akinobu Mizutani, Yuki Anamizu, Etsushi Ueda, Honoka Tamai, Saya Nakano, Leon Furuya, Hakaru Tamukoh, Yuichiro Tanaka, Hirofumi Tanaka
(Kyushu Institute of Technology, Japan)

OS18-2 *Basic Research on the Development of Space Standards for the Use of Service Robots in Housing Using the Urban Renaissance Agency's Housing Complex*
Ren Matsuoka, Kanon Nonoshita, Naoto Ishizuka, Ryohei Kobayashi, Akinobu Mizutani, Hakaru Tamukoh, Hirofumi Tanaka (Kyushu Institute of Technology, Japan)

OS18-3 *An Exhibition Environment with 2D Markers for Guide Robot*
Akinobu Mizutani, Yui Hattori, Naoto Ishizuka, Yuichiro Tanaka, Hirofumi Tanaka, Hakaru Tamukoh (Kyushu Institute of Technology, Japan)

OS18-4 *Prediction of Timing and Amount of Houseplants Watering by an Echo State Network on Jetson*
Wataru Yoshimura, Koshun Arimura, Ryohei Kobayashi, Akinobu Mizutani, Tomoaki Fujino, Yuichiro Tanaka, Tomomi Sudo, Naoto Ishizuka, Keitaro Ito, Hirofumi Tanaka, Hakaru Tamukoh (Kyushu Institute of Technology, Japan

11:30-12:15 OS16 Natural Computing (3)

Chair: Marion Oswald (TU Vienna, Austria)
Co-Chair: Yasuhiro Suzuki (Nagoya University, Japan)

OS16-1 *Modeling Yawning Contagion as a Reaction-Diffusion System: Emergence of Turing Patterns in Behavioral Contagion*
Yasuhiro Suzuki, (Nagoya University, Japan)

OS16-2 *Dominant Region Analysis: A Novel Framework for Quantifying Competitive Reactions Based on the Gillespie Algorithm*
Yasuhiro Suzuki, (Nagoya University, Japan)

OS16-3 *40 Hz sound exposure alters dissolved oxygen levels, gene expression, and colony formation in Saccharomyces cerevisiae BY4741*
Yasuhiro Suzuki, (Nagoya University, Japan)

15:40-16:55 OS11-1 Industrial Artificial Intelligence Robotics (5)

Chair Eiji Hayashi (Kyusyu Institute of Technology, Japan)

OS11-1 *Enhanced Deep Reinforcement Learning for Robotic Manipulation: Tackling Dynamic Weight in Noodle Grasping Task*
Gamolped Prem, Yon Pang Ja Sin, Vjosa Bytyqi, Eiji Hayashi
(Kyushu Institute of Technology, Japan)

OS11-2 *LiDAR-Enhanced Real-Time Tree Position Mapping for Forestry Robots*
M.A Munjer, Tan Chi Jie, Eiji Hayashi (Kyushu Institute of Technology, Japan)

OS11-3 *Kalman-YOLO Improving YOLO Tracking Performance through the Integration of a Kalman Filter for a Beach Cleaning Robot*
Rut Yatigul, Tan Chi Jie, Gamolped Prem, Eiji Hayashi
(Kyushu Institute of Technology, Japan)

OS11-4 *The research of AR System for introducing Industrial Robots*
Takuma Aiko, Gamolped Prem, Eiji Hayashi (Kyusyu Institute of Technology, Japan)

OS11-5 *Research on performance information editing support system for automatic piano - Development of a network model for improved dynamics accuracy-*
Taiyo Goto, Yoshiki Hori, Eiji Hayashi (Kyushu Institute of Technology, Japan)

17:05-17:35 OS11-2 Industrial Artificial Intelligence Robotics (2)

Chair: Eiji Hayashi (Kyusyu Institute of Technology, Japan)

OS11-6 *Research on Tactile-Gripping for Difficult-to-Grasp Objects*
Yoshitaka Sakata, Gamolped Prem, Eiji Hayashi (Kyushu Institute of Technology, Japan)

OS11-7 *Development of a drone obstacle avoidance system based on depth estimation*
Sora Takahashi, Eiji Hayashi (Kyushu Institute of Technology, Japan)

Room 405
10:00-11:15 GS5 Applications I (5)
Chair: Tsutomu Ito (Ube National College of Technology, Japan)

GS5-1 *A Study on Local Airports Contributions to Tourism Industry in Japan*
Tsutomu Ito[1], Seigo Matsuno[1], Makoto Sakamoto[2], Satoshi Ikeda[2], Takao Ito[3]
([1] Ube National College of Technology, Japan), ([2]University of Miyazaki, Japan)
([3]Hiroshima University, Japan)

GS5-2 *Analysis of Careless Mistakes Using Gaze Information*
Ryota Yabe, Noriko Takemura (Kyushu Institute of Technology, Japan)

GS5-3 *A Mathematical Framework for Logit Model in Transportation Mode Choice Analysis*
Ahmad Altaweel[1], Kazuhito MINE[1], Bo-Young Lee[2], Jang-Sok Yoon[2], Hiroaki Wagatsuma[1]
([1]Kyushu Institute of Technology, Japan; [2]Logistics Revolution Korea, Korea)

GS5-4 *A Computational Approach for Global Trade Analysis in Korea Contributing to the Forecasting of Future Efficacy in Global and Domestic Korean Transportations*
Bo-Young Lee[1], Ahmad Altaweel[2], Kazuhito Mine[2], Jang-Sok Yoon[1], Hiroaki Wagatsuma[2]
([1]Logistics Revolution Korea Co., Korea; [2]Kyushu Institute of Technology, Japan)

GS5-5 *Fundamental Research on Athlete Positions Estimation in Indoor Sports at Various View*
Iori Iwata, Yoshihiro Ueda, Kazuma Sakamoto, Riku Kaiba
(Komatsu University, Japan)

11:30-12:15 OS22 Navigation and Tracking (3)
Chair: Chan Gook Park (Seoul National University, Republic of Korea)

OS22-1 *Fine-registered Object LiDAR-inertial Odometry for a Solid-state LiDAR System*
Hanyeol Lee and Chan Gook Park (Seoul National University, Republic of Korea)

OS22-2 *A Fusion Method for Estimating the Walking Direction of Smartwatch Users*
Jae Hong Lee and Chan Gook Park (Seoul Nation University, Republic of Korea)

OS22-3 *Multi-Frame Track-Before-Detect with Adaptive Number of Frame as Noise Level*
Je Hwa Lee, Jae Hong Lee, and Chan Gook Park
(Seoul National University, Republic of Korea)

15:40-16:55 OS15 Robotic Manipulation (5)
Chair: Kensuke Harada (Osaka University, Japan)
Co-Chair: Tokuo Tsuji (Kanazawa University, Japan)
Co-Chair: Akira Nakamura (Saitama Institute of Technology, Japan)

OS15-1 *Surface Stiffness Estimation using Active Strobe Imager*
Taiki Yamaguchi[*1], Kensuke Harada[*1], Koji Mizoue[*2], Makoto Kaneko[*12]
([*1] Osaka University, Japan, [*2] Mizoue Project Japan Corp., Japan)

OS15-2 *Painting Task Planning for Large Structure using a Mobile Manipulator*
Hiroshi Tanaka[*1], Masato Tsuru[*1], Takuya Kiyokawa[*1], Kensuke Harada[*1]
([*1] Osaka University, Japan)

OS15-3 *Real-time Cable Tracking by Wire Segmentation and Coherent Point Drift*
Ryunosuke Yamada[1], Tokuo Tsuji[1], Takahiro Shimizu[2], Shota Ishikawa[1 2], Tomoaki Ozaki[2], Yusuke Sakamoto[1], Tatsuhiro Hiramitsu[1], Hiroaki Seki[1]
([1]Kanazawa University, [2]DENSO CORPORATION, Japan)

OS15-4 *Motion Prediction for Human-Robot Collaborative Tasks Using LSTM*
Kaihei Okada, Tokuo Tsuji, Tatsuhiro Hiramitsu, Hiroaki Seki, Toshihiro Nishimura, Yosuke Suzuki and Tetsuyou Watanabe (Kanazawa University, Japan)

OS15-5 *Individual Recognition of Food in Bulk by using 3D Model of Food*
Yuya Otsu, Tokuo Tsuji, Tatsuhiro Hiramitsu, Hiroaki Seki
(Kanazawa University, Japan)

17:05-17:50 OS24 New Media Interactions (3)
Chair: R.P.C. Janaka Rajapakse (Tainan National University of the Arts, Taiwan)

OS24-1 *Evaluation of Passive Interaction in XR Chakra Meditation Application Based on Behavioral Biometrics*
P. I. A. Gayathri Bimba (Japan Advanced Institute of Science and Technology, Japan)
Chien-Tung Lin (Tainan National University of the Arts, Taiwan)
R.P.C. Janaka Rajapakse (Tainan National University of the Arts, Taiwan)
Kazunori Miyata (Japan Advanced Institute of Science and Technology, Japan)

OS24-2 *ThoughtDiffusion: An Interactive Installation for Exploring Neuro-Art from EEG Data with Stable Diffusion Models*
R.P.C. Janaka Rajapakse (Tainan National University of the Arts, Taiwan)

OS24-3 *PassBy2: Passive Interaction through the Pedestrian Counts and Real-time Weather Information*
Chung Chien-Lin, R.P.C. Janaka Rajapakse (Tainan National University of the Arts, Taiwan)

Room 406

10:00-11:15 OS1-1 Human-Machine Interface (5)

Chair: Norrima Mokhtar (Universiti Malaya, Malaysia)

Co-Chair: Heshalini Rajagopal (Mila University, Malaysia)

OS1-1 *Non-Invasive Glucose Monitoring Based on Mid-Infrared Spectroscopy*
Puteri Nur Sofea Mohd Zakki, Nani Fadzlina Naim, Hasnida Saad, Wan Norsyafizan Wan Muhamad, Suzi Seroja Sarnin, Norsuzila Ya'acob, Noor Fitrah Abu Bakar
([1]Universiti Teknologi MARA (UITM), Malaysia)

OS1-2 *Investigation of Electromagnetic Radiation (EMR) Before and After Super Brain Yoga Exercise Comparing with Short-Term Memory*
Ros Shilawani S Abdul Kadir, Suzi Seroja Sarnin, Muhammad Afiq Kamil Arif, Faizul Hafizzi Ahmad, Wan Norsyafizan Wan Muhamad, Aziati Husna Awang
(Universiti Teknologi MARA (UITM), Malaysia)

OS1-3 *Preliminary Investigation of Electromagnetic Radiation (EMR) Between Adults and Children*
Ros Shilawani S Abdul Kadir, Aziati Husna Awang, Muhamad Azizularif Mohamad Azizan, Suzi Seroja Sarnin, Suhaila Subahir, Roshakimah Mohd Isa
(Universiti Teknologi MARA (UITM), Malaysia)

OS1-4 *Solar Powered Smart Parcel Box System: Energy Efficient Solution for Modern Deliveries*
Wan Norsyafizan W. Muhammad, AmerulAshraf Zulkepli, Nani Fazlina Naim, Suzi Seroja Sarnin, Ros Shilawani S Abdul Kadir, Md Nor Mat Tan
(Universiti Teknologi MARA (UITM), Malaysia)

OS1-5 *Desktop-Based Expiry Date Application for Retailers Inventory Management*
Nur Hazwani Ahmad Halil[1], Suzi Seroja Sarnin[1], Nani Fazlina Naim[1], Azlina Idris[1], Wan Norsyafizan W. Muhammad[1], Ros Shilawani S Abdul Kadir[1], Md Nor Mat Tan[1], Raudah Abu Bakar[1], Zarina Baharudin Zamani[2]
([1]Universiti Teknologi MARA (UITM), Malaysia), ([2]UTEM, Malaysia)

11:30-12:15 OS1-2 Human-Machine Interface (3)

Chair Norrima Mokhtar (Universiti Malaya, Malaysia)

Co-Chair Heshalini Rajagopal (Mila University, Malaysia)

OS1-6 *Automatic Metal Debris Collection Robot for Laboratory Safety: A Review*
Sophia Fahima Hapizan[1], Ja'aris Samsudin[1], Heshalini Rajagopal[2], Takao Ito[3], Muhammad Amirul Aiman Asri[4], Anees Ul Husnain[5]
([1]Mara-Japan Industrial Insititute, Malaysia), ([2]Mila University, Malaysia)
([3]Hiroshima University, Japan), ([4]Universiti Malaya, Malaysia)
([5]The Islamia University of Bahawalpur, Pakistan)

OS1-7 *Smart Solar LED Street Light with ESP32 Camera Modulee*
Suzi Seroja Sarnin[1], Ros Shilawani S Abdul Kadir[1], Nurul Farhana Zailani[1], Nani Fazlina Naim[1], Md Nor Mat Tan[1], Raudah Abu Bakar[1], Zarina Baharudin Zamani[2]
([1]Universiti Teknologi MARA (UITM), Malysia), ([2]UTEM, Malaysia)

GS5-6 *Overview of the development of low earth orbit satellite navigation enhancement technology*
Dingcheng Tang*, Jinliang Wang, Jianfeng Shan, and Guoji Zou
(Space star technology co, LTD, Beijing, China)

13:00-14:15 OS26-1 Navigating the Digital Frontier: Innovations in the Age of Industry Revolution 4.0 (5)
Chair: Wei Hong Lim (UCSI University, Malaysia)
Co-Chair: Takao Ito (Hiroshima University, Japan)

OS26-1 *Driver State Monitoring Using Pose Estimation: Detecting Fatigue, Stress, and Emotional States for Safer Roads*
Hao Feng Chan[1], Dexter Sing Fong Leong[1], Shakir Hussain Naushad Mohamed[1], Wui Chung Alton Chau[1], Takao Ito[2], Zheng Cai[1], Xinjie Deng[1], Yit Hong Choo[1*]([1]Deakin University, Australia) ([2]Hiroshima University, Japan)

OS26-2 *Optimizing Face Embedding Sizes and Accuracy in Facial Recognition Systems*
Wui Chung Alton Chau[1], Dexter Sing Fong Leong[1], Shakir Hussain Naushad Mohamed[1], Hao Feng Chan[1], Takao Ito[2], Zheng Cai[1], Xinjie Deng[1], Yit Hong Choo[1*]
([1]Deakin University, Australia) ([2]Hiroshima University, Japan)

OS26-3 *Suspicious Behavior Detection Using Computer Vision*
Dexter Sing Fong Leong[1], Hao Feng Chan[1], Shakir Hussain Naushad Mohamed[1], Wui Chung Alton Chau[1], Takao Ito[2], Zheng Cai[1], Xinjie Deng[1], Andi Prademon Yunus[2], Yit Hong Choo[1*]([1]Deakin University, Australia) ([2]Hiroshima University, Japan)

OS26-4 *Sign Language Recognition Algorithms Using Hybrid Techniques*
Shakir Hussain Naushad Mohamed[1], Hao Feng Chan[1], Dexter Sing Fong Leong[1], Wui Chung Alton Chau[1], Takao Ito[2], Zheng Cai[1], Xinjie Deng[1], Yit Hong Choo[1*]([1]Deakin University, Australia) ([2]Hiroshima University, Japan)

OS26-5 *Geographic and Risk Factor Analysis of Non-Communicable Cardiovascular Diseases in Central Java using Machine Learning*
Nurhasanah, Andi Prademon Yunus*(Telkom University, Indonesia)

14:20-15:20 OS26-2 Navigating the Digital Frontier: Innovations in the Age of Industry Revolution 4.0 (4)
Chair: Wei Hong Lim (UCSI University, Malaysia)
Co-Chair: Takao Ito (Hiroshima University, Japan)

OS26-6 *Analysis of Geographical Characteristics and Risk Factors for Non-Communicable Diseases: Diabetes in Central Java Using Random Forest and SHAP*
Ambar Arum Prameswari, Andi Prademon Yunus*(Telkom University, Indonesia)

OS26-7 *Geographic Analysis of Risk Factors for Chronic Respiratory Non-Communicable Diseases Using Machine Learning*
Ayu Susilowati, Andi Prademon Yunus*(Telkom University, Indonesia)

OS26-8 *Role-Play Prediction Using Ontology-Based Graph Convolutional Network Model*
Asyafa Ditra Al Hauna[1], Andi Prademon Yunus[1*], Siti Khomsah[1], Fukui Masanori[2]
([1]Telkom University, Indonesia, [2]Iwate Prefectural University, Japan)

OS26-9 *Experimental Exploration of Neural Style Transfer: Hyperparameter Impact and VGG Feature Dynamics in Batik Motif Generation*
Happy Gery Pangestu[1], Andi Prademon Yunus[1]*, Ratih Alifah Putri[1], Takao Ito[2]
([1]Telkom University, Indonesia) ([2]Hiroshima University)

15:40-16:40 OS26-3 Navigating the Digital Frontier: Innovations in the Age of Industry Revolution 4.0 (4)
Chair: Wei Hong Lim (UCSI University, Malaysia)
Co-Chair: Takao Ito (Hiroshima University, Japan)

OS26-10 *Exploring Non-Communicable Disease Risk Factors on Cancer Rates in Central Java Using Random Forest and SHAP*
Novi Ramadani, Andi Prademon Yunus* (Telkom University, Indonesia)

OS26-11 *Addressing Noise Challenges in CNN-based Pneumonia Detection: A Study Using Indonesian Thoracic Imagery*
Wahyu Andi Saputra*, Andi Prademon Yunus
(Telkom University, Indonesia)

GS4-5 *Developing Low-Cost BCI-Based Brain-Limb Interaction Device with Prosthetic Hand*
Nethika Jayith Rajapakse
(International Bilingual International Science Park, Taiwan)

17:05-17:50 OS2 Computer and Information Engineering (3)
Chair: Norrima Mokhtar (University of Malaya, Malaysia)
Co-Chair: Heshalini Rajagopal (MILA University, Malaysia)

OS2-1 *Efficient Weed Detection in Agricultural Landscapes using DeepLabV3+ and MobileNetV3*
Renuka Devi Rajagopal[1], Manthena Rishit Varma[1], Heshalini Rajagopal[2]
([1]Vellore Institute of Technology, India), ([2]Mila University, Malaysia)

OS2-2 *AI-Based Weed Detection Algorithm using YOLOv8*
Renuka Devi Rajagopal[1], Rethvik Menon C[1], T S PradeepKumar[1], Heshalini Rajagopal[2]
([1]Vellore Institute of Technology, India), ([2]Mila University, Malaysia)

OS2-3 *Novel Gender and Age- Based Detection Technique for Facial Recognition System*
Pratham Gupta[1], Amutha S[1], Dhanush R[1], Heshalini Rajagopal[2]
([1]Vellore Institute of Technology, India), ([2]Mila University, Malaysia)

February 16 (Sunday)

9:40-Registration

Room 403

10:00-11:15 OS12-1 Advances in Field Robotics and Their Applications (5)

Chair: Shinsuke Yasukawa (Kyushu Institute of Technology, Japan)

Co-Chair: Kazuo Ishii (Kyushu Institute of Technology, Japan)

OS12-1 *Practical Exercise on An Autonomous Driving System Using Mobile Devices and IoT Devices for An Agricultural Tractor*
Daigo Katayama, Yuto Nakazuru, Hikaru Sato, Shoun Masuda, Yuya Nishida, Shinsuke Yasukawa, Kazuo Ishii (Kyushu Institute of Technology, Japan)

OS12-2 *Estimation of Image-Based End-Effector Approach Angles for Tomato Harvesting Robots*
Kizuna Yoshinaga, Hikaru Sato, Kazuo Ishii, Shinsuke Yasukawa (Kyushu Institute of Technology, Japan)

OS12-3 *Visual-Based System for Fish Detection and Velocity Estimation in Marine Aquaculture*
Raji Alahmad, Dominic Solpico, Shoun Masuda, Takahito Ishizuzuka, Kenta Naramura, Zhangchi Dong, Zongru Li, Kazuo Ishii (Kyushu Institute of Technology, Japan)

OS12-4 *Evaluating of Tree Branch Recognition Algorithm in Pruning Robots under Augmented Environmental Conditions*
Mohammad Albaroudi, Raji Alahmad, Abdullah Alraee, Kazuo Ishii (Kyushu Institute of Technology, J Japan)

OS12-5 *Trajectory Analysis for a Mobile Robot Adapted Three Omni Rollers in Constant Roller's Speed*
[1]Kenji Kimura, [1]Kazuki Nakayama, [2]Katsuaki Suzuki, [3]Kazuo Ishii,
([1]National Institute of Technology, Matsue College, [2]Kumamoto Industrial Research Institute, [3]Kyushu Institute of Technology, Japan)

11:30-12:00 OS12-2 Advances in Field Robotics and Their Applications (2)

Chair: Shinsuke Yasukawa (Kyushu Institute of Technology, Japan)

Co-Chair: Kazuo Ishii (Kyushu Institute of Technology, Japan)

OS12-6 *Cross-Disciplinary Learning Through Manufacturing: Toward Student-Centered STEAM Education*
Kenji Kimura (National Institute of Technology, Matsue College, Japan)

OS12-7 *Development of a Rotary Actuator Capable of Multidirectional Rapid Motion and Variable Stiffness*
[1]Katsuaki Suzuki, [2]Yuya Nishuda, [3]Kenji Kjmura, [2] Kazuo Ishii
([1]Kumamoto Industrial Research Institute, [2]Kyushu Institute of Technology, [3]National Institute of Technology, Matsue College, Japan)

13:00-13:30 OS12-3 Advances in Field Robotics and Their Applications (2)
Chair: Shinsuke Yasukawa (Kyushu Institute of Technology, Japan)
Co-Chair: Kazuo Ishii (Kyushu Institute of Technology, Japan)

OS12-8 *Study of Evaluation Operation Log Analysis Using 2^3- ERC on Matsue National College of Technology*
Takumi Ueda, So Takei, Akira Nakano (National Institute of Technology, Kurume College, Japan), Kenji Kimura (National Institute of Technology, Matsue College, Japan), Kazutaka Matsuzaki (Nishinippon Institute of Technology, Japan)

OS12-9 *Efficient Ball Position Estimation for Tennis Court Robot Assistants using Dual-Camera System*
Abdullah Alraee, Raji Alahmad, Hussam Alraie, Mohammad Albaroudi, Kazuo Ishii (Kyushu Institute of Technology, Japan)

Room 404

10:00-11:15 OS21 Applications of Information Technology for Better Living (5)

Chair: Tetsuro Katayama (University of Miyazaki, Japan)

Co-Chair: Hiroki Tamura (University of Miyazaki, Japan)

OS21-1 *Prototype of MixVRT Which Is a Visual Regression Testing Tool That Highlights Layout Defects in Web Pages*
Naoki Aridome[1], Tetsuro Katayama[1], Yoshihiro Kita[2], Hisaaki Yamaba[1], Kentaro Aburada[1], Naonobu Okazaki[1]([1]University of Miyazaki, Japan), ([2]University of Nagasaki, Japan)

OS21-2 *Proposal of a Method for Automatic Fill-in Fields Detection and for Labels Assignment to Generate Electronic Forms*
Yuya Kimura[1], Tetsuro Katayama[1], Yoshihiro Kita[2], Hisaaki Yamaba[1], Kentaro Aburada[1], Naonobu Okazaki[1] ([1]University of Miyazaki, Japan), ([2]University of Nagasaki, Japan)

OS21-3 *A Study on Methodology of Measurement for the Physical Burden on Preschool Children*
Sachiko Kido, Hiroki Tamura (University of Miyazaki, Japan)

OS21-4 *Evaluation of Ankle Joint Movements in Frontal Plane for a Normal Coordinated Gait*
Praveen Nuwantha Gunaratne, Hiroki Tamura (University of Miyazaki, Japan)

OS21-5 *Development of a Real-Time Multi-Person 3D Keypoint Detection System Using Stereoscopic Cameras and RTMPose*
Taufik Hidayat Soesilo, Praveen Nuwantha Gunaratne, Hiroki Tamura
(University of Miyazaki, Japan)

11:30-12:00 OS23-1 Mathematical Informatics (2)

Chair: Takao Ito (Hiroshima University, Japan)

Co-Chair: Amane Takei (University of Miyazaki, Japan)

OS23-1 *Simplification of Rip Current Detection by Image Averaging Based on the Number of Wave Breaks*
Ota Hamasuna[1], Leona Kimura[1], Satoshi Ikeda[1], Kaoru Ohe[1], Kenji Aoki[1], Amane Takei[1], Akihiro Kudo[2], Makoto Sakamoto[1*]
([1]University of Miyazaki, Japan), ([2]National Institute of Technology, Tomakomai College, Japan)

OS23-2 *Automated Classification of High-Grade Dried Shiitake Mushrooms Using Machine Learning*
Leona Kimura[1], Ota Hamasuna[1], Kaoru Ohe[1], Satoshi Ikeda[1], Kenji Aoki[1], Amane Takei[1], Akihiro Kudo[2], Kazuhide Sugimoto[3], Makoto Sakamoto[1*]
([1]University of Miyazaki, Japan), ([2]National Institute of Technology, Tomakomai Collage, Japan), ([3]SUGIMOTO Co., Ltd., Japan)

13:00-15:00 OS23-2 Mathematical Informatics (8)
Chair: Takao Ito (Hiroshima University, Japan)
Co-Chair: Amane Takei (University of Miyazaki, Japan)

OS23-3 *Development of a Plant Growing Experience Application for Physically Challenged Children Using VR*
Masatoshi Beppu[1], Masatomo Ide[1], Kaoru Ohe[1], Satoshi Ikeda[1], Kenji Aoki[1],
Amane Takei[1], Akihiro Kudo[2], Makoto Sakamoto[1*]
([1]University of Miyazaki, Japan), ([2] National Institute of Technology, Tomakomai Collage, Japan)

OS23-4 *Exploring Social Media's Role in Predicting Stock Market Trends*
Masatoshi Beppu[1], Masatomo Ide[1], Seita Nagashima[2], Satoshi Ikeda[1]*,
Amane Takei[1], Makoto Sakamoto[1], Tsutomu Ito[3], Takao Ito[4]
([1]University of Miyazaki, Japan), ([2]MEITEC CORPORATION, Japan),
([3]National Institute of Technology, Ube College, Japan), ([4]Hiroshima University, Japan)

OS23-5 *Development of a Shrine Festival Support Application with Non-Technical Management Features: Functional Evaluation and Sustainability for Future Generations*
Masatomo Ide[1], Masatoshi Beppu[1], Satoshi Ikeda[1], Kaoru Ohe[1], Kenji Aoki[1],
Amane Takei[1], Akihiro Kudo[2], Makoto Sakamoto[1*]
([1]University of Miyazaki, Japan), ([2]National Institute of Technology, Tomakomai Collage, Japan)

OS23-6 *A Novel Approach to Reducing Ranking Discrepancies in Tennis Based on Tournament Choices*
Masatomo Ide[1], Masatoshi Beppu[1], Kousei Yano[2],
Satoshi Ikeda[1]*, Amane Takei[1], Makoto Sakamoto[1], Tsutomu Ito[3], Takao Ito[4]
([1]University of Miyazaki, Japan), ([2]GENBASUPPORT Co., Japan),
([3]National Institute of Technology, Ube College, Japan), ([4]Hiroshima University, Japan)

OS23-7 *Sound Field Evaluation on Acoustical Experiment with Several Loudspeaker Locations*
Akihiro Kudo[1*], Shun Kubota[1], Amane Takei[2], Makoto Sakamoto[2]
([1]National Institute of Technology, Tomakomai College, Japan), ([2]University of Miyazaki, Japan)

OS23-8 *Parallel High-Frequency Electromagnetic Field Analysis Based on Hierarchical Domain Decomposition Method*
Amane Takei[1*], Akihiro Kudo[2], Makoto Sakamoto[1]
([1]University of Miyazaki, Japan), ([2]National Institute of Technology, Tomakomai College, Japan)

OS23-9 *Adsorption Equilibrium of Selenium Oxyanions Using FeY Mixed Oxides*
Kaoru Ohe*, Amu Wakamatsu, Tatsuya Oshima (University of Miyazaki, Japan)

OS23-10 *Influence of CNN Layer Depth on Spiral Visual Illusions*
Kenji Aoki*, Makoto Sakamoto (University of Miyazaki, Japan)

Room 405

10:00-11:15 OS10-1 Pattern Recognition and Control - 2 (5)

Chair: Zhai Hongshuo (Tianjin University of Science and Technology, China)

Co-Chair: Li Huahao (Tianjin University of Science and Technology, China)

OS10-1 *Intelligent Temperature Control System for Chip Soldering Station*
Huahao Li [1], Junjin Chen [2], Ce Bian [3], Mengfan Zhang [3]
([1]Tianjin University of Science and Technology, China; [2] SMC (Beijing) Manufacturing Co., LTD., China; [3] Tianjin Tianke Intelligent Manufacture Technology Co., LTD., China)

OS10-2 *A Review of Object Detection Techniques Applied to Pest Images*
Hongshuo Zhai[1], Fengzhi Dai[1], Lijiang Zhang[2], Qiang Wang[3]
([1]Tianjin University of Science and Technology, China; [2]Xinjiang Shenhua Biotechnology Co., Ltd, Xinjiang, China; [3]Easy Control Intelligent Technology(Tianjin) Co., Ltd., China)

OS10-3 *Design of an Intelligent Pet Feeding System Based on STM32*
Shuhuan Peng[1], Qiang Wang[2] ([1] Tianjin University of Science and Technology, China;
[2] Easy Control Intelligent Technology (Tianjin) Co., Ltd., China)

OS10-4 *Design of Teaching Attendance System Based on Image Processing*
Shengyu Wang[1], Ce Bian[2] ([1] Tianjin University of Science and Technology, China,
[2] Tianjin Tianke Intelligent Manufacture Technology Co., LTD., China)

OS10-5 *Semi-automatic Leek Harvester Based on Multi-angle Adjustment*
Hongpi Zhao, Xuefeng Jia, Wenqi Fu, Yizhun Peng
(Tianjin University of Science and Technology, China)

11:30-12:00 OS10-2 Pattern Recognition and Control - 2 (2)

Chair: Zhai Hongshuo (Tianjin University of Science and Technology, China)

Co-Chair: Li Huahao (Tianjin University of Science and Technology, China)

OS10-6 *Smart Inspection Guard - Inspection Robot for Unattended Plants*
Liangyu Wang, Yanhong Yu, Yizhun Peng
(Tianjin University of Science and Technology, China)

OS10-7 *Deep Learning Based Integrated Removable Smart Waste Sorting Device*
Yanhong Yu, Liangyu Wang, Yizhun Peng
(Tianjin University of Science and Technology, China)

13:00-15:00 OS20 Applications (8)
Chair: Kasthuri Subaramaniam (University of Malaya, Malaysia)
Co-Chair: Abdul Samad Bin Shibghatullah (Universiti Tenaga Nasional, Malaysia)

OS20-1 *Low-light Image Enhancement with Color Space (Cielab)*
Lee Kok Xiong[1], Kasthuri Subaramaniam[2], Umm E Mariya Shah[1], Abdul Samad Bin Shibghatullah[3], Oras Baker[4]
([1]UCSI University, Malaysia, [2]University of Malaya, Malaysia, [3]Universiti Tenaga Nasional, Malaysia, [4]University of Ravensbourne, England)

OS20-2 *Integrated AI Voice Assistant News Website for Enhancing User Experience – AI-ReadSmart*
Mohammed Mohi Uddin[1], Ghassan Saleh Hussein Al-Dharhani[1], Keoy Kay Hooi[1], Chit Su Mon[2], Kasthuri Subaramaniam[3] ([1]UCSI University, Malaysia, [2]Heriot-Watt University Malaysia Campus, Malaysia, [3]University of Malaya, Malaysia)

OS20-3 *Developing a Mobile Healthcare Application – MyHealth*
Abdulrahman Salmo Alhamada[1], Ghassan Saleh Hussein Al-Dharhani[1], Kasthuri Subaramaniam[2], Raenu Kolandaisamy[1]
([1]UCSI University, Malaysia [2]University of Malaya, Malaysia)

OS20-4 *Developing a Body Posture Detection for Fitness*
Kai Xuan Chong[1], Abdul Samad Bin Shibghatullah[2], Kasthuri Subaramaniam[3], Chit Su Mon[4] ([1]UCSI University, Malaysia, [2]Universiti Tenaga Nasional, Malaysia, [3]University of Malaya, Malaysia, [4]Heriot-Watt University Malaysia Campus, Malaysia)

OS20-5 *Medical Mate: Healthcare and Medical Chat Bot*
Harris Hue Chee Kin[1], Javid Thirupattur[2], Kasthuri Subaramaniam[3], Shabana Anjum Shaik[4] ([1]UCSI University, [2]Sunway University, [3]University of Malaya, [4]Taylor's University, Malaysia)

OS20-6 *Crimes Identification System for Campus Safety and The Threat of Suspicious Student Conduct*
Wong Zhen Bang[1], Kay Hooi Keoy[1], Kasthuri Subaramaniam[2], Sellappan Palaniappan[3], Oras Baker[4]
([1]UCSI University, Malaysia, [2]University of Malaya, Malaysia, [3]Help University, Malaysia, [4]University of Ravensbourne, England)

GS1-5 *Intelligent Path Planning for Robots and Practical Implementation of Programmable Headlights for Autonomous Vehicles*
Farkad Adnan, Abdul Samad Bin Shibghatullah, Mohd Radzi Bin Aridi
(Universiti Tenaga Nasional (Uniten), Malaysia)

GS3-4 *Graphical User Interface (GUI) Design for Mobile Commerce Site for Women Seller in Rural Area*
Kho Irene[1], Dr. Shayla Islam[1], Abdul Samad Shibghatullah[2]
([1]UCSI University, Malaysia), ([2]University Tenaga Nasional, Malaysia)

Room 406

10:00-11:15 OS13 Research Towards the Renewable Energy and the Sustainable Development Goals (SDG's) / Part A (5)

Chair: Ammar A.M. Al Talib (UCSI University, Malaysia)

Co-Chair: Takao Ito (Hiroshima University, Japan)

OS13-1 *Solar-Powered IoT-Based Smart Aquaponic System for Sustainable Agriculture*
Alvi Khan Chowdhury[1], Sarah 'Atifah Saruchi[2], Ammar A.M. Al-Talib[1], Abdirisak Mubarik Muhumed[1], Teh Boon Hong[3], Pavindran A/L Shanmugavel[3], Annanurov Kerim[3], Ng Weng Kent[3]
([1]Monash University Malaysia, Malaysia), ([2]UCSI University, Malysia), ([3]UMPSA, Malaysia)

OS13-2 *AI-Powered Detection of Forgotten Children in Vehicles Using YOLOv11 for Enhanced Safety*
Nur Atikah Jefri[1], Sarah 'Atifah Saruchi[1], Radhiyah Abd Aziz [1], Aqil Hafizzan Nordin[1], Ammar A.M. Al-Talib[2], Zulhaidi Mohd Jawi[3]
([1]UMPSA, Malaysia) ([2]UCSI University, Malaysia) ([3]MIROS, Malaysia)

OS13-3 *Exploring the Performance of YOLOv11: Detecting Compostable and Non-Compostable Kitchen Waste in Real-Time Applications*
Ain Atiqa Mustapha[1], Sarah 'Atifah Saruchi[1], Mahmud Iwan Solihin[2], Fatima Karam Aldeen[2], Ammar A.M. Al-Talib[2] ([1]UMPSA, Malaysia), ([2]UCSI University, Malaysia)

OS13-4 *Comparative Analysis of Machine Learning Algorithms for Rainfall Prediction in Kuantan, Pahang, Malaysia*
Seri Liyana Ezamzuri[1], Sarah 'Atifah Saruchi[1], Ammar A.M. Al-Talib[2]
([1]UMPSA, Malaysia), ([2]UCSI University, Malaysia)

OS13-5 *Autonomous Vehicle Navigation in Highway with Deep Q-Network (DQN) using Reinforcement Learning Approach*
Sumiya Tamanna Fujita[1], Sarah 'Atifah Binti Saruchi[1], Ammar A.M. Al-Talib[2], Nurbaiti Wahid[3]. Siti Nurhafizza Maidin[3], Alvi Khan Chowdhury[4] ([1]UMPSA, Malaysia) ([2]UCSI University, Malaysia) ([3]UiTM Dungun, Malaysia) ([4]Monash Universiti, Malaysia)

11:30-12:15 OS4 Robot Images and Motion (3)

Chair: Miao Zhang (Tianjin University of Science and Technology, China)

Co-Chair: Peng Wang (Tianjin University of Science and Technology, China)

OS4-1 *An improved Laser SLAM algorithm based on Cartographer*
Lei Jiang, Miao Zhang (Tianjin University of Science and Technology, Tianjin, China)

OS4-2 *Semi-Global Stereo Matching Algorithm Based on Optimized Image Preprocessing*
Huaijiao Sha,Miao Zhang
(Tianjin University of Science and Technology, Tianjin, China)

OS4-3 *Simulation of a 3-DOF Robotic Arm Pick and Place Task Based on Inverse Kinematics*
Songyang Mei, Miao Zhang
(Tianjin University of Science and Technology, Tianjin, China)

13:00-14:30 OS3 Robot Path Planning (6)
Chair: Shengwei Liu (Tianjin University of Science and Technology, China)
Co-Chair: Yiming Wang (Tianjin University of Science and Technology, China)

OS3-1 *A Novel Path Planning Scheme Based on Improved Bi-RRT* Algorithm*
Shengwei Liu, Miao Zhang
(Tianjin University of Science and Technology, Tianjin, China)

OS3-2 *Rapidly Exploring Random Tree-back (RRT-Bcak)*
Junsheng Gao, Miao Zhang
(Tianjin University of Science and Technology, Tianjin, China)

OS3-3 *Path Planning for Mobile Robots Based on Improved A-star Algorithm*
Yuanyuan Zhang, Miao Zhang
(Tianjin University of Science and Technology, Tianjin, China)

OS3-4 *Improvement of the APF-RRT*-Connect Algorithm for Efficient Path Planning in 3D Environments*
Yiming Wang, Miao Zhang
(Tianjin University of Science and Technology, Tianjin, China)

OS3-5 *Improved RRT*-Connect based on MATLAB*
Ruofan Zhang, Miao Zhang
(Tianjin University of Science and Technology, Tianjin, China)

OS3-6 *Rapidly Exploring Gmapping*
Congchuang Han, Miao Zhang
(Tianjin University of Science and Technology, Tianjin, China)

Room 407
10:00-11:00 OS27 Industrial Revolution (4)
Chair: Hazry Desa (UniMAP, Malaysia)

OS27-1 *Digital Guardians: The Role of AI and Robotics in Protecting Construction Heritage*
Muhammad Azizi Azizan, Nurfadzillah Ishak, Hazry Desa (UniMAP, Malaysia)

OS27-2 *Architectural Memories: AI Redefines Dilapidation Analysis and Conservation*
Muhammad Azizi Azizan, Nurfadzillah Ishak, Hazry Desa, (UniMAP, Malaysia)

OS27-3 *The Future of Robotics in Contract Management*
Muhammad Firdzaus Mat Ros, Muhammad Azizi Azizan, Hazry Desa (UniMAP, Malaysia)

OS27-4 *Leveraging AI to Enhance Extended Producer Responsibility Compliance in Construction Waste Management*
Mohamed Fuad Shahariman, Muhammad Azizi Azizan, Hazry Desa, Nur Amierah Harun (UniMAP, Malaysia)

Farewell Party

Abstract

PS Abstract (3)

PS1 High-fidelity Multi-agent Simulations for Social Systems

Shinobu Yoshimura, Hideki Fujii (The University of Tokyo)

For realizing the rational and quantitative design of social systems, we have been developing intelligent multi-agent based simulations together with high-fidelity models of social systems. The one is MATES (Multi-Agents based Traffic and Environmental Simulator), and the other is a virtual nursing care process simulator based on a multi-agent model. In this talk, I first describe the objectives of the research and some key technologies, and then introduce their practical applications with verification and validation, i.e. Tram line extension problem in an actual middle sized-city, Okayama, Japan, and an excretion care process in an actual day-care facility for elderly persons.

PS2 Toward 2035: Renewable Energy Innovations Transforming Our Future

Firas Basim Ismail (Universiti Tenaga Nasional (UNITEN), Malaysia)

This paper explores the transformative role of renewable energy innovations in addressing global challenges such as climate change and energy security. By 2035, significant milestones are expected to be achieved through targeted policies and technological advancements. Key innovations in solar technology, wind energy, bioenergy, and energy storage are discussed, along with the role of digitalization and AI in optimizing renewable energy systems. The paper also highlights global and regional efforts, including Malaysia's National Energy Transition Roadmap (NETR), and addresses challenges such as intermittency, high costs, and material safety. The conclusion emphasizes the importance of strategic investments and collaboration to ensure a sustainable energy future.

PS3 Integration of Human – Device Interface: Transforming the Future of Interaction

Norrima Mokhtar, Takao Ito
(Universiti Malaya, Malysia) (Hiroshima University, Japan)

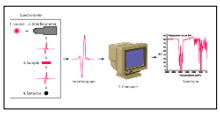
This paper explores advancement in Human-Device Interface technology, focusing on emerging trends like gesture control, brain computer interfaces, speech, eye movement via EOG, eye movement via camera and many more effortless inputs to enable user experience and action. Artificial intelligent techniques, whether supervise, semi- supervise and autonomous, play a major role in processing the input to classification categories for action and data monitoring. Potential applications include automation, healthcare, education, entertainment and the increasingly popular gaming industry. These technologies are redefining the Human-Device collaboration and significantly enhancing user experiences.

OS Abstract
OS1 Human-Machine Interface (7)
Chair Norrima Mokhtar (Universiti Malaya, Malaysia)
Co-Chair Heshalini Rajagopal (Mila University, Malaysia)

OS1-1 Non-Invasive Glucose Monitoring Based on Mid-Infrared Spectroscopy

Puteri Nur Sofea Mohd Zakki, Nani Fadzlina Naim, Hasnida Saad, Wan Norsyafizan Wan Muhamad, Suzi Seroja Sarnin, Norsuzila Ya'acob, Noor Fitrah Abu Bakar
(Universiti Teknologi MARA (UITM), Malaysia)

This paper presents on non-invasive method of glucose monitoring using Mid-Infrared (M-IR) spectroscopy. Glucose samples are prepared and analyzed using M-IR spectroscopy. Using Fourier-transform of the M-IR spectroscopy, we experimentally track variations in the mid-infrared glucose absorption peak. The glucose samples and the relation with diabetic people is also presented in this paper. It is found that as the glucose concentration increases, the wavelengths at which absorbance peaks occur also increase particularly for wavelength range 1400-1470nm.



OS1-2 Investigation of Electromagnetic Radiation (EMR) Before and After Super Brain Yoga Exercise Comparing with Short-Term Memory

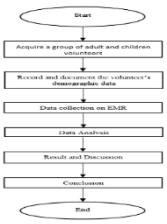
Ros Shilawani S Abdul Kadir, Suzi Seroja Sarnin, Muhammad Afiq Kamil Arif, Faizul Hafizzi Ahmad, Wan Norsyafizan Wan Muhamad, Aziati Husna Awang
(Universiti Teknologi MARA (UITM), Malaysia)

This research is concerned with the investigation of the Electromagnetic Radiation (EMR) on a human body before and after performing Super Brain Yoga (SBY) exercise compared with short-term memory. 20 participants were involved in this research and asked to perform SBY exercise for about two weeks, 20 times in the morning and 20 in the evening at their own comfortable place. From the analysis, it shows that the right side improved by 76% and the left side by 62%. Also, there are increments of 80% of the Digit Span test by the participant after performing SBY. Other than that, 3% of the participants decreased while 17% of them remained the same. In conclusion, this research finding shows that performing SBY exercise gives some benefits to an individual; the EMR of the human body is improving significantly with a better short-term memory of a participant.

OS1-3 Preliminary Investigation of Electromagnetic Radiation (EMR) Between Adults and Children

Ros Shilawani S Abdul Kadir, Aziati Husna Awang, Muhamad Azizularif Mohamad Azizan, Suzi Seroja Sarnin, Suhaila Subahir, Roshakimah Mohd Isa
(Universiti Teknologi MARA (UITM), Malaysia)

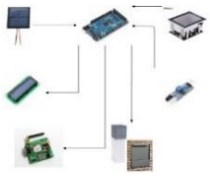
This research is concerned with the initial investigation of electromagnetic radiation (EMR) between adults and children which involved 30 participants from the adult group and 32 participants from the children group. A frequency detector was used to measure the EMR frequencies (in MHz) around 16 points of the human body. The obtained data were assessed by examining the pattern and behavior of captured frequencies, as well as comparing the frequencies of adults and children. From the data analysis, adults have higher frequencies of reading in all body points as compared to children. The analysis also showed that children have better health scores as compared to adults. In conclusion, the EMR emitted from adults and children are significantly different in frequency and have their own characterized frequency patterns and children have better health scores compared to adults.



OS1-4 Solar Powered Smart Parcel Box System: Energy Efficient Solution for Modern Deliveries

Wan Norsyafizan W. Muhammad, AmerulAshraf Zulkepli, Nani Fazlina Naim, Suzi Seroja Sarnin, Ros Shilawani S Abdul Kadir, Md Nor Mat Tan
(Universiti Teknologi MARA (UITM), Malaysia)

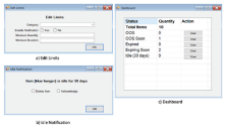
This work introduces an innovative solution: the "Energy Efficiency Smart Parcel Box System Using Solar Energy." The proposed system consists of a network of smart parcel lockers strategically placed in residential and commercial areas. Each locker unit is equipped with solar panels to power its operations, QR code authentication, an infrared sensor for detection and automated door closure, and a user-friendly mobile application. The system's ability to operate independently using solar power makes it a cost-effective and sustainable solution for modern parcel delivery needs. This innovation aligns with the ongoing global efforts to create a greener and more sustainable future, providing a promising solution for the challenges faced in modern logistics and parcel management.



OS1-5 Desktop-Based Expiry Date Application for Retailers Inventory Management

Nur Hazwani Ahmad Halil[1], Suzi Seroja Sarnin[1], Nani Fazlina Naim[1], Azlina Idris[1], Wan Norsyafizan W. Muhammad[1], Ros Shilawani S Abdul Kadir[1], Md Nor Mat Tan[1], Raudah Abu Bakar[1], Zarina Baharudin Zamani[2]
([1]Universiti Teknologi MARA (UITM), Malaysia), ([2]UTEM, Malaysia)

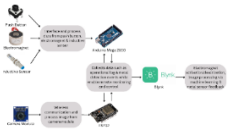
This project is proposed to automate inventory management process by developing a real-time inventory monitoring system and notify user on low stock items and items close to expiration. The desktop-based inventory management application is equipped with a PC and a handheld scanner and involve three main inventory processes; scan incoming inventory, scan outgoing inventory during customer checkout and allow users to manage stock counts and update data if necessary. With this system, issues related to inventory can be resolved quickly based on real-time data monitoring, less time spent for repetitive works while providing a better customer experience.



OS1-6 Automatic Metal Debris Collection Robot for Laboratory Safety: A Review

Sophia Fahima Hapizan[1], Ja'aris Samsudin[1], Heshalini Rajagopal[2], Takao Ito[3], Muhammad Amirul Aiman Asri[4], Anees Ul Husnain[5]
([1]Mara-Japan Industrial Insititute, Malaysia), ([2]Mila University, Malaysia)
([3]Hiroshima University, Japan), ([4]Universiti Malaya, Malaysia)
([5]The Islamia University of Bahawalpur, Pakistan)

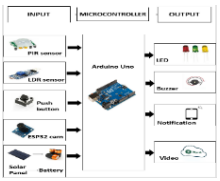
Laboratory safety is paramount, especially when managing hazardous metal debris. This review explores advancements in robotics for waste management, emphasizing autonomous sorting and collection systems driven by AI and machine learning. These technologies enhance the precision and adaptability of robots, enabling accurate detection, classification, and handling of metal debris. By integrating advanced sensors and real-time decision-making, such systems improve resource management and safety in laboratory environments. Challenges such as power efficiency and scalability are also discussed, highlighting future opportunities for optimizing robotic solutions in critical waste management applications.



OS1-7 Smart Solar LED Street Light with ESP32 Camera Modulee

Suzi Seroja Sarnin[1], Ros Shilawani S Abdul Kadir[1], Nurul Farhana Zailani[1], Nani Fazlina Naim[1], Md Nor Mat Tan[1], Raudah Abu Bakar[1], Zarina Baharudin Zamani[2]
([1]Universiti Teknologi MARA (UITM), Malysia), ([2]UTEM, Malaysia)

Streetlights are crucial for the operation of smart cities. The internet of things introduces the idea of smart lighting with solar technology. This study was to determine how smart streetlights can adapt to the environment, which helps people today with their ability to observe their surroundings clearly while avoiding the existence of places where criminals can hide. This project is designed based on LDR sensor to turn ON the LED depends on light intensity while PIR sensor to control the brightness and microcontroller used is Arduino Uno. Automation is intended to reduce manpower with the help of intelligent systems, since the supply of electricity is limited for various of reasons, power consumption is always a top priority.



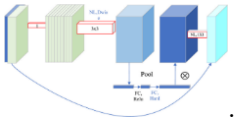
OS2 Computer and Information Engineering (3)

Chair Norrima Mokhtar (University of Malaya, Malaysia)
Co-Chair Heshalini Rajagopal (MILA University, Malaysia)

OS2-1 Efficient Weed Detection in Agricultural Landscapes using DeepLabV3+ and MobileNetV3

Renuka Devi Rajagopal[1], Manthena Rishit Varma[1], Heshalini Rajagopal[2]
([1]Vellore Institute of Technology, India), ([2]Mila University, Malaysia)

Weed detection is a crucial task in precision agriculture, significantly impacting crop yields and reducing the dependency on herbicides. Effective weed management enhances agricultural productivity by ensuring that crops receive adequate nutrients, water, and sunlight, which weeds would otherwise consume. Traditional weed control methods are labor-intensive and often rely heavily on chemical herbicides, which can have detrimental environmental effects. This paper presents a deep learning approach for weed detection, utilizing the DeepLabv3+ model with a MobileNetv3 backbone. This study underscores the potential of integrating advanced deep learning techniques into agricultural practices, paving the way for more sustainable and efficient weed management strategies.



OS2-2 AI-Based Weed Detection Algorithm using YOLOv8

Renuka Devi Rajagopal[1], Rethvik Menon C[1], T S PradeepKumar[1], Heshalini Rajagopal[2]
([1]Vellore Institute of Technology, India), ([2]Mila University, Malaysia)

The development of a country relies heavily on agricultural produce and its related sectors. However, farmers face significant challenges due to the uncontrolled growth of weeds, which reduces their yield. Weed detection is a key step in the removal process, and advances in technology, such as the YOLOv8 model, have simplified this task. YOLOv8 offers improved weed and crop detection, with enhancements of 1.3% and 1.17% in mAP50 and mAP50-95, respectively, over the previous YOLOv5 model. This allows farmers to efficiently identify and eliminate weeds, leading to higher productivity and better crop yields, ultimately supporting the agricultural growth of the country.

OS2-3 Novel Gender and Age- Based Detection Technique for Facial Recognition System

Pratham Gupta[1], Amutha S[1], Dhanush R[1], Heshalini Rajagopal[2]
([1]Vellore Institute of Technology, India), ([2]Mila University, Malaysia)

This paper presents gender and age-based classification methods in facial recognition, addressing challenges from demographic diversity. It employs unsupervised detection using autoencoders to learn facial features, enhancing robustness across populations. Ethical concerns, such as fairness and bias mitigation, are emphasized, ensuring more responsible use of facial recognition. The method effectively reduces biases found in traditional supervised approaches, improving system reliability in diverse real-world applications. The research is significant for developers, policymakers, and researchers focused on ethical AI, offering a novel approach that promotes inclusivity and fairness in facial recognition technologies.

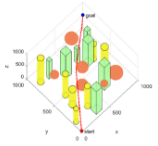
OS3 Robot Path Planning (6)

Chair Shengwei Liu (Tianjin University of Science and Technology, China)
Co-Chair Yiming Wang (Tianjin University of Science and Technology, China)

OS3-1 A Novel Path Planning Scheme Based on Improved Bi-RRT* Algorithm

Shengwei Liu, Miao Zhang
(Tianjin University of Science and Technology, Tianjin, China)

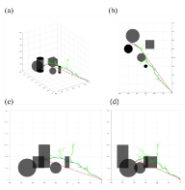
The Bi-RRT* algorithm is a path planning algorithm for industrial robots. In this paper, Bi-RRT* algorithm is studied and improved. The improved Bi-RRT* algorithm reduces the iteration time by introducing artificial potential field method. And, the path cost is reduced and the path smoothness is improved by introducing greedy algorithm. Finally, the improved Bi-RRT* algorithm was simulated in three dimensional environment, and the superiority of the improved Bi-RRT* algorithm was demonstrated by comparative experiments.



OS3-2 Rapidly Exploring Random Tree-back (RRT-Bcak)

Junsheng Gao, Miao Zhang
(Tianjin University of Science and Technology, Tianjin, China)

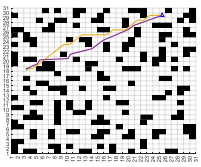
This paper proposes a backtracking Rapidly Exploring Random Tree (RRT-Back) algorithm to reduce the length of the generated path. The proposed algorithm enhances path optimization by employing path backtracking to eliminate redundant nodes and utilizing direct linear connections between discontinuous nodes to shorten path length. To minimize computational expense, the method incorporates cost-effective connections within the already generated path, following the principles of the RRT algorithm. The experimental results demonstrate that the RRT-Back algorithm significantly enhances the feasibility and efficiency of paths in complex environments.



OS3-3 Path Planning for Mobile Robots Based on Improved A-star Algorithm

Yuanyuan Zhang, Miao Zhang
(Tianjin University of Science and Technology, Tianjin, China)

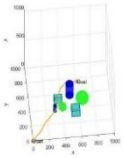
In this paper, an improved A* algorithm is presented, which decreases the search time and path cost by introducing a bidirectional search strategy, enhancing the evaluation function, and eliminating redundant nodes. Through the addition of a corner optimization algorithm, the path smoothness is augmented, and the running speed and reliability of A* are enhanced. Eventually, the superiority of the improved A* algorithm is verified through comparative experiments.



OS3-4 Improvement of the APF-RRT*-Connect Algorithm for Efficient Path Planning in 3D Environments

Yiming Wang, Miao Zhang
(Tianjin University of Science and Technology, Tianjin, China)

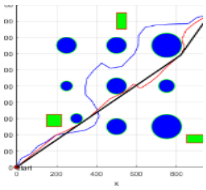
This paper presents an improved APF-RRT*-Connect algorithm for three-dimensional environments. The improved method integrates the APF during path generation to optimize each newly generated node in real-time. This approach reduces the number of node optimization processes, collision detections and optimizes the target nodes in the attractive potential field. Through Matlab simulation, the paper compares the path length and planning time of the traditional APF-RRT*-Connect algorithm and the improved algorithm. The results indicate that the improved algorithm can find shorter paths in less time and enhances the smoothness of the path.



OS3-5 Improved RRT*-Connect based on MATLAB

Ruofan Zhang, Miao Zhang
(Tianjin University of Science and Technology, Tianjin, China)

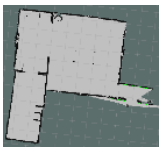
The article analyzes an improved RRT*-Connect path planning algorithm based on MATLAB software. First, the sampling domain of the algorithm is changed to an elliptical sampling domain. Second, adaptive compensation expansion is introduced to accelerate the search speed of the path planning algorithm. Finally, the algorithm is combined with a greedy algorithm to optimize the path. Simulation results show that this algorithm significantly improves both the path length and planning time compared to the traditional RRT*-connect algorithm.



OS3-6 Rapidly Exploring Gmapping

Congchuang Han, Miao Zhang
(Tianjin University of Science and Technology, Tianjin, China)

This paper presents an improved algorithm for the proposal distribution. The proposed algorithm enhances the range of filter values, the precision of re-sampling, and the accuracy of the map building. Additionally, the computational overhead is reduced, thereby optimizing the issue of the particle degeneration. The comparative experiments demonstrate that the proposed algorithm enhances the mapping precision and speed.



OS4 Robot Images and Motion (3)

Chair Miao Zhang (Tianjin University of Science and Technology, China)
Co-Chair Peng Wang (Tianjin University of Science and Technology, China)

OS4-1 An improved Laser SLAM algorithm based on Cartographer

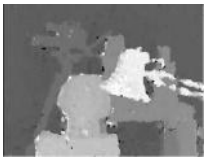
Lei Jiang, Miao Zhang
(Tianjin University of Science and Technology, Tianjin, China)

SLAM is one of the core technologies in the field of robotics. At present, Laser SLAM has become the mainstream mapping solution for general mobile robots. Cartographer algorithm is one of the mainstream Laser SLAM algorithms, which has attracted much attention because of its high accuracy and suitable for large scenes. However, the effect of sensor data fusion using Unscented Kalman Filter (UKF) is not ideal. Therefore, an improved Cartographer algorithm is proposed in this paper, which uses Adaptive Unscented Kalman Filter (AUKF) to fuse information of sensors, aiming to improve the accuracy of localization and mapping.

OS4-2 Semi-Global Stereo Matching Algorithm Based on Optimized Image Preprocessing

Huaijiao Sha, Miao Zhang
(Tianjin University of Science and Technology, Tianjin, China)

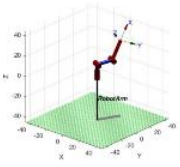
This paper proposes an improved Semi-Global Matching (SGM) algorithm that enhances the quality of disparity images by optimizing image preprocessing. The method applies denoising, contrast enhancement, and Sobel filtering to compute pixel gradients and highlight image edges, thereby improving image quality and reducing noise interference to enhance the clarity of feature boundary. The preprocessed images are used for the SGM algorithm, which improves matching accuracy and adaptability through adaptive sliding windows and dynamic aggregation strategies for cost calculation and aggregation. Experimental results indicate that the improved algorithm enhances the accuracy and robustness of disparity images.



OS4-3 Simulation of a 3-DOF Robotic Arm Pick and Place Task Based on Inverse Kinematics

Songyang Mei, Miao Zhang
(Tianjin University of Science and Technology, Tianjin, China)

This paper proposes a simulation method for grasping and placing a 3-DOF robotic arm based on inverse kinematics. Through the MATLAB GUI, the user enter target coordinates, computes the joint angles by a geometric approach and simulates the motion path to achieve the task operation. In this approach. the robotic arm can precisely reach specified positions, reducing the complexity and error. The position error is calculated by comparing the target with the actual position. The simulation results demonstrate that the robot arm shows a small average error in the five groups of experiments, and the maximum error is maintained within a reasonable range, thereby verifying the accuracy of the method in grasping and placing tasks.



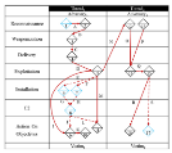
OS5 Intelligent Life and Cybersecurity (7)

Chair I-Hsien Liu (National Cheng Kung University, Taiwan)
Co-Chair Chu-Fen Li (National Formosa University, Taiwan)
Co-Chair Cheng-Han Lin (Fooyin University, Taiwan)

OS5-1 A Diamond Model Approach to Analyzing GhostSec's Intrusion Paths

Cheng-Ying He, Nai-Yu Chen, Jung-Shain Li, I-Hsien Liu (National Cheng Kung University, Taiwan)

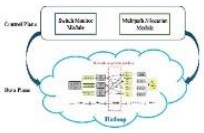
The convergence of Operational Technology (OT) and Information Technology (IT) has heightened risks for critical infrastructure (CI) and industrial control systems (ICS), leading to a surge in diverse and sophisticated OT attacks with severe consequences. Thus, this study combines the Diamond Model with the Cyber Kill Chain to analyze potential attack paths and methods in the GhostSec case, where attackers compromised a Berghof PLC to demonstrate their access capabilities. Understanding these attack paths offers valuable insights into adversary strategies, aiding in the development of defense measures to prevent similar attacks.



OS5-2 A Bandwidth-Aware Routing Mechanism to Control Hadoop Shuffle Traffic over Software-Defined Networking

Ming-Syuan Wu (National Kaohsiung University of Science and Technology, Taiwan)
Cheng-Han Lin (Fooyin University, Taiwan)
Wen-Shyang Hwang (National Kaohsiung University of Science and Technology, Taiwan)
Ce-Kuen Shieh, Mao-Syun Lin (National Cheng Kung University, Taiwan)

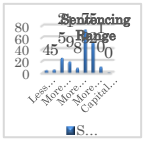
In the Hadoop computing architecture, MapReduce is the main operation program. Between the process of Map and Reduce, servers are necessary to exchange large amounts of data with each other. The shuffle stage exchanges data between servers which will cause the problem of insufficient network bandwidth. In this paper, we proposed an algorithm to distribute Hadoop shuffle traffic and allocate it to all the possible paths. By using the central control network architecture, Software Defined Network (SDN), the proposed mechanism collects the parameters of the network status for allocating shuffle traffic. In distributing the traffic of the Hadoop shuffle stage, the network operation was simulated by the Mininet simulator to build the network topology. The Ryu controller used to be the SDN controller in the simulation. As shown in the simulation results, the proposed mechanism is superior to the Spanning tree protocol and bandwidth-aware algorithm in Hadoop completion time by distributing Hadoop shuffle traffic.



OS5-3 AI Sentencing System: Homicide Case Study in Taiwan

Shih-Chin Lin, Cheng-Tsung Yeh, Chen-Yu Lai, Chih-Yun Chang, Chi-Ju Fu
(Ming Chuan University, Taiwan)

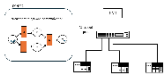
This study examines 198 homicide verdicts from district courts between 2016 and 2023, focusing on sentencing factors based on Article 57 of Taiwan's Criminal Code. It analyzes the most frequently considered factors by judges and the variations in sentencing severity that result from these considerations. In conclusion, this paper addresses potential challenges that may arise in the practical implementation of the sentencing information system and considers how judges might use it as a supplementary tool in sentencing, or whether it could fully guide sentencing decisions.



OS5-4 Inferring ICS Topology and Behavior through Network Traffic Analysis

Chien-Wen Tseng, Jung-Shain Li, I-Hsien Liu (National Cheng Kung University, Taiwan)
Chu-Fen Li (National Formosa University, Taiwan)

Ensuring the proper operation of industrial control systems (ICS) is a critical issue. Previous studies have focused on observing the controllers directly; however, this research proposes that analyzing network traffic could reduce system interference. This study utilizes a cybersecurity testing platform for dam systems to investigate network traffic as a means to infer the composition of network nodes and the communication behavior between them. By doing so, it provides an alternative perspective for monitoring ICS operations. This model aids in understanding system topology, tracking potential deviations, and ensuring operational stability.



OS5-5 Using fuzzy control routing for dynamic load balancing over Software-Defined Networks

Wen-Shyang Hwang, Ming-Syuan Wu, Sian-Fong Huang
(National Kaohsiung University of Science and Technology, Taiwan)
Cheng-Han Lin (Fooyin University, Taiwan), Yan-Jing Wu (Shih Chien University, Taiwan)
Ming-Hua Cheng (Tzu-Hui Institute of Technology, Taiwan)

Traditional Software-Defined Networks (SDNs) load-balancing and forwarding mechanisms often rely on static path selection. The conventional mechanisms lead to uneven resource utilization and bottlenecks under high traffic. Therefore, existing methods need more flexibility in decision-making. In order to solve the difficulty of setting multi-variable input thresholds, this study introduces a load-balancing algorithm based on fuzzy logic. The algorithm uses fuzzy logic to combine network parameters (queue length, link utilization, link delay, and packet loss rate) as fuzzy inputs. Converting fuzzy input into a score is the key to achieving the optimal traffic allocation in the mechanism. The proposed mechanism improves resource utilization, reduces bottlenecks and reliability in dynamic network load situation. The results indicate that the proposed method achieves higher throughput under high-load conditions. Moreover, the result also maintains low packet loss and delay rates. Based on the fuzzy logic, load balancing thus provides an effective solution for SDN environments.

OS5-6 The Application of AI in the Real Estate Industry: Business Model Innovation Perspective

Li-Min Chuang, Chih-Hung Chen (Chang Jung Christian University, Taiwan)

This paper mainly discusses how Taiwan's real estate agency system uses artificial intelligence (AI) to reshape the traditional business model and create business model innovation. This study uses the Fuzzy Analytical Hierarchy Process (FAHP) and the literature analysis method to construct an analytical framework of four major dimensions based on nine key elements of the business model. Through empirical analysis of relative weights, important propositions are established. The research object is targeted at Tainan, Taiwan. A survey of real estate agency companies and marketing businesses was conducted to show that AI technology drives real estate agency business model innovation, and based on consumer business behavior, it accurately predicts market trends and improves marketing performance, thereby enhancing competitive advantages.

OS5-7 The Impact of AI-Powered Health Monitoring on the Quality of Life and Social Participation of the Elderly: Technology Acceptance Model Perspective

Li-Min Chuang, Zong-Sheng Li (Chang Jung Christian University, Taiwan)

This study investigates the acceptance of AI-powered health monitoring systems among the elderly population in Taiwan. Utilizing the Technology Acceptance Model (TAM) as a theoretical framework, this research employed a combination of literature review and the Fuzzy Analytic Hierarchy Process (FAHP) to analyze questionnaire data collected from the elderly in Tainan, Taiwan. By examining perceived ease of use, perceived usefulness, attitude, and behavioral intention, and calculating the relative weights of these constructs, the study found that the introduction of AI-powered health monitoring systems enabled the elderly to obtain medical advice, thereby reducing the frequency of medical visits and enhancing their ability to live independently.

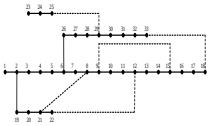
OS6 Intelligent Algorithm Application (7)

Chair Peng Wang (Tianjin University of Science and Technology, China)
Co-Chair Miao Zhang (Tianjin University of Science and Technology, China)

OS6-1 Reliability Analysis and Optimization of Distribution Network with Distributed Generation

Peng Wang, Mengyuan Hu, (Tianjin University of Science and Technology, China)

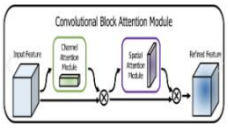
With the access of distributed power sources, the distribution network is facing the problems of voltage quality decline and cost increase. In this paper, the Markov Monte Carlo simulation method(MCMC) is used to verify the impact of the distributed power supply on the distribution network. Secondly, a bi-level joint programming model based on particle swarm optimization (PSO) and K-means clustering algorithm is used to minimize the cost. The results are applied to the upper planning level to improve energy efficiency and economy. Finally, the improved IEEE-33 node system is used to verify the example, and the optimal location of the distributed power supply are analyzed.



OS6-2 Research on Improved PPLCNet Classification Network Based on CBAM Attention Model

Peng Wang, Shengfeng Wang, Qikun Wang, Yuting Zhou
(Tianjin University of Science and Technology, China)

This paper studies pedestrian attribute recognition based on the pplcnet network because it is of great significance in the field of traffic security. Firstly, the research status of pedestrian attribute recognition and common deep learning models are introduced. Secondly, considering that CBAM contains both spatial attention module and channel attention module, we add this attention model to pplcnet to improve performance. Finally, this paper verifies the model through the pa100k dataset and obtains good results.



OS6-3 Optimizing Microgrid Power Dispatch with Integrated Ground Source Heat Pumps Using Cellular Automata

Peng Wang, Shunqi Yang (Tianjin University of Science and Technology, China)

As a new type of energy supply and management system, this paper improves a simulation method based on cellular automata (CA) to optimize power dispatching in microgrids, especially for the ground source heat pump (GHP) system. Firstly, this paper simulates the dynamic behavior and interaction of each unit in the microgrid using cellular automata, addressing uncertainties on both the supply and demand sides. Secondly, this paper uses a two-level optimization method to enhance the maximization of self-consumption and optimize energy flow in the grid. The results show that this method can effectively improve microgrid energy utilization efficiency, reduce operating costs, and enhance system reliability and resilience.

OS6-4 Indoor Personnel Thermal Comfort Monitoring System Based on Mobile Robots

Peng Wang, Zihang Zhou (Tianjin University of Science and Technology, China)

With the advancement of smart building technology, monitoring thermal comfort in indoor environments has become increasingly important. Research has shown that non-invasive infraredography (IRT) technology can effectively predict thermal comfort. This paper explores the use of mobile robots to monitor the thermal comfort of indoor occupants. Mobile robots can collect information of occupants from multiple perspectives, locate and estimate their thermal comfort in real time. This paper first studies how humans perceive temperature and how environmental factors affect comfort., experiments are conducted to evaluate the accuracy and reliability of the data collected by the robot. Finally, the paper analyzes how this data can be translated into thermal comfort.

OS6-5 Market Trading Strategy of Integrated Energy Park from the Perspective of Non-cooperative Game

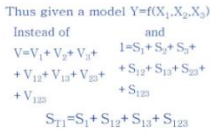
Peng Wang, Siyi Wang, Liangyu Wang, Chengkai Miao
(Tianjin University of Science and Technology, China)

This paper introduces a park trading framework including energy managers, distributed photovoltaic and wind power users and electric vehicle charging service providers, and establishes a non-cooperative game model in which three subjects pursue maximum benefits. Taking a typical winter day in a park as an example, the simulation results show that: in the game equilibrium, energy managers profit from energy supply, distributed photovoltaic and wind power users improve resource utilization and reduce costs through margin online sales, and electric vehicle charging service providers choose low-bid charging to reduce costs and assist users to absorb excess resources and reduce the load of distribution network.

OS6-6 Research on the Sensitivity of Thermal Comfort Using Sensitivity Algorithms Based on Variance and Stochastic Expansion

Peng Wang, Yuting Zhou, Liangyu Wang, Chengkai Miao, Qikun Wang

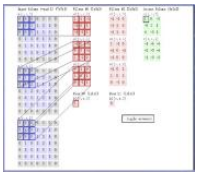
In the research field of modern architectural environment, the sensitivity research of human thermal comfort factors is of crucial significance. In this paper, first of all, common algorithms in the field of sensitivity analysis and data sets for thermal comfort research are elaborated in detail. Secondly. The variance method is taken into consideration. It has the capacity to reflect the fluctuation of the influence that different factors exert on the results. Meanwhile, the stochastic expansion method is also regarded. It is capable of handling complex non-linear relationships. A decision is made to combine these two methods. And the combined methods will be applied to conduct the sensitivity analysis of thermal comfort factors. Finally, the most critical factors for thermal comfort are successfully identified, providing an important basis for the construction and optimization of the thermal comfort prediction model.



OS6-7 Deep Learning Based Infant and Child Monitoring System

Peng Wang, Jiale Jia (Tianjin University of Science and Technology, China)

This study primarily investigates an infant monitoring system based on computer vision and a multi-branch convolutional neural network. Initially, the collected photos are processed, followed by training algorithms using the OpenCV library to obtain a model for detecting infant faces. Subsequently, leveraging the OpenCV and YOLOv8 algorithm technologies to track and analyze infant behavior trajectories and detect faces. Ultimately, functionalities such as target tracking, night vision enhancement, image segmentation, and infant facial detection are achieved with successful detection outcomes.



OS7 Intelligent Robotics and Systems (6)

Chair Kuo-Hsien Hsia (National Yunlin University of Science and Technology, Taiwan)
Co-Chair Jia-Ming Hsiao (National Yunlin University of Science and Technology, Taiwan)

OS7-1 Fuzzy-Controlled Multi-Valve Pneumatic Soprano Recorder Auto-Playing and Score Recognition System

Chun-Chieh Wang*, Chung-Wen Hung, Kuo-Hsien Hsia, Chian C. Ho, Ying-Yuan Yao (Nation Yunlin University of Science and Technology, Taiwan)

This study presents advanced enhancements in score recognition and soprano recorder performance. An improved method for removing staff lines enhances musical symbol distinction, while refined note classification ensures accurate pitch assignment. The playback system replaces motor-driven actuators with a solenoid-based 9-valve configuration, optimizing speed, reducing noise, and ensuring precise air pressure control across an extended pitch range. Automated tuning using fuzzy control significantly improves efficiency and accuracy. Experimental results demonstrate substantial improvements in tonal precision and overall performance quality for automated soprano recorder systems.

OS7-2 Development of agricultural robots based on ROS

Jr-Hung Guo*, Kuo-Hsien Hsia (National Yunlin University of Science and Technology, Taiwan)

The agricultural industry has become an important issue in many countries due to drastic changes in weather and a reduction in the number of manpower willing to engage in agriculture. Therefore, this study attempts to develop an agricultural robot platform so that robots can assist people in agricultural work. This research uses ROS as the software foundation. Through this convenient software foundation, different agricultural robots can be quickly developed. This research uses this architecture to develop lawn mowers and leaf sweepers, which can be easily converted to different agricultural applications in the future.

OS7-3 The ROS-based web information center of small manipulator

Yue-Jie Wang, Jia-Ming Hsiao*, Shao-Yi Hsiao
(National Yunlin University of Science & Technology, Taiwan)

A ROS-based web information center with respect to small manipulator is developed to show the feasibility of the one for factories. Small ROS-based 6-axis manipulators for teaching and research are utilized to simulate the applications of robot arms in the factories. The task of robot arm is designed to recognize the object color and then to grip the object to the desired storage area. Production operation data and status information from the robot arm are transmitted through the ROS rosbridge_suite to the web interface for display and saved in a database. A start-stop function is also implemented to remotely start and stop the operation of robot arm.

OS7-4 Image-assisted Assembly and Disassembly Process Using TM Six-Axis Collaborative Robotic Arm

Kuo-Hsien Hsia, Yi- Yan Liao, Ching-Yuan Pan
(National Yunlin University of Science & Technology, Taiwan)

This paper explores the development of the TM collaborative robot arm in industrial applications. With its in-house developed TMflow software, TM robot streamlines the intricate human-machine interface of industrial robots and modularizes various tool functions, allowing operators to quickly familiarize themselves. The focus of this paper is on programming the TM collaborative robot arm using TMflow to achieve automatic image-assisted localization for assembly and disassembly. Collaborative arms improve the accuracy and efficiency of assembly and disassembly, reducing manual errors and wasted time. In terms of safety, compared with general robotic arms, collaborative arms are safer, allowing them to cooperate safely with human workers and reducing the incidence of workplace accidents.

OS7-5 Quality Inspection of PVC Shoe Chopsticks: A Research Study

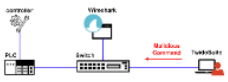
Shu-Li Pai, Kuo-Hsien Hsia, Chian-Cheng Ho
(National Yunlin University of Science and Technology, Taiwan)

In the past decade, the advancement of artificial intelligence technology has led to substantial growth in industrial automation. However, most manufacturing industries are still at the stage of physical labor automation, especially in the area of product inspection, where manual inspection is predominantly used. Taking a PVC shoe chopstick factory as an example, the production line operates 24 hours a day, but quality inspection requires employees to conduct checks on the next working day. This approach makes it difficult to promptly address any defects that occur during production. By incorporating computer vision technology into the PVC production line to track and measure products, it is possible to reduce the defect rate in production and decrease the personnel costs and time delays associated with manual inspection.

OS7-6 Obstructing PLC Operations through Modbus Command Manipulation

Nai-Yu Chen, Cheng-Ying He, Jung-Shain Li, Chu-Sing Yang, I-Hsien Liu
(National Cheng Kung University, Taiwan)

Security vulnerabilities in Programmable Logic Controllers (PLCs) within Industrial Control Systems (ICS) using the Modbus/TCP protocol pose significant risks, particularly through stop-and-start command injection attacks that impact PLC operations and cause severe industrial consequences. Supported by Taiwan's National Science and Technology Council (NSTC) and the Water Resources Agency, this research establishes a cybersecurity testbed for water resource systems to investigate these threats. Unauthorized or forged commands are shown to manipulate PLC configurations and ladder logic diagrams, revealing critical weaknesses. Flowchart analyses and Modbus packet examinations highlight the risks and offer actionable insights into effective defense mechanisms for enhancing ICS security.



OS8 Intelligent Systems and Applications (8)

Chair Chun-Liang Liu (National Yunlin University of Science and Technology, Taiwan)
Co-Chair Yuting Hsiao (National Yunlin University of Science and Technology, Taiwan)

OS8-1 MCU Ultrasonic oscillator driver with digital frequency sweep function

Chung-Wen Hung, Chun-Chieh Wang, Yu-Hsing Su
(National Yunlin University of Science and Technology, Taiwan)

An Ultrasonic oscillator driver with digital frequency sweep function is proposed in this paper. Ultrasonic transducers are widely utilized in various applications, such as liquid atomization. The drive circuit causes the ultrasonic transducer to vibrate, while the attached atomization component converts the liquid into fine particles. In this paper, the LC resonant circuit is adopted to drive the ultrasonic transducer. Due to small variations in the resonant frequency of each transducer, the optimal operating frequency also varies and may change as physical conditions change. Then, microcontroller units (MCUs) are used to control circuit switches to achieve frequency adjustment, scanning and tracking, so that the ultrasonic oscillator works in the best state.

OS8-2 Design and development of foot pressure sensing massage stick

Yuting Hsiao, Dengchuan Cai, Chung-Wen Hung
(Nation Yunlin University of Science and Technology, Taiwan)

There are three key points in the operation of the Foot Massage Stick: sequence, direction and force. However, the force is not easy to be described and not easy to be learned. In order to provide the operator with visualization and information about the force during the operation, a pressure sensing massage stick was developed in this study. The features developed in this study are as follows. 1) The function of the assistive device is in line with the precision level of commercially available instruments. 2) The force and time duration of the operation can be displayed at any time during the execution process. 3) At the end of the execution, the maximum, average, standard deviation, and time duration of the force of the operation can be presented. This visualizes the force of the operation and makes it easy for the learner to check and meet the requirements for use.

OS8-3 Effects on physiological indicators of foot massage using a pressure sensing massage stick

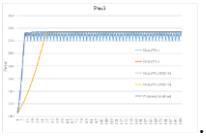
Dengchuan Cai, Yuting Hsiao, Chung-Wen Hung
(Nation Yunlin University of Science and Technology, Taiwan)

Foot massage is often used as a complementary and alternative therapy. This study uses a special foot pressure-sensing massage stick to massage the soles of the feet, and tests the effects on the physiological indicators of the massaged person after foot massage. After 3 sessions of reflexology, the results show: 1) Sleep quality and body energy scores improved. Women showed greater improvement than men. 2) Decrease in stress index and body age. For women, the decline was lower than that for men. 3) Blood oxygen concentration, respiratory rate, and heart rate amplitude do not change much and tend to decrease. The degree of decline was the same for both sexes. The planning and results of this study can provide a reference for the design of foot massage aids.

OS8-4 Study on Maximum Power Point Tracking Technology for Solar Power Systems Using Power Variation to Adjust Step Response

Chun-Liang Liu, Chung-Wen Hung, Yi-Feng Luo, Guan-Jhu Chen, Cheng-Sin Hu
(Nation Yunlin University of Science and Technology, Taiwan)

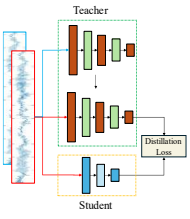
The Perturb and Observe (P&O) method is a popular MPPT algorithm for photovoltaic power generation systems. However, it has a trade-off between step size and transient response. This paper proposes an adjustable step size factor to address this issue. The method starts with a larger initial step size, which is then multiplied by a factor to reduce the perturbation step size. The method retains the transient advantage of a larger step size while reducing power loss by minimizing steady-state oscillations. It achieves faster perturbation convergence and up to 99.98% accuracy in steady-state tracking.



OS8-5 Bearing faulty prediction based on knowledge distillation

Chun-Liang Liu, Zheng-Jie Liao, Chung-Wen Hung
(National Yunlin University of Science and Technology, Taiwan)

This paper employs knowledge distillation to train teacher and student models using different motor bearing vibration datasets. The signal is transformed from the time domain to the frequency domain using Fast Fourier Transform (FFT), and a Convolutional Neural Network (CNN) model is used to recognize the bearing conditions. The teacher model is a deeper model trained with a larger dataset, while the student model is a shallower model trained with less data. The student model is guided by the soft labels provided by the teacher model. The results demonstrate that knowledge distillation improves the student model's recognition performance and enables knowledge transfer, allowing the student model to achieve good recognition accuracy even with limited training data.



OS8-6 Accurate Brain Age Prediction Through Advanced Preprocessing and 3D DenseNet-50 Modeling

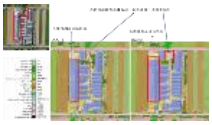
Ting-An Chang, Chiang-Ming Yeh, Chun-Liang Liu
(National Yunlin University of Science and Technology, Yunlin, Taiwan)

An innovative method for predicting brain age is proposed in this study. The approach consists of three key stages. First, during the data collection phase, high-resolution T1-weighted Magnetic Resonance Imaging (T1W-MRI) scans were gathered to ensure a sample with broad age distribution and diversity. Secondly, in the data preprocessing stage, several critical steps were implemented: skull removal was performed to eliminate interference from non-brain tissue, spatial standardization to the Montreal Neurological Institute (MNI) space was conducted to ensure comparability across subjects, and brain tissue segmentation was applied to extract gray matter, white matter, and cerebrospinal fluid. Finally, for the model architecture, a 3D DenseNet121 network was selected based on its proven efficacy in processing medical imaging data and capturing complex spatial features. This multi-step methodology was designed to develop an accurate and robust brain age prediction model.

OS8-7 Intelligent agricultural landscape identification system

Ching Ju Chen[1], Yu-Cheng Chen[1], Jing-Yao Lin[1], Rung-Tsung Chen[2], Candera Wijaya[3]
([1]National Yunlin University of Science and Technology, Taiwan) ([2]Taiwan Biodiversity Research Institute, Taiwan) ([3]Agricultural Engineering Research Center, Taiwan)

This paper addresses Taiwan's agricultural land decline and its impact on food supply and biodiversity. It proposes a semantic segmentation-based recognition system using drone technology to classify agricultural landscapes, watersheds, and habitats. Two models, U-Net with VGG16 and U-Net with ResNet50, are tested for semantic segmentation of farmland images. Results show that while these models effectively classify landscape categories, misclassification occurs for similar features like grassland, fallowland, and dry land. The paper suggests improving model accuracy by increasing dataset size and sample diversity.



OS8-8 Leveraging AIoT Visual Analytics for Optimizing Agricultural Sustainability and Efficiency

Hsueh-Yen Shih[1], Xi-Wei Lin[2], Zhao-Sheng Chen[2], Ying-Cheng Chen[3], Ching-Ju Chen[2]
([1]Agricultural Engineering Research Center, Taiwan) ([2]National Yunlin University of Science and Technology, Taiwan) ([3]Tainan District Agricultural Research and Extension Station, Taiwan)

This study integrates artificial intelligence (AI) technology and Internet of Things (IoT) sensors to enhance precision management and real-time monitoring of pests and diseases in agriculture, promote transparency of agricultural data and visual decision-making, and achieve optimized resource management, real-time pest control to reduce the use of pesticides and improve land reusability. By deploying sensors in the farmland and using AI to analyze data, the company will establish an intelligent decision-making platform to provide farmers with real-time, forward-looking management advice and collaborate to realize the sustainable development of smart agriculture and the environment.

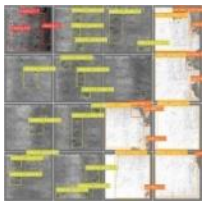
OS9 Pattern Recognition and Control 1 (7)

Chair Sun Haozhe (Tianjin University of Science and Technology, China)
Co-Chair Li Fangyan (Tianjin University of Science and Technology, China)

OS9-1 A Study on Surface Defect Detection Algorithm of Strip Steel Based on YOLOv8n

Haozhe Sun[1], Fengzhi Dai[1], Junjin Chen[2]
([1]Tianjin University of Science and Technology, [2]SMC (Beijing) Manufacturing Co., LTD., China)

Hotrrolled steel strip has been extensively applied in industrial production and processing due to its outstanding properties. Nevertheless, during the production procedure, as a result of technological constraints, defects will inevitably occur on the surface of the steel strip, and they significantly influencing the performance and safety of the steel strip. Hence, how to detect the surface defects of steel strips has turned into the key point. In this paper, an enhanced YOLOv8n network model is proposed to make it applicable for the surface defect detection tasks of hot rolled steel strips. The mAP50 of the enhanced model is superior to that of the original YOLOv8n model, particularly for small target defects.



OS9-2 Prediction of Winter Wheat Growth Trends Based on NDVI Vegetation Index

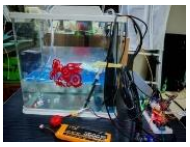
Lu Kang, Jiahao Xie, Chunli Li, Haoran Gong, Fengzhi Dai
(Tianjin University of Science and Technology, China)

As modern technology emerged, the level of agricultural remote sensing has been further improved. This paper takes winter wheat as the research object, studying on the area of Liangshan in Shandong Province, where the planting coverage of winter wheat is high. Image preprocessing is carried out using ArcGIS, combined with ENVI to invoke satellite data in the near-infrared and infrared bands to calculate the NDVI index from the regreening stage to the maturity stage of winter wheat in this area. During the maturity stage of winter wheat, NDRE is used instead of NDVI to solve the problem of inaccurate NDVI measurement in high-density vegetation coverage. The simulation results show that the test data matches the actual winter wheat output value.

OS9-3 A Study on Artemia Culture System and Its Application

Wanying Zhang, Yicheng Wu, Ziting Zhang,Yumei Huang
(Tianjin University of Science and Technology, China)

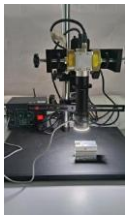
Aimed at the shortcomings of the low efficiency and high cost of Artemia culture, this paper proposes a high-density Artemia culture system based on the Internet of Things technology. The system detects and controls the breeding environment through sensors and actuators, and uses a cloud platform to analyze and process the collected data. Automation control and remote monitoring of the system reduce the cost of breeding and human resource. The system's Internet of Things technology provides scientific basis and decision support for Artemia culture.



OS9-4 Machine Vision-Based Chamfer Detection for Metal Parts

Shangying Han[1], Kaili Guo[1], Yanzi Kong[1], Yanliang Gong[1], Junjin Chen[2], Ce Bian[3], Mengfan Zhang[3]
([1]Tianjin University of Science and Technology, [2]SMC (Beijing) Manufacturing Co., LTD.,
[3] Tianjin Tianke Intelligent Manufacture Technology Co., LTD., China)

This paper introduces a detection system specifically designed for chamfering in metal holes, aimed at achieving precise detection of the chamfers. Chamfering, as a process of beveling the edges or corners of metal parts, plays a crucial role in the subsequent machining and assembly stages. Through multiple experimental validations, this paper employs an industrial camera with a telecentric lens to capture images of the metal chamfers, achieving optimal results. This paper utilizes computer vision techniques to accurately identify the location of the chamfers and delineate their dimensions. A comprehensive analysis of the chamfer radius effectively determines the presence of defects.



OS9-5 Deep Guard Dog - AI-Based Night Intrusion Detection Mobile Phone Software

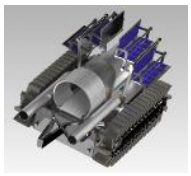
Keming Chen, Jiaxin Wang (Tianjin University of Science and Technology, China)

This article introduces an Android mobile app called "Super Electronic Watchdog", which aims to solve the problem of home security. The application utilizes Android Studio, NCNN framework and Opt2Ada night vision algorithm to realize humanoid object detection and night image enhancement. Users can switch the camera, select the humanoid detection model and CPU/GPU operation mode, and activate night vision through the app. The application has vibration and voice alarm functions to alert the user that someone has entered the monitored area. The software is divided into Native layer and Java layer, using C++ and Java development, the overall design structure is clear, efficient and practical.

OS9-6 Development of an Amphibious Surface Garbage Collection Robot and Its Applications

Yu Su, Xin Wang, Long Shen, Zhenxing Liu, Xinrui Zhao, Xin Lin, Mengchen Huo, Yawen Qiao, Yan Zhang (Tianjin University of Science and Technology, China)

This paper presents an amphibious water - surface garbage - collecting robot. It incorporates innovative technologies such as efficient garbage collection, accurate identification and classification, stable amphibious operation, and sustainable energy utilization. The double - four - bar linkage and "three - pipe" collection device ensure effective collection and classification. The amphibious crawler provides buoyancy and land - moving ability. Visual recognition technology has high accuracy. GPS automatic cruise and solar charging system are also included. The physical model meets design requirements, aiming to provide an efficient and intelligent solution for water - surface garbage disposal.



OS9-7 Design of an Intelligent Orbital Inspection Robot Based on Machine Vision and Ultrasonic Guided Waves

Xingwang Feng, Suqing Duan (Tianjin University of Science and Technology, China)

This paper introduces a track inspection robot based on machine vision and ultrasonic guided wave, integrating BeiDou positioning and autonomous driving system, which can efficiently detect defects such as track cracks and settlements. The innovative wheel-foot switching structure and electro-hydraulic leveling platform enhance the multi-terrain adaptability, and the combination of particle swarm optimization and support vector machine algorithm realizes defect recognition. Tests show that the system has high detection accuracy and stability, providing a technical reference for intelligent track inspection.

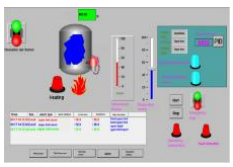
OS10 Pattern Recognition and Control - 2 (7)

Chair Zhai Hongshuo (Tianjin University of Science and Technology, China)
Co-Chair Li Huahao (Tianjin University of Science and Technology, China)

OS10-1 Intelligent Temperature Control System for Chip Soldering Station

Huahao Li [1], Junjin Chen [2], Ce Bian [3], Mengfan Zhang [3]
([1] Tianjin University of Science and Technology, China; [2] SMC (Beijing) Manufacturing Co., LTD., China; [3] Tianjin Tianke Intelligent Manufacture Technology Co., LTD., China)

Chip is the general name of semiconductor component products, mainly by the semiconductor material, solid state electronic devices, silicon wafers and other materials processed through a number of responsible processes. According to the functional requirements, the intelligent temperature control system of the chip welding bench is designed with PLC as the control core. In the PLC system design using PID instructions, when the temperature is close to the specified temperature using low-power heating, when the temperature difference is large high-power heating. In this paper, we design the temperature control system of chip soldering bench with Siemens S7-200 PLC as the control core.



OS10-2 A Review of Object Detection Techniques Applied to Pest Images

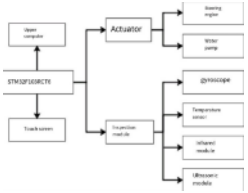
Hongshuo Zhai [1], Fengzhi Dai [1], Lijiang Zhang [2], Qiang Wang [3]
([1] Tianjin University of Science and Technology, China; [2] Xinjiang Shenhua Biotechnology Co., Ltd, Xinjiang, China; [3] Easy Control Intelligent Technology (Tianjin) Co., Ltd., China)

In agricultural information management, crop pest control has always been an important topic, and the image detection technology of small target pests is particularly critical in this process. At present, the technology faces challenges such as difficult data collection and insufficient robustness. This paper first introduces the development of object detection technology and its application in the field of agriculture, then analyzes the challenges of information-based pest control, discusses the research progress of pest dataset construction, image data augmentation technology and object detection algorithm, and finally points out the future research direction in this field.

OS10-3 Design of an Intelligent Pet Feeding System Based on STM32

Shuhuan Peng [1], Qiang Wang [2] ([1] Tianjin University of Science and Technology, China; [2] Easy Control Intelligent Technology (Tianjin) Co., Ltd., China)

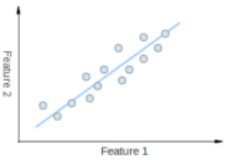
This design leverages the STM32F103RCT6 microcontroller to develop a smart pet feeding system, enabling automated food and water dispensing with a user-friendly interface and remote monitoring capabilities. The system uses infrared and ultrasonic sensors to control feeding with precision, preventing overfeeding or accidental dispensing. A gyroscope and temperature sensor ensure operational safety by monitoring device stability and environmental conditions. Users can easily set feeding schedules through a touchscreen interface, while Bluetooth connectivity allows real-time notifications to smart devices, keeping pet owners informed.



OS10-4 Design of Teaching Attendance System Based on Image Processing

Shengyu Wang [1], Ce Bian [2] ([1] Tianjin University of Science and Technology, China; [2] Tianjin Tianke Intelligent Manufacture Technology Co., LTD., China)

Traditional classrooms often require teachers to roll call one by one in class, which not only affects the length of the class but also affects the quality of the class, and there is no timely data feedback, resulting in the lag of the work of many college students. This topic mainly uses computer simulation software for algorithm research, which is mainly divided into four parts, the first is the initial establishment of the face library, the second is the use of PCA algorithm for face image dimensionality reduction in face recognition, the Euclidean distance is used again for face closest matching, and finally the function is realized by GUI interface.



OS10-5 Semi-automatic Leek Harvester Based on Multi-angle Adjustment

Hongpi Zhao, Xuefeng Jia, Wenqi Fu,Yizhun Peng
(Tianjin University of Science and Technology, China)

The team is committed to solving the domestic leek harvesting process of excessive human input, high cost, intelligence, low level of mechanization, to provide users with a diversified range of high-performance semi-automatic leek harvester equipment and solutions, which can make the leek production safer, time-saving, labor-saving. The team independently researched and developed leek harvester which can walk independently and harvest automatically, adopting new adjustable mechanical structure, artificial intelligence algorithm and human-computer interaction software application, which makes the domestic automatic harvesting gradually become possible.

OS10-6 Smart Inspection Guard - Inspection Robot for Unattended Plants

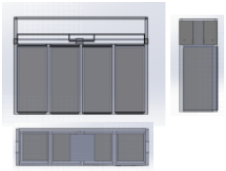
Liangyu Wang, Yanhong Yu, Yizhun Peng (Tianjin University of Science and Technology, China)

This document describes an intelligent inspection robot, based on Arduino and Raspberry Pi, with autonomous navigation and video surveillance. The robot uses infrared sensors for tracing, RFID for localization, and uploads the captured video to the server. The innovative integration of wireless charging technology realizes the unattended function, as well as the self-designed camera clamping mechanism. Key technologies cover differential control, wireless charging, data communication and server design. Tests show that the robot can improve inspection efficiency and quality, save labor costs, and comply with the trend of intelligent manufacturing.

OS10-7 Deep Learning Based Integrated Removable Smart Waste Sorting Device

Yanhong Yu, Liangyu Wang, Yizhun Peng (Tianjin University of Science and Technology, China)

In this study, an intelligent waste sorting device based on Inception v3 and migration learning is developed to achieve fast and accurate waste recognition and sorting through deep learning and sensor fusion techniques. The device is designed to be detachable and adaptable to existing bins, with the ability to continuously learn new waste types. Through real-time data transmission, the device supports remote monitoring and management, which effectively improves the efficiency of waste classification and is important for urban environmental protection.



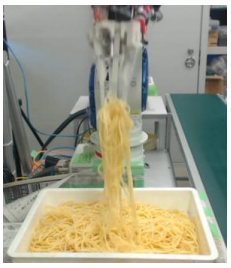
OS11 Industrial Artificial Intelligence Robotics (7)

Chair Eiji Hayashi (Kyusyu Institute of Technology, Japan)

OS11-1 Enhanced Deep Reinforcement Learning for Robotic Manipulation: Tackling Dynamic Weight in Noodle Grasping Task

Gamolped Prem, Yon Pang Ja Sin, Vjosa Bytyqi, Eiji Hayashi (Kyushu Institute of Technology, Japan)

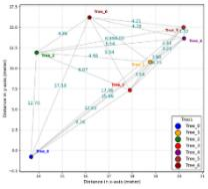
Handling food items with dynamic weight changes over time, which alter physical properties such as shape, size, and weight, poses significant challenges, particularly when precise output weight is required. This study introduces an enhanced deep reinforcement learning framework for robotic manipulation, focusing on the task of spaghetti grasping. Building on prior research, we propose a data augmentation strategy that simulates diverse environmental conditions, including variations in image observations and the physical properties of spaghetti, to improve models. The model is validated using metrics such as grasp success rate, average grasp time, and generalization score under varying environmental conditions. This work advances the robustness of robotic models in previously unseen environments.



OS11-2 LiDAR-Enhanced Real-Time Tree Position Mapping for Forestry Robots

M.A Munjer, Tan Chi Jie, Eiji Hayashi (Kyushu Institute of Technology, Japan)

This article evaluates the effectiveness of an autonomous robot in creating a real time tree pose map in both simulated and experimental environments. This paper also demonstrates the implementation of FastSLAM on a four-wheeled differential-drive robot, integrating real-time tree detection and tracking through LiDAR-based point cloud data. An algorithm is proposed to generate a map showing both the robot's path and detected tree positions during movement. Performance Metrics Analysis revealed a high True Acceptance (TA) rate, confirming accurate tree position estimation. Experimental results validated the algorithm's reliability, showcasing strong distance accuracy with minimal discrepancies between actual and estimated positions. These findings highlight the system's potential for advancing forestry management through precise robotic navigation and mapping.



OS11-3 Kalman-YOLO Improving YOLO Tracking Performance through the Integration of a Kalman Filter for a Beach Cleaning Robot

Rut Yatigul, Tan Chi Jie, Gamolped Prem, Eiji Hayashi (Kyushu Institute of Technology, Japan)

Ocean waste poses a significant threat to both human and marine life as industries and individuals continue to dump garbage into the ocean. Sea creatures are poisoned by materials such as plastics and chemicals, which in turn contaminate humans who consume them. This paper introduces an innovative approach using Image Instance Segmentation with YOLOv8 to segment and track beach garbage. However, YOLOv8's object tracking struggles in dynamic environments with challenges like occlusion, shadows, and perspective changes in RGB frames. To address this, the author presents Kalman-YOLO, combining the Kalman Filter with YOLO for improved performance. Results show notable performance improvement, especially in tracking garbage for the Beach Cleaning Robot.

OS11-4 The research of AR System for introducing Industrial Robots

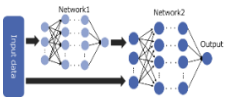
Takuma Aiko, Gamolped Prem, Eiji Hayashi (Kyusyu Institute of Technology, Japan)

In recent years, Japan has been suffering from a labor shortage in all industries. By introducing robots, it is possible to reduce manpower, and it is expected to contribute to resolving labor shortages. However, the introduction of industrial robots is not easy due to the high cost of equipment and system integration. Therefore, we are developing an Augmented Reality (AR) application for the purpose of introducing robots. In this study, we developed a mobile AR system that can check the movement path of a robot when it is introduced without using the actual robot and confirmed its operation.

OS11-5 Research on performance information editing support system for automatic piano - Development of a network model for improved dynamics accuracy-

Taiyo Goto, Yoshiki Hori, Eiji Hayashi (Kyushu Institute of Technology, Japan)

The automatic piano player, which was previously developed in this laboratory, is attached to the keys and pedals of a grand piano, and enables accurate keystrokes and pedal operation with appropriate control from a computer. To control the device, music data is required, but if music score data is simply input into the device, the performance will be flat, and will not sound like a human being, which is the goal. This is because pianists play with their own intonation when they play. Previous research has developed a system that uses deep learning to predict performance information, but the accuracy of predicting sound volume (Velo) was not good. This research aims to enhance the accuracy of Velo in automatic piano performance. A new deep learning system combining two networks was developed to address limitations in existing methods.



OS11-6 Research on Tactile-Gripping for Difficult-to-Grasp Objects

Yoshitaka Sakata, Gamolped Prem, Eiji Hayashi (Kyushu Institute of Technology, Japan)

This study focuses on the automation of food preparation and boxing in the food manufacturing industry. An important point of food grasping by robots is that the shape of the food should not be damaged. However, it is difficult for a conventional robot hand to perform this task perfectly. Therefore, an end-effector equipped with a camera-based tactile sensor has been developed to perform this task in previous studies. However, the performance of this end-effector depends on the reflectance of the target object, since it estimates contact based on the reflectance of light. We have developed a camera-based tactile sensor and contact estimation system to solve this problem. In addition, we have developed a pickup motion combined with object detection.

OS11-7 Development of a drone obstacle avoidance system based on depth estimation

Sora Takahashi, Eiji Hayashi (Kyushu Institute of Technology, Japan)

This study developed an obstacle avoidance system for drones using depth estimation from RGB cameras, aiming to reduce reliance on expensive sensors like RGB-D cameras or LiDAR. The system employs the deep learning model ZoeDepth for depth estimation and integrates it with ROS and Gazebo for simulation. Two autonomous systems were evaluated: one using RGB-D cameras and the other using depth estimation with RGB cameras. Experimental results show that while the RGB-D camera system outperformed in accuracy, the depth estimation-based system provided cost-effective and reasonable performance, especially in complex environments. The research concludes with plans to improve the system for denser obstacle environments and conduct real-world experiments.

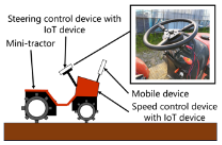
OS12 Advances in Field Robotics and Their Applications (9)

Chair Shinsuke Yasukawa (Kyushu Institute of Technology, Japan)
Co-Chair Kazuo Ishii (Kyushu Institute of Technology, Japan)

OS12-1 Practical Exercise on An Autonomous Driving System Using Mobile Devices and IoT Devices for An Agricultural Tractor

Daigo Katayama, Yuto Nakazuru, Hikaru Sato, Shoun Masuda, Yuya Nishida,
Shinsuke Yasukawa, Kazuo Ishii (Kyushu Institute of Technology, Japan)

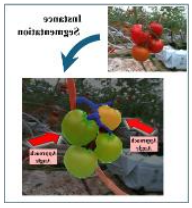
The current method of agriculture is expected to make sustainable production difficult due to the effects of a declining and aging workforce. To solve these issues, research and development of smart agriculture technologies, including automated tractor operation, have been underway. We have developed an automated driving system for a commercially mini-tractor using mobile and IoT devices to more facilitate the introduction of automated driving technology for tractors. In addition, the exercise was conducted for students to implement and operate this system with an aim of education for robotics engineers. This exercise consists of lectures and development exercises for the system. This paper describes the developed autonomous driving system, the overview of the exercise, and the results of the exercise.



OS12-2 Estimation of Image-Based End-Effector Approach Angles for Tomato Harvesting Robots

Kizuna Yoshinaga, Hikaru Sato, Kazuo Ishii, Shinsuke Yasukawa
(Kyushu Institute of Technology, Japan)

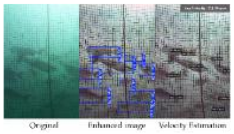
We propose a method to estimate a suitable approach angle for the end-effector of a tomato harvesting robot based on image data. Agricultural harvesting robots often face obstacles such as other fruits or stems around the target crop. Additionally, it is important to approach the target from a direction appropriate for harvesting, considering the shape of the end-effector. The proposed method uses a deep learning-based instance segmentation model to extract regions of fruits and stems, and estimates the suitable approach angle based on their positional relationships. We demonstrated the usefulness of the proposed method using an image dataset acquired in an actual tomato greenhouse.



OS12-3 Visual-Based System for Fish Detection and Velocity Estimation in Marine Aquaculture

Raji Alahmad, Dominic Solpico, Shoun Masuda, Takahito Ishizuzuka, Kenta Naramura, Zhangchi Dong, Zongru Li, Kazuo Ishii (Kyushu Institute of Technology, Japan)

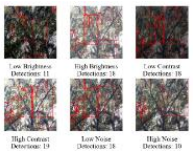
As global aquaculture continues to expand to meet the rising seafood demand, optimization of feeding remains a crucial issue for the industry to address to achieve sustainable development. This study proposed a visual-based system for estimating fish velocity, which is to be integrated into a farmer's feeding operation to determine the optimal feed amount. The YOLOv8 algorithm was utilized to detect fish in underwater videos, enabling precise monitoring of fish behavior. The results indicate a successful fish detection with an accuracy of 85%. The fish velocity estimation approach demonstrated the difference between the hungry fish and the normal fish behavior.



OS12-4 Evaluating of Tree Branch Recognition Algorithm in Pruning Robots under Augmented Environmental Conditions

Mohammad Albaroudi, Raji Alahmad, Abdullah Alraee, Kazuo Ishii
(Kyushu Institute of Technology, J Japan)

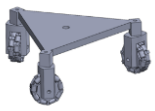
The integration of service robots has transformed various sectors by improving accuracy, efficiency, and scalability. In automating tasks like tree pruning, where precise branch detection is essential, this research examines YOLOv8's ability to recognize branches as a step toward full automation. To tackle challenges in diverse real-world conditions, video sequences are augmented with simulated variations in lighting, saturation, and noise. Metrics such as precision, true detections, and false detections reveal YOLOv8's robust performance in branch perception. These findings underscore its potential to enhance pruning systems, enabling efficient and scalable robotic solutions for tree maintenance and similar tasks.



OS12-5 Trajectory Analysis for a Mobile Robot Adapted Three Omni Rollers in Constant Roller's Speed

[1]Kenji Kimura, [1]Kazuki Nakayama, [2]Katsuaki Suzuki, [3]Kazuo Ishii,
([1]National Institute of Technology, Matsue College, [2]Kumamoto Industrial Research Institute,
[3]Kyushu Institute of Technology, Japan)

In recent years, mobile robots have been developed for the logistics industry. It is an omni-directional mobile mechanism with multiple omni rollers, and its kinematics have been proposed. In this study, a theoretical equation for the trajectory of the robot is derived when the roller speed is constant. In order to reduce the cost and time of validation experiments, the robot is validated in a simulation environment as a preliminary step.



OS12-6 Cross-Disciplinary Learning Through Manufacturing: Toward Student-Centered STEAM Education

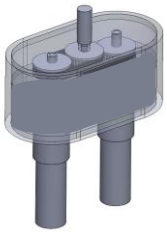
Kenji Kimura (National Institute of Technology, Matsue College, Japan)

In recent years, with the importance of cross-disciplinary educational programs such as STEAM education, it has become necessary to provide mathematical education at the early stages of elementary and junior high school to prevent the increase in the number of students who have dropped out of science. As a result, educational institutions are also becoming more active in efforts such as robot-themed education as part of their contribution to the local community. In this study, we propose a method for students to decide their own theme about mechanics, obtain a production budget, and engage in cross-disciplinary learning through extracurricular activities with support outside and inside the school.

OS12-7 Development of a Rotary Actuator Capable of Multidirectional Rapid Motion and Variable Stiffness

[1]Katsuaki Suzuki, [2]Yuya Nishuda, [3]Kenji Kjmura, [2] Kazuo Ishii
([1]Kumamoto Industrial Research Institute, [2]Kyushu Institute of Technology,
[3]National Institute of Technology, Matsue College, Japan)

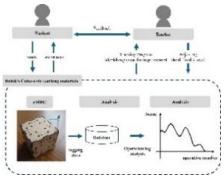
With the advancement of automation and digital transformation in the manufacturing industry, it is expected that industrial machines will be required to perform new tasks. Enhancing the multifunctionality of actuators is one approach to achieving these tasks. This paper proposes a new mechanism that combines two types of cams with different contour shapes, springs, two motors, and other mechanical components, and introduces an electric actuator incorporating this mechanism. The key feature of this actuator is its ability to achieve three functions (normal motion, rapid motion, and variable stiffness) while maintaining the same output characteristics, even when the initial posture of the output shaft is changed by switching the driving patterns of the two motors.



OS12-8 Study of Evaluation Operation Log Analysis Using 2^3- ERC on Matsue National College of Technology

Takumi Ueda, So Takei, Akira Nakano (National Institute of Technology, Kurume College, Japan),
Kenji Kimura (National Institute of Technology, Matsue College, Japan),
Kazutaka Matsuzaki (Nishinippon Institute of Technology, Japan)

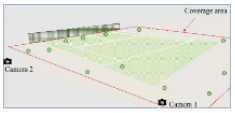
In response to the demand for educational proposals that address advancements in science and technology in Japanese school education, cross-disciplinary education and STEAM education are receiving increased attention. Given this context, a new unit called "Mathematics and Human Activities" was introduced. However, the need for innovative mathematics teaching materials is necessary. We developed the 2^3 Electric Rubik's Cube (2^3-ERC) with two LEDs for each cube edge for easy tractable operation logging data. By utilizing the operation log data as feedback, we evaluated log data analysis through the experiment on Matsue National Institute of Technology's students. The results from the operation log show the level of understanding of 2^3-ERC from the number of operations and consideration time.



OS12-9 Efficient Ball Position Estimation for Tennis Court Robot Assistants using Dual-Camera System

Abdullah Alraee, Raji Alahmad, Hussam Alraie, Mohammad Albaroudi, Kazuo Ishii
(Kyushu Institute of Technology, Japan)

During tennis training, professional players use many balls distributed randomly around the court. Collecting the balls manually is inefficient due to the effort and time required. A mobile robot for ball collection has been introduced to save energy and training time. The robot's tasks include ball detection, estimating positions, and finding the best path for efficient collection. In previous work, we addressed ball detection using a YOLOv8 neural network algorithm. This study focuses on the next step: ball position estimation using two cameras to cover the court. Results show successful position estimation on the x- and y-axes, with 94.48% accuracy.



Dual-Camera System for tennis ball detection

OS13 Research Towards the Renewable Energy and the Sustainable Development Goals (SDG's) / Part A (5)

Chair Ammar A.M. Al Talib (UCSI University, Malaysia)
Co-Chair Takao Ito (Hiroshima University, Japan)

OS13-1 Solar-Powered IoT-Based Smart Aquaponic System for Sustainable Agriculture

Alvi Khan Chowdhury[1], Sarah 'Atifah Saruchi[2], Ammar A.M. Al-Talib[3], Abdirisak Mubarik Muhumed[3,] Teh Boon Hong[3], Pavindran A/L Shanmugavel[3], Annanurov Kerim[3], Ng Weng Kent[3]
([1]Monash University Malaysia, Malaysia) ([2]UMPSA, Malaysia) ([3]UCSI University, Malysia),

This paper introduces a groundbreaking smart aquaponics system designed to address the limitations of conventional setups. The system leverages IoT technology, renewable energy, and automation to achieve real-time monitoring and environmental control. Key innovations include slidable grow beds for optimal sunlight exposure, solar tracking mechanisms for efficient energy utilization, and automated fish feeding using Real Time Clock (RTC) modules. The system demonstrated 90% water efficiency, significant energy savings, and streamlined resource management in prototype testing. With its modular and scalable design, this solution is ideal for urban farming and sustainable agriculture.

OS13-2 AI-Powered Detection of Forgotten Children in Vehicles Using YOLOv11 for Enhanced Safety

Nur Atikah Jefri[1], Sarah 'Atifah Saruchi[1], Radhiyah Abd Aziz[1], Aqil Hafizzan Nordin[1], Ammar A.M. Al-Talib[2], Zulhaidi Mohd Jawi[3],
([1]UMPSA, Malaysia) ([2]UCSI University, Malaysia) ([3]MIROS, Malaysia)

This study proposes a child presence detection system in vehicles, focusing on evaluating the performance of YOLOv11 for accurate detection and identification. To train the system, images simulating a child's presence in vehicles were collected using a doll, and these annotated images were labeled with the Computer Vision Annotation Tool (CVAT). The study emphasizes the potential of YOLOv11 as an effective and reliable solution for unattended child detection in vehicles. By leveraging advanced deep learning techniques, this research highlights the importance of addressing critical safety issues.

OS13-3 Exploring the Performance of YOLOv11: Detecting Compostable and Non-Compostable Kitchen Waste in Real-Time Applications

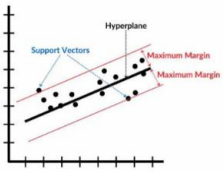
Ain Atiqa Mustapha[1], Sarah 'Atifah Saruchi[1], Mahmud Iwan Solihin[2], Fatima Karam Aldeen[2], Ammar A.M. Al-Talib[2] ([1]UMPSA, Malaysia) ([2]UCSI University, Malaysia)

This paper investigates the advancements of YOLOv11, the latest model in the YOLO series in real-time object detection tasks on small datasets of compostable and non-compostable kitchen waste. Using a custom compostable and non-compostable kitchen waste dataset, YOLOv11 achieves an accuracy of 90.7% and a mean Average Precision (mAP) of 0.91, with a reduced inference time of 10.5 milliseconds. The study highlights YOLOv11's architectural enhancements, training methodology, and potential applications in waste management. While YOLOv11 sets a new benchmark in object detection, challenges like high computational demands, paving the way for future research on optimization for edge devices

OS13-4 Comparative Analysis of Machine Learning Algorithms for Rainfall Prediction in Kuantan, Pahang, Malaysia

Seri Liyana Ezamzuri[1], Sarah 'Atifah Saruchi[1], Ammar A.M. Al-Talib[2]
([1]UMPSA, Malaysia), ([2]UCSI University, Malaysia)

This study compares the performance and accuracy of four ML algorithms which are Support Vector Regressor (SVR), Artificial Neural Network (ANN), Random Forest Regressor (RFR), and Linear Regression (LR) in the rainfall prediction application. All four methods employ the same input parameters which are temperature (°c), dew point (°c), humidity (%), wind speed (Kph) and pressure (Hg). Meanwhile the output parameter is set to be the rainfall (mm) which indicates the precipitation in Kuantan, Pahang, Malaysia. The analysis shows that the SVR consistently outperforms the other machine learning algorithms, achieving the lowest Mean Absolute Error (MAE) and Mean Squared Error (MSE).



OS13-5 Autonomous Vehicle Navigation in Highway with Deep Q-Network (DQN) using Reinforcement Learning Approach

Sumiya Tamanna Fujita[1], Sarah 'Atifah Binti Saruchi[1], Ammar A.M. Al-Talib[2], Nurbaiti Wahid[3], Siti Nurhafizza Maidin[3], Alvi Khan Chowdhury[4], ([1]UMPSA, Malaysia) ([2]UCSI University, Malaysia) ([3]UiTM Dungun, Malaysia) ([4]Monash Universiti Malaysia, Malaysia)

This study addresses the collision avoidance problem in autonomous vehicles under dynamic and unpredictable environments, such as rain and dust storms. A Proximal Policy Optimization (PPO)-based reinforcement learning approach is proposed to develop an autonomous driving agent capable of navigating safely in adverse conditions. The agent is trained using the CARLA simulator, specifically in the Town04 environment. The methodology involves dynamically adjusting the vehicle's steering angle and speed based on environmental feedback to prevent collisions. Experimental results demonstrate the agent's ability to learn effective driving strategies, showcasing the potential of reinforcement learning for enhancing the reliability of autonomous vehicles in challenging weather scenarios.

OS14 Research Towards Renewable Energy and the Sustainable Development Goals (SDG's)/ Part B (4)

Chair Firas Basim Ismail (University Tenaga National (UNITEN), Malaysia)
Co-Chair Takao Ito (Hiroshima University, Japan)

OS14-1 Empowering Decentralized Microgrids with A Blockchain-Based Peer-To-Peer Energy Trading Platform

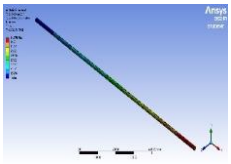
Firas Basim Ismail[1], Chetenraj Singh[1], Ammar A. Al-Talib[2], Nizar F.O. Al-Muhsen[3]
([1] UNITEN, Malaysia), ([2] UCSI University, Malaysia), ([3]Middle Technical University, Iraq)

This study explores the concept of a Peer-to-Peer Energy Trading Platform for Decentralized Microgrids through Blockchain Technology. The presented work focuses on the creation of a decentralized peer-to-peer energy trading platform using blockchain technology, which is designed for microgrid ecosystems. The study delves into blockchain's ability to build trust and ensure the integrity of energy transactions. The study concludes with recommendations for future enhancements, including expanding platform capabilities, integrating diverse energy sources, and navigating regulatory challenges for widespread adoption and impactful change.

OS14-2 Performance of Kenaf Fibre Reinforced Epoxy Biocomposite for High Voltage Insulator Applications

Kang Rui Tan[1], Cik Suhana Bt. Hasan[1], Nor Fazilah Abdullah[1], Farah Adilah Jamaludin[1], Meng Choung Chiong[1], Eryana Hussin[1] ([1]UCSI University, Malaysia)

The aim of this research is to evaluate the performance of kenaf fibre-reinforced epoxy composite as the core of high voltage insulator subjected to identified wind load conditions by using finite element analysis which is then further validated using the theory of mechanics of materials. The performance of kenaf FRP is almost comparable to the conventional material from glass FRP and the results indicate that the kenaf FRP is able to sustain different types of loads when it is under operating.



OS14-3 Detection of Bullet Holes for Target Board in Malaysia Military (ATM) Shooting Exam Application

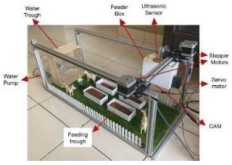
Jilian. H. Wai Yin, Idayu M. Tahir, Ammar A.M. Al Talib, Osama Mohamed Magzoub (UCSI University, Malaysia)

This study focuses on designing and developing a bullet hole detection system for target boards in the Malaysia Army (ATM) shooting exercise environment. The deep learning algorithm used is based on YOLO models, utilizing Raspberry Pi and IoT via Blynk for remote monitoring.. The prototype includes a Raspberry Pi 4b, HQ Camera Module Lens, 35mm Telephoto Lens, and tripod stand, all at an affordable cost. The study demonstrates that the bullet hole detection system is accurate and effective for ATM shooting exams, meeting SDG 3, SDG 9, SDG 11, and SDG 12 goals.

OS14-4 Mobile App Development for Monitoring Goat Activities

Samy M. Elmasri, Idayu M. Tahir, Ammar A.M. Al Talib (UCSI University, Malaysia)

"Mobile App Development for Monitoring Goat Activities" aims to create an automated and efficient system for managing goat feeding and water consumption. The prototype, constructed using a Raspberry Pi 4 equipped with a camera module and ultrasonic sensors, collects real-time data on the status of feeding troughs, detecting whether they are empty, partially empty, or full. By demonstrating the potential of integrating AI and IoT technologies in agriculture, this project highlights the benefits of continuous monitoring and timely alerts in maintaining a well-managed and sustainable farming operation.



OS15 Robotic Manipulation (5)

Chair Kensuke Harada (Osaka University, Japan)
Co-Chair Tokuo Tsuji (Kanazawa University, Japan)
Co-Chair Akira Nakamura (Saitama Institute of Technology, Japan)

OS15-1 Surface Stiffness Estimation using Active Strobe Imager

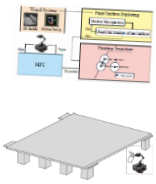
Taiki Yamaguchi[*1], Kensuke Harada[*1], Koji Mizoue[*2], Makoto Kaneko[*12]
([*1] Osaka University, Japan, [*2] Mizoue Project Japan Corp., Japan)

In this paper, we propose a method for estimating mechanical impedance of surface like skin using an Active Strobe Imager (ASI). ASI has the capability to non-contactly excite the target surface using an air jet flow, and to qualitatively observe traveling waves through strobe illumination. On the other hand, this paper shows that the surface impedance parameter can be estimated without contacting the target surface along with the visualization through ASI. We solve two problems: one is the inverse problem and the other is the forward problem. In the inverse problem, we estimate the spring constant of the target using information obtained from the measurement data. In the forward problem, we determine the surface displacement from the applied force, we compared the obtained displacement from the measurement data, demonstrating that the spring constants were correctly estimated.

OS15-2 Painting Task Planning for Large Structure using a Mobile Manipulator

Hiroshi Tanaka[*1], Masato Tsuru[*1], Takuya Kiyokawa[*1], Kensuke Harada[*1] ([*1] Osaka University, Japan)

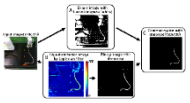
Painting a large structure with a robotic arm that is fixed to the ground is difficult due to its limited reachable range. To plan the robotic painting motion of such a large structure, we develop a ROS-based robotic software system assuming a mobile manipulator to explore the environment using SLAM. Our software system includes both detection of AR markers and construction of the envitonmental map to determine the painting location. It can measure the error in self-position estimation that occurs during the movement. It can also generate spray trajectories for the recognized painting location and control the whole body using Model Predictive Control (MPC) to perform painting over a wide area.



OS15-3 Real-time Cable Tracking by Wire Segmentation and Coherent Point Drift

Ryunosuke Yamada[1], Tokuo Tsuji[1], Takahiro Shimizu[2], Shota Ishikawa[1 2], Tomoaki Ozaki[2], Yusuke Sakamoto[1], Tatsuhiro Hiramitsu[1], Hiroaki Seki[1]
([1]Kanazawa University, [2]DENSO CORPORATION, Japan)

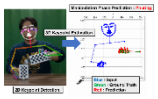
In this paper, a real-time cable tracking system by fast segmentation method and Coherent Point Drift (CPD) is proposed. Fast cable segmentation based on color space is inaccurate because of background contrast. Therefore, this technique uses edge information from the image to address this problem. The method consists of three processes: threshold processing in the Luv color space, edge processing using a Laplacian filter, and processing for extracting the common region of the binary images generated by each process. In the experiments, the accuracy of the segmentation region and the processing time required for each process of the tracking system are shown.



OS15-4 Motion Prediction for Human-Robot Collaborative Tasks Using LSTM

Kaihei Okada, Tokuo Tsuji, Tatsuhiro Hiramitsu, Hiroaki Seki,
Toshihiro Nishimura, Yosuke Suzuki and Tetsuyou Watanabe (Kanazawa University, Japan)

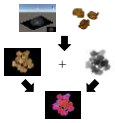
This study proposes an assistive robot system to reduce caregiving burdens in an aging society by supporting impaired body movements. The system focuses on bimanual tasks, such as pouring a drink from a bottle into a cup. Using 3D skeletal data excluding the impaired left hand, a deep learning model (LSTM) predicts the motion stages and 3D positions of the left hand, and the robot performs the substitute motions. The system uses data from multiple users to show its potential for improving patient independence and reducing caregiver workload.



OS15-5 Individual Recognition of Food in Bulk by using 3D Model of Food

Yuya Otsu, Tokuo Tsuji, Tatsuhiro Hiramitsu, Hiroaki Seki (Kanazawa University, Japan)

In this paper, we propose a method of individual recognition of food in bulk by using 3D model of food. First, color images and depth images of them are generated by using 3D model of food and physics engine of simulator. Then, color and depth composite images are created by converting two channels from color images and one channel from depth images. In the experiments, the accuracy of individual recognition of food in bulk with color and depth composite images are shown to compare the accuracy with only color images.



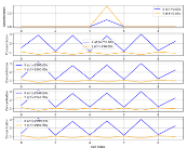
OS16 Natural Computing (3)

Chair Marion Oswald (TU Vienna, Austria)
Co-Chair Yasuhiro Suzuki (Nagoya University, Japan**)**

OS16-1 Modeling Yawning Contagion as a Reaction-Diffusion System: Emergence of Turing Patterns in Behavioral Contagion

Yasuhiro Suzuki (Nagoya University, Japan)

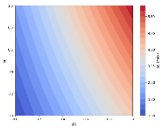
When we see someone yawning, we often feel compelled to yawn ourselves - a phenomenon known as behavioral contagion in psychology. While one person's yawn acts as an activator that triggers yawns in others, we sometimes suppress the urge to yawn in situations like meetings, representing an inhibitor of this behavior. We formulated this yawning contagion as a reaction-diffusion phenomenon in an activator-inhibitor system and confirmed the emergence of Turing patterns. Our findings provide a theoretical framework for understanding and potentially controlling the spread of social behaviors in human populations.



OS16-2 Dominant Region Analysis: A Novel Framework for Quantifying Competitive Reactions Based on the Gillespie Algorithm

Yasuhiro Suzuki (Nagoya University, Japan)

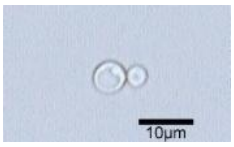
Understanding the quantitative relationships between competing reactions is crucial for analyzing chemical reaction systems. While conventional approaches often focus on static analysis, we propose a novel concept called "dominant region" to capture the dynamic nature of reaction competition. The dominant region concept can be viewed as an extension of the traditional rate-determining step in reaction kinetics. This enables quantitative prediction of how dominant reactions dynamically change with variations in reactant concentrations.



OS16-3 40 Hz sound exposure alters dissolved oxygen levels, gene expression, and colony formation in Saccharomyces cerevisiae BY4741

Yasuhiro Suzuki (Nagoya University, Japan)

We found that 40 Hz exposure significantly increased dissolved oxygen levels in yeast culture medium, but not in purified water. RNA-seq and DNA microarray analyses revealed that 40 Hz exposure significantly altered the expression of genes involved in cell adhesion, cell wall organization, and stress response. Notably, the expression of FLO11 and several PAU genes, which are important for yeast biofilm formation, was upregulated by 40 Hz exposure. Our results suggest that 40 Hz sound exposure can enhance dissolved oxygen levels and biofilm formation in S. cerevisiae, potentially through the upregulation of adhesion-related genes.



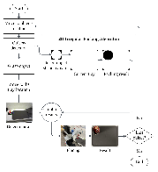
OS17 Artificial Intelligence for Embedded Systems and Robotics (10)

Chair Hakaru Tamukoh (Kyushu Institute of Technology, Japan)
Co-Chair Yuma Yoshimoto (National Institute of Technology, Kitakyushu College, Japan),
Co-Chair Dinda Pramanta (Kyushu Institute of Information Sciences, Japan)

OS17-1 Optimizing Object Placement for Human Support Robots Using a Two-dimensional Irregular Packing Algorithm for Efficient Tray Storage.

Natee Buttawong, Kosei Isomoto, Kosei Yamao, Ninnart Fuengfusin, Hakaru Tamukoh
(Kyushu Institute of Technology, Japan)

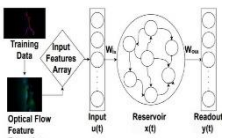
Human support robots (HSR) are robots that assist humans in their daily tasks. Their main application is tidying up, which involves detecting objects, determining appropriate placement locations, and organizing them. This study focuses on tidying up tray storage. Determining suitable storage positions is essential for storing objects in the tray. If the robot store objects in fixed predetermined locations, it can lead to inefficient use of storage space, and in the worst case, objects might collide and overflow from the tray. To address this limitation, we propose a 2-dimensional irregular packing algorithm utilizing an object mask method to calculate the best placement location. This study evaluates the proposed packing algorithm against the standard method to determine which approach is more effective in HSR applications.



OS17-2 Classification of Human Activity by Event-based Vision Sensors using Echo State Networks

Rohan Saini, Aryan Rakheja, Ryuta Toyoda, Yuichiro Tanaka, Hakaru Tamukoh
(Kyushu Institute of Technology, Japan)

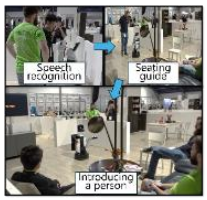
We propose a system for human activity recognition using an event-based vision sensor (EVS) with echo state networks (ESNs). Conventional cameras are susceptible to motion blur and require computationally intensive methods, whereas EVS provides no motion blur and low latency. Our research aims to enable accurate recognition of human activities by using energy-efficient methods. Therefore, we adopt ESNs, which require low computational costs, for the classifier. Additionally, we use feature extraction algorithms such as optical flow and histogram of gradients to improve accuracy. We used an EVS activity recognition dataset created by us containing six human activities and a total of 600 videos. The results showed that our hybrid approach outperformed several techniques. We achieved 89% accuracy when trained with ridge regression.



OS17-3 Integrating Advanced Speech Recognition and Human Attribute Detection for Enhanced Receptionist Task in RoboCup@Home

Koshun Arimura, Yuga Yano, Takuya Kawabata, Hakaru Tamukoh
(Kyushu Institute of Technology, Japan)

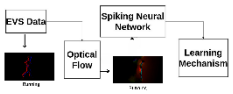
RoboCup@Home is held to integrate service robots into society. It includes a task called "Receptionist" that evaluates Human-Robot Interaction. In this task, a robot must ask guests for their names and favorite drinks and guide them to available seats. Additionally, the robot must introduce the guest's features such as their clothing to others. We developed a system integrating speech recognition and human attribute detection to achieve these functions. The robot can determine which seat a person is sitting in by detecting the person's skeletal coordinates. Additionally, the robot can identify individuals by recognizing human attributes. To verify the effectiveness of the developed system, we participated in the Receptionist task at RoboCup@Home 2024. We won first place in our league and demonstrated the effectiveness of our system.



OS17-4 Classification of Human Activity by Spiking Neural Networks using Event-based Vision Sensors

Aryan Rakheja, Rohan Saini, Ryuta Toyoda, Yuichiro Tanaka, Hakaru Tamukoh
(Kyushu Institute of Technology, Japan)

We propose a human action classification system that integrates spiking neural networks (SNNs) with event-based vision sensors (EVS) to address the limitations of conventional camera methods. Conventional approaches require significant computational resources and suffer from motion blur and limited dynamic range. EVS provides asynchronous data, enabling efficient and low-latency motion analysis with high temporal resolution and a wide dynamic range. SNNs further enhance this by processing data in an event-driven manner, reducing energy consumption and improving scalability. We created a dataset of 600 clips using EVS, with optical flow for feature extraction, achieving 93% classification accuracy. This approach offers an efficient solution for real-time action recognition in dynamic environments.



OS17-5 Robotic Grasping of Common Objects: Focusing on Edge Detection for Improved Handling

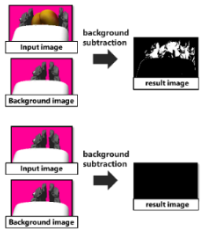
Tomoya Shiba, Hakaru Tamukoh (Kyushu Institute of Technology, Japan)

Grasping objects like plates and cups poses unique challenges for robots because of their irregular shapes and the difficulty of finding reliable grasp points. Traditional approaches often attempt to grasp the object at its center, but this strategy tends to fail for items like plates or cups, whose shapes deviate from simple forms like cubes or spheres. To address this issue, we propose a new method that utilizes AI-powered image analysis to identify the best edges for grasping. Through experiments conducted with a home service robot and a set of YCB objects, we evaluated the effectiveness of our approach compared to conventional methods. The results revealed a significant improvement in the success rate, particularly for objects with prominent edges, such as cups.

OS17-6 Proposal of a Grasp Verification Method Utilizing Background Subtraction and Depth Information

Ryo Terashima, Yuga Yano, Koshun Arimura, Hakaru Tamukoh (Kyushu Institute of Technology, Japan)

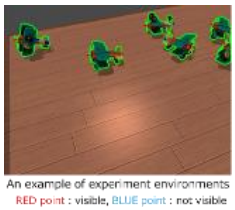
Commonly grasp verification approach involves using the opening width of the robot's gripper. However, methods based on the opening width of the gripper may not apply to slender objects. In this study proposes a grasp verification method using background subtraction. Our proposed method uses depth information to mask the background, isolating only the images of the gripper and the grasped object. Subsequently, a difference image is created by comparing the current image with the pre-grasp state, and the grasp state is detected based on the magnitude of the observed changes. The method minimizes environmental influences by masking the background, enabling highly accurate grasp verification even for complex objects. Through experiments, we validate the effectiveness of the proposed method.



OS17-7 Grasp Point Estimation Using Object Recognition Models with Simulator-Generated Datasets Including Pose Information

Ryoga Maruno, Tomoya Shiba, Naoki Yamaguchi, Hakaru Tamukoh (Kyushu Institute of Technology, Japan)

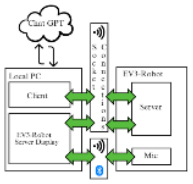
We have developed a system that automatically generates training datasets for object recognition models using a simulator. In this study, we have successfully incorporated pose information into the dataset. The figure shows part of the dataset generated by the simulator. We used this information to develop a system for estimating grasp points for objects that are difficult to grasp by robots. We chose a toy airplane as the target object. As shown in the figure, three specific points were assigned to the object: the front, center, and back. In the grasp point estimation process, the center point was designated as the grasp point. The appropriate grasp was achieved by moving the robot's arm perpendicularly to the line connecting the front and back points. This system calculates both the coordinates of the grasp point and the required arm angle.



OS17-8 A feasibility study of generative AI applications using EV-3 Robots at the Kyushu Institute of Information Sciences

Dinda Pramanta[1], Hakaru Tamukoh[2]
([1]Kyushu Institute of Information Sciences, [2]Kyushu Institute of Technology, Japan)

The advent of generative artificial intelligence (Gen AI) using large language models (LLMs) has brought about a transformation in the fields of education and home robotics. This study examines how students at the Kyushu Institute of Information Sciences perceive and utilize ChatGPT, with a particular on their familiarity, ethical considerations, and trust (FET) concerns. To further investigate this, we developed an educational EV-3 robot powered by ChatGPT and simulate the voice command using socket connections. By combining surveys with hands-on experiments, we uncovered the strengths and limitations of both the educational and home robotics roles. Our findings highlight the importance of FET, and 88% of respondents have no issues with implementing such technologies in the future.



OS17-9 Development of a Collaborative System Between A Drone and A Home Service Robot for Enhanced Operational Efficiency

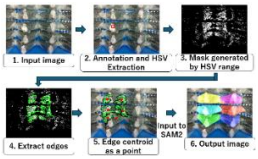
Haruki Miura, Rion Yohu, Yuma Yoshimoto (National Institute of Technology, Kitakyushu College, Japan)

When considering the operation of home service robots, there are problems such as the impossibility to obtain information on objects hidden behind obstacles or in distant areas of a large room. There is also the potential issue of not being able to detect people behind the robot, leading to collisions. Therefore, this research proposes a system that coordinates home service robots with drones to improve task efficiency. As an experiment, we conduct a search and pick-up task that integrates the home service robot and the drone. The drone's bottom camera and YOLOv8 are used to detect objects and send the information to the robot. The robot then moves to the room where the object is located and grasps it. The time required to complete the task is evaluated.

OS17-10 Efficient Object Detection with Color-Based Point Prompts for Densely Packed Scenarios in WRS FCSC 2024

Naoki Yamaguchi[1], Tomoya Shiba[1], Hakaru Tamukoh[1]
([1]Kyushu Institute of Technology, Japan)

We propose the use of color-based point prompts for efficient object detection in densely packed scenarios, specifically targeting the World Robot Summit (WRS) Future Convenience Store Contest (FCSC) 2024. Our system leverages color information to generate point prompts, which are processed by Segment Anything Model 2 (SAM 2) to create object masks and estimate grasping points. SAM 2 is a foundation model for image segmentation. It takes an image and prompts about object positions as input, then outputs the segments of the specified objects. We applied the WRS FCSC 2024 Stock Sub Task to evaluate the system. Despite achieving 7th place in the competition, the effectiveness of our recognition system was confirmed.



OS18 Robotics in Biophilic-Designed Space Toward Co-existence of Humans, Robots, and Plants (4)

Chair Yuichiro Tanaka (Kyushu Institute of Technology, Japan)
Co-Chair Naoto Ishizuka (Kyushu Institute of Technology, Japan)
Co-Chair Tomomi Sudo (Kyushu Institute of Technology, Japan)
Co-Chair Hakaru Tamukoh (Kyushu Institute of Technology, Japan)

OS18-1 Application of AI Robot Technology for Biophilic Design

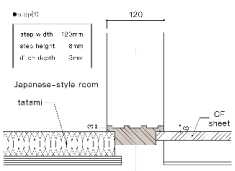
Kairi Manabe, Ryo Miyazono, Keitaro Ito, Tomomi Sudo, Naoto Ishizuka, Akinobu Mizutani, Yuki Anamizu, Etsushi Ueda, Honoka Tamai, Saya Nakano, Leon Furuya, Hakaru Tamukoh, Yuichiro Tanaka, Hirofumi Tanaka (Kyushu Institute of Technology, Japan)

To enhance human health and well-being, Biophilic design has been increasingly recognized in recent years. This design is characterized by the integration of natural elements such as plants, nature light, and water into spaces. However, challenges are posed by the maintenance of live plants, as their decline can be caused by insufficient environmental conditions. The aim of this study is to propose a robotic system of autonomously relocate houseplants to environments optimized based on sensor data, including light, temperature, and humidity. Through the integration of AI robotics with ecological design principles, it is aimed to enhance sustainability and redefine the relationship between humans, nature, and technology, fostering a harmonious interaction among "robots, nature, and humans."

OS18-2 Basic Research on the Development of Space Standards for the Use of Service Robots in Housing Using the Urban Renaissance Agency's Housing Complex

Ren Matsuoka, Kanon Nonoshita, Naoto Ishizuka, Ryohei Kobayashi, Akinobu Mizutani, Hakaru Tamukoh, Hirofumi Tanaka (Kyushu Institute of Technology, Japan)

This study conducts basic research on developing space standards for integrating home service robots in residences, using a room in an apartment complex from the Urban Renaissance Agency as a model. The study compares these spaces with existing robot mobility standards to identify issues. The robot-friendly level of the room was evaluated using the RFA standard. Results showed that most rooms fell into Level C, the lowest of three levels, in areas such as “fixture width” and “steps.” Furthermore, when operating two types of home service robots, the study uncovered unique robot behavior issues in the housing that were not anticipated by the RFA standard.



OS18-3 An Exhibition Environment with 2D Markers for Guide Robot

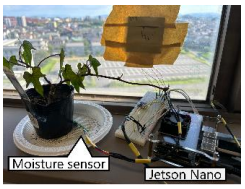
Akinobu Mizutani, Yui Hattori, Naoto Ishizuka, Yuichiro Tanaka, Hirofumi Tanaka, Hakaru Tamukoh
(Kyushu Institute of Technology, Japan)

The guide robot in an exhibition environment is expected to entertain visitors and reduce the maintenance cost of updating the robot database according to the changes in exhibition contents. The exhibition comprises printed panels for humans and a 2D marker printed with ultraviolet ink for robots. 2D markers are attached to the bottom of the exhibition furniture to make the markers invisible to visitors. The exhibition point may change depending on the contents of the exhibition. By searching for 2D markers autonomously in an exhibition space, the robot can update its internal database. This enables us to keep both the printed panel and the robot database without changing the robot database by users. The experiment is conducted in an exhibition environment, and the success rate in finding the exhibition point is evaluated.

OS18-4 Prediction of Timing and Amount of Houseplants Watering by an Echo State Network on Jetson

Wataru Yoshimura, Koshun Arimura, Ryohei Kobayashi, Akinobu Mizutani, Tomoaki Fujino, Yuichiro Tanaka, Tomomi Sudo, Naoto Ishizuka, Keitaro Ito, Hirofumi Tanaka, Hakaru Tamukoh
(Kyushu Institute of Technology, Japan)

Cultivating of houseplants in biophilic-designed spaces requires appropriate timing and amount of watering. However, determining them is challenging, as fluctuations in ambient temperature can influence these factors. We develop a system capable of predicting ambient temperature changes and determining the appropriate timing and amount of watering. The system acquires ambient data using sensors connected to a Jetson Nano and processes the data using a neural network for the prediction and determination. We adopt an echo state network, a lightweight neural network, enabling a power-efficient system capable of running on edge devices. Additionally, we implement a function to notify the user of the timing and amount of watering via LINE whenever the soil moisture content drops below a predefined threshold.



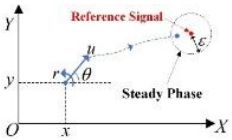
OS19 Intelligent Control (4)

Chair Yingmin Jia (Beihang University, P.R.China)
Co-Chair Weicun Zhang (University of Science and Technology Beijing, P.R.China)

OS19-1 Practical Linearization Control of Nonholonomic Unicycles

Lixia Yan, Yingmin Jia (Beihang University (BUAA), P.R.China)

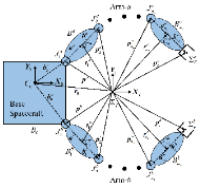
Due to underactuation, the states of nonholonomic systems cannot be steered toward arbitrary direction of the state space. This note takes unicycles as an example and demonstrates a new idea of control design for nonholonomic systems. More precisely, we apply state transformation technique and external dynamic oscillator, and convert an underactuated nonholonomic unicycle into a fully-actuated and linearizable one. A control law, capable of tracking and stabilization uses, is then constructed. The tradeoff therein is that the tracking/stabilization errors can only be steered into the neighborhood of the origin rather than converging to zero. Numerical simulations are carried out to validate the proposed control scheme.



OS19-2 Task-Space Tracking Control for Dual-arm Free-floating Space Manipulators with Disturbances and Uncertainties

Qian Sun, Yingmin Jia (Beihang University (BUAA), P.R.China)

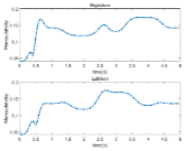
This paper investigates trajectory tracking control for dual-arm free-floating space manipulators (DFFSM) in task space subject to unknown disturbances, kinematic and dynamic uncertainties. First, we design an adaptive sliding mode disturbance observer to compensate for the unknow disturbances. Then, a backstepping tracking control algorithm is proposed, and two adaptive laws are developed to estimate the kinematic and dynamic uncertainties. It is validated through Lyapunov analysis that the tracking errors of the end-effectors are uniformly ultimately bounded with the proposed control scheme. Numerical simulations validate the effectiveness of the proposed control scheme.



OS19-3 Manipulability Optimization for Redundant Dual-Arm Robots at the Acceleration Level

Yang Zhang, Yingmin Jia (Beihang University (BUAA), P.R.China)

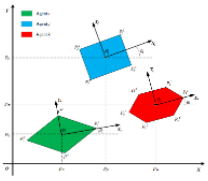
Existing manipulability optimization schemes typically solve at the velocity level, which cannot consider joint acceleration limits and are unsuitable for torque control of robotic arms. Therefore, this paper constructs a cost function that considers both joint torque constraints and manipulability optimization of the manipulator, and equivalently transforms it into a convex quadratic function. The proposed scheme addresses the non-convexity issue of manipulability with respect to the robotic arm joint acceleration and the inversion problem of the generalized Jacobian matrix. Simulation results show that the proposed method can maximize the manipulability of redundant dual-arm robots at the acceleration level, verifying the effectiveness of the scheme.



OS19-4 Flocking Control for Multiple Convex Polygonal Agents with Obstacle Avoidance

Yaxin Li, Yingmin Jia (Beihang University (BUAA), Beijing P.R.China)

This paper addresses the flocking control for second-order convex polygonal multiagent systems with obstacle avoidance. Typically, existing research reduces agent shapes to points or circles, which can lead to suboptimal use of spatial resources. To rectify this, the paper introduces an approach to compute the relative distance between agents. A potential function is designed based on these calculated distances. A flocking trajectory steers movement, while an obstacle avoidance path is triggered when an agent approaches an obstacle. The proposed control strategy integrates the potential function, reference trajectory, and obstacle avoidance trajectory to achieve flocking behavior and obstacle avoidance. Stability analysis proves the effectiveness of the algorithm.



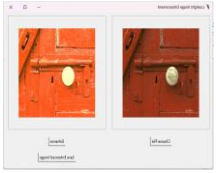
OS20 Applications (6)

Chair Kasthuri Subaramaniam (University of Malaya, Malaysia)
Co-Chair Abdul Samad Bin Shibghatullah (Universiti Tenaga Nasional, Malaysia)

OS20-1 Low-light Image Enhancement with Color Space (Cielab)

Lee Kok Xiong[1], Kasthuri Subaramaniam[2], Umm E Mariya Shah[1], Abdul Samad Bin Shibghatullah[3], Oras Baker[4] ([1]UCSI University, Malaysia, [2]University of Malaya, Malaysia
[3]Universiti Tenaga Nasional, Malaysia, [4]University of Ravensbourne, England)

In this project, we are implementing a color transformation from RGB to CIELAB to enhance low-light images. This transformation separates color information from brightness information, which improves contrast and overall quality. We are using a standard color conversion formula and combining it with other techniques, such as histogram equalization and neural networks, for better results. The project will have a user-friendly interface that allows users to upload and download images and compare the original and enhanced versions. The programming language used and the specific details of the implementation process are not mentioned.



OS20-2 Integrated AI Voice Assistant News Website for Enhancing User Experience – AI-ReadSmart

Mohammed Mohi Uddin[1], Ghassan Saleh Hussein Al-Dharhani[1], Keoy Kay Hooi[1], Chit Su Mon[2], Kasthuri Subaramaniam[3]
([1]UCSI University, Malaysia, [2]Heriot-Watt University Malaysia Campus, Malaysia
[3]University of Malaya, Malaysia)

The offline newspaper sector has been declining for years, and following the epidemic there were further decreases. To assist users with the complexity issue of the current online news sector, this study aims to develop a website that is beneficial to both users and the news sector. To ensure a seamless transition to online reading, research was conducted on the existing state of the online news sector. The survey used in this study allowed the researcher to understand how individuals feel about the state of the current online news sector as well as how they feel about voice integration on news websites.

OS20-3 Developing a Mobile Healthcare Application – MyHealth

Abdulrahman Salmo Alhamada[1], Ghassan Saleh Hussein Al-Dharhani[1], Kasthuri Subaramaniam[2], Raenu Kolandaisamy[1]
([1]UCSI University, Malaysia [2]University of Malaya, Malaysia)

MyHealth targets common mobile healthcare problems like medication forgetfulness and basic health knowledge gaps. This mobile application gives medication reminders, health lessons and appointment scheduling. It employs user centric design principles in combination with modern technology for user engagement & health management. System architecture, user interface design and development process are discussed with regard to healthcare accessibility and patient compliance impact.

OS20-4 Developing a Body Posture Detection for Fitness

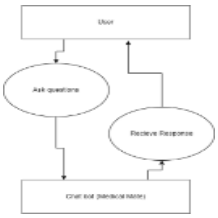
Kai Xuan Chong[1], Abdul Samad Bin Shibghatullah[2], Kasthuri Subaramaniam[3], Chit Su Mon[4]
([1]UCSI University, Malaysia, [2]Universiti Tenaga Nasional, Malaysia
[3]University of Malaya, Malaysia, [4]Heriot-Watt University Malaysia Campus, Malaysia)

The Body Posture Detection System for Fitness is an innovative technology that aims to enhance exercise technique and movement patterns by providing real-time monitoring and feedback. It utilizes computer vision and machine learning algorithms to track and analyze body movements during fitness. The system's ability to provide immediate feedback and correction significantly improves exercise effectiveness and user safety. These efforts are aimed at enhancing the functionality and usability of the Body Posture Detection System for Fitness while addressing user needs and optimizing fitness training experiences.

OS20-5 Medical Mate: Healthcare and Medical Chat Bot

Harris Hue Chee Kin[1], Javid Thirupattur[2], Kasthuri Subaramaniam[3], Shabana Anjum Shaik[4]
([1]UCSI University, [2]Sunway University, [3]University of Malaya, [4]Taylor's University, Malaysia)

The proposed idea is to develop a web-based medical chat bot called "Medical Mate" that will be placed by every patient's bedside, serving as a companion, and providing necessary care and support. It aims to offer convenience and accessibility for patients while easing the workload of hospital staff. Usability tests, employing mixed methods research, were conducted to ensure the chat bot's design and functionalities meet user requirements. Medical Mate pivoted to a web-based application using HTML, CSS, JS, jQuery, and MySQL. Ultimately, the goal of Medical Mate is to be a helpful and reliable companion for patients during their hospital stay, offering care and reducing the burden on medical personnel.



OS20-6 Crimes Identification System for Campus Safety and The Threat of Suspicious Student Conduct

Wong Zhen Bang[1], Kay Hooi Keoy[1], Kasthuri Subaramaniam[2], Sellappan Palaniappan[3], Oras Baker[4]
([1]UCSI University, Malaysia, [2]University of Malaya, Malaysia, [3]Help University, Malaysia
[4]University of Ravensbourne, England)

Ensuring campus safety is of paramount importance for educational institutions. With the increasing prevalence of crime and the potential threat of suspicious student conduct, there is a need for an effective crimes identification system. This paper aims to propose a comprehensive system that utilizes advanced technologies, such as video surveillance, data analytics, and behavioral monitoring, to detect and mitigate potential threats on campus. The proposed Crimes Identification System (CIS) integrates various components to enhance campus safety. These cameras capture real-time footage that is then processed using advanced video analytics algorithms.

OS21 Applications of Information Technology for Better Living (5)

Chair Tetsuro Katayama (University of Miyazaki, Japan)
Co-Chair Hiroki Tamura (University of Miyazaki, Japan)

OS21-1 Prototype of MixVRT Which Is a Visual Regression Testing Tool That Highlights Layout Defects in Web Pages

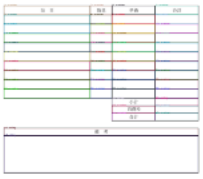
Naoki Aridome[1], Tetsuro Katayama[1], Yoshihiro Kita[2], Hisaaki Yamaba[1], Kentaro Aburada[1], Naonobu Okazaki[1]([1]University of Miyazaki, Japan), ([2]University of Nagasaki, Japan)

As a method for detecting layout defects in Web pages, image-based visual regression testing is proposed. However, it has the problem that it takes time to detect unintended layout differences that are not based on HTML code. This study proposes a prototype of MixVRT which is a tool to detect layout defects in Web pages. MixVRT detects differences by comparing images and detects changes due to changes in HTML code on the web pages before and after changes. By comparing them, MixVRT can detect layout defects, which are unintended differences in layout. From evaluation experiments, the time required to detect layout defects can be reduced.

OS21-2 Proposal of a Method for Automatic Fill-in Fields Detection and for Labels Assignment to Generate Electronic Forms

Yuya Kimura[1], Tetsuro Katayama[1], Yoshihiro Kita[2], Hisaaki Yamaba[1], Kentaro Aburada[1], Naonobu Okazaki[1]
([1]University of Miyazaki, Japan), ([2]University of Nagasaki, Japan)

The digitalization of forms is being promoted because it is required saving as data format by amendment of Electronic Books Maintenance Act. One of the effective ways to manage contents filled in fields is using electronic forms. Several tools have been developed to generate them automatically. However, when you use a paper form, it takes time to generate electronic one because it is necessary to place fill-in fields on an electronic form by dragging them with a mouse. This paper proposes a method for automatic fill-in fields detection and labels assignment to reduce time required to place fill-in fields. From evaluation experiments, it has confirmed that the proposed method has reduced the time to generate an electronic form.



OS21-3 A Study on Methodology of Measurement for the Physical Burden on Preschool Children

Sachiko Kido, Hiroki Tamura (University of Miyazaki, Japan)

Measuring the burden placed on the body of a preschool child is difficult and has rarely been measured using motion capture. In this paper, the AnyBody Modelling System was used to verify whether it is possible to calculate the burden on the preschool child's body using motion capture. The lumbar burden value for preschool children was calculated, defining the burden on the lumbar region as the burden on the body as a whole. Few measurements have been made on young children with the AnyBody Modelling System. Therefore, the validity of the pre-school child figure was verified by comparing the lumbar burden with that of adult male. In addition, by setting the adult male data based on the preschool child's height and weight and comparing the calculated values with the preschool child's actual values, the possibility of simulating children's body burden in various movements using adult body models in the future was examined.

A preschool child's Balance with AnyBody

An adult male's Balance with AnyBody

OS21-4 Evaluation of Ankle Joint Movements in Frontal Plane for a Normal Coordinated Gait

Praveen Nuwantha Gunaratne, Hiroki Tamura (University of Miyazaki, Japan)

As per the records, around 15% of the global population is experiencing some form of disabilities in lower extremity resulting in loss of accessibility to their basic routine movements. The ankle joint complex plays an important role as a weight bearing articulation in the lower extremity and is a key contributor to the power behind human locomotion. While sagittal plane ankle movements are crucial for gait, several studies have proven that inversion-eversion, the front plane movements oversee the pressure distribution at the ankle joint to ensure a well-coordinated gait. This paper presents an evaluation of prediction of such ankle joint movements using Electromyogram (EMG), Inertial Measurement Unit (IMU) and Force-Sensitive Resistor (FSR) measurements, which can later be adapted for use in anthropometric active ankle orthosis designs to assist dynamic ankle movements during normal gait in real-time.

OS21-5 Development of a Real-Time Multi-Person 3D Keypoint Detection System Using Stereoscopic Cameras and RTMPose

Taufik Hidayat Soesilo, Praveen Nuwantha Gunaratne, Hiroki Tamura
(University of Miyazaki, Japan)

In this paper we consider a real time multi-person detection and analysis system using stereoscopic cameras and RTMPose, a novel high real-time pose estimation framework. RTMPose offers real time analysis of 2D key points for the individuals and this data is later augmented with depth data coming from stereoscopic imaging to give 3D skeletal data. The benefit of employing RTMPose is that the system is able to perform accurate and fast multiple persons tracking despite present occlusion scenarios. Consequently, the system overcomes the drawbacks of prior methods, including reliance on wearable devices and unsuitability for out-of-door environments, by employing stereoscopic cameras and RTMPose with low-latency and high-accurate inference. Experimental results demonstrate the system's ability to provide detailed real-time analysis of posture and movement for multiple individuals in diverse scenarios.

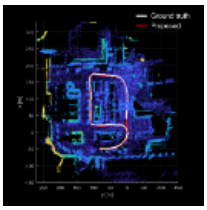
OS22 Navigation and Tracking (3)

Chair Chan Gook Park (Seoul National University, Republic of Korea)

OS22-1 Fine-registered Object LiDAR-inertial Odometry for a Solid-state LiDAR System

Hanyeol Lee and Chan Gook Park (Seoul National University, Republic of Korea)

We propose the LiDAR-inertial odometry with object measurements for the solid-state LiDAR system. Although the geometric feature has been used for the precise localization with LiDAR, the measurement vanishing can lead to the localization failure in the limited field-of-view. To address this problem, we utilize objects that are sufficiently present in a man-made environment as localization measurements. The point clouds in the object are registered and the processed measurements are coupled with the geometric measurements in the estimator. The effectiveness of the object measurements is verified through a virtual environment simulator, and the proposed algorithm shows superior localization performance compared to the case of geometric measurement alone.



OS22-2 A Fusion Method for Estimating the Walking Direction of Smartwatch Users

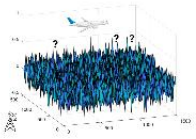
Jae Hong Lee and Chan Gook Park (Seoul Nation University, Republic of Korea)

Accurately estimating the walking direction of smartwatch users is critical for applications such as exercise trajectory analysis. This study introduces a novel approach that fuses estimation direction from inertial sensors and GPS. Inertial sensors provide stable estimates as they are unaffected by environmental conditions, but their accuracy can be impacted by sensor performance and user motions, such as hand swinging. GPS, in contrast, offers higher accuracy than inertial sensors under favorable signal conditions. To leverage the strengths of both sensors, the proposed method employs an information-weighted consensus filter, integrating direction estimates and error covariances. Experimental results demonstrate that the fusion approach reduces estimation errors compared to individual sensors.

OS22-3 Multi-Frame Track-Before-Detect with Adaptive Number of Frame as Noise Level

Je Hwa Lee, Jae Hong Lee, and Chan Gook Park (Seoul National University, Republic of Korea)

Multi-frame Track-Before-Detect (MF-TBD) is a batch processing method used to enhance detection and tracking performance in low SNR environments. Unlike traditional filtering techniques, MF-TBD does not apply thresholding and instead uses all observed data to reduce the risk of target loss. By integrating observations across multiple frames, it leverages space-time correlations to improve detection robustness. However, as the number of frames increases, the computational cost grows exponentially due to the need to correlate data over a larger dataset, leading to inefficiencies. Especially in high SNR conditions, where fewer frames are sufficient for accurate detection. To address this, we propose an Adaptive MF-TBD framework that dynamically adjusts the number of frames based on SNR levels



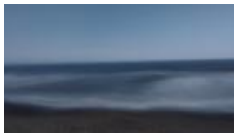
OS23 Mathematical Informatics (10)

Chair Takao Ito (Hiroshima University, Japan)
Co-Chair Amane Takei (University of Miyazaki, Japan)

OS23-1 Simplification of Rip Current Detection by Image Averaging Based on the Number of Wave Breaks

Ota Hamasuna[1], Leona Kimura[1], Satoshi Ikeda[1], Kaoru Ohe[1], Kenji Aoki[1],
Amane Takei[1], Akihiro Kudo[2], Makoto Sakamoto[1*]
([1]University of Miyazaki, Japan), ([2]National Institute of Technology, Tomakomai College, Japan)

According to a National Police Agency report, there were 1,392 water accidents in 2023, with 368 victims (dead or missing) in the sea, mainly due to rip currents. Detecting rip currents is crucial, and past studies have used image averaging, often relying on fixed-point cameras or lengthy videos, making it difficult for individuals to apply. This study proposes using smartphone videos, with durations adjusted by the number of wave breaks, to enable easier rip current detection. To test this, smartphone footage was recorded at Hitotsuba Surf Point in Miyazaki Prefecture for analysis.



OS23-2 Automated Classification of High-Grade Dried Shiitake Mushrooms Using Machine Learning

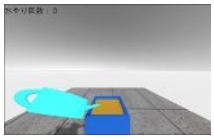
Leona Kimura[1], Ota Hamasuna[1], Kaoru Ohe[1], Satoshi Ikeda[1], Kenji Aoki[1],
Amane Takei[1], Akihiro Kudo[2], Kazuhide Sugimoto[3], Makoto Sakamoto[1*]
([1]University of Miyazaki, Japan), ([2]National Institute of Technology, Tomakomai Collage, Japan),
([3]SUGIMOTO Co., Ltd., Japan)

This study aims to automate high-grade dried shiitake mushrooms sorting using an anomaly detection system with Autoencoders (AE) trained on acceptable product data. Initial experiments using CNN approaches highlighted challenges in achieving high accuracy for acceptable product classification, necessitating improvement. The AE-based approach showed progress in detecting defective products via data cleansing, augmentation, and training optimization. However, misclassification of acceptable products with features like darker areas or complex textures remains an issue. This presentation outlines current findings and strategies, including data expansion and model improvements, to address these challenges.

OS23-3 Development of a Plant Growing Experience Application for Physically Challenged Children Using VR

Masatoshi Beppu[1], Masatomo Ide[1], Kaoru Ohe[1], Satoshi Ikeda[1], Kenji Aoki[1],
Amane Takei[1], Akihiro Kudo[2], Makoto Sakamoto[1*]
([1]University of Miyazaki, Japan), ([2] National Institute of Technology, Tomakomai Collage, Japan)

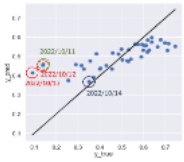
In 2016, the “first year of VR,” many VR platforms emerged, making VR technology more accessible. Currently, technology is expected to be applied and utilized in various fields. Application to the education sector is being promoted as part of the educational use of ICT. However, it is difficult to get the benefits of implementing VR due to lack of technology and equipment for teachers. Therefore, it is necessary to limit the scope of coverage. This study will focus on limb-challenged children and develop a VR application that allows them to experience plant growing. We believe that this will solve the problems that have been a concern for children with physical disabilities, such as the inability to perform exercises using soil and the lack of opportunities for trial-and-error. In this study, we also asked men and women in their teens to 40s to experience the apps we developed and obtained their evaluations through questionnaires. Within the survey, we received certain evaluations in areas such as trial and error. As for future issues, the application will be improved based on the feedback received from the survey. In addition, we believe it is necessary to evaluate the long-term effects of the application by having children with physical disabilities use it.



OS23-4 Exploring Social Media's Role in Predicting Stock Market Trends

Masatoshi Beppu[1], Masatomo Ide[1], Seita Nagashima[2], Satoshi Ikeda[1]*,
Amane Takei[1], Makoto Sakamoto[1], Tsutomu Ito[3], Takao Ito[4]
([1]University of Miyazaki, Japan), ([2]MEITEC CORPORATION, Japan),
([3]National Institute of Technology, Ube College, Japan), ([4]Hiroshima University, Japan)

This study analyzes tweets from the official Twitter accounts of NHK News and Nikkei to incorporate sentiment data into a predictive model for the Nikkei Stock Average. Adding sentiment data improved the R^2 score from 45.1% to a maximum of 70.5%, indicating the potential of SNS data in forecasting social indicators. However, no strong correlation between sentiment data and stock prices was observed. Challenges include the short data collection period and the difficulty of sentiment analysis in Japanese. Future work should focus on employing more effective methods for extracting sentiment.



OS23-5 Development of a Shrine Festival Support Application with Non-Technical Management Features: Functional Evaluation and Sustainability for Future Generations

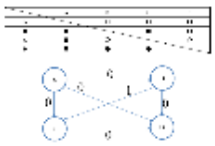
Masatomo Ide[1], Masatoshi Beppu[1], Satoshi Ikeda[1], Kaoru Ohe[1], Kenji Aoki[1],
Amane Takei[1], Akihiro Kudo[2], Makoto Sakamoto[1]*
([1]University of Miyazaki, Japan), ([2]National Institute of Technology, Tomakomai Collage, Japan)

This study focuses on developing and evaluating the usefulness of a web application that supports local shrine mythology and festivals, aiming to enhance their recognition and create lasting memories. The application incorporates features designed for both users and organizers to ensure accessibility and ease of maintenance across generations. Key functionalities include: (1) detailed event information, such as festival overviews, content highlights, and nearby facilities like parking and restrooms, enabling accurate and convenient information delivery; (2) an AR photo feature utilizing original character illustrations, allowing users to capture memorable photos; and (3) an admin-only feature for updating and editing essential information to maintain relevance over time. By combining technology with cultural heritage, this research demonstrates how digital tools can modernize traditional events and expand their appeal to broader audiences.

OS23-6 A Novel Approach to Reducing Ranking Discrepancies in Tennis Based on Tournament Choices

Masatomo Ide[1], Masatoshi Beppu[1], Kousei Yano[2],
Satoshi Ikeda[1]*, Amane Takei[1], Makoto Sakamoto[1], Tsutomu Ito[3], Takao Ito[4]
([1]University of Miyazaki, Japan), ([2]GENBASUPPORT Co., Japan),
([3]National Institute of Technology, Ube College, Japan), ([4]Hiroshima University, Japan)

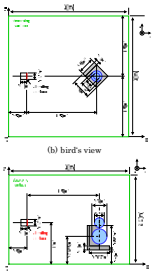
In tennis, discrepancies between rankings and head-to-head results arise because players select different tournaments for ranking. Existing methods using directed graphs cannot address discrepancies caused by varying tournament choices. This study proposes a ranking aggregation method that considers players' selected tournaments to reduce these inconsistencies. The method aggregates all chosen tournaments to form a collective ranking. Experimental results show a reduction in overall discrepancies, although some players saw an increase. This approach offers a partial solution to ranking inconsistencies caused by differing tournament selections in tennis.



OS23-7 Sound Field Evaluation on Acoustical Experiment with Several Loudspeaker Locations

Akihiro Kudo[1*], Shun Kubota[1], Amane Takei[2], Makoto Sakamoto[2]
([1]National Institute of Technology, Tomakomai College, Japan), ([2]University of Miyazaki, Japan)

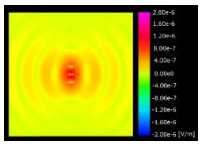
When a laboratory at a technical college is used as a site for psychoacoustic experiments, there are objects in the experimental environment such as walls, floors, ceilings, and chairs that obstruct the propagation of sound waves, which may change the accuracy of sound direction localization by altering the sound waves reaching the listener's ears. Therefore, the purpose of this study is to clarify the effects of these environments on sound localization characteristics using simulations. In this presentation, we will evaluate the effect of the reflection of sound waves by a chair set up to immobilize the subject on the subject's sound image localization for several loudspeaker positions. Fig. 1 takes one of several loudspeaker arrangements and shows the dimensions of its simulation model. The mesh size is set to 0.012m and the number of elements is 162,469,716. The acoustic impedance of the loudspeaker and a snowman as a subject and a chair is set to 4.56*109 kg/m2s to be completely reflect, the acoustic impedance of the room wall, ceil, floor is set to 445.9 kg/m2s to be completely absorbed. The sound field calculations are performed under non-stationary conditions. The time resolution is set to 1μs, and the duration time of simulation is set to 8000μs. The influence of the chair on the sound image localization is discussed by obtaining the time characteristics of the sound pressure at the subject's ear position from the simulation results.



OS23-8 Parallel High-Frequency Electromagnetic Field Analysis Based on Hierarchical Domain Decomposition Method

Amane Takei[1*], Akihiro Kudo[2], Makoto Sakamoto[1]
([1]University of Miyazaki, Japan), ([2]National Institute of Technology, Tomakomai College, Japan)

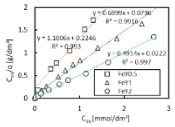
In this presentation, a parallel full-wave electromagnetic field analysis code based on an iterative domain decomposition method is explained that is named ADVENTURE_Fullwave. A stationary vector wave equation for the high-frequency electromagnetic field analyses is solved taking an electric field as an unknown function. Then, to solve subdomain problems by the direct method, the direct method based on the LDLT decomposition method is introduced in subdomains. The simplified Berenger's PML is introduced which these eight corners are given the average value of all PML's layers. And, we show a numerical example of a microwave in Fig.1. More detail will be shown in the conference.



OS23-9 Adsorption Equilibrium of Selenium Oxyanions Using FeY Mixed Oxides

Kaoru Ohe*, Amu Wakamatsu, Tatsuya Oshima (University of Miyazaki, Japan)

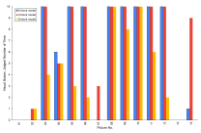
Selenium oxyanions (Se(IV) and Se(VI)) in wastewater are of concern as serious pollutants due to their easy bioaccumulation and toxicity to living organisms. In this study, mixed oxides with various Y/Fe molar composition ratios (x=0.5, 1, 2) were investigated the adsorption properties of selenium oxyanions, and were analyzed their adsorption mechanism. The experimental data best fits the Langmuir adsorption model, which is characteristic of monolayer adsorption (r^2 >0.991). The adsorption capacity (q_{max}) of Se(VI) increased in the order of FeY2>FeY1>FeY0.5. The effect of ionic strength and surface charge analysis of Se(IV) on FeY2 revealed that Se(IV) was adsorbed on FeY2 formed an outer-sphere complex.



OS23-10 Influence of CNN Layer Depth on Spiral Visual Illusions

Kenji Aoki*, Makoto Sakamoto (University of Miyazaki, Japan)

Understanding how visual illusions are generated through Convolutional Neural Networks (CNNs) can contribute to elucidating the mechanisms of visual information processing in the brain. Our previous research demonstrated the potential for the spiral illusions to manifest in CNNs. In this study, we focused on the depth of the CNN and examined the effect of the number of layers on the manifestation of the visual illusion. We provided 14 types of spiral illusion images to three CNNs with varying layers and tasked them with distinguishing between concentric circles and spirals. The results indicated that CNNs with fewer layers were more prone to the illusion, whereas CNNs with more layers were less likely to exhibit the illusion. These results suggest that the number of layers in a CNN influences the manifestation of visual illusions.



OS24 New Media Interactions (3)

Chair R.P.C. Janaka Rajapakse (Tainan National University of the Arts, Taiwan)

OS24-1 Evaluation of Passive Interaction in XR Chakra Meditation Application Based on Behavioral Biometrics

P. I. A. Gayathri Bimba (Japan Advanced Institute of Science and Technology, Japan)
Chien-Tung Lin (Tainan National University of the Arts, Taiwan)
R.P.C. Janaka Rajapakse (Tainan National University of the Arts, Taiwan)
Kazunori Miyata (Japan Advanced Institute of Science and Technology, Japan)

This study explores the effectiveness of an XR chakra meditation application developed using behavioral biometrics. A direct comparison with a similar application was impossible since no commercial XR-based chakra meditation apps exist. Instead, the study compared the XR application with popular YouTube chakra meditation-videos, widely used for meditation, as indicated by their high viewership and subscriber counts. Participants provided feedback through questionnaires and brainwave data to evaluate its strengths and weaknesses of use. The experiment focused on several aspects, including the level of interference with meditation, ease of learning and use, physical and emotional effects on users, user preferences, and the perception of vibrational realism between the two methods.

OS24-2 ThoughtDiffusion: An Interactive Installation for Exploring Neuro-Art from EEG Data with Stable Diffusion Models

R.P.C. Janaka Rajapakse (Tainan National University of the Arts, Taiwan)

ThoughtDiffusion is an interactive installation that combines cognitive processes with the generative capabilities of AI, for generating artistic images in real-time. The installation system uses Stable Diffusion models and state-of-the-art neural decoding techniques that allow the mapping of brainwave patterns into coherent visual representations. The installation is based on a non-invasive commodity EEG headset that records users' brain signals which were fed into a stable diffusion model to output images corresponding to the intended mental state but unique to the participants. This installation uses a Kinect V2 sensor to capture users' body movements which advance multimodal interaction significantly relates to relaxation, the state of being calm, and the state of attention

OS24-3 PassBy2: Passive Interaction through the Pedestrian Counts and Real-time Weather Information

Chung Chien-Lin, R.P.C. Janaka Rajapakse (Tainan National University of the Arts, Taiwan)

There is a proverb in my country that "Constant dropping wears the stone ". it means even something as small as a drop of water can cut through a stone after a long period of accumulation. It expresses the idea that the small changes we make unconsciously in our daily lives can leave unique traces over time. This project focuses on the impact of people on their surroundings which concerned a contemporary street scene projected in an open space and captured pedestrians' pass-by counts using a Kinect sensor. Based on the measured counts of pedestrians passing by and real-time weather information, the developed application controls the color of the street scene and gradually decreases as the pedestrians cross. Using the L-system generative algorithm, the trees in the street scene grow progressively as the pedestrians cross.

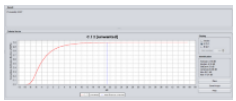
OS25 Robotic and Communications (6)

Chair Mastaneh Mokayef (UCSI University, Malaysia)
Co-Chair Takao Ito (Hiroshima University, Japan)

OS25-1 Exploring Techniques To Mitigate Interference In Drone Communication Systems

Ahmed Alsaeed Rashad[1], Mastaneh Mokayef[1]*, M.K.A Ahamed Khan[1], MHD Amen Summakieh[1], Kim Soon Chong[1], Abdul Qayyum[2], Moona Mazher[3], Sanjoy Kumar Debnath[4], Chin Hong Wong[5, 6], Chua Huang Shen[7]
([1]UCSI University, Malaysia), ([2] Imperial College London, UK), ([3] University College London, UK), ([4] Chitkara University Institute of Engineering and Technology, India), ([5] Fuzhou University, China) , ([6] Maynooth University, Ireland), ([7] UOW University Malaysia)

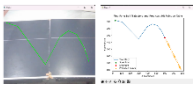
Despite the apparent advantages and strong economic efforts for cellular-connected drones, several critical challenges must be tackled for their successful implementation. Like any radio communication system interference is considered as the biggest challenge as it significantly decreases the efficiency and reliability of the drone. The Monte-Carlo simulation (MCS) strategy is based on the principle of taking samples of random variables from a given distribution. These samples are then used to assess interference in terms of the interference received signal strength compared to the desired received signal strength commonly known as C/I or SNR. The results then are derived using SEAMCAT software as probability of interference where 1 means that this system is always interfered and 0 means it's never interfered. The study has been conducted for separation distances of 2,3,4, and 6 km between the victim receiver and the interfering transmitter.



OS25-2 An Automated Tracking System for Locating Impact Points on a Table Tennis Surface Using Ping Pong Balls

Lee Wai Kit[1], Mastaneh Mokayef[1 *], MHD Amen Summakieh[1], M.K.A Ahamed Khan[1], Miad Mokayef[1], Sew Sun Tiang[1], Wei Hong Lim[1], Abdul Qayyum[2], Moona Mazher[3], Sanjoy Kumar Debnath[4]
([1] UCSI University, Malaysia), ([2] Imperial College London, UK), ([3] University College London, UK), ([4] Chitkara University, India)

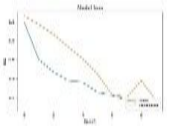
This project presents a novel system for real-time table tennis ball tracking and hitting point prediction, developed using OpenCV-Python. The system is designed to contribute to strategic analysis in the sport by accurately identifying the ball's trajectory and anticipating its landing point. The proposed system is comprised of four key modules: ball detection, ball tracking, hitting point prediction, and data visualization. Computer vision techniques are employed to effectively detect and monitor the ball's movement. Kalman filtering is utilized to refine the prediction of the ball's landing point. The generated data is then presented visually to facilitate analysis and comprehension of game dynamics.



OS25-3 An Innovative Deep Learning Technique to Identify Potato Illness

Abdul Majid Soomro[1 *], Muhammad Haseeb Asghar[2], Sanjoy Kumar Debnath[3], Susama Bagchi[3], and Awad Bin Naeem[2], M.K. A. Ahamed Khan[4], Mastaneh Mokayef [4]
([1] National University of Modern Languages, Pakistan), ([2] National College of Business Administration & Economics, Pakistan), ([3] Chitkara University, India), ([4]UCSI University, Malaysia)

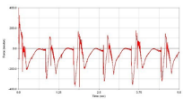
Potato cultivation is important for world food security as it itself is attacked by a great number of diseases like early blight and late blight, which cause a lot of damage to the yield and quality of the crop. But deep learning offers a great opportunity to address these disease detections; however, how effective this will be in the potato-growing environment in Pakistan is still not known. The project, therefore, tries to address data imbalance with the use of the synthetic minority oversampling technique (SMOTE) and develop a CNN architecture that is optimized to provide high diagnostic accuracy. This research can give innovative and productive locally useful solutions, which might transform the management of diseases for Pakistani farmers while improving food security and economic stability.



OS25-4 A Wearable Walking Support System Design And Simulation

Omar Ayaman Yehiya[1], M. K. A. Ahamed Khan[1] *, Mastaneh Mokayef [1], Ridzuan A[1], Abdul Qayyum[2], Moona Mazher [3], Susama Bagchi[4], Sanjoy Kumar Debnath[4]
([1]UCSI University, Malaysia), ([2] Imperial College, London, UK), ([3]University College London, UK), ([4]Chitkara University, India)

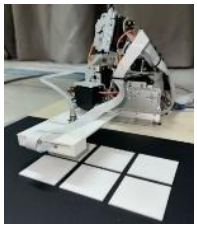
This research article is focused on the development of a Robotic lower limb exoskeleton model using MATLAB Simulink. The primary aim is to design a dynamic and flexible exoskeleton capable of assisting individuals with lower limb impairments, thus enhancing their mobility and overall quality of life. The model incorporates realistic representations of the lower limb anatomy, encompassing thigh, shank, and foot segments, with carefully integrated joints, constraints, and actuators to emulate natural human motion. A closed-loop control strategy optimizes the exoskeleton's performance, ensuring safe and stable operation during walking and other activities. Extensive simulations are conducted to evaluate the exoskeleton's efficacy, analyzing key parameters such as joint angles, joint torques, and power consumption



OS25-5 A Floor Tiling Robotic System

Hue Chau Jieng[1], M. K. A. Ahamed Khan[1] *, Mastaneh Mokayef[1], Ridzuan A[1], Abdul Qayyum[2], Moona Mazher [3]. Susama Bagchi[4], Sanjoy Kumar Debnath[4]
([1]UCSI University, Malaysia), ([2] Imperial College, London, UK), ([3] University College London, UK), ([4]Chitkara University, India)

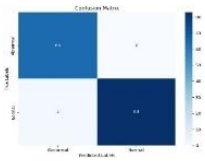
With the accelerated advancement of robot technology and sensor technology, construction challenges have become less difficult. The construction industry has been revolutionized by innovations in materials, equipment, and procedures, making it more efficient and safer.This paper proposes a Floor Tiling Robot robotic system that uses a vision-based solution to minimize labour-intensive, improve productivity, and increase the precision of the floor tiling process in order to reduce the material cost. The Floor Tiling Robot has implemented several systems, including a pneumatic vacuum suction system as a method for grasping floor tiles, a finite state machine as a method for robotic arm movement control algorithm and Canny Edge Detector algorithm as a method for floor tile positioning.



OS25-6 Evaluation of Heart Disease Risk Using Deep Learning Technique with Image Enhancement

Abdul Majid Soomro[1] *, Asad Abbas[2], Susama Bagchi[3], Sanjoy Kumar Debnath[3], Awad Bin Naeem[2], M. K. A. Ahamed Khan[4], Mastaneh Mokayef[4]
([1]National University of Modern Languages, Pakistan), ([2]National College of Business Administration & Economics, Pakistan), ([3]Chitkara University, India), ([4]UCSI University, Malaysia)

This study emphasizes the significance of the heart in the human body. Numerous serious vascular conditions exist in the heart and the blood. The dataset, study goals, methodology, approach, and efficient algorithms for identifying and classifying electrocardiogram (ECG) data are all covered in this paper. To assess ECG images, researchers used a convolutional neural network. Iterations in model training increase the accuracy. The system was constructed in Python using Matplotlib, NumPy, and Keras. The GPU-based machine learning platform was Google Colab. Photos were analyzed, categorized, and processed using MobileNet-V2. With a remarkable accuracy rate of 99.3 %, the developed model offers a viable basis for further hyperparameter investigation. Overall, this study combines advanced machine learning algorithms, to enhance the diagnosis of heart-related disorders.



OS26 Navigating the Digital Frontier: Innovations in the Age of Industry Revolution 4.0 (13)

Chair Wei Hong Lim (UCSI University, Malaysia)
Chair Takao Ito (Hiroshima University, Japan)

OS26-1 Driver State Monitoring Using Pose Estimation: Detecting Fatigue, Stress, and Emotional States for Safer Roads

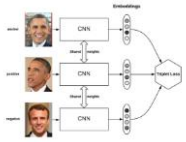
Hao Feng Chan[1], Dexter Sing Fong Leong[1], Shakir Hussain Naushad Mohamed[1], Wui Chung Alton Chau[1], Takao Ito[2], Zheng Cai[1], Xinjie Deng[1], Yit Hong Choo[1*]
([1]Deakin University, Australia) ([2]Hiroshima University, Japan)

Driving under fatigue, stress, or emotional impairment poses significant risks to road safety. This paper proposes a custom pose estimation framework designed to detect driver states, such as fatigue and stress, by analyzing body posture, head pose, and gesture dynamics. Using a novel deep learning approach trained on diverse driving scenarios, the model identifies physiological and behavioral markers associated with impaired states. Unlike existing methods, this system integrates pose estimation with real-time emotional and movement analysis, enabling robust performance in challenging conditions, including poor lighting and occlusions.

OS26-2 Optimizing Face Embedding Sizes and Accuracy in Facial Recognition Systems

Wui Chung Alton Chau[1], Dexter Sing Fong Leong[1], Shakir Hussain Naushad Mohamed[1], Hao Feng Chan[1], Takao Ito[2], Zheng Cai[1], Xinjie Deng[1], Yit Hong Choo[1*]
([1]Deakin University, Australia) ([2]Hiroshima University, Japan)

Face recognition technology is integral to security, access control, and identity verification in finance, healthcare, and transportation. It protects personal data, secures online transactions, controls access to areas, and helps prevent identity theft. This paper proposes a novel optimization algorithm to enhance face embedding sizes and facial recognition accuracy. We employ the FaceNet architecture, a deep neural network, alongside Triplet Loss metrics for efficient recognition. The model is tested with the Labelled Faces in the Wild (LFW) dataset, showcasing the effectiveness of the proposed algorithm.



OS26-3 Suspicious Behavior Detection Using Computer Vision

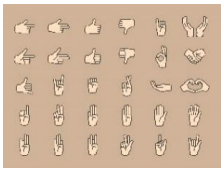
Dexter Sing Fong Leong[1], Hao Feng Chan[1], Shakir Hussain Naushad Mohamed[1], Wui Chung Alton Chau[1], Takao Ito[2], Zheng Cai[1], Xinjie Deng[1], Andi Prademon Yunus[2], Yit Hong Choo[1*]
([1]Deakin University, Australia) ([2]Hiroshima University)

Detecting suspicious activity is a crucial task for public safety. To be classified as suspicious, a person must exhibit specific body language, movement patterns, and reactions based on the context. Research has been conducted in this field using computer vision tools such as MediaPipe and YOLO. However, these approaches often face challenges, including high false positive rates and errors in detecting suspicious behavior in crowds. This paper aims to explore a novel approach to detecting suspicious activity using deep learning models, incorporating psychological behavior to classify suspicious behavior in crowded environments.

OS26-4 Sign Language Recognition Algorithms Using Hybrid Techniques

Shakir Hussain Naushad Mohamed[1], Hao Feng Chan[1], Dexter Sing Fong Leong[1], Wui Chung Alton Chau[1], Takao Ito[2], Zheng Cai[1], Xinjie Deng[1], Yit Hong Choo[1*]
([1]Deakin University, Australia) ([2]Hiroshima University)

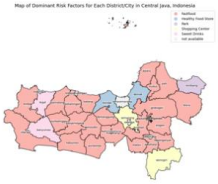
Sign language recognition is a vital tool for enabling communication with individuals who are hearing impaired. This paper proposes a custom gesture recognition framework designed specifically for sign language interpretation. The proposed model uses pose estimation and gesture dynamics, incorporating a deep learning approach trained on diverse datasets from Roboflow. The system achieves robust recognition of complex gestures while maintaining efficiency. This framework emphasizes adaptability to variations in sign language styles.



OS26-5 Geographic and Risk Factor Analysis of Non-Communicable Cardiovascular Diseases in Central Java using Machine Learning

Nurhasanah, Andi Prademon Yunus*
(Telkom University, Indonesia)

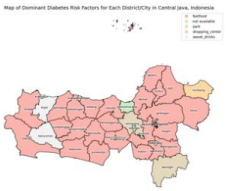
Non-communicable diseases (NCDs), especially cardiovascular diseases, are a major health problem in Indonesia and globally with a mortality rate of 17.9 million people per year. Central Java Province is one of the regions with a high number of cardiovascular patients, especially hypertension in 2023. NCD risk factor analysis is needed to map the distribution and identify high-risk areas. This study uses Machine Learning and Geo-Mapping to analyze risk factors such as unhealthy food consumption, physical inactivity, alcohol, smoking, stress, and access to public transportation. The results of the study are expected to be the basis for planning appropriate intervention programs to reduce the prevalence of cardiovascular disease and improve the quality of life of the people of Central Java Province, Indonesia.



OS26-6 Analysis of Geographical Characteristics and Risk Factors for Non-Communicable Diseases: Diabetes in Central Java Using Random Forest and SHAP

Ambar Arum Prameswari, Andi Prademon Yunus*(Telkom University, Indonesia)

Non-Communicable Diseases (NCDs) account for 71% of global deaths, posing a significant public health challenge, particularly in low- and middle-income countries where 77% of these deaths occur. In Indonesia, NCDs contribute to 76% of total mortality, with diabetes responsible for 7%, making it one of the leading causes of death. Central Java, a province with high population density, has experienced a concerning rise in diabetes cases, reaching 618,546 in 2021. This chronic condition significantly increases the risk of complications such as cardiovascular disease and stroke, underscoring the urgent need for effective prevention strategies. This study utilizes machine learning to analyze lifestyle behaviors and environmental factors, aiming to identify the key risk factors for diabetes in Central Java and map their geographical distribution.



OS26-7 Geographic Analysis of Risk Factors for Chronic Respiratory Non-Communicable Diseases Using Machine Learning

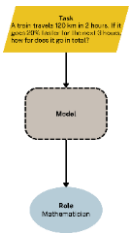
Ayu Susilowati , Andi Prademon Yunus*(Telkom University, Indonesia)

Non-communicable diseases (NCDs) account for approximately 74% of global deaths, with specifically 13% attributable to chronic respiratory diseases (such as asthma and COPD) in Central Java by 2023-a figure that is projected to continue to rise. The World Health Organization (WHO) has set a goal to reduce the incidence of NCDs by targeting behavioral risk factors, including alcohol consumption, air quality, smoking, and physical activity. This study aims to geo-mapping the distribution of non-communicable disease (NCD) risk factors offers crucial insights for pinpointing high-risk areas and developing targeted prevention strategies for chronic respiratory diseases by using machine learning.

OS26-8 Role-Play Prediction Using Ontology-Based Graph Convolutional Network Model

Asyafa Ditra Al Hauna[1], Andi Prademon Yunus[1*], Siti Khomsah[1], Fukui Masanori[2]
([1]Telkom University, Indonesia, [2]Iwate Prefectural University, Japan)

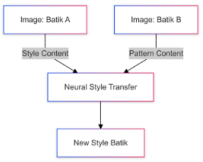
Current applications of large language models often assign tasks without consideration of how LLMs understand a given prompt. Simple commands sometimes do not guarantee desired responses, as LLMs are systems based on mathematical modeling and cannot cognitively be capable of understanding commands. Hence, a method is required to guide LLMs in performing tasks appropriately. This paper presents a method to develop model-based automation of role selection supported by ontology. This can allow for more accurate and relevant role recommendations than if done manually. As such, this optimization at hand improves the performance of LLMs for specific tasks and overcomes the limitations of previous works that define the roles by hand.



OS26-9 Experimental Exploration of Neural Style Transfer: Hyperparameter Impact and VGG Feature Dynamics in Batik Motif Generation

Happy Gery Pangestu[1], Andi Prademon Yunus[1*], Ratih Alifah Putri[1], Takao Ito[2]
([1]Telkom University, Indonesia) ([2]Hiroshima University)

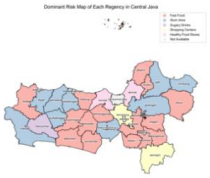
Batik, a traditional Indonesian art form that employs wax-resist dyeing to create intricate patterns, holds deep cultural and historical significance. Despite its value, the complexity of its production has led to a decline in interest, particularly among younger generations. This study explores the application of Neural Style Transfer (NST), a subset of Artificial Intelligence, to innovate batik design by transferring styles from images onto content. In our research, we utilized three pretrained Convolutional Neural Networks (CNN) such as VGG, ResNet, and Inception. We compared the performance of these models using their original weights and fine-tuned versions. The results demonstrate significant variations in the quality of the batik designs, depending on the models and their hyperparameters. Additionally, the selected images were found to play a crucial role in influencing the final results.



OS26-10 Exploring Non-Communicable Disease Risk Factors on Cancer Rates in Central Java Using Random Forest and SHAP

Novi Ramadani, Andi Prademon Yunus[*] (Telkom University, Indonesia)

Non-Communicable Diseases (NCDs), particularly cancer, remain a significant public health concern in Indonesia and globally. Central Java Province is one of the regions with a substantial number of cancer cases in Indonesia, emphasizing the need to understand its contributing factors. Mapping the distribution of NCD risk factors provides valuable insights for identifying high-risk areas and designing targeted preventive strategies. This study aims to analyze the geographical distribution of NCD risk factors and identify the most influential factors associated with cancer prevalence across cities and regencies in Central Java Province using Machine Learning and Geo-Mapping.



OS26-11 Addressing Noise Challenges in CNN-based Pneumonia Detection: A Study Using Indonesian Thoracic Imagery

Wahyu Andi Saputra[1], Andi Prademon Yunus[1]
([1]Telkom University, Indonesia)

Accurate pneumonia diagnosis is vital, especially in resource-limited areas like Indonesia. While CNNs show promise for automated detection using chest X-rays, real-world image quality affects their performance. This study addresses this challenge by using a primary dataset—images directly from Indonesian patients—to avoid the biases of pre-processed secondary data. This ensures our findings are relevant to the Indonesian context. We tested how different noise types (salt-and-pepper and Gaussian) impact the accuracy of several common CNN architectures. These noise types mimic common image imperfections. Our analysis reveals how much noise degrades the CNN's ability to correctly identify pneumonia. This highlights the need for better pre-processing methods and potentially specialized CNN designs to handle noisy images. Ultimately, our work improves our understanding of deploying CNNs for pneumonia diagnosis in real-world settings, leading to more reliable and helpful diagnostic tools. Using primary data from diverse populations is crucial for building trustworthy AI in healthcare.

OS27 Industrial Revolution (4)
Chair Hazry Desa (UniMAP, Malaysia)

OS27-1 Digital Guardians: The Role of AI and Robotics in Protecting Construction Heritage

Muhammad Azizi Azizan, Nurfadzillah Ishak, Hazry Desa, (UniMAP, Malaysia)

Preserving construction heritage is vital for safeguarding cultural legacies. Traditional methods often face resource, environmental, and structural challenges. This paper explores AI and robotics in heritage conservation, highlighting their efficiency and sustainability. Tools like 3D modeling, digital twins, and predictive analytics are examined, with applications in structural monitoring, restoration, and documentation. The Sultan Abdul Samad Building in Malaysia serves as a key case study, demonstrating how technology preserves authenticity while reducing invasive interventions. Challenges, including costs, data limitations, and ethical concerns, are addressed. By merging tradition with innovation, AI ensures the protection of cultural landmarks in a digital age.

OS27-2 Architectural Memories: AI Redefines Dilapidation Analysis and Conservation

Muhammad Azizi Azizan, Nurfadzillah Ishak, Hazry Desa, (UniMAP, Malaysia)

Heritage conservation faces challenges from urbanization, environmental degradation, and resource constraints. AI and advanced technologies are revolutionizing traditional practices by offering efficient, data-driven solutions. Focusing on Georgetown, Penang, a UNESCO World Heritage Site, this paper examines AI-driven tools like 3D scanning, predictive maintenance models, and drones for structural analysis and restoration. Results show a 60% reduction in inspection time and targeted interventions for 40% of buildings. While AI enhances accuracy and efficiency, high costs and ethical concerns limit widespread adoption. By merging AI with traditional methods, the study highlights how innovation can protect architectural heritage while honoring cultural authenticity.

OS27-3 The Future of Robotics in Contract Management.

Muhammad Firdzaus Mat Ros, Muhammad Azizi Azizan, Hazry Desa,
(UniMAP, Malaysia)

Robotics and AI are revolutionizing contract management by automating tasks, improving accuracy, and enhancing efficiency. This paper explores the role of technologies like RPA, natural language processing, and predictive analytics in streamlining contract creation, review, and compliance. Real-world case studies highlight benefits such as faster processes and better decision-making. It also addresses challenges, including ethical and workforce implications. The integration of smart contracts and blockchain signals a transformative future, requiring continuous innovation and adaptation in contract management practices.

OS27-4 Leveraging AI to Enhance Extended Producer Responsibility Compliance in Construction Waste Management

Mohamed Fuad Shahariman, Muhammad Azizi Azizan, Hazry Desa, Nur Amierah Harun
(UniMAP, Malaysia)

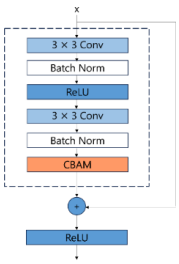
Extended Producer Responsibility (EPR) holds producers accountable for the environmental impact of their products, including waste management. In construction, EPR compliance is challenging due to material diversity and project complexity. This paper explores using AI technologies to enhance EPR compliance in construction waste management. AI-driven systems automate data collection, analysis, and reporting, improving efficiency, accuracy, and transparency. The study highlights AI's potential to revolutionize EPR compliance, delivering substantial environmental and economic benefits while addressing industry-specific challenges.

GS Abstract
GS1 Machine Learning & Autonomous Driving (5)
Chair Obada Al aama (Kyushu Institute of Technology, Japan)

GS1-1 Automatic classification of respiratory sounds by improving the loss function of ResNet

Ryusei Oshima[1], Tohru Kamiya[1], Shoji Kido[2]
([1]Kyushu Institute of Technology, Japan), ([2]Osaka University, Japan)

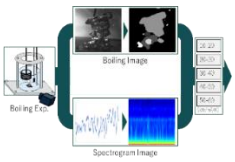
Respiratory diseases cause 8 million deaths annually, and this number is expected to increase. Breath auscultation, a primary diagnostic method, is noninvasive, repeatable, and immediate, but faces challenges such as reliance on skilled practitioners, difficulty in quantitative assessment, and limited accessibility in developing regions or disaster sites. To address these issues, we developed a deep learning-based breath sound classification system using the ICBHI 2017 dataset. Our method classifies breath sounds into four categories: Normal, Crackle, Wheeze, and Crackle and Wheeze. We use ResNet-34 as the base model, which is enhanced with CBAM for better spatial and channel feature extraction. To deal with class imbalances, we incorporate Focal Loss. The system achieves accuracy of 0.732, SE of 0.607, SP of 0.843, and ICBHI of 0.725.



GS1-2 Classification of Heat Transfer Coefficient Using Deep Learning with Information from Boiling Images

Fuga Mitsuyama, Ren Umeno, Tomohide Yabuki, Tohru Kamiya (Kyushu Institute of Technology, Japan)

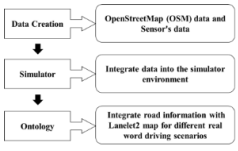
Recently, the high integration of electronic devices in many products has led to an increase in heat generation density. Boiling-cooling is attracting attention as a method that can efficiently cool heat sources. In this paper, we propose a method to predict the heat transfer coefficient (HTC), which is important for the design of cooling systems, from boiling sound data and boiling images using deep learning. This model learns the physical law of boiling by considering the information of bubbles, which significantly affects the HTC value, and improves the prediction accuracy compared to the conventional method using only the boiling sound data.



GS1-3 A Data Format Integration of Open-Street-Map and Lanelet2 Toward the Ontology Framework for Safety Autonomous Driving systems

Obada Al aama[1], Takahiro Koga[1], Tomoki Taniguchi[1], Davaanyam Jargal[1], Junya Oishi[2], Shigeru Nemoto[2], Wataru Mizushina[2], Kazuki Hirao[2], Hakaru Tamukoh[1], Hiroaki Wagatsuma[1]
([1]Kyushu Institute of Technology, Japan, [2]Aisan Technology Co., Ltd., Japan)

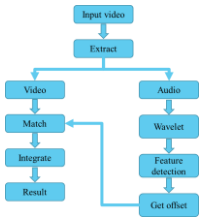
This study proposes a framework integrating OpenStreetMap (OSM) data with ontology-based systems to enhance autonomous driving systems. OSM provides static geographical data, while the Lanelet2 mapping framework incorporates lane-level road information and topological relationships, enabling advanced testing of vehicle behavior. Ontology-based integration offers semantic representations of road elements and traffic rules, supporting realistic modeling of complex driving scenarios. This structured approach ensures accurate simulation and testing, facilitating applications such as traffic analysis and route optimization, while improving scalability, precision, and safety in autonomous vehicle development.



GS1-4 Developing a Sound-Based Method to Synchronize Multiple Videos Recorded by Multiple Sound Sources

Davaanyam Jargal, Rena Kato, Tomoki Taniguchi, Kosei Shibata, Takahiro Koga, Obada Al aama, Hakaru Tamukoh and Hiroaki Wagatsuma (Kyushu Institute of Technology, Japan)

The environmental monitoring from a vehicle on the road is important for the driving behavior analysis as well as the monitoring of driver's operations. A light weight mobile camera is useful for the record of multiple directions from the vehicle simultaneously; however the timing synchronization is an issue need to be solved. In this purpose, we proposed the sound-based method to synchronize different videos recorded with environmental sounds. In this task, the extraction of common sound features and amplifying of the features are necessary to superimpose those sound profiles to find consisting time points. In the validation the effectiveness, we used recoded videos from the bus driven by an expert driver.



GS1-5 Intelligent Path Planning for Robots and Practical Implementation of Programmable Headlights for Autonomous Vehicles remote presentation

Farkad Adnan, Abdul Samad Bin Shibghatullah, Mohd Radzi Bin Aridi (Universiti Tenaga Nasional (Uniten), Malaysia)

The ability to move is essential for the development of intelligent robots for autonomous navigation. Neural networks outperform traditional methods in modeling complex relationships and identifying patterns, but current systems are limited to specific robots and sensors. This paper presents a universal method for interpreting data from different 2D sensors, predicting distances between robots and walls, and using neural networks for navigation. The goal is to create a versatile algorithm that can be applied to different robots and programmable lamps, reducing accidents. The thesis also explores programmable lamps that block light from reaching the eyes of passengers, using one network to determine free space using odometry data and another to find safe paths while avoiding obstacles. Simulated path examples will be presented.

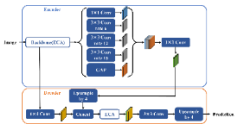
GS2 Image Processing I (4)

Chair Amane Takei (University of Miyazaki, Japan)

GS2-1 Recognition of Plastic Bottles Region Using Improved DeepLab v3+

Yusuke Murata, Tohru Kamiya (Kyushu Institute of Technology, Japan)

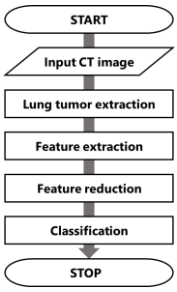
The shortage of factory workers is a major problem in Japan. This paper focuses on sorting plastic bottles at waste disposal plants as one of the solutions. We try to realize automation by recognizing plastic bottles from images and gripping them with a robot arm. In this paper, we propose an image analysis method limited to plastic bottles of 500 ml capacity. As a basic study, experiments were conducted to investigate how accurately a single plastic bottle can be recognized in an image. The method is semantic segmentation, and DeepLab v3+ was used as the deep learning model, with improvements by ECA block and Mish activation function. We compared the methods and found that the proposed method showed improvement in the area of misrecognition in the base model.



GS2-2 Non-Invasive Classification of EGFR Mutation from Thoracic CT Images Using Radiomics Features and LightGBM

Reo Takahashi[1], Tohru Kamiya[1], Takashi Terasawa[2], Takatoshi Aoki[2]
([1]Kyushu Institute of Technology, Japan), ([2]University of Occupational and Environmental Health, Japan)

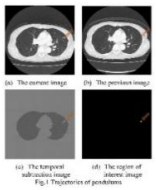
Cancer caused 9.7 million deaths in 2022, including 1.8 million from lung cancer, the leading cause of cancer death. EGFR mutation testing is essential for lung cancer treatment planning, but it is invasive and visual identification from chest CT images is difficult. This paper proposes a computer-aided diagnosis system to identify EGFR mutation status. Lung tumor regions were automatically extracted and radiomics features were obtained. Dimensionality reduction was performed using null importance, variance inflation factor, and recursive feature elimination. The method was applied to 143 cases and achieved 84.6% accuracy, 94.8% true positive rate and 25.5% false positive rate. The results suggest that CAD systems can improve the non-invasive detection of EGFR mutations in lung cancer.



GS2-3 Detection of Lung Nodules from Temporal Subtraction CT Image Using Elastic Net-Based Features Selection

Natsuho Baba, Tohru Kamiya (Kyushu Institute of Technology, Japan)
Takashi Terasawa, Takatoshi Aoki (University of Occupational Health)

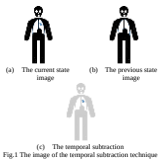
CT (computed tomography) is mainly used to diagnose lung cancer. Many CT images impose a heavy burden on visual screening, so a CAD (computer-aided diagnosis) system is expected to reduce the burden. In this paper, we propose an image analysis method to detect lung nodules from chest CT images using machine learning techniques. The best results were obtained for the method using LightGBM with feature reduction by Elastic Net.



GS2-4 Detection of Lung Nodules from CT Image Based on Ensemble Learning

Natsuho Baba, Tohru Kamiya (Kyushu Institute of Technology, Japan)
Takashi Terasawa, Takatoshi Aoki (University of Occupational Health)

Lung cancer is the most diagnosed cancer worldwide and the leading cause of cancer-related deaths, making early detection and treatment crucial. One method used in computer-aided diagnosis (CAD) systems is the temporal subtraction of images by performing a different operation between the current and previous images of a patient. In this study, radiomic features are extracted as explanatory variables from the temporal subtraction images. Feature selection is performed using Elastic Net, followed by the application of machine learning methods. Finally, ensemble learning is applied to classify unknown data into two categories: positive and negative lung nodules.



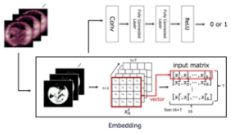
GS3 Image Processing II (4)

Chair Kuo-Hsien Hsia (National Yunlin University of Science and Technology, Taiwan)

GS3-1 Shape-Preserving Embedding Technique for Binary Classification of Video Image of the Solar Surface

Iori Tamura, Akiko Fujimoto, Soichiro Kondo, Reiri Noguchi (Kyushu Institute of Technology, Japan)

We study the embedding technique on the binary classification of video images as the explanatory variable. In this study, we assume the shape on video frame image have high sparsity and strong characteristic time evolution. In the embedding process, 2-dimensional image is resized keeping shape characteristics of the image and converted to a vector. The embedding allows dimensionality reduction from a 3-dimensional array (video image) as input data for machine learning to a 2-dimensional array of time sequences of embedded vectors. Using solar surface video images in the space weather field, we present evaluation experiments on multiple models with different embedding sizes, transformation formulas, and number of layers in the CNN.



GS3-2 Seated Posture Estimation Based on Monocular Camera Images

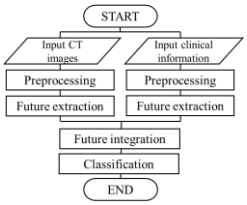
Hitoshi Shimomae, Tsubasa Esumi, Noriko Takemura (Kyushu Institute of Technology, Japan)

Poor seated posture significantly strains the body, leading to symptoms like shoulder stiffness and back pain. While research on seated posture estimation using images has been active, many studies focus on extreme postures not typically seen in daily desk work. This study aims to estimate common postures, such as slouching, which are often experienced in everyday settings. Due to the lack of medical quantitative metrics for evaluating posture quality, we manually annotated some of our collected posture data and used semi-automatic annotation by SVM to build a dataset. Using this dataset, we trained deep learning models for posture estimation with different input data types: RGB images, silhouette images, and posture key points, and compared their performance.

GS3-3 Identification of lung nodules based on combining multi-slice CT images and clinical information

Yuto Nishitaki, Tohru Kamiya (Kyushu Institute of Technology, Japan) Shoji Kido (Osaka University, Japan)

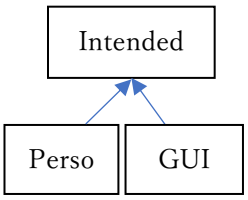
In recent years, a CT scan of the chest has played an important role in the diagnosis of lung cancer. However, the large number of CT images generated in a single examination places a heavy burden on the physician reading them. To solve this problem, computer-aided diagnosis (CAD) systems are being introduced. Conventional CAD systems are based on methods that use only image information. Recently, however, research on systems that incorporate clinical information in addition to image information has attracted attention. In this study, we propose a method for identifying nodular shadows that integrates a composite image created from multi-section CT images with clinical information such as the patient's age, sex, and medical history as recorded in the medical record.



GS3-4 Graphical User Interface (GUI) Design for Mobile Commerce Site for Women Seller in Rural Area remote presentation

Kho Irene[1], Shayla Islam[1], Abdul Samad Shibghatullah[2]
([1]UCSI University, Malaysia), ([2]University Tenaga Nasional, Malaysia)

GUI is a medium that allows users to communicate with electronic devices. Good GUI design is important because it allows users to learn how to use a system in the shortest amount of time and effectively operate it. Hence, a well-designed GUI for m-commerce sites is crucial to aid women sellers in rural areas to sell their products directly to customers. Unfortunately, the GUI of m-commerce sites caters only to IT-literate users with fast internet connections. Existing m-commerce sites' GUIs are compact with information. This may lead to an interface design that looks busy and messy unless women sellers are given proper guidance by IT experts. A research review about GUI requirements caters for women sellers' according to their personality types and hopes that they will be willing to explore m-commerce sites.

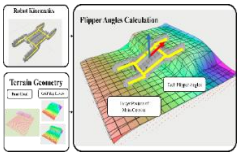


GS4 Robotics (5)
Chair

GS4-1 Obstacle-Aware Autonomous Flipper Control Method Based on Terrain Geometry

Kotaro Kanazawa, Noritaka Sato, Yoshifumi Morita (Nagoya Institute of Technology, Japan)

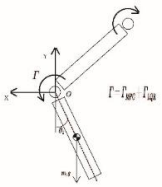
Rescue robots play crucial roles in search and rescue missions at disaster sites. Crawler mechanisms, which are valued for their high traversability on unstructured terrain, can be equipped with flipper arms featuring four single-rotation joints to enhance their performance. However, operating these flippers is challenging. Although various control methods have been developed recently, difficulties persist in adapting to three-dimensional uneven terrains and in avoiding interference between flippers and the environment. In this study, we propose an obstacle-aware autonomous flipper control method that actively adjusts the flippers based on the progress of the robot and terrain geometry.



GS4-2 An Adaptive Control Method for a Knee-Joint Prosthetic Leg Toward Dynamic Stability and Gait Optimization

Ge Yiqian[1], Purevdorj Choisuren[1], Shintaro Kasai[1], Hiroaki Wagatsuma[1]
([1]Kyushu Institute of Technology, Japan)

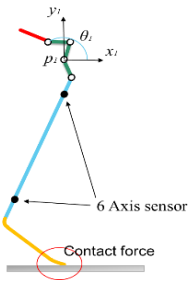
This study presents a control strategy for the knee joint of a prosthetic leg designed for below-knee amputation people. Model Predictive Control (MPC) and Linear Quadratic Regulator (LQR) are considered to be useful for the achievement of dynamic stability and adaptive motion control. MPC is employed to optimize the knee joint's trajectory in real-time, ensuring smooth and efficient motion while accommodating gait characteristics. LQR is integrated to regulate the center of mass (CoM) dynamics, maintaining overall stability by leveraging feedback from the prosthetic leg and user inputs. In the computer simulation, the feasibility of those control approaches will be examined whether they enhance a smooth control, in the sense of the stability and adaptability in human daily activities.



GS4-3 A Gait Analysis with Multibody Dynamics Toward Energy-Efficient Active Knee Prostheses

Purevdorj Choisuren[1], Ge Yiqian[1], Shintaro Kasai[1], Batbaatar Dondogjamts[2], Erdenesuren Naranbaatar[2] and Hiroaki Wagatsuma[1]
([1]Kyushu Institute of Technology, Japan; [2]Mongolian University of Science and Technology, Mongolia)

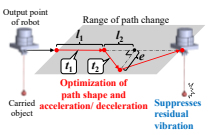
In general, prosthetic knee users have a large stress in the locomotion due to less smoothness and unnecessary energy consumption. In the passive prosthesis, it is difficult to regulate the stiffness depending on the ground contact force. In consideration of designs for such an adaptivity to improve passive systems, we propose an artificial knee kinematics design to absorb the redundant contact force for the smooth and stable walking and explore necessary constraints for the proposed mechanics to be able to have multi-functions not only for walking but also knee flexion accumulating the power for jumping. In the analysis, we used Multibody Dynamics (MBD) to investigate. This result will contribute to design an integrated dynamic model by incorporating a flexible body and ground contact forces in various purposes.



GS4-4 Suppressing of Multi-Axial Vibration Caused in Carried Objects by Robot Using a Heuristic Algorithm Based on Evaluation of Actual Machine Information

Yusuke Ueno[1], Hiroki Noguchi[1], Fumitoshi Shimono[1], Hiroshi Tachiya[2]
([1]Komatsu University, Japan) ([2]Kanazawa University, Japan)

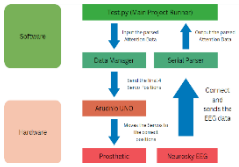
Residual vibrations induced in objects carried by robots cause the positioning accuracy to deteriorate, which makes the installation of carried objects difficult. This study proposes a method for determining a trajectory that can suppress residual vibration using a heuristic algorithm, based on the behavior of an object to be carried, which is measured by actually operating a robot. The method does not require a kinetic analysis of the carried object and can be applied to robots still in operation on the production line. Trajectories were generated for a commercially available industrial robot to suppress residual vibrations in two axial directions for a pendulum-shaped object to be transported. A significant reduction in vibration amplitude was achieved by optimizing path shape, acceleration and deceleration.



GS4-5 Developing Low-Cost BCI-Based Brain-Limb Interaction Device with Prosthetic Hand remote presentation

Nethika Jayith Rajapakse(International Bilingual International Science Park, Taiwan)

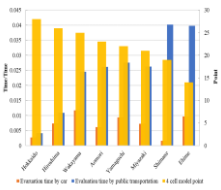
Inventions that are designed to heal the body and/or mind should always be sought. Currently, too many people are lacking access to cheap prosthetic devices, especially those that allow neural connections to be gained with such devices. This is the reason why this study intends to propose a low-cost invention that is able to enable people to gain back concentration with limb use using Python Programming language, an EEG Neurosky headset, an Arduino, and a 3D-printed prosthetic hand. With our implementation, the proposed method can explore the boundaries of improving attention and continue to develop higher-level BCIs for the mind-limb connection, improving on current-day prosthetics and concentration/limb connection rehabilitation.



GS5 Applications I (6)
Chair Tsutomu Ito (Ube National College of Technology, Japan)

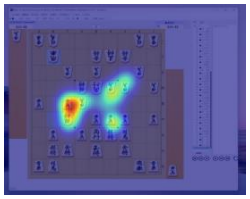
GS5-1 A Study on Local Airports Contributions to Tourism Industry in Japan
Tsutomu Ito[1], Seigo Matsuno[1], Makoto Sakamoto[2], Satoshi Ikeda[2], Takao Ito[3]
([1] Ube National College of Technology, Japan), ([2]University of Miyazaki, Japan)
([3]Hiroshima University, Japan)

This study examines the impacts of local airports on the regional tourism industry in Japan. A series of indexes of the tourists and a new measure of the time index have been developed based on our four-cell model to analyze the correlation between different indexes such as the number of airport tourists and the time used by public transportation. During the verification process, a correlation has been discovered between the number of tourists in the city where the airport is located and the number of airport users for specific regionally managed airports. Furthermore, regarding access to tourist attractions from airports, a strong negative correlation is confirmed between the evaluation index and the state of development of public transport, suggesting the importance of developing public transport, including airports, in attracting tourists.



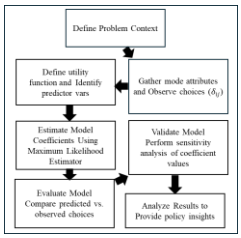
GS5-2 Analysis of Careless Mistakes Using Gaze Information
Ryota Yabe, Noriko Takemura (Kyushu Institute of Technology, Japan)

Careless mistakes are caused by a lack of concentration, time pressure, and information overload due to multitasking. If we predict careless errors, they could be helpful in various situations, such as learning support, business efficiency improvement, and medical diagnosis support. However, it is challenging to reproduce careless error situations, and few studies have been on predicting careless errors. Therefore, we focus on Shogi (Japanese chess), where situational awareness is complex, and players must maintain long periods of concentration, making careless mistakes. In this study, we collected eye-tracking data of players during a game and annotated careless errors based on the game's contents and surveys from the players. By analyzing this data, we have examined the conditions under which careless mistakes occur.



GS5-3 A Mathematical Framework for Logit Model in Transportation Mode Choice Analysis
Ahmad Altaweel[1], Kazuhito MINE[1], Bo-Young Lee[2], Jang-Sok Yoon[2], Hiroaki Wagatsuma[1]
([1]Kyushu Institute of Technology, Japan; [2]Logistics Revolution Korea, Korea)

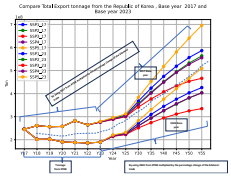
Traditional transportation demand forecasting has relied on massive zone-specific aggregations, which assume a linear demand increase. Such models may lack the flexibility needed to perform dynamic and context-sensitive analyses. Recently, disaggregated behavioral models have gained prominence for requiring less data and enabling sensitivity analyses in policy decisions. This study explores the feasibility of a model focusing on the mathematical formulation and validation of the transportation mode choice model. The study uses the logit model with a non-linear probability distribution function represented by a logistic curve and incorporates a linear combination of independent predictor variables. The mathematical model is examined for its ability to estimate choice probabilities. The methodology is formulated to be adaptable to diverse contexts that provide an analytical framework for transportation systems independently of geographic or demographic considerations.



GS5-4 A Computational Approach for Global Trade Analysis in Korea Contributing to the Forecasting of Future Efficacy in Global and Domestic Korean Transportations

Bo-Young Lee[1], Ahmad Altaweel[2], Kazuhito Mine[2], Jang-Sok Yoon[1], Hiroaki Wagatsuma[2]
([1]Logistics Revolution Korea Co., Korea; [2]Kyushu Institute of Technology, Japan)

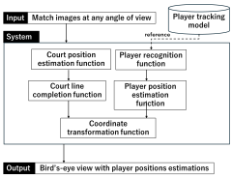
Economic forecasting studies are integral for shaping strategic policy decisions by providing data-driven insights that guide resource allocation, logistics and transportation, and long-term planning. This study investigate the trade dynamics of the Republic of Korea through the Global Trade Analysis Project Recursive dynamic GTAP-RD model with the GTAP v11 database to forecast economic scenarios and Shared Socioeconomic Pathways (SSPs) serve as growth trajectories. The analysis centers on the Republic of Korea's key trading partners, as identified by the GTAP database, and top trading sectors from the Korea Transport Database (KTDB) to compare the key influencers on Korea's trade thereby providing deeper strategic economic planning. This study investigates further the involvement of Korea's logistics and transportation by focusing on changes in import/export tonnage to inform infrastructure planning and strategic transport development. The evaluation of Korea's trade in the global context is of the essence to ensure adaptive logistics, backing economic resilience, and aligning with changeable global trade conditions.



GS5-5 Fundamental Research on Athlete Positions Estimation in Indoor Sports at Various View

Iori Iwata, Yoshihiro Ueda, Kazuma Sakamoto, Riku Kaiba (Komatsu University, Japan)

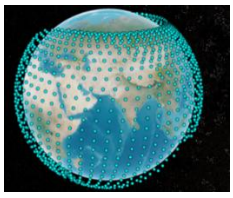
In sports such as volleyball, basketball, and soccer, the positioning of players is of great importance for the purposes of tactical analysis. In many cases, this is researched using image recognition techniques, which facilitate the creation of visual representations of player positions. Typically, images captured by cameras are transformed into a bird's-eye view through the application of algorithms such as projective transformation. Traditional methods rely on four reference points such as court line intersection to transform images into a bird's-eye view, which can be difficult to obtain because camera angles and camera angles of view change during a match. This research proposes a new method to overcome these limitations by automating the selection of reference points using net and court line coordinates. This approach enables accurate player position estimation even with partial court images and historical video data, expanding the possibilities for tactical analysis in volleyball.



GS5-6 Overview of the development of low earth orbit satellite navigation enhancement technology remote presentation

Dingcheng Tang*, Jinliang Wang, Jianfeng Shan, and Guoji Zou
(Space star technology co, LTD, Beijing, China)

Low Earth Orbit (LEO) satellites are expected to become a new increment in the development of the new generation of satellite navigation systems. The development direction of satellite navigation enhancement is gradually tilting towards the low orbit field, becoming a new growth and empowerment point for the next generation of satellite navigation. This article was on discussing the new development opportunities brought by low orbit navigation enhancement technology for building a Global Navigation Satellite Systems (GNSS) global space-based monitoring network, providing global quasi real time high-precision services, and providing global high integrity monitoring services.

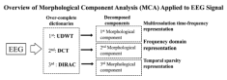


GS6 Applications II (5)
Chair Marion Oswald (TU Vienna, Austria)

GS6-1 Signal Decomposition and Noise Reduction in Single-Channel EEG: A Morphological Component Analysis (MCA) Approach

Kosei Shibata[1], Yide Yang[1], Rena Kato[1], (Kyushu Institute of Technology, Japan),
Hendry Ferreira Chame[2], Laurent Bougrain[2] (Université de Lorraine, CNRS, LORIA, France),
Tomohiro Shibata[1], Hiroaki Wagatsuma[1](Kyushu Institute of Technology, Japan)

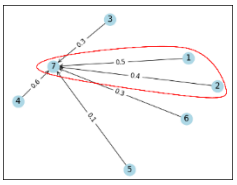
This study applies the Morphological Component Analysis (MCA) to single-channel EEG data obtained during human-to-human interactions in a board game (Hex-game). MCA, a dictionary-based signal decomposition method, separates signals into distinct morphological components. It enables the extraction of plausible brain activity and the removal of noise, such as ocular and muscular artifacts. By focusing on neural dynamics in interactive settings, this approach highlights the relationship between cognitive processes and social behavior. The approach suggest that MCA offers a promising framework for EEG analysis in complex, dynamic environments, combining effective feature extraction with robust artifact removal.



GS6-2 Variable Selection Methods for Multivariate Time Series Data Using Multivariate Granger Causality

Keita Ohmori[1,2], Toshiki Saitoh[1], Akiko Fujimoto[1], Eiji Miyano[1]
([1]Kyushu Institute of Technology, [2]SUMCO, Japan

In this paper we study variable selection methods for multivariate time-series data. Hmamouche et al. (2018) proposed a method that first constructs a causal graph based on Granger causality among time-series data, and then selects variables from clusters formed by clustering the vertices corresponding to each variable. However, this method only performs pairwise Granger causality tests, which may not fully capture the interactions among variables. To address this issue, we propose a variable selection method that performs multivariate Granger causality tests on all combinations of explanatory variables with respect to the target variable, selecting the combination with the strongest causality. Our new method successfully constructs a predictive model with a higher accuracy compared to the previous method.



GS6-3 A Support System for a Visually Impaired Person Finding Bus Route Numbers Employing MY VISION

Daichi Nanaura, Seiji Ishikawa, Yui Tanjo (Kyushu Institute of Technology, Japan)

A bus is not a very convenient means for a visually impaired person because of the difficulty in identifying its route number , although it is an economical tool for travel. This paper proposes a method identifying a bus route number using MY VISION system which employs an ego camera worn by a visually impaired person. The method finds a frontal area of an approaching bus using the video which the camera provides using optical flow and the random forest based on Haar-like features. It then extracts the upper destination panel area followed by detecting a route number at the right-hand side of the panel. Finally, the detected route number is identified by template matching. In the experiment, various kinds of videos containing busses were captured and the effectiveness of the proposed method was shown.

GS6-4 Human Pose Estimation from Egocentric Videos

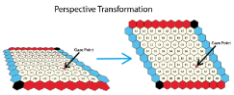
Shunya Egashira, Yui Tanjo (Kyushu Institute of Technology, Japan)

According to a survey conducted by the Ministry of Health, Labour and Welfare in 2019, about 30% of patients suffer from back pain and stiff shoulders. Although researches on pose estimation have been conducted for a long time, they cannot be used for daily pose estimation, because they need fixed cameras to capture target/subject motion. To solve this problem, the present paper, proposes a novel pose estimation method from egocentric videos using Epipolar Geometry. It computes three rotational angles, i.e., pitch, yaw and roll, from the egocentric motion videos to evaluate differences from his/her normal motion. In the experiment, three egocentric videos were used to verify the performance and effectiveness of the proposed method and reasonable/satisfactory results were obtained.

GS6-5 Analyzing Eye-Tracking Data to Detect Joint Attention in Hexgame Experiments

Yide Yang[1], Rena Kato[1], Kosei Shibata[1] (Kyushu Institute of Technology, Japan), Hendry Ferreira Chame[2], Laurent Bougrain[2] (Université de Lorraine, France),
Hiroaki Wagatsuma[1](Kyushu Institute of Technology, Japan)

This study aims to explore the mechanisms of joint attention in Hexgame experiments by analyzing Tobii eye-tracking data. In the experiment, two participants engaged in a strategic game, during which their gaze data was recorded. Through perspective transformation, the gaze points were mapped onto the coordinates of the game board to determine whether joint attention occurred during critical game states. The primary focus of this study is the analysis of eye-tracking data to identify attention coordination between players during the progression of the game. Future work will expand this framework to assess win probabilities and predict subsequent moves, providing deeper insights into strategic decision-making.



AUTHORS INDEX

Notation of session name

PS: Plenary Session IS: Invited Session, OS: Organized Session, GS: General Session,

Note: 33/90 = (page no. in Technical Paper Index) / (page no. in Abstracts)