

PS abstracts (4)

PS1 Human to Human Interaction using Virtual Agents Posing as Another Person

Kaoru Sumi (Future University Hakodate, Japan)

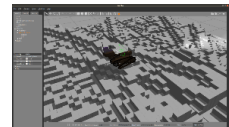
There have been ever expanding opportunities for online distance education in recent years, and agent-based interactions in virtual spaces have been attracting attention in this context. In a virtual space, we can communicate with others as if we were a virtual agent who is totally different from ourselves. Thanks to the recent advances in online software that enable us to communicate with virtual agents remotely, we will soon be able to have such experiences more easily. For example, a woman may become a male virtual agent, a man may become a female virtual agent, and someone could become a person of a different ethnicity. In this study, we investigate the various effects of interaction with virtual agents in a virtual space, such as how they feel about each other and what impacts there may be on a particular task.



PS2 Simulation Tools for Urban Search and Rescue Robotics

Evgeni Magid (Kazan Federal University, Russia)

Real world experiments are critical for validating performance of new concepts and algorithms in robotics field. Yet, experiments tend to be too expensive in terms of time and resources of a research team. Moreover, it is not feasible to conduct thousands of complex experiments with a physical robot in a real environment. To check new ideas, preliminary evaluate new algorithms and interaction protocols, on first stages of a research project it is reasonable to start within a simulation. To produce relevant results, a simulator should provide adequate models of robots and environments with realistic physical properties. This paper presents an overview of our experience in using robot operating system (ROS) with Gazebo and Webots simulators for urban search and rescue robotics projects and considers constructing new models of mobile robots and complicated environments, algorithm validation and comparative analysis.



PS3 Enhancement methodology for low light image

Xiwen Liang, Xiaoyan Chen (Tianjin University of Science and Technology, China)

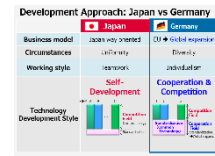
In order to solve the problems such as low brightness, high noise and poor contrast in under illumination images, there are several methods proposed to address this issue. Usually, these methods are categorized into two different ways. One is based on traditional light-based technology, the other is based on machine learning technology. The low-light image enhancement is often a challenging task because the noises in dark areas are amplified with the overall brightness and contrast of the image. With the development of machine learning techniques, deep learning networks are becoming the popular research topics recently to overcome the disadvantages of noisy dots. Based on the deep analysis of the current research work, we proposed a novel network and carried out lots of comparison experiments to analysis the performances of these methods. By training, validation and testing on the datasets, the evaluation critics are defined and utilized to analysis the efficiency of the methods. With the results, we draw the conclusion that the efficient low-light image method can make up for the shortcomings of the environment, bring better viewers' experience and provide preprocessing for subsequent high-level computer vision tasks, such as target recognition, face recognition, semantic segmentation, etc.



PS4“A New Style of Research and Development from the EU Perspective”

Masato Nakagawa (Denso Corporation, Fellow, Hiroshima University, Guest Professor, Japan)

This paper introduces a new style of research and development with a unique process of engineering development based on the EU perspective. Two different fields will be separated in the new style: competition field and non-competition field. The former is a specific area encouraging companies to develop their unique technology as differentiation strategy, and the later stresses collaborations among different companies and organizations for spreading the standardization of common technologies. This new style with two different fields shows us a new direction of the engineering development in various engineering industry. In addition, this paper explains robot technologies in the manufacturing of automotive sector in terms of smart manufacturing concept.



OS abstracts

OS1 Human-Machine Interface Application (7)

Chair Norrima Mokhtar (University of Malaya, Malaysia)

Co-Chair Heshalini Rajagopal (UCSI University, Malaysia)

OS1-1 Arduino Based Smart IoT Food Quality Monitoring System

Ashraf Ali Jamal Deen¹, Thivagar Chettiar Sarawanan¹, Heshalini Rajagopal², Devika Sethu¹, Neesha Jothi², Raenu Kolandaisamy²

(¹Manipal International University, Malaysia), (²UCSI University, Malaysia)

Food safety and hygienic as well as health are significant issues to stop food wastage. The high quality of the food requires to be kept track of and it should be also protected against deteriorating and decaying by the climatic variables like temperature level, humidity, and dark. In this paper, a comparable food quality monitoring tool will be created that will keep watch of ecological factors like temperature level, moisture, alcohol web content as well as exposure to light for fruits and vegetables. The system is built on Arduino UNO where it is interfaced with various sensors like DHT-22 to keep track of temperature level and humidity, MQ3 to identify alcohol material as well as LDR to gauge direct exposure to light. It sends the measured sensor data to an IoT system via ESP8266 Wi-Fi Module. The IoT system will certainly be made use of for logging and checking sensing unit data and this is beneficial in monitoring the food storage from anywhere and anytime.



OS1-2 Development of Image Quality Assessment (IQA) For Haze Prediction

Heshalini Rajagopal¹, Sayanth Sudheer², Neesha Jothi¹, Keoy Kay Hooi¹, Norrima Mokhtar³

(¹UCSI University, Malaysia), (²Manipal International University, Malaysia),

(³University of Malaya, Malaysia)

Haze is a term that is widely used in image processing to refer to natural and human activity-emitted aerosols. It causes light scattering and absorption, which reduce the visibility of captured images. This reduction hinders the proper operation of many photographic and computer vision applications, such as object recognition/localization. Therefore, an approach for haze density estimation is highly demanded. This paper proposes a model that is known as the haziness degree evaluator to predict haze density from a single image without reference to a corresponding haze-free image. The proposed model quantifies haze density by optimizing an objective function comprising haze-relevant features that result from correlation and computation analysis.



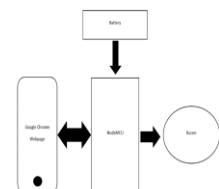
OS1-3 Development of IoT based Key Finder

Sayanth Sudheer¹, Heshalini Rajagopal², Azam Mohammed Al-Qussari¹, Norrima Mokhtar³, Neesha Jothi², Raenu Kolandaisamy²

(¹Manipal International University, Malaysia), (²UCSI University, Malaysia),

(³University of Malaya, Malaysia)

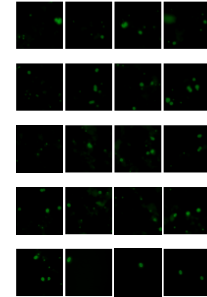
Typically, we misplace our keys and hunt for them throughout the home, eventually locating them with much difficulty after a long search. Therefore, we propose to develop a basic IoT-based Key finder utilizing NodeMCU, Buzzer, and Battery in this paper. In this paper, the development of key chain which can be attached to the keys will be explained. The paper also includes the creation of a website dedicated to the search for the missing keys. The missing keys can be located using a mobile phone's Google Chrome browser. When the webpage is enabled to find the missing keys, the designed IoT-based keychain is equipped with a buzzer that will make a beep sound. The developed IoT based key finder is important in terms of keeping track of the keys and could also save time.



OS1-4 Quality assessment for microscopic parasite images

Muhammad Amirul Aiman Bin Asri¹, Norrima Mokhtar¹, Heshalini Rajagopal², Wan Amirul Wan Mohd Mahiyiddin¹, Yvonne Ai Lian Lim¹, Masahiro Iwahashi³, Anees ul Husnain¹
(¹University of Malaya, Malaysia), (²UCSI University, Malaysia), (³Nagaoka University of Technology, Japan)

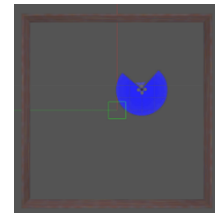
Water sample inspection is crucial for treated water monitoring, the quality of microscopic parasite images such as Giardia and Cryptosporidium need to be examined during treated water inspection. In this work, the subjective and objective evaluation of parasite images were performed. Parasite image database consisting of 20 reference images and 360 distorted images were used in the evaluation. The distorted images were generated from the reference images by applying distortion to the reference images with Gaussian White Noise and Motion Blur, at 9 levels of distortions. Twenty subjects scores obtained were transformed into Mean Opinion Score (MOS). In the objective evaluation, six Full Reference-IQA (FR-IQA) metrics, namely MSSIM, SSIM, FSIM, IWSSIM, GMSD and VIF were used to evaluate the distorted images. The subjective MOS scores were used as the benchmark to determine the most suitable objective IQA to assess parasite images. It was found that MSSIM is the most suitable IQA to assess parasite images distorted with Gaussian White Noise and Motion Blur.



OS1-5 A study on the Impact of Limitations in Multi-Rotor UAVs on Coverage Path Planning

Anees ul Husnain¹, Norrima Mokhtar¹, Noraisyah Mohamed Shah¹, Mahidzal Dahari¹, Muhammad Syazni¹
Ikmal Ramlee¹, Heshalini Rajagopal², Masahiro Iwahashi³
(¹University of Malaya, Malaysia), (²UCSI University, Malaysia), (³Nagaoka University of Technology, Japan)

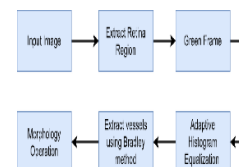
Search and explore missions through patrolling UAVs need effective strategies for area coverage. Various methodologies for coverage path planning were explored and analyzed through ROS-Gazebo simulation environment using Hector quadrotor model. Considering the impact of hardware limitations, simulations were conducted, for such missions where the UAV is needed to switch frequently between search and localize modes. This study investigated raster-scan exploration, expanding spiral search and zigzag pattern coverage to analyze the impact of limitations from Hector UAV on these models. The evaluation parameters were percentage of covered area, number of turns and time taken by the UAV.



OS1-6 Blood Vessels Segmentation in Eye Fundus Using Image Processing Algorithms

Obaid Al-quraan, Hiam Alquran, Mohammed Alsalatie, Wan Azani Mustafa, Wan Khairunizam
(University of Malaysia Perlis, Malaysia)

The retinal blood vessels have a huge impact on the diagnosis of eye diseases in addition to other systematic diseases in the human body. In this paper, we presented an automated segmentation method to extract retinal blood vessels, starting with preprocessing, then passing the image into segmentation stage using Bradley technique, and lastly, morphological operations. The proposed method was assessed and tested on STARE dataset, followed by comparing the auto-segmented images to the manually segmented ones. The comparison results Accuracy, Sensitivity, and Specificity were 94.63%, 95.02%, and 80.73% respectively.



OS1-7 Automated Diagnosis of Eye Fundus Images

Ala'a Zyout, Hiam Alquran, Wan Azani Mustafa, Mohammed Alsalatie, Aaa Al-Badarneh, Wan Khairunizam
(University of Malaysia Perlis, Malaysia)

Eye disease is a severe health problem. Advanced stages of the disease may lead to vision loss. Early detection may limit the development of the severity and enhance the chance of treatment. Computer-aided diagnosis (CAD) is the state-art-technology. This paper proposes a CAD system that combines image processing techniques and artificial intelligence. The proposed method used the green channel of fundus eye images to extract the most representative features by the trained convolutional neural network to classify five eye diseases of fundus images. The build CAD system exploits deep learning and support vector machine classifier to achieve a highly accurate model of 98% for five types of eye diseases.



OS2 Intelligent Life and Cybersecurity (6)

Chair I-Hsien Liu (National Cheng Kung University, Taiwan)

Co-Chair Chu-Fen Li (National Formosa University, Taiwan)

Co-Chair Chuan-Kang Liu (National Chin-Yi University of Technology)

OS2-1 The Dam Gate Cybersecurity Testbed

Chen-Yu Lee, I-Hsien Liu, Meng-Wei Chang, Jung-Shian Li (National Cheng Kung University, Taiwan)

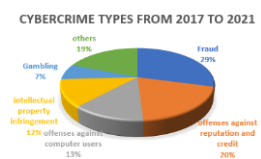
The testbeds are very important for cybersecurity research on critical infrastructure. In today's drastic climate change, the dam gate control system is a very important part of the critical infrastructure for people's livelihood. In traditional research, because the real control system cannot be used directly, most of the research can only be carried out in a simulation way. The research based on simulation alone lacks practical value due to too many assumptions. This research was supported by the Water Resources Agency, Ministry of Economic Affairs and National Science and Technology Council in Taiwan. The gate control cybersecurity testbed was built with a blueprint of the real world.



OS2-2 Domain Name Infringement in Taiwan

Shih-Chin Lin (Ming Chuan University, Taiwan)

Registering a domain name can assist in attracting new customers and in cultivating a strong market presence. However, when the desired domain name has been registered by someone else or is similar to a trademark, proceeding with registration could infringe upon an existing domain name or a trademark. This is so-called domain name Infringement, which is often accompanied by trademark infringement or a criminal act. This study thoroughly examined the research reports published by the TWNIC and relevant authorities to gain an understanding of domain name Infringement in Taiwan, ultimately revealing that domain name “.tw” infringement has not yet gained its due attention in Taiwan.

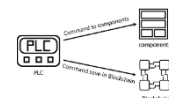


OS2-3 Device's Operation Tracking using Blockchain in Industrial Control System

Chien-Hsin Wu, I-Hsien Liu, Jung-Shian Li (National Cheng Kung University, Taiwan)

Chu-Fen Li ((National Formosa University, Taiwan)

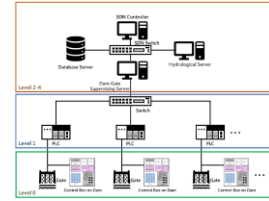
Many producing, monitoring and controlling needs are met by using programmable logic controllers. But there is no effective mechanism to audit PLC behavior. So this research designed a mechanism based on Blockchain for the purpose of effectively recording the commands and response actions received by the PLC. Due to the characteristics of the blockchain, the integrity of the data is also guaranteed.



OS2-4 Strengthen the security of the Industrial Control System using SDN technology

Min-Wei Huang, I-Hsien Liu, Hsin-Yu Lai, Meng-Huan Lee, Jung-Shian Li
(National Cheng Kung University, Taiwan)

In the field of OT, most of the network architectures operated in the way of isolation from internal and external networks. Only firewalls are installed on the external network without any protection measures for the internal network. In this paper, we leverage a Software-defined network (SDN) with an industrial control system (ICS), so controllers can manage the equipment and keep track of each switch and its connection with the programmable logic controller (PLC) in the ICS. Additionally, by adding flow entries, only the critical flows can be allowed. So the transmission between the PLC and Human Machine Interface (HMI) can be protected. The transmission quality of the ICS and its availability can be improved.



OS2-5 Fake Base Stations threats in 5G Standalone Networks

Meng-Huan Lee, I-Hsien Liu, Jung-Shian Li (National Cheng Kung University, Taiwan)

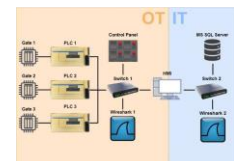
With 5G technology, traditional industrial and business equipment can now be connected wirelessly in a non-public network separated from public mobile services. Benefit from features such as high bandwidth, massive machine-type communications, and edge computing, while being able to control their own private 5G networks. But fake base stations or IMSI-Catchers used by law enforcement and hackers may collect private information and cause disruptions in cell services even if they're not public. In this research, we will analyze existing attack methods and detection mechanisms. And look at how those threats can affect the devices and operations in 5G non-public networks.



OS2-6 Cyber-Physical Security Testbed for River Basin Gate Control System

Meng-Wei Chang, I-Hsien Liu, Jung-Shian Li (National Cheng Kung University, Taiwan)

Due to the flourishing development of critical infrastructures in recent years, increasing importance has been attached to the security of the Cyber-Physical System (CPS) of the infrastructures. Machine learning technology nowadays is evolving rapidly, and is widely implemented in detecting or preventing such attacks. As a result, This research constructs a Testbed to collect relevant data sets to support machine learning requirements, such as training models and analyzing attacks, etc.



OS3 Advanced Information Processing Applications (4)

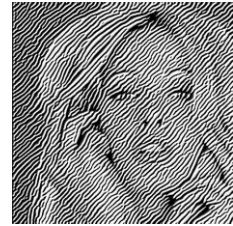
Chair Toru Hiraoka (University of Nagasaki, Japan)

Co-Chair Masaharu Hirota (Okayama University of Science, Japan)

OS3-1 Generation of Arbitrarily-Oriented Ripple Images Using Smoothing Filter with Translated Window

Shogo Noma, Toru Hiraoka (University of Nagasaki, Japan)

A non-photorealistic rendering method for automatically generating ripple images from photographic images using region-division smoothing filter has been proposed. Ripple patterns are composed of continuous lines with fluctuations, and ripple images are expressed by superimposing ripple patterns on photographic images. To create ripple images that give different visual effects, this paper develops a method for generating ripple patterns with a texture different from the conventional method. The proposed method is executed by an iterative calculation using smoothing filter with the translated window. In the proposed method, the orientation of ripple patterns can be arbitrarily controlled by changing the amount of translation of the window used in smoothing filter. To verify the effectiveness of the proposed method, an experiment using various photographic images was conducted. Additionally, an experiment to visually examine how ripple patterns generated by changing the values of the parameters in the proposed method change.



OS3-2 Generation of Moire-Like Videos from RGB-D Videos

Sho Enomoto, Toru Hiraoka (University of Nagasaki, Japan)

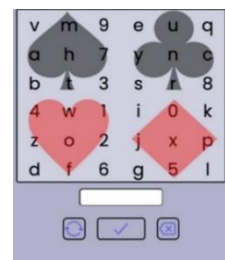
A non-photorealistic rendering method has been proposed to generate moire-like images from photographic images using bilateral filter and unsharp mask. Extensions to the conventional method have also been proposed to generate moire-like videos from videos or to generate moire-like images from RGB-D images. In this paper, a method is proposed to generate moire-like videos from RGB-D videos. Flickering is a problem in NPR videos, but the proposed method can suppress flicker. Through experiments using an RGB-D video taken by the authors, the flicker of moire-like videos generated by the proposed method was evaluated visually and quantitatively.



OS3-3 A Proposal of Shoulder-surfing Attack Countermeasure Method with Improved Usability

Yoshihiro Kita, Shingo Nakamura (University of Nagasaki, Japan)

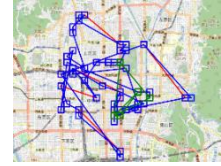
Shoulder-surfing attacks are one of the most familiar password exploitation attacks. It is vulnerable to be attacked while unlocking a smartphone screen. The smartphone users need to take countermeasures against that attack. The fingerprint-based screen unlock system has become the norm, but it is not safe, as there has been increased in the user's fingerprint theft. The existing methods to prevent the shoulder-surfing attacks are effective against such attacks, but many of them are complicated to operate, and difficult to use. In this paper, we propose the prevent method for surfing attacks that it is easy to use. The tool's user operates the lower buttons, moves characters to on the trump's marks in specified advance. The user can input as likely as the password. On the other hand, the attacker does not understand the input characters only shown these buttons has been pushed.



OS3-4 User-movement Estimation in Social Media Sites Based on Seq2Seq Model

Masaharu Hirota (Okayama University of Science, Japan)

Many tourists upload content about tourist attractions to social media sites. The location information annotated on the content represents the user's movement. This movement information is an important source of information that can be used for recommendations and advertisements. However, users do not consistently post content about all the places they visit on social media. Therefore, this study aims to develop a method to estimate the location of users' movements. The proposed method uses a Seq2Seq model, which learns the reconstruction of users' movement trajectories.



OS4 Artificial Life and Intelligent Systems (4)

Chair Chung-Wen Hung (National Yunlin University of Science and Technology, Taiwan)

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

OS4-1 Interactive Beating Drum Unity Game

Chung-Wen Hung, Cheng-Lung Ko, Wen-Huei Chou
(National Yunlin University of Science and Technology, Taiwan)

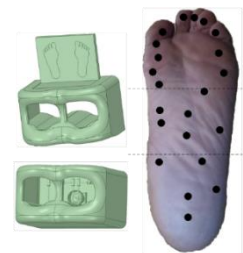
Interactive Beating Drum Unity Game is proposed in this paper. The pandemic forced individuals to maintain a prescribed social distance from others, and this way may ignore the individual's mental health and social needs, especially for the elderly. The Unity Engine is used to implement the system to provide a sport and social plane. And Bluetooth Low Energy (BLE) chip is adopted to transmit the beating signal to Unity Engine what following the Bluetooth (BT) protocol. Then the position beat by users will be showed on the user interface tablet. There are two play mode be implemented: single player mode and multiplayer mode, and the latter will include social function. The users are required to drum in short time interval accurately, and the game award points are evaluated for accuracy. The experimental results show the system workable, and the subjects unanimously stated that the operation of the game Easy-to-Use.



OS4-2 Error Backpropagation Neural Network Based Image Identification for a Foot Massage Machine and Its Mechanism Design

Chun-Chieh Wang (National Yunlin University of Science and Technology, Taiwan)

In the past ten years, many companies have developed different styles of foot massage machines. At present, the common massage products on the market include roller type and pressing type. However, it is very difficult to accurately stimulate all acupuncture points for different sizes of feet. Besides, the massage roller cannot be controlled independently. Therefore, a novel computer vision technology is proposed to identify the foot acupuncture points by error backpropagation neural network (EBNN) in this paper. First, we use cameras to capture the sole of users' soles and execute image preprocessing procedures to segment the region of interest (ROI) of soles. We map foot acupuncture points to foot images to obtain reference massage positions. Second, the YCbCr color space is used to separate the brightness to complete the segmentation of the foot image in the skin detection. Moreover, EBNN is used to train users' soles-image sets to improve the success rate of image segmentation. Finally, to improve the rate of image recognition and user convenience, a foot massage machine was redesigned. Experimental results validate the superiority and practicality of the proposed image identification method for foot massage machines.



OS4-3 Cross-domain sharing of robots in the community caring and practice of university social responsibility

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

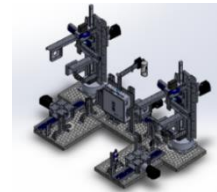
This paper focuses on community caring and social practice that assisting robot education development in rural schools to echo the two goals of the United Nations' SDGs (Sustainable Development Goals)–"Goal 4: Quality education" and "Goal 10: Reduce inequality". At the same time, in response to the scientific and technological literacy-oriented needs of the Curriculum Guidelines of 12-Year Basic Education in 2019, it is shown how to assist rural schools in Tainan City of Taiwan to develop computational thinking and cross-domain applications of robots under the COVID-19. Four robot education suites including LEGO Mindstorms EV3, Makeblock mBot, mBot2, and VEX IQ are applied in the rural schools. The dilemma and solutions of robot education in rural schools are also discussed in this article. Universities, non-profit organizations and robot equipment vendors work together to practice social responsibility.



OS4-4 Research on Design of Implementation Mechanism for Similar Production Line

Chia-Nan Ko, Yi-Yu Li, Ting-Ru Ko, and Ting-Yi Chen (Nan Kai University of Technology, Taiwan)

Recently, enterprises are actively investing in the research and development of practical technologies for similar production line organizations. Faced with various technological innovations in smart automation. In this paper, the object is to research and integrate intelligence through practical functional solutions to design and establish a production line implementation mechanism. We use the myRIO controller as the main core to plan the factory automation production line structure through the practical function research for building similar production line implementation organizations. In this paper, combining theoretical methodology and practical experiments to construct institutional design, electromechanical system and intelligent automation procedure. Evaluate the efficiency of the design automated production lines to improve the capabilities of similar production lines.



OS5 Intelligent Systems and Control (5)

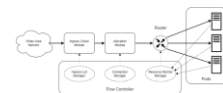
Chair Kuo-Hsien Hsia (National Yunlin University of Science and Technology, Taiwan)

Co-Chair Chian C. Ho (National Yunlin University of Science and Technology, Taiwan)

OS5-1 Using Multithreaded Load Balancer to Improve Connection Performance in Container Environment

Pang-Wei Tsai, Hong-Yu Wei, Yu-Chi Hsu (National Central University, Taiwan)

The virtualization technology has been widely used in computer system for a long period of time, it provides resource allocation, flexibility and efficiency by using hypervisor to manage virtual machine. Nevertheless, for lightweight workload, the container gains more advantages on transferability, rapid deployment, and robust ecosystem supports. Because of these characteristics, container is commonly used in edge computing and microservice to fulfill essential resource requirements. However, when service on the container receives too much requests without limitation, it may meet degrading effect which lowers down its performance and makes host network to be stuck. Hence, this research aims to focus on investigating this issue for finding better strategy to improve the connection performance of http-based service application with multithreaded load balancer.



OS5-2 Electronic Biometric Detector and Body Composition Index in Predicting Disease Risk

Wen-Fu Yang, Chung-Te Ting (Chang Jung Christian University, Taiwan)

According to the World Health Organization, COVID-19 has killed 14.9 million people worldwide by 2021. According to statistics from the World Obesity Alliance, if the domestic obese population exceeds 50% (three high diseases), the country's COVID-19 mortality rate will be 10 times higher. There seems to be a close relationship between obesity and the risk of hospitalization and treatment. In this study, the electronic biometric detector was used to collect the response values of the body cells of adults in Taiwan. Through the comparison and analysis of big data, the functional status of each organ system in the human body was calculated and compared with the body composition index. It was found that there is a high correlation between the two. The results of this study may provide feasibility of different health risk assessments.



OS5-3 Exploring Consumers' Intention to Use Mobile Payment APPs Based on Technology Acceptance Models - Taking Line Pay as an Example

Chun -Nan Chen, Yu-Sheng Huang (Chang Jung Christian University, Taiwan)

According to the statistics of the Financial Supervisory Commission, as of the end of March 2021, the cumulative transaction amount of the latest five mobile payments has reached 503.2 billion. LINE, a communication software that is inseparable from our lives, has launched a service - "LINE Pay", which has become the most commonly used mobile payment by Taiwanese consumers. This research mainly takes people who have installed LINE PAY as the research object, and uses three factors that may affect consumers' consumption patterns, such as "Brand Association", "Consciousness Risk" and "social impact", to explore consumers' usage intentions for mobile payment apps, hoping to gain a deeper understanding of their usage intentions.



OS5-4 Optimization of Robot Path and IoT Communication Path Based on Artificial Intelligence

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

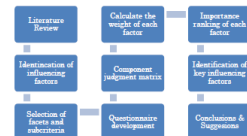
The Internet of Thin (IOT) and robotics are very popular research topics, and they have begun to enter people's daily life, and both robots and the Internet of Things have the problem of path optimization. For robots, Although the map can be established in advance and the robot can avoid obstacles, the robot's travel map is likely to change at any time, and a new path needs to be generated at this time. The Internet of Things will provide users or monitoring system information with the best transmission speed path. Based on the above requirements, this paper uses artificial intelligence to optimize the path between robots and the IoTs question. The method expected in this paper is to parameterize the length of each path, the number of obstacles, whether there will be collisions, etc., and then use the artificial intelligence algorithm of multi-tree and LSTM to find the best path.



OS5-5 Key Success Factors Affecting Family Members' Intention to Withdraw from Life-sustaining Treatment for Long-term Ventilator-dependent patients: Nursing Professionals' Perspective

Hsiao-Fang Chen, Jin-Yuan Chern (Chang Jung Christian University, Taiwan)

Nursing professionals are major caregivers of VDPs. They have abundant experience in observing VDP family members' reflections when confronting LST withdrawal-or-not issues. Therefore, this study aimed to explore, from the perspective of nursing professionals, the key success factors which would significantly affect VDPs' family members' decision about withdrawal from LST. This is a quantitative survey research study. Nursing professionals from a government-affiliated region-level teaching hospital in southern Taiwan were potential participants. First, based on an action-research design, a structured questionnaire composed of three constructs (18 sub-constructs) were developed through a literature review. Second, senior nursing professionals with abundant experience in caring VDPs were recruited for data collection. Third, the analytic hierarchy process (AHP) was adopted to collect and analyze the participants' responses. Overall, "subjective norms" was considered relatively important than "behavior/attitude" and "behavior control". Further, "family consensus" was considered as the first priority, followed by "quality assurance" and "individual value". On the contrary, "grief counseling", "communication timing" and "ethics and legal" were with the least priorities. Family consensus and quality assurance are the two key factors when family members confront the decision whether to withdraw the LST for their beloved person.



OS6 Modelling and Simulation in Robotics (8)

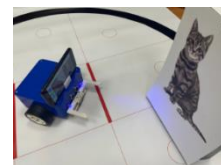
Chair Evgeni Magid (Kazan Federal University, Russia)

Co-Chair Kuo-Hsien Hsia (National Yunlin University of Science & Technology, Taiwan)

OS6-1 Android Based Educational Mobile Robot Design and Pilot Evaluation

Elvira Chebotareva, Maksim Mustafin (Kazan Federal University, Russia)

Educational robotics is a powerful tool for STEM and STEAM education. However, in practice, while trying to introduce educational robotics into a well-established educational process, a number of significant problems might arise. These include a high cost of an equipment and a lack of necessary competencies in the field of educational robotics among teachers. In this paper, we describe a concept of an inexpensive mobile robot equipped with a mobile device running Android operating system. We present sample projects that demonstrate how to extend capabilities of the educational mobile robot through the use of the mobile device. The proposed approach was preliminary evaluated in "Educational robotics" Bachelor level course and "Introduction to robotics" Master level course at Kazan Federal University.



OS6-2 Virtual Collaborative Cells Modelling for UR3 and UR5 Robots in Gazebo Simulator

Ramir Sultanov, Shifa Sulaiman, Tatyana Tsoy, Elvira Chebotareva
(Kazan Federal University, Russia)

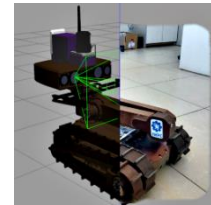
This paper presents virtual models of collaborative cells for two industrial collaborative robots UR3 and UR5 in the Gazebo simulator. Typically, the UR3 and UR5 robots are used by enterprises for packaging, assembly and sorting. Modeling and virtual experiments are an important stage in production processes planning, which involves joint human-robot work. Such models allow to plan safe human-robot interactions within a joint workspace and, if required, to rearrange the workspace. Our models of collaborative cells were adapted to several typical cases of joint human-robot operation scenarios and could be used in engineering design and testing for human-robot interaction in the field of production processes.



OS6-3 New Features Implementation for Servosila Engineer Model in Gazebo Simulator for ROS Noetic

Alexandra Dobrokvashina¹, Shifa Sulaiman¹, Timur Gamberov¹, Kuo-Hsien Hsia², Evgeni Magid¹
(¹Kazan Federal University, Russia)
(²National Yunlin University of Science & Technology, Taiwan)

Virtual experiments play an important part in robotics allowing to reproduce complex environments, perform complicated and risky tasks. Yet, a virtual model is not always a one-time build action and it requires revisions in a timely manner as operating systems and dependent software evolves. This article presents a number of technical updates of the Servosila Engineer crawler type robot virtual model. The model evolution necessity was caused by a migration from an outdated robot operating system (ROS) of Melodic version to the modern ROS Noetic version. In addition to migration issues, for the robot virtual model a new onboard torch control unit and a robot head aligning unit were developed.



OS6-4 Features of Interaction Between a Human and a Gestures-controlled Collaborative Robot in an Assembly Task: Pilot Experiments

Maksim Mustafin¹, Elvira Chebotareva¹, Hongbing Li², Martínez-García Edgar A³, Evgeni Magid^{1,4}
(¹Kazan Federal University, Russia) (²Shanghai Jiao Tong University, China)
(³The Autonomous University of Ciudad Juarez, Mexico) (⁴HSE University, Russia)

This paper presents results of pilot experiments that were run to study a human interaction with the UR5e collaborative 6-axis robot manipulator in a cooperative assembly task. The participants controlled the equipped with a screwdriver UR5e robot using computer vision and gestures. The purpose of the experiments was to identify the features of user interaction with the UR5e robot controlled with gestures in a task of a complex object assembly. Ten people took part in the experiments. The results of the experiments allowed to conclude on practical efficiency of cobots in joint assembly tasks. In addition, we identified preferable by the users location areas during the assembly task.



OS6-5 Modeling of Human Actions in a Collaborative Robotic Space Using AR601M Humanoid Robot: Pilot Experiments in the Gazebo Simulator

Aidar Zagirov, Artem Apurin, Elvira Chebotareva (Kazan Federal University, Russia)

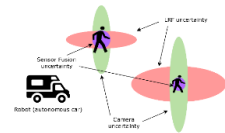
To guarantee a safe human-robot collaboration, a collaborative system development requires a significant amount of real world experiments. Yet, it is critical to avoid injury risks for participants of such experiments. The risks could be reduced by introducing a virtual experiments' stage to detect mistakes in a robot behavior prior to the real world experiments. This paper presents a virtual model of a humanoid robot AR601M in the Gazebo simulator. Unlike the standard human models in the Gazebo, this model allows to simulate the gross and fine motor skills of a human and could be used when performing various human actions in collaborative robotic cells.



OS6-6 Modern Methods of Map Construction Using Optical Sensors Fusion

Ramil Safin¹, Tatyana Tsoy¹, Roman Lavrenov¹, Ilya Afanasyev¹, Evgeni Magid^{1,2}
(¹Kazan Federal University, Russia) (²HSE University, Russia)

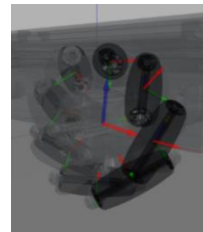
Map construction, or mapping, plays an important role in robotic applications. Mapping relies on inherently noisy sensor measurements to construct an accurate representation of a surrounding environment. Generally, individual sensors suffer from performance degradation issues under certain conditions in the environment. Sensor fusion allows to obtain statistically more accurate perception and to cope with performance degradation issues by combining data from multiple sensors of different modalities. This article reviews modern sensor fusion methods for map construction applications based on optical sensors, such as cameras and laser range finders. State-of-the-art mapping solutions built upon different mathematical theories and concepts, such as machine learning, are considered.



OS6-7 Omniwheel Chassis' Model and Plugin for Gazebo Simulator

Artem Apurin¹, Bulat Abbyasov¹, Alexandra Dobrokvashina¹, Yang Bai², Mikhail Svinin², Evgeni Magid¹
(¹Kazan Federal University, Russia) (²Ritsumeikan University, Japan)

Increasing a mobility of a robot in a limited space or in a presence of a large number of people is an important task. Mecanum wheels could provide the required high flexibility locomotion in any direction. This article presents a virtual model of an omniwheel robot in the Gazebo simulator. Freely rotating rollers were implemented to simulate the robot motion. We developed a four-wheel mecanum mobile robot plugin controls the robot by publishing linear velocity data along X and Y axes, and angular velocity data along Z-axis. The plugin could optionally publish a standard ground-truth odometry of the Gazebo or a calculated in real time wheel odometry. The open source code is extendable for similarly structured platforms and is available for a download via GitLab.



OS6-8 Using Optical Sensors for Industrial Human-Robot Interaction in Gazebo Environment

Elaman Kidiraliev, Roman Lavrenov (Kazan Federal University, Russia)

This paper presents an overview of a robot operating system based architecture for human-industrial robot interactions using peripheral optical sensors for real-time object detection and collision avoidance with an industrial robot in the virtual world of the Gazebo simulator. Machine vision plays a huge role in production automation, and develop a system based on Kuka KR3 industrial robot for detecting and tracking a human and other objects in a working area using optical sensors. The ability to work in low light and crowded conditions, as well as the ability to reconstruct a method of execution of a task, while maintaining control of a robot. This work considers several optical sensors and a comparative analysis.



OS7 Advanced Control Systems (7)

Chair Takuya Kinoshita (Hiroshima University, Japan)

Co-Chair Takao Sato (University of Hyogo, Japan)

OS7-1 Predictive Functional Controller Design with Disturbance Observer and Its Application

Syota Yoshida, Shin Wakitani (Hiroshima University)

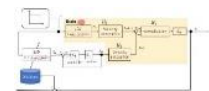
This paper discusses predictive functional controller (PFC) design using a disturbance observer for a system with a dead time. The PFC is a kind of model predictive controller that is an effective method for systems with a dead time. However, in PFC, the control performance is strongly affected by the accuracy of the designed model. Therefore, this research proposes a method that the PFC maintains good control performance under the modeling error by using the disturbance observer that can estimate the disturbance even if a system has dead time. The effectiveness of the proposed control scheme is evaluated by experimental results.



OS7-2 Study on a Construction of Velocity Perception Model and Kansei Feedback Control System in Active Behavior

Sota Takemura, Takuya Kinoshita, Toru Yamamoto (Hiroshima University, Japan)

In Japanese, there is a word "Kansei" which means "feelings, impulses, and desires stimulated by the senses. In addition, there is a field called Kansei Engineering which is recognized worldwide. In the case of human-operated machines, it is necessary to consider Kansei such as whether the operability is comfortable. Therefore, this paper describes a model that focuses on Kansei and control based on the model. It has been proposed that a human Kansei model based on the Weber-Fechner law. However, the Weber-Fechner law is applied to stimulus such as sound, smell, and light. The model needs to be improved to reduce the error between the velocity assumed in the brain and the actual velocity of the machines. Therefore, this paper proposes a new Kansei model that focuses on the relationship between the actual velocity and the perceived velocity when a human actively operates the machines.

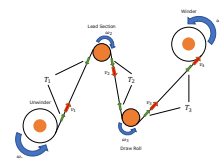


OS7-3 Design of a Database-Driven Control for a Web Conveyor

Atsushi Takatani, Takuya Kinoshita, Toru Yamamoto (Hiroshima University, Japan),

Tomohiro Hirakawa, Hiroki Hamamoto, Takashi Ochiwa, Hideki Tomiyama (Japan Steel Works, Ltd.)

Web conveying equipment used in the processing of plastic films and other materials is a large-scale system consisting of multiple drive rolls, and it is difficult to understand the system characteristics during driving. This study proposes a database-driven control method based on the FRIT method to implement motor control of this equipment without relying on system identification. In order to reduce the computational load, the concept of database design based on similarity is incorporated. The database, which holds the operation results, enables the web conveyor's operation output to quickly reach the reference signal.



OS7-4 Development of IoT self-tuning control device using Wi-Fi

Shinichi Imai (Tokyo Gakugei University, Japan)

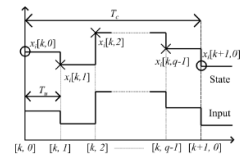
In this paper, development of IoT control device using Wi-Fi. In recent years, IoT has been attracting attention, and there are growing expectations in the industrial world for the utilization of data obtained from many sensors. These data are stored in databases in real time through communication between sensors and the cloud and communicating with the cloud. Meanwhile, digital controllers are widely used in the process industry as general-purpose controllers. However, it is difficult to incorporate AI, machine learning, and databases into general-purpose controllers due to data memory limitations. Therefore, in this paper, we develop an IoT self-tuning controller using Wi-Fi. As a result of experiments, the controller and computer were connected via Wi-Fi, self-tuning was performed on the computer side, and the calculated PID gains could be sent to the controller to achieve control.



OS7-5 Consensus Control for Dual-rate Multi-agent Systems

Takaya Tanaka, Natsuki Kawaguchi, Takao Sato (University of Hyogo, Japan)

The present study discusses the consensus control multi-agent systems. In such systems, the consensus is achieved through the exchange of information between neighboring agents. In order for mobile systems to consensus with each other, they must be designed with power consumption in mind. Therefore, since communication consumes power, it is important that the communication interval be as long as possible. The present study proposes a design methodology for the consensus achievement of dual-rate multi-agent systems, where the update period of agents is shorter than the communication period.



OS7-6 Data-driven Control Experiments of a Quadrotor Drone

Tomonori Yao, Natsuki Kawaguchi, Takao Sato (University of Hyogo, Japan)

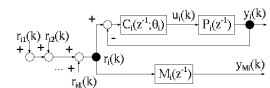
Multi-rotor unmanned aerial vehicle (UAV) have various advantages due to their high expected performance. Most conventional model-based design methods require the dynamic characteristics of UAV, whereas data-driven design methods allow the controller to be designed directly from flight data without a model. This study reports on the creation and flight experiments of a quadrotor drone with the aim of preparing an environment for implementing data-driven design for UAV. In addition, the usefulness of the controller directly designed from flight data is also reported.



OS7-7 Design of Data-driven Multi-agent Systems

Kenta Nagao, Natsuki Kawaguchi, Takao Sato (University of Hyogo, Japan)

This study discusses the consensus control of multi-agent systems. The consensus can be achieved when the closed-loop system of multi-agent systems is stable. In conventional model-based methods, since the controller is designed based on the dynamic characteristics of the agents, models of the agents must be used. On the other hand, this study examines data-driven design of multi-agent systems. In the proposed method, the controller of a multi-agent system is designed directly from the control data, where the controller structure is fixed. The usefulness of the proposed method is shown through numerical examples.



OS8 Intelligent Control (5)

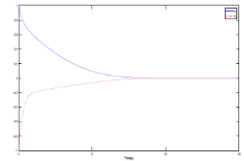
Chair Yingmin Jia (Beihang University, P.R.China)

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

OS8-1 A Self-triggering Control Based on Adaptive Dynamic Programming for Nonzero-sum Game Systems

Yibo Shi, Chaoli Wang (University of Shanghai for Science and Technology, China)

Recently, for the optimal control problem of nonzero-sum game systems, although it is discussed that these methods are event-triggered, it is still necessary to continuously monitor measurement errors during execution, which is difficult to achieve by hardware. In order to avoid continuous detection measurement errors, a self-triggered control based on adaptive dynamic programming is proposed to solve the optimal control problem for continuous-time nonlinear nonzero-sum game systems with unknown drift dynamics. Firstly, the principle of IRL method is used to avoid the requirement of system drift dynamics in the controller design. Then, to approximate the Nash equilibrium solution, a critic neural network is used to estimate the value function. Furthermore, a self-triggered adaptive control scheme is proposed according to Lyapunov theory to ensure the uniform ultimate boundedness (UUB) of the closed-loop system state. The self-triggered control obtained in this paper can calculate the next trigger point by the information of the current trigger moment.



OS8-2 Harmony of Agent System with Heterogeneity

Yunzhong Song¹, Weicun Zhang², Fengzhi Dai³, Huimin Xiao⁴, Shumin Fei⁵, Jichao Zhao⁶

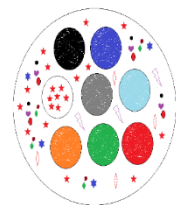
(¹Henan Polytechnic University, P.R.China) (²University of Science and Technology Beijing, P.R.China)

(³Tianjin University of Science and Technology, P.R.China)

(⁴Henan University of Economics and Law, P.R.China) (⁵South East University, P.R.China)

(⁶Tianjin University of Science and Technology, P.R.China)

This paper focuses on the integration of heterogeneous agents, also known as harmony of them, where heterogeneity emphasized so often. To advance the idea of heterogeneous agents, harmony of the agents, where homogeneity of the agent system turns into heterogeneity one at start, and then the heterogeneity turns back to homogeneity again after. Initiated from hybrid order agents, heterogeneity like social status, encapsulated agents will be introduced step by step. Finally, Chinese philosophy, which always inspires new ideas of thought, can be a good source of research topic. Conclusion that encapsulated agent is the capital Tao of agent systems was drawn from the paper.

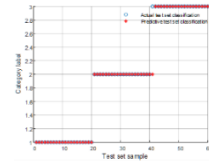


OS8-3 Apple Grading based on IGWO Optimized Support Vector Machine

Yi Zhao¹, Qunpo Liu^{1,2}, Yuxi Zhao¹, Yueqin Sheng¹
(¹Henan Polytechnic University, P.R.China)

(²Henan International Joint Laboratory of Direct Drive and Control of Intelligent Equipment, P.R.China)

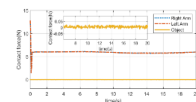
In order to improve the accuracy of apple external quality classification based on support vector machine, an improved grey wolf optimization algorithm IGWO was proposed by adding Logistic chaos mapping, nonlinear convergence factor and Cauchy variation to the grey wolf optimization algorithm. Firstly, different benchmark functions are used to test the improved IGWO algorithm. The test results show that the IGWO algorithm has improved the convergence speed and accuracy. Secondly, the image processing method is used to extract apple's external features as the data set. The improved grey wolf algorithm was used to optimize the penalty parameters and kernel parameters in support vector machine, and the optimal IGWO-SVM classification model was obtained. Finally, compared with the classification results of SVM and GMO-SVM, the results show that IGWO-SVM has the highest classification accuracy.



OS8-4 Cartesian Space Coordinated Impedance Control of Redundant Dual-Arm Robots

Yang Zhang, Yingmin Jia (Beihang University (BUAA), China)

This paper presents a cartesian space coordinated impedance control method to achieve coordination when a dual-arm robot operates an object. First, the relative positional and force errors when the two arms operate the object are defined. Then, these relative errors are introduced into the general impedance controller to achieve coordinated impedance control. Compared to the conventional impedance control, this scheme ensures the coordination between the two arms and reduces the contact force error between the end-effectors and the object.

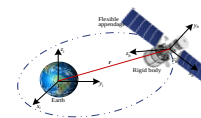


OS8-5 Disturbance Observer-based Anti-unwinding Control for Flexible Spacecrafts

Qian Sun¹, Yingmin Jia¹, Weicun Zhang²

(¹Beihang University (BUAA), China) (²University of Science and Technology Beijing, P.R.China)

The anti-unwinding control problem for the six-degrees-of-freedom (6-DOF) motion of the flexible spacecraft is studied in this paper. Firstly, the translation-rotation-vibration coupling motion of the flexible spacecraft is described by dual quaternion. Then, a nonlinear disturbance observer (NDO) is applied to estimate and compensate the lumped disturbances including the flexible vibration and unknown external disturbances. An anti-unwinding controller is designed based on the sliding mode technology. The stability of the closed-loop system is verified via Lyapunov method. Finally, numerical simulations indicate the effectiveness of the designed controller.



OS9 Intelligent Systems and Robotics – 1 (4)

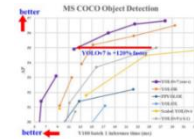
Chair Hucheng Wang (Tianjin University of Science and Technology, China)

Co-Chair Fengzhi Dai (Tianjin University of Science and Technology, China)

OS9-1 A Survey of Target Detection Based on Deep Learning

Hucheng Wang, Fengzhi Dai, Min Zhao (Tianjin University of Science and Technology, China)

Object detection is a hot topic in the field of visual detection. Deep learning can greatly compensate for the defect that traditional methods sacrifice real-time for improving accuracy. This paper mainly introduces the main networks and methods of two-stage deep learning algorithm and single-stage deep learning algorithm in the field of target detection. The advantages and disadvantages, usage scenarios and development of each network are described in detail. Finally, the follow-up development in this field is prospected.



OS9-2 A Design of New Air Ground Cooperative Unmanned Transportation System

Hucheng Wang, Min Zhao (Tianjin University of Science and Technology, China)

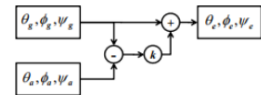
With the development of science and technology, the shortage of human resources in the labor market and the increase of human costs, intelligence and unmanned logistics have become the mainstream development trend. This paper introduces a new type of space ground coordinated unmanned transportation system, which aims to solve the problems of liberating labor, reducing the operating costs of logistics enterprises, reducing the contact between people, and impeding the spread of the COVID-19 epidemic. This paper introduces the research background and advantages of the system, and describes the selection and working principle of the system in detail.



OS9-3 Attitude Solution of Quadrotor UAV

Siyuan Liu, Zhihao Zhao, Haoran Gong (Tianjin University of Science and Technology, China)

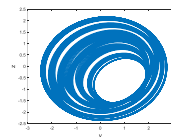
In this paper, the attitude solution of a quadcopter UAV is introduced, and the integrated circuit designed by the UAV is verified. The angular velocity data and acceleration data required for this solution are provided by two modules: gyroscope and accelerometer. In this attitude control, three values are used: quaternions, rotation matrices, and Euler angles. Through data algorithm analysis, integrated circuit design and program design, the feasibility of the attitude algorithm is proved. On this basis, the problem of combining two systems: attitude flight and fixed height and fixed point is solved.



OS9-4 A four-dimensional conservative chaotic system and its application in image encryption

Hongyan Jia, Wei Li, Jingwen Liu (Tianjin University of Science and Technology, Tianjin, China)

In this paper, based on numerical analysis, NIST test and FPGA implementation, a four-dimensional conservative chaotic system is firstly analyzed to investigate and find an applicable pseudo-random signal generator for image encryption algorithm. It is found that the four-dimensional conservative chaotic system shows some complex dynamics, such as multi-stability, strong pseudo-randomness, and physical characteristics. Finally, based on pseudo-random sequences and two-dimensional discrete wavelet transform, an image encryption algorithm is realized. Both the experiment results and the security analysis show that the algorithm show good encryption characteristics, which further prove the image encryption algorithm.



OS10 Intelligent Systems and Robotics – 2 (4)

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

Co-Chair Yande Xiang (Tianjin University of Science and Technology, China)

OS10-1 A Research on Image Defogging Algorithm Based on Enhancement

Fangyan Li, Haokang Wen, Chang Sheng, Min Zhao (Tianjin University of Science and Technology, China)

In order to solve the problem of low contrast image and loss of image details in the foggy weather, the image defogging technique is used to remove the noise in the image and improve the image contrast, so as to recover a clear and fog-free image. In this paper, we mainly introduce three image defogging algorithms: global histogram equalization, local histogram equalisation and the Retinex algorithm. The advantages and shortcomings of each algorithm are summarised through the study of the principles of each algorithm and the comparative analysis of the experimental result.

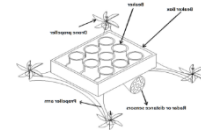


OS10-2 Autonomous Microcontroller-Based Aerial Water Sampling Device

Weifang Wang¹, Mingxia Kang², Ruming Kang³

(¹North Minzu University, China), (²Tianjin University of Commerce, China), (³Chongqing University, China)

Water quality testing starts with sampling. Traditional methods may cause water quality properties to change due to the limitation of sampling methods. In addition, it is difficult and risky to take samples in parts of special terrain, such as ravines and swamps, where manpower is difficult to reach. To this end, we combine a single-chip machine STM32-based sampling device with a UAV that can span complex terrain to solve the above problems. The characteristics of water quality without human intervention and equipment automation are of great significance.



OS10-3 Intelligent Electronic Guide Dog

Mengyu Liu, Yande Xiang, Zhi Qiao, Tao Zhu (Tianjin University of Science and Technology, China)

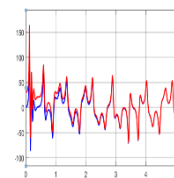
An intelligent mobile blind guide robot is designed in this paper. The robot is equipped with a variety of sensors and combined with the powerful computing power of the main control board to form a complete obstacle avoidance system to achieve autonomous navigation and obstacle avoidance in a complex environment. It controls GPS positioning through Jetson-Nano, plans the route, detects obstacles with the help of cameras and ultrasonic sensors, and gives users feedback through the alarm sound of the buzzer.



OS10-4 Research on Chaos Synchronization of Qi System and Lü System with Different Structures

Hanyuan Wang, Yiting Gao (Tianjin University of Science and Technology, China)

This paper introduces a three-dimensional chaotic synchronization method. The advantages and disadvantages of the synchronization controller designed by this method are analyzed. Firstly, the characteristics of two chaotic systems with different structures are studied. Secondly, the mathematical model is established, and the synchronization controller is designed by direct method, so that the two chaotic systems with different structures can be synchronized at different initial values. With the help of MATLAB, the error curve of the synchronous system is drawn when the synchronous controller acts on the response system.



OS11 Intelligent Systems and Robotics – 3 (4)

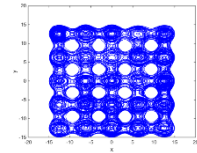
Chair Jiaxin Li (Tianjin University of Science and Technology, China)

Co-Chair Fengzhi Dai (Tianjin University of Science and Technology, China)

OS11-1 Generation and Analysis of a Multi-scroll Conservative Chaotic System

Jiaxin Li, Yong Liu, Min Zhao (Tianjin University of Science and Technology, China)

Chaos is one of the hot subjects in recent years. With the further study of chaotic systems, more and more chaotic systems have been found. Multi volume conservative chaotic system is a new kind of chaotic system, which has attracted extensive attention due to its complex dynamic characteristics. In this paper, we study a conservative chaotic system and introduce a sine function without multiple angles to make the conservative chaotic system generate multiple volumes, so as to construct a multiple volume conservative chaotic system. The system generates one-dimensional linear multi roll and two-dimensional grid like multi roll distributions by adjusting nonlinear functions.



OS11-2 A Design of Fire Detection Device Based on YOLOv5

Zhiyang Li, Yande Xiang, Haoyu Guo, Yu Chen, Wenxuan Pan, Fengzhi Dai
(Tianjin University of Science and Technology, China)

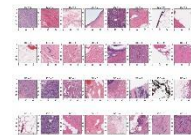
In recent years, fires have become more and more frequent, which has a great impact on people's production and life and even their lives. This paper designs a fire detection device based on YOLOv5, which is mainly composed of Raspberry Pi, OpenCV and buzzer. It can be widely used in narrow corridors, parking lots, shopping malls, forests and other scenarios. The device has the characteristics of high recognition rate, fast recognition speed and strong sensitivity, and has excellent recognition effect in fire detection.



OS11-3 Application of Convolutional Neural Network in Accurate Breast Cancer Identification

Zhiyang Li, Haoyu Guo, Yande Xiang, Wentao Kuang, Lu Chen
(Tianjin University of Science and Technology, China)

As one of the most common cancers in women, breast cancer has the highest incidence in the world. Nearly 600,000 people die from breast cancer each year, and early detection is essential for breast cancer treatment. In recent years, the rapid development of artificial intelligence has provided unprecedented ideas for the precise diagnosis and treatment of breast cancer. In this paper, the practical application of artificial intelligence convolutional neural network in breast cancer recognition is studied, which greatly improves the detection speed and saves a lot of time for doctors to further judge the condition.



OS11-4 Intelligent Infusion Service Based on Open MV

Haoran Gong, Zongyi Li, Qi Chu, Siyuan Liu, Feiyang Qu, Lu Wang
(Tianjin University of Science and Technology, China)

This paper presents an intelligent infusion service system designed to reduce the workload of doctors and nurses and for the health of patients. The system is applied to the drip stand to create a "new type of drip stand" that will effectively solve a number of problems. It is dedicated to: "intelligent infusion process, improving the efficiency of health care workers and reducing their work stress and psychological burden". It embodies the concept of economy and structural rationality.



OS12 Theory and Implementation of Neuromimetic Systems (2)

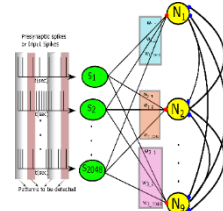
Chair Takashi Kohno (University of Tokyo, Japan)

Co-Chair Takuya Nanami (University of Tokyo, Japan)

OS12-1 Adaptive STDP Learning with Lateral Inhibition for Neuromorphic Systems

Ashish Gautam, Takashi Kohno (University of Tokyo)

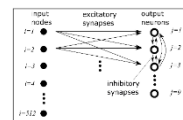
Implementing biologically plausible learning rules on neuromorphic chips is essential to explore the learning mechanisms in the brain. Spike-timing dependent plasticity (STDP) is one such rule but its multi-bit circuit implementation requires too much area. In our previous study, we proposed a bioinspired hardware-friendly learning rule named adaptive STDP and experimentally showed that its performance was similar to STDP learning in a very basic biologically plausible spike pattern detection task using a single neuron. In this study, we extend the adaptive STDP learning rule with lateral inhibition, a common motif observed in the brain, and solve a competitive spike pattern detection task with multiple neurons that compete to detect multiple patterns. Our results show that the performance is similar to STDP learning.



OS12-2 Spike pattern detection with close-to-biology spiking neuronal network

Takuya Nanami, Takashi Kohno (University of Tokyo)

The nervous system contains a variety of different types of neurons, each with different electrophysiological properties. However, their roles in information processing are poorly understood. Using the piecewise quadratic neuron (PQN) model that can reproduce a variety of electrophysiological properties, we demonstrate that performance on a biologically plausible task of spike pattern detection varies depending on the electrophysiological properties.



OS13 Industrial Artificial Intelligence Robotics (9)

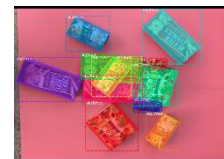
Chair Eiji Hayashi (Kyushu Institute of Technology, Japan)

Co-Chair Sakmongkon Chumkamon (Kyushu Institute of Technology, Japan)

OS13-1 Object Status Detection in clutter environment for robot grasping using Mask R-CNN

Kasman, Eiji Hayashi (Kyushu Institute of Technology, Indonesia, Japan)

Detecting object status in cluttered manipulator's robot environment before grasping is quite challenging to recognize the target because of unstructured and uncertainty scenes. Using Mask R-CNN for detecting the status of the object i.e. free for picking, close, overlapping and piling up to the other objects is very useful as computer vision before the manipulator doing next procedures to complete its task. This paper provides a systematic summary and analysis target detecting and recognizing object status using Mask R-CNN. Unlike related solution methods that use machine vision and deep learning directly and combine together for doing robot controlling, pushing and grasping, we are doing image processing separately and simply for detecting the object's status and location before performing like pushing the object for making free and easy grasping. Experiment with this method shows that it has good accuracy and can be implemented like as input control reinforcement learning in advance.



OS13-2 Deep-Learning-Based Designed Weight Picking Noodle-like Object

Nattapat Koomklang, Sakmongkon Chumkamon, Prem Gamolped, Tomofumi Tsuji, Eiji Hayashi
(Kyushu Institute of Technology, Japan)

For food packaging line, manual picking up of the noodle-like objects according to specific weight requires worker's experience for picking quickly and accurately. This article presents a robot arm with 6-fingers gripper picking up the noodle-like objects in specific weight using deep-learning-based to find the best possible action. For measuring the action, we use direct variation to probability of picking action at specific weight in this research use value for the likelihood of weight probability given an action. To find likelihood of weight probably deep-learning-based and use normal distribution for model distribution of the systems. For evaluation we passed any possible action to the network and find action that get maximum likelihood.



OS13-3 Research on grasping of string foods in the home meal replacement industry

Akihiro Ooya, Sakmongkon Chumkamon, Prem Gamolped, Tomofumi Tsuji, Eiji Hayashi
(Kyushu Institute of Technology, Japan)
Abbe Mowshowitz (The City College of New York, USA)

In recent years, automation by industrial robots has been desired in Japanese food manufacturing plants. This paper describes the development of an autonomous robot for automating the preparation of home meal replacement. The serving of lunchtime meals includes not only solid foods such as rice balls, but also string foods such as spaghetti. Unlike solidified foods, string foods require quantitative grasping. However, in the grasping experiments of string foods, the spaghetti deteriorates with time, and thus, a problem arises where an accurate quantitative grasping experiment cannot be performed. Therefore, in this study, we perform a quantitative grasping experiment by deep reinforcement learning using a material like string foods to verify the grasping and serving system for string foods.



OS13-4 Development of Drifting Debris Detection System using Deep Learning on Coastal Cleanup

Shintaro Ogawa, Sakmongkon Chumkamon, Eiji Hayashi (Kyushu Institute of Technology, Japan),
Ayumu Tominaga (National Institute of Technology, Kitakyushu College, Japan)

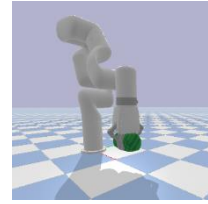
To solve the problem of litter drifting ashore, this study developed a litter detection system using deep learning. I used HTC (Hybrid Task Cascade) as a deep learning network. I also used Mask R-CNN for comparison. HTC is a model for instance segmentation that combines Cascade R-CNN and Mask R-CNN. Mask R-CNN is a model that adds segmentation capabilities to Faster R-CNN, a model for object detection. The dataset is a combination of a public dataset of general garbage called TACO and images taken at actual cleanup sites such as Hokuto Mizukumi Park. The discriminator was trained 2000 times with a learning rate of 0.002, and multi-class cross-entropy was used as the loss function.



OS13-5 Soft Object Dexterous Manipulation Using Deep Reinforcement Learning

Sornsiri Promma, Sakmongkon Chumkamon, Eiji Hayashi (Kyushu Institute of Technology, Japan)

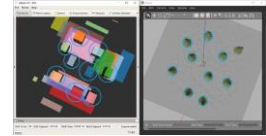
Manipulation of objects is one of the basic tasks that has been studied for a long time in the robotic field. Many experiments were setting the environment and using Deep Reinforcement Learning to train robot arm to grasp various objects. Still, most of those objects are solid objects, whereas nowadays, robot arms are used for grasping soft objects as well. In this study, we develop object manipulation tasks in pybullet simulation, focusing on soft objects by using Deep Reinforcement Learning (DRL) based on Soft Actor-Critic and Proximal Policy Optimization algorithm which aims to make the robot able to grasp soft objects in the exact position with proper force that does not damage them.



OS13-6 Practical Implementation of FastSLAM for Forestry Robot

Sylvain Geiser¹, Sakmongkon Chumkamon¹, Ayumu Tominaga², Takumi Tomokawa¹, Eiji Hayashi¹
(¹Kyushu Institute of Technology, Japan), (²National Institute of Technology, Kitakyushu College, Japan)

As the Japanese forestry workforce is shrinking, field robots are gaining interest in performing dangerous tasks in this environment. This paper presents research conducted on the SOMA robot designed at Hayashi Laboratory for this purpose. It focuses on theoretical and practical issues encountered through the implementation of the particle filter based FastSLAM algorithm on this mobile robot. In particular, the determination of the positions of trees from the raw pointcloud of the lidar, the side effects occurring at the boundary of the lidar visibility scope, and the modelling of motion and observation noises are discussed.



OS13-7 Research on AR system for industrial robot introduction

Takuya Matsumoto¹, Eiji Hayashi¹, Sakmongkon Chumkamon¹, Tomofumi Tsuji¹, Ayumu Tominaga²,
Abbe Mowshowitz³
(¹Kyushu Institute of Technology, Japan), (²National Institute of Technology Kitakyushu, Japan),
(³The City College of New York, USA)

In recent years, labor shortages in small and medium-sized enterprises (SMEs) have become a serious issue, and the demand for automation by robots is increasing. Another challenge is the high cost of introducing industrial robots. In order to reduce the introduction cost, we are developing an AR system with the aim of providing robot introduction support to SMEs. The AR system developed enables the display of the robot's movements on the AR screen of a smartphone by communicating with ROS while developing Google's ARCore in Unity. In this paper, we describe the system configuration and evaluate the application of an AR application that enables AR simulation and intuitive GUI operation to check the safety range at the time of robot introduction.



OS13-8 The BCRobo dataset for Robotic Vision and Autonomous Path Planning in Outdoor Beach Environment

Tan Chi Jie¹, Takumi Tomokawa¹, Sylvain Geiser¹, Shintaro Ogawa¹, Ayumu Tominaga², Sakmongkon Chumkamon¹, Eiji Hayashi¹

(¹Kyusyu Institute of Technology, ²National Institute of Technology (Kitakyushu College), Japan)

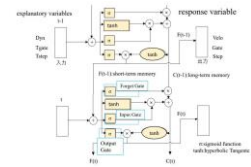
Along with the universalization of autonomous driving and image segmentation, various datasets are available freely for anyone to use to train their own neural network which speeds up the growth of deep learning technology. However, most of the datasets target only urban environments and other offroad environments are still lacking in datasets. This paper presents a beach environment dataset, BCRobo with the aim to contribute to closing the gap of robotic visual perception in offroad environment especially in beach. The dataset is also evaluated with two state-of-art image segmentation techniques to demonstrate the practical usage of the dataset.



OS13-9 The research about editing system of performance information for player piano. -Develop inference methods using machine learning -

Takaaki Ueno, Sakmongkon Chumkamon, Eiji Hayashi (Kyushu Institute of Technology, Japan)

In order for an automatic piano to perform like a human, it is necessary to have data with intonation for each note. However, existing automatic pianos do not have the ability to infer inflected data. For this reason, data inference has been performed manually until now. Therefore, the data We therefore attempted to construct a system that can infer data automatically by using machine learning. In this paper, we describe the machine learning system we have developed to infer performance information. This paper describes the actual inference system we developed. The data to be inferred was a performance of "Prelude Op.28 No.15" by Fryderyk Franciszek Chopin, composed by the world-famous pianist Vladimir Davidovich Ashkenazy. The performance is by the world famous pianist "Vladimir Davidovich Ashkenazy



OS14 Software Development Support Method (4)

Chair Tetsuro Katayama (University of Miyazaki, Japan)

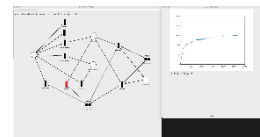
Co-Chair Tomohiko Takagi (Kagawa University, Japan)

OS14-1 Automated Random Simulation for Checking a Behavioral Model of Systems Based on Extended Place/Transition Net with Attributed Tokens

Sho Matsumoto¹, Tetsuro Katayama², Tomohiko Takagi¹

(¹ Kagawa University, Japan), (² University of Miyazaki, Japan)

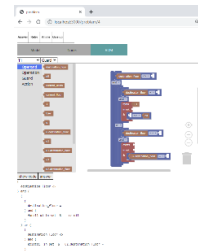
Extended Place/transition Net with Attributed Tokens (EPNAT) is one of formal modeling languages, and it enables system engineers to construct an executable and abstracted behavioral model of multiple software systems. In this paper, we propose an automated random simulation technique of an EPNAT model in order to detect failures in the model. In the simulation, input is an EPNAT selected for model execution. When a constraint given for each system or multiple systems is violated through the model execution, a failure is revealed. The simulation is terminated by the detection of a failure or the satisfaction of a criterion focusing on the combination of marking, data writing and reading between different systems. A prototype tool of the simulation technique was developed and applied to a trial model to discuss its effectiveness.



OS14-2 Training of Software Formal Modeling Using Visual Blocks for Actions and Guards of Extended Place/Transition Net

Akio Usuda, Ryoichi Ishigami, Tomohiko Takagi (Kagawa University, Japan)

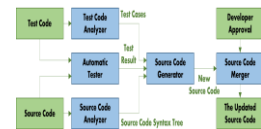
Extended Place/transition Net (EPN) that is one of software formal modeling languages consists of the parts of PN and VDM++. The former part represents abstracted state transitions of software. On the other hand, the latter part represents actions and guards on the transitions, and requires skills of system engineers who construct EPN models. We propose an extended training technique of EPN-based modeling using visual blocks for the VDM++ part. The visual blocks implemented by Blockly will be useful to accelerate the trainees' understanding of syntactical aspects of VDM++, and thus they are introduced into each step of the existing training technique for EPN. The effectiveness of the proposed technique is discussed through a preliminary experiment using our prototype tool.



OS14-3 Proposal of a Framework to Improve the Efficiency of the Implementation Step in Test Driven Development (TDD)

Takeaki Miyashita¹, Tetsuro Katayama¹, Yoshihiro Kita², Hisaaki Yamaba¹, Kentaro Aburada¹, Naonobu Okazaki¹ (¹University of Miyazaki, Japan), (²University of Nagasaki, Japan)

Test Driven Development (TDD) has three steps: test design, minimal implementation that passes the test, and refactoring. This research proposes a framework to support the implementation step in TDD to improve the efficiency of the implementation. The proposed framework firstly receives from the developer the test code and the source code that the test code does not fully pass. Next, It automatically generates new source code by modifying the given source code that the given test code can fully pass. And then, it shows the developer the differences between the given source code and the generated source code. Finally, it updates the source code if the developer approves the modification. By using this framework, developers can reduce the time required for the implementation step in TDD.

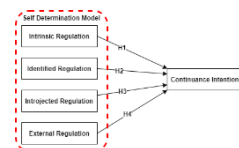


OS14-4 Continuance Intention Factor of Online Learning Management System in Case on Faculty of Computer Science at Brawijaya University in Indonesia

Mochamad Chandra Saputra¹, Tetsuro Katayama², Yoshihiro Kita³, Hisaaki Yamaba², Kentaro Aburada², Naonobu Okazaki²

(¹Brawijaya University, Indonesia), (²University of Miyazaki, Japan), (³University of Nagasaki, Japan)

The outbreak of the COVID-19 pandemic changed the model of the learning process. Online learning became one of the best solutions for many educational institutions, including the University, especially the Faculty of Computer Science, Brawijaya University. The continuance intention factor for using an online learning management system is important to ensure learning sustainability. To understand students' continuance intention this study proposes self determination model as a research model to find the factors affecting students' continuance intention toward online learning management systems. The proposed model is useful for investigating continuance intention factors. The study finds that intrinsic regulation, external regulation, identified regulation, and introjected regulation significantly positive impact on continuance intention in learning management systems. Finally, this study provides suggestions for the Faculty to improve the continuance intention of the student in using an online learning management system.



OS15 Robot Control (5)

Chair Yizhun Peng (Tianjin University of Science and Technology, China)

OS15 -1 Design of Intelligent Crutch System Based on STM32 and Raspberry Pie

Zongxuan Zhang, Jianhao Hu, Yizhe Sun, Yizhun Peng (Tianjin University of Science and Technology, China)

In order to strengthen the development of China's elderly care industry, the project has designed an intelligent crutch based on stm32 and raspberry pie. This product adds many functions on the basis of general intelligent crutches. It is equipped with real-time GPS monitoring and uploading APP. When the elderly fall, they can immediately and automatically alarm. When they fall, they can simultaneously emit an alarm sound of about 100 decibels to the surrounding. It provides a touch screen, supports voice recognition, and can achieve multiple functions. It is equipped with a step counting function, temperature and humidity display and other functions. The product uses 4G modules to communicate with the APP.



OS15-2 Design of Intelligent Fish Box Based on Machine Vision and Internet of Things Technology

Suqing Duan, Jiangyu Wu, Shuai Chen, Yizhun Peng (Tianjin University of Science and Technology, China)

The intelligent fish box based on machine vision and Internet of Things includes many fields such as machine vision, Internet of Things technology, single-chip microcomputer control and so on. It is an intelligent system that receives user instructions or voice control through the Internet to achieve a series of operations. At the same time, there is a temperature sensor in the fish box, which can transmit the temperature to the mobile phone APP in real time, and intelligent control the water temperature in the fish box. In addition, the fish box granaries send information to the user when the fish food is insufficient, and the camera in the fish box can monitor the situation of the fish box in real time, when a fish belly notifies the user to deal with.



OS 15-3 Design and Implementation of Internet of Things Planting System Based on esp32 MCU

Cuiying Ji, Yizhun Peng (Tianjin University of Science and Technology, China)

Agriculture is the country's fundamental industry, but there is still a lot of hard work because of climate pests. It is the development direction of agriculture to integrate traditional agriculture into modern Internet of Things technology and realize visualization and digital management of agricultural production.

This study combined modern information technology and used esp32 as the master to design and produce a plant planting system model for the Internet of Things. This research product uses a variety of sensors, Monitor the essential elements required for crop growth, including temperature, humidity, nutrient solution, soil moisture, etc. In the process of crop growth, automatic irrigation, nutrient solution supplement, ventilation cooling, light and other operations, greatly reduce the intensity of manual labor.



OS15 -4 A Customized Dispensing Robot Based on OpenMV Visual Recognition

Hongze Liu, Yizhun Peng (Tianjin University of Science and Technology, China)

Dispensing medicine in hospital wards is a mechanized process, but it is difficult to develop on a large scale due to the uncertainty of the environment. In this study, a customized dispenser robot was designed to automatically deliver drugs to the designated ward according to the given instructions. The Visual identity module (OpenMV) is designed to collect images from the progress and then compare them with pre-stored images to achieve automatic pathfinding. Among them, the tracking part uses PID open-loop operation to increase the accuracy of movement. The ward number enables the camera to recognize the number in different scenes for many times, which increases the accuracy of recognition. The unique structure of this study provides an innovative and effective way to customize ward dispensing.



OS15-5 An Intelligent Guide Hat Based on The Internet of Things

Suqing Duan, Yizhun Peng (Tianjin University of Science and Technology, China)

With STM32 as the control core, the new guide cap has ranging obstacle avoidance, ranging obstacle avoidance, intelligent recognition, voice interaction, GPS positioning and other functions. The system uses OpenMV4 Cam H7 Plus intelligent camera for continuous real-time monitoring and effective feedback of traffic lights, zebra crossings and other important road information; Assisted by ultrasonic sensor, the electrical signal is converted into ultrasonic output through the transmitter to effectively measure the distance of obstacles; At the same time, the user's location information is sent to the surrounding vehicles and passers-by in real time through the Wi-Fi module and GPS positioning, ensuring the user's safety to the greatest extent.



OS16 Robotic Manipulation (3)

Chair Kensuke Harada (Osaka University, Japan)

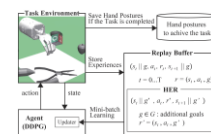
Co-Chair Tokuo Tsuji (Kanazawa University, Japan)

Co-Chair Akira Nakamura (Saitama Institute of Technology, Japan)

OS16-1 Acquisition of Synergy for Low-dimensional Control of Multi-fingered Hands by Reinforcement Learning

Kazuki Higashi, Tomohiro Motoda, Akiyoshi Hara, Kensuke Harada (Osaka University, Japan)

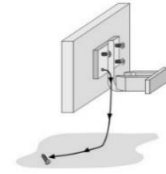
We propose a reinforcement learning platform to learn to perform various tasks with a robotic hand to acquire a synergy. The model of deep reinforcement learning is trained to grasp an object with a multi-fingered hand. The synergy space is calculated by principal component analysis of hand postures when the task is successfully executed. The reward system is designed to minimize the distance of orthogonal projection between the posture and the synergy space, and the synergy space is acquired simultaneously with reinforcement learning.



OS16-2 Error Recovery Techniques Focused on Revival Process from Failures in Robotic Manufacturing Plants

Akira Nakamura¹, Kensuke Harada² (¹Saitama Institute of Technology, ²Osaka University, Japan)

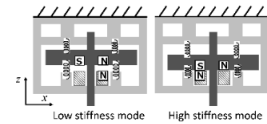
In recent years, working robots have been used in various fields from manufacturing industries to human living spaces. Therefore, more and more difficult tasks are performed by robots, necessitating the introduction of error recovery techniques. Our proposed error recovery technique is based on a method of going back to the process before the step in which the failure occurred and starting over from there. Of course, in practice, not only such a backward recovery but also a forward recovery that moves forward even after a failure occurs is used. This paper considers the various paths from failure occurrence to recovery execution and further discusses which path should be selected.



OS16-3 Flexible assembly system with stiffness switching joint

He Maïke, Tokuo Tsuji, Naoki Ichikawa, Takuro Sawada, Tatsuhiko Hiramitsu, Hiroaki Seki (Kanazawa University, Japan)

In this research, we aim to construct a flexible assembly system and realize precise assembly work by using a flexible-rigidity switchable joint for the wrist part of an industrial robot. We install magnets in the joints and change the structure of the joints by changing the state of attraction and repulsion of the magnets. The joint has two states, which are low stiffness and high stiffness.



OS17 Artificial Intelligence for Embedded Systems and Robotics (6)

Chair Hakaru Tamukoh (Kyushu Institute of Technology, Japan)

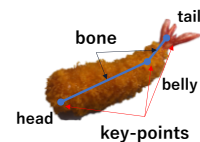
Co-Chair Yuma Yoshimoto (National Institute of Technology, Kitakyushu College, Japan)

OS17-1 Pose Detection for Flexible-Indefinite Objects using Pseudo-Bone Data

Yuma Yoshimoto¹, Hakaru Tamukoh²

(¹National Institute of Technology, Kitakyushu College, Japan), (²Kyushu Institute of Technology, Japan)

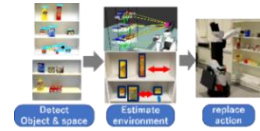
This paper proposes a method for recognizing the poses of a flexible-indefinite object. Some flexible-indefinite objects, such as fried shrimp, differ between individuals. Therefore, it is difficult to estimate the pose of these foods by point cloud fitting or other methods. We propose "pseudo-skeletal" data for these objects. Pseudo-skeletal data consists of "key-points," which are joints, and "bones," which connect between key-points. For example, fried shrimp are given 3 key-points; "head," "belly," and "tail." In addition, the bones that connect them are given. In the experiment, a objects pose recognition model based on the human pose recognition model trains pseudo-skeletal data of fried shrimp. We confirmed that the model estimates the poses in the images



OS17-2 Object Search and Empty Space Detection System for Home Service Robot

Tomoya Shiba¹, Tomohiro Ono^{1,2}, Hakaru Tamukoh¹
(¹Kyushu Institute of Technology, Japan), (²JSPS Research Fellow, Japan)

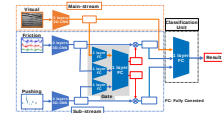
Home service robot has a pickup task to grasp and transport objects. When performing a pickup task, robots need to process to search for objects in the case of missing target objects. We propose approaches for the robot to search for objects from a shelf and a method for selecting empty spaces to move off-target objects. Proposed method is based on object recognition of graspable objects and shelf recognition model to select replacement locations and planned motions. The object to be moved and replace location are selected based on the size and position of empty spaces. In the experiments, the robot planned actions to search for the target object from a shelf and to replace the object near a group of similar objects. We used these in RoboCup@Home competition to evaluate the effectiveness of the proposed method.



OS17-3 Robust Classification Model with Multimodal Learning for Home Service Robots

Ikuya Matsumoto, Daiju Kanaoka, Hakaru Tamukoh (Kyushu Institute of Technology, Japan)

We propose an auxiliary data stream structure as a robust classification model as shown in the figure. The model treats one modal as a main input and other modals as support. We experimented with two and three modal inputs. Moreover, we added pseudo shadows to visual information for the experiment of three modal inputs. In all experiments, our proposed model improves accuracy and robustness to environmental disturbances by using multiple modals. In future works, we will attempt to implement and evaluate the proposed method on a home service robot.



OS17-4 Flexible Human-Robot Interaction in Domestic Environment Using Semantic Map

Yuga Yano¹, Yukiya Fukuda¹, Tomohiro Ono^{1,2}, Hakaru Tamukoh¹
(¹Kyushu Institute of Technology, Japan), (²JSPS Research Fellow, Japan)

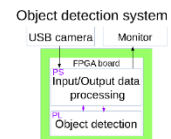
We propose an efficient semantic map to realize flexible human-robot interaction (HRI) in domestic environments. Our proposed map is created from an output of Simultaneous Localization and Mapping and already-known environmental information such as furniture and room. In this study, we evaluated the effectiveness of our proposed method on two benchmark tests for HRI in RoboCup@Home held in Bangkok in 2022. In the RoboCup@Home, we employ 3D human recognition to apply our proposed map to HRI, such as "find and offer an empty seat." We had the best score of all teams on both tests. The results of our experiments are available at <https://youtube.com/playlist?list=PLfbN50Mwh2DG3OPDeCHo4TNuyrU4qYCrJ>



OS17-5 Impact of PS Load on FPGA Object Detection System Performance

Yusuke Watanabe^{1,2}, Hakaru Tamukoh²
(¹CRAFTWORK Co. Ltd, Japan), (²Kyushu Institute of Technology, Japan)

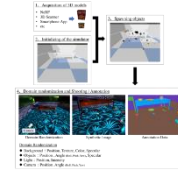
A field-programmable gate array (FPGA) device which has Zynq architecture recently became popular. It is featured by inclusion of both processing system (PS) and programmable logic (PL) to a single chip. In a system using FPGA, while we tend to focus on the performance of PL, we can not ignore PS load completely. In this paper, using our object detection system which works on a Zynq FPGA board, we explore how our FPGA object detection system performance changes depending on PS load and report experiment results.



OS17-6 An Effective Method for Minimizing Domain Gap in Sim2Real Object Recognition Using Domain Randomization

Tomohiro Ono^{1,2}, Akihiro Suzuki¹, Hakaru Tamukoh¹
(¹Kyushu Institute of Technology, Japan), (²JSPS Research Fellow, Japan)

Data-centric deep learning has attracted considerable research attention in an era where data is at the core of every decision-making process. Manual annotation is a common practice, but it is very expensive and problems such as oversight and mislabeling caused by human error occur. These problems are known to affect the quality of the datasets significantly. To resolve these problems, in this study, we propose a method to automatically generate high-quality and large datasets in a short time using a simulator. Our proposed method aims to minimize the domain gap using domain randomization without faithfully reproducing real scenes in the simulator. The generated data were trained on You Only Look Once v7 and achieves an accuracy of more than 80% against the real data, demonstrating the feasibility of Sim2Real.



OS18 Mathematical Informatics (7)

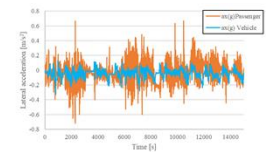
Chair Takao Ito (Hiroshima University, Japan)

Co-Chair Makoto Sakamoto (University of Miyazaki, Japan)

OS18-1 A Fundamental Study on Car Sickness Using Data Science

Tsutomu Ito¹, Seigo Matsuno¹, Makoto Sakamoto², Satoshi Ikeda², Takao Ito³
(¹NIT, Ube College, Japan), (²University of Miyazaki, Japan), (³Hiroshima University, Japan)

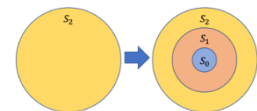
Car sickness often occurs with dizziness and discomfort accompanied by vomiting and headaches lasting several days in severely affected person. Car sickness has been studied from various standpoints on countermeasures and onset mechanisms, but a general measure has not been established yet. In this study, all dataset of the motion that occurs in the car and the head of the person sitting and/or driving in the car are collected based on data science. By validating the data, the characteristics of person who has experience of car sickness are tested. This study proposes a new measure aiming at development of motion sickness countermeasures that do not depend on car performance and find that the quick rotational motion of the head generated in the car could be considered as one of the factors that cause car sickness.



OS18-2 An Analysis of Quoridor by reusing the results of reduced version

Satoshi Ikeda¹, Takuro Iwanaga¹, Makoto Sakamoto¹, Takao Ito²
(¹University of Miyazaki, Japan), (²Hiroshima University, Japan)

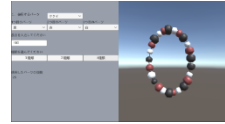
This paper presents a study of retrograde analysis using the board game " Quoridor " released by Gigamic Games. The retrograde analysis is performed by enumerating all the possible game phases. This leads to a huge search area and a problem of spatial computational complexity. In this study, we attempted to reduce the number of stations to be enumerated by reusing the results of the reduced version; when enumerating the S_2 stations, only the S_0 and S_1 stations can be omitted. This solves the Quoridor under the condition of having two fences each other.



OS18-3 Prototype Software for Designing Hula Accessories

Takumi Nakahara¹, Satoshi Ikeda¹, Amane Takei¹, Kenji Aoki¹, Makoto Sakamoto^{1*}, Tsutomu Ito², Takao Ito³
(¹University of Miyazaki, Japan), (²NIT, Ube College, Japan), (³Hiroshima University, Japan)

Today, there are two main types of hula: the classical hula "kahiko" and the modern hula "auana". Music, costumes, and accessories are essential to these hula. Auana, in particular, is danced to music played on Western instruments and expresses the mythology, history, and various aspects of Hawaiian culture. The costumes and accessories worn by the dancers are designed to match the music. Therefore, we thought that it would be possible to design costumes and accessories more in line with the image of the dancers if we could freely design them using a personal computer and simulate how they would look when finished. In this study, we focused on accessories and conducted basic research to develop a CAD system for the design of "leis," one of the accessories.



OS18-4 A Basic Study on Museum Exhibition Support Using AR Technology

Kakeru Takemura¹, Satoshi Ikeda¹, Amane Takei¹, Masahiro Yokomichi¹, Makoto Sakamoto¹, Shuichi Kurogi², Tsutomu Ito³, Takao Ito⁴
(¹University of Miyazaki, Japan), (²Miyazaki Prefectural Museum of Nature and History, Japan), (³NIT, Ube College, Japan), (⁴Hiroshima University, Japan)

Enasirassitake are mushrooms that can be observed a lot in Aoshima, Miyazaki. Garnet Ochibatake was discovered in 2016 and confirmed in Miyazaki. Both are glow-in-the-dark mushrooms and are attracting attention as a new tourist resource for Miyazaki. When I visited the exhibition at the Miyazaki Prefectural Museum, these mushrooms were very small and difficult to observe. The purpose of this research is to display 3DCG models of mushrooms using AR (Augmented Reality) technology in order to facilitate observation of these small mushrooms exhibited in museums.



OS18-5 Tourism Support for Bioluminescent Fungi Using Video Technology

Bidesh Biswas Biki¹, Kodai Hasebe¹, Fumito Hamakawa¹, Satoshi Ikeda¹, Amane Takei¹, Makoto Sakamoto¹, Shuichi Kurogi²
(¹University of Miyazaki, Japan), (²Miyazaki Prefectural Museum of Nature and History, Japan)

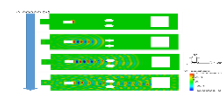
There are about many bioluminescent fungi all over the world, and in recent years, 11 types have been confirmed in Miyazaki Prefecture. It is a considerable number from the perspective of Japan as a whole. The purpose of this study is to make the general public aware of bioluminescent fungi, and to widely publicize mushrooms of Miyazaki prefecture. Therefore, we conducted basic study on three-dimensional computer graphics models and virtual reality, and on educational promotional video for the general public concerning bioluminescent fungi such as the *Favolaschia peziziformis* found in Miyazaki Prefecture. We also confirmed the usefulness of educational promotional video produced by conducting a questionnaire survey.



OS18-6 Parallel wave sound analysis based on hierarchical domain decomposition method

Amane Takei¹, Akihiro Kudo², Makoto Sakamoto¹
(¹University of Miyazaki, Japan), (²Tomakomai Collage, Japan)

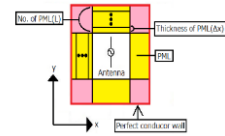
We are investigating a large-scale non-steady wave sound analysis method based on the parallel finite element method. The iterative domain decomposition method is employed in the analysis method as a parallel technique. We have confirmed that the non-steady wave sound analysis code is very high-accuracy with errors within the allowable range in a numerical analysis.



OS18-7 Parallel full-wave electromagnetic field analysis based on hierarchical domain decomposition method

Amane Takei, Nanako Mizoguchi, Kento Ohnaka, Makoto Sakamoto (University of Miyazaki, 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 LDL^T 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. More detail will be shown in the conference.



S19 Natural Computing (2)

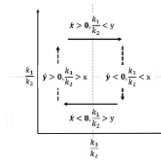
Chair Marion Oswald (Technische Universität Wien, Austria)

Co-Chair Yasuhiro Suzuki (Nagoya University, Japan)

OS19-1 Changes in the Behavior of a Small Number of Molecular Systems

Yasuhiro Suzuki (Nagoya University, Japan)

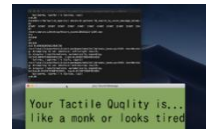
Molecular systems in chemical reaction systems have been considered continuous systems. However, chemical reactions in living organisms involve small molecules and cannot be considered a continuous system in some cases. In this study, we examine the behaviors of the two-party Lotka-Volterra model with a small number of molecules. We then show that there are cases in which intrinsic fewness is dominant.



OS19-2 Retrieval by Sensory Information

Yasuhiro Suzuki (Nagoya University, Japan)

Until now, information retrieval has been conducted by language. In recent years, information retrieval using smart microphones has also developed. However, voice-based retrieval is conducted by converting voice into linguistic information. In this study, we propose a search based not on linguistic information but on language sensitivity information. Language sensitivity information is a way of saying things. We perceive differences in the way we say the same word. In other words, the difference in how we say a word is the sensory information of the language. This study proposes a method for extracting and retrieving sensitive information from language.



OS20 Robot Competitions and Education (7)

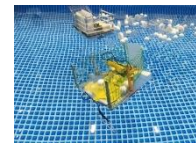
Chair Kazuo Ishii (Kyushu Institute of Technology, Japan)

Co-Chair Yasunori Takemura (Nishinippon Institute of Technology, Japan)

OS20-1 Report on Underwater-Robot-Festival Junior Division Aiming at Marine Debris Clean up

¹Takayuki Matsuo, ²Masanori Sato, ³Masayoshi Ozawa, ⁴Seiichiro Miura, ⁵Masakazu Arima, ⁶Kazuo Ishii
(¹National Institute of Technology, Kitakyushu College, Japan),
(²Nagasaki Institute of Applied Science, Japan),
(³Kobe City College of Technology, Japan), (⁴National Institute of Technology, Tokuyama College, Japan)
(⁵Osaka Metropolitan University), (⁶Kyushu Institute of Technology)

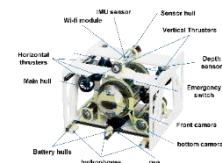
This paper reports the results of the Junior Division of the 8th Underwater Robot Festival held in August 2022. The junior division is a robotics competition for junior high and high schools, and 18 teams participated. The subject of the competition is Marine Debris Clean-up using surface ships with the theme of "Life Below Water" which is the 14th goal of SDGs. The competition consists of a poster session on the problem of garbage in the sea and a robot competition to compete the ability of their handmade ships to clean up floating objects. This paper gives an overview of the Junior Division and discusses its learning effects



OS20-2 Image-based navigation of Small-size Autonomous Underwater Vehicle “Kyubic” in International Underwater Robot Competition

Yusuke Mizoguchi, Daiki Hamada, Riku Fukuda, Irimiya R. Inniyaka, Kaito Kuwata, Keisuke Nishimuta, Akihiro Sugino, Rikuto Tanaka, Yoshiki, Tanaka, Yuya Nishida, Kazuo Ishii
(Kyushu Institute of Technology, Japan)

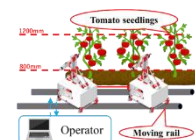
International underwater robot competition “RoboSub” is held in USA to demonstrate robot’s autonomy by completing underwater tasks, with a new theme each year. Student project team “Kyutech Underwater robotics” developed autonomous underwater vehicle (AUV) “KYUBIC” with built-in image processing board for the RoboSub. Sensors on the AUV are connected via ethernet and its automatic navigation program is built using ROS. The AUV moves through gate to the target panel based on self-localization using doppler velocity log and IMU. When approaching the panel, the AUV knows the direction to the panel based on the red line detection by image processing, and the type, the position and the attitude of the target panel are detected by deep learning on the board.



OS20-3 Development of Harvesting Robot for Tomato Robot Competition 2022 and Its Evaluation

Takeru Oshige¹, Moeko Tominaga², Takuya Fujinaga³, Yasunori Takemura², Jonghyun Ahn
(¹Hiroshima Institute of Technology, ²Nishinippon Institute of Technology, ³Fukuoka University, Japan)

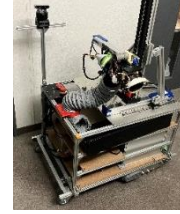
Agriculture is one of the most important industries for human food production. Recently, the number of farmers in Japan is decreasing, and the age of farmers is increasing. Therefore, automation of agriculture using robot systems is highly required. The “Tomato Robot Competition” is held every year in Fukuoka, Japan, to arouse student’s interest in the field of agriculture, and to promote the development of agricultural automation technology by robot systems. In this paper, we introduce the developed tomato harvesting robot to participate the “Tomato Robot Competition 2022”, and its harvesting performance evaluation. Developed tomato harvesting robot is composed of 3 linear arms, end effector, rail movement system and electronic system of communication and control. In the evaluation, developed tomato harvesting robot took approximately 1.3 [min] to harvest a single tomato.



OS20-4 Development of a Tomato Harvesting Robot for Farm Field

Shunsuke Oda, Ryuma Fukumoto, Kensuke Hirata, Shu Tahara, Keisuke Yoshida, Shinsuke Yasukawa, Kazuo Ishii (Kyushu Institute of Technology, Japan,)

The 9th Tomato Harvesting Robot Competition is held at the green house in Kitakyushu Science and Research Park. The competition consists of two leagues of different field aresa; rail-style for greenhouse and free-style area aiming for farm field, and our team jointed the free-style. In order to participate in free-style, tomato harvesting mechanism, mobility mechanism to move on the rough terrain, camera to photograph tomato, and self-location system are required. We development of 3-axis cartesian coordinates manipulator tomato harvesting robot that using crawler move on soil and tomatoes are harvested by suction and cutting. In this paper, we describe the system architecture of tomato harvesting robot and the results of 9th Tomato Harvesting Robot Competition in 2022.



OS20-5 Tomato-Harvesting Robot Competition: Developed Robots and Results of 9th Competition

¹Kazuo Ishii, ²Takayuki Matsuo, ³Yasunori Takemura, ³Takashi Sonoda, ³Atsushi Sanada, ¹Yuya Nishida, ¹Shinsuke Yasukawa, ⁴Takuya Fujinaga, ³Moeko Tominaga, ⁵Daisaku Arita, ⁶Kazushi Kawajiri, ⁷Kenich Ohshima, ⁷Masayuki Okada, ¹Kanako Shirahashi

(¹Kyushu Institute of Technology, Japan), (²National Institute of Technology, Kitakyushu College, Japan), (³Nishinippon Institute of Technology, Japan), (⁴Fukuoka University, Japan), (⁵University of Nagasaki, Japan), (⁶Hibikinada Greenhouse, Japan), (⁷Kyushu Polytechnic College, Japan)

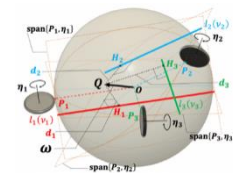
Tomato is one of the important fruit vegetables and most tomatoes are produced in the greenhouses, or large-scale farms, where the high temperature and humidity, and long harvest age force the farmer heavy works. To develop the tomato harvesting robot, many research issues exist such as manipulator design, end-effector design, collaborative behavior, artificial intelligence, motor control, image processing, target recognition and so on. With an aim to promote the automation of tomato harvesting, we have organized the tomato harvesting robot competition since 2014, and currently changed the competition field to the greenhouse in 2020. In this paper, we discuss the results of 9th tomato harvesting robot competition in 2022.



OS20-6 A Modeling of Sphere Considering Slipping Adapted Three-Rollers

¹Kenji Kimura, ²Kouki Ogata, ³Hiroyasu Hirai, ³Takumi Ueda, ³Kazuo Ishii
(¹National Institute of Technology, Matsue College, Japan), (²Saga University, Japan), (³Kyushu Institute of Technology, Japan)

Many types of spherical robots use friction-drive systems for locomotion because such systems enable omnidirectional movement and are more capable of climbing steps than mobile robots equipped with multiple omni-wheels. Slipping between spheres and rollers is a remarkable issue with friction-driven mechanisms. However, the previously established sphere kinematic models do not consider slipping, and kinematic models consider slipping in only two constraint rollers. In this study, we propose a mathematical model that allows for slipping on three constraint rollers and simulate the angular velocity vector of the sphere and slip vectors in each contact points.



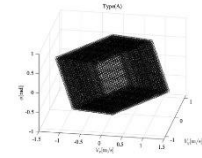
OS20-7 Roller Arrangement Problem of Omnidirectional Mobil Robot Adapted Three Omni Rollers

¹Kenji Kimura, ²Yuki Shigyo, ³Kazuo Ishi

(¹National Institute of Technology, Matsue College, Japan), (²Fujitsu, Japan),

(³Kyushu Institute of Technology, Japan)

Mobile robots adapted to omni rollers are required to have efficient mobility in areas like logistics. Since such systems are easily controlled and provide omnidirectional locomotion. But theoretical research about motion efficiency has not been conducted. In this study, we evaluate rollers arrangement from speed efficiency point of view assumed a mechanism where the roller placement position can be changed arbitrarily on a round shape mechanism and we consider roller arrangement using the theory of linear transformation.



OS21 Advances in Field Robotics and Their Applications (7)

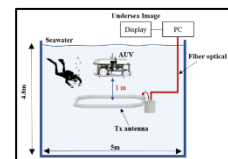
Chair Keisuke Watanabe (Tokai University, Japan)

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

OS21-1 Underwater Live Video Streaming Experiment Using Radio Frequency Communication for AUVs

Raji Alahmad, Yuya Nishida, Kazuo Ishii, Yukihiro Fukumoto (Kyushu Institute of Technology, Japan)

Many underwater applications need high data rate transmission to transmit the data such as images in real-time. Autonomous Underwater Vehicles (AUVs) require long-distance communication, especially in the deep sea. The technology of acoustic communication is the commonly used way for AUVs. The major drawback in underwater acoustic communication is the low transmission baud rate which is up to several kilobits per second (kbps). However, the reliable distance can be in tens of kilometers. On the other hand, the radio frequency (RF) communication provide much higher data rate. The electromagnetic wave is seriously limited by high attenuation in a water medium. In this paper, we investigate the Radio frequency communication in seawater, the experiment results show the effects of the distance between the transmitter and receiver, and the stability of the antennas. We could achieve HD video transmission with 25fps.



OS21-2 Control strategy to change the locomotion mode of a reconfigurable wheel/track robot based on the soil conditions

Supaphon Kamon, Enrico di Maria, Kazuo Ishii (Kyushu Institute of Technology, Japan)

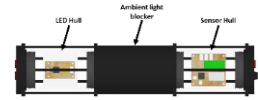
The use of agricultural machinery damages the soil by compaction and distortion, where the compaction is caused more by small contact areas like in wheeled vehicles, and the distortion is caused especially by tracks. In this work, we discuss a wheel/track reconfigurable robot which changes locomotion based on the soil conditions, to minimize the soil damage, energy consumption, and adapt the traversability. After giving an overview of the system, we propose a control strategy for switching between the locomotion modes.



OS21-3 Sea-floor Image Restoration with Variable Absorbance Coefficient.

Irmiya R. Inniyaka, Yuya Nishida, Kazuo Ishii (Kyushu Institute of Technology, Japan)

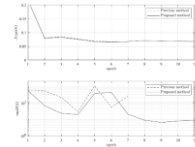
Scattering from suspended particles and visible light attenuation with water depth are constant phenomena that reduce underwater image quality due to low contrast and color distortion. Common image restoration techniques such as the image formation model, assumes a constant attenuation coefficient across color channels. This results in a restoration solution with limited application. We propose a method of image restoration that takes into account the wavelength-dependent attenuation of underwater images by taking in situ measurements of absorbance per image color channel. In this paper, a description of the design of a turbidity meter is made. It used to extract absorbance of light in the RGB channel. To evaluate the proposed method, image and absorbance data are collected concurrently from different water types. An analysis of image processing method presented in comparison to other methods.



OS21-4 Design of A Parameter Update Method of the Database-Driven PID Controller Considering Norm of the System

Takumi Ueda, Kazuo Ishii (Kyushu Institute of Technology, Japan)

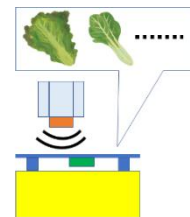
PID controllers are used in many applications, and they considered as typical examples of fixed-structure controllers. For each specific system, the PID parameters of the controller must be adjusted appropriately. Therefore, database-driven control, which automatically adjusts the parameters of the PID controller using a large amount of experimental data, has attracted attention. Database-driven control is one of the methods that does not require model information. Therefore, in the Database-driven PID (DD-PID), the Jacobian of the system used for the steepest descent method is unknown. In this paper, we present an optimization method using the Gradient descent method based on the local model of the system. And we proposed method that can suppress the increase of $\| \cdot \|$ norm more than the conventional DD-PID method.



OS21-5 Occluded Objects Detection by Ultrasonic Sensors

Ryuugo Mochizuki, Yuya Nishida and Kazuo Ishii (Kyushu Institute of Technology, Japan)

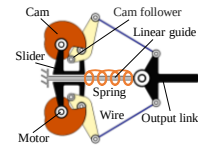
Crops are required to be processed in sanitary manner for lunchbox production in industries. Particularly, foreign object detection is crucial to guarantee consumer's health. Actually, foreign objects are mainly detected by visual check manually. Image processing method is an example to automate the foreign object detection process, however, is not valid to detect hidden objects, thus, non-destructive detection is essential. We propose a method of foreign object detection with ultrasonic reflection analysis. In our experiment, we selected four crops (lettuce, spinach, Perilla, komatsuna) for masking material, and a coin for foreign object. The coin was attached on the backside of masking. Reflected wave was recorded with the masking materials linearly moving. As the result, reflection intensity tripled by the existence of the foreign object.



OS21-6 Development of a Variable Stiffness Function for a New Multifunctional Wire Driven Joint Mechanism

Katsuaki Suzuki, Yuya Nishida, Kazuo Ishii (Kyushu Institute of Technology)

A mechanical variable stiffness can adapt to external forces beyond the control cycle, such as overturning of walking robots, which can help solve problems such as actuator and joint destruction. In this research, we will clarify the structure of a two-input, one-output joint mechanism that can realize three functions: normal motion, instantaneous motion, and variable stiffness function. As part of the development of the variable stiffness function, a mathematical model is derived and simulated for the relationship between the joint angle of the output link and the disturbance torque when a disturbance torque is applied to the output link of the proposed mechanism.



OS21-7 Analyzing an OFDM using Cyclic Prefix to Improve the Underwater Communication System

Alraie Hussam, Kazuo Ishii (Kyushu Institute of Technology, Japan)

The Underwater Communication is one of the most difficult challenges facing the researchers. OFDM technique has been used widely in 4G communication system, and recently it was approved to successfully implemented in 5G. Many researchers have improved the Underwater wireless communication system including the Acoustic communication using OFDM technique. In this study, we applied the Cyclic Prefix to improve the underwater communication system. We started by study the effects of Rician fading based on OFDM system on the wireless channel. Then we analyzed the Bit Error Rate (BER) of the system in several scenarios, by applying the AWGN, Rician fading, and absorption factor to simulate the underwater channel. The results showed that using Cyclic Prefix could improve the BER in underwater communication environment.

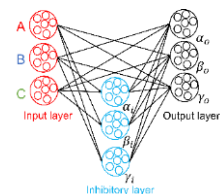


OS22 Bio-inspired Artificial Vision -Algorithms and Systems-(5) Chair Shinsuke Yasukawa (Kyushu Institute of Technology, Japan) Co-Chair Yuki Hayashida (Mie University, Japan)

OS22-1 Increasing selectivity to a feature combination using inhibitory synaptic plasticity in a spiking neural network

Mahiro Ikeda, Hirotsugu Okuno (Osaka Institute of Technology, Japan)

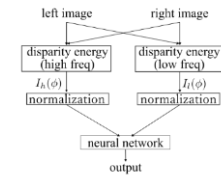
Applying spiking neural networks to artificial intelligence requires various techniques, such as a learning algorithm and a topology for extracting a feature combination, which have already been established for conventional neural networks. In this study, we designed a spiking neural network that uses synaptic plasticity to increase selectivity to a particular combination of features. The model of neurons used is a leaky integrate-and-fire model, and the learning rule used is the long-term potentiation of inhibitory inputs (LTPi). We investigated how the time constant of inhibitory presynaptic neurons whose weights were updated by LTPi affects to selectivity of the postsynaptic neurons. The results showed that the selectivity was increased effectively when the time constant of inhibitory neurons was slightly longer than that of postsynaptic neurons.



OS22-2 A binocular disparity estimation algorithm using multiple spatial frequency information and a neural network

Ryoka Sato, Hirotugu Okuno (Osaka Institute of Technology, Japan)

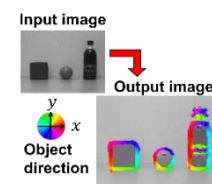
In this study, we developed a disparity estimation algorithm using multiple spatial frequency information and neural-network-based regression. First, the algorithm computes a value called disparity energy based on a model of neurons in the visual cortex that respond selectively to a particular disparity. A Gabor filter with a particular spatial frequency is used to compute the disparity energy, and therefore the disparity energy depends on the spatial frequency of the input image. To reduce the spatial frequency dependency, our algorithm uses disparity energy values computed from two different spatial frequencies for neural-network-based regression.



OS22-3 A figure-ground discrimination algorithm inspired by border-ownership selective cells

Tomoya Kobayashi, Hirotugu Okuno (Osaka Institute of Technology, Japan)

Figure-ground discrimination is one of the most important functions for image classification. In this study, we developed a figure-ground discrimination algorithm that is computationally inexpensive and is suitable for robot vision. The algorithm is inspired by the response properties of border-ownership (BO)-selective cells, which possibly support figure-ground discrimination in the visual nervous system. The output of our algorithm is affected by spatial parameters such as the characteristics of the spatial filter used for edge enhancement and the interval of model BO-selective cells. Therefore, we investigated relationship between the algorithm output with various spatial parameters and object sizes.

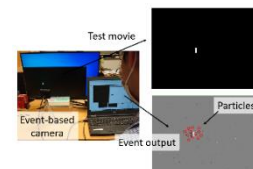


OS22-4 Event-Driven Particle Filter for Tracking Irregularly Moving Objects

Yuki Kawasaki¹, Masahiro Ohtani², Shinsuke Yasukawa¹

(¹Kyushu Institute of Technology, ²Mie University, Japan)

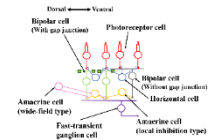
Conventional object tracking techniques that use general-purpose cameras and particle filters find it difficult to track irregularly and rapidly moving objects. To track an irregularly moving object without losing sight, quickly measuring the position of the object is necessary. In this study, we used a fast-response event-based camera, which is a bioinspired camera that produces a spiking output. We propose an event-driven particle filter that performs processing in response to the input from an event-based camera. Our proposed method was evaluated by presenting an event-based camera with a rectangular motion pattern that combines periodic and constant-velocity motions at various speeds. The experimental results demonstrated that our proposed method could track objects in a test video.



OS22-5 A simulation model for analyzing the spatiotemporal receptive field of retinal ganglion cells in the presence of fixational eye movements

Hiroyuki Yokota¹, Yuki Hayashida², Shinsuke Yasukawa¹
(¹Kyushu Institute of Technology, ²Mie University, Japan)

Understanding the receptive field dynamics of vertebrate retinal ganglion cells in the presence of fixational eye movements is considered to provide insights into information processing/encoding optimized for behaviors in animals and autonomous robots in the future. Previous studies have proposed computational models that account for fixational eye movements, suggesting that the long-range spatial inhibitions provided by wide field amacrine cells to some subtypes of bipolar cells and ganglion cells dynamically shape the responses of ganglion cells. In this study, we constructed a simulation model of a retinal circuit based on recent physiological findings. The model validity was tested through computer simulation experiments and by analyzing the time series of spike outputs from the ganglion cell unit. As a preliminary result, we were able to quantify the spatiotemporal receptive field by applying a simple white-noise movie stimulus.



OS23 STEM Education for fostering Innovators (4)

Chair Hiroyuki Y. Suzuki (Hiroshima University, Japan)

Co-Chair Kazuo Kawada (Hiroshima University, Japan)

OS23-1 Junior High School Rescue Robot Challenge for Fostering Problem-Solving Skills

Kazuo Kawada, Keita Murai, Yuta Susawa, Hiroyuki Y. Suzuki (Hiroshima University, Japan)

Junior High School Student Rescue Robot Challenge” is an annual activity organized by Hiroshima University in cooperation with construction equipment manufacturers. The Challenge has been continued for 18 years with a given theme in each year. Nonetheless, the theme was essentially changed from the last year, according to revised version of the Courses of Study for junior high schools announced by the Japanese Ministry of Education, Culture, Sports, Science and Technology, in which the both problem-finding and problem-solving skills are emphasized. The theme for 2022 includes proposal of the problem to be solved in disaster-stricken areas, and it will be solved by themselves by making prototype rescue robot by modifying remote-controlled excavator model of 1/14 scale.

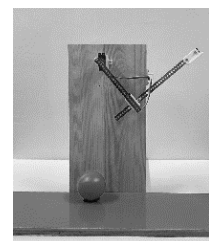


OS23-2 A Study of Experiential Learning Activities using Model Materials for the Kicking Motion

Teruyuki Tamai, Shoki Takeuchi, Yoshihiro Ohnishi (Ehime University, Japan)

Kazuo Kawada (Hiroshima University, Japan)

In this research, model teaching material to be used for cross-curricular learning, which is expected to be promoted in elementary and junior high school education, is explained. This material produced using materials such as servo motors and frames were proposed as teaching materials that would allow learners to consider the kicking motion. First, the relationship between cross-curricular learning and the proposed teaching material is explained. In particular, the relationship with the content of technology education in junior high schools is explained. Next, the structure and mechanism of the teaching materials and the programs used to make them are described. Finally, data and results obtained from the use of the materials are presented.



OS23-3 Making High Precision Single Balance in Active Learning Seminar for Hiroshima Univ. Monozukuri Junior Doctor Special Educational Program

Hiroyuki Y. Suzuki, Kazuo Kawada, Masayasu Nagamatsu (Hiroshima University, Japan)

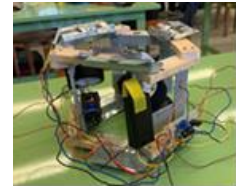
Hiroshima Univ. Monozukuri Junior Doctor” is a special educational program for young (11 – 15 in age) people. In the program we give several seminars for nurturing innovative minds and capacities, including an active learning seminar on making single balance. We prepared a number of pre-fabricated parts of deferent sizes, giving them to young participants teams (about 5 people each) to assemble single balance, putting their own ideas in the design by selecting favorite parts by themselves. Majority of the students could understand key concept of the balance (rule of moment) and assemble single balance with accuracy of milligrams.



OS23-4 Capstone Class of “Mechatronics Innovation Project” as STEM Educational Curriculum for Teacher Training Course

Hiroyuki Y. Suzuki, Masayasu Nagamatsu, Kazuo Kawada (Hiroshima University, Japan)

We have a set of STEM oriented special curriculum with name of “Mechatronics” in our teacher training course of “Program in Technology and Information Education, in School of Education, Hiroshima Univ.”. The mechatronics classes start from first grade, and they are eventually integrated in a capstone class of “Mechatronics Innovation Project” in third grade. We set a different theme in each year, and students are going to solve it by making automatic “mechatronics” machines. The theme in 2022 is guardrail cleaning robots. We are going to report the struggle of students to the theme and their outcomes, achievements and problems.



OS24 Applications of Unmanned Aerial System (3)

Chair Hazry Desa (Universiti Malaysia Perlis, Malaysia)

Co-Chair Nurfadzillah Ishak (Universiti Malaysia Perlis, Malaysia)

OS24-1 Effect of Spraying Dispersion Using UAV Spraying System with Different Height at Paddy Field

Hazry Desa¹, Muhammad Azizi Azizan¹, Nik Noriman Zulkepli¹, Nurfadzillah Ishak¹, Teh Xi Hang¹, Siti Syuhaidah Yahya¹, Aisyah Arina Mohammad Shahrazel¹, Fakhrul Mukmin Mansor¹, Siti Zaleha Abdul Aziz², Abadal-Salam T Hussain³

(¹universiti Malaysia Perlis, Malaysia), (²Mara Japan Industrial Institute (MJII), Malaysia)

(³Al-Kitab University, Iraq)

This study investigated the UAV spraying system height in relation to spraying uniformity and dispersion. The operating heights of the UAV spraying system at height of 1 m, 1.5 m, and 2 m from the hollow cone nozzles were investigated within a wind speed of 2.8 m/s. The tests were to determine the spray uniformity and dispersion on the water sensitive paper that was placed on the paddy plant. The results of water droplet samples were evaluated using ImageJ software. The results show the droplet distribution at 1.5 m height has high values for average droplet density, which is 162.7 deposits/cm² at the top area and 161.8 deposits/cm² at the bottom area. The percentage of coverage was also high, at 55.21% at the top area and 51.4% at the bottom area.

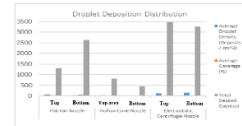


OS24-2 Spraying Dispersion Analysis with Different Nozzle Types Using UAV Spraying System in a Paddy Field

Hazry Desa¹, Muhammad Azizi Azizan¹, Nik Noriman Zulkepli¹, Nurfadzillah Ishak¹, Tan Yew Tian¹, Siti Syuhaidah Yahya¹, Aisyah Arina Mohammad Shahrazel¹, Fakhrul Mukmin Mansor¹, Siti Zaleha Abdul Aziz², Abadal-Salam T Hussain³

(¹universiti Malaysia Perlis, Malaysia), (²Mara Japan Industrial Institute (MJII), Malaysia)
(³Al-Kitab University, Iraq)

This study investigates the ability of Unmanned Aerial Vehicle (UAV) spraying systems to be used as an agriculture spraying method in Malaysia. The operating height of the UAV was 1.5 m with three different nozzles were investigated within a wind speed of 1.15 m/s to determine spray uniformity and dispersion in the paddy field conditions. The results from these samples were evaluated by using ImageJ software. The results show that the droplet distribution by using an electrostatic centrifugal nozzle has a high average droplet density, which is 134.03 deposits/cm² for the top area and 153.93 deposits/cm² for the bottom area. The electrostatic centrifugal nozzle also testified to the high value of total droplet deposit at 3478 for the top area and 3255 for the bottom area.



OS24-3 The capabilities and Readiness of Unmanned Aerial System (UAS) implementation in Construction Work Progression

Nurfadzillah Ishak, Muhammad Azizi Azizan, Hazry Desa (universiti Malaysia Perlis, Malaysia)

Unmanned Aerial Systems (UAS) have evolved over the past decade as both advanced military technology and off-the-shelf consumer devices. Nowadays, the implementation of Unmanned Aerial Systems technology is becoming increasingly widespread in construction industry. The uses of drones are increasingly moving towards successful remote procedures which can take place in a range of in building industry. Unmanned Aerial Systems remote sensing equipment is a way in which current building construction work progress can be analyzed and inspected. Therefore, this study would be beneficial as eye opener for building construction practitioner that this remote sensing equipment can replaced the manual paper-based supervision and unsystematic database of current conventional construction work progression process.

Table 1. Descriptive Analysis

Variables	Mean	Std. Deviation	Mean Value Score Interpretation
Capabilities			
Factors			
Control	4.60	0.54	High
System	4.47	0.44	High
Data			
Collection	4.43	0.44	
Safety			
Element	4.41	0.47	High
Factor			
Visual	4.38	0.52	High
Element			
Readiness			
Elements			
Optimism	3.50	0.44	High
Interactivity	3.24	1.18	Moderate
Discrepancy	3.08	0.95	Moderate
Discrepancy	3.15	1.97	Moderate

Note: The mean value categorized into three levels: low = 1.00 to 2.66; moderate = 2.67 to 3.32; and high = 3.34 to 5.00.

OS25 Emerging Technologies in Industrial Revolution 4.0 (IR 4.0) Era (8)

Chair Takao Ito (Hiroshima University, Japan)

Co-Chair Wei Hong Lim (UCSI University, Malaysia)

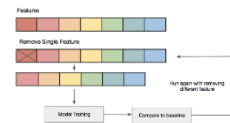
OS25-1 Chaotic African Vultures Optimization Algorithm for Feature Selection

Wy-Liang Cheng¹, Li Pan¹, Mohd Rizon Bin Mohamed Juhari¹, Chin Hong Wong^{2,3}, Abhishek Sharma⁴,

Tiong Hoo Lim⁵, Sew Sun Tiang¹, Wei Hong Lim¹

(¹UCSI University, Malaysia), (²Maynooth University, Ireland), (³Fuzhou University, China), (⁴Graphic Era University, India), (⁵Universiti Teknologi Brunei, Brunei Darussalam)

Feature selection is widely used to decrease the number of features by removing undesirable, noisy and inaccurate data while maintaining the classification accuracy. One way to improve the performance of feature selection is through metaheuristic search algorithms. Traditional optimization algorithms have poor initialization scheme that tend to trap into local optima when processing datasets with complex feature. A new variant known as Chaotic African Vultures Optimization Algorithm (CAVOA) is proposed to solve feature selection problems with better performances by leveraging the benefits of chaotic map in population initialization. Twelve datasets obtained from UCI Machine Learning Repository are used to investigate the capability of CAVOA in feature selection and compare with six competing algorithms. The proposed CAVOA has shown leading performance when against other competing algorithms by producing ten out of twelve best mean accuracies and four out of twelve datasets that have the lowest number of features.



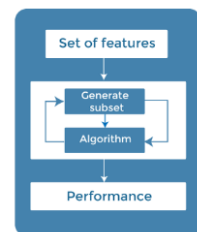
OS25-2 Multi Chaotic Flow Directional Algorithm for Feature Selection

Wy-Liang Cheng¹, Li Pan¹, Mohd Rizon Bin Mohamed Juhari¹, Abhishek Sharma², Hameedur Rahman³,

Chun Kit Ang¹, Sew Sun Tiang¹, Wei Hong Lim¹

(¹UCSI University, Malaysia), (²Graphic Era University, India), (³Air University, Pakistan)

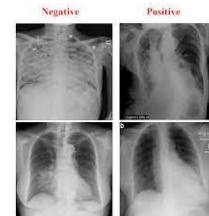
Feature selection is crucial in optimizing performance as it can reduce processing time and preserve classification accuracy. One way to further improve the capability is to implement a metaheuristic search algorithm as it is widely used by many researchers. This method has some disadvantages due to random population initialization scheme as it can easily trap in the local optima especially handling large quantities of features in the dataset. A modified algorithm known as Multi Chaotic Flow Directional Algorithm (MCFDA) is presented by incorporating multiple chaotic maps for population initialization. For validating the performance of the proposed algorithm, six competing algorithms are used to compare MCFDA on fourteen datasets received from UCI Machine Learning Repository. The results show that the proposed algorithm can obtain eight out of fourteen best mean accuracies and six out of fourteen datasets that have the least number of features.



OS25-3 Performance Comparison of Convolutional Neural Networks for COVID-19 Diagnosis

Suhaim Parvez Wadekar¹, Koon Meng Ang¹, Chin Hong Wong^{2,3}, Abhishek Sharma⁴, Tiong Hoo Lim⁵, Chun Kit Ang¹, Sew Sun Tiang¹, Wei Hong Lim¹
 (¹UCSI University, Malaysia), (²Maynooth University, Ireland), (³Fuzou University, China), (⁴Graphic Era University, India), (⁵Universiti Teknologi Brunei, Brunei Darussalam)

COVID-19 has devastated the global healthcare system as well as the economy with more than 600 million confirmed cases and 6 million deaths globally. A timely and accurate diagnosis of the disease plays a vital role in the treatment and preventative spread of disease. Recently, deep learning such as Convolutional Neural Networks (CNNs) have achieved extraordinary results in many applications such as medical classifications. This work focuses on investigating the comparison of nine state-of-the-art architectures: Alexnet, Googlenet, Inception-v3, Mobilenet-v2, Resnet-18, Resnet-50, Shufflenet, Squeezenet and Resnet-50 RCNN for COVID-19 classification by comparing with performance metrics such as accuracy, precision, sensitivity, specificity and F-score. The datasets considered in current study are divided into three different classes namely Normal Chest X-Rays (CXRs), Pneumonia patient CXR and COVID-19 patient CXR. The results achieved shows that Resnet-50 RCNN achieved an accuracy, precision, sensitivity, specificity and F-score of 95.67%, 95.71%, 95.67%, 97.84% and 95.67% respectively.



OS25-4 Classification of Wafer Defects with Optimized Deep Learning Model

Koon Hian Ang¹, Koon Meng Ang¹, Mohd Rizon Bin Mohamed Juhari¹, Chin Hong Wong^{2,3}, Abhishek Sharma⁴, Chun Kit Ang¹, Sew Sun Tiang¹, Wei Hong Lim¹
 (¹UCSI University, Malaysia), (²Maynooth University, Ireland), (³Fuzou University, China), (⁴Graphic Era University, India)

Wafer defect inspection is one of the crucial semiconductor processing technologies because it can help to identify the surface defects in the process and eventually improve the yield. Manual inspection using human eye is subjective and long-term fatigue can lead to erroneous classification. Deep learning technology such as convolutional neural network (CNN) is a promising way to achieve automated wafer defect classification. The training of CNN is time consuming and it is nontrivial to fine tune its hyperparameters to achieve good classification performance. In this study, Arithmetic Optimization Algorithm (AOA) is proposed to optimize the CNN hyperparameters, such as momentum, initial learn rate, maximum epochs, L2 regularization, to reduce the burden brought by trial-and-error methods. The hyperparameters of a well-known pretrained model, i.e., Google Net, are optimized using AOA to perform wafer defects classification task. Simulation studies report that the AOA-optimized Google Net achieves promising accuracy of 91.32% in classifying wafer defects.

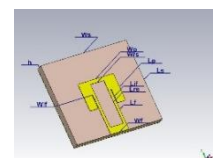
Test Data Confusion Matrix

	Center	Circle	Edge-Like	Line	Noise	Random	Scratch	Spot
Center	90.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Circle	0.0%	91.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Edge-Like	0.0%	0.0%	91.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Line	0.0%	0.0%	0.0%	91.0%	0.0%	0.0%	0.0%	0.0%
Noise	0.0%	0.0%	0.0%	0.0%	91.0%	0.0%	0.0%	0.0%
Random	0.0%	0.0%	0.0%	0.0%	0.0%	91.0%	0.0%	0.0%
Scratch	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	91.0%	0.0%
Spot	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	91.0%

OS25-5 Compact Wearable Antenna for Millimeter-Wave (mm-Wave) Fifth Generation (5G)

Wai Kiat Wong¹, Sew Sun Tiang^{1,*}, Wei Hong Lim¹, Mastaneh Mokayef¹, Chin Hong Wong^{2,3}
 (¹UCSI University, Malaysia), (²Fuzou University, China), (³Maynooth University, Ireland)

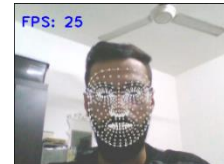
The need for networking, communication, and data sharing capabilities among users of wearable terminal devices has increased, and this has made the new wearable antenna one of the most active research areas. This work presents a wearable antenna for 5G applications based on a microstrip patch antenna type operating at 28GHz millimeter-wave (mm-wave). The operating frequency of 28GHz is expected to be appropriate for 5G mm-wave wearable antenna design. The design makes use of the semi-flexible Rogers Duroid RO3003 substrate, which has a thickness of 0.75mm, a loss tangent of 0.001 and a relative permittivity of 3. CST Microwave Studio software is used to analyze and evaluate the proposed antenna's performance to other existing designs in terms of return loss, bandwidth, gain, directivity, and point SAR value.



OS25-6 Driver's Fatigue Recognition using Convolutional Neural Network Approach

Samer Abbas¹, Sew Sun Tiang¹, Wei Hong Lim¹, Li Sze Chow¹, Chin Hong Wong^{2,3}
(¹UCSI University, Malaysia), (²Fuzou University, China), (³Maynooth University, Ireland)

Drowsy driving is a serious issue that has been leaking in our communities since long time, the definition of drowsy driving is when the driver is not aware enough to proceed with driving the vehicle causing catastrophic accidents. Multiple methods were found to approach this complication across the years. Convolution Neural Network has approved to be a reliable approach to treat this issue by using face feature detection. In this paper, the effect of key parameters of the trained framework based on the driver's fatigue recognition model are analyzed, and the accuracy of the driver's fatigue recognition model is investigated, as well as a driver's fatigue recognition is studied under different conditions using CNN. Transfer learning is used to develop a reliable method for detection, Mediapipe Face Mesh model is used to extract the features from the face. MAR (Mouth Aspect Ratio) as well as EAR (Eyes Aspect Ratio) are obtained through the detection, these terms are responsible for detecting the eye and mouth closure ratio, the model has proved to work with accuracy of 98.3% and in different light conditions with accuracy of 94.7% outperforming several past models.



OS25-7 Deep Residual Neural Network for Efficient Traffic Sign Detection System

Hanlin Cai^{1,2}, Jiaqi Hu^{1,2}, Zheng Li^{1,2}, Wei Hong Lim³, Sew Sun Tiang³, Chin Hong Wong^{1,2}
(¹Fuzou University, China), (²Maynooth University, Ireland), (³UCSI University, Malaysia)

This paper has proposed a deep residual neural network (RNN) model for traffic signs detection system (TSDS) research. Experiments are conducted to verify the feasibility of implementing the RNN model for traffic sign detection and recognition. Moreover, a new systematic analytic hierarchy process (AHP) method for model performance evaluation has been suggested, which is sufficient for deployment in the practical performance measurement of the deep learning model.

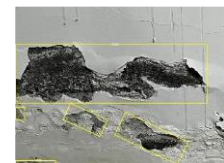


OS25-8 Wall Crack Detection based on Adaptive Double Threshold Grayscale Transform

Mingrui Lin^{1,2}, Xin Xu^{1,2}, Tengxiang Li^{1,2}, Yuhang Hong^{1,2}, Weiqin Wang^{1,2}, Shilin Chen^{1,2}, Wei Hong Lim³,
Chin Hong Wong^{1,2}

(¹Fuzou University, China), (²Maynooth University, Ireland), (³UCSI University, Malaysia)

The construction industry is an important supporting social-economic development, it is of great significance to detect cracks in walls to realize the analysis and provide early warning of building. A wall crack detection algorithm is proposed based on an adaptive double-threshold grayscale transform. The MATLAB built-in function graythresh is modified to have a flag bit to preliminarily select the grayscale transformation threshold. The grey transform and binarization threshold can be automatically adjusted based on the image processing effect using a preliminary-selected threshold. The MATLAB simulation results show that the algorithm has an accuracy of 96.16%.



OS26 Signals Processing and Automation I (6)

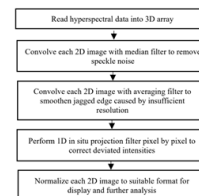
Chair Norrima Mokhtar (University of Malaya, Malaysia)

Co-Chair Heshalini Rajagopal (UCSI University, Malaysia)

OS26-1 Noise Filtering of Hyperspectral Data of Oil Palms by Median-Mean Projection Filtering

Imanurfatiah Ibrahim¹, Hamzah Arof¹, Mohd Izzuddin Anuar², Mohamad Sofian Abu Talip¹
(¹Universiti Malaya, Malaysia), (²Malaysian Palm Oil Board, Malaysia)

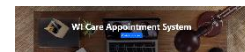
One of the many applications of hyperspectral imaging is in agriculture. However, hyperspectral data captured from airborne UAV sometimes contain noise that make their spectral signatures different from those of field spectroscopy using similar wavelengths. Therefore, there exists a need to filter noisy hyperspectral data to improve their quality so that a strong correlation can be established between the airborne and field hyperspectral data for effective analysis. For oil palm hyperspectral data, an efficient and effective method is introduced to filter noise using median-mean projection filtering. This novel approach generates superior results compared to those produced by the conventional method of convolving the data with 2-D filters, in terms of output quality and signal to noise ratio.



OS26-2 Smart Telehealth Appointment System – WI Care

Siah Cheong Lin, Heshalini Rajagopal, Chloe Thong Chee Ling (UCSI University, Malaysia)

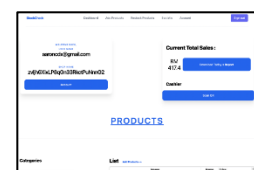
This study aims to create a Smart Telehealth Appointment System -WI Care that enables user to make an appointment in ease. Due to COVID-19 pandemics, constant lockdown had resulting social distancing measures, movement control order, and people avoid outdoor activities. The proposed system, WI Care will have an appointment system that can be managed by doctors meanwhile appointer can keep submitting form. WI Care ensure both parties can be conducting the same procedure as how every GPs and doctors able to work anywhere anytime. With dashboard and time scheduling, these are able to create chance for doctors and GPs having manageable workload as individual. This study suggests the healthy environment whereas every doctor can join WI Care to share skills and tackles problem together.



OS26-3 Web-based Stocktaking application in Businesses

Cheah Dei Xuan, Heshalini Rajagopal, Shayla Islam (UCSI University, Malaysia)

This study aims to develop a web-based application on business stock checking where workers able to track their quantity of their stock from running out of stock as well as to track the business statistic. This application is developed using Vue 2 framework, Java script language, html 5, and tailwind CSS. In this study, a database was developed for shopkeeper to store all the data related to the shop on cloud-based that able to prevent from disaster or human errors. Furthermore, a web-based system was developed to perform stock checking and monitoring which allow shopkeeper to check on statistic of the product and also the notify shopkeeper which stock are running low. In addition, a softcopy receipt was implemented as a default for customer instead of hardcopy.



OS26-4 Pharmacy Warehouse Management System

Gan Jhui Ken, Heshalini Rajagopal, Shaik Shabana Anjum (UCSI University, Malaysia)

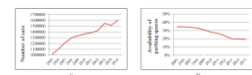
Managing of the stock and supply of medication plays an essential part for the provisioning of health care, therefore this study aims to develop the web-based warehouse system. With the use of modern technology, the warehouse management system can be made better to help improve the quality of work for both the employees and admins. Additionally, this system will include the basic functions of a warehouse management system that will allow users to utilize the system with ease. The proposed system aims to improve the current pharmacy warehouse management systems so that it will be viable for users to understand and utilize the system efficiently.



OS26-5 A Development of an Automatic Allocation Parking System

Ng Wai Lam, Neesha Jothi, Shayla Islam (UCSI University, Malaysia)

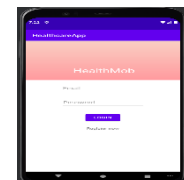
As the number of cars increases, the demand for parking spaces in the parking lot also increases. Due to the lack of parking spaces in the parking lot, people spend more time looking for parking spaces after entering the parking lot, and also consume a lot of car oil. Therefore, this project is to develop a new parking system that will automatically allocate parking spaces for user. In this study, literature review was done to determine how this type of system functions and how it is made. Then to make a questionnaire cantered on the users' previous experience on existing systems. Lastly, to make a comparison of existing systems and to analyze the systems strengths and weaknesses to determine what functions to add to this new system.



OS26-6 Healthcare Mobile Application

Yee Chee Hong, Neesha Jothi, Javid Iqbal (UCSI University, Malaysia)

This project aims to assist those people who live in a busy city to take care their health. They suffered a lot from working and other stress that caused themselves always to keep in unhealthy status. Although they know they are lives such unhealthy, still they have no time to manage it. Also, the unfriendly user interface of current healthcare mobile application that caused inconvenience to use them. This project will improve those weaknesses that allocated from current existing system. The healthcare mobile will open use to public users. It will come with online appointment, online pharmacy purchase, chat support and check information or history. New function added will be e wallet which can make payment or top up using serial number or smart wallet such as TNG pay and Shopee Pay.



OS27 Research Towards the Sustainable Development Goals (SDG's) (6)

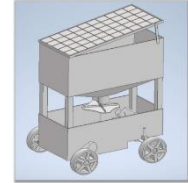
Chair Ammar A.M. Al Talib (UCSI University, Malaysia)

Co-Chair Takao Ito (Hiroshima University, Japan)

OS27-1 Solar Powered Seed Sprayer Machine

Ammar A.M. Al Talib, Yap Chee Xian, Ain Atiqa, Nor Fazilah Abdullah (UCSI University, Malaysia)

The main objective of this project is to fabricate a complete functional seed sprayer machine which is purely powered by solar energy. The performance is tested through the seed amount sprayed over time and the area that can be covered. In this project, a broadcast spreader has been used. It is solar powered with a wireless communication to remotely control the machine. The fabrication of the solar seed sprayer machine in this study has been divided into four main parts which are remote driving system, solar charging system, seed storage dispenser system, and impeller spreader system. Several experiments are conducted to analyze the performance of solar seed sprayer machine. The performance of the tested machine has been indicated through the capability of the machine on spreading different types of seeds with various sizes and shape.



OS27-2 Solar Powered Outdoor Air Purifier With Air Quality Monitoring

Ammar A.M. Al Talib, IK Chu Aung, Noor Idayu M. Tahir (UCSI University, Malaysia)

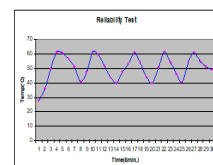
This paper is discussing the design and fabrication of a solar powered air purifier and its performance. Its aiming for the production of an outdoor air purifier powered by solar energy and with a High Efficiency Particulate Air Filter (HEPA) and Carbon Filters which can achieve air purification with self-sustainable ability. Several tests have been conducted to proof the good performance of air purifier. In the first indoor test, 15.79% of error and 67.37 % of efficiency was achieved during the solar panel efficiency test. Second test of air purifier test has shown the efficiency of cleaning ammonia pollutant in the air as 43.55% for burning cigarette and 35.33% for floor detergent using the equipped two MQ135 sensor. The findings has shown that the floor detergent might have higher rate of diffusion than ammonia molecule found in cigarette smoke. Comparisons have been conducted of theoretical and actual test results.



OS27-3 Design and Fabrication of a Mutual Control Electronic Circuit for Solar and Electrical Water Heating

Ammar A.M. Al Talib¹, Sarah Atifah Saruchi² (¹UCSI University, Malaysia), (²UTP, Malaysia)

This research is a temperature controller that will be implemented to ensure that the water temperature of the solar water heating unit is maintained at the desirable level all the time. This control circuit is designed to control the action of electrical heater according to specific temperature range. Temperature sensor will sense the water temperature constantly and send signal to a micro-controller unit. The micro-controller will process the data according to a written program and control the actions of electrical heater. At the same time, temperature reading will display through LCD and real-time data can be viewed from a computer via serial port. During times of sufficient sunlight, solar will be the main energy source used for heating water; otherwise, there will be an automatic switching to the electrical operated immersion heater. This controller will give reliability to users of solar water heating systems.



OS27-4 Optimization of the Major Factors Affecting The Home Recycling of Disposed (LDPE) Plastics

Ammar A.M.Al Talib, Chua Ray Sern Grayson, Ain Atiq (UCSI University, Malaysia)

Low-density polyethylene (LDPE), which is widely adopted in many daily life products, took more than hundreds of years to decompose in the landfill. Although various efforts were carried out to recycle LDPE, the operations were proved to be uneconomical as it needs sophisticated equipment. Hence, this study is aimed to encourage simple domestic recycling procedures and to investigate the optimum recycling conditions for disposed LDPE plastics and explore potential green applications for the recycled material. As proposed in this study, disposed LDPE bags are cut, washed, dried and then inserted into oven for melting at specified heating temperatures and different time duration's inside the oven. Mechanical tests are conducted which include hardness test, compression test and tensile test. The recycled LDPE achieved 90.2 Shore-A hardness point, 9.2599 MPa of compressive strength and tensile strength of 9.0705 MPa. The recycled LDPE plastics are found useful in many life appliances.



OS27-5 Investigation of the Mechanical Properties and Applicability of Recycled Plastic Bags

Ammar A.M.Al Talib, Wan Wai Kit, Nor Fazilah Binti Abdullah (UCSI University, Malaysia)

Low Density Polyethylene (LDPE) is a thermo-plastic made from the monomer ethylene. It is estimated that only a mere 5.7% of LDPE is recycled worldwide. This study is to reveal some of the mechanical properties of the recycled disposed plastic bags and finding the possible applications for them.. Mechanical properties such as hardness testing, compression testing and water absorption has been carried out on the LDPE recycled samples according to ASTM Standards. The mechanical tests conducted on the recycled specimens have indicated that the most suitable applications based on safety and satisfying needs would be the spring post that can be used on roads, field track or any situation where separation of section would be needed.



OS27-6 Design and Fabrication of Power Generating Treadmill

Ammar A. M. Al-Talib¹, They Kai Yang¹, Sarah Atifah², Noor Idayu M.Tahir¹
(¹UCSI University, Malaysia), (²UTP, Malaysia)

This paper aims to take advantage of treadmill's wasted electrical energy during a person's workout and utilize the energy for charging electrical appliances. In order to take advantage of this wasted energy, it could be harnessed by a power generator and stored in a battery bank. The prototype machine did not interrupt a person's workout flow and it can be attached to any treadmill due to its design features. Wasted energy was harnessed in this project by a non-traditional manner of using shaft and wheel method. A multi-meter was used to measure the voltage, current and power generated. The prototype machine is found able to fully charge a 3096mAh smartphone in 135 minutes and the phone could be fully charged for 2 charge cycles. This power generating treadmill machine is proved to be a very good application of the Sustainable development Goals (SDG's).



OS28 Is That Narratology ‘Post’? -Computational and Cognitive Approaches and Beyond (5)

Chair Jumpei Ono (Aomori University, Japan)

Co-Chair Hiroki Fxyma (Tainan University of Technology, Taiwan (ROC))

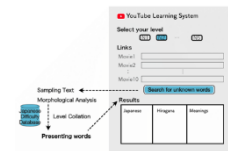
Co-Chair Yuki Hayashi (Chiba University / NINJAL, Japan)

Co-Chair Takashi Ogata (Iwate Prefectural University, Japan)

OS28-1 Proposing YouTube-based vocabulary learning system

Hiroki Fxyma (Tainan University of Technology, Taiwan (ROC))

This study proposes a language learning support system using YouTube. Motivations for language learning are becoming more diverse: exposure to multi-language information is becoming more common through SNS. Thus, it is expected that the number of potential "sub-learners," rather than explicit learners in the classroom, is increasing. This study proposes a system that allows these potential learners to focus on the words they need to watch videos that interest them. As a manual prototype, we will use an existing subtitle extraction system to extract text and create a corpus.



OS28-2 A Study on the Impact of “Trending” and “Flaming” on Content from “A Crocodile Who Will Die in 100 Days”

Taiki Sugimoto, Jun Nakamura (Chuo University, Japan)

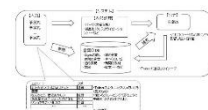
The subject of this research is “A Crocodile Who Will Die in 100 Days” which has experienced getting flamed. This study uses Sentiment Analysis and Key Graphics Analysis to capture a bird's eye view of the impact of trending and flaming generated through social media on content. The analysis and discussion clarify the following two points. First, there is a significant gap between the tendency of comments directly sent from recipients to senders and the tendency of comments shared by recipients during the period of being flamed on social media. Second, content that has gone up in flames will not be extinguished for a long period, and the fact that it has gone up in flames will itself be consumed as content.



OS28-3 Protocol analysis for constructing Verbalizing Support System

Yuki Hayashi (Chiba University/NINJAL, Japan)

In this paper, I will show a result of an experiment. The experiment was conducted using voice recorder and the participants was required to report what they think orally. I have been conducting experiments to know how people express their feelings and thinking in their daily lives. Previously, I suggested the basic concept of Verbalizing Support System (in Japanese). However, in this experiment, I tried to show the process of verbalizing people's feelings and thinking. In addition, I'll show the revised concept of Verbalizing Support System compared with the previous paper.



OS28-4 Story generation during appreciating an artwork based on an actual tale (Ugetsu-monogatari)

Akinori Abe (Chiba University, Japan)

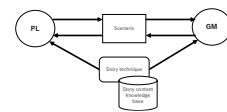
In this paper, I will show a result of an experiment. The experiment was conducted using an artwork based on an actual tale (Ugetsu-monogatari). Actually the tale is rather old one. I have been conducting experiments to know how people can generate stories from the artworks. Previously I did not use artworks based on actual tales. Only the exception was artworks based on “Alice in Wonderland.” These artworks were used to see how Visual Thinking Strategies (VTS) functions during art appreciation. Of course in the experiment, we asked participants to generate stories. However, in this experiment, I tried to see the process of the story generation during art appreciation.



OS28-5 Designing a Narrative Generation Game Based on the Russian Invasion of Ukraine

Jumpei Ono¹, Takashi Ogata² (¹Aomori University, Japan), (²Iwate Prefectural University, Japan)

We have previously proposed an automatic narrative generation game. The purpose of this paper is to propose a game concept based on the framework of the automatic narrative generation game. The proposed game uses the ongoing Russian invasion of Ukraine since February 2022. The game based on an analog game in which participants advance a shared storyline, mainly through dialogue. The proposed game is a game with story generation, and as a method of application, we intend to support the creation of stories through the game.



OS29 Signals Processing and Automation II (6)

Chair Norrima Mokhtar (University of Malaya, Malaysia)

Co-Chair Heshalini Rajagopal (UCSI University, Malaysia)

OS29-1 Weather Forecast System for Mobile Devices

Hu Jiahao, Neesha Jothi, Chloe Thong (UCSI University, Malaysia)

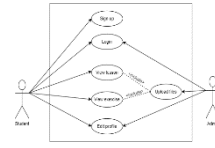
In the 21st century, a large number of personal computers appeared in daily life, and people began to be familiar with obtaining the required information through the Internet. Subsequently, as mobile development technology became increasingly popular and rapidly occupied the Internet market, the development of mobile terminals also made a breakthrough. At present, Android and iOS platforms dominate mobile platforms. Most applications are developed based on a single platform, and the development efficiency is not ideal. Therefore, cross platform technology has gradually entered the vision of developers, easing the problem of cross platform development. It provides opportunities to meet people's needs for real-time, accurate and diverse weather information.



OS29-2 Development of a Novel E-Learning System for Improved Usability

Soo Yang Yew, Shaik Shabana Anjum, Shayla Islam (UCSI University, Malaysia)

E-learning is a learning approach that combines organized instruction with the use of technological resources such as laptops, computers, and tablets. It allows students to study at any time and from any location with the help of Information Communication Technologies (ICT) that can connect instructors and pupils who are separated by thousands of miles. The criticality of this study is to fulfill students' and instructors' expectations of using virtual learning systems while having thrilling and interesting learning and teaching experience. This proposed system will help them to know more about the technology tools functioning and teach them a better understanding of using the system's features. Most lecturers and students faced challenges in utilizing e-learning systems with such factors being reviewed by some researchers.



OS29-3 A Development of a Prototype-based Mobile Pet Care Application

Gan Ai Leen, Shaik Shabana Anjum, Chloe Thong Chee Ling (UCSI University, Malaysia)

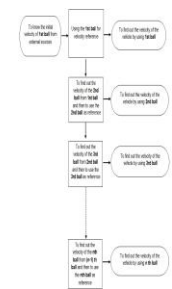
The keeping of domesticated pets has become a norm in today's society, and taking care of them has become a part of the humane culture. Therefore, this project aims to create prototype-based mobile pet care application that is able to make the user's life easier. The pet care application is based on the android application. Its objective is to provide the users a way to book the necessary appointment through the use of mobile phone without having to do it manually. Additionally, the application will include a chat function which can connect with the users and the admin. The application will enable the pet owners to get timely updates about their pets when they are away and under pet care. It will also provide options for grooming and healthcare facilities for the pet.



OS29-4 Modeling of an Environmentally Independent and Contactless Speed Sensor for Measuring the Speed of Ships, Submarines, and Aircraft in Relation to the Ground Development of Image

Jakaria Mahdi Imam, Mohammad Aminul Islam, Norrima Binti Mokhtar, S. F. W. Muhamad Hatta (Universiti Malaya, Malaysia)

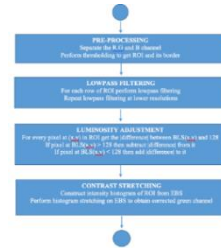
We are presenting a theoretical and mathematical model for an environment-nondependent contactless speed sensor that can measure directly the horizontal speed of ships, submarines, and/or aircraft with respect to the ground. Currently, available standalone onboard speed sensors used in ships, submarines, and aircraft measure the speed of the vehicle with respect to the water or air; not the ground. In this paper, we have shown that a novel speed sensor can be designed by using small size objects dropped inside a vacuum chamber. Unlike the conventional methods, our proposed method can measure the speed of ships, submarines, and aircraft with respect to the ground directly. Another issue is that current speed sensors are environment-dependent, meaning they or their probes require some type of touch with the operational environment. The complete sensor assembly can be placed inside the vehicle.



OS29-5 On Correcting Luminosity and Contrast of Retinal Images with Reflectance

Mofleh Hannuf AlRowaily¹, Hamzah Arof¹, Imanurfatiehah Ibrahim¹, Wan Amirul Wan Mohd Mahiyiddin¹,
Norrina Mokhtar¹, Haniza Yazid²
(¹Universiti Malaya, Malaysia), (²Universiti Malaysia Perlis, Malaysia)

In this paper, we perform an automatic correction of luminosity and contrast of retina images. Retina images with varying level of reflectance taken from online databases are used to test the effectiveness of the method. The approach is implemented in 4 stages. In pre-processing, the three components of a color retina image are separated and only the green channel is processed further. Then the region of interest (eye region) and its border are marked. Next, the ROI of the green channel is filtered using a lowpass filter row by row to create a smooth background brightness surface. Three types of lowpass filters are used and their performances are compared. Using the background surface, the luminosity of the ROI is adjusted so that every pixel has the same brightness. Finally, the contrast of the ROI is improved by histogram stretching.



OS29-6 Rate Adaptation for Quality of Service Improvements in IEEE 802.11ax

Hazwani Zawawi¹, Wan Norsyafizan W Muhamad¹, Nani Fadzlina Naim¹ (¹Universiti Teknologi, MARA)

This paper presents rate adaptation for Quality of Service (QoS) improvement in IEEE802.11ax. This study implemented a link adaptation technique which adapts the transmission data rate in IEEE 802.11ax WLAN. The main objectives of this paper are to design a link adaptation which adapts the transmission data rate based on radio channel conditions and to verify the effectiveness of the proposed algorithm. Simulation results show that the data rate adaptation technique offers better performance in terms of throughput and delay.



OS30 Embedded systems projects (3)

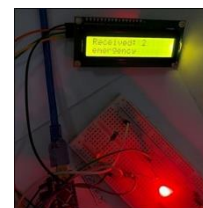
Chair Mastaneh Mokayef (UCSI University, Malaysia)

Co-Chair Takao Ito (Hiroshima University, Japan)

OS30-1 Data Transmission by Li-Fi in Coal Mining

Myadadha Goutham Reddy¹, Tan Jia Wei¹, Mandigiri Golla Jagan Kumar¹, Vytla Poojitha¹, Kaki Harshavardhan Goud¹, Wang Ji¹, MHD Amen Summakieh¹, Atefeh Mohammadpour², Mastaneh Mokayef^{1*}
(¹UCSI University, Malaysia) (²California State University, USA)

In this paper, we proposed and designed a method to utilize the Li-Fi technology for data transmission which are equipped with sensors to provide real time situation stat to the coal miners to ensure their safety. One of the most dangerous gases in coal mining is the carbon monoxide (CO). Hence, specific type of sensor is used and connected to a core component which is the microcontroller and placed at different parts of the coal mine. When the concentration level exceeds a certain threshold value, the buzzer will be triggered, and the notification is sent to the central database to inform the workers. Li-Fi provides the solution for slow data transmission or data loss which enhances the safety and improve the working condition of labors in coal mining sectors.

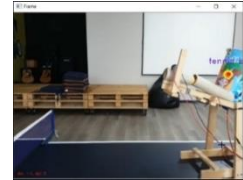


OS30-2 Embedded Table Tennis Ball Launcher with a Trajectory Path Analyzer for Junior Players

Mastaneh Mokayef¹, Lee Qi Jian¹, Bushra Naeem², Miad Mokayef¹, M.K.A Ahamed Khan¹,
MHD Amen Summakieh¹

(¹UCSI University, Malaysia) (²Balochistan University of Information Technology, Pakistan)

In this project, a pitcher machine as a personal Table Tennis trainer has been designed and the trajectory path analysis of the practical performance of player is analysed accordingly. In the proposed system, a camera is presented to track the table tennis ball. The obtained images from the camera are processed by OpenCV software and the flying trajectory is predicted based on the X and Y coordinates of a ball position to analyse the performance of player in each direction. The pitcher machine is then set via smart phone to the direction with weak performance to shoot more balls in that direction. However, the spinning serve is yet to be added in the proposed system, this project offers an acceptable platform for the early stage of the table tennis training. Experimental results show the acceptable performance analysis in complex mess environment and background.

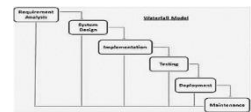


OS30-3 Table Tennis Tournament Scores and Statistics Web Application

Belal Khaled¹, Mastaneh Mokayef^{1*}, Chin Hong Wong², Sew Sun Tiang¹, Wei Hong Lim¹, MHD Amen Summakieh¹, Miad Mokayef¹

(¹UCSI University, Malaysia) (²Fuzhou University, China)

The objective of this project is to develop a functional web application that will retrieve or store table tennis tournament statistical data and visualize them using tables, bar charts, pie charts, histograms as a medium of demonstration for the user. Moreover, the application will perform specific analysis on the scores and display insightful data about the tournament for league structures investigation. The developed system will include a database to store and retrieve data for display on the user interface. The development of the project is fully stacked (front-end and back-end), so it is built with the appropriate web technologies to function in the background (PHP, MySQL, Apache) while displaying results (HTML, CSS, JavaScript) on the page for the user. The project is managed using effective project management methods to plan, design, implement, develop, and maintain the application.



OS31 Image Processing and Reconstruction (5)

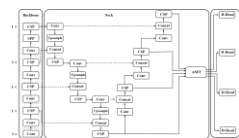
Chair Chair Xiaoyan Chen (Tianjin University of Science and Technology, China)

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

OS31-1 Small-Target Detection Based on YOLOX

Keying Ren¹, Xiaoyan Chen^{1*} (Tianjin University of Science and Technology, China)

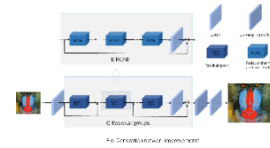
With the development of drone, Small-Target detection has become a hotspot of current research. In this paper, the network of Small-Target detection is based on YOLOX is studied. There are a lot of small targets in the images taken by UAV, which brings great difficulty to the detection task. A four-scale adaptive spatial feature fusion pyramid is used to filter the conflicting information between different scales and improve the expressive accuracy of the small target features. Experiments show that the proposed method has a mAP average accuracy of 32.83% in the self-built dataset, which is 2.53% higher than that of YOLOX-s, 1.53% higher than that of Yolov6-s, and 5.73% higher than that of YOLOv5-s.



OS31-2 Super Resolution Reconstruction Model Based on Attention Mechanism and Generative Adversarial Network

Xia Miao, Xiaoyan Chen (Tianjin University of Science and Technology, China)

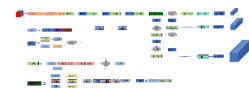
With the continuous improvement of the screen quality of various electronic devices, the public's pursuit of fine visual effects is also increasing. However, due to the degradation phenomenon in the actual imaging and transmission process, there is a contradiction between the obtained low resolution image and the high quality screen. The purpose of image super resolution reconstruction is to recover high frequency details from low resolution images containing little information, so as to improve the visual effect of images. Based on the problems existing in the current Adversarial network generation methods, this paper constructs Channel Attention (CA) and Generative Adversarial Networks. CA-SRGAN is applied to image super resolution reconstruction, and the image super resolution reconstruction module is implemented.



OS31-3 Pedestrian-vehicle detection based on YOLOv7

Xiaoyan Chen, Zhihui Chen (Tianjin University of Science and Technology, China)

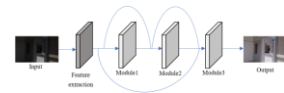
With the continuous development of information technology, it is constantly improving. The security industry is constantly expanding. Therefore, object detection has become more important. In this paper, a large number of experiments have been made to improve the detection accuracy of pedestrians, vehicles and license plates in cities. The improved YOLOv7 algorithm was used to conduct a large number of experiments on the urban pedestrian vehicle dataset. Experiments show that new improvements have improved detection accuracy.



OS31-4 A lightweight, faster, more generalized low light image enhancement network

Yutao Jin, Xiaoyan Chen (Tianjin University of Science and Technology, China)

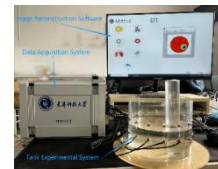
Existing methods based on deep learning have achieved great success in low light image enhancement. However, these methods generally have a very large amount of computation and poor generalization ability for low light images in different scenes. In order to solve this problem, this paper explores a wonderful way to assist training by introducing auxiliary blocks in the training process. These blocks can connect the feature map input to each stage with the input to the first stage of the model to explore whether the model converges. In the prediction phase, due to the superior capabilities of the network, we use only one basic block for inference, so as to greatly reducing the computational cost. Thanks to the flexibility of the network, the model can easily handle low light images in a variety of complex environments.



OS31-5 An Improved Landweber Method for Electrical Impedance Tomography

Qian Wang, Xiaoyan Chen (Tianjin University of Science and Technology, China)

Electrical impedance tomography (EIT) is a non-destructive monitoring technique. Its image reconstruction problems have serious nonlinear and ill-posed nature, which leads to the low spatial resolution of the reconstructed images. The iterative algorithm is an effective method to deal with imaging inverse problem. However, the existing iterative imaging methods have many problems, such as many iterations and unstable convergence. To solve this problem, this paper proposes an improved Landweber iterative image reconstruction method. By adding a regularization term to the objective function of the inverse problem of EIT, the method improves the convergence speed. The physical experiment results show that the improved Landweber method is superior to the Landweber method in convergence speed.



OS32 AR, VR and Digital Contents

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

Co-Chair Yoshimasa Tokuyama (Transworld University, Taiwan)

OS32-1 A Kinect-based Augmented Reality Game for Arm Exercise

Toshimasa Tokuyama (Transworld University, Taiwan)

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

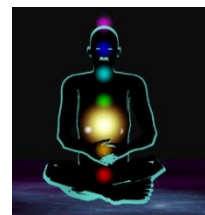
Augmented reality (AR) is where 3D virtual objects are integrated into a 3D physical environment in real-time. Augmented reality applications such as medical visualization, maintenance and repair, robot path planning, entertainment, military aircraft navigation, and targeting applications have been proposed. This paper introduces the development of an augmented reality game that allows the user to carry out arm exercises using a natural user interface based on Microsoft Kinect. The system has been designed as an augmented game where users' hands are in a world augmented with virtual objects generated by computer graphics. The player is sitting in a chair, grasping the yellow stars displayed on the stage. It encourages the activities of a large number of arm muscles which will prevent decay. It is also suitable for rehabilitation.



OS32-2 Development of EEG-based VR Application for Chakras Guided Meditation

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

In a rapidly changing world, everyone is under a lot of pressure, both visible and invisible. Therefore, stress causes several diseases. Meditation through mindfulness is one of the ways to relieve stress. This paper studies how to properly meditate in a VR environment and increase the effect of chakra meditation by real-time EEG data. The theory of chakras has existed for thousands of years and still exists in modern society. The balance of their energy is essential to everyone. Meditation on the chakras is beneficial to the health of the body. But for ordinary people, chakra is invisible and unimaginable. It is easy to associate it with religion. Therefore, we developed the application in a VR environment. Users can sit inside a non-distracting environment with chakra visualization. It's easier for ordinary people to understand chakras meditation. The application can understand the user's condition by the EEG data and change to the next chakra in sequence.



OS32-3 A Study on Flower Patterns of Temple Cut-and-Paste Decorations based on L-system

Meng-Fan Huang, Tzu-Hsien Yuan, R.P.C. Janaka Rajapakse (Tainan National University of the Arts, Taiwan)

"Cut-and-paste" is an architectural skill used in traditional Chinese temples to make various decorations by pasting tiles and glass. This traditional craft has a history of more than 400 years, and each piece of work has noble artistry. This kind of craftsmanship is usually shown on roofs and walls of temples, so it is also called "art on the roof." However, due to the time-consuming or labor-intensive production and the aging of many craftsmen, this traditional handicraft is slowly disappearing. Although the paste decoration of the Temple has been registered and preserved by the Taiwan government many years ago, there are very few related studies, and many works are also in a state of being damaged and difficult to repair. Therefore, this study will discuss the decorative flower patterns in the paste decoration of the temple, analyze the growth of plants with the L-System, and then use TouchDesigner to create interactive works, hoping to transform traditional handicrafts into public art so that more people realize the importance of craft preservation.



OS32-4 Pass-By: Development of Pedestrian Counts-based Art Installation for Passive Interaction.

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

The trees in the streetscape grow as pedestrians pass by; we are always taking away and bringing in our surroundings without realizing it, perhaps some of the changes are very small, and we only notice them when they have grown to colossal size. This work presents a pedestrian counts-based art installation for multi-user passive interaction. This work 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 an Arduino ultrasonic sensor. Based on the measured counts of pedestrians passing by, the developed application controls the color of the street scene and gradually decreases as the pedestrians cross. Using the L-system application, the trees in the street scene grow progressively as the pedestrians cross.



GS abstracts

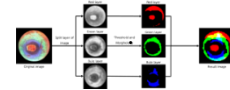
GS1 Machine Learning & Neural Network & Artificial Life (3)

Chair Masato Nagayoshi (Niigata College of Nursing, Japan)

GS1-1 Defect Solder Classification in Print Circuit Boards using Machine Learning

Watcharin Tungsuksan, Hattapat Silangren, Phattharaporn Iamcharoen, Wisanu Jitviriyaya
(King Mongkut's University of Technology North Bangkok, Thailand)

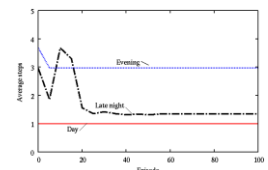
This research proposes the solder inspection using the digital image processing technique and machine learning base with our machine vision prototype. There are five classes of classifying solder, including acceptable, short circuit, insufficient, blow hole and too much of solder. Automatic Optical Inspection (AOI) is used for the light source in the designed prototype and industrial camera which are installed on the mini-CNC. For the algorithm, this research applies the scanning line of binary image for detecting short circuit defection and the Random Forrest model for classifying other defects. According to the experiments, the system can classify the defect types for two classes (acceptable and unacceptable types) and five classes as 89% and 71% of accuracy, respectively



GS1-2 A dynamic nurse scheduling using reinforcement learning: Dealing with various sudden absences of a nurse

Masato Nagayoshi (Niigata College of Nursing, Japan), Hisashi Tamaki (Kobe University, Japan)

In nurse scheduling, whereby work schedules for nurses are created, it is very difficult to create a work schedule that satisfies all the various requirements. Hence, various studies have been conducted on the nurse scheduling problem. However, for practical use, adjustments including various constraints and evaluation values are required, as the created shift schedule is often not practical as it is. Therefore, we have proposed a work revision method using reinforcement learning on a constructive nurse scheduling system. Furthermore, we have proposed an extension of the proposed method to dynamic nurse scheduling, in which the work schedule is revised or rescheduled when an absence occurs. In this paper, we confirm whether or not the extended method can be used to create a work schedule that is feasible in various sudden absences of a nurse.

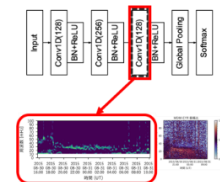


GS1-3 Classification of Time Series Data Obtained by the Satellite by Using Rule-Based and Machine-Learning Methods

Satoko Saita¹, Mariko Teramoto², Kentarou Kitamura²

(¹National Institute of Technology, Kitakyushu College, Japan), (²Kyushu Institute of Technology, Japan)

Scientific observations by nano-satellites need to reduce downlink data by onboard data preprocessing because of its communication volume constraints. We tried to classify time series data of geomagnetic field obtained by the SWARM satellite in order to integrate machine-learning techniques, and to determine the most appropriate method for onboard classification of a phenomenon in the geomagnetic field. The classifications have been executed by using rule-based, K-means, and combined CNN methods. The experimental results demonstrated the effectiveness of machine-learning model with LSTM networks. This study will contribute to development of machine-learning capable nano-satellites.



GS2 Image Processing I (5)

Chair Watcharin Tangsuksant (King Mongkut's University of Technology North Bangkok, Thailand)

GS2-1 Microalgae Detection by Digital Image Processing and Artificial Intelligence

Watcharin Tangsuksant, Pornthep Sarakon
(King Mongkut's University of Technology North Bangkok, Thailand)

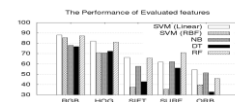
This article presents a technical approach to the video computer analysis, to automatically identifying the two most frequently identified microalgae in water supplies. To handle some difficulties encountered in image segmentation problem such as unclear algae boundary and noisy background, we proposed a deep learning-based method for classifiers or localizers to perform microalgae detection and counting process. The system achieves approximately 91% accuracy on Melosira and Oscillatoria detection, which around 4.82 seconds per grid. (Intel Xeon(R) CPU E5-2667 12 CPU at 2.66GHz and 32.0GB RAM, NVIDIA Quadro K5200 with 2304 CUDA cores). The system can significantly reduce 33.33 - 55.56% of the counting time when compared with the visual inspection of manual methods, and eliminate the error due to the human fatigue.



GS2-2 SmartCropPlanting: IoT-Based Mobile Application for Hydroponic System

Sung Jun Kyu¹, Chit Su Mon², Kasthuri Subaramaniam³
(^{1,3}UCSI University, Malaysia) (²Heriot-Watt University Malaysia, Malaysia)

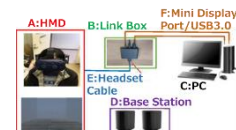
Hydroponic crop production is challenging for farmers and gardeners; they must continuously monitor and control the crop environment to achieve or maintain the best plant growth. Climate changes and disease/pests might occur anytime at anywhere which will consequence in crop-damaging. Studies show that slight rises in temperature from 1°C to 4°C can resulting in a decrease in the production of 10 to 41%. Another study shows that depending on the severity of leaf spot disease it will damage the crop by 10 to 50%. Therefore, this study proposed to improve the current hydroponic system by implementing the Internet of Things and Image Processing technique to optimize and reduce the infeasible tasks with mobile applications. This study has conducted a mixed-mode method with home gardeners, farmers, and related experts. The results show that 80% of respondents agree that SmartCropPlanting will improve the productivity and efficiency of crop planting with IoT and Image Processing techniques.



GS2-3 Detection of Eye Misalignment Using an HMD with an Eye-tracking Capability

Yoki Nagatomo, Noriyuki Uchida, Takuya Ikeda, Kayoko Takatsuka, Masayuki Mukunoki, Naonobu Okazaki
(University of Miyazaki, Japan)

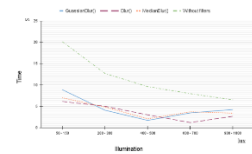
In this study, we implemented the Cover-Test, a test method for diagnosing eye misalignment using a head-mounted display with an eye-tracking capability. Specifically, we created a virtual examination environment in a VR space. The eye-tracking technique collected eye movements immediately after the covering or uncovering of the eyes. Thus, we calculated the amount of eye deviation and developed a system to determine the presence and magnitude of strabismus and heterophoria. We then assessed the system in the verification experiment by examining the consistency between the judgment results provided by this system and the clinical evaluation approach with the Maddox rod. The result was that we could verify the horizontal eye movements more accurately.



GS2-4 Using OpenCV for real-time image recognition through augmented reality devices

Gabdullina Dinara, Zykov Evgeniy, Kugurakova Vlada (Kazan Federal University, Russia)

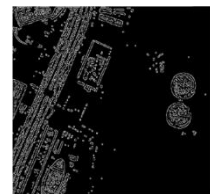
This article describes the peculiarities of writing libraries and the rapid development of augmented reality applications on the Unity platform and the OpenCV open-source library. The application of OpenCV functions to work with augmented reality objects is discussed in detail. On their basis, algorithms and methods were developed and an open library was created that implements the stable recognition of objects in various conditions by means of binding to the marker and their visualization on the augmented reality devices. On the basis of the developed library, a complete application was created to illustrate the possibility of applying virtual reality technologies for optical control of the assembly of radio electronic boards and for personnel training.



GS2-5 A Structure Pattern Extraction by Using Morphological Component Analysis in the Aerial Image Edge Detection

Wataru Oshiumi, Ankur Dixit, Hiroaki Wagatsuma (Kyushu Institute of Technology, Japan)

T An automated extraction of areas of interest from aerial images is a central issue of map makers. The road skeleton is one of the most frequent targets and then the prefiltering of road structures is highly important; however, the isolation of man-made structures from a natural landscape is technically difficult, because image parts to represent natural geographical features are not uniform patterns. In the present study, we focused on the function of Morphological Component Analysis (MCA) method to extract structural patterns when dictionaries were appropriately given and demonstrated an effectiveness of the edge detection if the prefiltering was done by using MCA. In our computer experiments, MCA decomposes the image into two patterns with Curvelet transform and Local Discrete Cosine Transform (LDCT) dictionaries. This approach will explore extensive possibilities of structural data extraction from complex images as an automated method.



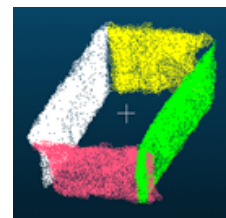
GS3 Image Processing II (4)

Chair Joo Kooi Tan (Kyushu Institute of Technology, Japan)

GS3-1 3D Point Cloud Registration and Segmentation of Reflective Metal Objects Using Go-ICP and Improved RANSAC

Kairi Morita, Ziyue Liu, Jing Cao, Seiji Ishikawa, Masuhiro Nitta, Joo Kooi Tan
(Kyushu Institute of Technology, Japan)

Registration and segmentation of 3D data are necessary in many fields, such as factory automation, automated driving, or even in the medical field. However, the technique is generally applied to non-metal objects. One of the problems of registration of a metal object is that the point clouds representing a metal object contain many outliers and missing points because of its reflective nature. This makes the accuracy of the registration and segmentation degrade. In this paper, we propose registration and segmentation techniques that are robust to outliers. For registration, we use globally optimal Go-ICP (Global optimal - Iterative Closest Point) algorithm considering goodness of a combination of point cloud sets to escape from convergence to a local solution. In segmentation, we address the problem of RANSAC generating false segments consisting of nearly identical multiple planar points by improving RANSAC. We use three kinds of metal tray to show the effectiveness of the proposed technique.



GS3-2 Development of a Safe Walking Assistance System for Visually Impaired Person Using MY VISION — Estimation of a Safe Passage from Sidewalk Information Based on Transfer Learning of VGG-16 Network

Takumi Yokote, Joo Kooi Tan (Kyushu Institute of Technology, Japan)

In recent years, the number of visually impaired person has been increasing year by year, and outdoor accidents have also been increasing when they go out. It is difficult to detect hazards on sidewalks even with the currently popular technique, such as a semantic segmentation technique or YOLO, because sidewalk situations are complicated and change frequently. For this reason, we propose a method of recognizing sidewalk situations from a self-viewpoint video called MY VISION. Conventional methods detect objects surrounding the sidewalk by learning the objects' features beforehand and guiding visually impaired person according to the position/direction of the detected object. The proposed method neither learns objects nor detects objects. We focus on sidewalk situations and use a multi-class classification based on transfer learning of VGG-16 to guide visually impaired person's walk according to three kinds of sidewalk information to ensure more safety. The effectiveness of the proposed method was confirmed by experiments.



GS3-3 Detection of Fallen Persons and Person Shadows from Drone Images

Taisei Ono, Haruka Egawa, Seiji Ishikawa, Joo Kooi Tan (Kyushu Institute of Technology, Japan)

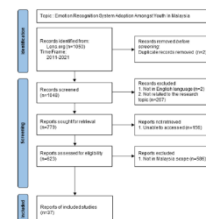
In recent years, the development of automatic search methods based on aerial images taken by drones has been attracting attention in order to prevent secondary disasters and to perform rescue operations quickly in the search for victims of natural disasters. Although various methods exist for automatic human detection for search, they are based on the assumption that the background area of a person captured by a drone camera is a uniform ground in which only those persons who require rescue exist without any shadows or trees. In this paper, we propose a method of automatic detection of both fallen persons and person shadows, or trees on the ground. The method is a combination of Ri-HOG and Ri-LBP features to search for fallen persons. These features are robust to rotation. We then employ Grabcut and brightness values to detect shadows. The effectiveness of the proposed method was verified by experiment.



GS3-4 A Systematic Literature Review on Emotion Recognition System in Malaysia

Muhammad Nadzree Mohd Yamin, Kamarulzaman Ab. Aziz, Tan Gek Siang, Nor Azlina Ab. Aziz (Multimedia University, Malaysia)

Artificial intelligence (AI) is an important technology that evolved from theories into tangibility with significant impacts and applications across sectors. AI is one of the key technologies that gave rise to the fourth industrial revolution (IR 4.0). One key subcategory of AI is the automated emotion recognition system (ERS); the application of AI to recognize human emotional states. ERS can be embedded in our daily lives. The importance of ERS will become more significant as we move towards the fifth industrial revolution (IR 5.0). ERS is a bridging technology from IR 4.0 into IR 5.0. Crucial for this, is good adoption or diffusion levels of ERS amongst society. Therefore, there is a need to understand the factors that affect the adoption of ERS. This paper seeks to establish and discuss the current ERS research landscape in Malaysia through systematic literature review covering works over a decade; from 2011 to 2022.



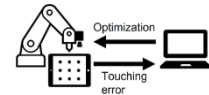
GS4 Robotics I (4)

Chair Amornphun Phunopas (King Mongkut's University of Technology North Bangkok, Thailand)

GS4-1 A Basic Study of Hand Eye Calibration using a Tablet Computer

Junya Sato, Takayoshi Yamada, Kazuaki Ito (Gifu University, Japan)

In this study, we describe a hand eye calibration method for calibrating an attached camera and a handmade end-effector to a robot by utilizing a tablet computer. For accurate manipulation, calibrating the camera, robot hand, and end-effector is important. However, general hand eye calibration methods do not consider dimensions of an end-effector and attached position to the robot in the calibration process. Thus, additional calibration of the attached end-effector for accurate manipulation is required when there is no detailed information of the end-effector such as a handmade one. To avoid this, we propose a novel method using a tablet computer. By iterating the touching black dots displayed in the computer and optimizing robot parameters to minimize the touching error, the hand eye calibration is achieved without the end-effector information such as the dimensions and attached position.



GS4-2 Human Detection with Uprisen Angle of a Camera for the Service Robot

Watcharin Tangsuksant, Amornphun Phunopas, Pornthep Sarakon, Aran Blattler
(King Mongkut's University of Technology North Bangkok, Thailand)

In order to improve the intelligent service robot, visual perception is crucial. This paper presents human detection for a service robot. The camera is installed at the robot's uprisen angle of around 30 degrees. Two feasible algorithms for the real-time detection between the Haar cascade and Single Shot Detector (SSD) algorithm are compared. This research collects the training data as 1,000 images of the uprisen angle, the different views of the human within 60 cm of the user range from a camera to a human. The proposed method has a higher performance than traditional Haar cascade and SSD. Therefore, the proposed method is suitable and feasible to deploy to the service robot.



GS4-3 Synthesis of Drive Systems of Flapping and Feathering Motions for Bird-like Robot using Twist Drive Mechanism

Jun Iwao, Hiroshi Ohtake (Kyushu Institute of Technology, Japan)

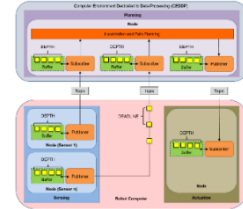
In the research field of flying robots, many studies on flapping-wing aircraft have been conducted in recent years. In this research, we focus on a bird-shaped flapping wing aircraft. In our previous research, we have developed a robot that mimics the musculoskeletal structure of an actual bird using a twist drive mechanism, and have achieved two types of wing motions, which are flapping and feathering, independently of each other. In this study, we have synthesized the drive systems of flapping and feathering, and have succeeded to interlocked two motions. In addition, we have covered the wings with a membrane to verify the wing motion under the condition of a membrane wing, which is strongly affected by air resistance. The flapping motion with twisting of the hands, such as actual birds do in flight, has been achieved.



GS4-4 Optimization Algorithm for Balancing QoS Configuration in Aggregated Robot Processing Architecture

Abdul Jalil, Jun Kobayashi, Takeshi Saitoh (Kyushu Institute of Technology, Japan)

This study aims to design an optimization algorithm to find the optimal value of DEPTH and DEADLINE in the Quality of Service (QoS) configurations while the Robot Operating System 2 (ROS 2) nodes are communicated using the RELIABLE and KEEP_LAST options. We implemented this optimization to improve the quality of data transmission in Aggregated Robot Processing (ARP) architecture. Strict reliability is not guaranteed if ROS 2 uses the RELIABLE and KEEP_LAST options to transmit the message data between the publisher and the subscriber. In addition, unbalancing DEPTH and DEADLINE configurations can affect the high latency time of message data transmission and packet loss in RELIABLE connections. The result of this study shows that the optimization algorithm can determine the optimal value of DEPTH and DEADLINE to balance the QoS configuration to improve robot data transmission in the ARP architecture.



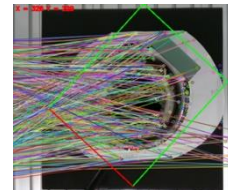
GS5 Robotics II (4)

Chair: Takayoshi Yamada (Gifu University, Japan)

GS5-1 Research on robotic assembly of gear motors (Stator recognition using keypoint matching and stator insertion using contact position estimation)

Yasumoto Imai, Takayoshi Yamada, Junya Sato (Gifu University, Japan)
Toshiki Hayashi, Shota Aono (Tsubakimoto Chain Co., Japan)

Assembly tasks in various fields, which require dexterous skills, are still often performed manually. Humans use information such as vision and hand sensation to accomplish these tasks. This paper describes a robotic assembly system for gear motors. Two main methods, key point matching and contact position estimation, are used to realize the gear motor assembly work, which is the insertion of the stator into the reducer. Keypoint matching is used to recognize the position and orientation of the part using a camera. Contact position estimation is used to detect contact between parts in the insertion process using a force sensor to prevent failure of the insertion operation. An experimental system using these methods is developed to achieve automatic stator insertion.



GS5-2 Robot Arm Operating Interface for Easy Grasping by Specifying the Gripping Width of End-effector

Rio Takeuchi, Laijun Yang, Norihiko Kato (Mie University, Japan)

In Japan, cervical cord injuries affect roughly half of all patients with spinal cord injuries. High-Level spinal cord injuries make it particularly difficult for patients to pick up objects from the ground because of the functional impairment of the trunk. To help these people become more independent, welfare robot arms have been developed recently. In our lab, an interface has been proposed to control the robotic arm by drawing a line on a touch screen in order to grasp an object on the floor and deliver it to the user. This technique has a fixed closing width for grasping, making it challenging to use when the object's sizes change. Therefore, we proposed a method that allows the adjustment of the closing width according to the drawn line on the touch panel interface. As a result, we found that the grasping was still possible even the object was altered.



GS5-3 3D Real-Time Conversational Virtual Agents System: Do Facial Expressions and Camera Angles Persuade Human

Pinkie Anggia, Kaoru Sumi (Future University Hakodate, Japan)

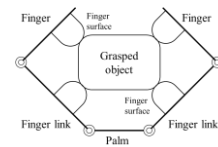
This paper aims to uncover state-of-the-art on persuasion through a dialogue interaction system between human and virtual agents. 37 participants interacted with a virtual agent system from facial expressions and camera angles in three conditions. Through empirical measurements using the Big Five theory, we discover that virtual agents' friendliness becomes a solid persuading factor to our predominantly extroverted participants. The experiment deduces that openness, conscientiousness, and extraversion personalities are easily persuaded by our virtual agents, unlike reversed-conscientiousness and neuroticism personalities.



GS5-4 Quasi-static Stability Analysis of Frictionless Planar Enveloping Grasps (Analysis of curvature effects at contact points)

Takayoshi Yamada, Junya Sato, Kazuaki Ito, Hidehiko Yamamoto (Gifu University, Japan)

Humans can grasp and manipulate various types of objects dexterously. In recent years, in order to obtain appropriate grasps, deep learning methods are introduced. On the other hands, in one of traditional ways, grasp stability based on potential energy of the grasp system replaced with an elastic system is investigated in order to derive grasp evaluation. In this paper, we discuss grasp stability of frictionless planar enveloping grasps. The stiffness matrix of the grasp system is derived. The grasp stability is evaluated by the eigenvalues of the matrix. We show that the matrix depends on grasp positions, grasp forces, local curvatures, etc., at contact points. Moreover, we analyze curvature effects on the grasp system by differentiating the matrix by the curvatures.



GS6 Applications I (5)

Chair Minoru Kumano (University of Miyazaki, Japan)

GS6-1 My Tally -A Personal Book Keeping Mobile Application

Li Zhihan¹, Abdul Samad Shibghatullah¹, Nur Hazirah Hamdan²

(¹UCSI University, Malaysia), (²Universiti Teknologi MARA,UiTM, Malaysia)

Bookkeeping has a long history and is charming and colorful. Throughout the ages, people have used the experience of abacus bookkeeping; Later, we used pens and books to keep accounts, supplemented by calculation results. In the information age of the 21st century, the popularization of computer software makes us turn to excel or other desktop software with powerful analysis function for computer bookkeeping. However, all the above methods are limited by time and space. My Tally focuses on the construction of Android environment, functionally designed many aspects involved in people's daily consumption. The personal bookkeeping application designed in this paper not only reflects the convenience of recording income and expenditure information, but also analyses the financial situation, so that people can record information faster and in real time and provide users with the ability to record and manage daily financial events. Compared with the traditional accounting methods, the personal bookkeeping application designed in this paper has the characteristics of security, portability and practicability.



GS6-2 A Survey on Charitable Acts, Challenges and Using Charitable Mobile Application

Nan Pepin¹, Abdul Samad Shibghatullah¹, Kasthuri Subaramaniam¹, Nur Hazirah Hamdan²
(¹UCSI University, Malaysia), (²Universiti Teknologi MARA, Malaysia)

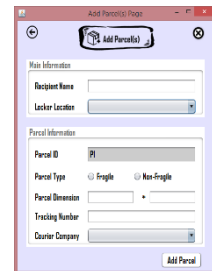
A donation is a gift that is given voluntarily or sincerely without the expectation of receiving something in return. Donating in contemporary terminology is better known by the term philanthropy. Today, the emergence of charity platforms resulted in a modern society increasingly making donations in cyberspace, which are referred to as online charity. Although the use of digital technology allows for philanthropic activities to be carried out, there are still shortcomings in this online system. This paper aims to study mobile charitable applications among users. The survey has been conducted via Goggle form and distributed to 110 participants through the internet. The findings show that there are not many applications of this sort being produced by other developers and there is a need to develop a mobile application that can help donors and receivers. The proposed mobile applications should be faster, easy to manage and transparent.



GS6-3 Online Parcel Management System (PMS) for Small and Medium Company

Chew Cheng Jin¹, Kasthuri Subaramaniam¹, Abdul Samad Shibghatullah¹, Salini Devi Rajendran²,
Nur Hazirah Hamdan³
(¹UCSI University, Malaysia), (²Taylor's University, Malaysia),
(³Universiti Teknologi MARA,UiTM, Malaysia)

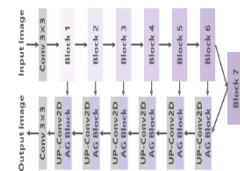
This research is going to gather more information of the recipient viewpoint on how Parcel Management System can help current system to reduce the workload and manpower to handle all these parcels, increase efficiency and save time and effort which make the staff of the reception counter easier to work and no need to use back the old method to record the details of the parcel. The result of the survey was analyzed in detail and find out the problem of the current parcel management system. The system development approach that the researcher used for this system is Rapid Application Development (RAD) Model. The reason that the researcher chooses this methodology is because there is lack of time and money to do this project. There is four of the stages in Rapid Application Development (RAD) methodology life cycle, which is requirement planning phase, user design phase, construction phase and transition phase. There are several phases in this project such as planning, requirement gathering and analysis, design and implementation and there is also have some deliverable in those phases.



GS6-4 Automatic Classification Method for Plastic Bottles and Caps Using Multi Attention Eff-UNet

Shunsuke Moritsuka, Tohru Kamiya (Kyushu Institute of Technology, Japan)

In Japan, the increase of general waste has become a problem. One solution is to recycle used plastic bottles. However, plastic bottles are thrown away with their caps still attached, requiring the caps to be removed manually. To solve this problem, we develop a method to automatically identify plastic bottles and caps using deep learning. In this paper, we add an attentional structure to Eff-UNet to build a model with reduced over-detection, as shown in the figure on the right. To extract features for objects of various sizes, we also propose a model that combines different numbers of blocks of the model shown on the right. In fact, experiments were conducted on an image of a plastic bottle, and this model succeeded in improving accuracy by 1.7% compared to Eff-UNet.



GS6-5 Research on the structure of consciousness of people who maintain and manage parks

Jun Sanbuichi¹, Minoru Kumano¹, Toru Hiraoka²

(¹University of Miyazaki, Japan), (²University of Nagasaki, Japan)

Due to population decline, unused vacant land is expected to increase in the region in the future. So, it is considered important to have local residents maintain and manage local spaces. However, consciousness indicators of how to encourage maintenance and management are not clear. Therefore, the purpose of this study is to clarify the consciousness structure of people who maintain and manage park. The investigation method is a questionnaire to park volunteers. In the consciousness analysis of park volunteers, factor analysis and covariance structure analysis were performed. As a result, it was proved that six consciousness (Interest in greening etc.) are related to the comprehensive consciousness index of park maintenance behavior.



GS7 Applications II (3)

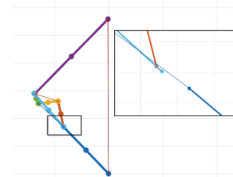
Chair Hiroaki Wagatsuma (¹Kyushu Institute of Technology, ²RIKEN CBS, Japan)

GS7-1 An Accuracy Evaluation of Multibody Dynamics for the Knee Support Exoskeleton Model

with Respect to Implicit Methods for Numerical Integration

Shintaro Kasai, Hiroaki Wagatsuma (Kyushu Institute of Technology, Japan)

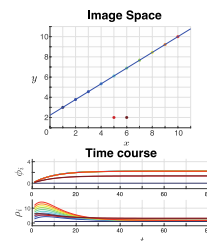
Numerical integration takes an important role to analyze models described by ordinary differential equations and it largely contributes to an assurance of the accuracy in displacement analyses of multibody dynamics if the model consists of several bodies especially with dynamic components such as springs and dampers. Exoskeletal assistive devices require flexible materials for absorbing reaction forces from human joints, which implies an inevitable necessity of an accurate evaluation of elastic effects in the model. In the present study, we introduced implicit methods for numerical integration to analyze the model under the formulation of multibody dynamics and computer experiments demonstrated results from explicit and implicit methods for the numerical integration as a comparison analysis. It can improve a degree of accuracy in inverse dynamics even in the theory of flexible Multibody Dynamics (fMBD).



GS7-2 A Basic Concept of the Nonlinear Oscillator-Based Hough Transform Implementation to Improve the Voting Procedure in the Scheme of Continuous Dual Spaces

Amarbold Purev, Hiroaki Wagatsuma (Kyushu Institute of Technology, Japan)

Hough Transform (HT) is a well-known algorithm to detect arbitrary lines in the image. The algorithm of HT consists of two processes mapping to the parameter space and voting to find a solution. The former process is executed in the continuous space, while the latter process relies on counting in the mesh as a discrete space, which increases susceptibility to noise. In the present study, we proposed attractor dynamics in coupled nonlinear oscillators instead of discrete voting. In our computer experiment, image pixels were mapped to the parameter spaces, and they were attracted to the crossing point of lines in the space. The approach may contribute not only to line detections in the image but also to other shape detections by using a consistent mathematical formulation.



GS7-3 Survey on Harness Design for CubeSats: Understanding the Constraints of CubeSats Design and Toward an Optical Wireless Bus for CubeSats

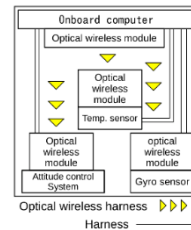
Masahiro Tokumitsu¹, Masatoshi Tsuji², Jun Nakaya³

(¹National Institute of Technology (KOSEN), Yonago College, Japan)

(²National Institute of Technology (KOSEN), Kagawa College, Japan)

(³Aichi Institute of Technology, Japan)

CubeSats of nano-satellites have attracted the attention of space scientists and engineers seeking to observe the space environment and develop innovative technologies in space engineering. The CubeSat is a class of miniaturized satellites with a form factor based on a 10 cm cube. However, the dimensional constraints of CubeSats restrict the embedding of relatively large mission devices, such as attitude control systems, into the satellites. Moreover, the harness used to transfer the data and supply power to the mission devices also occupies physical space to embed the mission devices. Therefore, this research surveys earlier studies on nano-satellite harness design. In addition, we consider the possibility of an optical wireless harness for the satellite bus system to achieve a more effective and reliable design for the CubeSats.



Poster

Chair Yong Hun Kim (Sejong University, Korea)

POS Magnetic Anomaly-Matched Trajectory and Dead Reckoning Fusion Mobile Robot Navigation

Yong Hun Kim, Bo Sung Ko, Jin Woo Song (Sejong University, Korea)

This paper presents a navigation algorithm based on the magnetic anomaly-matched trajectory for an indoor mobile robot. An environment with many similar magnetic field distortions cannot navigate stably with a magnetic anomaly-based navigation algorithm. In this study, we propose that stable navigation solution in various indoor environments through a fuse between magnetic anomaly-matched trajectory and mobile robot inertial trajectory. The proposed method uses dead reckoning(DR) as the primary navigation system and determines the similarity between magnetic anomaly-matched trajectory and DR trajectory to generate a trajectory key-frame. When the key-frame is detected, perform an extended Kalman filter(EKF) measurement update. In this study, an open dataset is used to verify the algorithm's performance, and we compared the existing algorithm. Since the method proposed uses only odometer, gyroscope, and magnetometer for indoor navigation, it has the advantage of building a system at a low cost.

