ICIPRoB2024 Conference Program

The Program is Scheduled as Sri Lanka Local Time(GMT+5:30)

Day 01 : March 09, 2024

Opening Ceremony   **(08.40 - 09.00)**

Welcome speech by ICIPRoB2024 General Chair

ICIPRoB2024 opening speech by Mr. Dhammika Marasinghe / Chair IEEE Sri Lanka section

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Keynote speak 01 **(Chair: Prof. Lasith Gunawardana)(09.00 -10.00)**

Prof. Emi Yuda

Associate professor, Graduate School of Information Sciences (GSIS) Tohoku University

Title: **Method for objectively evaluation of human-robot interactions using emotion measurement**

Abstract:

Emotion measurement has become increasingly important in robotics-human interactions in recent years. Robots are increasingly used in many areas of everyday life, such as caregiving, education, entertainment, counseling, etc. In these applications, emotional interactions between humans and robots are key to success. In this talk, I will discuss the application of objective evaluation methods for human emotion measurement. Actual projects and research results on emotion measurement techniques using biometric signal processing will be presented. Through this talk, I will provide insights into the development of robotics technologies that incorporate emotion. It could lead to revolutionary advances in future robot applications.

Tea Break : 10.00~ 10.15

Keynote speak 02(Chair: Prof. Susantha Wijesinghe)(10.15 - 11.15)

Prof. Tetsuya Ogata

Professor, Department of Intermedia Art and Science, Faculty of Science and Engineering, Waseda University, Japan.
Joint Appointed Fellow, Artificial Intelligence Research Center, National Institute of Advanced Industrial Science and Technology

Title: **Enhancing Robot Performance: Deep Predictive Learning for Adaptive Perception and Action**

Abstract:

Our research tackles challenges in artificial intelligence known as 'Moravec's Paradox.' We aim to enhance robots' performance in various tasks, including those requiring multiple arms. We introduce a novel method, 'deep predictive learning,' which combines ideas from neuroscience's 'predictive coding' with robotics. This keynote presents our findings in robotics research utilizing deep predictive learning, along with our collaborations with prominent companies. We also provide an overview of our remarkable smart robot, 'AIREC,' backed by Japan's Moonshot project led by the Cabinet Office.

Keynote speak 03 (Chair: Dr. Waruna Premachandra)(11.15 - 12.15)

Dr Patrick Holthaus

Senior Research Fellow and Robot House Manager
Robotics Research Group, School of Physics, Engineering and Computer Science,
University of Hertfordshire, United Kingdom

Title: Socially credible robot companions

Abstract:

Assistive robots are designated to support people in their daily activities. In this keynote, I will discuss how such robots can deliver various types of assistance when designed as robot companions and what scientific questions are important to address in this context. My presentation will also introduce the UH Robot House, a unique facility for researching human-robot interaction, along with its robot residents. Robot House provides a realistic home environment off-campus where our research team can investigate the aforementioned questions looking towards a future where robotic companions play a greater role in caring for older people. The third part of the keynote will address one of the fundamental research questions of social robots, that is, how nonverbal communication can facilitate interactions between humans and robots. For that, I will present a few studies with human participants that look at what effects robot social behaviors have on human trust and acceptability towards them.

Lunch Break : 12.15~ 13.15

Day 01 : March 09, 2024 (13.15~14.30)

Session 01: Computer vision & Image processing 1 **Chairs: Prof. Naiwala Chandrasiri, Prof. Yuji Iwahori**	
Paper ID	Title, Authors and Abstract
3	**Title: Synthesis of super-resolution images by GAN using Channel Attention** **Authors**: Jingan Liu, Naiwala P. Chandrasiri **Abstract** With the development of deep learning, many studies have been conducted on techniques to generate high-resolution images from low-resolution images containing different types of degradation and noise. In this paper, we proposed two super-resolution image synthesis approaches based on a mainstream algorithm ESRGAN. The first approach is to apply channel attention to the generator of ESRGAN. The second one is to add an image quality evaluation metrics Learned Perceptual Image Patch Similarity (LPIPS) to the discriminator. Channel attention has been used to obtain positive results in image classification. We expect that the combination of channel attention and convolutional neural networks could be used to generate high-quality super-resolution images. Most of the recent studies use the peak-signal-to-noise ratio (PSNR), the structural similarity index measure (SSIM), etc. as image evaluation metrics and aim to improve their scores. However, these metrics evaluate images on a pixel-by-pixel basis, which raises a gap with human evaluation results. In our experiment, we evaluated our proposed methods on two image quality indices, Naturalness Image Quality Evaluator (NIQE) and LPIPS, using a benchmark dataset. The evaluation by NIQE and LPIPS showed that our proposed channel attention-based models significantly improved the naturalness and perceptual evaluation value of images compared to previous studies. LPIPS and NIQE scores of the synthesized images were closer to the values of the original high-resolution images generated by the model proposed in this study.
5	**Title: Data Augmentation Method for Classification of Lymph Node Metastasis using Diffusion Model** **Authors: Kosuke Suzuki, Yuji Iwahori, Kenji Funahashi, M. K. Bhuyan, Akira Ouchi, Yasuhiro Shimizu** **Abstract** Automatic judgment of the presence or absence of cancer metastasis to lymph nodes is an important topic in cancer staging to reduce the burden of medical doctors to check a large number of CT images. Therefore, the machine learning approach becomes helpful and desired. However, using CT images for machine learning requires annotation by a special radiologist, and it is difficult to prepare a large dataset. In recent years, many approaches to the generation of images by machine learning have been proposed and applied to medical images. In this paper, we propose a method to generate images around a lymph node in an arbitrary metastatic state using a diffusion model, which is a generative model that is gaining attention on behalf of GAN. Experiments were also conducted to learn the classification of cancer metastasis using the generated images for data augmentation, showing that the generated images are effective in improving classification performance.

6	**Title: Image Processing based Real-Time Online Attendance Monitoring System using Facial Recognition** **Authors: Ravishka Fernando, Hashini Athauda** **Abstract** With the advancement of technology and due to the recent pandemic situation, the education sector has turned to the online teaching method. But the main problem here is the inconvenience and irregularities in the student's attendance. To ensure traditional attendance and reduce time wastage, this research aims to explore and implement an automated attendance marking system using facial recognition technology. This will enable students to be marked present or absent in real-time and will also help teachers to identify students who are present or absent for the online session. As a novelty of this research gives a more efficient and accurate method for attendance marking and eliminating manual and false attendance marking in online sessions. The proposed system employs the latest advancements in image processing and machine learning techniques such as the Haar Cascade feature and LBPH algorithm to accurately detect and recognize the face of a student. The performance of the system is evaluated on its own dataset which was the images of students captured through a video stream from a web camera and the results demonstrate through a confusion matrix its effectiveness in accurately recognizing faces and marking attendance in real-time. The results showed that the attendance system achieved 99.22% accuracy and can accurately mark the attendance of students in an Excel sheet. This real-time GUI-based system is unique in that it revolutionizes the traditional attendance marking process by automating it and providing real-time attendance data.
18	**Title: Image Classification Method to Identify Mature Coconut** **Authors: K.K.L.B. Adikaram, A.M.N.N. Senevirathna, W.P.P.M. Wijesinghe, Chinthaka Premachandra** **Abstract** This study focuses on developing an automated image classification method to identify mature coconuts, a critical phase in coconut harvesting. By emulating the technique of expert coconut pickers who assess color and texture, our goal is to revolutionize the industry, enhancing efficiency, reducing labor costs, and mitigating environmental impact. The preliminary model developed using Teachable Machine an established image classification software tool showed highly promising results in the identification of mature coconuts.
25	**Title: Enhancing Sign Language Classification through Reservoir Computing and Depth Camera Technology** **Authors: Witchuda Thongking, Ardi Wiranata, Shingo Maeda, Chinthaka Premachandra** **Abstract** The depth camera has emerged as a efficacious tool for facilitating interactions between individuals and machines. Its advantageous features, including a lightweight design, high durability, completeness, superior image quality, and versatility, have prompted researchers to explore its integration into advanced applications. Currently, the prevailing methods for classifying sign language exhibit certain limitations, such as suboptimal accuracy and inefficiency in gesture recognition technologies. In this study, we conduct a comprehensive examination of hand language characteristics rooted in American Sign Language (ASL), utilizing gesture-based interactions and augmenting sensing performance through preprocessing and the application of reservoir computing in the training model. We undertake an evaluation of gesture characteristics captured by the depth camera, delineating a method for preprocessing, machine learning, and the technical prediction of pertinent gesture features derived from

	standard depth camera video footage, thereby establishing a robust signal model. Our machine-learning models adeptly predict American Sign Language signs. Correlation values derived from the depth camera data demonstrate a pronounced alignment with naturally occurring variations in metrics observed within specific gestures. Our methodologies for quantifying gestures with depth cameras contribute to heightened accessibility in quantitative motion analysis. The outcomes of the reservoir computing implementation exhibit the successful classification of three hand language signs, thereby manifesting high precision and recall. The robust performance of the classification is pivotal for practical applications and underscores the efficacy of our approach.

Day 01 : March 09, 2024 (14.30~15.30)

Session 02: - AI and applications- **Chairs: Dr. Sagara Sumathipala, Dr. Naohisa Hashimoto**	
Paper ID	Title, Authors and Abstract
4	**Title: Mobility Environment Evaluation Platform Using Location-Based Big Data** **Authors: Takumi Soma, Tetsuya Manabe** **Abstract** This paper constructs a mobility environment evaluation platform to realize comfortable mobility environments for pedestrians by using location-based big data. This platform can directly evaluate the walkability of mobility environment considering crowded ratio, walking routes, and time change, by using location-based big data. First, the data estimated to pedestrians in walking is extracted from location data of Global Navigation Satellite System (GNSS). Next, the inflow/outflow data of the based region is extracted. And the walking routes is visualized every hour of the target area including based region. Finally, the walkability discussed by using various graphical representations. Consequently, this paper shows availability of this platform by the walkability analysis.

7	**Title: Centralized and Labeled Academic Journal Library Using Machine Learning & Deep Learning Approaches** **Authors: Ranul Dayarathne, Naveen Hedalla Arachchi, Nipuna Dilshan, Wanuja Ranasinghe, Gamage Upeksha Ganegoda** **Abstract** An academic journal library which is centralized and labeled by subject areas gives all learners, researchers, and scholars an opportunity to easily get the information they want in diverse fields. The study uses a high-level architecture design based on a data set from a sci-hub database which consists of components such as layout extraction, error detection, summarization, multi-label classification, and contextual search query optimization. These methodologies consist of a process for extracting the content, checking grammar or spelling errors, checking errors in structure and a two-step summarization process. In multi-label classification, NLP and algorithms are used to tackle the problem of class imbalance. This study also presents a contextual analysis and search query refinement approach via NER, synonym expansion, and intent classification. Machine learning models along with relevant feature extraction enhance search result optimization. Some future works include extending error detection beyond IEEE and Springer format, studying summarization via ROUGE score and relevance measure, and enhancements in the evaluator metrics for user query analysis and search result ranking. This study intends to transform how academic papers are discovered to provide an enjoyable and informative knowledge-searching process.
13	**Title: Smart Agro Soil Analyzer for Sustainable Farming** **Authors: Ashan Pathiraja, Susantha Wijesinghe, Anil Pradeep Kumara** **Abstract** Chemical fertilizers are crucial for increasing crop productivity and soil fertility, but their continuous use leads to a decline in soil organic matter and a reduction in agricultural soil quality. To address this issue and protect soil health, soil micronutrient content, and overall soil health must be measured and analyzed. This paper presents the development of a portable, low-power consumption soil analyzing system that supports both online and offline modes for small- and large-scale farmers, combining cellular-based low-power wide area network technologies with commercially available integrated soil sensors. Extensive field testing, encompassing small and large-scale farming operations, validates the system's accuracy and usability. The user-friendly interface and cost effectiveness make it an accessible tool for diverse agricultural landscapes.

56	**Title: Design and Development of a Voice Interactive Children Educational Robot 'TINY' with Natural Language Processing** **Authors: Nohori Jobaida, Mohammad Shidujaman, Ahsan Mahbub, Hooman Samani, Chinthaka Premachandra, Mohammad Faisal Uddin, Saadia Binte Alam** **Abstract** Educational robotics is to improve children's and teenagers' skill and competency development via the use of electronic components and robots in an interdisciplinary learning environment. It focuses mostly on the STEAM fields, while it can also touch on subjects like geography, history, and languages. STEAM education relates these 5 subjects those are-Science, Technology, Engineering, Arts and Mathematics. The capacity to which children could interact with a social robot in a novel learning environment is being studied. A method for measuring how actively children with learning difficulties participate in adequately prepared activities is described, utilizing multimodal machine learning. The goal is to find the child's sustained attention throughout the conversation. To achieve this goal, visual and aural data are recorded between the kid and the robot. Education robots for kids are emerging as tools for learning which can enhance young children's early reading and language skills considering recent technical developments. Social robots are those that can interact with humans on a mental and social level. The most recent studies on social robots and how typically developing kids, aged 0 to 8, pick up early language and literacy abilities have been examined. For the entirety of the study, five main themes were identified. Our designed robot TINY, a theoretical foundation for social robotic education, which stands for Teach, Inspire, Nurture, and Yield. Research has shown that social robots can facilitate early language acquisition, a thorough study has been done on the formation of early reading abilities. Although it has been demonstrated that educational robots for young children can develop language development, further research is required to ascertain the impact of social robots on early literacy development in youngsters.

Tea Break : 15.30~ 15.40

Day 01: March 09, 2024 (15.40~17.00)

Session 03 -Robot, IOT1-
Chairs: Dr. Upeksha Ganegoda, **Prof. Tomotaka Kimura**
Paper ID   Title, Authors and Abstract

2	**Title: TechGrow: IoT Application for Implementation of Smart Farming System** **Authors: Mohamed Buhary Fathima Sanjeetha, Pradeep Abeygunawardhana** **Abstract** Over the last several years, there has been growing interest in building smart agricultural systems. Smart farming practices may increase crop production while using less input. Most farmers don't know about new technology and methods. In this study, a unique IoT-based wireless assistant is conceived and will deploy for field activities. This suggested wireless assistant has environmental sensors such temperature, soil moisture and humidity. It also incorporates model rsp 32. This innovative wireless assistant can sense wetness, temperature, move forward or backward, and light on a particular work. Also, we use repeats to spread the Wi-Fi to the surroundings farm. The suggested wireless assistant will be tested in the fields, with excellent results. This technology is helpful for smart agricultural systems.
10	**Title: Pear Blossom Counting System with Drones Using YOLO and Deep SORT** **Authors: Sota Okubo, Kohei Tsunewaki, Tomotaka Kimura, Hiroyuki Shimizu, Takefumi Hiraguri, Akane Shibasaki, Tomohito Shimada, Yoshihiro Takemura** **Abstract** In this paper, we propose a pear blossom counting system with drones using YOLO (You Only Look Once) and Deep SORT (Simple Online and Realtime Tracking) for pollination system. To establish the pollination system, it is necessary to understand the blossoming status of pear blossoms. In our proposed system, a drone is flown to capture movies among pear trees, and the number of pear blossoms and buds are counted from the images using a object detection method, i.e, YOLO. If the number of pear blossoms and buds can be counted, it is possible to estimate the best time for pollination. Moreover, to estimate the number of blossoms, we use a tracking algorithm, i.e., Deep SORT. Through experiments using movies taken during the blossoming period, we show that the proposed method can count the number of blossoms and buds.
11	**Title: Path Finding Robot for Energy Efficient Automated Grass Cutter** **Authors: U Premarathne, P Wijesinghe** **Abstract** Coverage path planning is a well identified problem in robotics. For lawn mover applications this is a formal problem modeled using cell based coverage problem. In this paper, we describe an energy efficient design and development of a robot that can cut grass over a flat terrain using offline coverage path planning. Cell sizes differ in geometric shapes. Simulations of the coverage and the field tests were conducted. As evidenced by the results, energy efficient design is suitable for small and medium lawns. Modular design can be used to extend the coverage over much larger areas with expected energy efficiency.

12	**Title: IoT-Based Smart Medicine Dispenser**
	Authors: Ashan Pathiraja, Susantha Wijesinghe
	Abstract This research introduces an innovative solution to address medication adherence challenges, particularly prevalent among the elderly and individuals facing health limitations. The proposed IoT-based Smart Medicine Dispenser combines a physical device, mobile application, and cloud server to create a complete system. The device accurately dispenses medications according to a schedule, with real-time monitoring facilitated by a Human Machine Interface (HMI) display. The mobile app allows easy schedule configuration, while the cloud server stores and syncs data. Various testing demonstrated the system's reliability and potential to enhance patient outcomes. Identified capabilities, such as user-friendly interfaces and cloud storage, highlight the system's effectiveness. Despite room for improvement, including canister detecting mechanisms and audible instructions, this research lays the groundwork for advanced smart medication dispensing systems, offering a promising avenue to combat medication non-adherence and improve overall healthcare outcomes.
38	**Title: Fall detection in automated buses using in-vehicle camera -basic study using support vector machine** **Authors: Kousei Ido, Amey Dakare, Yen Tran, Naohisa Hashimoto, Toru Kumagai, Takahiro Miura, Yanbin Wu, Makoto Itami**
	Abstract To enhance in-vehicle safety in automated buses, a system that can detect whether falls have occurred in the bus can support the remote human controllers in quickly responding to the running bus. In this study, we designed a fall detection system that utilizes Wong Kin Yiu's yolov7 for extracting features from the video data. Then support vector machine was used for the discriminant task of whether a fall has occurred or not given an image as the input data. We tested our system with various settings, including full features versus reduced features, and raw images from the camera versus images which contain full views of the human inside the bus, all with multiple camera views. And finally, we confirmed that the 360-degree camera could detect human falls. Using several evaluation criteria, such as accuracy, precision, recall, and F1 scores, we showed how the detection ability of the system varied according to different settings of the test. The highest F1 score of 0.977 was achieved in the experiment. In addition, we found that if a full-body view of a human being could be achieved, the accuracy of the fall detections would be greatly improved. Finally, we discuss several potential directions for further research of this topic.
	End of Day 01

Day 02 : March 10, 2024

Workshop 01 (Chair: Prof. Susantha Wijesinghe)(08.30 - 09.00)

Dr. Sagara Sumathipala

 Senior Lecturer, University of Moratuwa, Sri Lanka

Title: Enhancing Information Retrieval in the Age of Gen AI

This workshop explores the evolution of AI applications in information extraction. With the availability of large datasets and high computational power, the industry has witnessed a remarkable rise in AI advancements. The next wave of AI, known as Gen AI, is now ubiquitous, reshaping today's dynamic business landscape. The demand for chatbots capable of delivering personalized information extraction has surged. Leveraging large language models (LLM) that gather insights from vast document repositories has greatly facilitated addressing this demand. In this workshop, we aim to uncover the transformative potential of Retrieval Augmented Generation (RAG) technology within the space of Conversational AI. RAG revolutionizes traditional chatbots by enhancing their capabilities and intelligence. Participants will dig into the fundamentals of RAG architecture and understand how it empowers chatbots to become exceptionally intelligent. Through interactive sessions, attendees will obtain practical experience implementing RAG models, enabling them to develop chatbots proficient in understanding queries and providing insightful responses.

Workshop 02 (Chair: Dr. K.K.L.B. Adikaram)(09.00 - 09.30)

Dr. Asanka Perera

Mechatronics Lecturer, University of Southern Queensland, Australia

Title: Human life sign detection from drone video

In search and rescue operations, it is crucial to rapidly distinguish between those who are alive and those who are not. With this information, emergency teams can prioritize their operations to save more lives. However, in some natural disasters, people may be lying on the ground, covered with dust, debris, or ashes, making them difficult to detect through video analysis tuned to human shapes. We have introduced a technology that estimates the locations of people from aerial videos using image and signal processing designed to detect breathing movements. Our study demonstrates the effectiveness of this method in detecting both clearly visible people and those who are fully occluded by debris.

Workshop 03 (Chair: Dr. Sagara Sumathipala)(09.30 - 10.00)

Mr. Chamika Janith Perera

PhD Researcher, Graduate School of Engineering, Mie University, Japan

Title: Use of Drone based Spectral imaging in agricultural decision making- an introduction

Modernizing the agricultural decision-making process is a long-overdue step to meet the increasing demand with limited available resources. Sensing plays a crucial role in prediction, estimation, and detection tasks within agriculture. Among the various sensing methods, spectral sensing (Hyperspectral and Multispectral) has emerged as a key component in the decision-making process. This workshop session will focus on introducing hyperspectral and multispectral imaging in the context of agricultural decision-making. We will discuss the importance of sensing, what is spectral imaging, key highlights of spectral imaging, the current state of the art, entry barriers, and will place specific emphasis on drone-based sensing methodologies.

Tea Break : 10.00~ 10.15

Day 02 : March 10, 2024 (10.15~11.15)

Session 04: Data Analytics, AI, Data Mining- **Chairs: Dr. Mohammad Shidujaman, Prof. Emi Yuda**	
Paper ID	Title, Authors and Abstract
17	**Title: Classification of Football Player Actions Using Sensing Data** **Authors: Yukito Hirasawa, Yuichiro Kinoshita, Latifah Munirah Kamarudin, Ammar Zakaria** **Abstract** This study classifies the actions of football players using sensing data acquired from wearable sensors attached to players and the ball. More than 800 sensing data with the labels of five types of player actions were created as a dataset. The neural networks were trained using 19 input items created by considering time-series variations in player and ball locations. The trained neural network model demonstrated a classification accuracy of 82.08 %. The model successfully obtained sufficient accuracy for all types of actions. These results demonstrate that the sensing data and created input items can be effectively utilized for classifying the actions of football player.
22	**Title: Proximity-Based Reward Systems for Multi-Agent Reinforcement Learning** **Authors:Marc-André Blais, Moulay Akhloufi** **Abstract** Unmanned vehicles, such as drones, have surged in popularity in recent years. Swarms of these vehicles offer new opportunities in applications such as agriculture, weather monitoring and natural events management. However, efficiently controlling a large swarm of unmanned vehicles poses a significant challenge. Intelligent solutions, particularly reinforcement learning, have been proposed to address this challenge. We introduce a proximity-based reward system for multi-agent reinforcement learning to handle the issue of reward sparsity. Our goal is to develop an approach for controlling a swarm towards a common objective while maintaining robust swarm cohesion. In this paper, we compare various distance-based functions to build a comprehensive reward system. Specifically, we explore the Euclidean, Manhattan, Chebyshev and Minkowski distances in our experiments. We evaluate the impact of these proximity-based reward systems on four RL algorithms. We conduct a comparison of our reward systems using various metrics during validation and test episodes. Our goal is to highlight the importance of comparing different algorithms and distance functions in the development of multi-agent reinforcement learning systems.We conduct a comparison of our reward systems using various metrics during validation and test episodes. Our goal is to highlight the importance of comparing different algorithms and distance functions in the development of multi-agent reinforcement learning systems.

28	**Title: Ontology based Machine Learning Approach for Facial Skincare Products Recommendation** **Authors: Maduri Hansanie, Thushari Silva** **Abstract** The need to preserve facial skin health and improve attractiveness has become more widespread in the modern world. There has been competition among skincare companies to research and create novel products. The dynamic skincare market creates a wide range of skincare products. Therefore, selecting the best skincare products suitable for a consumer's skin type and condition can be quite challenging. Skin impairments could worsen if products contain ingredients inappropriate for the user's skin type. This study proposes a unique system architecture for recommending facial skincare products that combine ontological and machine-learning benefits. The ML engine is developed for facial skin condition identification, which uses a CNN model to identify acne severity based on the user's facial image. An ontology was constructed using the Protégé ontology editor, which included hierarchical relationships between user profiles, skincare information, and skincare product information. The semantic similarity between these concepts was mapped by the Protégé tool for the skincare product recommendation engine. The system UI takes inputs for customization and recommendation of facial care products based on key factors such as the user's skin type, concerns, acne severity level, and allergy ingredients. Users can provide feedback and ratings for the products recommended. The developed system had an accuracy of 87.5% based on a survey conducted with 24 participants who tested the system. Therefore, the proposed ontology-based ML approach is effective and accurate for facial skincare product recommendations.
57	**Title: Sentiment Analysis with Deep Learning Methods for Performance Assessment and Comparison** **Authors: Achhiya Sultana, Mahady Hasan, Mohammad Shidujaman, Chinthaka Premachandra** **Abstract** The activity of obtaining and evaluating perspectives of individuals, feelings, mindsets of others, views, and so on, toward various things including subjects, goods, and ideas is known as sentiment analysis (SA), often called sentiment mining (SM). People are producing massive quantities of thoughts and feedback regarding goods, offerings, and daily operations as a result of the quick expansion of using online applications like blogs, social media platforms, and web pages. Companies, government agencies, and institutions can collect and evaluate general population attitudes along with opinions using sentiment analysis to acquire business insight and improve decision-making. The paper represents a complete research on sentiment analysis based on DL (deep learning) approaches to give researchers an idea of the evaluation of feelings and associated disciplines. This research represents the previous studies of emotional analysis and illustrates the methodology of our work. The methodology explains data extraction, data preprocessing, text preprocessing, feature extraction, feature selection, and so on. The dataset applied in the study is an IMDb movie reviews dataset containing equal amounts of samples for training and testing. Then, we discussed sentiment analysis techniques which are Simple Neural Networks (SNN), Convolutional Neural Networks (CNN), and Recurrent Neural Networks (RNN). Using the methods, the outcome states that the simple neural network model generates an accuracy of 74.99% and a Convolutional Neural Network of 85.79%. Besides, the Recurrent Neural Network shows 86.46% which is the highest one. Furthermore, based on the results of the confusion matrix, we investigated the optimum model to attain the highest precision, recall, and F1 score.

Day 02 : March 10, 2024 (11.15~12.30)

Session 05: - Computer vision & Image processing 2- Chairs: Dr. Kohei Shimasaki, Dr. Surangi Bandara	
Paper ID	Title, Authors and Abstract
26	**Title: Analyze the Efficacy of Parkinson's Disease Detection using features from Fundus Images** **Authors: Justin Paul Kolengadan, Dr. Pitchumani Angayarkanni S** **Abstract** To address the challenge of bridging the gap between virtual and real-world environments in robotics, this study proposes an innovative approach that leverages Luma AI's Neural Radiance Fields (NeRF) and Unreal Engine 5 (UE5). The study uses standard smartphone cameras to capture video footage and efficiently create photorealistic 3D virtual environments. These environments are then integrated with UE5 to simulate realistic robotic navigation and manipulation tasks. The method's effectiveness is validated through objective evaluations using Navigation2 for operational efficacy and YOLO for accurate object recognition in both virtual and real settings. The study demonstrates a significant reduction in the time and resources required for environment creation compared to existing methods like NeRF2real and Matterport3D. This advancement facilitates simulation-driven development and testing in robotics and establishes a new standard for virtual environment generation.
29	**Title: Near Infrared Therapy: A Non-invasive Device for Arteriovenous Fistula Patency in Dialysis Treatment** **Authors: Jaichandar Kulandaidaasan Sheba, Sun Tianyu, Cai Zhi Qiang** **Abstract** A novel, non-invasive device that provides simple method for arteriovenous fistula (AVF) maintenance. This device performs near infrared (NIR) therapy on dialysis patients with AVF created on them. The objective of this device is to improve the AVF patency by implementing light with combination of different NIR wavelengths. According to studies, this would be able to deliver energy to AVF, stimulate and activate cell activities that leads to higher AVF patency and maturation rate. Here we have designed a device that can be used in the experimental study to increase the flow rate across AVF.

32	**Title: Disease Detection in Tomato Plant using Deep Residual Learning** **Authors: Aakanksha Sharaff, Aman Dhale, Druva Kumar Gunda, Nisheeth Agrawal** **Abstract** With the accelerated rise of human population, food is bound to be quintessential of our worries in the future, thus mitigating plant diseases, and errors in their detection would be extremely helpful. The traditional method of examining plant diseases involved an erudite of the field to be present, but various developments in neural networks have made this process trivial by requiring only the image of the crop for its disease detection. There has been a myriad of attempts to improve the scope of plant disease detection to try and make it a lot more computer-dependent and mitigate the involvement of the end-user by using deep learning. This is achieved by using convolutional neural networks which excel in the field of image detection. This paper is based on the fine-tuning aspect of deep learning, i.e., this paper tries to improve the performance of a pre-trained model and compare the accuracies of pre-existing models which are popular in this aspect of plant disease detection. This model has been trained specifically for tomato plant leaf dataset, which was sourced from Kaggle, which includes 10 distinct classes including both diseased and healthy leaves.
35	**Title: Object substitution-based contextual domain randomization for generating neural network training data** **Authors: Wen Kang Teoh, Ikuo Mizuuchi** **Abstract** Domain randomization is a data synthesis approach for training neural network models on simulated images for the purpose of generalization to real-world images through randomizing parameters of the rendering process such as lighting, backgrounds, object poses, and object textures, leading to improved performance in image-based neural network applications. Domain randomization increases the amount of variability in simulated data to handle the amount of variability that exists in real-world data. In this paper, we present a novel substitution-based approach, object substitution-based contextual domain randomization (OSCDR), which preserves the contextual and structural integrity of real-world data, and it is expected to enable the synthesis of cheap, high quality, and highly variable datasets for a wide variety of image-based neural network applications, including object detection/localization, autonomous driving, and robot navigation.
48	**Title: Pixel-level Vibration Imaging for Flying Objects with Translational Slide Image Sequences** **Authors: Kohei Shimasaki, Tomoaki Okamura, Idaku Ishii** **Abstract** We propose a pixel-level vibration imaging method for high frame rate (HFR)-video-based localization of flying objects with large movement. When the ratio of the translation speed of a target to its vibration frequency is large, obtaining its frequency response in image intensities becomes difficult because one or no waves are observable at the same pixel. Our method can precisely localize flying and moving objects with fllapping vibration frequency by virtually translating multiple image sequences for pixel-level short-time Fourier transform to observe multiple waves at the same pixel to estimate moving direction. The effectiveness of the proposed method is demonstrated by analyzing several HFR videos of flying insects in real scenarios.

12.30-13.30 Lunch Break

Day 02 : March 10, 2022 (13.30~14.45)

Session 06: - Security, UAV and automation- Chairs: Dr. K.K.L.B. Adikaram, Mr. B. H. Sudantha	
Paper ID	Title, Authors and Abstract
36	**Title: Maritime Security Enhanced: A Fuzzy Logic Approach to Bilge and Flooding Risk Assessment in Warships** **Authors: Mihiraj Karunanayake, Savindu Nanayakkara, Thilina Kumara, Thathsara Nanayakkara, Pradeep Gunathilaka** **Abstract** To maintain a ship's stability, early detection of bilges and flooding is crucial. Loss of the stability will lead to risk of life and property onboard ships. In order to identify bilge/flooding sites and ring alarm with an audible and visual warning that specifies the bilge location/area on a monitoring panel, ships are equipped with traditional bilge alarm systems. In the aspect of a war ship, flooding risk is higher than that of a cargo/merchant ship. Due to that, conventional monitoring systems have become inefficient to assure safety of life out at sea. Hence, the proposed system is designed to logically reason many aspects of bilge and flooding to give accurate bilge alarms and support decision making. Fuzzy logic has been found as an emerging technology in the research field to comply this research gap. In the proposed system, sensors have been utilized to acquire input variables in real time. Output is forwarded to the end user after applying Mamdani fuzzy inference to decide the bilge/flooding condition and risk severity of the ship. Center of Gravity (COG) de-fuzzification method has been applied to extract the crisp value of the risk severity as a percentage. The test results have been evaluated after installing onboard a warship.The input and output fuzzy membership functions have been optimized by evaluating the results with the aid of expertise personnel. Thus, the determined risk factor is proved to be sound enough to take efficient and effective action against flooding or high bilges.

27	**Title: RapidSim: Enhancing Robotic Simulation with Photorealistic 3D Environments via Smartphone-Captured NeRF and UE5 Integration**
	Authors: Yuminosuke Sato, Yaguchi Yuichi
	Abstract To address the challenge of bridging the gap between virtual and real-world environments in robotics, this study proposes an innovative approach that leverages Luma AI's Neural Radiance Fields (NeRF) and Unreal Engine 5 (UE5). The study uses standard smartphone cameras to capture video footage and efficiently create photorealistic 3D virtual environments. These environments are then integrated with UE5 to simulate realistic robotic navigation and manipulation tasks. The method's effectiveness is validated through objective evaluations using Navigation2 for operational efficacy and YOLO for accurate object recognition in both virtual and real settings. The study demonstrates a significant reduction in the time and resources required for environment creation compared to existing methods like NeRF2real and Matterport3D. This advancement facilitates simulation-driven development and testing in robotics and establishes a new standard for virtual environment generation.
49	**Title: Comparative Analysis of Two Pico Satellites: Performance, Sensor Integration, and Communication Technologies**
	Authors: Md Hasibur Rahman, Dr. Saadia Binte Alam, Dr Mohammad Faisal Uddin
	Abstract In this research, we evaluate the effectiveness of two Pico satellite designs – a can-shaped model and a cube-shaped model – focusing on their performance during controlled parachute descents from a specific altitude. The study centers on embedded sensors in these satellites, which collect environmental and kinematic data throughout the descent. These sensors track temperature, humidity, barometric pressure, gyroscope readings, acceleration, and magnetometer data, offering detailed insights into each design's descent dynamics. The primary goal is to assess how the can and cube-shaped Pico satellites withstand descent pressures and their data gathering efficacy during parachute-assisted landings. This evaluation is crucial for understanding how structural designs impact the performance and adaptability of pico-satellites in freefall conditions. Additionally, the research includes a comparative analysis of two communication devices: the cube satellite equipped with an NRF24L01+LNA, and the can satellite with an ESP32S wireless development board. This comparison aims to identify which communication technology is more suitable for the challenging environment of parachute-assisted descent, with a focus on the reliability and quality of data transmission.
9	**Title: UAV Wireless Power Supply Planning Based on Sensing Intervals**
	Authors: Shouta Sogawa, Tomotaka Kimura, Jun Cheng
	Abstract In this paper, we propose a power supply planning method for unmanned aerial vehicles based on the sensing interval of sensors. The sensors do not require a constant supply of power, and can determine whether sufficient power is available to complete their next sensing operation. Therefore, there is no need to supply power to sensors with long sensing intervals, with power instead being supplied when the sensing time approaches. In this way, unmanned aerial vehicles can prioritize other sensors that are approaching their sensing time, thus improving the system performance. Through simulation experiments, it is shown that the proposed method improves the rate at which sensing is performed at the desired time.

30	**Title: A Review: Attacks, Detection, and Prevention on the Commercial Drones** **Author: Kolitha Warnakulasooriya** **Abstract** In recent years, the rising popularity of commercial drones across various industries and applications has been notable. These modern drone systems boast an array of advanced features such as Autopiloting, Video Streaming, and Swarming. However, the pressing need to address the cybersecurity vulnerabilities inherent in commercially available drones cannot be overstated. The prevalence of open technologies, coupled with constraints on costs for robust security implementations, and the overshadowing focus on other functionalities, underscores the urgency of this discussion. This paper aims to engage in a comprehensive discussion of current threats and propose easily implementable prevention mechanisms for manufacturers to enhance the cybersecurity of commercial drones at a broad level.

Day 02 : March 10, 2024 (14.45~16.00)

Session 07: Robot, IOT 2 -

Chairs: Dr. Patrick Holthaus, Prof. Lasith Gunawardane

Paper ID	Title, Authors and Abstract
42	**Title: Optimization of Monocoque Drone Frame Using Generative Design** **Authors: Arockia Selvakumar Arockiadoss, R A Nikki Novah, K S Sajal, S Sayee Pratap, S Sivarajan, S Sivarajan, Daniel Schilberg** **Abstract** Current issues in the drone fabrication are to increase the structural rigidity by having an optimum or by reducing weight of the drone. Similarly, to have enhanced structural integrity of the frame while lifting heavy loads during the flight, a solution to this problem will lead to reduce the flight time completion of tasks. To address these problems a generative design approach is implemented to design a monocoque drone frame. The designed frame has been analyzed to withstand the various failure loads using Autodesk Fusion 360. Based on the generative design approach 20 possible design outcomes are obtained and out of 20 one best design is selected based on the factor of safety and the stress values. Further, four different load cases are considered for the static structural analysis of the selected drone frame to withstand the payload of 1.5 kg. The results obtained from the simulations and finite element analyses were found to be satisfactory. Finally, the drone was fabricated using Nylon PA12 material and the drone frame weight is found to be 150 grams lighter than the conventional drone.

44	**Title: Fabrication of a Revolutionary Pick-and-Place Robot with Omnidirectional Mobility** **Authors: Md Hasibur Rahman, Dr. Saadia Binte Alamm, Md Fayed Al Monir, Dr Mohammad Faisal Uddin** **Abstract** The paper outlines the creation of an innovative robot capable of omnidirectional movement, enhancing its ability to navigate confined industrial spaces. This robot, uniquely designed for picking and placing tasks, underwent a comprehensive development process, including planning, design, fabrication, and programming. It represents a notable advancement in the field of industrial robotics, with potential applications in environments where traditional robots may be less effective. The discussion also covers possible future improvements and broader applications of this technology.
50	**Title: A Companion Robot for Reducing Stress and Increasing Workability** **Authors: Nihara Mayurawasala, Udaka Manawadu, Dilmi Kulugammana, Ravindra Silva** **Abstract** This research explores the efficacy of a companionrobot as a stress intervention for professionals working from home. The robot, designed to observe and engage in friendly conversations, offers stress-reducing suggestions based on continuous monitoring of user behavior. Our findings demonstrate that the stress reduction companion robot effectively reduced stress and improved workability by accurately detecting facial emotions, stress levels, and speech. The system's ability to minimize distractions and interpret facial expressions highlights its success in enhancing user well-being and overall experience. Further research is needed to assess long-term effectiveness and address ethical considerations for widespread implementation. This study presents a novel approach to address stress-related issues and enhance workability in various settings.
16	**Title: Implementation of human-following robot system applying virtual delay to posture of a leader** **Author: Fumiaki Takemori** **Abstract** This paper develops an implementation of a measurement and control system in which a vehicle follows its predecessor while maintaining a certain distance. First, we construct a model that virtually delays the reference coordinates of the leading target backwards, and propose a control law that follows the steering angle of the following vehicle to that virtual delay point. Next, a range sensor is used to detect the position and orientation of the leader, and the position and orientation is estimated using a template matching method based on the person's body contour point group measured by the sensor. Finally, the effectiveness (including robustness) of the proposed system is demonstrated in some simulations and human tracking experiments.

55	**Title: Roopkotha: A Companion Robot for Enhancing Interactive Storytelling with Natural Interaction** **Authors: Kazi Mayesha Mehzabin, Md. Zahidul Islam, Md. Ashaduzzaman Nur, Mohammad Shidujaman, Hooman Saman, Haipeng Mi** **Abstract** Roopkotha is a storytelling robot that seamlessly combines traditional story-telling methods and technology, creating a captivating robot storyteller. We are creating a special prototype in the world of robots that tells stories in a way that is easy to understand and enjoy. In this era of technological advancement, Roopkotha combines voice recognition with Bangla Language processing, emotion recognition, human behavior detection along environmental monitoring of humidity and temperature. Roopkotha aims to revolutionize the way stories are told and engage with users on a deep emotional level. Furthermore, Roopkotha is equipped with advanced facial expressions and emotion recognition technology. The emotion recognition feature helps the robot to have a profound connection with the users.
58	**Title: Visual Light Communication Based User Verification System for Drone Delivery** **Authors: Nilupul Senevirathna, Chinthaka Premachandra** **Abstract** The realm of goods transportation has witnessed a paradigm shift with the advent of modern technological advancements, notably the utilization of drones for efficient and innovative movement of goods. This paper explores the challenges and advancements in drone delivery systems, emphasizing the critical need for secure and accurate parcel handover methods. We introduce a novel drone delivery LED array-based light communication system that addresses the drawbacks associated with traditional verification processes. The system employs pattern recognition technology, facilitated by a Raspberry Pi single-board computing unit and integrated with a smartphone application for seamless interaction. Through comprehensive testing and analysis, our research showcases the effectiveness and potential of the proposed system in revolutionizing parcel delivery services.

16.15-16.30 Tea Break

Day 02 : March 10, 2024 (16.30~16.45)

Award Ceremony : 16.30~16.45

By Award Chairs

Vote of Thanks:

End of Day 02