ICIPRoB2022 Conference Program

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

Day 1 : March 12, 2022 (7.40AM - 10.45AM)

Opening Ceremony **(Chair: Mr. Isanka Diddeniya)** **(7.40AM - 8.00AM)**

Welcome speech by ICIPRoB2022 General Chair

Keynote speak 1 **(Chair: Prof. Lasith Gunawardana)(8.00AM-9.00 AM)**

Prof. Hironori Kasahara

Senior Executive Vice President, Waseda University, Tokyo

IEEE Computer Society President 2018

Title: Green Multicore Computing for Scientific, Image and Deep Learning Computation

Abstract:

This Keynote talks about Green Multicore Computing systems' architectures, software, and performance. Here, Green Computing means environment-friendly Low Power, High-Performance Multicore Computing that allows us to execute scientific, image, real-time control, deep learning computation with small electric power consumption. It introduces homogenous and heterogeneous multicore architectures, an automatic parallelizing and power reducing compiler, and their parallel processing performance for scientific benchmark programs, medical image processing, OpenCV face detection, automotive control, MATLAB/Simulink, Deep Learning, and so on.

Keynote speak 2 (Chair: Dr. Susantha Wijesinghe)(9.00AM-10.00AM)

Dr. Francisco (Frank) Lamosa

Principal computer vision engineer, Mawari Inc.

Title: **Computer Vision: A Hybrid Model**

Abstract:

In the last 5 to 10 years, we have seen a huge resurgence of machine learning based approaches to computer vision, in particular, neural network-based models. Impressive achievements have been attained with these techniques, and there is very significant progress being made. At the same time, it is important to keep in mind the massive amounts of data required to generate the models, the massive computing power needed to yield the attainments that have been published, and the challenges in understanding these models. On the other hand, in many cases, the physics of the problems provide some clear deterministic mechanisms for the manifestation of physical phenomena in camera (and other sensor) systems. These approaches can lead to clearly explainable results, and often at lower power consumption and development time. The challenge is to identify the domains where each approach is best suited and to complement the strengths of each set of approaches to yield a robust, and efficient (in terms of time and computing power – and in power consumption, itself, especially in view of the environmental concerns we face) solution.

Workshop 1 (Chair: Dr. Susantha Wijesinghe)(10.00 AM - 10.30AM)

Dr. Mohammad Shidujaman

Department of Electrical and Electronic Engineering, Faculty of Engineering, American International University- Bangladesh

Title: **Interdisciplinary Research Method Towards Successful HRI Solutions**

We hope this workshop can provide a multi-disciplinary forum where HRI researchers, engineers, biomedical professionals, artists, designers and entrepreneurs can jointly work together, and come up with strategies to take laboratory research ideas, from benchtop to bedside, into feasible commercializable products in a shorter pathway. We especially welcome the female participants to share their point of views in terms of discovering local challenges and creative HRI/AI solutions to solve the pandemic disease challenges. We are also targeting at bridging an ecosystem of from user-centered process of inventing HRI solutions starting from understanding local real-world medication problems, and fill the gap of road to market, link between research and industry

Tea Break : 10.30~ 10.45

Day 1 : March 12, 2022 (10.45AM~12.00NOON)

Session 1
Chairs: Dr. Francisco (Frank) Lamosa

Paper ID	Title, Authors and Abstract
9	**Title & authors:** Pulsar Candidate Selection Using Gaussian Hellinger Extremely Fast Decision Tree Venoli Gamage, Mohamed Ayoob and Krishnakripa Jayakumar. **Abstract:** Radio wave data gathered by pulsar finding telescopes are required to be classified while being streamed. The reason for that is the practical constraints of traditional machine learning algorithms on streaming datasets. Traditional machine learning algorithms would take considerable compute power, memory and time to give pragmatic results. (recent surveys collect data at the rate of 0.5 - 1 terabyte per second) Stream classification algorithms are specifically developed to address the above limitations and can classify data streams without taking up a lot of memory or training time. They relate with characteristics of data streams such as concept drift and limited memory. Extremely Fast Decision Tree is one of the stream classification algorithms that can learn incrementally when it sees new data. However, data from pulsar detecting datastreams are highly imbalanced (there are less examples of pulsars in the data than non-pulsar objects). Learning incrementally from such a datastream would be a destructive interference for the model's precision (of detecting pulsars). In this research, we introduce an improved version of the Extremely Fast Decision Tree, that is able to learn imbalanced data streams. Our approach is fast, accurate, and avoids the pitfalls of class imbalance and concept drift.
14	**Title & authors:** Alternating Direction Method of Multipliers for Convex Optimization in Machine Learning - Interpretation and Implementation Kuan-Min Huang, Hooman Samani, Chan-Yun Yang and Jie-Sheng Chen. **Abstract:** The alternating direction method of multipliers (ADMM) is an important method to solve convex optimization problems. Due to the optimization tasks increased with the sort of machine learning applications, ADMM has gained much more attention recently. The principle of ADMM solves problems by breaking them into smaller pieces to specially limit the problem dimension. Each of the pieces are then easier to handle and speed up accordingly the total computational time to reach the optimum. With the speeding-up, it was widely adopted for optimization in a number of areas. In this paper, we start the explanation from the constrained convex optimization, and the relation between primal problem and dual problem. With the preliminary explanation, two optimization algorithms are introduced, including the dual ascent and the dual decomposition approaches. An introduction of augmented Lagrangian, the key to

	success ADMM, is also followed up ahead for elaboration. Finally, the main topic of ADMM is explained algorithmically based on the fundamentals, and an example code is outlined for implementation.
33	**Title & authors:** Optimized Text Summarization method based on Fuzzy Logic Nilantha Premakumara, Chamani Shiranthika, Chathurangi Shyalika and Surangani Bandara. **Abstract:** Text summarization is the task of condensing a text segment into a shorter version, reducing the size of the original text context while also preserving the informational elements and the meaning of the content. Manual text summarization will involve a significant amount of time and thus become time expensive and generally laborious task. Aiming to reduce these pitfalls in manual text summarization, automatic text summarization has been evolving now bearing a strong motivation for academic research. Text Summarization is carried out by two main approaches, namely Extraction and Abstraction. This paper utilizes the extraction process for sentence selection. We also used some feature-based sentence scoring techniques, which plays an important role in text summarization. Recently fuzzy logic-based research projects have been popularizing among the researchers and have been extensively applied in the domain of Natural Language Processing. Our main goal in this paper is to apply fuzzy logic in the task of text summarization. Finally, we analyzed the performance metrics resulted from the fuzzy logic-based text summarization with the benchmark methods; Rule Base and Neural Network techniques for computing the values for Precision, Recall and F-Measure. In the process of applying the Fuzzy logic, rules were used to balance the weights between important and unimportant features based on the Feature Extraction. With the experimental results achieved, it was concluded that approaching Fuzzy Logic in the process of text summarization yield more successful results than the Rule Base and Neural Network methods.
36	**Title & authors:** Melanoma Detection Using Analysing Mutations in Gene DNA Sequences and Their Primary Protein Structures Dilini Peiris, Amesh Jayaweera and Upeksha Ganegoda. **Abstract:** Melanoma is the deadliest form of skin cancer, whereas it has a metastases form when advanced into later stages. While skin cancers are most prominent in individuals with white skin, any individual can be diagnosed with skin cancers at any point in their life. Melanoma, mostly left untreated and undetected till its later stages make the patients' lives be challenged, which has increased the importance of detecting it at its early stages. In this research, a novel approach is proposed for detecting Melanoma by analyzing gene DNA sequences of a subject, where the mutations are analyzed from nucleotide level up to the amino acid level. The research also consists of making sure the sequences are less fragmented when extracting and also conducts a thorough analysis on the effect of various features such as gene, protein primary structure, age, tumor, tier, etc. to Melanoma with the help of machine learning algorithms. The obtained results are evaluated based on cross-validation and results from existing approaches.

56	**Title & authors:** Converting high resolution multi-lingual printed document images in to editable text using image processing and artificial intelligence
	Waruna Premachandra, Hiroharu Kawanaka and Anuradha Jayakody.
	Abstract: The optical character recognition technique is used to convert information, mainly printed or handwritten text in paper materials, into an electronic format that the computers can edit. According to the literature, there are few competent OCR systems for recognizing multilingual characters in the form of Sinhala and English characters together. The lack of an appropriate technology to recognize multilingual text still remains as a problem that the current research community must address, and it has been designated as the key problem for this study. The main goal of this research is to develop a multi-lingual character recognition system that uses character image geometry features and Artificial Neural Networks to recognize printed Sinhala and English scripts together. It is intended that the solution would be improved to cover three Sri Lanka's most commonly spoken languages, with the addition of Tamil as a later upgrade. The primary technologies for this study were character geometry features and Artificial Neural Networks. At the moment almost an 85 percent of success rate has been achieved with a database containing around 800 images, which are divided into 46 characters (20 Sinhala and 26 English), and each character is represented in 20 different forms of character images. Recognition of text from printed bi-lingual documents is experimented by extracting individual character data from such printed text documents and feeding them to the system.

Lunch : 12.00~ 13.00

Day 1 : March 12, 2022 (13.00PM~14.30PM)

Session 2
Chairs: Prof. Chan-Yun Yang, **Prof. Hiroshi Ikeoka**

Paper ID	Title, Authors and Abstract
7	**Title & authors:** Arc-Fault Detection method with Saturated Current Transformer Sittichai Wangwiwattana and Koike Yoshikazu. **Abstract:** In this research, we devised a low cost and low voltage arc-fault detector. The circuit detection method is to measure peak current from the current transformer and make the comparison between non-arc-fault state and arc-fault state. Since the output current peak created by the current sense transformer in arc-fault state has certain jagged edge, voltage output from the transformer is substantially lower than that of normal state. Such a voltage variation causes into changes of magnetic flux in the current transformer. It is expected that the large voltage difference between arc fault and non-arc fault state appears. It can be used to detect and identify the arc-fault even if arc-fault influence on the supplied voltage is quite low. In this report, we are able to detect the direct pattern difference between non-arc fault and arc fault state. The detection setup for proposed method can be created successfully.
15	**Title & authors:** ANDTi Virtual Assistant Fathima Nihla Mohamed Iqbal, Dinesha Akalanka, Dilini Subhani, Isuru Dissanayaka, Thanuja Sanduni, Windhya Rankothge, Prabuddhi Wariyapperuma and Praveen Kehelella. **Abstract:** Due of the current COVID-19 pandemic crises, there is a worldwide need for quick medical findings. Furthermore, due to a lack of medical facilities and medical practitioners' hectic schedules, several examinations must now be performed by the general public. Also because of the high rate of transmissibility of COVID-19, even asymptomatic patients can readily transfer the virus to others, faster detection is critical during the initial phase of COVID-19, which is early identification. The earlier a patient is detected; the better the virus's spread may be stopped and the patient can undergo proper treatment. As the nationwide vaccination process is in its later part, it is obvious that the government will uplift its regulations and the employees will have to return to their workplaces or offices. As a solution to this upcoming urgency the authors would like to propose a solution to identify COVID-19 patients in advance at corporate level. As an IoT based solution a device is supposed to be setup on top of each employee's desk, which in return will be used to monitor the oxygen level, temperature, and heartbeat rate of the employees.

17	**Title & authors:** Implementation of Supply Chain Management System to Prevent Counterfeit Using IoT device and Blockchain
	Shunpei Oi, Kitahiro Kaneda and Keiichi Iwamura.
	Abstract: Currently, supply chain management (SCM) manages products by externally attaching barcodes, RFID, etc. However, if RFID is physically peeled off from the product, it cannot be managed. As one of the solutions, SCM using physically unclonable function (PUF) is being considered, especially for devices such as semiconductor chips, genuine devices and counterfeit devices. An individual identification system has been devised that uses technology to identify the device. However, since PUF technology deals with minute physical features unique to the device, considerable difficulties remain in its practical application. Using a new authenticity judgment that overcomes the problems, we have realized and implemented SCM system using IoT device and blockchain that performs the same functions as PUF even for devices and substances for which PUF technology has not been established. We describe the evaluation and future of the implemented system.
20	**Title & authors:** Real-Time Position Tracking of Indoor Games Player Based on Radio Frequency (RF) and Ultrasonic (US)
	Surangani Bandara and Kanthasamy Sarankan.
	Abstract: In this paper, we have proposed a low-cost position tracking system for tracking indoor game players using minimal infrastructures with cost-effective electronic components. Various positioning systems were introduced in previous to track game players, but they have complications due to time synchronization. To overcome this problem the proposed positioning system is constructed by using Ultrasonic (US) and Radio frequency (RF). This system uses open-source platforms with good user-friendly interface software, so the system can be operated by a user without prior knowledge of it. The system has two segments, which are the transmitting unit and the receiver unit. The transmitting unit has one RF transmitter and one ultrasonic Transmitter. The receiver unit has one RF receiver and three ultrasonic receivers. In this system, the arduino module is used to control the components and calculate the position estimation. The proposed system is using the theory of time difference of arrival for range measuring. The performance limitation of the system was also analyzed experimentally, such as a single range and positional accuracy in 2D & 3D space. Based on the results of the analysis, major changes and substitutes in the circuits will improve the accuracy and performance limitation of the system such as making the circuits with high-quality ICs & ultrasonic transducers, implementation of a high pass or bandpass filters in receiver circuits and integrating the receiver circuits with voltage regulators.

38	**Title & authors:** Study on Adaptation of Auto Feeding System for Sillago Japonica to Actual Aquacluture Environment
	Yutaka Saragai, Takuya Sato, Haruki Kuroki, Hiroshi Ikeoka and Koichi Isawa.
	Abstract: Sillago japonica is a popular fish in Japanese cuisine, and a stable aquaculture method for growing fish of over 25 cm length, which are traded at high prices, may help revitalize the aquaculture industry. However, it is difficult to raise Sillago japonica in aquaculture using conventional simple automatic feeding systems. Recently, AI and IoT are used in the field of aquaculture. We thus have been developing a fish distribution recognition system using an image recognition AI: preprocessing of an automatic feeding control AI to optimize feeding timing. In this study, not only fish positional recognition but fish directional recognition is achieved by recognizing the position of the head to fine-tuned feeding using AI. Moreover, in order to adapt the system to the actual aquaculture environment, we implemented a mechanism to operate the actual feeder by the instructions of the AI developed on the simulator. At that time, we mainly studied the following two items for practical use. First, we studied the mechanical operation of the actual feeder to be used. Secondly, we built a system of the wireless communication between the feeding control process and the feeder action process.
53	**Title & authors:** 1DOF Inverted Pendulum Balanced Control using the method of Momentum Exchange
	Ridma Ganganath and Buddhika Annasiwaththa.
	Abstract: Inverted Pendulum system is one of the key nonlinear problems in control engineering research, and it can be widely used in many control applications. Apart from the standard conventional pendulum systems, non-linearized balance control of the inverted pendulum using an inertia wheel through angular momentum exchange has been introduced. The closed-loop PID control is used to balance the pendulum and in order to filter the noise effects, a discrete-time FIR filter has been introduced. In order to verification of the developed controller, the computer simulation-based non-linear simulator using the MATLAB Simulink has been introduced. With simulations resultants, control design successfully stabilizes the system for both noise-free as well as the added Gaussian white noise environment have been shown.

Tea Break : 14.30~ 15.00

Day 1 : March 12, 2022 (15.00PM~16.30PM)

Session 3: **Chairs: Dr. Upeksha Ganegoda, Dr. Surangi Bandara**	
Paper ID	Title, Authors and Abstract
16	**Title & authors:** Solving Well-posed Shape from Shading Problem Using Implicit Neural Representations Wanxin Bao, Ren Komatsu, Atsushi Yamashita and Hajime Asama. **Abstract:** We propose a method for solving well-posed shape from shading problem by using implicit neural representations. We build an image irradiance equation and solve the equation by a sinusoidal representation network called SIREN, which is proposed by Sitzmann et al. in 2020. Object surface is expressed by Oren-Nayar model and a perspective projection model with light source located at the optical center is considered. Based on the above models, image irradiance equation is constructed, which is a partial differential equation. We introduce a neural network SIREN to solve this PDE, where implicit neural representations use the sine as a periodic activation function. Experiments are performed on three synthetic images and two real images. Results demonstrate that our proposed method performs with much higher accuracy.
23	**Title & authors:** Machine learning based classification of ripening and decay stages of Mango (Mangifera indica L.) cv. TomEJC for post-harvest quality assessment Warunika Hippola, Deepika Priyadarshani, Thilini Rajakaruna, Lasith Yasakethu and Mishenki Rajapaksha. **Abstract:** Tom EJC is a variety of Mango grown in tropical countries like Sri lanka and India which has a very large demand and hence expensive. From the early stage of ripening, until the senescence stage, the process takes 10-14 days. The fruit shows a yellowish color starting from the very early stage of ripening, throughout the period until it reaches the senescence stage. Unlike the other Mango varieties, it is difficult for a regular customer to determine the stage of ripening of the Tom EJC fruit, by observation. This paper focuses towards developing a vision-based classifier to rapidly identify ripening and decay stages of Tom EJC mango using surface image captures. A dataset of Tom EJC mango images were collated at different maturity levels. A Convolutional Neural Network (CNN) is proposed and tested using over 6000 Tom EJC. Images The proposed model is shown to have a 76% testing accuracy in identifying four stages of matuarity.

31	**Title & authors:** AI Based Object Recognition Performance between General Camera and Omnidirectional Camera Images Shota Kaneda and Chinthaka Premachandra. **Abstract:** In this paper, we present a comparison of the accuracies of AI-based object recognition using a general camera and an omnidirectional camera. Recently, with the improvement in machine learning technology, there has been significant research related to the detection and classification of objects from images and videos. In this field, it is common to use horizontal images and videos. However, omnidirectional cameras, which can acquire information from the entire surrounding area, are becoming popular in addition to general cameras. Although there are some studies on object recognition using these cameras, almost no studies have focused on comparisons between object recognition using general and omnidirectional cameras. Therefore, in this study, we compared the recognition rate of object recognition using the YOLO algorithm on both general and omnidirectional images taken in the same environment.
35	**Title & authors:** Melanoma Skin Cancer Detection from Dermoscopic Images using Computer Vision Chinthaka Jayatilake and Upeksha Ganegoda. **Abstract:** Skin cancer is a form of cancer that is most common among Caucasians and is rapidly increasing year by year. Melanoma is the most dangerous type of skin cancer making it the world's 19th most common cancer type. It is vital to detect Melanoma at its early stages in order to cure the patient without letting the cancer further grow. The proposed solution in this paper is to develop a system that can detect Melanoma by analysing the dermoscopic images while extracting Asymmetry, Border Irregularity, Colour, Diameter (ABCD) features and other dermoscopic features which are more often visible in Melanoma skin lesions. Python language is being used for the implementation and as computer vision is the main component in this research the OpenCV library is being used extensively in the pre-processing and feature extraction stages. Different classification methods are also being evaluated to identify which classifier works best with the dermoscopic features extracted in the feature extraction stage so that the highest accuracy could be obtained in diagnosing Melanoma. Therefore, when a dermoscopic image is given to this proposed system it will output whether the patient is diagnosed with Melanoma along with the confidence level of the diagnosis result based on the various dermoscopic features extracted from the image.
45	**Title & authors:** YouTube Trending Video Analysis in Sri Lanka Isanka Diddeniya, Hansi Gunasinghe and Chinthaka Premachandra. **Abstract:** YouTube, owned by Google LLC, is the most widespread video platform. It has gained much popularity in Sri Lanka within the last couple of years. Youth has an interest of becoming full-time content creators, but lacks technical and marketing knowledge. In this paper, we present a computer aided analysis to provide insights of trending YouTube videos in Sri Lanka. The system gets YouTube trending video data of one and a half months in year 2021 as input and analyze them to report information on video title, description and thumbnail which are the main parameters of YouTube algorithm when deciding on a trending video. Particularly, the system uses YOLO and RetinaNet for detecting objects in thumbnails. Moreover, Sri Lankan video content mainly include Sinhala language which is the mostly used language in the country. We used Sinhala language processing techniques for reporting various information. In summary, using the provided information, a YouTuber can decide on the: (1) colors and objects to include in the thumbnail, (2) title and the description by considering word count and symbols, (3) number of tags, words and phrases to include in a tag and (4) date and time to publish the video. The results indicate that

	the proposed approach can significantly support an accurate decision of YouTube video upload with a little computational effort.
46	**Title & authors:** Border Control by Multi-biometric Identification using Face and Ear images Susara Thenuwara, Hiroharu Kawanaka and Chinthaka Premachandra. **Abstract:** Biometrics are critical authorization method in border control areas such as airports. This study explores the usage of the ear and face biometric for verification at the physical appearance of the border points and indicates experimental results collected on a newly made database containing four hundred and twenty images. The images have been taken through a quality module for the purpose of reducing the False Rejection Rate. The approach that was used is The Principal Component Analysis (PCA) that is "eigen ear" for obtaining the recognition rate of 89.3%. After the ear was fused with face biometric, there was an improvement in the recognition. The fusion is done at the level of decision making, hitting a recognition of 97.1%, which is an improvement of 8.2%.
	End of Day 01

Day 2 : March 13, 2022 (8.00AM~10.30AM)

Keynote speak 3 (Chair:Dr.Senaka Amarakeerthi)(8.00AM-9.15 AM)

Prof. Lafifa Jamal

Department of Robotics and Mechatronics Engineering, University of Dhaka

Title: **Intelligent Robotics System for Early Childhood Education**

Abstract:

Education is a primary right for every individual. It is the most important foundation which paves the future roadmap for a person. An individual's formal education begins with learning to read and write the alphabet and the quality of learning is heavily influenced by the teaching process. An automated interactive process can greatly assist in learning more efficiently. Despite Bengali is the seventh most spoken language in the world, very few interactive systems are available on it. In this talk, I will overview the existing systems including our attempts to develop an AI-based interactive system to automate the Bengali handwriting teaching process for children. The system detects and assesses the quality of handwriting of children. I will also show experimental results that demonstrate the effectiveness of the proposed system.

Workshop 2 (Chair: Prof. Atsushi Inoue)(9.15 AM - 10.00AM)

Mr. Isanka Diddeniya

Department of Physics, Faculty of Applied Sciences,
University of Sri Jayewardenepura, Srilanka

Title: **A ROS based autonomous robot using SLAM algorithm**
An autonomous robot is a built physical system that can move in space to complete a specific task without human instructions or control through the real-world environment that has not been specially made for a robot. Nowadays, autonomous robot navigation is a significant area for the world because the autonomous navigable robot can be used for particular tasks such as space exploration and experimentation, military tasks, deep-sea exploration and experimentation, etc. SLAM (Simultaneous Localization and Mapping) is the most important topic for autonomous navigation. Also, ROS (Robot Operating System) is a trending open-source robotics middleware suite that can be used to develop an autonomous navigable robot. This workshop aims to demonstrate a cost-effective indoor autonomous navigable robot system using SLAM based on techniques in the ROS.

	Tea Break: 10.00~10.30
	Invited talk 1 (Chair:Dr. Sagara Sumathipala) (10.30 AM - 12.00AM) **Prof. Atsushi Inoue, Ph.D** Visiting Professor, Regional Innovation Studies, Mie University, Tsu, Japan **Title: Machine Learning Mastering Guide ~Essentials & Pinpoint Tips~** Machine Learning has become available in our lives – so-called democratization. Yet, many people still struggle with utilizing it. This lecture covers essentials and pinpoint tips of setting up the environment and successfully performing Machine Learning practice. Topics include, but are not necessarily limited to, introduction to various Machine Learning algorithms and their comparisons; software tools and their setup; computing environment and its scale-up such as GPU, virtualization, and cloud computing; and processes and operations of Machine Learning practice. First 60 minutes for lecturing + following discussions for the remaining 30 minutes.
	Lunch Break: 12.00~13.00

Day 2 : March 13, 2022 (13.00AM~14.30)

	Session 4: Chairs: Prof. Genci Capi, Prof. Lafifa Jamal
Paper ID	Title, Authors and Abstract
6	**Title & authors:** Development of Agriculture Robot for Plant Detection and Fertilizer Dispense Hayato Suzuki, Ryosuke Osawa, Hiroto Saegusa, Shin-Ichiro Kaneko and Genci Capi. **Abstract:** With the growing world population, limited agriculture resources and reduced number of people working in agriculture sector, the need for intelligent autonomous robots is increasing. Agriculture robots must perform a wide range of operations like spraying pesticides, dispense fertilizers, remove weeds. In this paper, we explain in detail an agriculture robot developed in Assistive Robotics Laboratory, Hosei University. It consists of three subsystems: 1) The wheel-type actuated system; 2) A parallel link arm and 3) Fertilizer system. The robot utilizes the visual information and the Convolution Neural Networks to recognize the target plants. To evaluate the performance of developed robot, we performed experiments for spinach recognition, fertilizer dispenser and robot spraying.
12	**Title & authors:** Theatrical Robotic Actor Developed Using the Interpersonal Communication Principles Udaka Manawadu, Hasini Perera, D.A.A. Deepal, Ann Fernando and Ravindra De Silva. **Abstract:** Stage drama is a unique literary form because they are designed to be acted out on a stage before an audience. Among the key elements of a drama, indubitably acting is the utmost essential element. For a drama to be more successful, it should consist of naturalism, realistic interactions, better coordination, and high engagement. Through the evolution of robots, a great milestone remarks the rise of robotic actors where robots have stepped the live theatre. In this study, it was identified that interpersonal communication principles are a major source to be utilized which unwittingly helps in building strong bonds between humans. This paper describes, developing a theatrical robotic actor using the principles of interpersonal communication which comprises the key behaviors of the robotic actor that are best suited in response to the human actor's behaviors in a theatrical play that will result in human actor-like behavior in the live theatre. The experiment of the study was designed using three approaches. Through the results of this study, it was concluded that the robotic actor designed by following interpersonal communication key principles is capable of having better coordination and realistic interactions with the human actor and the play was more natural and realistic. Also, this study has introduced a novel concept of making theatrical robotic actors in a way to emphasize the human actor-like behavior in live theatre.

13	**Title & authors:** Development of a walking assistive robot for elderly people in outdoor environments
	Toshinori Nagasawa, Kodai Oyake, Masanori Kawahara, Shin-ichiro Kaneko and Genci Capi.
	Abstract: In this paper, we present a new robotic system to assist elderly people during walking in outdoor environments. The walking assistive robot is equipped with depth camera, GPS, compass and ultrasonic sensors. The robot generates the route to the goal location using the google map. Based on the sensor information the robot follows the generated route while avoiding obstacles. In addition, the robot adjusts its speed based on the walking speed of the user and sends information to the family members of the user about the location in the google map. The robot checks the condition of the user and his/her distance to the robot and takes the appropriate decisions. The usefulness of the proposed system is examined experimentally.
21	**Title & authors:** Automatic Generation of Feedback Stabilizable State Space for Non-holonomic Mobile Robots
	Ken Nakahara and Yuichi Kobayashi.
	Abstract: Learning approaches to robot control problems generally require a number of trials, which is crucial to make the approaches available in wider applications. As a means to improve learning efficiency, it is promising to introduce methodologies and ideas developed in the field of control theory. This paper presents an acquisition of a state space that allows control to reach a target for the two-wheeled mobile robot with non-holonomic constraint, under an assumption that knowledge on the sensor is not available in advance. An adaptive grid distribution algorithm to cope with a non-holonomic controller scheme is proposed. It was experimentally confirmed that the robot could reach the target point stably by the proposed method. The proposed method presents an idea to effectively integrate machine learning and control theory and it has the potential to become a unified learning method that can be applied to various control targets with less samples or trials.
39	**Title & authors:** Symbiotic Organism Search-based Locomotion of Underwater Snake Robot in various Environments
	Bhavik Patel, Jyotindra Narayan and Santosha K. Dwivedy.
	Abstract: Biological snakes can efficiently move from one place to another in different environmental conditions. Inspired by such locomotion behaviours, a biomimetic snake robot should have some adaptability features to foster several engineering applications. In this work, for energy-efficient locomotion, the optimal gait parameters of an underwater snake robot are investigated at the expense of different environmental drag force conditions and water current velocity. At first, mathematical modelling of underwater snake robot is briefly presented. Thereafter, a symbiotic organism search (SOS) algorithm is exploited to obtain the optimal gait parameters subjected to the cost function of maximum tangential velocity and minimum power consumption. The simulation runs have shown the potential of the proposed optimization algorithm for a cost effective locomotion of the underwater snake robot.

41	**Title & authors:** Exploring a Comfort Zone in Side-by-Side Communication for Human Robot Interaction
	Udaka A. Manawadu, M. A. H. Deen and P. Ravindra S. De Silva.

Abstract: Robots have been known to assist in making our lives more convenient in everyday situations by interacting with humans. Human-Robot Interaction is the area that focuses on developing methods that allow robots to interact with humans effortlessly. Humans may not be comfortable interacting or working together with robots in close proximity. However, the need for this close interaction with robots in situations such as escorting a group of people and guiding a group of people has led to situations where humans and robots are required to move and walk together. Research conducted into human walking behavior has shown that humans tend to walk in a side-by-side formation whenever possible. Therefore, the designers of new generational robots began to capture these qualities of humans when designing their robots. However, a major problem that arose when attempting to implement side-by-side motion models for robots was the fact that humans tend to have an intimate or personal space that is considered as a comfort zone for them. Therefore, the necessity arose to find a method that facilitates side-by-side walking for robots without invading human personal space. As a remedy for this issue, a methodology was developed that was focused on exploring a comfort zone in side-by-side communication for human-robot interaction that allows the robot to walk side by side along with humans in a controlled environment without invading the human companion's personal space. This research will attempt at bringing the human quality of companionship to robots to enhance human-robot interaction

Day 2 : March 13, 2022 (14.30PM~15.45PM)

Session 5: **Chairs: Mr. B.S. Sudantha, Dr. Isuru Jayarathne**	
Paper ID	Title, Authors and Abstract
22	**Title & authors:** Continuous User Authentication using Keystroke Dynamics for Touch Devices Charuka Herath, Chameera Dulanga, Donishka Tharindu and Upeksha Ganegoda. **Abstract:** Using behavioral biometrics to authenticate users has increased due to failures in traditional authentication systems. Keystroke dynamics-based authentication is one of the most secure behavioral biometric authentication systems. This study aims to research and implement a non-fool proof, low-cost continuous authentication system for touch devices based on keystroke dynamics. The specialized mobile application was used to collect users' keystroke dynamics and bigrams were used as input parameters. 2 artificial neural networks were used in this study and the first network was used to identify users' handedness while the second one decided used validity. Also, input was not limited, and users were allowed to type free text. As the result, overall accuracy was above 83.74%. Based on the results, we concluded that keystroke dynamics can be used for continuous user authentication purposes even with freely typed tests.
29	**Title & authors:** Segmentation of Mammogram Images Using Deep Learning for Breast Cancer Detection Sagar Deep Deb and Rajib Kumar Jha. **Abstract:** Breast Cancer is one of the most common forms of cancer occurring in women. According to GLOBCON, 24.2\% of new cancer types are related to breast cancer. Early detection followed by a proper diagnosis can help to combat this kind of serious disease. Segmentation of mammography lesions has been proven to be a valuable source of information for the detection and classification of breast cancer. Segmentation can assist both in extracting shape-related features and providing accurate localization of the lesions. In this paper, detailed research on the segmentation of the mammography images using two different networks, namely U-Net and BCDU-Net is done. A comparison of the performance concerning Dice Coefficient and Jaccard Similarity is done on two subsets of the same dataset, one on the full mammogram image and another on the ROI extracted from the mammogram. The evaluation results of the proposed research achieve the highest Jaccard and Dice coefficient of 0.7872 and 0.8376 respectively on the full mammogram. Whereas the figures for ROI segmentation are 0.8098 and 0.8723 respectively. These results demonstrate that, with equal data size, both the network provides better segmentation performance on ROI than on full mammogram.

32	**Title & authors:** Deep Learning Models for Emotion Classification in Human Robot Interaction Platforms Jose Balbuena and Cesar Beltran. **Abstract:** Human Robot Interaction (HRI) main purpose is to improve the communication between robots and people, in special the service robots which principal function is interacting with users. Service robots could be virtual or physical, such as a chatbot or humanoid robot. The increase of internet access and the use of online services have produced an exponentially use of chatbots. This situation generate people spending more time using this technology and trying to humanize it. Therefore, giving robots emotional capabilities have become an important issue in the field. For this reason, the purpose of this article is to analyzed and compared the performance of common deep learning techniques (CNN, RNN) that could be used as a emotion classifier for HRI platforms such a chatbots or humanoid robots. Two kind of input signals were evaluated: text and images of faces. In addition, different metrics were selected to evaluate the accuracy and time performance of the models.
43	**Title & authors:** Conceptual Representation and Evaluation of an FPS Game Commentary Generator Sachin Mamoru, Avarjana Panditha, Jayashakthi Perera and Upeksha Ganegoda. **Abstract:** Playing video games has been popular across all the age limits of modern society. In the beginning, it was limited among the younger community and it was just a hobby limited to individuals. Even though the majority of society sees video gaming as having a negative impact on society, this modern industry acts a significant role in healing the present competitive, stressful society. Game commentary has played a major role in the domain of competitive ESports. A proper game commentary is beneficial to both players and the audience. The aim of this project is to analyze the gameplays to produce a commentary track while balancing the contributing factors, color commentary, and play-by-play commentary. The project consists of three modules that perform the study in three perspectives: 1. Word sets related to action, spatial, temporal, and statistical information, 2. Word sets related to color commentary, 3. Word sets related to play-by-play commentary. In each module, a game commentary is generated using only the word sets related to that module. For evaluation, the similarity between the human commentary and the generated commentaries individually will be calculated.
52	**Title & authors:** Multiclass-Classification of Algae using Dc-GAN and Transfer Learning Mr Abdullah, Ziaullh Khan, Wajid Mumtaz, Abdul Samad Mumtaz, Subrata Bhattacharjee and Hee-Cheol Kim. **Abstract:** The growth of algae is a natural process and highly increase in concentration has a bad impact on water bodies as well as other creatures. The monitoring and classification of algae by using the traditional method is a tedious and time-consuming task. The reliable and robust development of the alternative method is crucial to do these tasks, however, advanced machine learning, computer vision, and deep learning are excessively used to address this problem. In this paper, we have used the transfer learning technique, in which various pre-train models are used to train on our custom dataset. We conducted a series of experiments to classify genera of harmful algae bloom (HAB). Furthermore, we compare each pre-train architecture performance on our unique dataset. As the transfer learning model needs more data to train it, so we used a direct generative adversarial network (Dc-GAN) to enhance the quantity of data. In this work the four popular pre-train models are used, namely, inceptionv3, google net, Rest-Net18, and VGG16. The VGG16 model performance score is highest, which is 98.07%. The transfer learning model approach would be an effective tool for rapid operational response to algae bloom events. The experimental results show that the transfer learning method is more effective and reliable to detect and classify algae.

Day 2 : March 13, 2022 (15.45PM~16.45PM)

Session 6:

Chairs: Dr.Senaka Amarakeerthi, Prof. Lasith Gunawardane

Paper ID	Title, Authors and Abstract
19	**Title & authors:** FCH-SLAM: A SLAM Method for Dynamic Environments using Semantic Segmentation Youwei Wang, Masahiko Mikawa and Makoto Fujisawa. **Abstract:** Static environments are a prerequisite for most visual simultaneous localization and mapping (SLAM) systems because the dynamic matching points from moving objects in the camera's field of view interrupt the localization process. The noise of the dynamic objects also contaminates the constructed maps. In this study, we propose a SLAM system designed to reduce the effects on the accuracy caused by dynamic objects to solve this issue. The noise points of dynamic objects are removed by combining depth information and semantic information. We evaluated the proposed method on the TUM RGB-D dataset, and the experimental results show that it performed well in dynamic environments, obtaining a high accuracy in most situations with a relatively high processing speed.
26	**Title & authors:** Sound-to-Sound Translation Using Generative Adversarial Network and Sound U-Net Yugo Kunisada and Chinthaka Premachandra. **Abstract:** In this paper, we propose a generic learning method for training conditional generative adversarial networks on audio data. This makes it possible to apply the same generic approach as described in this study to problems that previously required completely different loss formulations when learning audio data. This method can be useful for labeling noises with a certain number of identical frequencies, generating speech labels corresponding to each frequency, and generating audio data for noise cancellation. In this study, we realized a wide applicability of our system, owing to its ease of implementation without a parameter adjustment, as well as a reduction in the training time for audio data. During the experiment, reasonable results were obtained without manually adjusting the loss function.

54	**Title & authors:** Design and Implementation an IoT Based Smart Traffic System Using Renewable Energy Sources Sakibur Rahman Kazemee, Md Azmaeen Rahman Khan, Yasin Rahman, Md. Sujon Mahmud, Md. Kabiruzzaman and Bishwajit Banik Pathik. **Abstract:** Congestion in the streets is a big issue in many countries. Traffic congestion has been caused by signal failure, poor law enforcement, and inefficient traffic management. One of the biggest issues in many countries is that the existing infrastructure cannot be expanded further, leaving only better traffic management as an option. Overcrowding has a negative economic impact, on the environment, and on the general quality of life. As a result, it is past time to address the traffic congestion issue efficiently. For traffic control, visual data analysis, IR sensors, inductive loop detection, remote monitoring, and other methods are available. The problem of traffic congestion has had a significant impact on the country's transportation system. This creates a slew of issues, particularly when there are emergency situations at traffic signal junctions, which are always congested. To address these issues, a traffic light controller system was created. When the system received a radio frequency (RF) transmission signal from an emergency vehicle, the speaker was triggered, and the traffic police were notified. The road was thereafter cleared by the traffic police. This technique will decrease accidents that occur frequently at traffic light crossings since other vehicles must congregate in order for an emergency vehicle to be given a unique route. This system was designed to run when it received a radio frequency (RF) transmission signal from an emergency vehicle, then the speaker was activated, also notifying the traffic police by the server. We include many features of a smart traffic system, such as voice announcement for ambulances with radio frequency, renewable energy source, extra power supply for residential areas, overspeed protection system, automatic street lights only for night time, pressure sensor traffic manual system, accident tracking and sending SMS with the accident location, local server, and global application/IoT base. Traffic congestion will be decreased as a result of the use of this innovative technology. Bottlenecks will be spotted early, allowing for early preventative steps to be performed, saving the driver time and money.
55	**Title & authors:** Kinematics analysis of a quadruped robot: Simulation and Evaluation Md.Hasibur Rahman, Md.Mazharul Islam, Dr.Saadia Binte Alam, Md.Fayed Al Monir and Dr Mohammad Shidujaman. **Abstract:** Kinematics analysis is one of the most important terms in order to find the robot manipulator's joint motions. By using kinematics, we can determine how the robot's arms will move and the probable directions of that arm's end effector. Kinematics analysis is split into two parts as Forward Kinematics and Inverse Kinematics. Forward Kinematics measure the positions and orientations of the robot's end effector. In inverse kinematics by using forward kinematics to measure end effector positions; we can calculate joint angles. In this study, we provided mathematical derivation for forward and Inverse kinematics to determine our robots' positions and joint angle. To implement different walking motions in a quadruped robot; at first, we need to analyze the single-leg structure. In this study, we analyze and derived the forward and inverse kinematics of the quadruped robot's single leg and verify their correlation. For mathematical programming, we used python and Pybullet physics engines to analyze our robot leg motions.

Day 2 : March 13, 2022 (16.45PM~17.15PM)

Award Ceremony : 16.45~17.00 By Award Chairs
Vote of Thanks: 17.00
End of Day 02