ICIPRoB2020 Conference Program

Day 1 : March 6, 2020 (9.00AM~10.30AM)

Opening Ceremony (Chair: Susara Thenuwara)　　(9.00~9.30)

Welcome speech by ICIPRoB2020 general chair

Keynote speak 1 (Chair: Sagara Sumathipala)(9.30~10.30)

Prof. Genci Capi

Department of Mechanical Engineering,
Hosei University, Japan.

Title:

Machine Learning for Socially Assistive Intelligent Robots Operating in Human Environments.

Abstract:

The research on intelligent robots will produce robots that are able to operate in everyday life environments, to adapt their policy as environment changes, and to cooperate with other team members and humans. Operating in human environments the robots have to be process in real time a large number of sensory data such as vision, laser, microphone, in order to determine the best action. Learning and evolution have been proved to give good results generating a good mapping of various sensory data to robot action.

In this talk, I will overview the existing efforts including our attempts at creating intelligent robots operating in everyday life environments. In particular, I will focus on remotely operating surveillance robot, robot navigation in urban environments, and assistive humanoid robot. I will show experimental results that demonstrate the effectiveness of proposed algorithms.

Tea Break: 10.30~11.00

Day 1 : March 6, 2020 (11.00AM~12.30PM)

	Session 1:Special session of "Robotics for Challenging Environment" Chairs: Lafifa Jamal and Mohammad Shidujaman
Paper ID	Title, Authors and Abstract
18	**Title & authors:**"I trust you more": A Behavioral Greeting Gesture Study on Social Robots for Recommendation Tasks. Mohammad Shidujaman (Tsinghua University); Haipeng Mi (Tsinghua University); Lafifa Jamal (University of Dhaka) **Abstract:** In this paper, we present our effort in understanding how an agent's recommendation can affect human decision making by establishing trust and familiarity in a cross-cultural context. We designed four different greeting gestures for the NAO robot based on human's greeting custom and conducted a user experiment in which participants from different countries interact with the robot for a designated recommendation task. In the experiment, we investigated how "Cultural familiarity affects acceptance of an agent's recommendation". We recruited 20 participants from four different countries in the experiment. The result of the experiment suggests a cross-cultural design method can increase the likelihood of acceptance of a humanoid social robot's recommendation task when interacting with users with different cultural backgrounds.
23	**Title & authors:** Development of a Sign Language for Total Paralysis and Interpretation using Deep Learning. Zahan Zib Sarowar Dhrubo (University of Dhaka); Md. Ashiful Islam Hridoy (University of Dhaka); Lafifa Jamal (University of Dhaka); sujansarker (University of Dhaka); Mohammad Shidujaman (Tsinghua University) **Abstract:** People with total paralysis suffer not just from physical disability but also from the agony of the inability to communicate and express their feelings. Researches have long tried to solve this problem with various techniques such as collecting the patient's message directly from the brain using Brain-Computer interface and determining the gaze of the patient on a screen that contains letters and symbols. The first approach proved to be expensive and less accurate. The second one needs very fine calculation of the pupil center and even if done correctly the drifting of the human eye makes it hard to get a better accuracy. Again, all of these methods are dependent on electronic devices. In this paper, we proposed a solution that does not require the help of any electronic devices by developing a sign language for eye movements. We also proposed an approach to automatically interpret the patient's sign using Convolutional Neural Network and achieved great accuracy on the training data. This suggests that our network can be used to provide a better communication method for paralyzed patients.
44	**Title & authors:** Preliminary Experiment for Mental-Supporting Control Rehabilitation Robot based on Emotion Estimation. Atsushi Hoshina (Shibaura Institute of Technology); MayuYokoya (Panasonic Corporation); Kazunori Yamada (Panasonic Corporation); Midori Sugaya (Shibaura Institute of Technology) **Abstract:** These days, many rehabilitation robots that support patients physically or mentally are being proposed. The robots that offer physical support are used as treatment to improve the physical condition such as weakness or lack of muscles by estimating and changing dynamic control depending on the muscle status. These robots are successfully supporting the patient. However, control of the robot based on the patient's emotion such as depression and stress is more difficult than to support the patient physically. One of the problems comes from the lack of the clear relation between accurate detection of emotion such as depression and stress, and successful control of the robot. To solve this problem, we firstly try to measure the relation between the control of the rehabilitation robot and the dynamic change in the patient's emotion. We propose a method to control the rehabilitation robot based on the user's mental status. We evaluated the emotions of the person operating the rehabilitation robot using an index to estimate their mental state from heart rate variability (HRV). HRV is used to measure the valence, an index of pleasure. We conducted an experiment in which the participants were directed to control the rehabilitation robot with three different levels of pushing force required to operate the robot. From the results, we confirmed that the emotion of the participants had significantly changed depending on the load applied to the robot.
48	**Title & authors:** Low-cost Talking Calculator for Visually Impaired People in Sri Lanka.

	Nilupul Nuwan Senevirathna (wayamba university of srilanka); W.A.Susantha Wijesinghe (Wayamba University); Chinthaka Premachandra (Shibaura Institute of Technology) **Abstract:** Assistive tools are required for people who are visually impaired to learn as others. In this paper we describe a development of a low cost talking calculator that can be used by blind people in Sri Lanka to perform basic mathematical operations.
25	**Title & authors:** An Induction Type Displacement Sensor Used in a Novel Soft Robotic Muscle Actuator. Rancimal Binoy Arumathanthri (University of Moratuwa); Asitha L Kulasekera (Department of Mechanical Engineering, University of Moratuwa); Damith Chathuranga (Department of Mechanical Engineering, University of Moratuwa) **Abstract:**This paper presents the development of a displacementsensor used in a novel soft robotic muscle actuator. Thisdisplacement sensor has significant features over existing sensorsused in soft muscle actuators such as ease of fabrication andminimal effect on the performance of the actuator. Moreoverthe soft actuator and sensor is inexpensive compared to existingsoft actuators and sensors. A novel inductance sensing methodwas used to find the displacement of the actuator which enables closed loop control of the actuator. The authors have experimentally evaluated the performance of the displacement sensor. The proposed sensor has a sensitivity of 0.00244 mH=mm and hysteresis is below 1.5% with average error less than 4%. Position feedback control of the actuator using built-in displacement sensor was tested and validated by controlling the actuator through a sinusoidal curve. The results suggested that this sensor can successfully measure the displacement of the said soft muscle actuator with high accuracy which can be used in different soft robotic applications.
Lunch : 12.30~ 13.30	

Day 1 : March 6, 2020 (13.30PM~15.00PM)

Session 2: Intelligent Transport Systems **Chairs:** BS Sudantha and Susantha Wijesinghe	
Paper ID	Title, Authors and Abstract
2	**Title & authors:** Significance of Predictive Motion Control. Rastri Dey (KPIT TECHNOLOGIES LIMITED); Soumyo Das (KPIT TECHNOLOGIES LIMITED); Sandeepan(KPIT TECHNOLOGIES LIMITED) **Abstract:** This research paper emphasizes on the development of an advanced controller for the adaptive cruise control system. The performance of headway or time gap control plays a pivotal role in an automated longitudinal motion. The controller stability in a traffic follow mode is predominantly governed by the longitudinal motion profile of the preceding vehicle. The measurement of acceleration of the preceding vehicle using heterogeneous sensors are challenging pertaining to the shortfall of longitudinal motion control through classical mechanism. Thus, a predictive model with defined constraints of vehicle dynamics has been designed to demonstrate the improved system performance during preceding target follow mode. A novel approach of predictive control adopting multifarious states of cruise and target follow mode is discussed to address the deficit of classical control. Furthermore, the non-linear tracking differentiator theory acts as an observer model for the estimation of an acceleration profile of the host vehicle. The integrated CarMaker vehicle dynamics model in conjunction with the controller establishes a podium for evaluating system performance in a closed loop simulation. The target trajectory estimation and motion characterization are the determinants of target selection which further aids to conduct smooth and consistent actuation. The performance of the conventional control is compared with proposed adaptive model predictive control under standard yardsticks of adaptive cruise control operation to demonstrate an improved system efficiency.
46	**Title & authors:** Vehicle Accident Detection and Warning System for Sri Lanka Using GNSS Technology. Kapilan Kumaravelrajah (Sabaragamuwa University of Sri Lanka); Surangani Bandara (Sabaragamuwa University of Sri Lanka); Thilantha Dammalage (Sabaragamuwa University Of Sri Lanka) **Abstract:** As the usage of vehicles is increasing drastically in Sri Lanka, the rate of road accidents is also increased today, especially two-wheelers. Low and middle-income countries like Sri Lanka are the most affected because road traffic crashes and injuries are linked not only to the number of vehicles, road conditions,

and drivers' behavior but also to the country's level of economic and social development. The main causes for these mishaps are due to the fault of driver/rider like, high-speed, drunk and drive, diversion of minds by stress or electronic gadgets as well as faults of authorities such as poor road infrastructure, inappropriate mixing of vehicle types, inadequate traffic law enforcement and delayed implementation of road safety policies, etc. Even some mild injuries may cause severe problems to a victim without prompt medical health. The physical condition of the victim who met with an accident is not always going to be good enough to seek medical help. Sometimes the victim may be in an unconscious stage or maybe fainted away. This paper deals with automatic accident detection and also introduces automated accidents alerting when the accident occurs to the vehicle. Once the accident occurs to a certain vehicle, the proposed system will detect it and send an alert containing the required information to a certain registered number instantly.

42	**Title & authors:** Improvement of Driver Visibility at Night by Ego Vehicle Headlight Control. H. A. Harindu Y. Sarathchandra (Wayamba University of Sri Lanka); Kithsrii JRKC jayakody (Wayamba University of Sri Lanka); Chinthaka Premachandra (Shibaura Institute of Technology) **Abstract:** For drivers it is significant to have an appropriate intensity level of light for proper visibility of the road. But, driving a vehicle at night is very difficult task due to the direct headlights from vehicles which drives in opposite directions and uncontrollable light sources from outside. Moreover when the headlights are dim, the intensity level of the light is not sufficient for the drivers which causes to increase the accidents rate rapidly specially in urban areas. This is mainly due to manual lightening systems. Therefore this research is focus on developing an efficient image processing based algorithm to ensure the sufficient intensity level of the lights to the driver while providing the least intensity level for the opposite drivers automatically. Pixel based image segmentation was used as a basis of this research. Testing the algorithm was done in a simulated environment to verify the accuracy of the algorithm.
3	**Title & authors:** Path Tracking and Control for Parallel Parking. Soumyo Das (KPIT TECHNOLOGIES LIMITED)*; Meer Reshma Sheerin (KPIT TECHNOLOGIES LIMITED); Sabarish R. P. Nair (KPIT TECHNOLOGIES LIMITED); Prashantkumar B. Vora (KPIT TECHNOLOGIES LIMITED); RastriDey (KPIT TECHNOLOGIES LIMITED); Milankumar A. Sheta (KPIT TECHNOLOGIES LIMITED) **Abstract:** This paper demonstrates path planning and motion control for an automated parallel parking. The ultrasonic sensor based parallel parking control algorithm provides parking assist to ease the effort of driver. The trajectory for parking maneuver is generated based on the path planning algorithm to assist vehicle in the identified space with single maneuver. The lateral control with longitudinal aid provides accurate maneuver of the vehicle in a parking space. The performances of proposed fuzzy and conventional lateral control are compared to highlight the benefit of the proposed integrated fuzzy based lateral control with longitudinal aid. The lateral controlled steering command is fed to the system to maneuver the host vehicle successfully in parallel parking space. The novel approach of fuzzy based integrated feedback and feed-forward control for parallel parking has been illustrated in the paper as an optimized resolution for trajectory tracking in limited space parking application. The model based development approach has been adopted to develop path plan and control, however the designed model gets integrated with vehicle dynamics of CarMaker to validate the parking efficiency. The case study of parallel parking has been demonstrated in the research paper to comprehend the significance of path planning and rule based motion control.
15	**Title & authors:** An Automated Railway Level Crossing System. Thangathurai Kartheeswaran (Vavuniya Campus of the University of Jaffna) **Abstract:** Telecommunication, and computing technologies are the key technologies that can be used to derive solutions for many real-world problems. The developing countries still facing many issues in railway level crossings. The level crossing accidents may cause many serious hazards such as deaths, injuries, and vehicle damages, which altogether lead to a fall on a country's economy. This problem can be solved by adopting IoT technologies in the railway sector. There are many automated systems suggested by different researchers with different IoT approaches in the past. However, as we analyzed the literature thoroughly, there are shortcomings in each study performed. This paper proposes a novel system to overcome the shortcomings of the automated railway gates using IoT and machine learning concepts in an excellent and efficient way to reduce the fatal accidents of the level crossing into almost null. A comprehensive embedded system is proposed with two subsystems, which are Train Detection Subsystem (TDS) and Level Crossing Subsystem (LCS). The TDS is done using a vibration sensor and inductive proximity sensors, and a camera module accomplishes the vehicle

	detection process of LCS with image processing and a machine learning algorithm. The wireless communication process uses the AES algorithm for secure data transmission between LCS and TDS through Radio Frequency (RF) communication module. This model will be an efficient model to avoid many fatal accidents in the railway crossings and also will be an excellent solution to contribute to a country's economy indirectly.
8	**Title & authors:** IoT Based Photovoltaic Power-Adjustable Solar Street Light. Amila Nuvan Perera (Wayamba University of Sri Lanka); Chinthaka Premachandra (Shibaura Institute of Technology); Ajith Kumarayapa (Wayamba University of Sri Lanka) **Abstract:** This study introduces an IOT (Internet Of Things) based power-adjustable solar street light system to reduce electric power cost for illuminating cities as well as roads. This system is based on the idea of efficient usage of available energy. This proposed system sense environment light intensity and adjusts bulb output power according to the illumination intensity of the installed place. Hence, the loss of energy due to the unnecessary glow of the street light can be avoided. The system is fully solar-powered and solar energy, which is available during the day time, is stored in a solar cell and the same is utilized to glow the street light during the whole night. Furthermore, solar charging efficiency and battery health can be monitored through the internet. If the system experiences hardware failure it will be identified through IOT dashboard and it alerts sending an SMS (Short Message Service) using GSM (Global System for Mobile) technology. Since this bulb consumes minimum energy level it does not need a high capacity battery for power storage. Therefore, this can be introduced as a low cost, energy-saving solar streetlight system. Even though there are many solar street light systems available in the market, the novelty of our research is to propose an output power adjustable method for solar street lights.
Tea Break : 15.00~ 15.30	

Day 1 : March 6, 2020 (15.30PM~17.15PM)

Session 3: AI &Intelligent Systems	
Chairs: Lasith Gunawardena and Takumi Ichimura	
Paper ID	Title, Authors and Abstract
22	**Title & authors:** Bearing Fault Diagnosis with Deep Learning Models. Chan-Yun Yang (National Taipei University); Chia-An Yi (National Taipei University); Yu-Ling Wang (National Taipei University); Huei-Yang Lai (National Taipei University); Yi-Wei Chen (National Taipei University) **Abstract:** Since the first industrial revolution in 1800s, rotating machinery has played an indispensable role in the manufacturing systems. Due to its importance, fault detection and diagnosis of rotating machinery is a major challenge in the industrial applications to maintain the productions a good quality. Having the merit of learning from data – the big data issue, the diagnosis takes a significant advance in its efficiency recently, and becomes a data-driven predictive task. In order to thoroughly recognize the advantage of the data-driven techniques in the effective diagnosis of rotating machinery faults, this study sought to have solutions of deep learning techniques for this kind of diagnostic task, and tested the capability the solution could reach. By gathering data, extracting features, and learning the task through the architectures of a Convolutional Neural Network (CNN) and a Recurrent Neural Network (RNN), an experiment was conducted to know the capability. The outputs show the roughly fair predictive accuracies of 99.02% and 86.01% for both the CNN and RNN models. Although the close accuracies, there are still differences in both the models. Comparisons arise thereafter for the model selection in the future applications.
47	**Title & authors:** An Autonomously Guided Differential Drive Robot Base Using Asus® Xtion Pro Live. Isanka A P Diddeniya (University of Sri Jayewardenepura); Janith Liyanage (eVision Microsystems (Pvt) Ltd); Indika Wanniarachchi (University of Sri Jayewardenepura); Chinthaka Premachandra (Shibaura Institute of Technology); Hansi N Gunasinghe (Sabaragamuwa University of Sri Lanka)

	Abstract: Robots have been popularized in the world during past two decades and its development has overtaken many tasks performed by people, from household to largest companies. Further, robotics has its applications in almost all the industries and sectors. Robots are available in many sizes, weights and appearances based on its usage and applicability. In our study we introduce a novel robot base. We have developed the basic structure of the base using low cost materials and open source software packages. We used a 3D vision sensor for capturing the environment. Xtion Pro Live sensor by Asus was chosen for the purpose as it is light weight, small and can be powered through a USB cable. We selected Raspberry Pi computer as the processing unit of the base because of its light weight and low cost. Further, it functions efficiently in an indoor environment using wheels. It is Pentagon shaped, 35 cm long and 30 cm wide. It can carry up to 5 kg weight. We have tested the robot base in an unstructured indoor environment for goal completion using five locations. The accuracy of goal achievement of the robot is 92%. We have made a prototype of novel robot base with the intention of developing it to append a robotic arm. The system will be able to mimic the tasks in a storage area, having the ability to add, remove and re position the items in racks.
51	Title & authors: Standardizing Sinhala Code-Mixed Text using Dictionary based Approach. Archchana Kugathasan (University of Moratuwa); Sagara Sumathipala (University of Moratuwa) **Abstract:** Code-mixing is one of the biggest challenges when processing social media text. This paper presents a thorough review on the state of the art code-mixed text processing and identified the main challenges in processing Sinhala code-mixed text. In this study we could identify how researchers conducted different kinds of tasks such as normalization of codemixed data, word level language identification of the code-mixed text etc. The study lead to identify the challenges in Sinhala code-mixed text such as phonetic transliterations, borrowing of words, spelling errors, embedded languages, the use of numeric characters in words, discourse marker switching etc. Based on this challenges identified, it was necessary to standardize the Singlish text to Sinhala letters, since there are so many representations for the same word. So a dictionary is proposed where Sinhala letters are mapped to Singlish text which could be used as a standardization. Finally the paper discuss about the future work planed on using the proposed dictionary for Sinhala codemixed data analysis.
55	Title & authors: Ontology based Disease Prediction and Consultant Recommendation System. Mathangki Sundaram (University of Moratuwa); Pirinthika Amirthalingam (University of Moratuwa); Sabthavi Jatharthanathan (University of Moratuwa); Sagara Sumathipala (University of Moratuwa) **Abstract:** Since people today are very busy, they don't have time to take care of their health. Sometimes consulting a doctor is very time-consuming. People seek online solutions to avoid time wastage. But this is not advisable as these online predictors are considering only the general symptoms and no inter dependencies of symptoms are considered are to provide that prediction. This prediction mostly lack accuracy and misleading sometimes. Normally for a differential diagnosis other attributes such as age, family history, risk factors should be taken into consideration. And it will be easy for people if they could express their symptom in natural language than in medical terms. For this purpose, we propose a system where a user can interact with the chat bot in natural language through a series of questions and could predict the disease condition the user has, and the type of consultant user should consult.
20	Title & authors: Stepper Motor Wire Breaks Diagnose and Redundant Control System for Factory Automation. Amila NuvanPerera (Wayamba University of Sri Lanka); Chinthaka Premachandra (Shibaura Institute of Technology); Melaka Senadeera (Wayamba University of Sri Lanka) **Abstract:** This study introduces a reliable factoryautomation system to reduce the downtime of factories. This system is based on the feedback voltage monitoring method toidentify the fail wires of a stepper motor. This proposed systemdiagnoses the loose wires and malfunctioning devices in thefactory automation system and continues the process withsecondary networks and devices. As soon as fail devices or failwires were recovered, this system automatically continue withthe primary device. Then the secondary devices set to sleep mode. This process takes less than one second and the systemhelps to avoid unplanned production stoppages andbreakdowns. Therefore the system reduces factory downtime.Even though there are many breakdown diagnose systemsavailable in the market, novelty of our research is, proposing aloop feedback voltage monitoring system for the industry.Available systems use current flow sensing systems to identifybreakdowns. Our proposed system is comparatively faster andlower cost than the available systems. Also, our proposed systemcan be inbuilt in the stepper motor driver itself.
54	Title & authors: Water Level Modelling and Prediction of Floods, Evacuation Plan and Reservoir Inflow, Based on Deduru Oya Basin, Sri Lanka.

	Thiman Krishly (University of Moratuwa); Hasarangi Galagedara (University of Moratuwa); Shyamika Manthi (University of Moratuwa); Dilanka Tharindri (University of Moratuwa); Sagara Sumathipala (University of Moratuwa); B.H Sudantha (University of Moratuwa) **Abstract:** In water resources reservoir plays an important role as it functions for different purposes in different times such as providing effective water storage, water for hydropower generation, water for irrigation activities, mitigating the impacts of disastrous environmental effects, as well as meeting the water demand for the people in drought conditions. In order to minimize the impacts which are faced by the people in downstream areas and also for the safety and maintenance of the reservoir it requires fast and accurate prediction of decisions. These impacts are mainly caused due to the uncertain weather and climate conditions, other geographical characteristics and also due to the reservoir operations. So that implementing a system which consists of accurate modelling and prediction of water levels, floods existence and flood evacuation plan, and optimization of reservoir operations based on inflow prediction in order to minimize these impacts have been taken into consideration throughout the study. Since Artificial Neural Network (ANN) shows a significant improvement in the area of hydrological modelling in last decade, multilayer perceptron (MLP) method is applied to develop the flood model. Long Short-Term Memory (LSTM) models are developed for the modelling and prediction of water levels of downstream locations and also for the reservoir inflow prediction from the upstream basin based on the nonlinear time series analysis of hydrological data around the area.
89	**Title & authors:** Open Source IoT Framework for Environmental Sensing BH Sudantha (University of Moratuwa) **Abstract:** With the rapid development of technology and the competitive technology revolution, climate monitoring systems too have gained more advanced in vast functionalities. Thus, a large set of environmental real-time data can be generated from modern smart devices. Also, open weather monitoring systems too have been introduced in various parts in Sri Lanka to observe the weather data and analyze climatic conditions. These monitoring systems primarily measure climate data, rainfall, humidity, temperature and wind speed mainly. However, it has been observed that the climatic parameters deviate more from the original due to various reasons. Currently Sri Lanka does not have a proper well-connected weather observing network that routinely provide data with necessary quality and temporal density. As same as the weather monitoring systems developed by similar developing countries, systems already developed by Sri Lanka too are not real time. And also, they are not dense enough to monitor local conditions that can evolve rapidly. Major reasons for this situation include the limited budget, lack of technical infrastructure and associated expertise, rapid deterioration, lack of skilled maintenance, high-priced non-locally available spare parts etc. This project aims to develop open technologies based non-conventional environmental monitoring systems for deploying low cost, in Deduru Oya river basin area of Sri Lanka.

Day 2 : March 7, 2020 (8.00PM~9.30PM)

	Session 4: Image processing and IoT
	Chairs: Chinthaka Premachandra
Paper ID	Title, Authors and Abstract
52	**Title & authors:** A recommender system for job seekers to show up companies based on their psychometric preferences and Company sentiment scores. Amanulla Ashraff (Informatics Institute of Technology); Fathima Farhath (IIT) **Abstract:** Recent statistics show an increase in staff turnover which has negatively impacted the organization as well as the employee. The reasons being company culture, working flexibility (work from home opportunity), no learning advancements and pay scale. In this paper, we propose an approach to study the available review data on IT companies (score their reviews based on user review sentiments) and gather information on job seekers which includes their Psychometric evaluations. Then presents the job seeker with useful information or rather outputs on which company is most suitable for the job seeker. The theoretical approach and the importance of such system will be discussed in this paper.
57	**Title & authors:** Shoplister - A Grocery List Management Application. Abdulqader A.Q Firoz (Informatics Institute of Technology); Gayashini Ratnayaka (Informatics Institute of Technology) **Abstract:** Shopping for grocery is a very essential part of human lives activity performed regularly. However, it can be observed that people spend very little time to plan and manage their grocery lists as this task is often considered to be undervalued. People also tend to find grocery shopping complex and frustrating. The goal of this paper is to analyze the problems faced by people with creating and managing grocery lists and identifying the gap in current techniques used. It can be observed that human interaction with their smartphones is massive in this era, hence a mobile based solution which helps create and manage grocery lists can be very useful. A proposed solution prototype 'Shop-Lister' is then discussed along with implementation and design methodologies, which is a mobile based application that enables people to create grocery lists, manage (add/delete/cross items) lists, find nearby supermarkets available, recommend items to added to list along with brand suggestions and also helps locate items within a supermarket through the use of augmented reality. This type of solution will help improve people's lifestyle and reduce the level of complexity faced in grocery list management.
58	**Title & authors:** GoPlay - Sports Facility Reservation Application. Oshan S Mendis (Informatics Institute of Technology); Gayashini Ratnayaka (Informatics Institute of Technology) **Abstract:** Sri Lanka has many sports enthusiasts and sports venues which are being used daily. Most popular venues which are being used are cricket pitches/nets, football/futsal and badminton courts. There are many sports enthusiasts who are willing to play sports but unfortunately due to difficulties in making reservations, most of them are getting lazy. There are many problems which have been encountered such as checking availability, real time booking and cancellations, payment methods etc. The aim of this project is to provide an application to provide benefits for users and venue owners by having an automated reservation system and to overcome all the obstacles faced. The use of data mining to obtain recommendations of previous booking routines, nearby venues based on preference, business intelligence to obtain analytics of each user through graphs and augmented reality to show a graphical view of the venue are being used in this application. In addition, a points system is provided for users to obtain discounts or promotions. The application is being built through Flutter, Google API which will help to find venues in Colombo. Further expansions will be done in the future which will expand across the country.
62	**Title & authors:** Best Dish: A Digital Menu and Food Item Recommendation System for Restaurants in the Hotel Sector. Dinushika Gunawardena (Informatics Institute of Technology) **Abstract:** This paper highlights the number of contributing factors that make food decision making a difficult and timeconsuming task. The survey carried out confirms the difficulties identified through literature and establishes that the use of digital menus is a preferred alternative to restaurant's customers. A digital menu

	comprising of sufficient information regarding items will be introduced, which will allow customers to make well informed food decisions. Further, the deep learning technique, neural networks, will be implemented to build a food item recommendation engine that offers personalized recommendations that customers are likely to enjoy.
63	**Title & authors:** A Critical Analysis of Computer Aided Approaches for Skin Cancer Screening. Minoj Selvarasa (Informatics Institute of Technology)*; Achala Aponso (Informatics Institute of Technology) **Abstract:** T. Skin Cancer is life-threatening when diagnosed ata later stage. Early detection of skin cancers such as melanoma indicates a higher survival rate for the patient. Non-computer aided tools were used in the past such as the visual inspection using tools like the dermoscopy. Commercial tools were later introduced that allowed the examiners to examine the images obtained from the dermoscopy using techniques such as the ABCD rule and 7-point checklist. Deep Learning has proven to be the state-of-the-art for computer vision problems such as image classification. Researches are being carried out in the application of deep learning for skin cancer screening. This paper presents an analysis of the existing work carried out in the area of computerized approaches for skin cancer screening and the different steps carried out to build a skin cancer classification tool. The limitations of the various existing approaches are explored, and the results of the analysis will be used as part of an ongoing research to design and develop a robust system that will address the identified cons.
67	**Title & authors:** Technological Review on Integrating Image Processing, Augmented Reality and Speech Recognition for Enhancing Visual Representations. R.M Jayamanne (Informatics Institute of Technology); Dilan Shaminda (Informatics Institute of Technology) **Abstract:** There is still a lack of research focus on augmenting user engagement by AR-based applications. As technology has grown, the movie industry has been undergoing a remarkable change in the past few years. Visually attractive movie posters play a major role in advertising even in the era of digital promotion. This paper is a review of the use of technologies such as Image processing, Augmented Reality and Speech Recognition to interactively present movie information to users in a more convenient method.
77	**Title & authors:** Use of Image Processing to minimize ICU transfer delays in Sri Lanka. Gayalie Jayawardhane (Informatics Institute of Technology); Janice Abeykoon (Informatics Institute of Technology) **Abstract:** The delay encountered when transferring a critical patient from a hospital ward to an Intensive Care Unit (ICU) is one of the ongoing problems encountered in the Sri Lankan health sector. ICU transfer delays have a significant impact on a critical patient's condition as it often increases mortality. There are several factors that cause ICU transfer delays. This paper discusses ICU transfer delays, the problems associated with delays and the use of Image Processing to minimize delays. Additionally, a review of similar applications and identification of theories, tools and techniques relevant to the area of study has been assembled.

Day 2 : March 7, 2020 (9.30AM~10.15AM)

Keynote speak 2(Chair: Susara Thenuwara)

Prof. Yo-Ping Huang

Department of Electrical Engineering.
National Taipei University of Technology, Taipei, Taiwan.

Title: AIoT Systems and their Applications.

Abstract:

Through several waves of downhills and uphills in the past decades, Artificial Intelligence (AI) has now evolved into a must have new technology or tool in every domain. Furthermore, with the advent of powerful GPU, AI-related research or AI-based applications have sprouted in every corner of the world. Originated from pure internet connectivity the Internet of Things (IoT) has become a structure that can collect every piece of data from physical devices, daily activities, images or video into a data reservoir. As a result, tons of data are automatically generated into an enterprise database in a single day. This creates continuing demands on applying AI, IoT, and big data analytics to extract juicy contents from the huge databases. This talk will address from the AI and IoT, big data mining and system engineering perspective for systems developed to resolve the sensing, networking and applications faced in healthcare, defect image detection in manufacturing, and agriculture. Case study of AIOT in exercise monitoring and control using Kinect and Tensorflow, rehabilitation monitoring and tracking on joint rehabilitation monitoring after Total Knee Arthroplasty Reconstruction (TKA), Parkinson's Disease (PD) using sensor devices, ophthalmological images classification, AOI defect image detection and labelling, fruit, vegetable and fish growth monitoring will be demonstrated in the talk.

Tea Break : 10.15~10.30

Day 2 : March 7, 2020 (10.30AM~11.30AM)

Keynote speak 3(Chair: Waruna Premachandra)

Prof. Atsushi Inoue

Professor of Information Systems and Business Analytics, Eastern Washington University, USA
CTO & Global R&D Leader.
BaaSid Project, the Pas Pacific Venture in JP, KR, HK, TW, SG, AU & US.

Title:

Fuzzy Logic for Artificial Intelligence.
~Contributions and Advantages~

Abstract:

This talk addresses what and how Fuzzy Logic has contributed to the advancement of Artificial Intelligence, and why it is advantageous to be considered and indeed utilized. Such advantages are introduced within the fundamental framework of Artificial Intelligence consisting of logic and probability, and by showing how Fuzzy Sets and Logic may extend those and more (e.g. Neural Networks and Evolutionary Computing). Applications relevant to Image Processing and Robotics are introduced within this extended framework. Last but not the least, such a framework does indeed demonstrate the consistency between computing in numbers and human reasoning in languages -- so-called Computing with Words by Professor Lotfi A Zadeh.

Day 2 : March 7, 2020 (11.30PM~12.30PM)

	Session 5: Image Processing & Computer Vision Chairs: Norishige Fukushima and Surangani Bandara
Paper ID	Title, Authors and Abstract
10	**Title & authors:** Development of simulator for efficient aquaculture of Sillago japonica using reinforcement learning. Haruki Kuroki (Fukuyama University); Hiroshi Ikeoka (Fukuyama University); Koichi Isawa (Fukuyama University) **Abstract:** Recently, the situation in the Japanese fishing industry has become critical, resulting in one of the most significant food issues in Japan. Aquaculture technology is expected to be a solution to this problem. Sillago japonica is a fish that inhabits shallow waters in parts of Asia, and large Sillago japonica is very expensive. Therefore, we believe that aquaculture of this fish would help revitalize the fishing industry in Japan. However, aquaculture requires considerable manual labor. Hence, we need to introduce new technologies for the aquaculture of Sillago japonica. Specifically, we have been developing two systems to improve efficiency and

reduce costs of this aquaculture: an environment control system and an automatic feeding system. The former is to maintain favorable environment conditions for the fish in the aquaculture tank. The latter is for optimal feeding of the fish. In this paper, we describe the development of an automatic feeding system using artificial intelligence (AI). This system includes four processes: image input, image recognition, feeder control, and feeding action. We have adopted AI technologies to assist in the second and third processes. Although these two processes can be implemented together, it is easier for the AI to learn them as two separate processes. In particular, the second (image recognition) process uses supervised learning, and the third (feeder control) process uses reinforcement learning. However, it is impractical to train the AI in the third process in a real-world aquaculture environment that sustains many failures. Therefore, we have developed an aquaculture simulator to facilitate AI learning of the feeder control process. Additionally, we performed an experiment to validate our simulator using the number of feeders and the number of fish as a parameter.

11	**Title & authors:** Constant-Time Gaussian Filtering for Acceleration of Structure Similarity. Tomohiro Sasaki (Waseda University); Norishige Fukushima (Nagoya Institute of Technology); Yoshihiro Maeda (Tokyo University of Science); Kenjiro Sugimoto (Waseda University); Sei-ichiroKamata (Waseda University) **Abstract:** In this paper, we propose an acceleration method of structural similarity (SSIM) and its multi-scaled version called MS-SSIM.The calculation process of SSIM and MS-SSIM includes multiple Gaussian filters, and the cost of the filter is dominant for the entire process; thus, to accelerate SSIM, we replace the Gaussian filter using convolution with using sliding DCT.Gaussian filter based on sliding DCT is faster than the usual convolution method.Besides, its computational complexity does not depend on the filter window length.Also, naive implementations of SSIM and MS-SSIM scan image many times for the pixel-wise operation; however, these operations can be incorporated into Gaussian filters.Thus, we optimize the processing pipeline to achieve high cache efficiency.As a result, the proposed SSIM computation was accelerated by 6.36 times and MS-SSIM by 8.11 times.
34	**Title & authors:** Initial Performance Improvement for Fuzzy RANSAC Algorithm Based on Weighted Estimation Model. Toshihiko Watanabe (Osaka Electro-Communication University) **Abstract:** The computer vision involves many modeling problems with preventing noise caused by disturbance and sensing unit conditions. In order to improve computer vision system performance, a robust modeling technique must be developed for essential models in the system. The random sample consensus (RANSAC) and least median of squares (LMedS) algorithm have been widely applied in such issues. However, the performance deteriorates as the noise ratio increases and the modeling time for algorithms tends to increase in industrial applications. As an effective technique, we proposed a new fuzzy RANSAC method based on reinforcement learning concept for robust modeling. In this study, we proposed a new technique for the fuzzy RANSAC in order to improve learning performance in initial learning stage based on weighted modeling technique. Through modeling synthetic nonlinear data and camera homography experiments, the performance of the technique was evaluated. Their results found the proposed technique to be promising for improving modeling performance in initial learning stage.
49	**Title & authors:** Comparative Analysis of CNN Architectures for Image Classification. Waruna H.Premachandra (Wayamba University of Sri Lanka) Nuwan Chathuranga (Pearson Lanka(Pvt) Ltd.); Dharshana M Kasthurirathna (Sri Lanka Institute of Information Technology) **Abstract:** Picture acknowledgment and classification is a quickly developing area in Artificial Intelligence (AI) domain. Specially, object acknowledgment is a key component of picture classication, and the business ramifications of this are immense. Other than the traditional image classification approaches like Artificial Neural Network (ANN), Support Vector Machine (SVM), Convolution Neural Network (CNN), Histogram of Oriented Gradients (HOG), and Image Pixels (IP) for face recognition, there are considerable number of approaches with the helpof transfer learning for image classification also like AlexNet, DenseNet, GoogLeNet, ResNet, VGGNet, Xception and Inception. This paper presents different sorts of Articial Neural Network (ANN) approaches like Simple three-layered Convolutional Neural Network (CNN-3) to Deep Convolutional Neural Networks (DCNN) methodologies. At long last, presented the comparison ofpre-trained Deep Convolutional Neural Network(DCNN) VGG16 and utilizing ImageNet and CNN-3 models. The experimental results show that the MobileNet approach clearly outperformed the others approaches. Anaconda Navigator used as the software platform for this experiment. Keras(TensorFlow as backend)with CUDA GPU support,

	Jupiter Notebook, NumPy and sci-kit learn etc. are some of key development tools.
7	**Title & authors:** YOLO-6D+: Single Shot 6D Pose Estimation Using Privileged Silhouette Information. Jia Kang (University of Electronic Science and Technology of China); Wenjun Liu (University of Electronic Science and Technology of China); Wenzhe Tu (University of Electronic Science and Technology of China); Lu Yang (University of Electronic Science and Technology of China) **Abstract:** The task of estimating the 6D pose of the object from a single RGB image is important for augmented reality and robotic grasping applications. In this work, we introduce YOLO-6D+, a new end-to-end deep network for 6D object pose estimation. In particular, we propose a novel silhouette prediction branch that outputs the predicted segmentation mask in our network, which can force underlying features to learn the silhouette information of the object. Furthermore, we introduce edge restrain loss, a new loss function that focuses on constraining the 3D shape of an object. We use a two-stage method: we predict 2D keypoints firstly and then 6D pose is estimated using the PnP algorithm. On the public LINEMOD dataset, we demonstrate the proposed approach can outperform the state-of-the-art YOLO-based single shot pose estimation approach by 4.09% and 11.72% under the 2D projection metric and the ADD(-s) metric respectively.

Lunch : 12.30~ 13.30

Day 2 : March 7, 2020 (13.30PM~15.15PM)

Session 6: UAV, IoT and Learning Applications Chairs:Susantha Wijesinghe and Lafifa Jamal	
Paper ID	Title, Authors and Abstract
79	**Title & authors:** IoT Based Greenhouse System for Tropical Countries. BH Sudantha (University of Moratuwa) **Abstract:** With the degradation of the environment due to soil erosion and the mass developments and the mechanical revolutions, the Agriculture becomes a challenge with unfavorable environmental conditions. Therefore alternatives should be introduced and greenhouse is one of the best options. By combining IoT with greenhouse technology, the processes can be automated and increase the productivity and the efficiency. This will discuss on the green houses and the tropical environment conditions. Also discussion on other researches that were carried out in the past also mentioned and evaluated according to the current perspective. A new proposal is also discussed by looking at the advantages and disadvantages that were found out. This also point out the further work that could be carried out to improve the given model.
84	**Title & authors:** Sensory Evaluation of Foods using Modern AI Techniques and Brain Wave Analysis. BH Sudantha (University of Moratuwa) **Abstract:** Sensory Evaluation of foods is one majoractivity done in almost all the food manufacturingindustries in the world. They perform sensoryanalysis, in order to determine the product'ssuitability for consumption, which is done by either atrained or untrained panelist. The decision is madefrom their final result made either verbally orwritten. There is a high possibility of getting theresult miss-interpreted. During the taste perception,brain emits brain waves specified to each tasteintensity. By analyzing those sensitive waves, it ispossible to compare the results of the panelists, theactual feeling of the test subject. This mitigates the risk of miss-nterpretation. From this method, anumerical value for the like or dislike can be obtained.
56	**Title & authors:** Customer Churn Reasoning in Telecommunication Domain. Stehani Sathiyanandan (University of Moratuwa); Karunya Navanesan (University of Moratuwa); Rebekah Ranjan (University of Moratuwa); Sagara Sumathipala (University of Moratuwa); T.C. Sandanayake (UOM) **Abstract:** Today every industry tries their best to satisfy and maintain their existing customers or clients and attract new customers to their network. Similarly, telecommunication companies also working hard to increase their customer retention within the organization. However due to increasing demand customers try to switch the network connections frequently. Therefore, it is important to recognize whether the customer satisfies with the existing mobile connection or the possibility to change in future. This research analyses the churn customer

	details and predict the probability to churn in future using modern machine learning techniques. It is also important to identify the reasons to the churn in order to take actions to retention of the customer. Reasons for the churn were analyzed using the decision path of the Random Forest machine learning algorithm.
12	**Title & authors:** Eagle Eye for ER Doctor: Basic Study of Drone based Tele Monitoring System for an Inaccessible Area. Yashodha C Karunarathna (Mie University); Hiroharu Kawanaka (Mie University); Chinthaka Premachandra (Shibaura Institute of Technology); Shinji Tsuruoka (Mie University) **Abstract:** Telemonitoring is one of the emerging fields, wherethe healthcare professionals meet the client via the web-basedsystem, communication and information provided via personaldigital assistant such as smartphones personal computers. Clientsin inaccessible areas are currently able to access their healthcare suppliers through real-time monitoring, conferencing andalternative varieties of technology. This approach is applicableto the emergency situation to establish communication betweenthe patient who is in an isolated area and rescue team with thesupport of drone technology. Therefore, in this study, we are goingto present a basic study of design a drone-based telemonitoringthe system as a solution of the patient who is in an unreachablearea. Furthermore, from the system, we are able to identify thean alive person with their thermal image and established smoothcommunication in the environment which was unable to establishcommunication protocol like Wi-Fi, GPS, etc.
24	**Title & authors:** Effect of Innovation and Security of E-Services on Automated Self Service Banking Technology Adoption in the Context of Sri Lankan Commercial Banks. D A Gayan Nayanajith (University of Kelaniya) **Abstract:** Nowadays tech savvy banks offer automated self-service banking facilities empowering customers to conveniently attend to numerous financial services expeditiously. This research analyses the effect of innovation and security of e-services towards adoption of self-service banking in Sri Lankan commercial banking context. Sample was drawn from Kelaniya University students those who are using self-service banking services. Data analysis was performed using 287 questionnaires by using hierarchical linear model. TAM has been extended using the innovation and security of e-services variables. Empirical evidence supported the significance of security of e-services, innovation and interaction effect (innovation and motive towards innovation) aspects on adoption of automated self-service banking. Time restrictions and constrained sample were limitations of the study. Nonetheless, findings are beneficial for banks, banking technology developers and other related stakeholders, the same. Originality of the research is that the application of particular hierarchical linear model and combination of TAM and DOI models, given the specific research context. Future researches could be performed in search of diverse findings in different country contexts by incorporating diverse models and perspectives.
90	**Title & authors:** Open technologies based hydrological model for reservoir management BH Sudantha (University of Moratuwa) **Abstract:** Inclusion of hydrological modelling approaches for making water release decisions is not practiced among water practitioners of Sri Lanka due to inadequacy of quality data, high purchasing cost of modelling software and lack of expertise knowledge on handling modelling tools. During the rainy periods, they face difficulties in taking timely decisions on deciding the magnitude of inflows to the reservoirs, for the safe disposal of excess flow. Currently, the water from the reservoir is released once it reaches to a particular threshold. This creates floods in the lower basin due to the massive water flow released from the reservoirs. Therefore, for a low-income country, a total open source framework amalgamated with low cost open source hardware and free open source software, standards and data, was seen as the only possible mean to overcome the flood risk associated with reservoirs. Hence, the aim of this study is to demonstrate the capability of such a system in simulating the inflows to the reservoir, triggered during the rainfall events. The calibration and validation results of the model have discovered the capability of the open source technologies-based system in decision making pertaining to water resources management. As the model operates as a semi-distributed continuous model at hourly time-step, it doesn't demand massive amount of data and not required to apply initial discharge at every occasion that the model runs.
	Tea Break : 15.15~15.30

Day 2 : March 7, 2020 (15.30PM~17.00PM)

	Session 7:Wheel Robotics and Learning Applications Chairs:Genci Capi and Sagara Sumathipala
Paper ID	Title, Authors and Abstract
17	**Title & authors:**Intelligent Agent to Negotiate on Goal Oriented Conversations. Yomal De Silva (University of Sri Jayewardenepura) **Abstract:** In this study we propose a model to develop intelligent agents which are capable of negotiating on goal orientedconversations. These agents have the ability to learn negotiationusing past experience and form strategies such as persuasionto negotiate successfully. In order to train these agents, theywere made to interact with Simulated Users (SU). A corpus wasgenerated and then annotated with speech acts to be used by an-gram model. The SUs use this model to generate responses. Inthis study, we focused on single issue negotiations. A MarkovDecision Process (MDP) was used to model the problem bydefining the states and actions. The agent was made to interactwith the SU to learn an optimal policy. For this we used theSARSA algorithm which is a temporal difference (TD) method.Once the agent is trained it was evaluated by a set of SUs builton different cultural norms. The number of dialogue turns andthe policy score obtained when negotiating with these SUs wererecorded and evaluated. It was observed that the agent was ableto successfully negotiate to make a deal and also persuade themto a profitable offer. It can be concluded that the proposed modelis successful and it can be used to train intelligent agents whichcan negotiate.
19	**Title & authors:** An Adaptive Structural Learning of Deep Belief Network for Image-based Crack Detection in Concrete Structures Using SDNET2018. Shin Kamada (Prefectural University of Hiroshima); Takumi Ichimura (Faculty of Management and Information Systems, Prefectural University of Hiroshima, Japan); Takashi Iwasaki (Mitsui Consultants Co. Ltd.) **Abstract:** We have developed an adaptive structural Deep Belief Network (Adaptive DBN) that finds an optimal network structure in a self-organizing manner during learning. The Adaptive DBN is the hierarchical architecture where each layer employs Adaptive Restricted Boltzmann Machine (Adaptive RBM). The Adaptive RBM can find the appropriate number of hidden neurons during learning. The proposed method was applied to a concrete image benchmark data set SDNET2018 for crack detection. The dataset contains about 56,000 crack images for three types of concrete structures: bridge decks, walls, and paved roads. The fine-tuning method of the Adaptive DBN can show 99.7%, 99.7%, and 99.4% classification accuracy for three types of structures. However, we found the database included some wrong annotated data which cannot be judged from images by human experts. This paper discusses consideration that purses the major factor for the wrong cases and the removal of the adversarial examples from the dataset.
5	**Title & authors:** Neural Network based 3D Mapping Using Depth Image Camera. Dung Duc Tran (Hosei University); GenciCapi (Hosei University) **Abstract:** Mapping is a crucial task for robot navigation. Especially, in order to develop a fully autonomous robot that can interact well with human, the map is not only required to contain geometry but also the semantic contents. Building a detailed map of the environment, makes it easy for the robot complete its mission. In this paper, we propose a method for environment 3D map building using the depth image camera. A Feed-Forward neural network is trained to convert the depth image into real-world coordination. The results show good performance of the proposed algorithm.
41	**Title & authors:** SLAM-Based Autonomous Indoor Navigation System For Electric Wheelchairs. Tharindu Lakmal Ihalage (Wayamba university of srilanka); Amila Nuvan Perera (Wayamba University of Sri Lanka); H. A. Harindu Y. Sarathchandra (Wayamba University of Sri Lanka); Chinthaka Premachandra (Shibaura Institute of Technology) **Abstract:** Commercial electric wheelchars have become cheaper due to the development of related technologies and equipment in recent years. Most of them need the user to control directions using joysticks or handles in order to navigate in indoor environments. This paper presents the development of an indoor autonomous navigation system for electric wheelchars. The developed system uses 2d lidar to scan obstacles, walls around it and then create a map of its surrounding and localize itself in the map while moving

	autonomously in indoor environments without inputs from a user. The system is integrated using hardware which is safe for humans and uses open-source software which permits easy and safe integration with an existing electric wheelchair.
66	**Title & authors:** Technological Analysis of ECG Classification based on Machine Learning and Deep Learning Techniques. BH NisalSudila (IIT); Guhanathan Poravi (Informatics Institute of Technology) **Abstract:** The analysis and processing of the Electrocardiogram (ECG) reveals key information about the condition of the heart. The detection of the QRS wave segment in the ECG signal is crucial as it is the start of extracting relevant features for the classification of heart arrhythmia. This paper presents algorithms for each block in the typical structure of an ECG classification system with the recent researches, advantages and limitations of the presented algorithms. Some including adaptive filter, wavelet Transform ANN, GWO (Grey Wolf Optimization), deep residual Convolutional Neural Networks (DRCNN), SVM.
64	**Title & authors:** Review On Approaches for Theme Extraction and Sentence Ordering For Prioritization Of Journalistic Notes. Devon C.N Wijesinghe (Informatics Institute of Technology); Kaneeka Vidanage (Informatics Institute of Technology) **Abstract:** In the stages of pre-writing and writing of a news article, journalists require to process the gathered data to identify important points and events which will predominantly support the main theme of the news story. In relation to the field of computer science, there is a lack of intelligent systems to help organize unstructured journalist data and optimize the news data pre-processing stage. There are existing research projects in the area of natural language processing which are focusing on text ordering and main theme identification of textual documents. However, there is no system, which is fine-tuned for the journalism domain, that can utilize the main theme of an unstructured textual document (journalistic notes) to semantically organize and prioritize text.
Award Ceremony : 17.00~17.30	
By Award chairs	
Final remarks	
Conference Dinner: 18.30~ (Place will be noticed at the conference)	