International Conference on Advanced Research in Computing

ICARC 2021

"Towards a Digitally Empowered Society"

ABSTRACTS

OF THE PROCEEDINGS OF ICARC 2021

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Faculty of Applied Sciences
Sabaragamuwa University of Sri Lanka

ICARC - 2021

"Towards a Digitally Empowered Society"

International Conference on Advanced Research in Computing

23RD & 24TH February 2021

Faculty of Applied Sciences, Sabaragamuwa University of Sri Lanka,
Belihuloya, Sri Lanka

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Message from Vice Chancellor

As the Vice Chancellor of Sabaragamuwa University of Sri Lanka, it gives me a great pleasure to convey this message for the book of abstracts of 1st International Conference on Advanced Research in Computing - ICARC 2021. On this occasion, I would like to extend my warmest welcome to all the delegates and participants to our university, on behalf of Sabaragamuwa University of Sri Lanka.

ICARC 2021 is organized on the timely theme, "Towards a Digitally Empowered Society", which reflects our passion and commitment to promote the exchange of state-of-art scientific knowledge in a wide array of disciplines within the purview of our teaching and research. We truly believe that this conference takes an in-depth look at many issues raised by the electronic technology today, the obstacles and opportunities created by the new products, services and applications. This conference is a step towards achieving our vision in becoming a world-class academic and research institution in order to produce human capital with the first class mentality.

Meanwhile Sabaragamuwa University is also marching towards the concept of a "Smart University" which is an emerging and fast evolving area that represents the creative integration of innovative concepts, smart software and hardware systems, Smart Classrooms with state-of-the-art technologies and technical platforms, Smart Pedagogy based on modern teaching and learning strategies, Smart Learning Analytics and academic analytics, and various branches of computer science and computer engineering. Therefore, ICARC 2021 will be a good starting point for Sabaragamuwa University of Sri Lanka and international universities to interchange knowledge and skills. We are looking forward to finding new solutions in this area and forecast future trends in order to realize Sri Lanka's aspiration and to contribute to global needs.

I would like to congratulate the Department of Computing and Information Systems of Sabaragamuwa University of Sri Lanka for their commitment and superb drive in organizing this conference. I am very certain that this occasion will be able to provide a platform towards strengthening our relationships in sharing knowledge while at the same time to provide the necessary thrust in joint research collaborations and product commercialization within the research society. It is my aspiration that this conference will be a foundation for the growth of new ideas towards a better tomorrow.

Last but not least, I would also like to thank all those who have contributed to ICARC 2021 with their research findings, all session chairs and our sponsors for their continued support and interest on us, I am sure that the quest of making Sabaragamuwa University of Sri Lanka a top class university is not going to be impossible to achieve.

Professor R.M.U.S.K. Rathnayaka
Vice Chancellor
Sabaragamuwa University of Sri Lanka

Message from Dean

The concept of empowerment first emerged in the 17th Century which had multiple meanings and one is 'to enable'. Information Technology plays a massive role in 'enabling' of multi-disciplinary fields. "Towards a Digitally Empowered Society", the first International Conference on Advanced Research in Computing (ICARC) will bring up recent innovations, trends, challenges and solutions in their digital journey to enable or empower the society 'to do things better'. Especially, in the field of education, technology-enhanced science education provides a holistic approach where these digital tools are utilized to improve the knowledge acquisition and retention in the learning process. Moreover, and most importantly the field of computing and information technology simply enables 'networking' the society which is one of the most vital things today.

I am delighted today to deliver this speech as the Dean of the Faculty of Applied Sciences, inaugurating the first International Conference of the Faculty, which is a limitless effort of few wonderful individuals. Let me offer my appreciation to the organizing committee of the conference, all staff of the Department of Computing and Information Systems; lead by Prof. Vasanthapriyan, the Head of the Department and Dr. Piumi Isanka, the conference chair. I am well aware that you all worked 'an extra mile' to make this happen today.

At the same time let me convey my gratitude to our key note speakers Prof. Meikang Qiu, Prof. C. Premachandra and special technical speaker Mrs. Dilrukshi Gamage for glamourizing this occasion with their presence and enlightening us with their knowledge sharing.

I believe that these two days of ICARC conference will contribute well to knowledge and application platforms in the related field, provide insights into the directions of empowerment in diverse fields, while offering 'know how' to the researchers in other fields to enable their research integrating computing and IT.

I wish you all successful two days with this research dialogue, congratulate the organizers for this intellectually glamourous event and wish ICARC will sustain successfully and achieve more in the years to come.

Dr. Rasangi Sabaragamuwa
Dean
Faculty of Applied Sciences
Sabaragamuwa University of Sri Lanka

Message from Head of the Department

I'm delighted to open the 1st International Conference on Advanced Research in Computing (ICARC) of Department of Computing Information Systems of Sabaragamuwa University of Sri Lanka. On behalf of Organizing and Steering Committees, it is my great pleasure and privilege to welcome you to this virtual online conference. Covid-19 disease presented a problem for almost all businesses and activities our civilization relies on. It is not different with the ICARC, but we are very proud that our 1st ICARC takes place even in these circumstances.

In this International Conference, our theme is "Towards a Digitally Empowered Society". In connection with the theme, we present several speakers as the main speakers who deliver material related to the main theme of this conference. Members of the Organizing Committee have been working very hard. I will like to thank them for their dedication, time and efforts.

I do hope through this conference we can share information about various strategies in order to improve the ability of researchers in research field and to implementation of the research results. In addition, through this conference should expect to create innovation and meet the demands of the development of science, technology and social culture, especially in computer field.

I feel that this is an exceptionally high quality technical event, but you must judge that for yourselves. I am certain that you will have an exciting, stimulating, thought provoking and productive conference and enjoy not only the technical programs but also the tremendous ambience of the Sabaragamuwa University, which just completed its twenty years of service to the nation.

Professor S. Vasanthapriyan
Head/ Department of Computing Information Systems
Sabaragamuwa University of Sri Lanka

Message from General Chair

It is my great pleasure to welcome all of you to the 1st International Conference on Advanced Research in Computing (ICARC 2021). The main objective of the conference is to provide a premier interdisciplinary platform for researchers, practitioners, and educators to present and discuss the most recent innovations, trends, and concerns, as well as practical challenges encountered and solutions adopted in the field of Computing.

Recent advancements in Computing lead to emerge of novel computer and information technologies in many research fields such as Embedded Computing, Smart and Intelligent Computing, Ubiquitous Computing, Convergence Computing, and Human Computing, etc. The ICARC 2021 opens seven tracks for researchers to provide a valuable forum to present their innovations. The theme of the ICARC 2021, 'Towards a Digitally Empowered Society' entrusts a dialogue for multi-disciplinary researches by applying emerging computing techniques in different research fields. ICARC 2021 remarks as the first conference of the Faculty of Applied Sciences and as the organizing committee, we believe this will contribute significantly to the field of Computing.

ICARC 2021 programme includes two keynote speeches, two workshops, and seven technical sessions run in four parallel tracks. I must thank the keynote speakers of the conference, Prof. Meikang Qiu, Department of Computer Science and Information Systems, Texas AM University, Commerce, USA, and Associate Prof. C. Premachandra, Department of Electronic Engineering, Shibaura Institute of Technology, Japan. Also, I would like to thank all the plenary speakers for the valuable effort in making ICARC 2021 a success.

None of this would have happened without the earnest efforts of the organizers behind the scenes. I appreciate the untiring efforts of all the staff members of the Department of Computing and Information Systems to organize ICARC 2021.

I would like to highlight the extended support by the Head, Department of Computing and Information Systems Prof. S. Vasanthapriyan, by leading the team to launch ICARC from 2021. Furthermore, I would like to acknowledge the support and encouragement from the Vice-Chancellor Prof. R.M.U.S.K. Rathnayaka and Dean of the Faculty of Applied Sciences of Sabaragamuwa University of Sri Lanka, Dr. R.S. Sabaragamuwa. Finally, I would like to thank all the authors who submitted papers to ICARC 2021.

Last but not least, we thank all our patrons and sponsors for their generous support.

Dr. U.A. Piumi Ishanka
Chair - ICARC 2021

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Outline of Keynote Speech - 1

AI Enhanced Cyber Security

Prof. Meikang Qiu
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Chair of IEEE Smart Computing Special Technical Community
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Bio: Meikang Qiu received the BE and ME degrees from Shanghai Jiao Tong University and received Ph.D. degree of Computer Science from University of Texas at Dallas. Currently, He is the Department Head and tenured full professor of Texas AM University Commerce. He is an ACM Distinguished Member and IEEE Senior member. He is the Chair of IEEE Smart Computing Technical Committee. His research interests include Cyber Security, Big Data Analysis, Cloud Computing, Smarting Computing, Intelligent Data, Embedded systems, etc. A lot of novel results have been produced and most of them have already been reported to research community through high-quality journal and conference papers. He has published 20+ books, 600+ peer-reviewed journal and conference papers (including 300+ journal articles, 300+ conference papers, 100+ IEEE/ACM Transactions papers). His paper on Tele-health system has won IEEE System Journal 2018 Best Paper Award. His paper about data allocation for hybrid memory has been published in IEEE Transactions on Computers has been selected as IEEE TCSC 2016 Best Journal Paper and hot paper (1 in 1000 papers by Web of Science) in 2017. His paper published in IEEE Transactions on Computers about privacy protection for smart phones has been selected as a Highly Cited Paper in 2017-2020. He also won ACM Transactions on Design Automation of Electrical Systems (TODAES) 2011 Best Paper Award. He has won another 10+ Conference Best Paper Awards in recent years. Currently he is an associate editor of 10+ international journals, including IEEE Transactions on Computers and IEEE Transactions on Cloud Computing. He has served as leading guest editor for IEEE Transactions on Dependable and Secure Computing (TDSC), special issue on Social Network Security. He is the General Chair/Program Chair of a dozen of IEEE/ACM international conferences, such as IEEE TrustCom, IEEE BigDataSecurity, IEEE CSCloud, and IEEE HPCC. He has won Navy Summer Faculty Award in 2012 and Air Force Summer Faculty Award in 2009. His research is supported by US government such as NSF, NSA, Air Force, Navy and companies such as GE, Nokia, TCL, and Cavium.

Abstract: This talk will first illustrate how to use AI techniques to enhance cyber security of various systems. There are several ways to apply AI to cyber security area. This talk will use prediction-based AI technics to enhance the total security of the V2X (Vehicle-to-Everything) communication system. The talk takes serious considerations of latency while implementation the data encryption for V2X communication systems. Furthermore, the talk will discuss about deep reinforcement learning to protect the security of V2X system without scarifying safety of the vehicles. Examples and experimental results will be given to show the detailed techniques on applying AI techniques to enhance cyber security of vehicles, with the potential of implementing them to various cyber-physical systems.

Outline of Keynote Speech - 2

Computing Approaches for Improving Omnidirectional Image Generation and Capturing

Prof. Chinthaka Premachandra
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Bio: Chinthaka Premachandra was born in Sri Lanka. He received his B.Sc. and M.Sc. degrees from Mie University, Tsu, Japan in 2006 and 2008 respectively, and his Ph.D degree from the Nagoya University, Nagoya, Japan, in 2011. From 2012 to 2015, Dr. Chinthaka Premachandra was an assistant professor in the Department of Electrical Engineering, Faculty of Engineering, Tokyo University of Science, Tokyo, Japan. From 2016 to 2017, he was an assistant in the Department of Electronic Engineering, School of Engineering, Shibaura Institute of Technology, Tokyo, Japan. In 2018, he was promoted to Associate Professor in the Department of Electronic Engineering, Graduate School of Engineering, Shibaura Institute of Technology. In addition, he is the manager of Image Processing and Robotic Lab at the same department. His research interests are Image Processing and Robotics. Former research includes computer vision, pattern recognition, speed up image processing, and camera based Intelligent Transportation Systems, while latter fields include terrestrial robotic systems, flying robotic systems, and integration of terrestrial robot and flying robot. Dr. Chinthaka Premachandra is author/co-author of more than 120 publications, including books, papers published in journals, magazines and conference proceedings. He received the FIT Best Paper Award and FIT Young Researchers Award from IEICE IPSJ, Japan in 2009 and 2010 respectively. He has served many international conferences and journals as a steering committee member and an editor respectively. Dr. Chinthaka Premachandra is the founding chair of International Conference on Image Processing and Robotics (ICIPRoB).

Abstract: Applications for omnidirectional cameras are increasing, because they allow one-shot capture of panoramic images. In an one-shot captured image, there are two circular images, each simultaneously captured by one of the two fisheye lenses on either side of the camera. Due to the panoramic capturing ability, there are many potential applications for omnidirectional cameras, including, drive recorders, surveillance cameras, marine photography, and aerial photography when mounted on a drone. However, omnidirectional camera images generally have lower resolution than available cameras, leading to difficulty in identifying objects farther from the camera. On the other hand, omnidirectional cameras have a fisheye lens on either side, so when mounting them on robots, drones, or automobiles, they must be mounted so that the fields of view of the fisheye lenses will not be obstructed. This keynote focuses on computing based solutions to above mentioned weaknesses of omnidirectional cameras. They include development of a camera platform that can capture regions where recognition is difficult due to the low resolution issue and generation of panoramic images by two hemispherical cameras independent of installation location to reduce the obstruction in image capturing.

Outline of Special Technical Speech

Workforce STEM Pipeline Needs to Re-imaging: Improving Access and Participation of Women in STEM

Mrs. Dilrukshi Gamage
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Despite the demands in the global workforce, women's labor force participation is significantly disproportionate in many countries and Sri Lanka is forecasting a lower rate. However, Sri Lanka is a fore-runner in many human developments, healthcare, education, and gender equality among the South Asian countries, yet the contribution from the female workforce to the economy is at a persistently low rate around 30-35% of working-age women during 2011-2020. This is a significantly lower rate given the fact that higher educational attainment of the female population in Sri Lanka. It is an alarming indicator for the female STEM workforce where the technology industry has far more work to do to attract women to STEM careers.
The world bank report hypothesized three major reasons for the Workforce gap: (1) household roles and responsibilities, which fall disproportionately on women, and the associated socio-physical constraints on women's mobility; (2) a human capital mismatch, whereby women are not acquiring the proper skills demanded by job markets; and (3) gender discrimination in job search, hiring, and promotion processes. The solutions to the key question "How do we re-imagine and build a pipeline of female talent in technology?" need much careful exploration. This presentation will share some of the suggested solutions and initiatives taken in the local context to reduce the gap of the female STEM workforce in the industry.

Outline of Plenary Speech - Human-Computer Interaction Track

Navigating through Human-Computer Interaction Curriculum and Research Trends

Mrs. Dilrukshi Gamage
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Human-Computer Interaction (HCI) is an interdisciplinary field of research and practice that focuses on both the interaction between computers and users (human) and the design of interfaces that enable the interaction between them to be more effective. Learning HCI as a field has been challenging in comparison to traditional areas in computer science. Mainly, due to the rapid changes in technology, and thus, changes in user populations and their needs, it is evident that many researchers have identified the dynamic nature of HCI discipline. HCI education is required to provide foundational knowledge on HCI methods and practices thus igniting interdisciplinary interest for researchers to work on multiple research areas. Navigating through the HCI education landscape, it is evident that many institutions in Global North are working through a living curriculum for HCI. This presentation is framed to provide an overview of HCI pedagogical landscape and elaborate on the latest HCI research themes. It will help the participants to navigate their research interests and incorporate such interests applicable to the wider HCI domains and conjunction with a variety of interdisciplinary research.

Outline of Plenary Speech - Software Engineering Track

Continuous Software Engineering for AI Powered Cyber Physical Systems

Dr. Sidath R. Liyanage
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Development and evolution of modern cyber-physical systems (CPS) that incorporate various types of Artificial Intelligence (AI) and Machine Learning (ML) algorithms are a challenging due to the versatility of architectures and cascading effects subtle changes in the IOT, AI and ML configurations. A cyber-physical system (CPS) is a system of collaborating computational elements controlling physical entities. CPS are physical and engineered systems whose operations are monitored, coordinated, controlled and integrated by a computing and communication core. They allow us to add capabilities to physical systems by merging computing and communication with physical processes. CPS with AI-components such as distributed heuristics employing Multi Agent Systems (MAS) or ANNs have become popular in the domain of CPS. Verification of these software using the established software engineering practices are risky. Continuous Software Engineering (CSE) addresses the need for continuous software planning, building, operation and evaluation, which is vital for systems that have components such as AI,ML, and IOT found in CPS. CSE aims to establish a continuous flow between software-related activities, taking into consideration the entire software life cycle. It is a recent topic that seeks to transform discrete development practices into more iterative, flexible and continuous alternatives, keeping the goal of building and delivering quality products according to established time and costs. In this session I present the current state of the art in CSE pertaining to the development of modern software such as CPS with AI and ML components and the recommended best practices.

Outline of Plenary Speech - Data Science and Applications Track

Improving the Performance of Sinhala to English Translation Using Neural Machine Translation Approach

Dr. Sagara Sumathipala
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Machine Translation is an automatic translation from one natural language to another. Automatic Translation of local languages in Sri Lanka to other languages is challenging due to many reasons. Sri Lanka's culture mixes many cultures with modern and traditional aspects and is known for its regional diversity. Sri Lanka has three official languages, and most of the informal conversations are happening in a mix of these languages. Majority of Sri Lankans do code mixing in informal contexts or casual conversations like in social media, online chats/ reviews or personnel communications. This type of noisy text carries a higher level of spelling and grammar mistakes, improper language use (e.g.:'good job putha'), wordplay ('helloooo' for 'hello'), creative spelling ('Gud 9t' for 'good night'), abbreviations ('TC' for 'Take Care'), Meta tags (URLs), and so on. Most language processing models in today's world are monolingual, which shows poor performances in these multilingual platforms. Besides, there is a minimal number of resources to train local language models, including Sinhala and Tamil. These challenges badly affect the performance of the Machine Translation approaches focused on Sinhala to other language translations. This research is focused on improving the performance of Singlish to English translation systems used in Sinhala – English Code-Mixed Text. The research proposes a seq2seq Neural Machine Translation based on the attention mechanism. The proposed approach achieved 24.13 BLEU score on Singlish-English.

Outline of Plenary Speech - Knowledge Management and Information Systems Track

Science of Ontological Designs for Information System Engineering

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Ontological analysis Designing of Information Systems (IS) and their operational eco-system could result in precise and complete awareness of the spectrum of "artefacts" of interests with utmost importance. However, such sound Ontological foundations in Information Systems Engineering processes are yet to receive adequate attention both in IS literature as well as in relevant professional/industrial IS sectors. This necessity could be framed into two perspectives; 1) having its root to ontological basis and 2) methodological adoption for IS developments. Such a framework could be adopted as a structural approach to the IS engineering paradigm which combines the philosophical foundations ranging from ontological and epistemological levels to the concrete methodological choices in designing artefacts of concerned IS eco-systems.In this plenary session, discussions are centered around establishment of ontological analysis for IS and emerging methodologies for design and development of artefacts to eco-system of IS solutions.

Outline of Plenary Speech - Open Track

The Significance of Multidisciplinary Studies on the Path Towards a Digitally Empowered Society

Dr. Pradeep Kalansooriya
General Sir John Kotelawala Defence University, Sri Lanka
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The intelligent and smart man is always looking for ways to ease up his arduous tasks. From the Stone Age, humans have been a unique group of animals in appreciating taste and smell. Further, humans were ahead of other animals in mathematics and logic, but it was insufficient to cope with the expected rapid progress in lifestyle. Hence, the man was always looking to find effective solutions to solve complex problems.The rapid advancements of the computer have paved the way for creating interactive computer-based solutions in many different fields, which is therefore, the approach has become multidisciplinary. This spans from tiny scale macroscopic computing to large-scale computing solutions. Besides, the increasing complexity of global problems urges the need for new fast methods of problem-solving competencies. Further, the complexity of deep problems requires new problem-solving skills. Therefore, an extensive study is essential in providing computer-based solutions to various fields such as management, medicine, engineering, law, astrology, social sciences, aesthetics, culture, etc...No matter how advanced the computer technology is, it is vital to recognize the limitations of providing practical computing solutions. For example, if a graphic system cannot update the display faster than ten times per second, the animation's illusion will begin to crash. Recognizing such limitations and exploring new research opportunities will inspire the multidisciplinary studies in the journey to a digitally empowered society.

Outline of Plenary Speech - Parallel and Distributed Computing Track

Parallel and Distributed Computing for Cloud Computing

Dr. Windhya Rankothge
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Parallel and distributed computing gained the attention of technological world, as a solution for solving complex problems by first using multiple processing elements and then multiple computing nodes in a network. The transition from sequential to parallel and distributed processing offers high performances and reliability for applications. Cloud computing leverages these models, abstractions, and technologies and provides a more efficient way to design and use distributed cloud systems by making entire systems or components available on demand. However, there are several new challenges to be addressed, in terms of hardware architectures, technologies for inter-process communication, and algorithms and system design. In this talk, I will discuss how parallel and distributed computing is being used with cloud computing, its challenges, and possible research directions.

Data Science and Applications Track

Loan Data Analysis Using Data Warehouse Techniques

Maduka Ashan Perera, Chathura Madhuranga Boralugoda and P.P.G. Dinesh Asanka
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Most of the financial institutions are running their operations smoothly and in a profitable way without any interruptions with the help of data analytical techniques. This study will be able to enhance the business's ability to expand its market by providing meaningful and key analysis of consumer behavior. Financial institutions should have proper parameters to identify the right customer base with the capacity of their repayments. To identify those parameters, BI technologies and the data warehouse techniques such as inspecting, cleansing, transforming, and modeling was used to convert data to meaningful information. The star schema is used for this data warehouse design, which includes one fact table surrounded by several dimensions. This study mainly focused to identify the borrower's response to the calls taken by call center agents on a time basis per day. As a result, it was identified that several parameters such as age groups and gender-wise response times are different. Those factors will be evaluated by using a decision tree in future work. This will increase the loan collection efficiency.

Keywords: *Loan Repayment, Loan Arrears, Response Times, Decision Tree, Data Warehouse*

A Data Mining Approach to Identify Associations Between Job Titles and Skills in Job Vacancies

Sadeepa Kuruppu and Kalpana Galappaththi
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At present, job vacancies apper in online job vacancy repositories. They are available in the form of images or in the form of Portable Digital Format Documents. Text information is embedded in them. By mining that text information, current dynamics of the job market can be identified. As the Information Technology industry is dynamic, it is worth understanding what associations exist between job titles and technologies that frequently appear together, when applying for a job. For this purpose two algorithms can be used. They are Apriori algorithm and Frequent Pattern Growth algorithm. Among these two algorithms, this study emphasizes the importance of using Frequent Pattern Growth algorithm because it has eliminated the issue of performing so many scans in the database, which lead the Apriori algorithm less efficient. The Frequent Pattern Growth algorithm used to mine the association rules which exist between the job titles and technologies required for them. The aim of the study is to mine how technologies appear associated with each other in job vacancies. Job seekers can be made aware of what technologies are having association trends in the job market and that would be helpful to reduce the gap existing between skills of job seekers and the industrial demands.

Keywords: *Data mining, Association Rule Mining, Apriori, FP Growth*

Voice-Assisted Real-Time Traffic Sign Recognition System Using Convolutional Neural Network

Mayura Manawadu and Udaya Wijenayake
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Traffic signs are important in communicating information to drivers. Thus, comprehension of traffic signs is essential for road safety and ignorance may result in road accidents. Traffic sign detection has been a research spotlight over the past few decades. Real-time and accurate detections are the preliminaries of robust traffic sign detection system which is yet to be achieved. This study presents a voice-assisted real-time traffic sign recognition system which is capable of assisting drivers. This system functions under two subsystems. Initially, the detection and recognition of the traffic signs are carried out using a trained Convolutional Neural Network (CNN). After recognizing the specific traffic sign, it is narrated to the driver as a voice message using a text-to-speech engine. An efficient CNN model for a benchmark dataset is developed for real-time detection and recognition using Deep Learning techniques. The advantage of this system is that even if the driver misses a traffic sign, or does not look at the traffic sign, or is unable to comprehend the sign, the system detects it and narrates it to the driver. A system of this type is also important in the development of autonomous vehicles.

Keywords: *Convolutional Neural Networks, Deep Learning, Traffic Sign Detection and Recognition, YOLO (You Only Look Once)*

Source Impact and Credibility Assessment on Twitter Users

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Due to the improvement of the internet, several platforms such as Twitter, Facebook, LinkedIn, Instagram were very popular. They were attracted by the people as the mass media platform's cost is very high. Because of this popularity, most of the users rely on the information published on social platforms. The problem is ensuring their reliability; what we read is not fake. Credibility is a major issue when dealing with online social media platforms. The focus of this study is measuring user credibility based on the tweets published by each user. In this study, we compare an approach called Credibility Outcome (CREDO) which aims at marking the credibility of an article in an open domain setting, to create a credibility assessment model for Twitter users. CREDO approach consists of various modules to capture the features responsible for the credibility of unstructured texts such as Semantic similarity of articles, Sentiment conveyed by the article, Information source credibility, and Keyword extraction value. As tweet is also an unstructured text, it uses CREDO algorithm to measure Twitter user credibility based on the above features and experiment on Twitter dataset reveals that CREDO outperforms the state-of-the-art approaches based on linguistic features.

Keywords: *Machine Learning, Keyword Extraction, Sentiment Analysis, Semantic Similarity, Source Credibility*

Study of Image Recognition Based Travel Destination Recommendation

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Sri Lanka is a country with different types of tourist destinations. However, lack of popularity to many such attractive destinations is a major issue identified. Images of Sri Lankan destinations are published in Social Media platforms, often without the correct geo-location tagging. Therefore, most of the places are not popularized among international and local tourists. Key problem domain identified would be the inability to recognize specific location of such images. Due to high similarity and complex nature of images related to this field, effectiveness of existing methodologies have become questionable. Focus of this research would be a suitable image identification methodology-based model, which can identify an image based on their destination and provide advanced recommendations. Thereby, it would ensure promotion and focus towards attractive, yet widely unpopular destinations in Sri Lanka. However, in general this is not a problem specific to Sri Lanka, but other countries like Sri Lanka as well. Therefore, in large, this model can be applicable to similar other countries as well, even though data and evaluations of this research are from Sri Lanka.

Keywords: *Image Recognition, Convolutional Neural Networks, Geo Location, Destination Identification*

Detection and Classification of Rice Plant Diseases Using Image Processing Techniques

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Plant leaf disease detection and classification is one of the interesting research areas in the agricultural sector. An approach based on image processing and machine learning techniques is proposed in this paper to detect and classify paddy leaf diseases. Leaf Blast, Brown Spot and Bacterial Leaf Blight diseases are considered to calculate the performance of this proposed methodology. Color thresholding is applied to identify the disease area in the paddy leaf. Hence, various feature categories such as colour, texture, and shape features are extracted from the affected area of the diseased image. Support Vector Machine (SVM) and k-nearest neighbors (k-NN) algorithms are used as classifiers and the performance of the proposed methodology is evaluated using these classifiers. The experimental results are compared with state-of-the-art work approach. Our proposed approach achieves 89.19%, 82.86%, and 89.19% of accuracy for detecting the rice plant diseases such as leaf blight, brown spot and leaf blast respectively.

Keywords: *Rice Leaf Disease, Color Thresholding, Disease Classification, SVM-classifier, k-NN Classifier*

Fuzzy Logic-Based Paddy Yield Prediction to Facilitate Weather Index-Based Crop Insurance

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Weather risk can be considered as the dominant among the risks associated with agriculture. The unpredictability of weather and its adverse impact on agriculture has made the industry unstable. However, the authorities have not been able to provide farmers with a mechanism which assures that their livelihood is preserved. To address this issue, Weather Index-based Crop Insurance has been used in many countries. Risk modeling is an important component in this insurance. After quantifying the uncertainties in crop harvest due to weather factors, the insurance company can guide the farmers accordingly. Crop yield prediction based on weather factors can be used for this. This study proposes a Fuzzy Logic System which relates input (weather factors) and output (crop yield) variables through linguistic rules. The output of this model can be used for risk modeling in weather index-based crop insurance, based on which the possible paddy crop damage can be minimized.

Keywords: *Crop Yield Prediction, Fuzzy Logic, Rule-based Systems*

Text Similarity-Based Approach to Detect Sinhala Language Fake News in Social Media: An Approach using Hybrid Features

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In this rapidly evolving digital age, societies rely heavily upon social media to share news publicly due to the speed of dissemination. With billions of users, the sharing of a news item only takes a few minutes to represent diverged views, with malicious or misleading content, to go viral. In 2018, Sri Lanka experienced anti-Muslim riots, and in 2019, racist uprisings initiated fake news in social media mainly in Sinhala language. Considering the massive number of Sinhala language posts shared at present and the efficiency of research work in Sinhala fake news detection, an automatic fake news detection technique is proposed in this research that can help to identify fake news published in the Sinhala language which circulates on social media sites. Approaches to detect fake news depend heavily upon features inherent to either the explicit or implicit features of user account and text content-based features of the post, or any hybrid set of above features. Based on the literature, social media users mainly consider verifiability to identify fake news content. Therefore, the hybrid methodology proposed in this research work mainly focused on the checking and verifying whether the news text content appears on the credible sources. The authenticity features of the user account that used to obtain the news content were evaluated in the rule based points allocation schema. An accuracy of 78% was gained in predicting fake news with this Rule-Based implementation.

Keywords: *Fake News, Social Media, Hybrid Methodology, Rule-Based*

Novel Approach for Improving Quality and Process Optimization in the Garment Industry

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The garment industry is one of the intensive manufacturing industries operating in Sri Lanka, catering to the world's number one brands from US and Europe. Its contribution to the economy is immense. Given the situation explained above, we need to improve the technical knowledge and the product quality for meeting the deadline with regards to on-time delivery. To be more competitive in the market, to improve productivity and the quality of the product along with optimizing the process workflow using improved techniques is a must. Due to the poor workmanship and other human errors and poor human supervision, the quality of products tends to decrease. Therefore, increasing efficiency and decreasing quality cost are the main objectives. This paper presents suitable solution using machine learning techniques such as a method to identify defect co-occurrences using association rule mining, a method to optimize employee leave management using classification techniques, a method to optimize seating arrangements in sewing lines using Genetic Algorithms, and a method to implement predictive maintenance of machinery using classification techniques in data mining.

Keywords: *Genetic Algorithms, Machine Learning, Predictive Maintenance, Data Science, Association Rule Mining, Classification*

Deep Neural Network-Based Approach to Classification the Crime Related News Posts

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Crime is an important topic that is experienced by the present society. The quality of life and economic development have been seriously impacted by crimes. We can track and analyze historical data to classify crime trends and predict crimes. However, some crimes are unregistered and unsolved due to lack of evidence. Researchers have used numerous sources to create the prediction model to get crime-related data. However, certain crimes have not been reported. In this paper, we detected crimes using online news releases in order to prevent local authorities from ignoring events. As the first step, we fetch the news posts using predefined keywords relating to the crimes. Then, we proposed the Long Short-Term Memory (LSTM) approach based on a deep learning model for the classification of crime types and non-crime related posts. To evaluate the selected model, we compared it with different approaches models. The selected approach out-performed the existing approaches by obtaining 88.4% accuracy and 90% precision.

Keywords: *Crime Detection, Online News, LSTM, GloVe*

Deep Learning of Gene Expression Data for Breast Cancer Classification

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Breast cancer is a type of cancer which most of the cancer patients commonly suffer. At present, identifying the type of breast cancer is an essential step to be done in drug discovery for breast cancers. Thus, the treatments could address the key features of cancer and the breast cancer can be successfully cured. Majority of the related studies on cancer classifications are based on clinical diagnosis, hence affected with restricted classifications. Thus, gene expression data which is obtained via transcription proifling on microarrays have been used as the input for the classification of cancer in this study. The key goal of this study is to research the existing methods of breast cancer classifications and implement an efifcient breast cancer classiifcation method based on deep learning, using gene expression data which overcomes the defects of existing methodologies of breast cancer classification. Two different deep learning architectures were implemented by this study which is Convolutional Neural Network (CNN) and Deep Belief Network (DBN) using Tensorflow framework to classify breast cancers under the classiifcation based on gene and protein status. Finally, we compared the performance of those two architectures with the deep learning architecture, autoencoder which was implemented before in another study in classifying breast cancer using gene expression data. The two proposed architectures perform better than autoencoder with respect to precision, recall, F1 score and accuracy. In conclusion, CNN is the best supervised deep learning architecture which yielded an accuracy of 63.4395% and DBN is the best unsupervised deep learning architecture that yielded an accuracy of 63.3545% in classifying breast cancers using gene expression data based on gene and protein status.

Keywords: *Autoencoder, Breast Cancer Classification, Convolutional Neural Network, Deep Learning, Deep Belief Network*

Sri Lankan Sign Language to Sinhala Text using Convolutional Neural Network Combined with Scale Invariant Feature Transform (SIFT)

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Sri Lankan sign language (SSL) is a visual gestural language used by the deaf community for communication. Hearing-impaired people cannot effectively communicate with a normal person due to difficulty in understanding sign language. SSL to Sinhala text interpreting technology using gesture recognition helps to fill up this communication gap since Sinhala is the majority language used in Sri Lanka. Hand gesture recognition can be achieved by using vision-based or sensor-based approaches. Vision-based approaches are comparatively simple and less costly but sensor based approaches are complex. Scale, rotation, occlusion affects the accuracy of gesture recognition, and keypoints act as better features to handle them. The research focuses on a combined approach of Convolutional Neural Network (CNN) and Scale Invariant Feature Transform (SIFT) to develop a camera-based low-cost solution to interpret static gestures of SSL into Sinhala text. The SSL to Sinhala text translation model reached an accuracy of 86.5% when a dataset of images of 20 static SSL gestures was used. The classifier showed robustness to scale variations when the distance to the camera was varied and uniform color backgrounds were used. Further improvements can be done for recognition of dynamic gestures and facial expressions of SSL.

Keywords: *Sign Language, Key Points, CNN, SIFT*

A Language Modelling Approach to Authorship Identification for Online Examinations in Sinhala

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With the Covid-19 outbreak, e-learning has become the 'new normal' with many universities and institutions adopting online platforms to deliver their programs. One aspect of this that has posed many challenges is conducting written examinations. This is mainly because it has become increasingly difficult to verify the identity of individuals sitting for an examination remotely. The primary objective of this research is to address the above mentioned problem by developing a Language Model that can be used in authorship identification for online examinations conducted in Sinhala. Essentially, the idea is to train a language model solely on the writings of a given author, and it will be possible to determine the likelihood (probability) of an entirely new piece of writing having been written by that author. It was found that a character-level language model can be used to identify the author whose writings it was trained, using the concept of perplexity.

Keywords: *Authorship Analysis, Language Models, Natural Language Processing, RNN, LSTM*

Parallel and Distributed Computing Track

Development of Cyber Threat Intelligence System in a SOC Environment for Real Time Environment

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Now a days, Information Communication Technology (ICT) plays an important role in the world. In IT, Cyber Security holds a vast place. Cyber Threat Intelligence (CTI) leads a significant place within Cyber Security, as many Cyber Threats need to be faced every day by a particular organization. Security Operation Center (SOC) helps to monitor and analyze an organization's security position in Real Time. This paper proposes about the Cyber Threat Intelligence framework in a SOC Environment in Real Time. The proposed framework contains three layers, which are built above Security Onion. The Layer 1 comprises of input data from online and offline sources. In Layer 2, two components namely Filter data and Cut down data are implemented, which receive the data from Layer 1. Finally, Layer 3 delivers a detailed report. As the input for the Layer 1, Financial Datasets are used. These Financial Datasets, helps to detect the Financial Frauds. Machine Learning is used to train the model. Implementing CTI System helps an organization to gain predictive output regarding the upcoming threats. Also, it helps to ensure the reputation of the organization by establishing trust between the users. Further this helps to increase the number of customers of an organization. The above mentioned are the advantages that can be gained by a particular organization by having a CTI System.

Keywords: *Information Communication Technology, Cyber Security, Cyber Threat Intelligence, Security Operation Center, Security Onion, Elastic search-Logstash-Kibana, Machine Learning*

MedCode: A Blockchain Based Patient Referral System

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In the current healthcare system, it's a common practice to refer patients from one medical practitioner to another to complete his/her treatment procedure. This process is known as a referral. Currently in Sri Lanka, lack of a well-organized referral system has led to many shortcomings in the health sector. These include misplacement of referral forms causing repetitions of the same treatment procedures, long queues, and congestion in hospital premises. It has even led to misdiagnosis and incorrect treatment procedures which in some cases has led to the loss of a patient's life. As a result, patient's faith in the entire health care system has begun to deteriorate. The primary scope of this research is to promote an Electronic health Record system (ESR) to provide solutions to the challenges which are met by the current system. In this study, the IBM Hyperledger Fabric framework is used to create a prototype. Then the prototype is tested against common cases found in the health sector.

Keywords: *Blockchain, Electronic Health records (EHR), Healthcare, Medical Referral, Smart Contract*

Inventory Management with Origin Tracing Using LSTM and Blockchain

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Vegetable waste can often be found in Sri Lanka. It can be either a waste of certain vegetables, or a shortage. Farmers will overproduce certain vegetables without knowing the exact amount required for that period. As we can adjust market prices on the basis of demand and price predictions, accurate demand and price estimation for goods is an important part of supply chain management. This paper focuses on two main retail vegetable predictive areas. Each area is dealt using a range of machine learning and deep learning models, and the assessment chooses the best solution. Checking the origins of the vegetables using blockchain in the supply chain and the selection of the best vendors is another important area that we explore in our project. To address this, we use the vegetables monitoring mechanism to increase transparency within the vegetable supply chain and to choose the best supplier we use the weighted sum ranking process.

Keywords: *LSTM, Blockchain, Weighted Sum Ranking Method*

Human-Computer Interaction Track

Automatic Segmentation of Lung Nodule from CT Images Using Fuzzy C-Means Clustering Algorithm and Active Contour Model

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Lung nodule segmentation is an important part in computer-aided diagnosis (CAD) system for lung cancer detection and diagnosis. The key issue in CAD of lung nodule is to correct and accelerate rapid segmentation of diseased tissue. This paper provides a novel approach to develop a region based active contour model and Fuzzy C-Means clustering technique for segmentation of lung nodules. Computed Tomography (CT) imaging is an efficient medical screening test used for lung cancer diagnosis and detection. Fuzzy c-means clustering algorithm (FCM) is sensitive to noise and local spatial information is often introduced to improve the robustness of the FCM algorithm for image segmentation. The methodology involves image acquisition, seeks the contour of the object using active contour model and segment the lung nodule using fuzzy c-means clustering algorithm. The experimental results of this method show that it is superior to other typical algorithms in the segmentation of lung nodules.

Keywords: *Fuzzy C-Means Clustering (FCM), Computed Tomography (CT), Active Contour Model (ACM)*

Sri Lankan Currency Detector for Visually Impaired People

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Blind people face more difficulties in day-to-day life. One pressing problem is they also want to use physical currency (notes and coins) as others. They always have a hard time when trying to recognize the value of a currency, we intend to address this matter by developing a mobile application for blind people. We are going to implement this currency recognition mobile application along with counting and voice command compatibility and also this application is having user-friendly interfaces; therefore, easy to negotiate. By using this mobile application blind people can give voice commands to navigate and start the intended function as a currency recognition or counting as pleased. We are going to use the user's mobile phone camera to get input into the app and then classify the currency as a note or a coin. After that, the features of the currency note and coin by using Convolutional Neural Network and the value of the currency note and coin is predicted. This mobile application can extract the value of the coins are extracted and notes without any issue. Finally, we used Artificial Neural Network for the classification of notes and coins. In order to get the real value of the notes. Finally, the Sinhala and English voice commands were trained using the CNN model to get them out as a voice.

Keywords: *Convolutional Neural Network (CNN), Mel – Frequency Cepstral Coefficient (MFCC)*

AR Interior: Guidance Tool for Interior Designing

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The ability to think in three dimensions and to visualize is one of the greatest significance in the field of Interior Designing. It is well examined, that the most prevalent concern about interior designing is the interpretation gap between the client and the designer. The clients' imagination to visualize the final arrangement of the interior is more dominant than metaphysical concepts in the conceptual Interior design stage. The purpose of the study is to analyze Human-Computer Interactions (HCI) utilizing the widely researched Augmented Reality (AR) technologies, to decrease the gap of the design interpretation in the process of traditional Interior Designing. Specifically, it evaluates the best way to communicate the concept of Interior Designing to the client in an immersive virtual blueprint and to analyze the process. To examine the requirement of a virtual interior design that leads to ensure the client's satisfaction, an interview was conducted with interior designers and people who recently got their houses built or re-furnished. The results revealed the difficulties in understanding the client's personality and preferences in the designing process. Moreover, clients are more likely to get dissatisfied with the real application of the interior even if they pay a high cost for the designing. This paper presents four enhanced methodologies to make an impact on the visualization and analysis of the design process, to produce a room with a new look cost-effectively, create a virtual measuring tool by utilizing the AR and computer vision algorithms such as Canny edge detection, dilation, and erosion, to sort out the best wall paint and to estimate the number of coats by applying Machine Learning (ML) algorithms, to sort out the best-matched furniture by utilizing decision tree algorithm and to distinguish the best furniture to position according to interior design principles by using marker less Simultaneous Localization and Mapping (SLAM) mobile technologies.

Keywords: *Augmented Reality (AR), Interior Design, An- droid platform, Concurrent Odometer and Mapping (COM), Simultaneous Localization mapping (SLAM), Virtual Reality (VR)*

Knowledge Management and Information Systems Track

The Impact of Green Supply Chain Management on Inter-Organizational Supply Interaction: A Review

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In a business, Supply Chain Management is the technique of transforming raw materials into final products and services within the same limited procurement procedure with a minimized waste. Concept of Green Supply Chain Management seems to be an upgraded process of Conventional Supply Chain Management, which focuses primarily on green production, green packaging, green distribution, and marketing. This survey shows that conventional supply chain management is the key reason for resulting environmental degradation, deforestation, carbon emissions, loss of resources and significant waste of manufactured goods. To suppress and reduce these adverse issues, logisticians and consultants have introduced the Green Supply Chain Management concept. After the introduction of the Green Supply Chain Management framework, experts have identified that the effect of above harmful problems had been reduced. The first section of the paper is on the principles of Conventional and Green Supply Chain Management. Also it describes the increasing problems in Conventional Supply Chain Management and then how Green Supply Chain Management implementation can address these problems. The next section addresses the transformation difficulties and challenges facing in Green Supply Chain Management. The conducting section of the paper summarizes the effect of Conventional Supply Chain Management on Green Supply Chain Management and the proposed solutions.

Keywords: *Traditional Supply Chain Management, Green Supply Chain Management, SCM, GSCM*

Development of an Information Flow Model to Overcome the Challenges in Sri Lankan Handicraft Industry

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The handicraft industry has been rising in the past few years in the global market. Digitalization has become a major reason for the growth of the industry around the world. But the Sri Lankan handicraft industry shows a decline over the past few years due to several reasons. There are government and non-government institutes which are responsible for the development and the sustainability of the industry. Their efforts seem to be less effective due to the lack of awareness among the crafters about the work carried out by the stakeholders and the institutions. The study was conducted to identify the problems in the handicraft industry and to propose an information flow model to mitigate the above problems. Primary data collection was done with one-on-one interviews and circulating a questionnaire. Interviews were done using the industry experts and officers. The questionnaire was distributed to a sample of 30 artisans. An information flow model for the industry was developed using the analyzed data. This information flow model is a stakeholder centric one and can be used in the future to design digital tools to communicate among the stakeholders more effectively.

Keywords: *Information Flow Model, Handicraft Industry, Information Ecosystem*

Adoption of Business Intelligence Tools by Small and Medium-Scale Enterprises in North Central Province, Sri Lanka

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Business Intelligence (BI) is one of the decision support tools that offer the ability to gather, store, access and analyze huge amounts of data and support for making effective decisions. There is a rich body of literature relating to BI adoption and their related benefits over the Small and Medium Enterprises (SMEs) in developed countries. But the researcher's pilot survey depicts that in developing countries, especially in Sri Lanka, if larger companies adhere to the new technologies, it's remaining very low to the SMEs. Therefore, those companies are still taking a long time to analyze data, interpret data and present data so on. The objective of this study is to address this research gap by examining the factors affecting BI adoption by SMEs in the North Central Province in Sri Lanka. North Central Province was selected due to the ease of access to the sample for data collection. By initiating the deductive approach, a research model was developed using independent variables of relative advantages, complexity, organizational resource availability, competitive pressure and the dependent variable of BI adoption by SMEs. 150 SMEs were considered the sample out of 7461 SMEs of the total population which was obtained from the Divisional Secretariat Offices in Anuradhapura and Polonnaruwa. An administrative questionnaire was distributed to collect the data adhering to the Stratified Sampling technique. The collected data was analyzed using SPSS version 21.0 and the results revealed that relative advantages, complexity, organizational resource availability and competitive pressure have a high effect on BI adoption and the mean value is higher than 3.0. According to correlation analysis, three factors showed a significant and positive relationship with the dependent variable except for complexity with BI adoption. According to that three hypotheses were accepted and one was rejected. The research findings elaborate and statistically proved the reasons for minor adoption of new technologies including Business Intelligence by SMEs in North Central Province. Furthermore, this study highlighted the actions that are needed to be taken by the Sri Lankan government and IT/IS vendors while providing directions for future researchers.

Keywords: *Business Intelligence, Information Systems, Small and Medium-Sized Enterprises*

E-government Adoption in Sri Lanka - Barriers and Challenges from International Perception: A Literature Review

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E-government is commonly introduced as governments' use of Information and Communication Technologies (ICTs) combined with organizational change to improve the structures and operations of government. E- governments are characterized by providing increased levels of convenient efficiency to citizens, while ensuring a better quality of customer service and convenience in accessing better information. Many technical and non- technical obstacles are faced in the adoption and dissemination of e-government regardless of how advanced a country in terms of ICT infrastructure and deployment is. The understanding of e-government barriers and challenges is a significant strategic phase toward reliable and effective e-government adoption. The aim of the study is to identify barriers and challenges in adopting e- government in Sri Lanka. A range of earlier studies in India, Nepal, Nigeria, Romania, UAE have been critically examined and analysed to identify challenges of e- government. This paper then presents a critical analysis of barriers and challenges experienced in public sector organisations in the light of Sri Lankan context using an e government architecture consisted of four layers. Findings reveal that Sri Lanka faces more or less similar challenges including financial constraints, policy barriers, infrastructure, lack of integration across government systems and organizations, change management, security risks and trust issues and low IT literacy which should be addressed in a holistic approach. Introducing a new e government and ICT policy is recommended as an initial step to overcome the barriers and challenges.

Keywords: *E-government, Barriers and Challenges, Sri Lanka*

Policy Framework for Healthcare Responsibility Assignment

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Healthcare service mainly consists of a set of clinical workflows carried out by a group of actors who have multiple responsibilities. Current E-Health system engineering primarily focuses on HC service process requirements while less focus on realizing medical knowledge and higher-level guidelines. Also, maintaining interoperability among heterogeneous systems is another major issue that makes less usability of e-Health systems. Thus, it is necessary to design a systematic approach to ensure multiple data sharing requirements of stakeholders. To identify and represent complex higher-level rules and guidelines and to facilitate data sharing, this research contributes Healthcare Responsibility Assignment Matrix (HCRAM). The matrix represents the governing perspectives by indicating different roles of stakeholders on specific service processes in HC. Then the identified rules via HCRAM have been realized by indicating them in the process model. The proposed approach contributes the rule driven process model for healthcare system engineering.

Keywords: *HC Service Process, HCRAM, Governing Perspectives, Behavioral Rules*

Software Engineering Track

Guru Gedara: Smart Mathematical e-learning Platform for Grade Five Students

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This paper introduces a web-based educational support system developed aiming at optimizing mathematical knowledge of Grade 5 students. This application can be also used as a distance learning method for the lockdown situations occurred due to COVID-19 pandemic. Both primary class students and teachers face various difficulties, due to competitiveness of grade 5 scholarship examination. Consequently, emotion analysis which is a sub section in this system, uses sentiment analyzing to boost the students' emotional state, while Automated MCQ generated sub section can be used to gain mathematical knowledge, by facing MCQ quizzes. Additionally, Smart Video-based Learning Environment sub section can be used to gain knowledge related to mathematics by searching relevant videos. In addition, the Voice- based Question and Answering section can be used to get answers orally for the questions asked in voice format. However, some sections use IQ level of each student to provide better solutions. Above all, it can be used at home as an online service while identifying and solving student's weaknesses.

Keywords: *Video Base Techniques, Question Generation, Speech Recognition, Sentiment Analysis, Natural Language Processing*

Exsia - Advanced Smart Buy and Sell Application

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E-commerce is a widely spread area of online business. Our main objective to enhance the future of smart buy and sell system by providing main unique features such as Augmented Reality, Ethereum Blockchain based ownership management, Sentiment Analysis on Product Reviews for Singlish Language and Natural Language Processing, Machine Learning based product matching. Currently we have focused only on the smart phones as the product. We augment the view of created 3D model. Recently Ethereum Blockchain has been used by many industries and E-commerce platforms. It transforms the way of providing trust and security. Blockchain can potentially be used to provide trusted authenticity, origin and ownership for smart phones. Singlish typing and its common usage in the Social media platforms such as Whatsapp, Facebook and YouTube among Sri Lankans are taken into consideration to build up a seller rating in the system. This User requirement to buy a most appropriate product is a function which must be taken into consideration. Here we train number of datasets and filter the best product matching the user preference. Finally, our vision is to provide a good satisfaction and a trustful service to the buyers and sellers.

Keywords: *Augmented Reality, Ethereum Blockchain, Singlish language, Sentiment Analysis, Phone Detector*

North West Corner Rule Based Programming Development to Find the Initial Basic Feasible Solution of Transportation Problem

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The transportation problem is one of the leading problems among the operation research problems which is associated with day- to-day activities in our real life that mainly deals with logistics. It is a very important class of model in linear programming and related with the condition where transporting commodities or resources from sources to destinations. The main purpose of the problem is to save transportation time and steps by using the minimal cost of transformation. The solution for this problem is basically divided into two categories such as the Initial Basic Feasible Solution (IBFS) and the Optimal Solution (OS). The objective of this research is to develop a program to find the initial basic feasible solution to the transportation problem using the North West Corner Rule (NWCR). The C programming language has been used to develop this programme for both balanced and unbalanced situations. Also, this can be used to solve any situation of transportation problem using the North West Corner Rule with a wider range than other methods. Finally, this proposed programme is more helpful for the decision makers who are handling the unbalanced supply and demand quantities frequently. Also, this is time saving and a robust method for using the NWCR method and therefore, the final answer has a higher level of reliability without human errors rather than applying the method manually.

Keywords: *Transportation Problem, Initial Basic Feasible Solution, Optimal Solution, Unbalanced Transportation Problem, North West Corner Rule*

Open Track

Warehouse Space Optimization Using a Linear Programming Model

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Warehouse operations play a key role in manufacturing organizations, providing support to run production processes smoothly. As a part of warehouse operations in a supply chain, loading problems are a point that allows optimization to be carried out with significant cost implications and a considerable impact on the rest of the supply chain in manufacturing organizations. The paper proposes a simple and effective linear programming model to use warehouse storage space optimally by efficient palletizing. The quantity of total pallets required per day is derived based on the available demand per day and other constraints related to warehousing operations in a multi-product manufacturing context. Requiring moderate computational efforts and time, generates optimal solutions of almost all examples analyzed, using Microsoft Excel add-in, Solver and the Solver Engine - Simplex Linear Programming, which were used to implement the model. For scenarios considered, and a sample scenario demonstrated in the paper, the model generated feasible solutions, all constraints satisfied.

Keywords: *Palletization Problem, Warehouse Optimization, Linear Programming*

A Simulation Model to Optimize Pre-sewing Operations in the Apparel Industry: A Case Study from Sri Lanka

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The most crucial factor in apparel manufacturing is catering for due dates. The unoptimized, ad-hoc scheduling and static routing of Production Orders (POs) result in late deliveries of orders. The inability to analyze the available pre- sewing capacity against the demand results in last moment revelation of resource over utilization. This study proposes a systematic approach in analyzing pre-sewing capacity against the demand. A mathematical model in estimating pre-sewing job completion times for six chosen pre-sewing departments is proposed. Operation Flexibility and Routing Flexibility in pre- sewing section are analyzed and integrated in scheduling through Precedence Diagramming Method (PDM) and priority scheduling algorithm. An optimized scheduling approach with a simulation model to facilitate the visibility of resource utilization and PO completion times is adopted. The simulation model provides approximated PO completion time with optimized criterion, provides measures on resource utilization and queue wait times, thus facilitating proactive measures for the management at an early stage of the production.

Keywords: *Routing Flexibility, Operation Flexibility, PDM, Optimization, Simulation*

Occupational Stress of Women Workforce in the IT Industry: With Special Reference to Colombo District, Sri Lanka

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Occupational stress is the physical or emotional response people have when they are working with demanding situations that do not match the employee's knowledge and abilities. Occupational stress is one of the major problems for women in the IT industry. It affects the behavior of the employee towards her co-workers, administration and most importantly the productivity. The main objective of this study is to find out the key factors which manifest occupational stress of women IT professionals in the Colombo district, Sri Lanka. To conduct this survey, primary data were collected through a questionnaire from 81 employees working in Colombo district under cluster sampling, to identify the factors affecting the occupational stress of women employees in the IT industry. Descriptive statistic results of this study highlights that there are considerable a large number of women employees are under high stress levels. Furthermore, factors such as conditions in the working environment, role conflict, co- worker support, work-life balance and mental demands affect occupational stress of these employees which are significant with -0.525, -0.716, -0.751, -0.770, -0.585 correlations respectively.

Keywords: *Occupational Stress, Women Workforce, IT Industry*

LEXIS: A Preliminary Screening and Intervention Tool for Children with Dyslexia

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Children with dyslexia often struggle at school as their reading and writing skills are adversely affected. However, if identified early, the necessary support can be provided to help manage the condition. Unfortunately, a significant number of dyslexics go undiagnosed and unaddressed which leads to an increase in the school dropout rate and discontinuation of higher education. To address this issue, a cloud-based web application, LEXIS was designed and developed to screen young children based on a well-rounded criterion including their background, behavior, reading, writing, spelling, memory, rapid naming and math abilities. An immediate evaluation including the identified weaker areas are provided along with effective and interactive learning modules and activities targeted at improving those identified areas.

Keywords: *Dyslexia, Specific Learning Disability, Preliminary Screening Tool, Intervention Activities, AI Based Cognitive Services, Cloud Based Web Application*

Cell Selection Analysis in 5G for the Emergency Communications

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The fifth generation (5G) cellular network is playing a major role today. One of the 5G potential application is the Emergency Communications. 5G cellular networks provide dynamic coverage with respect to time and overlapped cell areas can endure. Therefore, the devices in 5G network can be shielded by more than one 5G cells. Due to this reason, the devices in Emergency Communications need the reliable cell selection is needed in 5G. This is a captious decision for users on the overlapping cells in the 5G network. The various researches were done to find appropriate cell selection in 5G by considering only the signal strength. In this research, a solution is proposed by considering two schemes. The first scheme is based on the distance from the base stations. Additionally, the second scheme is the combination of the number of devices and distance in a cell. The execution of these two schemes were analyzed by using performance parameters such as the fairness index and the blocking probability. By reviewing all the results obtained, for cell selection, scheme 2 is best for the 5G cell selection rather than scheme 1.

Keywords: *Cell Selection, Emergency Communications, Performance Parameters*

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