6th International Conference on Information Technology Research - ICITR 2021

1st - 3rd, December 2021, Faculty of Information Technology
University of Moratuwa, Sri Lanka

Abstracts of the Proceedings of ICITR 2021

IEEE

IEEE Sri Lanka Section

IEEE Robotics & Automation Society Sri Lanka

Abstracts of the Proceedings of ICITR 2021

of

6th INTERNATIONAL CONFERENCE ON
INFORMATION TECHNOLOGY RESEARCH
ICITR 2021
1st – 3rd December 2021

"DIGITAL RESILIENCE & REINVENTION"

Information Technology Research Unit
Faculty of Information Technology
University of Moratuwa
Sri Lanka.

International Conference on Information Technology Research (ICITR)
www.icitr.uom.lk

ICITR 2021, 1st – 3rd December 2021

Conference mode: Online

Conference organized by: Information Technology Research Unit,
Faculty of Information Technology,
University of Moratuwa

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Published by:

Information Technology Research Unit, Faculty of Information Technology, University of Moratuwa, Katubedda, Moratuwa, 10400, Sri Lanka.

International Conference on Information Technology Research

The 6th International Conference on Information Technology Research (ICITR 2021) to be held from 1st to 3rd December 2021. This is an annual event organized by the Information Technology Research Unit (ITRU), which is the research dissemination arm of the Faculty of Information Technology, University of Moratuwa, Sri Lanka. While we regret that the COVID-19 pandemic prevented us from holding the conference physically in the University of Moratuwa, we are continuing to explore the opportunities of holding an innovative virtual conference.

The theme of the conference is *"Digital Resilience & Reinvention"*. We are in a Digital Revolution and the Age of Digital Enlightenment. The main focus of this conference is to provide a forum to discuss the rapid advances being made in research and development in Digital Transformation. ICITR is a well-recognized conference in the field of Information and Communications Technology (ICT). The conference scope includes subareas of ICT including but are not limited to Web Intelligence, Network Mobility Management, Embedded Systems, Decision Making and Risk Management, Psycholinguistics and Language Processing, Cognitive Mechanisms of Decision Making, Artificial Intelligence, etc.

ICITR 2021 is technically co-sponsored by IEEE Sri Lanka Section Chapter and IEEE Robotics and Automation Society, Sri Lanka Section Chapter. Financially sponsored by FGS Funding for International Conference and Symposia. All the accepted papers to the ICITR 2021 will be indexed in IEEE Xplore Database. This year the conference received around 160 research papers, and 41 papers were accepted by maintaining the acceptance ratio around 25%.

Editorial Board

Formatting, Artwork & Cover Design

Abstracts of the blind-reviewed full papers are included in this conference proceeding.

Message from the General Chair

B. H. Sudantha
General Chair – International Conference on
Information Technology Research (ICITR 2021)

Welcome to the University of Moratuwa and the 6th International Conference on Information Technology Research (ICITR 2021). The objective of the conference is to provide a forum for researchers world-wide to unveil their latest work in Information Technology Research. The theme of the Conference, "*Digital Resilience & Reinvention*" gives the direction, and it covers a broad spectrum of allied fields also.

Maintaining a high quality of a conference requires various levels of involvement including a well-balanced review process. This year, 142 full papers were submitted to the conference. Each paper was subject to review by at least two reviewers, and finally, 41 papers were selected as full paper publications for the conference. I would like to express my sincere thanks to the reviewers for their dedicated, efficient, responsible and rigorous review process, ensuring the high quality of the conference papers. And also, I should be much more thankful to authors who share their research experiences in the conference of their hard work. It helps us prepare proceedings in an excellent level.

Three workshops are organized to benefit the conference participants in various new trends and stimulate their research experiences. A very special thank should go to our four distinguished keynote speakers, Professor Jiang Liu from Waseda University, Japan, Dr. Yogachandran Rahulamathavan, Senior Lecturer and the Programme Director for MSc Cyber Security and Data Analytics at Loughborough University's London Campus in the United Kingdom, Professor Sunny Joseph Kalayathankal, Jyothi Engineering College, Kerala India and Dr. Sadeep Jayasumana, Senior Research Scientist at Google Research. I would also thank to our invited speaker Mr. Rohan Fernando, Associate Director, Acuity Knowledge Partners.

I would like to thank everyone who has given his or her time, energy and ideas to assist in organizing this event, including all the members of the organizing committee, the TPC Co-Chairs, TPC members and all the reviewers, for the quality and depth of the reviews, and their sense of responsibility and responsiveness under very tight deadlines. In particular, I would like to highlight and acknowledge the tremendous efforts of especially the Director, Information Technology Research Unit, the Editorial Board, ICITR Committees including various energetic Chairs and organizing committees of

workshops and the conference, and finally, our dedicated faculty staff members who gave their support and they worked tirelessly on various conference-related tasks in order to bring the conference to this level and to conquer the challengers raised due to the Covid-19 outbreak.

Finally, we hope that the participants enjoy the outstanding conference program of the 6th International Conference on Information Technology Research ICITR 2021.

Wishing you all a very fruitful and rewarding conference!

Message from the Conference Chair

Dr. Sagara Sumathipala
Director – Information Technology Research Unit

It is my great honour and pleasure to welcome you to the 6th International Conference on Information Technology Research (ICITR 2021). This is an annual event organized by the Information Technology Research Unit, which is the research dissemination arm of the Faculty of Information Technology, University of Moratuwa. While we regret that the COVID pandemic prevented us from holding the conference physically, we are excited about the opportunities of holding an innovative virtual conference. The COVID-19 pandemic has created an unprecedented challenge for society and has highlighted the importance of scientific research.

This year we run the conference under the theme of '***Digital Resilience & Reinvention'***. The conference is well recognized as a forum to discuss the rapid advances being made in research and development in Digital Transformation. We are living in extraordinary times. Today, we have adjusted to a new normal of working from home, meeting and shopping online, and generally relying on technology to help us overcome barriers and restrictions on our freedom of movement.

The conference scope covers the whole spectrum of ICT. ICITR 2021 is technically co-sponsored by the IEEE Sri Lanka Section and IEEE Robotics and Automation Society Sri Lanka Section Chapter. All the accepted papers to the ICITR 2021 will be indexed in IEEE Xplore Database. This year we received around 162 research papers, and 41 papers were accepted by maintaining the acceptance ratio of around 25%.

This year's conference will feature four keynote talks by prominent academic personalities. We wish to welcome our eminent keynote speakers: Professor Jiang Liu from Waseda University, Japan; Dr. Yogachandran Rahulamathavan, Senior Lecturer and the Programme Director for MSc Cyber Security and Data Analytics at Loughborough University's London Campus in the United Kingdom, Professor Sunny Joseph Kalayathankal, Jyothi Engineering College, Kerala India and Dr. Sadeep Jayasumana, Senior Research Scientist at Google Research, United States. In addition, this year's conference offers three pre-conference workshops, ten technical sessions, and an invited talk conducted by Mr. Rohan Fernando, Associate Director, Acuity Knowledge Partners. We hope these experts' varied opinions and comments will be undoubtedly the most informative to the audience present on this day.

Our success greatly depends on many people who have worked tirelessly with us at every stage of the event. I take this opportunity to express my sincere gratitude to the conference chairs for their leadership and all committee members for their tremendous support. I would like to take this opportunity to thank the technical programming committee and all the reviewers for their commitment and dedication towards making this review process a success. I must mention our deep sense of appreciation for the keynote speakers, invited speakers, session chairs and paper evaluation panels. Especially I would like to thank all the authors of the conference proceeding for selecting our conference to publish their valuable research findings. I also extend our sincere thanks to Dr. Maheshi Dissanayake, Chair, IEEE Sri Lanka Section, Dr. Subodha Charles, Secretary, IEEE Sri Lanka Section, Prof. Chandima Pathirana, Chair, IEEE Robotics and Automation Society Sri Lanka Section Chapter, Mr. Tharindu Adhikari, Secretary, IEEE Robotics and Automation Society Sri Lanka Section Chapter, Prof. Ruwan Gopura, Dr. Windhya Rankothge and Dr. Sanath Jayawardana, senior members of IEEE Sri Lanka Section for their tremendous support given to obtain the IEEE Technical Sponsorship for the conference. I wish to express my sincere gratitude to the Faculty of Graduate Studies (FGS), University of Moratuwa, for funding this event to keep down the costs of ICITR 2021.

I would like to express our appreciation to Professor Niranjan Gunawardene, Vice-Chancellor, University of Moratuwa, Mr B. H. Sudantha, Dean, Faculty of Information Technology, Mr. Saminda Premaratne, Head, Department of Information Technology, Dr. Thushari Silva, Head, Department of Computational Mathematics, Dr. Thanuja Sadanayake, Head, Department of Interdisciplinary Studies for their constant support and guidance. In particular, I want to thank the Program Chair, Dr. Subha Fernando, for her wise advice and brilliant suggestions on organizing the technical program.

Especially I would like to express my sincere thanks to the Conference Secretary, Dr. Thilini Piyatilake, Finance Chair, Dr. Isuru Manawadu, Publication Chair, Dr. Upeksha Ganegoda, and all the members of the respective committees for their meticulous work in support of many conference activities. I also would like to express my sincere thanks to Mr. K. B. G. Samantha, Ms. Dulakshi Wageeshani, Mr. Charitha Abeynayake and all the team members for their enormous cooperation in the organization of this event. They are gratefully acknowledged. Last but not least, we would like to thank all of the conference participants for their active participation and inputs. At this challenging time, I urge you all to take care, and I am sure all of you find this conference stimulating, rewarding and meaningful.

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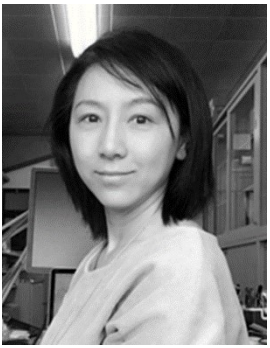


Professor Jiang Liu
Waseda University, Tokyo,
Japan.

Jiang Liu is an Associate Professor at Waseda University in Japan. She obtained her Ph.D. degree in Information and Telecommunications from Waseda University in 2012. After that, she joined the Faculty of Science and Engineering at Waseda University as an assistant professor, and since 2017 she has been an associate professor affiliated with the International Center for Science and Engineering Programs. Her research focuses on Near Field Communication, Wireless Network Systems, and their applications in healthcare industry and 6G network design. She is a senior member of IEEE and a committee member of the Institute of Image Electronics Engineers of Japan (IIEEJ). She also serves as the secretary of the Japan Division for the Institution of Engineering and Technology (IET).

Keynote Title: "Near Field Communication Based Smart Devices and Health Monitoring Systems"

Abstract

Nowadays the spread of the Covid-19 has caused significant changes in society and is triggering many people to develop a new lifestyle. The awareness of vital sign such as blood oxygen saturation concentration (SpO2) has been improved since SpO2 can help monitor and detect breathing issues. This motivated us to develop some smart devices to obtain useful vital data continually and easily. In this research direction, Near Field Communication (NFC) technology has attracted much attention in developing sensing systems for health care monitoring and high-secure, short-range data exchange. We design and develop contactless smart devices using NFC technology to obtain the vital data such as pulse rate, SpO2, blood pressure, blood glucose and others. We also aim to develop some smart devices to recognize human languages or understand human emotions without traditional input interface. To accomplish this goal, we design and test a sensor-based data acquisition glove for Japanese Sign Language (JSL) hand gesture recognition, and a wearable air-writing system that enables users to write the English alphabet in the three-dimensional space without any writing rules. In summary, this discussion delivers an introduction of the non-contact data sensing technology and smart devices along with our latest research outcome.

Keynote Address 2

Dr. Yogachandran Rahulamathavan
Loughborough University London,
United Kingdom.

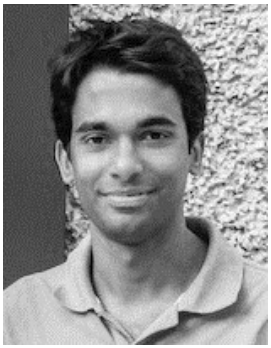
Yogachandran Rahulamathavan is a Senior Lecturer and the Programme Director for MSc Cyber Security and Data Analytics at Loughborough University's London Campus in the UK. Yoga obtained his PhD degree from Loughborough University in mathematical optimisation techniques for information processing in 2012. His research interest is on developing novel security protocols to advance machine learning techniques to solve complex privacy issues. Currently focussing on post-quantum encryption techniques to develop privacy-preserving machine learning algorithms. Currently, Dr Rahul coordinates a UK-India project between Loughborough University London, IIT Kharagpur, India and City, University of London. He is a Senior Member of IEEE and an Associate Editor for the IEEE Access journal.

Keynote Title: "Hide-And-Seek: Machine Learning in Encrypted Domain"

Abstract

Machine Learning models were built using a huge amount of high-quality and application-specific data. Even though the machine learning models can only be trained at places where the data is available, anyone can use the trained model for classification tasks via the Internet. While it sounds revolutionary, the trained ML models are not readily available to users in healthcare, finance, or marketing due to privacy issues. Users do not want to share their sensitive data with service providers due to a lack of trust. Simply encrypting the data only protects them during storage and transmission. Researchers and industries are developing novel techniques known as privacy-preserving techniques to process the data in an encrypted domain to tackle the privacy issue. Homomorphic encryption plays a key role in developing privacy-preserving machine learning algorithms. While homomorphic properties exist in traditional cryptographic schemes such as RSA, this talk will focus on fully homomorphic encryption from lattice-based cryptography. We will also go through the state-of-the-art works, challenges and future trend in this domain.

Keynote Address 3



Dr. Sadeep Jayasumana
Senior Research Scientist at Google Research,
New York.

Sadeep Jayasumana is a Senior Research Scientist at Google Research, New York. His research interests are in the areas of computer vision, deep learning, and machine learning in general. Before joining Google, Sadeep has held research positions at Five AI, a UK-based self-driving car startup, and Man AHL, a London-based quantitative hedge fund. During his time in academia, Sadeep completed a Postdoc at the University of Oxford, and a PhD at the Australian National University - both in computer vision. He obtained his undergraduate degree from the Department of Electronic and Telecommunication Engineering, University of Moratuwa.

Keynote Title: "Advances in Deep Learning"

Abstract

Deep learning has become the key machine learning tool in various AI application areas such as computer vision, natural language processing, and speech recognition. Systems powered by deep learning are already in everyday use; examples are: image and voice recognition software on smartphones, recommendation systems on eCommerce websites, and language translation software. Even more exciting deep-learning-powered systems like self-driving cars are just around the corner.

Keynote Address 4

Professor Sunny Joseph Kalayathankal
Jyothi Engineering College, Thrissur, Kerala, India.

Prof. Sunny Joseph Kalayathankal received the MSc. degree from Kerala University , Kerala, India in 1986, BEd from Calicut University, Kerala in 1987, MPhil Kerala University in 1993 and Ph.D (Mathematics) degree in 2010 from Kerala University, MCA from Indira Gandhi National Open University, New Delhi, India in 2002, M.Tech IT from Karnataka State Open University in 2013 and Ph.D. in Computer Science under Bharathiar University, Coimbatore, India in 2018. He is currently working as a Principal (Professor and Dean of Research) Jyothi Engineering College Affiliated to APJ Abdul Kalam Technological University, Thrissur, Kerala India and has 34 years and 8 months of teaching and 16 years of research experience. He has published more than 84 papers in the areas of Fuzzy modelling and decision making, Graph theory and Applied Mathematics. He has served as Keynote and invited speaker in various National and International conferences. He is the reviewer of Iranian Journal of Fuzzy System, International Journal of Fuzzy system and Journal of Mathematical Modeling and Computer Simulation.

Keynote Title: "Fuzzy Modeling and Decision-Making Applications in Engineering Science"

Abstract

The thought process involved in the act of decision making is a complex array of streaming possibilities in which a person selects or discards information made available from diverse sources. In doing so one is led by a meaningful analysis of available information and optimal selection out of several apparently equi-efficient decisions. Since Zadeh (1965) published the fuzzy set theory as an extension of classic set theory, it has been widely used in many fields of application, such as pattern recognition, data analysis, system control, etc. The unique characteristic of this theory, in contrast to classic mathematics, is its operation on various membership functions (MF) instead of the crisp real values of the variables. Molodtsov (1999) initiated the concept of soft set theory as a new mathematical tool for dealing with uncertainties. Pabitra Kumar Maji et al. (2001) introduced fuzzy soft set theory which also deals with uncertainties.

Out of the several higher order fuzzy sets, intuitionistic fuzzy sets by Atanassov (1985) and Ordered intuitionistic fuzzy sets proposed by Kalayathanal et al. (2010) have been found to be highly useful to deal with vagueness. Intuitionistic fuzzy set is described by

two functions: a membership function and a non - membership function. We develop and apply similarity measures between ordered intuitionistic fuzzy sets to multiple attribute decision making (MADM) under fuzzy environment

Invited Speech

Mr. Rohan Fernando,
Associate Director, Specialised Solutions,
Acuity Knowledge Partners

A charted IT Professional and postgraduate in Enterprise Application Development with over 16 years of experience in enterprise application, data engineering, building analytics platforms, designing, programming and implementing applications (especially in Microsoft.NET technologies, such as .NET 4.0 framework, C#, ASP.NET, AJAX, WCF, WF, WPF and parallel computing with CUDA), Python, QlikView, SSRS-based enterprise reporting solutions, workflow-based applications and SharePoint-based content management and collaboration portals.

Currently working as Associate Director at Acuity Knowledge Partners, Rohan manages the company's data engineering and technology team.

Prior to joining Acuity, Rohan worked at Virtursa as a Senior Software Engineer. A member of British Computer Society, Rohan holds a Master of Science (Enterprise Application Development) from Sheffield Hallam University, UK, and a Bachelor of Science in Information Technology from Middlesex University, UK.

Title: "Rise of Machines in Capital Markets"

Programme Agenda

Day 1: 1st December 2021

09.00 AM – 12.00 PM	Workshop 1
Title:	"Spatial Data Analysis using Opensource Tools"
Resource Person:	Dr. RMKGSPB Koswatte Head, Department of Remote Sensing and GIS, Faculty of Geomatics, Sabaragamuwa University of Sri Lanka
12.00 PM – 01.00 PM	Lunch Break
01.00 PM – 02.00 PM	Workshop 2
Title:	"Artificial Intelligence in Healthcare - Concepts to Product Realization"
Resource Persons:	Mr. Keerthi Kodithuwakku, Efective Solutions (Pvt) Ltd., Sri Lanka Ms. Indeewari Chandrasekara, Efective Solutions (Pvt) Ltd., Sri Lanka Mr. Shashika Chamod, Efective Solutions (Pvt) Ltd., Sri Lanka
02.30 PM – 05.30 PM	Workshop 3
Title:	"SRE vs. DevOps"
Resource Persons:	Mr. Amalka Pathirage, Pearson (Pvt) Ltd., Sri Lanka Mr. Eranga Kodikara,Pearson (Pvt) Ltd., Sri Lanka Mr.Tharindu Dulaj Koggalahewa, Pearson (Pvt) Ltd., Sri Lanka

Day 2: 2nd December 2021

08.45 AM – 09.15 AM	Joining of Guests
09.15 AM – 09.20 AM	National Anthem
09.20 AM – 09.30 AM	University Corporate Video Presentation
09.30 AM – 09.45 AM	Welcome Address by Director, Information Technology Research Unit, University of Moratuwa, Sri Lanka
09.45 AM – 10.00 AM	Address by Dean, Faculty of Information Technology, University of Moratuwa, Sri Lanka
10.00 AM – 11.00 AM	Keynote Address 1 by Professor Jiang Liu, Waseda University, Tokyo, Japan
11.00 AM – 11.15 AM	Tea Break
11.15 AM – 12.35 PM	ICITR Technical Session 1 ICITR Technical Session 2
12.35 PM – 01.45 PM	Lunch Break
01.45 PM – 03.05 PM	ICITR Technical Session 3 ICITR Technical Session 4
03.05 PM – 03.30 PM	Tea Break
03.30 PM – 04.30 PM	Keynote Address 2 by Dr. Yogachandran Rahulamathavan, Loughborough University London, United Kingdom
04.30 PM – 05.50 PM	ICITR Technical Session 5 ICITR Technical Session 6
05.50 PM	End of the Conference Day 01

Day 3: 3rd December 2021

09.00 AM – 10.20 AM	ICITR Technical Session 7 ICITR Technical Session 8 ICITR Technical Session 9
09.00 AM – 10.40 AM	ICITR Technical Session 10
10.20 AM – 10.45 AM	Tea Break
10.45 AM – 11.45 AM	Keynote Address 3 by Dr. Sandeep Jayasumana, Senior Research Scientist at Google Research
11.45 AM – 12.45 PM	Lunch Break
12.45 PM – 01.45 PM	Invited Talk "Rise of Machines in Capital Markets" by Mr. Rohan Fernando, Acuity Knowledge Partners
01.45 PM – 02.45 PM	Keynote Address 4 by Professor Sunny Josseph Kalayathankal, Jyothi Engineering College, Thrissur, Kerala, India
02.45 PM – 03.15 PM	Tea Break
03.15 PM – 03.45 PM	Presentation of Awards and Vote of Thanks

Detailed Session Plan of ICITR 2021

Thursday, 2nd December 2021
ICITR Technical Session 1

Session Chair Dr. Menaka Ranasinghe, The Open University of Sri Lanka

Time 11:45 AM - 01:05 PM

Time	Title & Author (s)
11.45 AM – 12.05 PM	Exploring Unorthodox Predictors of Smartphone Addiction during the COVID-19 Outbreak *G H B A De Silva, T C Sandanayaka and M F M Firdhous*
12.05 PM – 12.25 PM	Automated Question and Answer Generating System for Educational Platforms *M Thiruvanantharajah, N Hangarangoda and S Rajapakshe*
12.25 PM – 12.45 PM	Machine Learning-Based Automated Tool to Detect Sinhala Hate Speech in Images *E Silva, M Nandathilaka, S Dalugoda, T Amarasinghe, S Ahangama and G T Weerasuriya*
12.45 PM – 01.05 PM	Heuristics-Based SQL Query Generation Engine *C Sugandhika and S Ahangama*

ICITR Technical Session 2

Session Chair Professor Jiang Liu, Waseda University, Japan.

Time 11:45 AM - 01:05 PM

Time	Title & Author (s)
11.45 AM – 12.05 PM	User Friendly Promotion Recommendation System Based on Location *P K A Lakshan, P H P A Chandima, H H N Perera and K P A K Pathirana*
12.05 PM – 12.25 PM	Thuryalankara: Artificial Intelligence Based Audio Plugin For Sri Lankan Percussion Instruments *P D C Fernando, B A N Fernando, I U Wanaguru, M A P A Perera, T Buddhika, N Kodagoda and D Ganegoda*
12.25 PM – 12.45 PM	How to pretrain an efficient cross-disciplinary language model: The ScilitBERT use case *Jean-Baptiste de la Broise, Nolwenn Bernard, Jean-Philippe Dubuc, Andrea Perlato and Bastien Latard*
12.45 PM – 01.05 PM	Vision Based Intelligent Shelf-Management System *H A M Priyanwada, K A D D Madhushan, C Liyanapathirana and L Rupasinghe*

ICITR Technical Session 3

Session Chair Mr. Saminda Premarathne, University of Moratuwa, Sri Lanka

Time 01:45 PM - 03:05 PM

Time	Title & Author (s)
01.45 PM – 02.05 PM	Convolutional Neural Network to Reproduce Selfie Images after Removing Supportive Hand *W M H I Weerakoon and R G N Meegama*
02.05 PM – 02.25 PM	Smart Photo Editor for Differently-abled People using Assistive Technology *A S Buddhika,* P K Wijesekera, D G H Kavindu, S D Dilshan, S S U Srimath and T A Kuruppu
02.25 PM – 02.45 PM	Kidland : An Augmented Reality-based approach for Smart Ordering for Toy Store *W M C D Wijayalath, R M T T Ranasinghe, S Kumari, M T H Thennakoon, H D Vithanage and S Chandrasiri*
02.45 PM – 03.05 PM	Web Based User-Friendly Graphical Interface to Control Robots with ROS Environment *D D Rajapaksha, M N M Nuhuman, S D Gunawardhana, A Sivalingam, M N M Hassan, S Rajapaksha and C Jayawardena*

ICITR Technical Session 4

Session Chair Dr. Thushari Silva, University of Moratuwa, Sri Lanka

Time 01:45 PM - 03:05 PM

Time	Title & Author (s)
01:45 PM - 02:05 PM	Ontology Based Fake News Detection for Sinhala Language *O Bandara, D Jayarathne, D Shashinika and L Ranathunga*
02:05 PM - 02:25 PM	Diagnostic Intervention for Mental Disorder *S Senanayake, C Karunanayaka, L Dananjaya, L Chamodya, S Kumari and S Chandrasiri*
02:25 PM - 02:45 PM	A Rule based Approach for Hemorrhage Detection in Digital Fundus Photographs *S C Munasingha, P Pathirana, K K Priyankara , R G Upasena and A Ikeda*
02:45 PM - 03:05 PM	A Data Driven Approach for Detection and Correction of Spelling Errors in Sinhala Essays *P M Samarasinghe, W B I Sewwandi, L Ranathunga and W A S N Wijetunge*

ICITR Technical Session 5

Session Chair Dr. Yogachandran Rahulamathavan, Loughborough University London, United Kingdom

Time 04:30 PM - 05:50 PM

Time	Title & Author (s)
04:30 PM - 04:50 PM	Development of Digital Storytelling Platform for Children based on Emotions *T Vijayakumaran, T Thavachelvam, A Gnaeswaran, T C Sandanayake, K A S N Sumathipala and K M S Bandara*
04:50 PM - 05:10 PM	Adapting MaryTTS for Synthesizing Sinhalese Speech to Communicate with Children *M A J A Lakmal, K A D G Methmini, D M H M Rupasinghe, D I Hettiarachchi, V Piyawardana, M Senarathna, S Reyal and K Pulasinghe*
05:10 PM - 05:30 PM	Fleet management with real-time data analytics *R P D T Rathnayaka, K V J P Ekanayake, H U W Rathnayake and H R Jayetileke*
05:30 PM - 05:50 PM	Cheating Detection in Browser-based Online Exams through Eye Gaze Tracking *N Dilini, A Senaratne, T Yasarathna, N Warnajith and L Seneviratne*

ICITR Technical Session 6

Session Chair Dr. M. F. M. Firdhous, University of Moratuwa, Sri Lanka

Time 04:30 PM - 05:50 PM

Time	Title & Author (s)
04:30 PM - 04:50 PM	Solve Manufacturer's Pallet Loading Problem (MPLP) with Practical Warehouse Constraints *K Gunawardena, A Wijayanayake and C Kavirathna*
04:50 PM - 05:10 PM	Design of a Novel Current Controlling Module for Functional Electrical Stimulation (FES) System *D R P Chamal, M I M Fernando, W P M W Kulathunga, K D Pathirana and N W Prins*
05:10 PM - 05:30 PM	Smart and Efficient Personal Driving Assistant Application *A Vethakulan, K R M A Nusry, B Washington, J Sangeethan, P Rathnayake and P S Bandara*
05:30 PM - 05:50 PM	Open, IoT powered Environmental Air Pollution Monitoring Framework for Traffic Management *M A L S K Manchanayaka, J P D Wijesekara, C Y Yang, C Premachandra, M F M Firdhous and B H Sudantha*

Thursday, 3rd December 2021
ICITR Technical Session 7

Session Chair	Dr. Upeksha Ganegoda, University of Moratuwa, Sri Lanka
Time	09:00 AM - 10:20 AM

Time	**Title & Author (s)**
09.00 AM – 09.20 AM	Computational Modelling of Synaptic Plasticity: A review of models, parameter estimation using deep learning, and stochasticity *K P S D Kumarapathirana, D Kulasiri, S Samarasinghe and J Liang*
09.20 AM – 09.40 AM	Determining Flood Risk Vulnerability Using Factor Analysis Approach *A W S P Karunarathne and I T S Piyatilake*
09.40 AM – 10.00 AM	Usage of Topic Modeling Method for High Dimensional Gene Expression Data Analysis *S P B M Senadheera and A R Weerasinghe*
10.00 AM – 10.20 AM	Classification of age-related biomechanical data based on kinematics gait analysis using K-means and Kohonen Maps *U Indumini and A Jayakody*

ICITR Technical Session 8

Session Chair	Prof. Chinthaka Premachandra, Shibaura Institute of Technology, Japan
Time	09:00 AM - 10:20 AM

Time	**Title & Author (s)**
09.00 AM – 09.20 AM	Digital Platform to Empower the Self-Employment in Sri Lanka *H C P Wickramasinghe, T D Thebuwana, G K H S Wijesinghe, U N Dissanayake, N Kodagoda and K Suriyawansa*
09.20 AM – 09.40 AM	Stress Management System For University Students In Sri Lanka *K G P R Chandrasiri, A A Chandrasena, L H C R D Silva, H W V O Jayasinghe, G T Dassanayake and O Seneweera*
09.40 AM – 10.00 AM	Ontology-Based Knowledge Modelling for Handling Criminal Law Cases in Sri Lanka *K Amarasena,U Weerasinghe, D Weththasinghe and T Silva*
10.00 AM – 10.20 AM	eKeth: A Machine Learning-Based Mobile Platform to Facilitate the Paddy Cultivation Process in Sri Lanka *J S A N W Premachandra and P P N V Kumara*

ICITR Technical Session 9

Session Chair	Dr. Kulani Mahadewa, University of Moratuwa, Sri Lanka
Time	09:00 AM - 10:20 AM

Time	**Title & Author (s)**
09.00 AM – 09.20 AM	Open Innovation Practices in Sri Lankan Tech-startups: a pilot study *N P Samarasinghe, T C Sandanayake and G D Samarasinghe*
09.20 AM – 09.40 AM	Novel Approach for Load Balancing in Mobile Cloud Computing *R A A I B Ranapana and K P N Jayasena*
09.40 AM – 10.00 AM	A Framework to Detect Sale Forecasting with Optimum Batch Size *R M S Saradha, M A Samadhi, I Manawadu and G U Ganegoda*
10.00 AM – 10.20 AM	GIS Powered an Automated Generic Flood Model for River Basins in Sri Lanka *M N L Bandara, H M R Premasiri and B H Sudantha*

ICITR Technical Session 10

Session Chair	Dr. Lochandaka Ranatunga, University of Moratuwa, Sri Lanka
Time	09:00 AM - 10:40 AM

Time	**Title & Author (s)**
09.00 AM – 09.20 AM	Image Breaking Method For Lung Isolation from Chest X-rays *C A Samarasinghe and G U Ganegoda*
09.20 AM – 09.40 AM	Performance Analysis for Different Optimizers on the CNN Model for COVID-19 Disease Prediction Based on Chest X-Ray Images *G H G S A D Dhanapala and S Sotheeswaran*
09.40 AM – 10.00 AM	Taxonomic Identification of Sri Lankan Freshwater Fish based on Advanced Feature Extraction Techniques *G D C H Semapala and T C Sandanayake*
10.00 AM – 10.20 AM	Detection of Suicide Ideation in Twitter using ANN *K Y D H T Yatapala and B T G S Kumara*
10.20 AM – 10.40 AM	IoT and Machine Learning Based Efficient Garbage Management System for Apartment Complex and Shopping Malls *M R M Rilf and J D Kanchana*

Abstracts of the Full-Papers of ICITR 2021

Exploring Unorthodox Predictors of Smartphone Addiction during the Covid-19 Outbreak

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Abstract—Smartphones became an integral part of household management and corporate management across all industries during the pandemic, resulting in high screen time that could lead to smartphone addiction. This study attempts to examine the relationship between socio-demographic factors in smartphone addiction among HRM professionals in Sri Lanka. Kwon's (2013) validated smartphone addiction survey was used to collect data from the identified subjects (n = 192), and descriptive analyzes and statistical crosstabs were used to infer the associations. The results show that Sex and Age category are strong predictors of smartphone addiction. Women over men tend to get addicted to smartphones. Age under 25 is highly addicted to smartphones, and age over 41 is less smartphone addict. The level of education is a moderately fair predictor of smartphone addiction. The higher the level of education, the higher the tendency to become addicted to smartphones. Marital status is not a good predictor of smartphone addiction in context, and there is no difference between being married or not of smartphone addiction. Perceived smartphone addiction is a good predictor of smartphone addiction. Those who think they are addicted are more likely to become addicted to smartphones, and vice versa.

Keywords— Smartphone Addiction, Socio-demographic Status, Perceived Smartphone Addiction, High Screen time, On-site to online spatial transformation

Automated Question and Answer Generating System for Educational Platforms

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Abstract—Learning through the web gets to be well known which encourages learners to learn any kind of stuff at any time from the internet assets. In exam preparing questions and answering is have moved into the technology world. In Many industries, more activities have begun to shift as a result of the increased changes brought about by the Covid-19 virus to people's usual livelihoods, and one significant component whose technologization has created concerns is education. This paper presents a novel system that has been introduced to improve the standards of instructing via virtual and non-virtual platforms by ensuring that both the educational staff and the students are provided with the same level of understanding of their education. The support system ensures that the students and educational staff are provided with an automatic question and answer generation mechanism which will thereby improve the quality of education by presenting a standardized method of preparing questions to the educational staff, while similarly providing a better opportunity to improve study methods for the students.

Keywords— automated question generation, automated answer generation, instructors, students

Machine Learning-Based Automated Tool to Detect Sinhala Hate Speech in Images

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Abstract—Social media platforms have emerged rapidly with technological advancements. Facebook, the most widely used social media platform has been the primary reason for the spread of hatred in Sri Lanka in the recent past. When a post with Sinhala hate content is reported on Facebook, it is translated to the English language before the review of the moderators. In most instances, the translated content has a different context compared to the original post. This results in concluding that the reported post does not violate the established policies and guidelines concerning hate content. Hence, an effective approach needs to be in place to address the aforementioned problem. This research project proposes a solution through an automated tool that is capable of detecting hate content presented in Sinhala phrases extracted from Facebook posts/memes. The tool accepts an image that contains Sinhala texts, extracts the text using a Convolutional Neural Network (CNN) model, preprocesses the text using Natural Language Processing (NLP) techniques, analyzes the preprocessed text to identify hate intensity level and finally classifies the text into four main domains named Political, Race, Religion and Gender using a text classification model.

Keywords—Hate content, Facebook, Sinhala language, Convolutional Neural Network, Natural Language Processing, Text classifier model

Heuristics-Based SQL Query Generation Engine

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Abstract—A database is one of the prime media to store data. Most of the time, relational databases are preferred over other databases due to their ability to represent complex relationships between data. Languages like Structured Query Language (SQL) are used to retrieve data stored in relational databases. Information stored in these databases is often accessed by naïve users who do not possess high competencies in technical database querying. Therefore, Natural Language Interfaces to Databases (NLIDB) are being developed to translate natural language into SQL queries and retrieve the corresponding database results. This paper proposes a novel NLIDB called SQL Query Generation Engine which has been developed using a heuristics-based approach. The system was tested with more than 200 natural language queries and has shown an overall accuracy of 93%.

Keywords—heuristics-based approach, naïve users, natural language query, NLIDB, NLP, relational database, SQL

User Friendly Promotion Recommendation System Based on Location

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Abstract—In recently merchants provide number of offers related to their product to keep better engagement with their users and magnetize more incipient users to their shops. By now, most of the merchants incline to provide offers because of this reason. When providing offers are increased, users can reach more and more offers which may useful and not useful them. Hence, there is indispensability to have a method to filter out offers predicted on user preferences. This paper describes a proposal to develop a location-based notification offer system considering user preferences. Proposed solution mainly focuses about not only users but additionally merchants. When consider about the merchants' side, proposed system analyzes the user behaviors for offer and give an overview and suggestions about offers. Merchants have a chance to get overview conception about how users interact with offers and according to that, good decisions can be taken when provide offers. Normally merchants put their offers in their social media pages. Merchants don't like to put offer details by themselves. Hence, system filters out offer details from social media. When look into users' side, users want to filter out offers which they may like. Normally, users don't like to get all notifications from all offers.Further,it is good to have system which can show searching results also according to the user's preferences rather provide popular offers. Proposed solution has considered about user location based send offer notifications. With all kinds of new features, proposed solution is endeavored to provide better user-friendly system to get offer notifications. Proposed solution gets the utilization of modern technologies like image processing, natural language processing, Deep Learning and Machine learning techniques to build this smart offer notification system.

Keywords— Machine learning, Deep Learning, Natural Language Processing, Image Processing, Recommendation, User Preferences, Location based offer notification

Thuryalankara: Artificial Intelligence Based Audio Plugin For Sri Lankan Percussion Instruments

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Abstract—Sri Lankan music is yet to prove its musical prowess by incorporating artificial intelligence tools, therefore, this research introduces a novel invention, an automated audio plugin for music producers, so the process of creating, mixing, mastering, and producing music is easier. To achieve this, the research introduces a Variational AutoEncoder (VAE) machine learning model to create and generate music, an artificial intelligence (AI) system that can automate the mastering process. This research also introduces an innovative component, a virtual instrumentation tool using MIDI technology for the Sri Lankan percussion instruments that allow users to play the instrument virtually using a MIDI keyboard, and alongside it, a preset beat generator that automatically maintain tempo consistency. Thuryalankara was able to receive a collective average of 80% accuracy rate exceeding the predicted accuracy rate of 65% from the software benchmarking test and the physical survey conducted with music producers. Finally, with the inclusion of powerful tools like this, the ultimate objective of this research is to take the Sri Lankan instruments to the international level where any producer from little to plenty experience is able to use this plugin to enhance their musical production.

Keywords—Audio plugin, Sri Lankan music, Machine Learning, Virtual Instrumentation, Mix and Master

How to pretrain an efficient cross-disciplinary language model: The ScilitBERT use case

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Abstract—Transformer based models are widely used in various text processing tasks, such as classification, named entity recognition. The representation of scientific texts is a complicated task, and the utilization of general English BERT models for this task is suboptimal. We observe the lack of models for multidisciplinary academic texts representation, and on a broader scale, a lack of specialized models pretrained on specific domains, for which general English BERT models are suboptimal. This paper introduces ScilitBERT, a BERT model pretrained on an inclusive cross-disciplinary academic corpus. ScilitBERT is half as deep as RoBERTa, and has a much lower pretraining computation cost. ScilitBERT obtains at least 96% of RoBERTa's accuracy on two academic domain downstream tasks. The presented cross-disciplinary academic model has been publicly released1. The results obtained show that for domains that use a technolect and have a sizeable amount of raw text data; the pretraining of dedicated models should be considered and favored.

Keywords—language models; clustering, classification, and association rules; benchmarking; text analysis

Vision Based Intelligent Shelf-Management System

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Abstract—Currently supermarkets are more popular, and the local stores are leaving the competition. When people go to supermarkets, they find various items stocked on seemingly unlimited shelves. Supermarket shelves needed to be filled with the items accordingly. The most common problems in the supermarkets are identifying the empty shelves, on-shelf availability, and future sales. The labors cannot always track the empty shelves and on shelf availability levels due to their workloads. Moreover, it is a time-consuming method for the labors which can affect the customer satisfaction and business profit. Every month, supermarkets buy the required number of products from related manufacturing companies by analyzing the previously purchased products and their sales. This is usually done manually by managing excel sheets which is also time consuming and not reliable. Especially during the seasonal times or pandemic situations they cannot use the manual method which must also be done as fast as possible. Therefore, this system can be used to assist in empty shelf detection, percentage of on-shelf availability and in the prediction of future sales. The implementation of on-shelves percentage detection service is done using machine learning. Machine learning processes are carried out for implementing the necessary functionalities and algorithms. Initially, the camera captures clear and real time images regularly. Then the system processes and detects the image similar to the threshold percentage or detect the empty shelves. When the system detects the threshold percentage or empty shelves, the system will provide an alert to the labors. The Implementation of the predicting the future supply and demands is done using time series analysis using several existing machine learning algorithms by utilizing historical data. In this research the prediction of future sales and demand in the supermarkets is done by considering the customers' behavior, the variety of product groups they buy and seasonal changes. These predictions are made on the assumption of a constant per capital supply of products and demand in our system.

Keywords—camera captured images, empty shelf detection, on shelf availability, prediction of future sales, machine learning, time series analysis

Convolutional Neural Network to Reproduce Selfie Images after Removing Supportive Hand

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Abstract— Although selfie images have become popular among smartphone users, the supportive hand that holds the camera ruins the beauty of the picture. The captured images will look more realistic if the supporting hand is removed from the original image. This paper proposes a machine learning and a computer vision based approach to remove the supportive hand and reconstruct the removed hand that matches with the person who took the picture. A fully convolution neural network (FCN) and a partial convolution neural network (PConv Net) have been used to accomplish this task. Results indicate that the FCN gives 94.58% validation accuracy with the PConv Net is utilized to train the model for background matching and hand creation. The FCN and PCovNet models minimize validation lose up to 1.73 and 1.95, respectively.

Keywords— fully convolutional network, partially convolutional neural network, machine learning

Kidland : An Augmented Reality-based approach for Smart Ordering for Toy Store

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Abstract—Augmented reality (AR) is an iconic topic that can be applied in different domains in modern world technology. With the rapid development of technologies, eCommerce (Online Shopping) has become closer to human life. As a result, AR was started implemented with eCommerce platforms by the developers. With the busy lives and the pandemic situation, people are limited to visiting toy stores while providing a solution. An AR-based virtual toy store is proposed with 3D Toy generation for visualizing selected toys, a Virtual tour for enhancing the remote virtual shopping experience, and an Indoor navigation system visualizing the path within large scale shopping malls are new features of the proposed system. The majority of the existing eCommerce platforms are missing image search features. As a solution, "KidLand" has implemented an image search engine, suggesting add-on-related items and nearest branches using machine learning algorithms. An intelligent chatbot uses a reinforcement learning algorithm and Natural Language Understanding (NLU) to give possible solutions regarding the toy store. As a solution to the language literacy problem, developed a chatbot that can chat both English and Sinhala languages. "Kidland" was developed to provide the users the next level of shopping experience with attractive features of AR technology with marketing and use advanced technologies overcoming the issues of ordinary eCommerce platforms. In Sri Lanka, this system has been identified as a solution for the issues with ordinary shopping platforms.

Keywords—augmented reality, virtual tour, indoor navigation, mobile application, machine learning, NLP

Smart Photo Editor for Differently-abled People using Assistive Technology

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Abstract—Differently-abled people are significant minority groups, have many limitations to live everyday life, are starved of services, and are mostly ignored by society due to many types of disabilities. This problem may lead to massive frustrations and disappointments among themselves. Assistive technology may easily fill this gap with the enhanced different aiding applications. It helped in various ways, such as helping them to interact, communicate with people and allow people to do basic daily tasks by themselves. Nevertheless, there were fewer applications developed to entertain their leisure time. Therefore, the proposed solution provides a Smart Photo Editor, a handfree mobile application with attractive photo editing features. This application focused on people having hand motor disabilities. Users can interact with the application using simple head gestures, eye gaze, and eye blinks. Head gestures and eye blinks are used as commands for application operations, while eye gaze is used for cursor enabling, which is helpful for navigation on application screens. Machine Learning (ML) and image processing techniques are used for real-time gesture recognition and eye gaze detection, using the input video frames captured by the inbuilt front-facing camera of the mobile phone. Moreover, in addition to the image processing techniques, Mask Recurrent-Convolutional Neural Network (R-CNN) is used to develop enhanced image adjusting features and customization of backgrounds based on object detection.

Keywords—Assistive Technology, Gesture Recognition, Eye Gaze Detection, Machine Learning, Image Processing

Web Based User-Friendly Graphical Interface to Control Robots with ROS Environment

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Abstract—We have proposed a web-based approach to controlling robots in simulation. This web application will provide a simple user interface to demonstrate the various capabilities of robots. It is intended to be used by beginners who are interested in working with the Robot Operating System(ROS). The evaluation of the system is specifically achieved with Turtlebot3 waffle pi model. All the robot's functionalities are displayed in a simulated environment so users do not need an actual robot or direct access to ROS. The application covers various manual and autonomous functionalities of the robot while trying to be as interactive as possible. Each interface provides an overview of the function and basic implementation details. The goal of the proposed system is to make robotics accessible to anyone with web access and to mitigate the need to have a specific computer environment and knowledge in programming to access Robotics.

Ontology Based Fake News Detection for Sinhala Language

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Abstract—With the current trend in extensive use of internet technologies, people are accustomed to a life of being online. Similar phenomena apply for news awareness as well where social media has become one of the main sources of information of these tech-savvy people. Even though it gives easy access to information, there is a problem with the trustworthiness and authenticity of the news posted on social media. As such, fake news detection in social media platforms has become an active research area. Despite that, for the Sinhala language, there are only a few attempts carried out to detect fake news. With this background, this research project has come up with a novel idea of ontology-based fake news detection for news published using Sinhala language. We believe that content-based fake news identification is the most appropriate method to assess the truthiness of a news article and our system was able to give promising results in detecting fake news.

Keywords—ontology-based information extraction, named entity recognition, fake news, natural language processing.

A Data Driven Approach for Detection and Correction of Spelling Errors in Sinhala Essays

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Abstract—This paper proposes novel approaches for checking and correcting spelling errors in Sinhala essays written by candidates of grade five scholarship examination. They don't have a proper mechanism to identify their spelling mistakes in essays by themselves. Spelling errors by such students may occur due to the violation of spelling rules, missing or adding of letters, missing modifiers, inaccurate spelling in a similar structure, and similar sound letters]. To mitigate such challenges, the Sinhala corpus file has been developed to identify the accurate and inaccurate spellings of the written words. The role of this application is to identify the correct and incorrect words which are entered by the user and generate the most correct words as suggestions for the incorrect words. This paper introduces three new novel approaches to detect the correctly spelled words in Sinhala essays namely object word checker method, suffixes checker method and similar word checker method. With addition to that this paper discusses three approaches to generate accurate suggestions including one novel approach. When evaluating the accuracy of the spelling error detection and correction module the overall results for precision, recall, and the f -measure were recorded as 83.05%, 85.57%, and 86.62% respectively.

Keywords—Sinhala spelling, correction, detection, suggestion generation

Diagnostic Intervention for Mental Disorder

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Abstract—Mental health is one of the essential factors in the topic of healthcare and wellbeing. However, mental health disorders could cause severe damage, even loss of life to the person or the surroundings, if mental health disorders were not identified and appropriately cured. Unfortunately, though there is good help there, some people have a hard time detecting whether they are suffering from mental health disorders or not. In this study, the team proposes a system to detect mental health issues using facial emotion recognition (FER), sleeping patterns, social media web scraping, and heart rate. The intention is to give an accurate prediction of the mental health status of a person using these threes nodes.

Keywords—Mental health, depression, heart rate, facial emotion recognition, sleeping patterns, social media web scraping

A Rule based Approach for Hemorrhage Detection in Digital Fundus Photographs

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Abstract— Hemorrhages are one of the earliest signs of Diabetic Retinopathy, hence accurate detection of hemorrhages is crucial in an automated DR detection system. In this paper, a novel and robust rule based methodology for automated detection of hemorrhages is proposed. We present an ensemble technique for hemorrhage classification by incorporating size-based classification, color-statistic-based classification, and shape-based classification along with a novel dual step filtering approach for candidate detection. Finally, we present an experimental study carried out on DIARETDB database using the proposed method to detect and segment hemorrhages in retinal images.

Keywords— Diabetic Retinopathy, Hemorrhage, Image Processing, Segmentation, Rule-based Classification

Development of Digital Storytelling Platform for Children based on Emotions

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Abstract—Storytelling is one of the means to make Gen Alpha children attractive to books. This is becoming a challenging task for parents, as they have to spend time telling stories to children. This research proposed a system that can emotionally tell stories as a human storyteller tells stories with twists and suspense. This research involves the implementation of technologies related to Natural Language Processing and Deep Learning, especially the inclusion of Convolutional Neural Networks, Transformers. Camera images of the storybook are the input for optical character recognition (OCR) of the Storybook. Here, various complex algorithms are used throughout the processes of optical character recognition (OCR), sentence-level contextual emotion recognition(CER), and emotional text to speech(TTS) synthesis to implement the Emotional digital storyteller. In addition, immense testing is carried out to explore the effectiveness and characteristics of the implemented model. We achieve 75% and 72.09% accuracy in OCR and CER respectively and MOS values of 3.85 and 1.65 in neutral and emotional TTS respectively. The experiment results show that each model performs well in the children's domain, specifically storytelling books.

Keywords—Children emotion recognition, Storytelling, Text detection, Text to speech

Adapting MaryTTS for Synthesizing Sinhalese Speech to Communicate with Children

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Abstract—The majority of the Sri Lankan population speak Sinhala, which is also the country's mother tongue. Sinhala is a difficult language to learn by children aged between 1-6 years when compared to other languages. Text to speech system is popular among children who have difficulties with reading, especially those who struggle with decoding. By presenting the words auditorily, the child can focus on the meaning of words instead of spending all their brainpower trying to sound out the words. In Sri Lanka, however, computer systems based on the Sinhala language especially for children are extremely rare. In this situation having a Sinhala text-to-speech technology for communicating with children is a helpful option. Intelligibility should be considered deeply in this system because this is specific for children. Recordings of a native Sinhalese speaker were used to synthesize a natural-sounding voice, rather than a robotic voice. This paper proposes an approach of implementing a Sinhalese text-to-speech system for communicating with children using unit selection and HMM-based mechanisms in the MaryTTS framework. Although a work in progress, the intermediate findings have been presented.

Keywords—text-to-speech, Sinhala language, children, unit selection, HMM-based, MaryTTS

Fleet management with real-time data analytics

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Abstract—Significant effort has to be devoted to surviving the businesses relying on fleet vehicles in the year 2020 and ahead as the novel coronavirus (COVID-19) epidemic became pandemic. Executing profitable business while keeping the staff safe and productive is a critical challenge to deal with. To find a solution, we focus on driver management out of major functions in fleet management such as vehicle, driver, and operation management. We were unable to identify a study conducted to capture real-time data on a ride in a fleet. Therefore, to fill that gap we implemented a cost-effective real-time Fleet Management System (FMS) using data analytics with the use of ESP32 SIM800L with reprogrammable capabilities. Fleet can use this system to monitor real-time data on vehicle location, remaining time to the destination, vehicle speed, and distance traveled. Moreover, the system can be personalized as it has reprogrammable features to be enabled or disabled based on the customer's preference. Once the data is captured through the Global Positioning System (GPS) receiver, data will be transmitted via General Packet Radio Service (GPRS) to two remote servers. One server is hosted locally with SQL and where the other is hosted in a cloud environment with a Firebase realtime database. The vehicle location is tracked using GPS. For fast data transfer, 3G Global System for Mobile communications (GSM) with ESP32 800L microprocessor was used. A web-based graphical user interface is developed to analyse and present the transmitted data. Vehicle information can be viewed and located on the web application in form of google maps. Real-time data analytics is used with Firebase's real-time database. Furthermore, Short Message Service (SMS) facility is made available for the driver to communicate with configured mobile numbers

Keywords—ESP32 800L, fleet management, GPS, GPRS, IoT

Cheating Detection in Browser-based Online Exams through Eye Gaze Tracking

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Abstract—Eye-tracking can detect and examine human visual attention, emotional conditions, latent cognitive processes such as efforts to recall a concept or the fear of running out of time, and so on. Hence, we can use eye-tracking to identify deviant behavior patterns in learning and problem-solving. At present, given the existence of a global pandemic, online exams are widely used by educational institutions to evaluate students' performance. However, identifying cheating is challenging due to the absence of a human (invigilator) monitoring students' behavior as done in exams held in a physical location. In an online environment, students' behavior, and attempts to cheat, can only be captured via a computer, thus requiring a mechanism for online proctoring with capabilities for cheating detection. In this research paper, we present a browser based cheating detection approach in online examinations through eye gaze tracking. We developed a browser plugin to track the eye gaze movements through the in-built web camera. Using the plugin, we generate an eye gaze dataset while a student faces an online examination. We then process and analyze this dataset to detect any misbehavior during an online examination. The underlying research work of this paper identifies different eye gaze patterns during online examinations and present a cheating detection mechanism. For anomaly detection in the eye gaze data, we use a One-Class Support Vector Machine (OCSVM). We then use these identified anomalies to predict cheating behaviors of the test takers. The given approach can be used for any web-based quiz examination such as academic institutions' exams, company recruitment exams, and overseas testing exams to detect any anomalous behaviors of the test takers during the examination period. The given eye tracking approach can also be applied to other research domains such as online gaming, and web usability studies to capture information related to user behaviors.

Keywords—Online proctoring, eye tracking, one-class support vector machine, anomaly detection, unsupervised outlier detection.

Solve Manufacturer's Pallet Loading Problem (MPLP) with Practical Warehouse Constraints

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Abstract—This study presents a two-phase algorithm for solving the Manufacturer's Pallet Loading Problem (MPLP) while considering overhang and stability constraints using a block approach. The MPLP involves determining a loading pattern that can load the most identical rectangular boxes onto a larger rectangular pallet. The proposed model is developed to obtain the maximum number of boxes that could be loaded onto a layer considering and without considering the overhang according to eight predetermined block arrangements (BAs) in the first phase. Then, the obtained overhang solutions are checked against the stability constraint in the second phase. Finally, the maximum number of boxes per layer is determined based on the results from the two phases. The validity and the performance of the proposed algorithm have been tested on available datasets in the literature. The proposed algorithm increased the number of boxes per layer; one to six boxes while considering overhang and stability, improving the pallet area utilization by 2.5% up to 14.3% for the tested datasets.

Keywords—Manufacturer's Pallet Loading Problem (MPLP), overhang, stability, heuristic algorithm

Design of a Novel Current Controlling Module for Functional Electrical Stimulation (FES) System

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Abstract—Functional electrical stimulation (FES) is widely used in rehabilitative therapies such as restoration of motor function for post-stroke and other types of paralysis. Here we present the design of an FES current controlling module which can be directly connected with micro-controllers to provide repetitive rehabilitation therapies. The key features in this module are the ability to generate customized pulse trains, interfacing with the computer, and low cost. The results show that the output current is independent of the load and the current can be controlled 0 – 25 mA at 40 Hz frequency.

Keywords—Functional electrical stimulation (FES), Rehabilitation, Howland constant current pump.

Smart and Efficient Personal Driving Assistant Application

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Abstract—Vehicle users are rising all around the world. As a result, new issues emerge in the modern world on a daily basis. According to the Sri Lankan Department of Motor Traffic's website's statistics, motor car's population grew from 756,856 to 875,864 in Sri Lanka from 2017 to 2019. With the increasing of vehicle's population, number of accidents and deaths are also getting increased because most of the drivers are not abiding the road signs properly. According to our study, we identified the key difficulties that the drivers are facing and they are, negligence of road signs and drowsiness, fines and accidents caused by the drowsiness, forgetting to visit locations scheduled, and locating parking spaces in emergency situations are some of them. As a result, we intend to address these concerns in a prudent manner with Artificial Intelligence, Machine Learning, Image Processing, Convolutional Neural networks and deep learning techniques. So, this new application will aid to the drivers to minimize their difficulties. The sole of this research relies on the Smart phone that embeds a mobile application which accompanies the individual functionalities. Additionally, by using External cameras some data will be collected in realtime for tracking the vehicle's current location, detecting driver's drowsiness level, and alerting purposes. The location tracking and finding the available parking slots, detecting traffic signs and all the alerts will be displayed through the mobile application which is easily maintainable with voice, real-time and of high performance with a friendly user interface with level of high accuracy.

Keywords—Artificial Intelligence, Machine Learning, Geo positioning system, Voice Assistant, Artificial Neural Network, Text to speech

Open IoT powered Environmental Air Pollution Monitoring Framework for Traffic Management

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Abstract—An IoT enabled Environmental Air Pollution Monitoring System has been developed using open technologies stack including open hardware, open software, and open standards and it can detect and measure the concentrations of major air pollutant gases.. This system measures concentrations of air pollutant gases such as CO, NO2, SO2 and O3 using gas sensor modules. The system was developed to comply with IEEE 1451 standard, where the Smart Transducer Interface Module (STIM) was implemented using the Arduino Mega controller. Network Capable Application Processor (NCAP) was implemented using a NodeMCU and ATmega328P controller which is connected to the STIM via the Transducer Independent Interface (TII). In the EAPMS, the STIM measures the concentrations of pollutant gases and converts into digital data when a request is made by the NCAP. Gas concentration levels and averaged to 10 min intervals would be sent to central server with the time stamp and data quality index. For the implementation of fully open framework data is free and anyone can access data and could be used with quality index. A model for the prediction of air pollutant is being developed and after implementing the model predicted and current information can be used to determine the best path for travelers not only considering the traffic data but also the pollutant levels of the area.

Keywords— IoT, air pollution monitoring, gas sensors, IEEE 1451 standards, smart transducers, STIM, electronic data sheet, traffic data, Arduino, NodeMCU

Computational Modelling of Synaptic Plasticity: A review of models, parameter estimation using deep learning, and stochasticity

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Abstract—It is imperative to understand the human memory formation and impairment to treat dementia effectively. There is ample scientific evidence that memory formation is strongly correlated to synaptic connections. Synaptic plasticity reflects the strength of these connections and is strongly related to memory formation and impairment. The complexity in the signalling pathways and interactions among proteins demands a systemic approach to study synaptic plasticity. Hence systems biology approaches are used in computational neuroscience. In this paper, we review the key computational models related to synaptic plasticity, the use of deep learning in parameter estimation, and the incorporation of epistemic stochasticity in the models.

Keywords—synaptic plasticity, synaptic transmission, memory formation, computational modelling, stochastic modelling, parameter estimation

Determining Flood Risk Vulnerability Using Factor Analysis Approach

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Abstract—Floods are becoming a frequent natural disaster in Sri Lanka. Although it is an uncontrollable natural event, it is essential to pay attention in necessary policy making in order to control floods in the future. Therefore, this study targets to develop a framework to identify the high risk areas in Sri Lanka. This provides useful information to the government as well as the policymakers to take necessary preparedness, prevention, and awareness actions to lessen the risk from floods. This study uses principal component analysis (PCA) to explore the flood situation in Sri Lanka and to rank the main regions according to the risk level by considering flood risk and controlling factors. Twelve factors including both flood risk and controlling indicators are identified based on prior literatures and then the original data set is constructed. With the aid of the PCA method, four principal components are identified, and they are human induced factor, natural induced factor, human induced controlling factor, and natural induced controlling factor. Based on the weights of the principal components a comprehensive score is derived. Finally, the main regions are ranked using the comprehensive scores. The results reveal that Rathnapura, Kalutara, Colombo, Kurunegala and Matara regions have a high-risk chance of having floods.

Keywords—Floods, Principal Component Analysis, Rank

Usage of Topic Modeling Method for High Dimensional Gene Expression Data Analysis

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Abstract—Gene expression data analysis is a major area in biological system interpretation. Since, gene expression data have large numbers of variables, high dimensional clustering methods are required for analysis. The objectives of this study were to understand the effectiveness of different clustering methods in gene expression data analysis based on biological relatedness and study of the advantages and disadvantages of different clustering strategies in gene expression analysis. The data was obtained from the GSE19830 dataset and the brain tumor data (TCGA project). To test the hard clustering, hierarchical clustering and fuzzy clustering, the K-means algorithm, HClust and topic modeling were used respectively. Prior knowledge about the dataset was required to define the number of clusters (K). Initially, the GSE19830 (Brain, Lung, Liver tissue mixture) dataset was used for developing the clusters. All models clustered the observations similar to the physical tags in the dataset. Secondly, Clustering methods were developed with the brain tumor dataset consisting of 202 samples (four specified physically categorized tumors). According to hierarchical clustering and topic modeling, when analyzing similar tissues, gene expression tumor subtypes (clusters) were not aligned with physical categorization. Finally, 81 cancer genes were filtered and generated a topic model. In order to understand the biological relevance of the final model, Reactome and PCViz tools were used. Reactome results supported topics developed from topic modeling. According to the results, in high dimensional data analysis, topic modeling was found to be a promising approach for gene expression based clustering while K-means was found to be inappropriate for gene clustering.

Keywords—Topic modeling, clustering, gene expression

Classification of age-related biomechanical data based on kinematics gait analysis using K-means and Kohonen Maps

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Abstract—Monitoring gait characteristics over time proved that it is very useful in the early diagnosis of diseases and their complexities. Most recently, the analysis of gait has been used to differentiate one individual from others and is used for the purpose of biometric identification. A sophistication of observational analysis is the filming of the individual's gait, allowing the specialist the possibility of repeating the observation several times and comparing the situation before and after treatment. These conventional methods often do not have a high precision index, since the results depend exclusively on the knowledge and skill of the doctor, sometimes making the conclusion subjective. Due to the complexity of that evaluation, a machine learning algorithm can be used to cluster the gait patterns. Kohonen Maps (KM) and k-means clustering have been combined to cluster the gait parameters according to the age groups to identify the principal gait characteristics which are affected the locomotion. 180 gait data which have been gained through the inertial measurement unit (IMU) have been used to analyze the results. The proposed algorithm is showing low computational cost and time which is more efficient. The algorithm has proved robust enough to achieve good accuracy rates in classification between groups with little apparent difference. The results suggest the general importance of Cadence. As well it is noted that Cadence is the determining factor in all experiments that reached rates above 80%. These results provide clues for the health professionals to identify and evaluate the difficulties of walking patterns of patients according to the age and greater efficiency in the process, supporting the assessment of gait disorders.

Keywords—Kohonen Maps, K-means cluster analysis, Kinematics, Machine Learning, Gait analysis, Cadence

Digital Platform to Empower the Self-Employment in Sri Lanka

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Abstract— Unemployment is a huge problem around the world because a lack of job opportunities. People are unable to find the job opportunities according to their preferences and qualifications. As a solution for this, many countries are attempting to empower self-employment. Most of current world problems have been solved using modern technologies. Therefore, the development of self-employment also can be achieved through modern technology. The objective of our proposed platform, HIRELANCER, is empowering selfemployment using modern technologies. HIRELANCER is bringing the consumers, service providers, and suppliers into the same platform. HIRELANCER will consist of innovative features that go beyond comparatively to other platforms such as an advanced mechanism to find best suitable service providers/suppliers for the service, handling the virtual frontdesk, cost estimation for the services prior to contacting a service provider, and advanced facility to find a suitable career path for the people who are seeking career guidance. This research paper discusses how the innovative features of HIRELANCER will be beneficial for consumers, service providers, and suppliers and ultimately achieve our main objective, which is empowering self-employment in Sri Lanka.

Keywords—Self-employment, HIRELANCER, Service providers, Suppliers, Consumers, Virtual front desk, Cost estimation, Career guidance

Stress Management System For University Students In Sri Lanka

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Abstract—Stress, if defines naively, is the body's response to pressure. Sri Lanka is a South Asian country where mental health is not given a much of a concern comparing with the Western and European countries. The Mental Health Foundation stated that some stress responses can be managed, and some can be useful but too much stress can cause negative effects and long-term stress may affect human's physical and mental health in advance [1] . According to the statistics of the World Health Organization (WHO) 5%-10% of the Sri Lanka population suffer from mental health problems which needs the attention of the professionals [2] . The present case study aims at the efficient and effective management of stress of University Undergraduates of Sri Lanka who can be a victim of stress due to several reasons. The proposed system aims to help the university undergraduates by providing them with a mobile application which collects and calculates the current stress levels and stress scores of undergraduates using different techniques and suggesting the stress relieving activities for that specific stress level via a recommendation system which contains multiple stress relieving activities which can be used to cater with different stress levels.

Keywords—stress, undergraduates, health, stress relieving activities.

Ontology-Based Knowledge Modelling for Handling Criminal Law Cases in Sri Lanka

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Abstract— Law can be considered as one of the required fields, which controls the behaviour of people within the society to a greater extent. In most legal systems, constitutions, legislation, case laws etc., are documented in natural language. Lawyers, law students and other related parties who need to access these legal documents for a specific legal case encounter the difficulty of extracting only the relevant data from these documents. Systems to manage criminal cases and facilitate extracting crucial facts regarding past cases are rare in practice. On the other hand, some systems which focus on general document retrieval utilize traditional classification techniques to facilitate document retrieval. Such a system overlooked domain-specific attributes such as dynamic knowledge updates for knowledge retrieval. To address this deficiency, an ontology-based knowledge modelling system is proposed to automatically identify and extract the necessary information based on the legal cases provided.

Keywords—dynamic ontology, ontology-based information extraction, self-populating ontology, Long Short-Term Memory (LSTM), topic modelling, Latent Semantic Analysis (LSA)

eKeth: A Machine Learning-Based Mobile Platform to Facilitate the Paddy Cultivation Process in Sri Lanka

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Abstract— Agriculture is a significant source of human survival and it accounts for the socio-economic growth in many developing countries including Sri Lanka. Paddy Cultivation occupies a remarkable place in Sri Lankan agricultural sector. Unpredictable climatic change has become a critical issue for paddy farmers while unawareness on pest, diseases, new technologies, etc. have also adversely affected Paddy Cultivation productivity. As a solution, the focus on the requirement of accurate weather predictions and timely access to the information for decision-making in Paddy Cultivation is highly progressive. This study introduces eKeth: a mobile platform that provides proper guidance for Sri Lankan paddy farmers through allowing timely access to data enhanced with machine learning. A weather prediction model based on machine learning has been developed to recommend the most suitable days for each farming task in paddy cultivation. The application includes several other features integrated with this machine learning model. Farmers can directly reach help from agriculture experts by posting a query on pest and disease-based issues. Fertilizer management feature allows calculating the amount of fertilizers upon different paddy types and growth stages. Buy and sell feature integrated with this mobile solution guide farmers on newly available machineries and the places where they can make purchases. Farmers can stay updated with the latest agriculture news though the news module while maintaining communications with other farmers and agriculture experts through the community forum empowered by this application. Machine Learning Model used in weather prediction achieved 89% accuracy for Random Forest. Statistical analysis of the user testing results recognizes that the system has been able to achieve a higher user satisfaction.

Keywords—Agriculture, Paddy Cultivation, Machine Learning, Mobile Development

Open Innovation Practices in Sri Lankan Techstartups: a pilot study

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Abstract— Tech-startups are vital entities in a business context, which are contributing to the economic and social development of a country. Tech-startups are identified as a booming industry segment in Sri Lanka that involves innovative solution development. Innovativeness is an unavoidable concept in today's business world because innovativeness has become a competitive advantage in each industry. In terms of innovations, there are open and closed innovations. Open innovation is the most attentive topic in the innovation field and in the global context also this field is still emerging. The open innovation perspective in the Sri Lankan context is having much more avenues to explore within many industries. This pilot study is completely focused on identifying the open innovation practices in the Sri Lankan tech-startups; to get an understanding of the current situation of Sri Lankan tech-startups in open innovation perspective. The study was conducted to do a situational analysis of open innovation practices while interviewing the key personalities of Sri Lankan tech-startups including CEOs, founders and co-founders of the tech-startups. The interviews were conducted in distance mode and each interview has taken 20 to 25 minutes. As a pilot study, the findings were really interesting and the findings of the study will be used in future studies for the uplifting the open innovation practices in Sri Lankan tech-startup culture.

Keywords—Innovations, Inside-out Open Innovation practices, Outside-in Open Innovation Practices, Tech-startups

Framework to Detect Sale Forecasting with Optimum Batch Size

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Abstract— Today, sales forecasting plays a key role for each business. To maintain the sales process successfully, every manufacture focus on retaining optimum production batch size. Therefore, this study aims to develop a framework to detect sale forecasting with optimum batch size. This work focuses on predict future sales and optimum production batch size by using different machine learning techniques and trying to determine the best algorithm suited to the problem. Here, Auto-Regressive Integrated Moving Average (ARIMA) model is used to predict future sales and Artificial Neural Network (ANN) model is developed to determine the optimum level of production as a function of product unit, setup cost, and holding cost in our approach and have found these models have better result than other machine learning models.

Keywords— sales forecasting, auto-regressive integrated moving average, optimum batch size, artificial neutral network

GIS Powered an Automated Generic Flood Model for River Basins in Sri Lanka

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Abstract— Flood is the most common and deadliest form of disaster that affects lives and properties all around the world. Predicting natural disasters is very complex due to the lack of proper methods and resources in countries like Sri Lanka. But if there is an efficient prediction system it helps to save not only lives but the environment and infrastructure too. Therefore, the aim of this study is to pave the pathway to build an efficient and effective flood prediction system through analysing available flood modelling techniques and their applications to find their strengths and weaknesses. Then the result of the study could be used to put the foundation for the main requirement of building the system to predict natural disasters. A generic model was developed to take any DEM data and a pour point feature class layer for the specific DEM to generate outputs based on other variables that could be input to the model. It gave model calibration capability as well as significant time saving on tasks. The use of special tools like the 'Parse Path' tool in ArcGIS Pro, gave the capability to name output easily and quickly. And it also made saving so efficient because it automatically saves all the results to the file path of the DEM. Due to these factors, when it starts raining in the upper catchment area, could forecast due inundation area in minutes. Including the GIS technology could improve the data quality and availability while incorporating different data sources for more in-depth analysis could give more accurate predictions. Using the GIS-based hydrological model, a suitable system to implement in Sri Lanka could be developed.

Keywords—Flood, Daduru Oya, Geographic Information Systems (GIS), Digital Elevation Model (DEM), Hydrological Model, ArcGIS Pro, ModelBuilder, Unit Hydrograph

Novel Approach for Load Balancing in Mobile Cloud Computing

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Abstract— Mobile cloud computing (MCC) was used in many sectors in the current day world, and it combined mobile computing and cloud computing technology to provide mobile services. Mobile devices have short battery life and storage; MCC plays a significant work in compromising that issue. When users are in a hotspot, they face more difficulties and a bad user experience. Load balancing gives a better user experience in the MCC domain. Edge computing and edge clouds are beneficial for load balancing in MCC. There are various algorithms for load balancing in MCC. This research in a simulation environment rather than a natural environment. This research, is focusing on developing a hotspot migration mechanism, reducing mobile devices' battery usage, and developing a novel load balancing algorithm. This research focuses on providing solutions for the limited battery life of mobile devices and the gap in load balancing in mobile cloud computing and provides suggestions
to future researchers.

Keywords—Load Balancing, Mobile Cloud Computing, Resource Management, hotspot migration, Edge Computing

Image Breaking Method For Lung Isolation from Chest X-rays

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Abstract— Most of the techniques that are available for chest x ray image segmentation are not purely based on image processing. Majority of the existing work involves a limited preprocessing part, and the rest is conducted with the leverage of Machine learning and Convolutional neural networks. This study strives to fill this void by introducing a fully image processing-based lung segmentation method. This paper discusses a novel method introduced to segment lungs from chest x ray images purely based on image processing. The method introduced here is named as "Image Breaking method" due to its unique wary of breaking the CXR in to segments to maximize the data extraction. Reason for selecting Xray images is X Ray images are common and reachable in almost all the general hospitals and for most of the lung related diseases CXRs are the most common primary medical imaging technique that is used. Because of its complexity and lesser quality of the image, chest x ray images are hard to segmentate only based on image processing. Here we have taken an attempt to provide guidance for consumers the pathways that can be taken to achieve this task only using image processing. It needs lesser resources; lesser line of code and all the steps are based on experience we gained through experiments. Final evaluation showed that this method provides a fairly good output when it compared with structural similarity to images that are segmented by specialists.

Keywords—Chest x ray, Medical image processing, Lung Segmentation, Thresholding, Lung masks

Taxonomic Identification of Sri Lankan Freshwater Fish based on Advanced Feature Extraction Techniques

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Abstract—Sri Lanka is a tropical composed of different kinds of animals living in different environments. Among these, various kinds of fish species can be identified around Sri Lankan rivers and basins. Freshwater fish species vary between marine and brackish forms. Some human activities destroy their environment and, as a result, Sri Lankan freshwater fish species are at risk. onsequently, the implementation of the freshwater fish classification system has become very important to remedy this situation. Research indicates that Malpulutta Kretseri, Belontia Signata, and Puntis Tittaya are the freshwater fish species selected for classification. The main objective is to extract features more precisely and accurately while optimizing each feature extraction technique to the optimum level. Initially, four algorithms were used, and checked the results were. Then, two better-performing algorithms namely, SIFT and ORB were sorted out and carried out further tests. These two algorithms used corners, blobs, and edges to extract features. Furthermore, the test was done by segmenting as Body, Head, and Fins, and the results were improved significantly. For implementing the system 1000 data training images and 180 data testing images and data validation images were used. ORB algorithm gives 96.7% accuracy and SIFT algorithm gives 85% accuracy. The segmentation method adapted to the characteristics results in a precision of 82%. According to the research, the ORB algorithm-based feature extraction is the more sophisticated
technique.

Keywords—Freshwater fish, Feature extraction, Segmentation

Detection of Suicide Ideation in Twitter using ANN

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Abstract—Suicide is considered one of the leading problems in the present. Detecting suicide earlier and providing a solution is considered the most successful way to suicide ideation and suicide attempts prevention. At present, online communication channels are used to express the suicidal tendencies of some people. This paper presents a machine learning approach to identify suicide pattern and detect suicide ideation or thoughts by considering online user-generated content with the aim of suicide ideation detection. People who have suicidal ideations, express strong negative feelings. Here, an Artificial Neural Network is used as a machine learning algorithm. To detect ideations of suicide, we generate feature vectors using different techniques including Word2Vec, Doc2Vec, and TF-IDF features. As the online user communication channel, we select Twitter.

Keywords—Suicide ideation, Data Mining, Neural Network, Twitter, Word2Vec

Performance Analysis for Different Optimizers on the CNN Model for COVID-19 Disease Prediction Based on Chest X-Ray Images

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Abstract—This paper analyzes the performance of different optimizers on the Convolutional Neural Network (CNN) model for COVID-19 disease prediction based on Chest X-ray images. The novel coronavirus known as 'COVID-19' or 'Corona Virus Disease 2019' has become a severe problem for the world community. Reverse Transcription Polymerase Chain Reaction (RT-PCR) can be known as a significant test used to diagnose COVID-19. However, some of the results of these tests were reported as false-negative, and healthcare facilities face limitations on RT-PCR tests since they are costly, complicated, less optimal of sensitivity, and time-consuming. Perceiving these limitations, detection and the classification of COVID-19 using chest X-ray images can be more accurate, faster, and less expensive when considering RT-PCR tests since X-ray imagery is one of the standard methods that has been used for several decades in medical diagnosis. Diagnosis of COVID-19 related to the radiological manifestations using chest X-ray images is unfamiliar since it is a new experience for many experts. The manual investigation is challenging and requires expertise radiologists. Therefore, a more robust 17 layered CNN model is carried out hereafter doing an experimental analysis on five different optimizers such as Stochastic Gradient Descent (SGD), Adaptive Gradient Descent (Adagrad), Adadelta, Root Mean Square Propagation (RMSprop), and Adaptive Moment Estimation (Adam) for the detection of COVID-19 disease based on chest X-ray images. The chest X-ray images under COVID-19 and normal were collected from a multi-class dataset in the Kaggle repository. The proposed model outperformed a training accuracy of 99% and a validation accuracy of 99% with the optimizer Adam along with max-pooling.

Keywords—Chest X-ray images, Convolutional Neural Network, Coronavirus, COVID-19, optimizers

IoT and Machine Learning Based Efficient Garbage Management System for Apartment Complex and Shopping Malls

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Abstract—Cities have a high population density comparatively to rural areas and villages. Tons of garbage are created on a daily basis, and yet no properly designed infrastructure to manage the waste in developing countries. Due to these open waste dumping is practiced and hence waste is dumped to land owned by the government, which results in a series of negative consequences. Depreciation of health levels and living conditions of people living near the landfills are common problems. Transporting garbage requires high fuel-intensive vehicles and those vehicles do not use the optimum pathway in the garbage collection routine. The decomposing waste produces valuable biogas and organic liquid fertilizer as a byproduct. Which can solve the problems caused by using chemical fertilizer and help reduce fossil fuel consumption overall. In this paper, we present a novel method to efficiently manage garbage collection. Our focus is to reduce the fuel consumption of the garbage collection. It involves facilitating in-house methane production processes and methane leakage detection systems. Also, the proposed system needs less maintenance staff thereby reducing the operational cost and maintenance cost. Further, the proposed system consumes less space than traditional systems for garbage storage.

Keywords—garbage management, IoT, Smart sensors, Artificial Intelligence

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