



8th International Conference on Information Technology Research

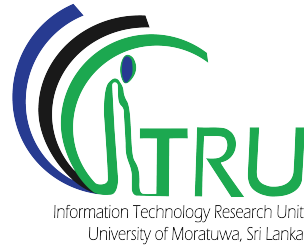
ICITR 2023

"The Next Evolution in Digital Transformation"

ABSTRACTS OF THE
PROCEEDINGS OF ICITR 2023

DECEMBER 7-8
FACULTY OF INFORMATION TECHNOLOGY
UNIVERSITY OF MORATUWA, SRI LANKA





Abstracts of the Proceedings of ICITR 2023

of

**8th INTERNATIONAL CONFERENCE ON
INFORMATION TECHNOLOGY RESEARCH
ICITR 2023**

7th - 8th December 2023

**“THE NEXT EVOLUTION IN DIGITAL
TRANSFORMATION”**

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 2023, 7th - 8th December 2023

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Faculty of Information Technology,
University of Moratuwa

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International Conference on Information Technology Research

The 8th International Conference on Information Technology Research (ICITR 2023) is set to take place on December 7th and 8th, 2023. This annual event, organized by the Information Technology Research Unit (ITRU), the esteemed research dissemination arm of the Faculty of Information Technology at the University of Moratuwa, Sri Lanka, promises a dynamic exploration of cutting-edge technological developments.

Under the overarching theme of “The Next Evolution in Digital Transformation,” ICITR 2023 aims to provide a robust forum for in-depth discussions on the rapid advancements occurring in research and development within the realm of digital transformation. Esteemed as a cornerstone in the field of information and communications technology (ICT), ICITR invited paper submissions across five compelling tracks: computer vision, artificial intelligence, data science, data-driven applications, and technology trends.

In a demonstration of collaborative support, ICITR 2023 is honored to receive technical co-sponsorship from the IEEE and the IEEE Sri Lanka Section Chapter, as well as financial sponsorship from Cambio Software Engineering. This year, the conference witnessed an impressive submission of around 223 research papers, with a discerning acceptance of 47, maintaining an acceptance ratio of approximately 21%. All accepted and presented papers will be submitted to the IEEE Xplore digital library, indexed by SCOPUS.

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

Message from the General Co-Chair

B. H. Sudantha
General Chair
International Conference on Information
Technology Research (ICITR 2023)



Welcome to the University of Moratuwa and the 8th International Conference on Information Technology Research (ICITR 2023). The objective of the conference is to provide a forum for researchers worldwide to unveil their latest work in information technology research. The theme of the conference, “The Next Evolution in Digital Transformation,” gives direction, and it covers a broad spectrum of allied fields as well.

Maintaining the high quality of a conference requires various levels of involvement, including a well-balanced review process. This year, 223 full papers were submitted to the conference. Each paper was subject to review by at least two reviewers, and finally, 47 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, I should be much more thankful to the authors who shared their research experiences at the conference for their hard work. It helps us prepare proceedings at an excellent level.

Three workshops were organized to benefit the conference participants in various new trends and stimulate their research experiences. A very special thank you should go to our three distinguished keynote speakers: Prof. Sardar M. N. Islam from ISILC, Victoria University, Melbourne, Australia; Prof. Chung-Yih Wang, Director of the Department of Radiation Oncology, Cheng Hsin General Hospital, Taipei, Taiwan; and Prof. Chan-Yun Yang, Professor at the Department of Electrical Engineering, National Taipei University, Taiwan.

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, the 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 worked tirelessly on various conference-related tasks in order to bring the conference to this level.

Finally, we hope that the participants enjoy the outstanding conference program of the 8th International Conference on Information Technology Research, ICITR 2023.

I wish you all a very fruitful and rewarding conference!

Message from the General Co-Chair

Dr. I.T.S. Piyatilake
Director
Information Technology Research Unit



We are pleased to welcome you to the 8th International Conference on Information Technology Research (ICITR 2023) organized by the Information Technology Research Unit (ITRU), Faculty of Information Technology, University of Moratuwa. This year, we run the conference under the theme “The Next Evolution in Digital Transformation.” The conference is well recognized as a forum to discuss the rapid advances in research and digital transformation development.

The research papers published in the proceedings are comprehensive in that they contain a wealth of information that is extremely useful to academics and professionals working in related fields. It is my pleasure to announce the participation of leading academics and researchers in their respective areas of focus from various countries at this event. The conference proceedings and the presentations made at ICITR 2023 are the end result of a tremendous amount of innovative work and a highly selective review process. This year, we received around 223 research articles, and 47 were accepted, maintaining an acceptance ratio of about 21%. ICITR 2023 is technically co-sponsored by the IEEE, the world’s largest technical professional organization dedicated to advancing technology, and the IEEE Sri Lanka Section. All the accepted papers for the ICITR 2023 will be indexed in the IEEE Xplore Database. There will be “BEST PAPER AWARDS” for authors to recognize outstanding contributions and research publications.

We thank all authors for their participation, and we are happy that they have chosen ICITR 2023 as the platform to present their work. Credit also goes to the Program Committee members and review panel members for their contribution in reviewing and evaluating the submissions and for making ICITR 2023 a success. I wish all of you the very best in your future research.

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Keynote Speakers

Keynote Address 1



Prof. Sardar MN Islam
SILC, Victoria University, Melbourne, Australia

Prof. Sardar M. N. Islam (Naz) is currently a professor at Victoria University, Australia. He is also a Distinguished Visiting Professor of Artificial Intelligence, UnSri Adjunct Professor of IT and Business, Armstrong Institute, Melbourne, and Editor-in-Chief of "International Transactions on Artificial Intelligence."

Prof. Islam is a highly motivated and committed academic with excellent international performance, as is evidenced through his outstanding publications, many Distinguished Visiting/Visiting Professor appointments, Keynote Speaker at a large number of international conferences, editorial roles in 11 good journals, and being a highly complex interdisciplinary researcher focused on advanced computational mathematical modelling and computer programming-based computer science, artificial intelligence, data science, and data analytics.

He has made a large number of publications, including 31 authored research books, 4 edited books, and about 250 articles in different disciplines such as computer science, artificial intelligence, business analytics, mathematics, law, etc. His academic work has gained a high international reputation and appreciation.

His qualifications include a Ph.D. (Australia), a CPA (Accounting), an LL.B. (Law), M. A. (First Class), M. A. (Canada), B. A. (Hons), and a Short Course on Counselling.

His current areas of interest and expertise are the following: Computer Science, IS, and Business Analytics: Quantum Computing, Artificial Intelligence, Robots/Robotics, Analytics, Machine Learning, Data Science, Python Programming, Blockchain, Cybersecurity, etc.; Their Advanced Mathematics and Statistics; and Their Applications in Biomedical Sciences, Bioengineering, Health, Business Disciplines, Engineering Management, Law, etc.

Keynote Title: Quantum Computing: Technologies, Programming, Applications, and the Future – Its Urgent Adoption

Abstract

In this presentation, the issues of quantum computing, quantum technologies, applications, and the future of mankind and the world will be discussed. A profoundly disruptive emerging computing technology, quantum computing, will change computation machines, algorithms, methods and technologies, transforming the world. Quantum computers have substantially different hardware and software and can solve complex, intractable problems exponentially faster than classical computers. The combination of quantum computing and artificial intelligence gives a new paradigm and many new opportunities for fundamental changes in the world. This transformative potential extends to many areas of life, including quantum health, artificial intelligence, financial modelling and management, cryptography, health care, and drug discovery, optimisation, climate modelling and weather forecasting. Quantum computing is expected to transform all areas of human life. It can address some of our most serious challenges. However, quantum computing has the potential to unlock new frontiers of knowledge in the future. This leaves us with a sense of urgency to adopt quantum computing by all for a better future for humanity and the world.

Keynote Address 2



Prof. Chung-Yih Wang
Director of Department of Radiation Oncology, Cheng Hsin General Hospital, Taipei, Taiwan

Prof. Wang earned his Bachelor of Medicine from National Taiwan University Medical School and later pursued a Master's in Molecular Biology at the University of Wisconsin, Madison, followed by a Ph.D. in Microbiology and Immunology at the University of Michigan, Ann Arbor, Michigan. Prof. Wang's extensive career includes an internship at the National Taiwan University Hospital and post-doctoral research in immunology at Chicago University. Fluent in Chinese, Taiwanese, Japanese, Spanish, and Italian, with basic communication skills in French and German, Prof. Wang has held various academic positions, including Associate Professor at the Institute of Microbiology and Immunology, National Yang-Ming University. Currently serving as the Department Chief of the Department of Radiotherapy at Cheng Hsin Hospital, Taipei, his notable contributions to the scientific literature encompass studies on the radiosensitivity of liver metastatic tumor cells and the biological behavior of gold nano-core-encapsulated nanoparticles in tumor models. With a wealth of professional experience, Prof. Chung-Yih Wang continues to make significant strides in the fields of oncology and immunology.

Keynote Title: Bio-informatics: the future roadmap for the advancement of medicine

Abstract

From the dawn of human civilization, advancement of medical knowledge has always been an excruciatingly slow processes. Before the epoch of modern scientific method, discovery of new medication was a trial and error procedure , in which error denotes death , even for a successful trial, it was difficult , if not impossible to derive useful knowledge from.

With the coming of modern medicine, clinical trials based on scientific principles become the golden standard for the advancement of medical knowledge. Yet the procedure of modern clinical trials require tremendous time and resources to conduct. It is not unusual to take several decades plus astronomical sum of money for a potential novel treatment to go through pre-clinical trial to the phase III clinical trial. Much better than it was before, but it is not a game everyone can participate.

The advancement of informatics science in the recent decades is changing the traditional roadmap of medical advancement. Examples such as novel technologies for gene sequencing, protein structure prediction have contributed to the “quantum leap” of understanding and new treatment of diseases that were unsolvable enigmas a few decades ago. In addition, this added tool of informatics makes participation in the advancement of medical knowledge without tremendous resources possible.

Taken as an example of our initial research on Reinforced Learning in the hope of helping physician make better decision in patient treatment. I hope to demonstrate that this bio-informatics approach is a novel way for people / country with less resources to participate in the revolution of medical science.

Keynote Address 3



Prof. Chan-Yun Yang
National Taipei University, Taiwan

Prof. Chan-Yun Yang received his B.Sc. and M.Sc. degrees from National Taiwan University, Taiwan, in 1985 and 1989, respectively, and got his Ph.D. degree in Bio-Industrial Mechatronics Engineering from National Taiwan University in 2001. He is currently a professor in the Department of Electrical Engineering at the National Taipei University, the director of the Intelligent Modeling and Control Laboratory at NTPU, and an associate editor of the Computer & Electrical Engineering Journal. His research focused on complex system modeling to reflect the real physical or biological facts behind the systems. Kinds of mathematical, statistical, and machine learning skills, together with inspirations directly from the facts, are often involved in his research

Keynote Title: Modeling semiconductor CMP polishing process by a physics-informed neural network

Abstract

The physical model of an underlying system is vital when people are managing to behave or interact with it. The speech introduces a method to do this kind of modeling work. In the era of big data, we often originate from data to solve the problem. However, the data-driven solution generates only numerical functionals to represent the model, with no physical facts behind it. An emerging technique, Physical Informed Neural Network (PINN), was recently developed to tackle the problem. With an example of the semiconductor Chemical Mechanical Planarization (CMP) process, the speaker will reveal the details of the modeling process as it was successfully realized recently by PINN. The insights of the modeling will also be examined in the speech to know PINN's attributes.

Programme Agenda

Day 1: 7th December, 2023

09.00 AM – 11.00 AM Workshop 1

Title "Advanced Machine Learning Techniques
for Processing Complex Data"

Resource Person Professor Dixon Vimalajeewa
Department of Statistics, Nebraska Lincoln
University, USA

01.30 PM – 03.30 PM Workshop 2

Title "Designing and Deploying
High-Performing Mission-Critical Apps on
AWS"

Resource Persons Mr. Chameera Dulanga
99X Technology

Mr. Lakindu Hewawasam
Enlear

Day 2: 8th December, 2023

07:45 AM – 08:30 AM	Registration of Participants
08:30 AM – 9:00 AM	Inauguration Ceremony
09:00 AM – 10:00 AM	Keynote Address by Professor Sardar M. N. Islam Victoria University, Australia Topic: Quantum Computing: Technologies, Programming, Applications, and the Future - Its Urgent Adoption
10:00 AM – 10:10 AM	Presentation by the Platinum Sponsor Cambio Software Engineering
10:10 AM – 10:30 AM	Tea Break
10:00 AM – 11:30 AM	Session on Agile Development by Cambio Software Engineering
10:30 AM – 12:30 PM	ICITR Technical Session 1 ICITR Technical Session 2 ICITR Technical Session 3 ICITR Technical Session 4
12:30 PM – 01:30 PM	Lunch
01:30 PM – 02:30 PM	Keynote Address by Professor Chung-Yih Wang Cheng Hsin General Hospital, Taiwan Topic - Bio-informatics: the Future Roadmap for the Advancement of Medicine
02:30 PM – 04:50 PM	ICITR Technical Session 5 ICITR Technical Session 6
04:50 PM – 05:00 PM	Tea Break
05:00 PM – 05:30 PM	Keynote Address by Professor Chan-Yun Yang National Taipei University, Taiwan Topic - Modeling Semiconductor CMP Polishing Process by a Physics-Informed Neural Network
05:30 PM – 06:00 PM	Awards Ceremony

Detailed Session Plan of ICITR 2023

Friday, 8th December 2023

ICITR 2023 Technical Session 1 - Computer Vision

Session Chairs

Dr. Thushari Silva &
Mr. S.G.S.Hewawalpita

Time

10.30 AM – 12.30 PM

Time

Title & Author (s)

10.40 AM – 10.55 AM

Using Multispectral UAV Imagery for
Marine Debris Detection in Sri Lanka
*Purushoth Velayuthan, Vinuri Piyathilake,
Kavinda Athapaththu, Damitha
Sandaruwan, Asanka P. Sayakkara, Enosha
Hettiarachchi*

10.55 AM – 11.05 AM

Dominant Color Palette Extraction in
Resumes using the New Color Pixel
Quantifier Algorithm
*N. N. Perera, S. P. Warusawithana, R. L.
Weerasinghe, T. M. Hindakaraldeniya, G.
U. Ganegoda*

11.05 AM – 11.20 AM

Occlusion Resilient Similar-Colored
Separable Food Item Instance Segmentation
*Rukshan Karannagoda, Yomal Perera, Dion
Weiman, Subha Fernando*

11.20 AM – 11.35 AM

Generating Photographic Face Images from
Sketches: A Study of GAN-based
Approaches
K Kovarthanan, K M S J Kumarasinghe

11.35 AM – 11.50 AM

Green Insight: A Novel Approach to
Detecting and Classifying Macro Nutrient
Deficiencies in Paddy Leaves
*D.M.G.D Rathnayake, K.M.S.J
Kumarasinghe, R.M.I.K. Rajapaksha,
N.K.A.C Katuwawala*

11.50 AM – 12.05 PM

RiceGuardNet: Custom CNNs for Precise
Bacterial and Fungal Infection
Classification

*N.K.A.C Katuwawala, K.M.S.J
Kumarasinghe, R.M.I.K Rajapaksha,
D.M.G.D Rathnayaka*

12.05 PM – 12.20 PM

Cross-ViT: Cross-attention Vision
Transformer for Image Duplicate Detection

*M.D.N. Chandrasiri, Priyanga Dilini
Talagala*

ICITR 2023 Technical Session 2 - Artificial Intelligence

Session Chairs

Dr. Rukshima Dabare &
Dr. Asanka Gunawardana

Time

10.30 AM – 01.00 PM

Time

Title & Author (s)

10.30 AM – 10.45 AM

Predicting the Performance of Electrical
Machines using Machine Learning
V Joshi Manohar, Sumit Kumar Jha

10.45 AM – 11.00 AM

Personal Loan Default Prediction and
Impact Analysis of Debt-to-Income Ratio
*K.L.S Rodrigo, T. C. Sandanayake, A.T.P.
Silva*

11.00 AM – 11.15 AM

Resume Content Scoring and Improvement
Suggestions Using NLP and Rule-based
Techniques
*R.L. Weerasinghe, N.N. Perera, S.P.
Warusawithana, T.M. Hindakaraldeniya, G.
U. Ganegoda*

11.15 AM – 11.30 AM

ResBot: A Bi-Lingual Restaurant Booking
Conversational Artificial Intelligence
L.K.D. Fernand, G. U. Ganegoda

11.45 AM – 12.00 PM

Explainable AI Techniques for Deep
Convolutional Neural Network Based Plant
Disease Identification
*Sashika Kiriella, Subha Fernando Sagara
Sumathipala, E.P.N. Udayakumara*

12.00 PM – 12.15 PM

Improved Particle Swarm Optimization for
Optimizing the Deep Convolutional Neural
Network
A.W.C.K. Atugoda, Subha Fernando

12.15 PM – 12.30 PM

Learning Application for Educational and Skills Development of Primary Children
M.D.J. Malshika, N.S. Wijeratne, P.K.P. Kavishka, Bhagyanie Chathurika, Supipi Karunathilaka

12.30 PM – 12.45 PM

Classification of Fungi Images Using Different Convolutional Neural Networks
U.M.M.P.K. Nawarathne, H.M.N.S. Kumari

12.45 PM – 01.00 PM

Enhancing DDoS Attack Detection via Blending Ensemble Learning
C.R. Joseph Amalraj, P.G.G. Madhusankha

ICITR 2023 Technical Session 3 - Data Science & Data Driven Applications

Session Chairs

Dr. Sadun Dassanayake &
Dr. Sagara Sumathipala

Time

10.30 AM – 12.00 AM

Time

Title & Author (s)

10.40 AM – 10.55 AM

Alzheimer's Disease Prediction Using
Clinical Data Approach
L.R.D. Perera, G.U. Ganegoda

10.55 AM – 11.05 AM

Alzheimer's Disease Detection Using
Blood Gene Expression Data
G.D.S. Yasodya, G.U. Ganegoda

11.05 AM – 11.20 AM

Performance Improvement of Proxy Server
Cache Management Using Web Usage
Mining
Thasan Leenas, H.A. Caldera

11.20 AM – 11.35 AM

Modeling Sri Lankan GDP Using
Macroeconomic Indicators: An Approach
Using Principal Component Analysis
Sachini Karunarathne, Thilini Piyatilake

11.35 AM – 11.50 AM

An Agile Project Management Supporting
Approach for Estimating Story Points in
User Stories.
*K. Jithmini Wanigasooriya Arachchi, C.R.J.
Amalraj*

ICITR 2023 Technical Session 4 - Technology Trends

Session Chairs Dr. Upeka Premaratne &
Dr. Romesh Thanuja

Time 10.30 AM – 12.50 PM

Time **Title & Author (s)**

10.40 AM – 10.55 AM Game-based Analytical Skills Testing for Graduate Software Engineering Recruitment
D.W.M.N.C. Dasanayake, T.C. Sandanayake, S.M.U. Premasiri

10.55 AM – 11.05 AM Cloud-based Weather Condition Monitoring System using ESP8266 and Amazon Web Services
Anes Mohamed, Gunaseelan Gunasegaran, Daminda Herath

11.05 AM – 11.20 AM Intelligent IoT Daily Running Log with OBD Data Monitoring and Alerts System
C.M.S. Madushan, Sondarngallage D.A. Sanjeewa, H.M.R.G. Herath

11.20 AM – 11.35 AM Real Time Energy Market for LV Distribution Networks in Smart Grid Using Blockchain Technology
N.S. Hasaranga, N.S.A.D.S. Nanayakkara, W.Y.U.N. Botheju, D.S. De Silva

11.35 AM – 11.50 AM Blockchain-Based Software Subscription and Licenses Management System
Hithru De Alwis, Adeesha Wijayasiri, Shamila De Silva, Kasun De Silva

11.50 AM – 12.05 PM

AI-Driven User Experience Design:
Exploring Innovations and Challenges in
Delivering Tailored User Experiences
*Prasadini Padmasiri, Pramukthika
Kalutharage, Nethma Jayawardhane,
Jagath Wickramarathne*

12.05 PM – 12.20 PM

A Robotic Hand for Rehabilitation of Wrist
and Fingers
*W.A.K.C. Weerasoory, U.R.E. Kumasaru,
H.M.W. Nipun, H.H.M.J. De Silva, R.K.P.S.
Ranaweera, R.A.R.C. Gopura*

12.20 PM – 12.35 PM

ITConnect: Real-time Personalized Job
Posting Platform for IT Professionals
*Karunanayake K.R.D.S.K. , Chandrawansa
K.T.M., Gunatilleke L.C.T., Menuranga
K.Y.D.B., Asiri Gawesha, Kalpani
Manathunga*

12.35 PM – 12.50 PM

IoT Empowered Open Sensor Network for
Environmental Air Pollution Monitoring
System in Smart Cities
BH Sudantha

ICITR 2023 Technical Session 5 - Computing

Session Chairs

Prof. Chung-Yih Wang &
Dr. Dushyanthi Vidanagama

Time

02.30 PM – 04.50 PM

Time

Title & Author (s)

02.40 PM – 02.55 PM

Acoustic Signature Analysis for
Distinguishing Human vs. Synthetic Voices
in Vishing Attacks
*Prarthana Gamage, Dushan Dissanayake,
Niroopama Kumarasinghe, Gamage
Upeksha Ganegoda*

02.55 PM – 03.05 PM

Local Planning of an Autonomous Driving
Car Prototype
*A.M. Amrith, A.L. Faris, M.H.A.A. Madhi,
Chathurika S. Silva*

03.05 PM – 03.20 PM

Leveraging Artifact Reputation Analysis
and Contextual Sentiment Analysis for
Advanced Detection of Vishing and
Smishing Attacks
*Dushan Dissanayake, Prarthana Gamage,
Niroopama Kumarasinghe, Gamage
Upeksha Ganegoda*

03.20 PM – 03.35 PM

Multi-Modal Defect Detection System for
Single Color Fabrics in the Apparel
Industry
*Vimeshi Silva, Thilakshi Senevirathne, Nifla
Fareed, Thanuja Sandanayake, Indika
Karunaratna*

03.35 PM – 03.50 PM

Version Controlling of User Content in
Learning Management Systems for
Supporting the Teaching/Learning Process.
*Mohamed Fazil Mohamed Firdhous, Walid
Elbreiki, Chaman Wijesiriwardana*

8th International Conference on Information Technology Research 2023

- 03.50 PM – 04.05 PM Time analysis side channeling attack in symmetric key cryptography
M.J. Hettiarachchi, H.H.G.D. Sandanuwan, R.W. Balasooriya, R. Hettiarachchi, K.Y. Abeywardena, K. Yapa
- 04.05 PM – 04.20 PM Developing a Secure System for Telemedicine
Isuru Wijeratne, Nipunajith Kariyawasam, Lahiru Alahakoon, Nimali Senevirathna
- 04.20 PM – 04.35 PM ROS-based Mobile robot PID and MPC control
Pei-Lun Chiang, Yu-Chi Wu, SSU-CHIEN, CHEN, Chan-Yun Yang
- 04.35 PM – 04.50 PM Enhanced Timetable Scheduling: A High-Performance Computational Approach.
Asanka Sovis, Chathuni Patikirige, Yohan Pandigama

ICITR 2023 Technical Session 6 - Artificial Intelligence

Session Chairs

Professor Chan-Yun Yang &
Dr. Thilina Thanthriwatte

Time

02.30 PM – 04.30 PM

Time

Title & Author (s)

02.30 PM – 02.45 PM

Accelerated Adversarial Attack Generation
and Enhanced Decision Insight
*N.K.Y.S. Kumarasiri, S.C. Premaratne,
W.M.R.M. Wijesuriya*

02.45 PM – 03.00 PM

The Application of Convolutional Neural
Network In The Context Of Tamil
Handwritten Character Recognition
*Ponraj Thuvarakan, Parameswaran
Kowreesan, Satkunaratanam Jeyarooban, M.
Janatheepan, E. M. U. W. J. B. Ekanayake*

03.00 PM – 03.15 PM

Layout Aware Resume Parsing Using NLP
and Rule-based Techniques
*S.P Warusawithana, N.N. Perera, R.L.
Weerasinghe, T.M. Hindakaraldeniya, G. U.
Ganegoda*

03.15 PM – 03.30 PM

Multiple Objective Optimization Based
Dietary Recommender System
*Yomal Perera, Rukshan Karannagoda, Dion
Weiman, Subha Fernando*

03.30 PM – 03.45 PM

Detecting Tabnabbing Attacks Via An
RL-Based Agent
*Ashani Fonseka, Pamali Pashenna, Subhash
N. Ariyadasa*

03.45 PM – 04.00 PM

Early Identification of Deforestation using
Anomaly Detection
*Nethmi Wijesinghe, Rashmi Perera,
Nethmee Sellahewa, Priyanga Dilini
Talagala*

04.00 PM – 04.15 PM

InPRA – An Intelligent System for Writing
while Doing Research

Asoka Karunananda, Thushari Silva

04.15 PM – 04.30 PM

Optimization of Real Time Panel Trip
Detection in Industrial Systems Using IoT
and Mathematical Modeling

Thushani Mallikarathne, Hashan

Abeyasinghe, Chamod Rathnayake, Dilki

Gauder

Abstracts of the Full-Papers of ICITR
2023

Using Multispectral UAV Imagery for Marine Debris Detection in Sri Lanka

*Purushoth Velayuthan
BPH 200 PTE. LTD.
Bukit Merah, Singapore
vpurushoth97@gmail.com*

*Vinuri Piyathilake
University of Colombo
School of Computing
(UCSC)
Colombo, Sri Lanka
vin@ucsc.cmb.ac.lk*

*Kavinda Athapaththu
University of Colombo
School of Computing
(UCSC)
Colombo, Sri Lanka
kav@ucsc.cmb.ac.lk*

*Damitha Sandaruwan
University of Colombo
School of Computing
(UCSC)
Colombo, Sri Lanka
dsr@ucsc.cmb.ac.lk*

*Asanka P. Sayakkara
University of Colombo
School of Computing
(UCSC)
Colombo, Sri Lanka
asa@ucsc.cmb.ac.lk*

*Enosha Hettiarachchi
University of Colombo
School of Computing
(UCSC)
Colombo, Sri Lanka
eno@ucsc.cmb.ac.lk*

Abstract - Marine pollution is a significant issue in Sri Lanka, with the country being a major contributor to marine debris. Marine pollution has the potential to adversely impact marine and coastal biodiversity, as well as the fishing and tourism industries. Current methods for monitoring marine debris involve labor-intensive approaches, such as visual surveys conducted from boats or aircraft, beach clean-ups, and underwater transects by divers. However, an emerging trend in many countries is the use of Unmanned Aerial Vehicle (UAV) imagery for monitoring marine debris due to its advantages, including reduced labour requirements, higher spatial resolution, and cost-effectiveness. The work presented in this study utilizes multispectral UAV imagery to monitor marine debris in a coastal area of Ambalangoda, Sri Lanka. For the automated detection of marine debris in captured images, this work replicates the state-of-the-art CutPaste method for region detection and utilized the ResNet-18 model with Faster R-CNN for the final classification of marine debris instances. The implemented approach demonstrated a classification accuracy of approximately 60% in automatic marine debris detection, laying the groundwork for potential enhancements in the future.

Keywords — *marine debris monitoring, unmanned aerial vehicles, multispectral camera, self-supervised learning, anomaly detection*

Dominant Color Palette Extraction in Resumes using the New Color Pixel Quantifier Algorithm

N. N. Perera
Faculty of Information
Technology
University of Moratuwa
Moratuwa, Sri Lanka
nimnaperera98@gmail.com

S. P. Warusawithana
Faculty of Information
Technology
University of Moratuwa
Moratuwa, Sri Lanka
supunawa@gmail.com

R. L. Weerasinghe
Faculty of Information
Technology
University of Moratuwa
Moratuwa, Sri Lanka
reshakalakshan@gmail.com

T. M. Hindakaraldeniya
Faculty of Information Technology
University of Moratuwa
Moratuwa, Sri Lanka
tharushi.18@itfac.mrt.ac.lk

G. U. Ganegoda
Faculty of Information Technology
University of Moratuwa
Moratuwa, Sri Lanka
upekshag@uom.lk

Abstract - In the realm of resume analysis and enhancement, the extraction of dominant color palettes plays a pivotal role in assessing the visual impact of resumes. Existing methods designed for images with extensive color ranges have proven to be suboptimal when applied to the distinct context of resumes, which inherently possess a limited color palette. This paper introduces a novel approach that addresses this challenge effectively and efficiently. By minimizing the time required for palette extraction without compromising accuracy, the proposed method offers a practical solution for resume feedback systems. It is important to clarify that this research neither rejects nor supports existing methods; instead, it presents an alternative, tailor-made solution for resume analysis. In summary, this paper sets a promising precedent for more streamlined and functional dominant color palette extraction methods in the context of resumes, promising advancements in resume analysis and improvement.

Keywords — *color palette extraction, resume design analysis, color pixel quantifier*

Occlusion Resilient Similar-Colored Separable Food Item Instance Segmentation

Rukshan Karannagoda
Faculty of Information
Technology
University of Moratuwa
Sri Lanka
rukshan.18@itfac.mrt.ac.lk

Yomal Perera
Faculty of Information
Technology
University of Moratuwa
Sri Lanka
yomal.18@itfac.mrt.ac.lk

Dion Weiman
Faculty of Information
Technology
University of Moratuwa
Sri Lanka
dion.18@itfac.mrt.ac.lk

Subha Fernando
Department of Computational Mathematics
University of Moratuwa
Sri Lanka
0000-0002-2621-5291

Abstract - The task of recognizing non-Western and non-Chinese food items as well as accurately segmenting food item instances is a seldom researched and challenging task in the field of Computer Vision. Food items such as Sri Lankan short eats snacks have high inter-class visual similarity, mainly in terms of color and the fact that food images are highly prone to occlusion or item overlap where a portion of an object is hidden from sight. Existing databases are few and synthetic and current systems do not handle food item occlusion. In this paper a novel Sri Lankan short eats food item instance segmentation and amodal completion approach is introduced as well as two novel datasets for Sri Lankan short eats instance segmentation and amodal instance segmentation. The proposed method shows model performance improvements up to 88.4% mAP in Instance Segmentation and up to 90% mIoU in Amodal Completion, as well as the advantage of real-time inference in less than 1.7 seconds per frame.

Keywords — *Computer Vision, Amodal Instance Segmentation, Amodal Completion, Occlusion Handling, Food Recognition*

Generating Photographic Face Images from Sketches: A Study of GAN-based Approaches

K Kovarthanan

*Department of Information Technology
University of Moratuwa
Katubedda, Sri Lanka
184081d@uom.lk*

K M S J Kumarasinghe

*Department of Information Technology
University of Moratuwa
Katubedda, Sri Lanka
sashikaj@uom.lk*

Abstract - Generative Adversarial Networks (GANs) have attracted a lot of attention in recent years due to their potential to advance various fields. The high generative quality of GANs has been harnessed for creating photographic facial portraits from sketches in the field of computer vision. Given the increasing importance of computer vision, the ability to transform hand-drawn sketches into realistic facial images has emerged as a compelling area of research. This practical implication can contribute to diverse fields, including law enforcement, forensics, security, and expedited generation of authentic suspect photos in crime investigations. Despite the inherent lack of specific information in sketch images, the training process necessitates meticulously crafted hand sketches to yield accurate and high-quality results. This paper explores various approaches employed to address the challenges of translating facial sketches into photographic images, with a particular focus on GANs and their applications. The study aims to deliver a comprehensive analysis of state-of-the-art GAN-based methods for generating photographic faces from sketches. By offering a thorough overview of the strengths, methodologies, and advances in this field, this paper aims to pave the way for further advancements in the exciting area of sketch-to-photo face generation. Performance comparisons have been conducted among the different approaches in generating facial images from hand-drawn sketches, showcasing the effectiveness of several GAN architectures, each with a unique set of benefits and drawbacks.

Keywords — *GAN, face image generation, image to image translation, face sketch, sketch to image*

Green Insight: A Novel Approach to Detecting and Classifying Macro Nutrient Deficiencies in Paddy Leaves

D.M.G.D Rathnayake
Department of Information
Technology
University of Moratuwa
Sri Lanka
geethma.18@itfac.mrt.ac.lk

K.M.S.J Kumarasinghe
Department of Information
Technology
University of Moratuwa
Sri Lanka
sashikaj@uom.lk

R.M.I.K. Rajapaksha
Department of Information
Technology
University of Moratuwa
Sri Lanka
inoshi.18@itfac.mrt.ac.lk

N.K.A.C Katuwawala
Department of Information Technology
University of Moratuwa
Sri Lanka
ayoma.18@itfac.mrt.ac.lk

Abstract - Macro nutrient deficiency in paddy leaves is a critical concern in agriculture that impacts crop yield, food security, and sustainable farming. Addressing nutrient deficiencies in paddy plants is vital for ensuring these concerns. This research focuses on automating the detection and classification of common macro-nutrient deficiencies, specifically Nitrogen (N), Phosphorus (P), and Potassium (K). Utilizing image processing techniques, the study identifies distinct color patterns associated with each deficiency, providing a non-invasive and efficient approach. The analysis involves pixel ratio calculations within defined HSV color ranges and threshold values. A modular workflow encompasses pre-processing, horizontal partitioning, pixel ratio computation, and deficiency classification. The innovative methodology we introduced demonstrates promising outcomes, achieving a 96% accuracy rate in identifying nitrogen deficiency, along with 90% accuracy for phosphorus deficiency and 92% accuracy for potassium deficiency detection. While the methodology showcases promise, certain limitations, such as the requirement for leaf symmetry and single-deficiency identification, are recognized. These findings lay the groundwork for more accurate and automated nutrient deficiency detection, and the future work aims to address the identified limitations and generalize the solution for broader applications in real-world agricultural settings.

Keywords — *Nutrient Deficiencies, Image processing, Color Analysis, Classification, HSV*

RiceGuardNet: Custom CNNs for Precise Bacterial and Fungal Infection Classification

N.K.A.C Katuwawala
Department of Information
Technology
University of Moratuwa
Sri Lanka
ayoma.18@itfac.mrt.ac.lk

K.M.S.J Kumarasinghe
Department of Information
Technology
University of Moratuwa
Sri Lanka
sashikaj@uom.lk

R.M.I.K Rajapaksha
Department of Information
Technology
University of Moratuwa
Sri Lanka
inoshi.18@itfac.mrt.ac.lk

D.M.G.D Rathnayaka
Department of Information Technology
University of Moratuwa
Sri Lanka
geethma.18@itfac.mrt.ac.lk

Abstract - Rice cultivation is a vital component of many nations' agricultural landscapes, often relying on traditional knowledge passed down through generations. However, disease identification in rice crops presents challenges, as many diseases are difficult to discern through visual inspection alone. This leads to delayed or inaccurate diagnoses, placing entire plantations at risk and discouraging new entrants to the field. This research addresses the pressing issue of timely and accurate disease identification in rice plants, focusing on three common diseases: Bacterial Leaf Blight, Brown Spot, and Leaf Smut, which are caused by bacteria and fungi. These diseases can proliferate rapidly, making early detection crucial. A custom Convolutional Neural Network (CNN) model was developed and trained using a dataset comprising 16,000 images, with 4,000 images for each disease and a healthy class. The model achieved an impressive accuracy of 99.87% on the test dataset, demonstrating its effectiveness in disease classification. This innovative approach provides a solution to the challenges faced by rice farmers, enabling quick and accurate disease identification. The research findings hold significant promise for improving rice cultivation practices, reducing the risk of crop loss, and encouraging new entrants into the field of rice farming.

Keywords — *Convolutional Neural Networks (CNNs), Image processing Image classification, plant disease diagnosis, Data augmentation*

Cross-ViT: Cross-attention Vision Transformer for Image Duplicate Detection

M.D.N. Chandrasiri
Faculty of Information Technology
University of Moratuwa
Moratuwa, Sri Lanka
dncnawodya@gmail.com
0009-0004-6869-2303

Priyanga Dilini Talagala
Department of Computational Mathematics
University of Moratuwa
Moratuwa, Sri Lanka
priyangad@uom.lk
0000-0003-2870-7449

Abstract - Duplicate detection in image databases has immense significance across diverse domains. Its utility transcends specific applications, adapting seamlessly to a range of use cases, either as a standalone process or an integrated component within broader workflows. This study explores cutting-edge vision transformer architecture to revolutionize feature extraction in the context of duplicate image identification. Our proposed framework combines the conventional transformer architecture with a ground-breaking cross-attention layer developed specifically for this study. This unique cross-attention transformer processes pairs of images as input, enabling intricate cross-attention operations that delve into the interconnections and relationships between the distinct features in the two images. Through meticulous iterations of Cross-ViT, we assess the ranking capabilities of each version, highlighting the vital role played by the integrated cross-attention layer between transformer blocks. Our research culminates in recommending a final optimal model that capitalizes on the synergies between higher-dimensional hidden embeddings and mid-size ViT variations, thereby optimizing image pair ranking. In conclusion, this study unveils the immense potential of the vision transformer and its novel cross-attention layer in the domain of duplicate image detection. The performance of the proposed framework was assessed through a comprehensive comparative evaluation against baseline CNN models using various benchmark datasets. This evaluation further underscores the transformative power of our approach. Notably, our innovation in this study lies not in the introduction of new feature extraction methods but in the introduction of a novel cross-attention layer between transformer blocks grounded in the scaled dot-product attention mechanism.

Keywords — *Duplicate Image Detection, Vision Transformers, Attention*

Predicting the Performance of Electrical Machines using Machine Learning

V Joshi Manohar

Department of Electrical & Electronics

Engineering

Presidency University

Bengaluru, India.

joshimanohar@presidencyuniversity.in

Sumit Kumar Jha

School of Electrical Science

Indian Institute of Technology

Bhubaneswar, Odisha, India

skjha@ieee.org

Abstract - Electrical machines play an important role in our day-to-day life. Electric machines like DC motors and 3- phase induction motors are essential systems and widely used in domestic, industrial and transportation systems. In order to operate the machines optimally and efficiently, in real time operations, it is required to predict the performance parameters at various loaded conditions. With the advancements in the field of predictive modelling and analytics, several researchers have applied in the area of energy consumption prediction, fault prediction, weather prediction, power grid management and so on. In this paper, the machine learning techniques are demonstrated that may be used to examine the performance of electrical machinery by forecasting performance characteristics like speed and efficiency. To validate the performance of the predictive model, an experiment was conducted at the laboratory on dc motor and 3- phase induction motor to generate the required dataset to train the regression algorithms. The model evaluation metrics such MSE and the R2 value showed that the model efficiently predicted the performance of the electrical machines.

Keywords — *DC motors, Induction motor, Machine Learning Python, Machine Learning, Performance prediction*

Personal Loan Default Prediction and Impact Analysis of Debt-to-Income Ratio

K.L.S Rodrigo
Faculty of Information
Technology
University of Moratuwa
Sri Lanka
samadhilesha@gmail.com

T. C. Sandanayake
Faculty of Information
Technology
University of Moratuwa
Sri Lanka
thanujas@uom.lk

A.T.P. Silva
Faculty of Information
Technology
University of Moratuwa
Sri Lanka
thusharip@uom.lk

Abstract - Loan defaults affect the financial sector, particularly impacting banks and lending institutions, resulting in a rise of non-performing assets and financial strain. To counteract this trend, traditional credit assessments use methods like credit scores and exploitation of socio-demographic composition of the customers. However, customers may possess numerous debt obligations that credit bureaus uncover, which can help to measure their repayment ability. This study proposed a comparative methodology that leverages five machine learning algorithms to predict personal loan defaults using debt-to-income ratio apart from the credit scoring models that prevail at banks. It analyzed the impact of debt payments on loan defaults and applied ensemble clustering to categorize customers' risk levels based on their debt-to-income ratio. Experimental results indicated that ensemble clustering has enhanced the prediction power compared to conventional classification models to predict loan defaults.

Keywords — *Personal loan default, Machine learning, Ensemble clustering, Debt-to-income ratio, Classification*

Resume Content Scoring and Improvement Suggestions Using NLP and Rule-based Techniques

<i>R.L. Weerasinghe</i> Faculty of Information Technology University of Moratuwa, Sri Lanka reshakalakshan@gmail.com	<i>N.N. Perera</i> Faculty of Information Technology University of Moratuwa, Sri Lanka nimnaperera98@gmail.com	<i>S.P. Warusawithana</i> Faculty of Information Technology University of Moratuwa, Sri Lanka supunawa@gmail.com
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T.M. Hindakaraldeniya
Faculty of Information Technology
University of Moratuwa, Sri Lanka
tharumadurangi97@gmail.com

G. U. Ganegoda
Faculty of Information Technology
University of Moratuwa, Sri Lanka
upekshag@uom.lk

Abstract - Having a proper resume is very important for undergraduates or fresh graduates to find their dream job. But most of them find it difficult to prepare their resume properly by themselves. It often needs a third party to review the resume to identify missing parts and content improvements of the resume because most of the time candidates make some mistakes. When it comes to resume review systems, most of the systems are based on the recruiter perspective which does not provide any insights for the candidate to improve their resumes. Hence, it is helpful if a proper resume content reviewer is there for candidates to analyze their resumes. This study is focused on developing a model to resume content scoring and suggest missing content based on NLP and rule-based techniques. Two separate approaches were developed and tested for the proposed system and then the comparison of those approaches were carried out through this study.

Keywords — *Resume Content Scoring, Missing Content Suggestion, NLP, Rule-based Techniques*

ResBot: A Bi-Lingual Restaurant Booking Conversational Artificial Intelligence

L.K.D. Fernando

Faculty of Information Technology

University of Moratuwa

Katubedda, Sri Lanka

kalpafernando1998@gmail.com

G. U. Ganegoda

Faculty of Information Technology

University of Moratuwa, Sri Lanka

upekshag@uom.lk

Abstract - AI-powered chatbots in the service industry enhance customer service and enable data-driven decisions. However, in a conversation, the user's input may not always align closely with the training examples, causing even advanced Natural Language Understanding pipelines to occasionally misinterpret the intent behind user utterances, leading to potential conversational missteps. This paper introduces ResBot, an innovative bi-lingual chatbot (Sinhala and English) with a novel hybrid intent classification mechanism. This approach emphasizes the importance of generalization in intent recognition beyond training data using a language model. Furthermore, by automating reservations through its chat interface, the chatbot transforms customer experience and optimizes restaurant operations in an increasingly digital landscape.

Keywords - *Natural Language Processing (NLP), Chatbot, Machine Learning (ML), Artificial Intelligence (AI), Zero-Shot Classification, Intent Classification, Entity Recognition*

Explainable AI techniques for Deep Convolutional Neural Network based plant disease identification

Sashika Kiriella
Department of
Computational Mathematics
University of Moratuwa
Moratuwa, Sri Lanka
shkiriella@agri.sab.ac.lk

Subha Fernando
Department of
Computational Mathematics
University of Moratuwa
Moratuwa, Sri Lanka
subhaf@uom.lk

Sagara Sumathipala
Department of
Computational Mathematics
University of Moratuwa
Moratuwa, Sri Lanka
sagaras@uom.lk

EPN Udayakumara
Department of Natural Resources
Sabaragamuwa University of Sri Lanka
Balangoda, Sri Lanka
udayaepn@appsc.sab.ac.lk

Abstract - Deep learning-based computer vision has shown improved performance in image classification tasks. Due to the complexities of these models, they have been referred as opaque models. As a result, users need justifications for predictions to enhance trust. Thus, Explainable Artificial Intelligence (XAI) provides various techniques to explain predictions. Explanations play a vital role in practical application, to apply the exact treatment for a plant disease. However, application of XAI techniques in plant disease identification is not popular. This paper discusses the key concerns and taxonomies available in XAI and summarizes the recent developments. Also, it develops a tomato disease classification model and uses different XAI techniques to validate model predictions. It includes a comparative analysis of XAI techniques and discusses the limitations and usefulness of the techniques in plant disease symptom localization.

Keywords — *Explainable Artificial Intelligence, Plant Disease, Deep Learning*

Improved Particle Swarm Optimization for Optimizing The Deep Convolutional Neural Network

A.W.C.K. Atugoda

Department of Computational Mathematics Department of Computational Mathematics

University of Moratuwa

University of Moratuwa

Colombo, Sri Lanka

Colombo, Sri Lanka

atugodac@itum.mrt.ac.lk

subhaf@uom.lk

Abstract - In recent years, Deep Neural Networks (DNN) have been employed in different types of fields for recognizing, classifying, detecting and sorting, etc. Thus, optimizing the DNN is very essential to obtain a potential solution with high accuracy. Neural network(NN) can be optimized by optimizing the weight values of the network. Many studies have been done utilizing conventional optimization techniques such as Stochastic Gradient Descent(SGD), Adam, Ada Delta, and so on. Employing traditional optimization approaches in optimizing the deep neural network, on the other hand, results in poor performance due to trapping at local extremes and premature convergence. As a result, researchers looked into Swarm Intelligence(SI) optimization algorithms, which are fast and robust global optimization methods that have gained a lot of attention due to their capability to deal with complicated optimization problems. Among different types of SI algorithms, Particle Swarm Optimization (PSO) is mostly used in NN optimization as it has a few parameters to be tuned, and no derivative for simplification. However, recent studies have shown that the standard PSO is not the best tool for tackling all engineering problems since it is slow in some contexts, such as biomedical engineering and building construction, and converges to local optima. Therefore, improving the PSO algorithm is critical for obtaining a feasible solution to NN optimization problems. Hence, the main goal of this study is to make advanced enhancements to the PSO algorithm to optimize DNN while addressing several concerns, such as minimizing the computational cost or Graphical Processing Unit (GPU) dependency and having large input data in Deep Convolutional Neural Network (DCNN) training.

Keywords — *Deep Neural Network, Neural Network Optimization, Swarm Intelligence, Weight Optimization, Swarm Based Particle Swarm Optimization*

Learning Application for Educational and Skills Development of Primary Children

<i>M.D.J. Malshika</i> <i>Faculty of Computing</i> <i>Sri Lanka Institute of</i> <i>Information Technology</i> <i>Malabe, Sri Lanka</i> <i>jananimalshika98@gmail.com</i>	<i>N.S. Wijeratne</i> <i>Faculty of Computing</i> <i>Sri Lanka Institute of</i> <i>Information Technology</i> <i>Malabe, Sri Lanka</i> <i>comnusharawijeratne@gmail.com</i>	<i>P.K.P. Kavishka</i> <i>Faculty of Computing</i> <i>Sri Lanka Institute of</i> <i>Information Technology</i> <i>Malabe, Sri Lanka</i> <i>pasindukavishka5@gmail.com</i>
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Bhagyanie Chathurika
Faculty of Computing
Sri Lanka Institute of Information
Technology
Malabe, Sri Lanka
bhagyanie.c@sliit.lk

Supipi Karunathilaka
Faculty of Computing
Sri Lanka Institute of Information
Technology
Malabe, Sri Lanka
supipi.k@sliit.lk

Abstract - This research uses interactive web-based learning tools to improve primary school children's language skills, mathematical competency, and critical thinking ability. The study attempts to bridge the gap between linguistic and numerical literacy while also including critical thinking aspects into the learning process, resulting in a full and interesting educational experience. The importance of this study stems from its dedication to comprehensive growth through the integration of technology and education. The technique integrates auditory, visual, and interactive components to make language and mathematical skill development successful and pleasant by providing a dynamic platform that accommodates varied learning styles. The project's methodology entails rigorous data gathering, the building of strong neural network models for linguistic and arithmetic skills, and the use of facial expression detection technologies to test critical thinking skills. Through various data sources, these models are taught to recognize and improve handwriting, numbers, and mathematical problem-solving. The study yields favorable results in all three categories. Significant increases in letter and numerical recognition, vocabulary enhancement, and mathematical competency have been demonstrated via interactive games aimed to promote language and mathematics ability. Furthermore, the use of facial expression detection technologies in educational games analyses and improves the critical thinking skills of primary school children. Finally, this study pioneers a strategy that demonstrates

the potential of interactive web-based learning apps to improve linguistic, mathematics, and critical thinking skills. The findings reflect a huge step forward towards a more integrated and effective learning environment, with technology aiding an all-encompassing education. The research emphasizes the need to integrate technology and education to provide kids with language, numeracy, and critical thinking abilities that will prepare them for future problems.

Keywords — Primary, Language, Mathematical, Critical thinking, Technology, Education, Facial expression, Problem- solving, Neural network, Handwriting, Auditory

Classification of Fungi Images Using Different Convolutional Neural Networks

U.M.M.P.K. Nawarathne

Computing Centre

Faculty of Engineering

University of Peradeniya

Peradeniya, Sri Lanka

mnawarathne20@gmail.com

H.M.N.S. Kumari

Computing Centre

Faculty of Engineering

University of Peradeniya

Peradeniya, Sri Lanka

nadeeshaku@sci.pdn.ac.lk

Abstract - Fungi offer vital solutions to humanity through roles in medicine, agriculture, and ecological balance while presenting potential threats. They have yielded antibiotics, food fermentation, and nutrient recycling however, fungal infections, crop diseases, and spoilage highlight their dark side. Therefore, it is important to identify fungi to harness their potential benefits and mitigate threats. Offering quick and accurate identification through image classification improves the aforementioned features. Therefore, this study classified images of five types of fungi using convolutional neural networks (CNN). Initially, dataset distribution was observed, and it was identified that there was a class imbalance in the dataset. To address this issue, data augmentation technique was used. Several pre-processing techniques were also applied to understand the model training behavior with their application. Then the images were rescaled into six different resolution combinations such as original images, low-resolution images, high-resolution images, a mix of original and low-resolution images, a mix of original and high-resolution images, and a mix of low and high-resolution images. Then these data were trained using 13 pre-trained CNN models such as Xception, VGG16, VGG19, InceptionResNetV2, ResNet152, EfficientNetB6, EfficientNetB7, ConvNeXtTiny, ConvNeXtSmall, ConvNeXtBase, ConvNeXtLarge, ConvNeXtXLarge, BigTransfer (BiT). To evaluate these models, accuracy, macro average precision, macro average recall, macro average f1- score, and loss learning curve assessment were used. According to the results, the BiT model preprocessed with normalization, which used a mix of original and high-resolution images, performed the best, producing a model accuracy of 87.32% optimal precision, recall, and f1-score. The loss learning curve of the BiT model also depicted a low overfitting aspect proving the model's optimal behavior. Therefore, it was concluded that the BiT model with the mix of original and high-resolution data can be used to detect fungi efficiently.

Keywords — *BigTransfer (BiT model), convolutional neural network, fungi, image classification, transfer learning*

Enhancing DDoS Attack Detection via Blending Ensemble Learning

C.R. Joseph Amalraj
Faculty of Information Technology
University of Moratuwa
Colombo, Sri Lanka
amalraj@uom.lk

P.G.G. Madhusankha
Faculty of Information Technology
University of Moratuwa
Colombo, Sri Lanka
madhusankhamrtit97@gmail.com

Abstract - This research focuses on identifying DDoS attacks using an ensemble learning approach that incorporates blending techniques. We developed an innovative methodology by selecting the 21 most significant features from the CIC-DDoS2019 dataset. To improve classification accuracy, we used a two-layer blending ensemble technique. In the first layer, we combined Decision Tree, Logistic Regression, and KNN classifiers, while the second layer used a Random Forest classifier. The model achieved exceptional results, with a 99.94 and a 97.35 accuracy. We also created a user-friendly web portal to make the model accessible for individuals in network security, regardless of their technical expertise. This approach advances DDoS attack detection and enhances usability for users in the field of network security.

Keywords — *DDoS attacks, CIC-DDoS2019, Blending Ensemble*

Alzheimer's Disease Prediction Using Clinical Data Approach

L.R.D. Perera

*Faculty of Information Technology
University of Moratuwa
Colombo, Sri Lanka
rashmildp@gmail.com*

G. U. Ganegoda

*Faculty of Information Technology
University of Moratuwa
Colombo, Sri Lanka
upekshag@uom.lk*

Abstract - Alzheimer's Disease (AD) is a progressive neurodegenerative condition that profoundly affects cognition and memory. Due to the absence of curative treatments, early detection and prediction are crucial for effective intervention. This study employs machine learning and clinical data from Alzheimer's Disease Neuroimaging Initiative (ADNI) to predict AD onset. Data preprocessing ensures quality through variable selection and feature extraction. Diverse machine learning algorithms, including Naive Bayes, logistic regression, SVM-Linear, random forest, Gradient Boosting, and Decision Trees, are evaluated for prediction accuracy. The model resulted with random forest classifier together with filter method yields the highest AUC. The study highlights important analysis using Random Forest and Decision Trees, revealing significant variables including cognitive tests, clinical scales, demographics, brain-related metrics, and key biomarkers. By enhancing predictive capabilities, this research contributes to advancing Alzheimer's disease diagnosis and intervention strategies.

Keywords — *Machine Learning, Supervised Learning, Feature importance*

Alzheimer's Disease detection using Blood Gene Expression Data

G.D.S. Yasodya

Faculty of Information Technology

University of Moratuwa

Colombo, Sri Lanka

sudam.18@itfac.mrt.ac.lk

G.U. Ganegoda

Faculty of Information Technology

University of Moratuwa

Colombo, Sri Lanka

upekshag@uom.lk

Abstract - Alzheimer's disease is the most prevalent form of dementia with no established cure. Extensive research aims to comprehend its underlying mechanisms. Genetic insights are sought through gene expression data analysis, leveraging computational and statistical techniques to identify risk-associated genes. This study focuses on accurate AD detection using blood gene expression data. Four feature classification methods—TF- related genes, Hub genes, CFG, and VAE are employed to identify crucial AD-related genes. Five classification approaches—RF, SVM, LR, L1-LR, and DNN—are used, evaluated by AUC. The VAE + LR model yields the highest AUC (0.76). The study identifies 100 influential AD-associated genes where data is sourced from Alzheimer's Disease Neuroimaging Initiative (ADNI). Findings hold promise for advancing early diagnosis and treatment, enhancing AD patients' quality of life.

Keywords — *blood gene expression, machine learning, alzheimer's disease*

Performance Improvement of Proxy Server Cache Management Using Web Usage Mining

Thasan Leenas
Information Technology Center
Trincomalee Campus
Eastern University, Sri Lanka
leenast@esn.ac.lk

H. A. Caldera
University of Colombo School of
Computing
Colombo, Sri Lanka
hac@ucsc.cmb.ac.lk

Abstract - In these modern industries, all sectors are transitioning from manual to web-oriented applications. Thus, the number of Internet users are increasing drastically. Therefore, there is a substantial traffic, which increases the demand on the server and server response latency to obtain web objects. The proxy server caching mechanism is one of the approaches to enhance the performance of accessing web objects via the Internet. Since the cache is typically limited in size, a replacement strategy is required to decide which cached web object should be eliminated to allow spaces for fresh web items. Proxy servers make use of various cache replacement strategies such as Least Recency Used (LRU), Least Frequently Used (LFU), and SIZE. The web objects in the proxy cache are influenced by variables like recency, frequency, fetching time, and size. The traditional caching policies decide only one factor at a time, unpopular web objects are wasted in the cache memory (cache pollution) and the performance of the proxy cache decreases. To increase its performance, we propose using the proxy server log file to identify individual users and their sessions as well as categorize the web objects into three groups: high priority, average priority, and low priority web objects. The prepared log file is used to train the classifiers. Future requests are classified as high, average, or low objects using the classifiers, and it is then chosen whether to store them in the proxy cache or not. The objective of this research is to enhance the proxy caching mechanism by implementing the techniques mentioned above. We compared the performance of the suggested approach with traditional caching policies using a trace-driven simulation method. Two performance metrics, Hit Ratio (HR), and Byte Bit Ratio (BHR), were used for our investigation. Our experimental findings demonstrate that the suggested approach outperforms traditional caching policies.

Keywords — *proxy server, caching, web usage mining, log files, caching policies*

Modeling Sri Lankan GDP using Macroeconomic Indicators: An Approach Using Principal Component Analysis

Sachini Karunarathne
Department of Mathematics
University of Ruhuna,
Sri Lanka

sachinikarunarathne94@gmail.com

Thilini Piyatilake
Department of Computational Mathematics
University of Moratuwa
Sri Lanka
thilinispi@uom.lk

Abstract - Economics is conventionally divided into two parts, namely, microeconomics and macroeconomics. While microeconomics delves into individual and business decisions, macroeconomics examines the broader decisions made at the county and government levels, providing a comprehensive understanding of the economy as a whole. The macroeconomic indicators are crucial reflectors of the country's economic status as they underscore their pivotal role in sustaining economic growth. This study focuses on analyzing the relationship between macroeconomic indicators and the economic growth of Sri Lanka. Nineteen macroeconomic indicators were extracted from the CBSL reports and the data were collected for the period of 1976-2018 from the World Bank website. The choice of PCA is strategic due to the pronounced high correlation among the variables. Subsequently, forward regression analysis is conducted to model relationships with identified principal components, aiming to determine the most influential macroeconomic indicators impacting GDP and to identify the most reliable model with the highest predictive power for GDP. The two principal components extracted from the analysis are found to closely mirror government activities and human capital involvement in the economy. The robust predictive power of these two principal components in forecasting GDP is evident, with an impressive R-squared value of 99.74. This underscores their reliability and effectiveness in predicting economic growth.

Keywords — *Macroeconomic indicators, PCA, Forward regression analysis*

An Agile Project Management Supporting Approach for Estimating Story Points in User Stories

K. Jithmini Wanigasooriya Arachchi
Department of Information Technology
University of Moratuwa
Katubedda, Sri Lanka
184067p@uom.lk

C.R.J. Amalraj
Department of Information Technology
University of Moratuwa
Katubedda, Sri Lanka
amalraj@uom.lk

Abstract - While significant research has been conducted on software analytics for effort estimation in traditional software projects, limited attention has been given to estimation in agile projects, particularly in estimating the effort required for completing user stories. In our study, we present a novel prediction model for estimating story points, which serves as a common unit of measure for gauging the effort involved in completing a user story or resolving an issue. To achieve this, we propose a unique combination of two powerful deep learning architectures, namely LSTM and RHN. What sets our prediction system apart is its end-to-end training capability, allowing it to learn directly from raw input data without relying on manual feature engineering. To support our research, we have curated a comprehensive dataset specifically tailored for story points-based estimation. This dataset comprises 6801 issues extracted from 6 different open-source projects. Through an empirical evaluation, we demonstrate the superiority of our approach over three common baselines. In summary, our study addresses the gap in research regarding agile project estimation by introducing a prediction model that effectively estimates story points. By leveraging the combined power of LSTM and RHN architectures.

Keywords — *effort estimation, story point estimation, deep learning*

Game-based Analytical Skills Testing for Graduate Software Engineering Recruitment

D.W.M.N.C. Dasanayake
Faculty of Information
Technology
University of Moratuwa
Moratuwa, Sri Lanka
ncdasanayake@gmail.com

T.C. Sandanayake
Faculty of Information
Technology
University of Moratuwa
Moratuwa, Sri Lanka
thanujas@uom.lk

S.M.U. Premasiri
Faculty of Information
Technology
University of Moratuwa
Moratuwa, Sri Lanka
upremasiri@uom.lk

Abstract - Game-based recruitment is an emerging trend adopted by organizations globally, given its proven results in boosting candidate perceptions of the company and providing an improved recruitment experience. This paper explores the use of game-based analytical skill testing in the recruitment process of entry-level graduate software engineers in Sri Lanka. The Test of Logical Thinking by Tobin and Capie has been used as a reference, and a game-based version has been developed using the MDA framework, relying on mechanics, dynamics, and aesthetics. The testing phase has been carried out using a focus group of eight fresh graduate software engineering recruits, and the results have depicted a significantly high level of accuracy between the results produced through the paper-based and game-based versions. Candidate perceptions of the recruitment process and the employer have been recorded to be positively influenced by the introduction of game-based testing in the recruitment process.

Keywords — *Game-based recruitment, TOLT Test, MDA Framework, Digitized recruitment*

Cloud-based Weather Condition Monitoring System using ESP8266 and Amazon Web Services

Anes Mohamed
Faculty of Information
Technology
Horizon Campus
Malabe, Sri Lanka
anasm0869@gmail.com

Gunaseelan Gunasegaran
Faculty of Information
Technology
Horizon Campus
Malabe, Sri Lanka
gunanishan5@gmail.com

Daminda Herath
Faculty of Information
Technology
Horizon Campus
Malabe, Sri Lanka
dherath10@gmail.com

Abstract - In the recent years, there has been a lot of interest in global climate change. People want to be aware of the most recent weather conditions in their vicinity and immediate surroundings. This study presents a prototype of an Internet of Things-based system that uses sensors to monitor weather conditions. Three separate sensors, including an ultrasonic sensor, a raindrop sensor, and a pressure sensor, were used. The microcontroller board served as the system's brain. The sensors continuously collect weather data and transmit it through Wi-Fi to a remote server. The weather data is moved to a cloud platform, which gives real-time weather informatics reporting on a website after that. The platform employed in this study was Amazon Web Services (AWS) IoT, and Amazon DynamoDB was used to store sensor data. The IoT presents a novel perspective on future environmental monitoring. Consequently, the role of the Internet of Things in the developing field of environmental informatics is also covered in this study.

Keywords — *ESP8266, Internet of Things (IoT), MQTT, Weather Monitoring, Amazon Web Services (AWS)*

Intelligent IoT Daily Running Log with OBD Data Monitoring and Alerts System

C.M.S. Madushan
Department of Electrical & Electronics
Technology
University of Vocational Technology
Ratmalana, Sri Lanka
shashikamadushan0220@gmail.com

Sondarngallage D.A. Sanjeewa
Department of Electrical & Electronics
Technology
University of Vocational Technology
Ratmalana, Sri Lanka
sdsanjeewa@uovt.ac.lk

H.M.R.G. Herath
Department of Electrical & Electronics Technology
University of Vocational Technology
Ratmalana, Sri Lanka
ravindu@ieee.org

Abstract - This paper presents an IoT-based Daily Running Log with OBD Data Monitoring and Alerts System, featuring advanced vehicle management. It includes real-time online daily running chart updates, a GPS-integrated security system, trip information messaging, voice messaging, continuous vehicle data monitoring, precise error diagnostics, an intuitive online dashboard, a secure data repository, a vigilant warning system, and a user-friendly web app. The architecture uses an economical Wi-Fi-enabled ESP8266 platform with three NodeMCU modules. The design phase has PCBs, waterproof 3D-printed enclosures, and displays. Data is collected, monitored, and stored via a remote IoT cloud. Real-world data was analyzed using simulation software, aiming to extend vehicle lifespans by curbing abuse. The primary objective of this research is to curb vehicle abuse, thereby enhancing vehicle lifespan by mitigating potential damages.

Keywords — *Internet of Things, On Board Diagnostic, GPS, Real time Monitoring*

Real Time Energy Market for LV Distribution Networks in Smart Grid Using Blockchain Technology

<i>N.S. Hasaranga</i> <i>Department of Electrical Engineering</i> <i>University of Moratuwa</i> <i>Moratuwa, Sri Lanaka</i> <i>sahanhasaranga885@gmail.com</i>	<i>N.S.A.D.S. Nanayakkara</i> <i>Department of Electrical Engineering</i> <i>University of Moratuwa</i> <i>Moratuwa, Sri Lanaka</i> <i>nanayakkara68@gmail.com</i>	<i>W.Y.U.N. Botheju</i> <i>Department of Electrical Engineering</i> <i>University of Moratuwa</i> <i>Moratuwa, Sri Lanaka</i> <i>yohanumesh8@gmail.com</i>
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D.S. De Silva
Department of Electrical and Information Engineering
University of Ruhuna
Hapugala, Sri Lanaka
saman@eie.ruh.ac.lk

Abstract - This paper presents a novel blockchain-based approach for establishing a decentralized real-time energy market in low voltage (LV) distribution networks. As the integration of distributed energy resources (DERs) surges and efficient energy management becomes imperative, demand for a transparent marketplace grows. Blockchain ensures secure, peer-to-peer energy trading among prosumers via smart contracts, ensuring real-time transaction validation. Utilizing the Corda blockchain architecture, transaction data relevant to each node is stored, safeguarding privacy, confidentiality, and immutability. The developed user-friendly web interface enables users to initiate, modify, and accept proposals, granting them control over transactions and promoting overall efficiency. This approach fosters a sustainable energy ecosystem, encouraging clean energy adoption and grid efficiency, thus pioneering the way to a decentralized, efficient, real-time energy market.

Keywords — *Real time energy market, Blockchain technology, LV distribution network, Energy transactions.*

Blockchain-Based Software Subscription and Licenses Management Systems

*Hithru De Alwis,
Department of Computer
Science and Engineering
Faculty of Engineering
University of Moratuwa
Sri Lanka
hithru.18@cse.mrt.ac.lk*

*Adeesha Wijayasiri
Department of Computer
Science and Engineering
Faculty of Engineering
University of Moratuwa
Sri Lanka
adeeshaw@cse.mrt.ac.lk*

*Shamila De Silva
Department of Computer
Science and Engineering
Faculty of Engineering
University of Moratuwa
Sri Lanka
shamila.18@cse.mrt.ac.lk*

*Kasun De Silva
Department of Computer Science and Engineering
Faculty of Engineering
University of Moratuwa
Sri Lanka
kasun.18@cse.mrt.ac.lk*

Abstract - Current software licensing models exhibit short comings in transparency, security, and adaptability. Addressing these challenges, this study presents a novel blockchain-based licensing system using the Ethereum platform. By employing smart contracts and the ERC721 and ERC20 token standards, the system ensures automated, transparent, and secure license agreement enforcement and facilitates license token operations. Influenced by the rise of subscription licenses and the implications of the UsedSoft court decision, the research designs a blockchain-driven subscription license model, analyses the UsedSoft case's impact on license transfers, and formulates specialized smart contracts for varied licensing models. The approach signifies a marked advancement in contemporary software licensing practices.

Keywords — *Blockchain, Smart Contracts, Ethereum, Software Licensing, Software Subscriptions, License Transfer, License Activation*

AI-Driven User Experience Design: Exploring Innovations and Challenges in Delivering Tailored User Experiences

Prasadini Padmasiri
Faculty of Graduate Studies
and Research
Sri Lanka Institute of
Information Technology
Malabe, Sri Lanka
prasadinipadmasiri@gmail.com

Pramukthika Kalutharage
Faculty of Graduate Studies
and Research
Sri Lanka Institute of
Information Technology
Malabe, Sri Lanka
yazpk60@gmail.com

Nethma Jayawardhane
Faculty of Graduate Studies
and Research
Sri Lanka Institute of
Information Technology
Malabe, Sri Lanka
nethmaa.d@gmail.com

Jagath Wickramarathne
Faculty of Computing
Sri Lanka Institute of Information Technology
Malabe, Sri Lanka
jagath.w@sliit.lk

Abstract - In today's digital landscape, providing user experiences is considered paramount in respect of user satisfaction and engagement. Artificial Intelligence (AI) has emerged as a transformative force in the User Experience (UX) design field, offering innovative solutions. Our research delves into key innovations and challenges enabled by AI in UX design particularly guided by Design Thinking (DT) process. The methodology involved administering a questionnaire to UX professionals in Sri Lanka using a snowball sampling method. The questionnaire, distributed through online platforms, explored participants' familiarity with AI-driven UX design, contributions of AI in the DT process, and challenges faced, and the responses were analyzed using MS Excel and R Studio. The results demonstrate that AI technologies certainly empower UX professionals to design user-centric solutions adhering to DT process. A "Recommendation Guide" is provided, featuring a set of recommended tools for UX professionals to integrate AI technologies into the DT process.

Keywords — *AI Tools, Artificial Intelligence, Design Thinking Process, User Experience*

A Robotic Hand for Rehabilitation of Wrist and Fingers

<i>W.A.K.C. Weerasoory</i> <i>Department of Mechanical Engineering</i> <i>University of Moratuwa</i> <i>Katubedda, Sri Lanka,</i> <i>10400</i> <i>kulun@ieee.org</i>	<i>U.R.E. Kumasaru</i> <i>Department of Mechanical Engineering</i> <i>University of Moratuwa</i> <i>Katubedda, Sri Lanka,</i> <i>10400</i> <i>udeeshakumasaru975@gmail.com</i>	<i>H.M.W. Nipun</i> <i>Department of Mechanical Engineering</i> <i>University of Moratuwa</i> <i>Katubedda, Sri Lanka,</i> <i>10400</i> <i>nithanipun1@gmail.com</i>
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<i>H.H.M.J. De Silva</i> <i>Department of Mechanical Engineering</i> <i>University of Moratuwa</i> <i>Katubedda, Sri Lanka,</i> <i>10400</i> <i>manurajithmal@gmail.com</i>	<i>R.K.P.S. Ranaweera</i> <i>Department of Mechanical Engineering</i> <i>University of Moratuwa</i> <i>Katubedda, Sri Lanka,</i> <i>10400</i> <i>pubudur@uom.lk</i>	<i>R.A.R.C. Gopura</i> <i>Department of Mechanical Engineering</i> <i>University of Moratuwa</i> <i>Katubedda, Sri Lanka,</i> <i>10400</i> <i>gopurar@uom.lk</i>
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Abstract - Carpal Tunnel Syndrome is a common neural disease among people with repetitive wrist movements. It affects the sensation and movement of the thumb, index finger, middle finger, and half of the ring finger. The syndrome can be treated effectively through therapeutic exercises in the early stages of diagnosis or through surgery in more severe cases. However, the lack of physiotherapists poses a significant challenge in hospitals where thorough observation is required. The proposed rehabilitation robot focuses on wrist and finger exercises designed explicitly for Carpal Tunnel Syndrome and intended for clinical use. The sensors detect the patient's range of motion and display the data for the therapist, who can then determine the appropriate exercises. Finger exercises include flexion-extension, mimicking grasping patterns, while wrist exercises include flexion-extension and hyperextension. The rehabilitation program consists of three stages and several iterations, progressing according to the patient's recovery, which can be observed through the data collected from the sensors. The rehabilitation robot utilizes an under-actuation method that drives proximal interphalangeal, and distal interphalangeal joints of the four fingers using two servo motors for finger rehabilitation. The thumb is actuated using a separate servo motor. A stepper motor actuates wrist movement. A mathematical model was developed to simulate the movements of the linkage system, which is deployed in the sagittal plane of the fingers. The effectiveness of the rehabilitation robot has been verified through simulations and experiments.

Keywords — *Rehabilitation, Robotics, Robot-assisted Therapy*

ITConnect: Real-time Personalized Job Posting Platform for IT Professionals

Karunanayake K.R.D.S.K.
Faculty of Computing
Sri Lanka Institute of Information
Technology
Sri Lanka
karunanayake.sayuri@gmail.com

Chandrawansa K.T.M.
Faculty of Computing
Sri Lanka Institute of Information
Technology
Sri Lanka
chandrawanshathisara@gmail.com

Gunatilleke L.C.T.
Faculty of Computing
Sri Lanka Institute of Information
Technology
Sri Lanka
thilini99gunathilaka@gmail.com

Menuranga K.Y.D.B.
Faculty of Computing
Sri Lanka Institute of Information
Technology
Sri Lanka
bdishma@gmail.com

Asiri Gawesha
Faculty of Computing
Sri Lanka Institute of Information
Technology
Sri Lanka
asiri.l@sliit.lk

Kalpani Manathunga
Faculty of Computing
Sri Lanka Institute of Information
Technology
Sri Lanka
kalpani.m@sliit.lk

Abstract - This study offers an innovative job platform created especially for IT professionals in Sri Lanka to address pressing issues in the IT job market. The platform focuses on four main challenges: identifying fake job postings using NLP techniques, providing customized job recommendations based on skill assessments, enhancing the candidate application process through facial analysis, and evaluating resumes based on experience and job levels. The DistilBERT text analysis fake job detection model achieves a remarkable overall accuracy of 98% combines skill assessments with content-based filtering to deliver useful job recommendations. The stress level estimator and Siamese models are used to face verification while assessing the candidate's stress level. The resume enhancement system powered by PyPDF2 and a deep neural network, boasts an impressive 86.6% accuracy in evaluating job candidates' experience. It also streamlines resume creation with a ReactJS generator.

Keywords — *IT Workforce, Online Recruitment, Fake Job Post Detection, BERT transformers, NLP, Siamese models, Resume Generator, content-based filtering, Job Recommendation System*

IoT Empowered Open Sensor Network for Environmental Air Pollution Monitoring System in Smart Cities

B.H. Sudantha

Faculty of Information Technology

University of Moratuwa

Sri Lanka

sudanthabh@uom.lk

Abstract - Designing of an IoT-based air pollution monitoring system is a proactive and impactful approach to tackle the critical issue of air pollution and its adverse effects on the environment. Such a system is instrumental in offering real-time air quality data, empowering swift responses when pollution levels exceed acceptable thresholds. The system's design encompasses various hardware components, including carefully chosen air quality sensors, a microcontroller (Arduino Mega 2560), a communication module for the network connectivity, and a sustainable power supply. On the software front, the system involves data collection from sensors, data processing with calibration and conversion to air quality parameters, secure data transmission, storage, analysis, and an alerting mechanism. User interface development facilitates real-time and historical data visualization, while stringent security measures ensure data protection. Scalability, integration, and strategic deployment in key areas further enhance the system's effectiveness. Regular maintenance and updates are vital to ensuring accurate and reliable performance. Overall, implementing an IoT-based air pollution monitoring system is an essential step toward monitoring and addressing air quality concerns in a comprehensive and timely manner, ultimately fostering environmental awareness, and driving pollution mitigation efforts.

Keywords — *IoT, AQM, environmental monitoring System, Open Hardware, Open Software, Semiconductor Sensors, Air pollution, Microcontrollers, Arduino Mega, Air Quality Index (AQI)*

Acoustic Signature Analysis for Distinguishing Human vs. Synthetic Voices in Vishing Attacks

Prarthana Gamage
Faculty of Information
Technology
University of Moratuwa
Moratuwa, Sri Lanka
prarthana.18@itfac.mrt.ac.lk

Dushan Dissanayake
Faculty of Information
Technology
University of Moratuwa
Moratuwa, Sri Lanka
dushan.18@itfac.mrt.ac.lk

Niroopama Kumarasinghe
Faculty of Information
Technology
University of Moratuwa
Moratuwa, Sri Lanka
prasadi.18@itfac.mrt.ac.lk

Gamage Upeksha Ganegoda
Faculty of Information Technology
University of Moratuwa
Moratuwa, Sri Lanka
upekshag@uom.lk

Abstract - Cybercrimes targeting mobile devices are on the rise, with vishing and smishing attacks being particularly prevalent. These attacks exploit social engineering techniques to manipulate individuals into divulging personal information or engaging in unintended actions. To counter this evolving threat landscape, this research proposes a pioneering methodology rooted in voice feature analysis. By distinguishing between human and robotic voices, this approach aims to discern legitimate calls from potential scams, thereby mitigating the associated financial losses and reputational damage. The research delves into the intricacies of voice feature analysis, leveraging natural language processing (NLP) and machine learning (ML) techniques to extract and analyze audio attributes such as pitch, volume, and temporal patterns. The ultimate objective is to create a binary classification model that accurately differentiates between human voice calls and robocalls, incorporating a comprehensive dataset comprising actual call recordings and synthesized scenarios. This research advances beyond conventional practices by championing a holistic analysis of both human and robocalls, contrary to the prevalent assumption of robocalls exclusively constituting scams. The application of various audio features, coupled with nuanced weightage allocation, enhances the model's discernment capabilities. The resultant binary classifier is an exemplar of the innovative fusion of technology and human expertise. In conclusion, this research introduces a novel dimension to the combat against vishing and smishing attacks, with a robust voice feature analysis methodology capable of accurately identifying human and robotic voices. By effectively distinguishing legitimate calls from potential threats, this approach presents a promising avenue for safeguarding individuals

and organizations against the far-reaching consequences of cybercrimes. The comprehensive analysis, validation, and insights presented in this paper contribute significantly to the field of cybersecurity and voice-based communication analysis.

Keywords — cyber security, vishing, extraction, audio feature analysis, classification model

Local Planning of an Autonomous Driving Car Prototype

A.M. Amrith
Department of
Instrumentation and
Automation Technology
Faculty of Technology
University of Colombo
Sri Lanka
amm.amrith@gmail.com

A.L. Faris
Department of
Instrumentation and
Automation Technology
Faculty of Technology
University of Colombo
Sri Lanka
farisahamedlebbe2@gmail.com

M.H.A.A. Madhi
Department of
Instrumentation and
Automation Technology
Faculty of Technology
University of Colombo
Sri Lanka
mhaamahdhi@gmail.com

Chathurika S. Silva
Department of Instrumentation and Automation Technology
Faculty of Technology
University of Colombo
Sri Lanka
chathurika@iat.cmb.ac.lk

Abstract - Autonomous vehicles are mobile robots that integrate advanced technology for navigation, decision-making, and control. These vehicles have been developed in response to the growing concerns around accidents and injuries caused by human drivers, as well as to reduce the negative impact of cars on the environment, including energy consumption, pollution, and congestion. A combination of sensors and algorithms gives autonomous cars a comprehensive understanding of their surroundings, allowing them to safely navigate roads, detect other vehicles, pedestrians, and traffic lights, and reach their destination. This research is intended plan the path with obstacle avoidance while restricting to the constraints imposed by the maximum lateral acceleration and turning angles along lane. The proposed approach is capable of real-time detection and recognition of obstacles and tracking lanes. Several obstacle detection sensors are used to detect and avoid obstacles coming from the front, left and right directions with the detection accuracies of 96%, 87% and 81% respectively. Lane line detection and tracking are performed by the real-time acquisition of images followed by real-time image processing. Evaluation results prove that the proposed method can efficiently detect and avoid obstacles while following the lane lines on the road.

Keywords — *autonomous self-driving, sensors, obstacle detection, lane tracking, image processing*

Leveraging Artifact Reputation Analysis and Contextual Sentiment Analysis for Advanced Detection of Vishing and Smishing Attacks

Dushan Dissanayake
Faculty of Information
Technology
University of Moratuwa
Moratuwa, Sri Lanka
dushan.18@itfac.mrt.ac.lk

Prarthana Gamage
Faculty of Information
Technology
University of Moratuwa
Moratuwa, Sri Lanka
prarthana.18@itfac.mrt.ac.lk

Niroopama Kumarasinghe
Faculty of Information
Technology
University of Moratuwa
Moratuwa, Sri Lanka
prasadi.18@itfac.mrt.ac.lk

Gamage Upeksha Ganegoda
Faculty of Information Technology
University of Moratuwa
Moratuwa, Sri Lanka
upekshag@uom.lk

Abstract - The rise of advanced mobile technology has brought about the widespread presence of mobile devices in our society. These portable and versatile gadgets have become essential items for individuals due to their convenience and capabilities. As technology continues to play a pivotal role in modern life, an ever-growing number of people rely on mobile devices for almost all life activities including crucial financial activities and business routines. However, the increasing popularity of mobile devices has also exposed users to a heightened risk of falling victim to fraudulent schemes. Perpetrators have been exploiting mobile users by pretending to present authentic and legitimate requests and opportunities, leading to the divulgence of personal and sensitive information. These deceitful activities have seen a significant increase, affecting individuals of various ages, educational backgrounds, and levels of technological literacy. Additionally, malicious actors employ advanced methods to conceal their identities, making it challenging to prevent and counter these attacks. Two prevalent yet under-addressed issues in this context are vishing and smishing. This research study introduces a system designed to detect vishing and smishing attempts more accurately. The system analyzes the reputation of suspicious artifacts in messages and call conversations using third party threat intelligence services. Further, it employs natural language processing and machine learning techniques to examine the content of voice calls and SMS messages. It identifies suspicious elements such as keywords and phrases commonly used in phishing attacks, sensitive information as well as the context of the content.

Keywords — *cyber security, phishing, natural language processing, machine learning, contextual sentiment analysis*

Multi-Modal Defect Detection System for Single Color Fabrics in the Apparel Industry

Vimeshi Silva
*Faculty of Information
Technology*
University of Moratuwa
Vimeshi.bhagya@gmail.com

Thilakshi Senevirathne
*Faculty of Information
Technology*
University of Moratuwa
thilakshids@gmail.com

Nifla Fareed
*Faculty of Information
Technology*
University of Moratuwa
niflafareed1998@gmail.com

Thanuja Sandanayake
Department of Interdisciplinary Studies
Faculty of Information Technology
University of Moratuwa
thanujas@uom.lk

Indika Karunaratne
Department of Information Technology
Faculty of Information Technology
University of Moratuwa
indikak@uom.lk

Abstract - In the textile sector, fabric quality plays a pivotal role in maintaining competitiveness, as defects in fabrics cause detrimental effects on the market. Traditionally, fabric inspection has relied on human intervention for a long time. However, this study aims to address this issue by developing algorithms that can accurately detect defects in single-color knitted fabrics. To effectively identify and analyze defective fabric images, this research has employed multiple methodologies, including Neural Networks, Image Processing, and Morphological operations. These techniques enable the detection and analysis of three common defects (stains, holes, and thread missing) in fabrics. By automating the defect detection process, this system can potentially offer significant benefits to the apparel industry, such as cost and time savings, as well as enhancing the overall efficiency of the quality inspection process.

Keywords — *Fabric defect detection, Convolutional neural network, Morphological operations, Defect detection*

Version Controlling of User Content in Learning Management Systems for Supporting the Teaching/Learning Process

*Mohamed Fazil Mohamed
Firdhous
Department of Information
Technology
University of Moratuwa
Moratuwa, Sri Lanka
firdhous@uom.lk
ORCID:
0000-0002-3807-2435*

*Walid Elbreiki
Department of Computer
Science
College of Computer
Technology
Benghazi, Libya
elbreiki@cctben.edu.ly
ORCID:
0009-0001-4331-3109*

*Chaman Wijesiriwardana
Department of Information
Technology
University of Moratuwa
Moratuwa, Sri Lanka
chaman@uom.lk
ORCID:
0000-0002-1124-425X*

Abstract - E-Learning or online learning has become an integral part of the educational system all over the world in recent times. The importance of online learning is really felt by almost everybody in the recent COVID19 pandemic as no physical activity could be conducted that required people to meet or gather at a specific place. Learning or Content Management Systems play an important role in any online learning system as most of the teaching and learning activities occur in a disconnected or asynchronous form. One of the main features of any learning management systems is collection and distribution of learning/teaching materials as well as other documents. In this paper, the authors present the results of an in depth study carried out on the need for version controlling of user uploaded documents to the learning management systems. Also, presented is a document validation technique with a pilot implementation that can effectively compare and cross validate two uploaded files.

Keywords — *elearning, learning management systems, document uploads, version controlling, VCS, LMS, LCMS*

Time Analysis Side Channeling Attack in Symmetric Key Cryptography

M.J. Hettiarachchi
Faculty of Computing
Sri Lanka Institute of
Information Technology
(SLIIT)
Malabe, Sri Lanka
it20189808@my.sliit.lk

H.H.G.D. Sandanuwan
Faculty of Computing
Sri Lanka Institute of
Information Technology
(SLIIT)
Malabe, Sri Lanka
it20141424@my.sliit.lk

R.W. Balasooriya
Faculty of Computing
Sri Lanka Institute of
Information Technology
(SLIIT)
Malabe, Sri Lanka
it20134594@my.sliit.lk

R. Hettiarachchi
Faculty of Computing
Sri Lanka Institute of
Information Technology
(SLIIT)
Malabe, Sri Lanka
it20190934@my.sliit.lk

K.Y. Abeywardena
Faculty of Computing
Sri Lanka Institute of
Information Technology
(SLIIT)
Malabe, Sri Lanka
kavinga.y@sliit.lk

K. Yapa
Faculty of Computing
Sri Lanka Institute of
Information Technology
(SLIIT)
Malabe, Sri Lanka
kanishka.y@sliit.lk

Abstract - Protecting sensitive data in the field of symmetric key cryptography requires strong security against side-channel attacks. The confidentiality and integrity of cryptographic systems are seriously threatened by side-channel attacks, which take advantage of accidental information loss through a variety of physical channels. This research provides a comprehensive analysis of side-channel attacks and suggests an analysis method to highlight the vulnerability of a given symmetric algorithm. The relevance of side-channel attacks and their impact on cryptographic solutions are first discussed in the study. Following that, it concentrates on a well-known side-channel attack category which is Time Analysis attack. The simulation of this attack will be primarily tested on DES (Data Encryption Standard) algorithm. This research contributes to the present day attempts to strengthen the security of symmetric key cryptography by providing a thorough analysis of side-channel attacks.

Keywords — *Attacks, Cipher text (ct), Cryptography, DES, Encryption, K (Key), LAN (Local Area Networks), Masking, NPT (New Plain text), NK (New Key), Plain text (pt), Side-channel, and T (Time)*

Developing a Secure System For Telemedicine

Isuru Wijeratne
Faculty of Computing
Sri Lanka Institute of
Information Technology
Colombo, Sri Lanka
isuruwijeratne99@gmail.com

Nipunajith Kariyawasam
Faculty of Computing
Sri Lanka Institute of
Information Technology
Colombo, Sri Lanka
achinthanipu000@gmail.com

Lahiru Alahakoon
Faculty of Computing
Sri Lanka Institute of
Information Technology
Colombo, Sri Lanka
lahirualahakoon24@gmail.com

Nimali Senevirathna
Faculty of Computing
Sri Lanka Institute of Information Technology Colombo, Sri Lanka
hansikanimali6@gmail.com

Abstract - Telemedicine uses communications and IT to provide medical care remotely. Improved healthcare access may benefit rural and underserved patients and those who live at home or can't commute to a doctor. Telemedicine systems may transmit private patient data over public networks, raising security concerns. It presents a research framework for secure telemedicine systems. The framework is based on confidentiality, integrity, and availability. Telemedicine systems can be protected by several security measures in the framework. Encryption, authentication, authorization, and auditing are used. This paper presents a research framework for secure telemedicine systems that protect patient data and ensure quality care.

Keywords — *telemedicine, cyber security, artificial intelligence, machine learning, health industry, encryption, blockchain, cryptocurrency, biometrics*

ROS-based Mobile robot PID and MPC control

Pei-Lun Chiang
Department of Electrical
Engineering
National Taipei University
New Taipei City, Taiwan
ray890401@gmail.com

Yu-Chi Wu
Department of Electrical
Engineering
National United University
Miaoli, Taiwan
ycwu@nuu.edu.tw

SSU-CHIEN, CHEN
Department of Electrical
Engineering
National Taipei University
New Taipei City, Taiwan
ooxx123456tw@gmail.com

Chan-Yun Yang
Department of Electrical Engineering
National Taipei University
New Taipei City, Taiwan
cyyang@mail.ntpu.edu.tw

Abstract - In this study, a Robot Operating System (ROS) based Mecanum-wheeled mobile robot is designed for two algorithms developed scheme, one is a Proportional-Integral-Derivative (PID) control algorithm directly implemented into the online controller firmware, and the other hand is a Model Predictive Control (MPC) algorithm implemented on an independent PC for a remote control. In the PID control algorithm, ultrasonic distance detection is used to keep the vehicle running parallelly along a wall. In the MPC algorithm, the vehicle is able to run according to planned paths and create the map by Lidar SLAM. In the paper, the real implementation of the system is detailed practical experiment validations.

Keywords — *Robot Operating System, Mecanum Wheel, Lidar, PID control, Model Predictive Control*

Enhanced Timetable Scheduling: A High-Performance Computational Approach

Asanka Sovis
School of Engineering
SLTC Research University
Meepe, Sri Lanka
akashsovis@gmail.com

Chathuni Patikirige
School of Engineering
SLTC Research University
Meepe, Sri Lanka
chathunipatikirige@gmail.com

Yohan Pandigama
School of Computing
SLTC Research University
Meepe, Sri Lanka
pandig911@gmail.com

Abstract - Timetable scheduling is a complicated, expensive and resource-intensive Optimization Problem. This project aims to suggest a solution to this problem using multiple strategies. The core strategy is to use Artificial Intelligence and Machine Learning to optimize a timetable. The result is optimized further by reapplying this optimization mechanism iteratively without aiming to build a perfect result in a single iteration. The project uses the concepts of High-Performance Computing and Cluster Computing to provide flexibility and efficiency on a hardware level. These form the basis of Project Almanac: a robust and flexible timetable optimization architecture. Project Almanac aims to generate a ‘good enough’ timetable by adjusting the expenses according to the end-user requirements. Alternatively, the solution also intends to offer a faster, cheaper and more flexible hardware-software architecture to generate optimized timetables for diverse applications.

Keywords — *Artificial Intelligence, Cluster Computing, High- Performance Computing, Machine Learning, Optimization Problem*

Accelerated Adversarial Attack Generation and Enhanced Decision Insight

N.K.Y.S. Kumarasiri
Faculty of Information
Technology
University of Moratuwa
Moratuwa, Sri Lanka
yashmi110@gmail.com

S.C. Premaratne
Faculty of Information
Technology
University of Moratuwa
Moratuwa, Sri Lanka
samindap@uom.lk

W.M.R.M. Wijesuriya
Faculty of Information
Technology
University of Moratuwa
Moratuwa, Sri Lanka
wijesuriyar@uom.lk

Abstract - Adversarial Attack is a rapidly growing field that studies how intentionally crafted inputs can fool machine learning models. This can have severe implications for the security of machine learning systems, as it can allow attackers to bypass security measures and cause the system to malfunction. Finding solutions for these attacks involves creating specific attack scenarios using a particular dataset and training a model based on that dataset. Adversarial attacks on a trained model can significantly reduce accuracy by manipulating the decision boundary, causing instances initially classified correctly to be misclassified. This alteration results in a notable decline in the model's ability to classify instances after an attack accurately. The above process helps us develop strategies to defend against these attacks. However, a significant challenge arises because generating these attack scenarios for a specific dataset is time-consuming. Moreover, the disparity between the model's prediction outcomes before and after the attack tends to lack clear interpretability. In both above limitations, the common limiting factor is time. The time it takes to devise a solution is crucial because the longer it takes, the more opportunity an attacker has to cause harm in real-world situations. In this paper, we propose two approaches to address the above gaps: minimizing the time required for attack generation using data augmentation and understanding the effects of an attack on the model's decision-making process by generating more interpretable descriptions. We show that description can be used to gain insights into how an attack affects the model's decision-making process by identifying the most critical features for the model's prediction before and after the attack. Our work can potentially improve the security of machine learning systems by making it more difficult for attackers to generate effective attacks.

Keywords — *Adversarial Machine Learning, Adversarial Attack, Explainable AI*

The Application of Convolutional Neural Network in the Context of Tamil Handwritten Character Recognition

Ponraj Thuvarakan
Department of Computer
Science and Informatics
Uva Wellassa University
Sri Lanka
iit18059@std.uwu.ac.lk

Parameswaran Kowreesan
Department of Computer
Science and Informatics
Uva Wellassa University
Sri lanka
iit18004@std.uwu.ac.lk

Satkunaratnam Jeyarooban
Department of Computer
Science and Informatics
Uva Wellassa University
Sri lanka
iit18042@std.uwu.ac.lk

M. Janotheepan
Department of Computer Science and
Informatics
Uva Wellassa University
Sri Lanka
janotheepan.m@uwu.ac.lk

E. M. U. W. J. B. Ekanayake
Department of Computer Science and
Informatics
Uva Wellassa University
Sri Lanka
jayalath@uwu.ac.lk

Abstract - This research paper presents an in-depth investigation into the application of Convolutional Neural Networks (CNNs) for Tamil handwritten character recognition. We explore existing research, methodologies, and cutting-edge techniques, showcasing CNNs' effectiveness in achieving a remarkable 95 accuracy. Our dataset comprises 247 Tamil characters and 18 North Indian characters, accommodating diverse writing styles. We tailor CNN architectures for Tamil characters, implement advanced preprocessing, data augmentation, and training methods to enhance model performance. Our paper tackles challenges posed by accessible datasets, offering remedies for data scarcity, class imbalance, and writing style variations. Our distinct contribution lies in achieving 95% accuracy across 247 Tamil characters and 18 North Indian characters, demonstrating CNNs' potential for document processing, language preservation, and automation in Tamil-speaking regions. This work advances the field by introducing novel techniques, a comprehensive dataset, and strategic insights, serving as a significant step forward in Tamil character recognition.

Keywords — *Convolutional Neural Networks, Tamil handwritten character recognition, Deep Learning, Tamil*

Layout Aware Resume Parsing Using NLP and Rule-based Techniques

S.P Warusawithana
Faculty of Information
Technology
University of Moratuwa
Sri Lanka
supunawa@gmail.com

N.N. Perera
Faculty of Information
Technology
University of Moratuwa
Sri Lanka
nimnaperera98@gmail.com

R.L. Weerasinghe
Faculty of Information
Technology
University of Moratuwa
Sri Lanka
reshakalakshan@gmail.com

T.M. Hindakaraldeniya
Faculty of Information Technology
University of Moratuwa
Sri Lanka
tarumadurangi97@gmail.com

G. U. Ganegoda
Faculty of Information Technology
University of Moratuwa
Sri Lanka
upekshag@uom.lk

Abstract - As a result of the rapid development seen in the field of IT, there has been a surge in the number of students choosing IT field related degrees in recent years. When those students try to secure a better job position in the field of IT, a resume plays a vital role as it is often the first document a recruiter will see in the recruitment process. Therefore, this paper introduces a layout aware resume parsing system based on NLP and rule-based techniques to extract the section wise text content from the resume. This output can be used as the input for the resume content scoring model as a resume content review system to get feedback for the resume. When comparing existing methods with the proposed system, the layout of the resume would be considered in the proposed system, and it would extract content for each section. In addition to that, the proposed system would extract all the text content, but existing systems only extract the entities. In summary, this study is focused on developing a layout aware resume parsing system based on NLP and rule-based techniques to extract the section wise text content from the resume for an accurate resume review.

Keywords — *Layout aware, Resume Parser, Text extraction, NLP, Rule-based Techniques*

Multiple Objective Optimization Based Dietary Recommender System

Yomal Perera
*Faculty of Information
Technology*
University of Moratuwa
Sri Lanka
yomal.18@itfac.mrt.ac.lk

Rukshan Karannagoda
*Faculty of Information
Technology*
University of Moratuwa
Sri Lanka
rukshan.18@itfac.mrt.ac.lk

Dion Weiman
*Faculty of Information
Technology*
University of Moratuwa
Sri Lanka
dion.18@itfac.mrt.ac.lk

Subha Fernando
Faculty of Information Technology
University of Moratuwa
Sri Lanka
0000-0002-2621-5291

Abstract - In contemporary society, the profound impact of an individual's diet on their health underscores the critical importance of dietary choices in maintaining overall well-being. Amidst the challenges posed by modern, hectic lifestyles, the manual tracking of meals becomes a cumbersome task. This paper addresses this issue through the development of a comprehensive meal recommender system. The envisioned system aims to automatically analyze and offer a nutritional breakdown of meals, alleviating the burden on individuals to manually track their dietary intake. It goes beyond conventional solutions by providing personalized recommendations that not only satisfy daily nutritional requirements but also cater to user preferences and promote meal diversity. This research endeavors to contribute to the enhancement of customers' overall well-being by leveraging the capabilities of an advanced recommendation system. The paper outlines the design and implementation of this system, highlighting its potential to revolutionize how individuals manage their diets in contemporary, fast-paced lifestyles.

Keywords — *multiple objective optimization, food recommendation system, user preference, food diversity, nutritional score, recommender system*

Detecting Tabnabbing Attacks Via an RL-Based Agent

Ashani Fonseka
Department of Computer
Science and Informatics
Uva Wellassa University of
Sri Lanka
Badulla, Sri Lanka
Email:
cst18021@std.uwu.ac.lk

Pamali Pashenna
Department of Computer
Science and Informatics
Uva Wellassa University of
Sri Lanka
Badulla, Sri Lanka
Email:
iit18046@std.uwu.ac.lk

Subhash N. Ariyadasa
Department of Computer
Science and Informatics
Uva Wellassa University of
Sri Lanka
Badulla, Sri Lanka
Email: subhash@uwu.ac.lk

Abstract - Tabnabbing attacks exploit user behavior in web browsers, deceiving users by altering content in inactive tabs to appear legitimate, leading to data disclosure or unintended actions. This research evaluates the effectiveness of Reinforcement Learning (RL) in detecting Tabnabbing attacks at the web browser level, presenting a proactive defense mechanism against this cyber threat. The study began with a literature review to find the top 5 critical features of Tabnabbing attacks and were extracted using a publicly available dataset from "Phishpedia". Data preprocessing is conducted to handle missing and incorrect data, resulting in a refined dataset. The RL agent is designed using the Deep Q-Network (DQN) algorithm, which effectively handles high-dimensional state spaces. The evaluation of the RL agent demonstrates promising results. However, there is room for improvement requiring further research and model tuning.

Keywords — *Cybersecurity, Tabnabbing, Reinforcement Learning, Phishing, DQN*

Early Identification of Deforestation using Anomaly Detection

<i>Nethmi Wijesinghe</i>	<i>Rashmi Perera</i>	<i>Nethmee Sellahewa</i>
<i>Faculty of Information Technology</i>	<i>Faculty of Information Technology</i>	<i>Faculty of Information Technology</i>
<i>University of Moratuwa Moratuwa, Sri Lanka</i>	<i>University of Moratuwa Moratuwa, Sri Lanka</i>	<i>University of Moratuwa Moratuwa, Sri Lanka</i>
<i>nethmiw.17@itfac.mrt.ac.lk</i>	<i>rashmiperera1997@gmail.com</i>	<i>nssellahewa@gmail.com</i>

Priyanga Dilini Talagala
Department of Computational Mathematics
University of Moratuwa
Moratuwa, Sri Lanka
priyangad@uom.lk
0000-0003-2870-7449

Abstract - Research involving anomaly detection in image streams has seen growth through the years, given the proliferation of high-quality image data in various applications. One such application that is in urgent need of attention is deforestation. Detecting anomalies in this context, however, remains challenging due to the irregular and low-probability nature of deforestation events. This study introduces two anomaly detection frameworks utilizing machine learning and deep learning for the early detection of deforestation activities in image streams. Furthermore, Explainable AI was used to explain the black box models of the deep learning-based anomaly detection framework. The class imbalance problem, the inter-dependency between the images with time, the lack of available labelled images, a data-driven anomalous threshold, and the trade-off of accuracy while increasing interpretability in the black box optimization methods are some key aspects considered in the model-building process. Our novel framework for anomaly detection in image streams underwent rigorous evaluation using a range of datasets that included synthetic and real-world data, notably datasets related to Amazon's forest coverage. The objective of this evaluation was to detect occurrences of deforestation in the Amazon. Several metrics were used to evaluate the performance of the proposed framework.

Keywords — *Anomaly Detection, Image Time Series, Machine Learning, Deforestation, Explainable AI*

InPRA – An Intelligent System for Writing while Doing Research

Asoka Karunananda

Department of Computational Mathematics

Faculty of Information Technology

University of Moratuwa

Sri Lanka

asokakaru@uom.lk

Thushari Silva

Department of Computational Mathematics

Faculty of Information Technology

University of Moratuwa

Sri Lanka

thusharip@uom.lk

Abstract - Research students have difficulty following at least some steps in research methodology. Nowadays, computing technology has made it easy for researchers to execute the steps with the support of software tools. Although many research students gradually manage to conduct the research, some find it challenging to write the thesis in time. This issue stems from separating the conduct of research from writing the thesis. This paper presents the extension to our Intelligent Personal Research Assistant, InPRA, to enable a researcher to write the thesis incrementally while doing the research. Here, we have introduced an intelligent writing template, which guides the writing process differently from the order of chapters of the thesis. The intelligent template is also integrated with tools such as Zotero, MS Word, and Grammarly software. The incremental writing process enables the generation of research proposals, progress reports, conference papers, theses, and journal papers. The writing extension to InPRA has been evaluated with research students at the postgraduate level.

Keywords — *Research Methods, Multi-Agent Systems, Ontology*

Optimization of Real Time Panel Trip Detection in Industrial Systems Using IoT and Mathematical Modeling

Thushani Mallikarathne
Department of
Instrumentation and
Automation
Faculty of Technology
University of Colombo
Colombo, Sri Lanka
2017t00042@stu.cmb.ac.lk

Hashan Abeysinghe
Department of
Instrumentation and
Automation
Faculty of Technology
University of Colombo
Colombo, Sri Lanka
2017t00002@stu.cmb.ac.lk

Chamod Rathnayake
Department of
Instrumentation and
Automation
Faculty of Technology
University of Colombo
Colombo, Sri Lanka
2017t00056@stu.cmb.ac.lk

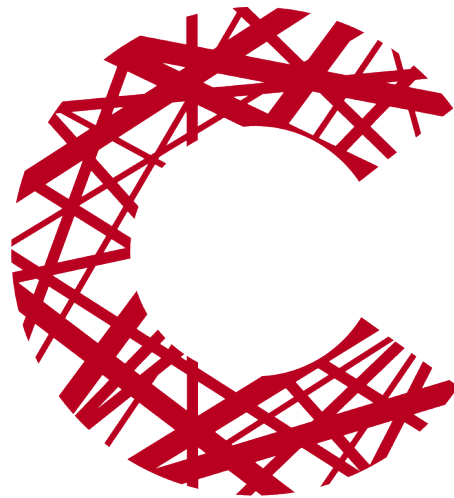
Dilki Gauder
Institute of Technology
University of Moratuwa
Colombo, Sri Lanka
dagauder@gmail.com

Abstract - In modern setups, the detection and prompt acknowledgment of panel trips are crucial for ensuring the smooth operation and safety of critical systems. This presents a solution for implementing a Panel Trip Acknowledgment System using ESP32, WiFi client-server, and Telegram. The proposed system leverages the capabilities of ESP32, which provide built-in WiFi functionality, making them ideal for wireless communication that utilizes IOT. A client-server is established, where the ESP32 acts as a client, continuously monitoring the status of various panels within the industrial setup that incorporates power backup capabilities. Whenever a panel trip is detected, the ESP32 client sends a notification to a central server. To facilitate real-time notifications and easy accessibility, a Telegram bot is integrated into the system. The server, upon receiving a panel trip notification, triggers the Telegram bot to send an alert to authorized personnel or groups. This ensures that the relevant individuals are informed about the panel trip, enabling them to take appropriate action and minimize downtime. A mathematical model has been created to evaluate and improve the performance of the Panel Trip Acknowledgment System. Important components of the system are included in this model. The model determines the likelihood that a panel trip will occur during a monitoring interval and the likelihood that a panel trip will be detected during that time. It also calculates how long it takes to notice a panel trip and alert the appropriate people. The mathematical model offers important insights into the system's performance in various operational settings when combined with

simulation data. The effectiveness of panel trip detection and warning can be increased by using this modeling approach to optimize crucial parameters like monitoring intervals and transmission periods. The research results enhance the Panel Trip Acknowledgment System's effectiveness in guaranteeing operational continuity and safety by assisting in its design and implementation in industrial settings. This study lays the groundwork for the implementation of cutting-edge IoT-based solutions for critical system monitoring and quick reaction in industrial settings.

Keywords — ESP32, Telegram Bot, Real-time notifications, Remote Monitoring, Mathematical Modeling

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