

7th International Conference on Information Technology Research - ICITR 2022

**7th - 8th, December 2022, Faculty of Information Technology
University of Moratuwa, Sri Lanka**



ABSTRACTS OF THE PROCEEDINGS OF ICITR 2022





Abstracts of the Proceedings of ICITR 2022

of

7th INTERNATIONAL CONFERENCE ON
INFORMATION TECHNOLOGY RESEARCH
ICITR 2022

7th – 8th December 2022

"DIGITAL RESILIENCE & REINVENTION"

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

International Conference on Information Technology Research (ICITR)

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ICITR 2022, 7th – 8th December 2022

Conference mode: Online

Conference organized by: Information Technology Research Unit,

Faculty of Information Technology,

University of Moratuwa

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International Conference on Information Technology Research

The 7th International Conference on Information Technology Research (ICITR 2022) to be held from 7th to 8th December 2022. This is an annual event organized by the Information Technology Research Unit (ITRU), which is the research dissemination arm of the Faculty of Information Technology, University of Moratuwa, Sri Lanka.

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

ICITR 2022 is technically co-sponsored by IEEE Sri Lanka Section Chapter and IEEE Robotics and Automation Society, Sri Lanka Section Chapter. Financially sponsored by the the Codegen(Pvt) Ltd. and Bistec Global (Pvt) Ltd. All the accepted papers to the ICITR 2022 will be indexed in IEEE Xplore Database. This year the conference received around 86 research papers, and 24 papers were accepted by maintaining the acceptance ratio around 27.9%.

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

Message from the General Chair

B. H. Sudantha

*General Chair – International Conference on
Information Technology Research (ICITR 2022)*



Welcome to the 7th International Conference on Information Technology Research (ICITR 2022) organized by the Information Technology Research Unit, University of Moratuwa. The objective of the conference is to provide a forum for researchers worldwide to reveal their latest research in Information Technology Research. The theme of the conference, “Digital Resilience & Reinvention”, gives the direction and covers a broad spectrum of allied fields.

Maintaining a high-quality conference requires various levels of involvement, including a well-balanced review process. This year, 86 full papers were submitted to the conference. In addition, each paper was subject to review by at least two reviewers, and finally, 24 papers were selected as full-paper publications for the conference. I would like to express my sincere thanks to the reviewers for their dedicated, efficient, responsible and rigorous review process, ensuring the high quality of the conference papers. And also, I should be much more thankful to authors who share their research experiences at the ICITR 2022 conference. It helps us prepare proceedings at an excellent level.

Conference workshops are organized to benefit the conference participants in various new trends and stimulate their research experiences. A special thank should go to our three distinguished keynote speakers, Prof. Emi Yuda from the Center for Data-driven Science and Artificial Intelligence, Tohoku University, Japan; Professor Yo-Ping Huang, National Penghu University of Science and Technology, Taiwan, and Mr. Damith Hettihewa, President Computer Society of Sri Lanka & Managing Director of Nimbus Cloud Lanka Ltd.

I would like to thank everyone who has given his or her time, energy and ideas to assist in organizing this event, including all the members of the organizing committee, the TPC Co-Chairs, TPC members and all the reviewers, for the quality and depth of the reviews, and their sense of responsibility and responsiveness under very tight deadlines.

In particular, I would like to highlight and acknowledge the tremendous efforts of especially the Director, Information Technology Research Unit, the Editorial Board, ICITR Committees, including various energetic Chairs and organizing committees of workshops and the conference, and finally, our dedicated faculty staff members who gave their support and they worked tirelessly on various conference-related tasks in order to bring the conference to this level and to conquer the challengers raised in various ways.

Finally, we hope that the participants enjoy the outstanding conference program of the 7th International Conference on Information Technology Research ICITR 2022.

Wishing you all a prolific and rewarding conference!

Message from the Conference Chair

*Dr. Sagara Sumathipala
Director – Information Technology Research Unit*



It is my great honour and pleasure to welcome you to the 7th International Conference on Information Technology Research (ICITR 2022). Information Technology Research Unit (ITRU), the research dissemination arm of the Faculty of Information Technology, University of Moratuwa, organizes this annual event. This year we run the conference under the theme “Digital Resilience & Reinvention”. The conference is well recognized as a forum to discuss the rapid advances in research and digital transformation development. In the past century, technology has been developing rapidly, brought about by men’s continuous battles to reign supreme on Earth. Today, we are living in extraordinary times. We have adjusted to a new normal of remote working, online meetings and shopping, and generally relying on technology to help us overcome barriers and restrictions on our freedom of movement.

The conference scope covers the whole spectrum of Information and Communications Technology. ICITR 2022 is technically co-sponsored by the IEEE, the world's largest technical professional organization dedicated to advancing technology, IEEE Sri Lanka Section and IEEE Robotics and Automation Society Sri Lanka Section Chapter. All the accepted papers to the ICITR 2022 will be indexed in IEEE Xplore Database. This year we received around 86 research articles, and 24 were accepted by maintaining the acceptance ratio of about 27.9%.

This year's conference featured three keynote talks by prominent academic & industrial personalities. We wish to welcome our eminent keynote speakers: Prof. Emi Yuda from the Center for Data-driven Science and Artificial Intelligence, Tohoku University, Japan; Professor Yo-Ping Huang, National Penghu University of Science and Technology, Taiwan, and Mr. Damith Hettihewa, President Computer Society of Sri Lanka & Managing Director of Nimbus Cloud Lanka Ltd. In addition, ICITR 2022 offers a pre-conference workshop conducted by Dr. (Mrs.) K. P. N. Jayasena, Senior Lecturer, Sabaragamuwa University of Sri Lanka, Sri Lanka and four technical sessions. We hope these experts' varied opinions and comments will undoubtedly be the most informative to the audience present on this day.

Our success greatly depends on many people who have worked tirelessly with us at every stage of the event. I take this opportunity to express my sincere gratitude to the conference chairs for their leadership and all committee members for their tremendous support. I would like to take this opportunity to thank the technical programming

committee and all the reviewers for their commitment and dedication towards making this review process a success. I must mention our deep sense of appreciation for the keynote speakers, invited speakers, session chairs and paper evaluation panels. I would especially like to thank all the authors of the conference proceeding for selecting our conference to publish their valuable research findings. I also extend our sincere thanks to Prof. Pradeep Abeygunawardhana, Chair, IEEE Sri Lanka Section, Dr. Waranatha Abeygunasekara, Secretary, IEEE Sri Lanka Section, Prof. Chandima Pathirana, Chair, IEEE Robotics and Automation Society Sri Lanka Section Chapter, Mr. Tharindu Adhikari, Secretary, IEEE Robotics and Automation Society Sri Lanka Section Chapter, for their tremendous support given to obtain the IEEE Technical Sponsorship for the conference. Further, I express my sincere gratitude to the Platinum sponsor, CodeGen (Pvt) Ltd. and Gold sponsor Bistec Global (Pvt) Ltd., for their generosity in keeping the costs of ICITR 2022. Your financial contributions have taken care of us and enabled us to provide high-quality services during the conference.

I would like to express our appreciation to Professor Niranjan Gunawardene, Vice-Chancellor/ University of Moratuwa, Dr. D. P. Chandrasekara, Deputy Vice-Chancellor/University of Moratuwa, Mr. B. H. Sudantha, Dean/Faculty of Information Technology, Dr. S. C. Premaratne, Head/Department of Information Technology, Dr. (Mrs.) A. T. P. Silva, Head/Department of Computational Mathematics, Dr. (Mrs.) T. C. Sadanayake, Head/Department of Interdisciplinary Studies, Ms. T. S. Nanayakkara, Assistant Registrar/Faculty of Information Technology for their constant support and guidance.

I would especially like to express my sincere thanks to the Conference Secretary, Dr. (Mrs.) I. T. S. Piyatilake, Finance Chair, Dr. I. N. Manawadu, Publication Chair, Dr. G. U. Ganegoda, Technical Programming Committee Chair, Dr. T. S. S. Jayawardena and all the members of the respective committees for their meticulous work in support of many conference activities. I also would like to express my sincere thanks to Mr. K. B. G. Samantha, Ms. R. D. Wageeshani, and all the team members for their enormous cooperation in organizing this event. They are gratefully acknowledged. Last but not least, I would like to thank all the conference participants for their active participation and input. At this challenging time, I urge you all to take care, and I am sure all of you will find this conference stimulating, rewarding and meaningful.

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Keynote Speakers

Keynote Address



Professor Emi Yuda

*Center for Data-driven Science and Artificial Intelligence,
Tohoku University, Japan*

Keynote Title: "Creating technologies to enrich human society using human bio-signals and huge signal database"

Abstract

Bio-signal processing is one of great technology that greatly contributes to estimation of the human life dynamics transitioning from healthy to diseased states and to the early detection of diseases. Many pathological data measured in hospitals are accumulated in the hospital and are the subject of research by many medical researchers. In addition, physiological research using animal models is also in progress. However, in "human" physiology research, it is not possible to conduct highly invasive research as in animals. And, subjective assessments such as questionnaires are not available for all people, interventions for sick, elderly and infants are difficult. Therefore, interpreting the state from bio-signals, it is important role in understanding humans. In order to do, engineering is indispensable, such as signal processing and system control. In this talk, I will review heart rate variability (HRV) analysis and cardiac autonomic nerve analysis, which are important indicators of human physiological and psychological states, and introduce recent approaches to human state estimation, including machine learning and data science.

Keynote Address



Damith Hettihewa

*President Computer Society of Sri Lanka &
Managing Director of Nimbus Cloud Lanka Ltd.*

Keynote Title: Digital Reinvention for Economic Resurgence of Resilient Sri Lanka

Abstract

Resilience has been a key strength of Sri Lanka over the years. Sri Lanka sailed through troubled waters for centuries due to foreign invasions. Even after receiving independence from its European colonial rulers in 1948, Sri Lanka had major catastrophes to deal with. 1971 youth uprising, 1983 July riots followed by 30 years of civil war, 1988 youth insurgency, 2004 Tsunami, 2019 Easter Sunday bombing are to name the highlights. Ongoing economic crisis followed by Covid-19 pandemic is the latest crisis and it is testing times for Sri Lanka now. Amidst globally widespread digitalization due to Industry 4.0 which was further accelerated by the Covid-19 pandemic, Sri Lanka has to gear up to achieve cyber resilience in order to realize an economic resurgence after the crisis. Though Sri Lanka has been in the forefront in South Asia for legal enactments for digitalization, this keynote will review whether the prevailing laws are sufficient to achieve cyber resilience in Sri Lanka. The world order has been changing from exploitation of poor nation's assets to wealth creation through Tech innovations. The global wealth is shifting to Digital space. Reinvention of a country's digital capabilities are imperative to achieve prosperity through digital innovations for problem solving. This talk will highlight Sri Lanka's opportunity to capitalize on the new world order to get out of the current economic crisis and reinvent itself to leverage industry 4.0 to become a wealthy nation.

Keynote Address



*Professor Yo-Ping Huang
Chair Professor,
Department of Electrical Engineering
National Taipei University of Technology, Taiwan*

Keynote Title: " AIoT and its Applications"

Abstract

Through several waves of ups and downs in the past decades, artificial intelligence (AI) has evolved into a must-have new technology or tool in various domains. Furthermore, with the advent of powerful GPU, AI-related research or AI-based applications have sprouted in every corner of the world. Originating from pure network connectivity, the Internet of Things (IoT) has become a structure that can collect every piece of data from physical devices, daily activities, images, or videos into a data reservoir. As a result, tons of data are automatically generated into an enterprise database in a single day. This creates research opportunities on integrating AI, IoT, big data, and cloud or edge computing, to improve the quality of industrial production or medical service. Applications of AI algorithms, fuzzy modeling, and/or intelligent systems play important roles and can be found everywhere, including widespread usage in industry and medical systems for tasks such as locating and detecting scratches or defects in product surface, printed circuit board manufacturing, monitoring rehabilitation progress for patients with Parkinson's disease or stroke, autonomous moving and planning of service robots in healthcare, and short-term or long-term prediction of air quality in certain areas. Furthermore, AI can be integrated with other techniques, such as Internet of things, fuzzy modeling, and edge computing to become powerful tools for industry and medicine domains. This talk will address AIoT systems and their applications industry and healthcare.

Polynomial Regression Real Patient State Estimate for Clinical Decision-Making

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Abstract—With the progress of the times, science and technology are changing with each passing day. Clinical decision has become more and more important in medicine nowadays. Clinical decision not only helps clinicians to get immediately crucial decisions; but also provides advices to inexperienced clinicians. In the early days, clinicians could only rely on their own experience and medical reports to make decisions. This process that clinicians analyze patients was very time-consuming. In order to solve these problems, we developed a scoring model. We can analyze patient conditions according to the value of each parameter by using the patient data collected by the hospital. Through computer analysis, evaluations, predictions and optimizations, the suitable model for clinicians and patients can be built. In this paper, we propose a nonlinear polynomial regression approach as a model for predicting patient health scores. The model that predicts patient health score fits multiple researches and clinical examinations through computer simulations. The predicted results are corresponded to the real results when we use the model. With the benefit of the model, it would be easier for clinicians to make clinical decision. In conclusion, our model can not only analyze patient's conditions, but also predict patient health score via the support of appropriate parameters. This model has the potential to become a valuable tool for clinicians on clinical decision-making in the near future.

Keywords— *Clinical decision-making, computer analysis, scoring models, nonlinear polynomial regression, prediction.*

Day 1: 7th December 2022

09.00 AM – 12.00 PM Conference Workshop

Title: "Resource Management in Mobile Cloud Computing for Next-generation Mobile Applications"

Resource Person: Dr. K P N Jayasena
Department of Computing and Information Systems,
Sabaragamuwa University of Sri Lanka, Sri Lanka

Day 2: 8th December 2022

07.45 AM – 08.15 AM Joining of Guests

08.15 AM – 08.20 AM National Anthem

08.20 AM – 08.30 AM University Corporate Video Presentation

08.30 AM – 08.45 AM Welcome Address by Director, Information Technology Research Unit, University of Moratuwa, Sri Lanka

08.45 AM – 09.00 AM Address by Dean, Faculty of Information Technology, University of Moratuwa, Sri Lanka

09.00 AM – 10.00 AM Keynote Address by Professor Emi Yuda,
Center for Data-driven Science and Artificial Intelligence,
Tohoku University, Japan

10.00 AM – 10.30 AM Tea Break

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 – 02.00 PM Lunch Break

02.00 PM – 03.00 PM Keynote Address by Mr. Damith Hettihewa,
President, The Computer Society of Sri Lanka

03.00 PM – 03.15 PM Tea Break

03.15 PM – 04.15 PM Keynote Address by Professor Yo-Ping Huang,
Chair Professor, Department of Electrical Engineering
National Taipei University of Technology, Taiwan

04.15 PM – 04.45 PM Awards and Vote of Thanks

***Detailed Session Plan of
ICITR 2022***

Thursday, 8th December 2022

ICITR Technical Session 1

Session Chair Dr. Sanath Jayawardene

Session Co-Chairs Dr. Thilina Thanthiriwaththa
Ms. Ishara Devendra

Time 10:30 AM - 12:30 PM

Time	Title & Author (s)
10.30 AM – 10.45 AM	Walkable Space Estimation for Visually Impaired Persons in 3D Simulated Environment <i>C S Silva and P Wimalaratne</i>
10.45 AM – 11.00 AM	Automating the Initial Configuration of SDN Switches in a Hybrid-SDN Environment <i>W K N Bolonghe, P M Rupasinghe, K S B Umayanga, K L H I Weerasiri, D De Silva and P Wijesiri</i>
11.00 AM – 11.15 AM	Gender and Age Estimation From Facial Images using Deep Learning <i>R Thaneeshan, K Thanikasalam and A Pinidiyaarachchi</i>
11.15 AM – 11.30 AM	Automated commentary generation based on FPS gameplay analysis <i>D L S Mamoru, A D Panditha, W A S S J Perera and G U Ganegoda</i>
11.30 AM – 11.45 AM	Using CNN to Identify the Condition of Edible Fish <i>R Mahendran and G P. Seneviratne</i>
11.45 AM – 12.00 PM	A Dual CNN Architecture for Single Image Raindrop and Rain Streak Removal <i>A Sivaanpu and K Thanikasalam</i>
12.00 AM – 12.15 PM	EDUZONE – A Educational Video Summarizer and Digital Human Assistant for Effective Learning <i>T Wangchen, P N Tharindi, K C C C De Silva, W D T Sandeepa, N Kodagoda and K Suriyawansa</i>

ICITR Technical Session 2

Session Chair	Dr. Saminda Premarathne
Session Co-Chairs	Ms. Chamalka Rajapaksha Mrs. Nishara Batagoda
Time	10:30 AM - 12:30 PM
Time	Title & Author (s)
10.30 AM – 10.45 AM	Multi-AI Based Wireless Sensor Node for Forest Fire Detection <i>T P D Pieris, A L Kulasekera and K V D S. Chathuranga</i>
10.45 AM – 11.00 AM	Closed-Loop DC Motor Embedded Control Platform based on ARM® for Distance Learning Experiments <i>R Ganganath, C Ranganath and D C Jayasekara</i>
11.00 AM – 11.15 AM	Intelligent Wheelchair with Emotion Analysis and Voice Recognition <i>S Perera, S Gamage, C Weerasinghe, C Jayawardena, K Pathinayake and S Rajapaksha</i>
11.15 AM – 11.30 AM	Design and Testing of an Arduino-based Network Jammer Device <i>M N M Herath, H M D S Najath and A Rajapakse</i>
11.30 AM – 11.45 AM	Development of Nonlinear Dynamics Simulator for 2-DOF Ball Balancing Platform to Assist Distance Learning of Control Systems <i>C Ranganath and B Annasiwaththa</i>
11.45 AM – 12.00 PM	Computer Vision Based Navigation Robot <i>M Haputhanthri, C Himasha, H Balasooriya, M Herath, S Rajapaksha and S M B Harshanath</i>
12.00 AM – 12.15 PM	Elderly Care Home Robot using Emotion Recognition, Voice Recognition and Medicine Scheduling <i>B M U S Kularatne, B M J N Basnayake, P D L A M Sathmini, G V U Sewwandi, S Rajapaksha and D De Silva</i>

ICITR Technical Session 3

Session Chair	Dr. Upeksha Ganegoda
Session Co-Chairs	Dr. A.L.A.R.R. Thanuja Ms. Shashika Kumarasinghe
Time	10:30 AM - 12:30 PM
Title	Title & Author (s)
10.30 AM – 10.45 AM	Peer Learning – An Interactive and Collaborative ELearning Application for College Student <i>H A P M Sirithunga, B G S Deshan, P H D Sigera, P Y Udagedara, U Samarakoon and S Kumari</i>
10.45 AM – 11.00 AM	A Visually Interpretable Forensic Deepfake Detection Tool Using Anchors <i>K Jayakumar and N Skandhakumar</i>
11.00 AM – 11.15 AM	COVID-19 Infection Risk Assessment for Shoppers in Retail Stores <i>B R M S R B Rathnayake, R I A Senadheera, R A K H Ranasinghe, U M Sameer and J Wickramarathne</i>
11.15 AM – 11.30 AM	Analysis and Prediction of Severity of United States Countrywide Car Accidents Based on Machine Learning Techniques <i>L S Boyagoda and L S Nawarathna</i>
11.30 AM – 11.45 AM	Impact of Innovation and R & D on Financial Performance of Telecommunication Sector in Sri Lanka <i>J A Prabath and T C Sandanayake</i>
11.45 AM – 12.00 PM	Polynomial Regression Real Patient State Estimate for Clinical Decision-Making <i>C Y Hung, C Y Wang, K W Chen and C Y Yang</i>

ICITR Technical Session 4

Session Chair	Dr. Thanuja Sandanayake
Session Co-Chairs	Mrs. Roshani Wijesuriya Mr. Upulanka Premasiri
Time	10:30 AM - 12:30 PM
Time	Title & Author (s)
10.30 AM – 10.45 AM	Evaluating the Inter-Service Communication on Microservice Architecture <i>L D S B Weerasinghe and I Perera</i>
10.45 AM – 11.00 AM	Event Driven Share Price Forecasting based on Change based Impact Analysis <i>C Bombuwala, K Kahatapitiya, R Kumaranayaka, S Weerasinghe, U Ganegoda and I Manawadu</i>
11.00 AM – 11.15 AM	Escort - Natural Language Processing Based University Students Guidance System <i>D Srinivasan, A Uthayakumar, P Thiyagalingam, S Ravindran, H De Silva and D Kasthuruarathna</i>
11.15 AM – 11.30 AM	IHI :- A Mobile Application for ADHD Analysis and Detection <i>A S Chandrasena, G G D D Weerasinghe, K G T Dilshan, G W P Sadun, U Samarakoon and P Ratnayake</i>
11.30 AM – 11.45 AM	Automobile Product Ranking based on the Singlish Comments in Social Media Platforms <i>A Warnakulasooriya, T C Sandanayake, G A M P S Wickramasinghe, R A D W Ranasinghe and K A S N Sumathipala</i>

Walkable Space Estimation for Visually Impaired Persons in 3D Simulated Environment

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Abstract—Environmental perception is the process by which visually impaired people tend to sense, understand, and build awareness of the walking environment and the surrounding objects. Walkable space includes any space that the visually impaired person is physically capable of walking. The task of estimating the walkable space is performed by estimating pixels belonging to the ground plane in the scene. Plane parameters are estimated based on the input of 3D point coordinates of pixels belonging to the sidewalk in the outdoor environment. Moreover, the curb line is estimated using the output of the walkable space calculation to determine whether the visually impaired navigator is walking along the sidewalks or on the road. Proof of concept and evaluation experiments are conducted on a 3D simulated environment with the use of RGB, semantic and depth images taken from the wearable RGB camera, segmentation camera and depth camera. The results are benchmarked with the existing image processing-based methods and showed that the proposed method can be successfully implemented for the safe navigation of visually impaired users with minimum computational complexity in image processing.

Keywords—semantic segmentation, walkable space estimation, assistive navigation, image processing, depth image

Automating the Initial Configuration of SDN Switches in a Hybrid-SDN Environment

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Abstract—At present for SDN environments, there are many proposed mechanisms to improve its reliability, and performance. The challenges faced by SDN networks are mainly related to Scalability, Reliability and Performance. As an example, for scalability related challenges, many SDN networks have problems when replacing or installing new SDN switches to the network. The problems are mainly the cost and errors while the installation process. To overcome this issue, a mechanism is proposed to automate the initial configuration of the newly added SDN switches. When it comes to the performance, there are problems such as load balancing, looping and traffic related issues due to broadcast messages. To minimize these challenges the project also brings solutions by implementing DHCP relays and STP inside the network. Also, with the multi-controller architecture proposed it increase the efficiency and Performance. To automate the initial configuration of the switches, the newly added switch is detected at first and then a relationship is established between the newly added switch and an existing SDN switch. Then the newly added switch establishes a connection with the automation server, which then results the automation process to start. The proposed mechanism is implemented in a testing environment using Mininet which creates a virtual environment, a RYU controller as the SDN controller and the OpenFlow is used as the protocol for communication between interfaces. The proposed mechanism will bring many benefits like minimize the errors and save time due to the automated initial configuration in a hybrid-SDN environment, increase efficiency and Performance comparing to the present hybrid-SDN environments.

Keywords— *Hybrid SDN, OpenFlow, DHCP Relay, STP, Automation.*

Gender and Age Estimation From Facial Images Using Deep Learning

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Abstract—Automated gender and age estimation from facial images are important for many real-world applications. Although, several studies have been proposed in the past, most of them are proposed as individual models and a considerable performance gap is noticed. Moreover, deep learning based approaches treated their model as a black box classifier and hence their model's knowledge representation is not understandable and difficult to further improve. In this manuscript, we have proposed a simple and efficient CNN model architecture by considering gender and age estimation as a multi-label classification problem. The proposed model is trained and then evaluated on the publicly available Adience benchmark dataset. Experimental results demonstrated that the proposed model showed better performance than the similar approaches with an accuracy of 84.20 % on gender estimation and an accuracy of 57.60 % on age estimation. In addition, we have proposed a visualization technique to explain the classification results and then the gender-specific and age group-specific landmark facial regions are identified.

Keywords— *Age estimation, Gender classification, CNN, Visualizing CNN's Decisions*

Automated commentary generation based on FPS gameplay analysis

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Abstract—Video games evolved into competitive sports within a short span of time. Commentary plays a key role in any sport. Commentary is useful to understand the game as well as to capture key moments of the game. The balance between play-to-play commentary and color commentary creates the whole value of commentary. Additionally, it has been proven that contribution factors play a major role in the meaning of an automated commentary as well. The proposed commentary generator takes all three factors into account to generate a commentary track for the first-person shooter game Valorant. Human evaluation along with numerical figures are taken to evaluate the quality of the generated commentary. The evaluation results suggest that the proposed model performs on par with the human commentary.

Keywords—*First Person Shooter, commentary generator, gameplay analysis*

Using CNN to Identify the Condition of Edible Fish

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Abstract—Evaluating the edibility of fish by its freshness is an essential process for the fisheries industry as it contributes to customers' health and the taste of food. In general, identifying freshness of fish is a difficult task for the customers due to lack of experience or knowledge. Using a real-time application which employs real-time images of fish is the best solution to identify their freshness. In this study, a model was developed using VGG16 architecture in a deep convolutional neural network (CNN) to extract the features of the fish and to classify them based on their freshness. Here, Bluefin Trevally fish was selected as a sample and its freshness was detected using real-time images. Those images were collected in various backgrounds with different lightning by different devices. In real-time images, features of fish such as the colour of the eye and frozen blood colour of the operculum were used to identify the freshness of fish. An accuracy of 99% on identification of freshness was achieved by this model.

Keywords—*CNN, VGG16, edible fish, fish quality, Deep learning, Non-destructive, fish freshness*

A Dual CNN Architecture for Single Image Raindrop and Rain Streak Removal

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Abstract—Visual quality of rainy images are considerably poor due to the raindrops in camera lens and the rain streaks in the background scenes. Although the raindrops and rain streaks are appeared together in real-world rainy images, most of the previous approaches are proposed to remove either of them. In this paper, we have proposed a novel CNN model architecture to remove raindrops and rain streaks together. The proposed CNN model architecture has two branches and it consumes two formats of a rainy image via an encoder-decoder network and a dense CNN network. At the end of the architecture, outputs of both branches are combined to produce a high-visibility rain free image with natural colors. In addition, internal and external skip connections are introduced in the blocks of these branches to improve the performance further. The proposed model is trained and then tested on Raindrop, Rain100H, Rain100L, and Rain12 benchmarks and showed excellent performance than the state-of-the-art approaches.

Keywords— *Raindrop removal, rain streak removal, Deraining, Convolutional Neural Network*

EDUZONE – A Educational Video Summarizer and Digital Human Assistant for Effective Learning

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Abstract—The availability of technology and the expansive nature of the internet have created a surge in the demand for online learning. Despite so many advantages, there are some existing drawbacks related to online learning. The lengthy recorded video lectures of different subjects and modules in a static manner, are extremely tedious for the learner to understand the contents available. And lack of assistance for academic-related problems of students is also stated as a major issue that comes with online education. EDUZONE provides a reliable solution to mitigate and overcome these challenges. This tool is educational assistance that generates a summarized version of the video lectures which depicts the overall idea of the whole video with the capability of a lecture notes generator along with a digital human which helps to clarify students' problems and build an efficient conversational flow. The summarized video content can be used by the learners for revisions and as a quick reference before any examinations. In addition to generating short and precise content, EDUZONE also indexes any specific topics to make it easier to find content and generate class notes, highlighting all the important content. Overall EDUZONE can be considered a time-efficient educational assistant which helps students with their studies.

Keywords— *video summarization, digital human, class notes, video indexing, video lecture, OCR, VSU Model*

Multi-AI Based Wireless Sensor Node for Forest Fire Detection

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Abstract—Forest fires are one of the major environmental issues in many countries around the world. There are many ways to detect these forest fires, such as optical camera-based systems, satellite-based systems, fire prediction systems, and wireless sensor nodes (WSN). They have major issues such as line-of-sight limitations in optical camera-based systems, low detection delay of satellite systems, and need more time to model the environments for fire prediction systems. The most suitable way of fire detection is the usage of wireless sensor network based systems because they have low detection delay, more fire behavioral information, good stability, etc. In WSNs, there are many methods of fire detection such as thresholding data, fuzzy logic, neural networks, multi-AI, etc. Here, the proposed WSN based system consists of multi-AI. The system was evaluated with test fires. The proposed system could successfully identify the created fires, and this system is simpler than existing systems.

Keywords—wireless sensor node, forest fire detection, artificial intelligence, multi-A

Closed-Loop DC Motor Embedded Control Platform based on ARM® for Distance Learning Experiments

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Abstract—DC motor controlling is known to be one of the most crucial application in the Engineering world, where precise motion control is commonly found in industrial and commercial applications. Hence, learning the fundamentals of DC closed-loop motor control is beneficial for undergraduate students studying Engineering courses. However Due to the ongoing unprecedented economic crisis in Sri Lanka, the lack of access to electronic components, has become very challenging and in turn, affects implementing and testing of the theories on real prototypes. Hence In this paper, a low-cost ARM® based DC motor embedded control platform is presented so the students who are following control courses can implement their own prototype for an affordable cost using only a few common components. The closed-loop control algorithm is designed by using the PID controller, tuned the system using the classical: trial & error method and tested the system responses in real-time, according to different load conditions. Moreover, ARM® based STM®32F407G micro-controller has been used to program the controller and keil® uVision® software is used as the programming IDE. Using MATLAB® and Simulink® platforms, a comparison of the system responses with no-load, lite load and full-load conditions has been presented.

Keywords—*Embedded Control, Closed-loop Control, DC Motor, PID Control, ARM® based Programming, Distance Learning*

Intelligent Wheelchair with Emotion Analysis and Voice Recognition

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Abstract—Intelligent wheelchairs are becoming more and more prevalent in contemporary life, and the peaceful interaction of humans with wheelchairs is one of the most popular research topics. The development of a voice recognition and emotion recognition based intelligent wheelchair framework is being addressed here for truly impaired/disabled people who are unable to operate the wheelchair by hand. The patient can operate the wheelchair using voice commands, and the wheelchair's Emotion Analysis module recognizes the patient's face and records the patient's emotions before sending the information to a cell phone application. A portion of the intelligent wheelchair is made to gather crucial information given by other units and send out emergency calls or notifications to the caregivers. Face recognition technology uses image processing to identify facial expressions by detecting the patient's face and facial expressions. This helps the other components collect and send data via Internet of Things technologies. Speech – to –Text and Text – to- Speech Methodology is used in the voice recognition module and it captures the voice command data set and extracts the features of the commands. The model is already built and trained to recognize the commands and to send action request to the relevant unit. The Responsive AI auto starts the timer when the patient moves away from the wheelchair, recognizes time and responses back. This unit auto also sends the alert and calls to the guardian when the user has no response.

Keywords—*Intelligent wheelchair, face recognition, emotion analysis, voice recognition, responsive AI, emergency alerts*

Design and Testing of an Arduino-based Network Jammer Device

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Abstract—A computer network is described as two or more devices connecting and communicating, each known as a computer network. These types of networks work on wired and wireless mediums. A sort of transmission medium is wired communications, also referred to as directed media. This form of communication is more reliable than wireless since it is the most stable. In wired communication, twisted pair cable, coaxial cable, and fiber optic cable are used to send data from the source to the destination. Wireless communication is also called "unguided" or "unrestricted" transmission media. In this mode, no physical medium is required to transmit electromagnetic signals. On the other hand, in wireless communication, a message can transfer through the air, water, or vacuum, i.e., infrared, radio, and microwave waves. Therefore, this research mainly focuses on wireless communication using radio frequency technology. This technology is also used on TVs, radios, laptops, modems, mobile phones, and pagers. People constantly interact with this technology in the modern world, and all these people have secure data and confidential information. However, in this case, someone uses this technology and tries to get the data illegally. It is a big problem for all civilians and the government. In this situation, a network jammer device can be used to protect those data from snooping attempts, location tracking, limiting cell phone activity, and cheating. This paper describes a low-cost network jammer that uses an Arduino and an RF 433 MHz module to create a frequency between 315 MHz and 433 MHz. It uses the denial-of-service technique to prevent illegal activities within a 100-meter range.

Keywords— *Arduino, Denial of service, Jammer, Radiofrequency*

Development of Nonlinear Dynamics Simulator for 2-DOF Ball Balancing Platform to Assist Distance Learning of Control Systems

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Abstract—In a wide range of control applications, balance control systems are known to be one of the most crucial and challenging applications. 2-DOF ball balancing platform is an experimental platform which can perform various kinds of balance control experiments. Hence, this laboratory experiment is widely used in many control engineering courses. But with COVID-19, travel restrictions and social distancing, performing laboratory experiments have become much more challenging. Hence, this research explores the feasibility of performing control engineering experiments on Ball on plate system in a simulation environment for distance learning purposes. This paper represents the control design theory, system modelling & simulations of ball balancing platform and proposes a method of performing lab experiments for remote-learning. All the system modelling and simulations of this research were done using MATLAB Simulink based on the Sims cape model developed using SolidWorks.

Keywords— *ball on plate; PID; nonlinear control; MATLAB simulink; simscape simulations; FIR; filtering; distance learning*

Computer Vision Based Navigation Robot

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Abstract—The majority of industrial environments and homewares need help when exploring unknown locations owing to a lack of understanding about the building structure and the various impediments that may be faced while transporting products from one spot to another. This is because there is a lack of knowledge about the building structure and the potential obstacles that may be encountered. This paper provides “Computer Vision-Based Navigation Robot” as a strategy for indoor navigation with optimal accessibility, usability, and security, decreasing issues that the user may encounter when traveling through indoor and outdoor areas with real-time monitoring of the most up to date IoT technology. The article is titled “Indoor Navigation with Optimal Accessibility, Usability, and Security.” This article proposes “Computer Vision-Based Navigation Robot” as a solution for interior navigation that provides optimum accessibility, usability, and security. This is done in order to tackle the issue that was presented before. Since the readers of this post include people who work in industry as well as physically challenged people who live alone, CVBN Robot takes object-based inputs from its surroundings. This is because the audience for this essay includes both groups of people. This study also covers a variety of methods for localization, sensors for the detection of obstacles, and a protocol for an Internet of Things connection between the server and the robot. This connection enables real-time position and status updates for the robot as it navigates a known but unknown interior environment. In addition, this study covers a variety of methods for localization, sensors for the detection of obstacles, and a protocol for an Internet of Things connection between the server and the robot.

Keywords— *computer vision, localization, navigation, obstacle, IoT, CVBN, protocol*

Elderly Care Home Robot using Emotion Recognition, Voice Recognition and Medicine Scheduling

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Abstract—The robotic concept is used for several tasks to easier human day-to-day tasks. There are various recreational studies have been done on the elderly people's care system. In this study, the system can identify the elderly people's emotional status using thermal image processing that eliminates the halo effect issue in thermal images using a single discriminator Cycle-GAN model, serving medicine to elderly people by moving towards the elderly person while avoiding obstacles using point to point algorithm and obstacle avoidance and identify the semantic analysis by using web ontology based language. The integrated system is evaluated using the Gazebo simulator because the cost is lower than implementing the features in a real robot.

Keywords— *Computers, Emotion recognition, Web ontology, Robot vision systems, Human-robot interaction*

Peer Learning – An Interactive and Collaborative ELearning Application for College Student

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Abstract—Since the start of the COVID-19 epidemic in 2020, the entire educational system has been challenging and Sri Lanka economic crisis, but this is especially effect for students who are now enrolled. This developmental milestone is reached when adolescents begin to assume responsibilities and acquire leadership skills through participation in a range of team activities. It is easiest to gain experience working in a group setting while still in school. Nevertheless, given the current stage of the Sri Lanka economic crisis, students will face a range of challenges. They are incapable of participating in group activities that are relevant to the subjects they teach, and, as previously indicated, enhancing their leadership skills, which is particularly problematic when working with students. The "Peer Learning" solution is a web-based application that supports students in enhancing their collaborative learning skills. Through the system, students have the opportunity to study a variety of collaborative tasks, which improves their educational and interpersonal abilities. In addition, professors can share their knowledge with students by personalizing questions, posting films, and demonstrating figures. Students can easily comprehend the system's operation due to its user-friendly design, which enables advanced technological methods for monitoring and guiding students' activities simultaneously.

Keywords— *Collaborative learning; COVID-19; Economic Crisis; Peer learning; Group work; E-learning; Collaborative Quiz*

A Visually Interpretable Forensic Deepfake Detection Tool Using Anchors

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Abstract—“Deepfakes” have seen a dramatic rise in recent times and are becoming quite realistic and indistinguishable with the advancement of deepfake generation techniques. Promising strides have been made in the deepfake detection area even though it is a relatively new research domain. Majority of current deepfake detection solutions only classify a video as a deepfake without providing any explanations behind the prediction. However, these works fail in situations where transparency behind a tool’s decision is crucial, especially in a court of law, where digital forensic investigators maybe called to testify if a video is a deepfake with evidence; or where justifications behind tool decisions plays a key role in the jury’s verdict. Explainable AI (XAI) has the power to make deepfake detection more meaningful, as it can effectively help explain why the detection tool classified the video as a deepfake by highlighting forged super-pixels of the video frames. This paper proposes the use of “Anchors” XAI method, a model-agnostic high precision explainer to build the prediction explainer model, that can visually explain the predictions of a deepfake detector model built on top of the EfficientNet architecture. Evaluation results show that Anchors fair better than LIME in terms of producing visually explainable and easily interpretable explanations and produces an anchor affinity score of 70.23%. The deepfake detector model yields an accuracy of 91.92%.

Keywords— *Deepfake Detection, XAI, Computer Vision, Deep Neural Networks, Anchors, Digital Media Forensics*

COVID-19 Infection Risk Assessment for Shoppers in Retail Stores

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Abstract—Over the last few years, a large number of smartphone apps have been developed to "flatten the curve" of the rising number of COVID-19 infections. Knowledge of potential symptoms and their distribution enables the early identification of infected individuals. We developed a mobile app-based crowdsourcing methodology to assess the COVID-19 infection risk through shopping habits at indoor retail stores. The app's goal is to instil trust in customers to visit stores, which will assist small and medium businesses to survive their operations in the near term. According to the literature, there are several implementations for COVID-19 infection risk estimations for such scenarios. A mobile app prototype was developed, and the risk was calculated using the COVID-19 Aerosol Transmission Estimator model established by the University of Colorado Boulder. The developed prototype mobile app was tested with end users to gather their feedback through a questionnaire. In comparison to the complex implementation associated with AI-based alternatives, this solution could be delivered at a lower cost with adequate accuracy of COVID-19 infection risk assessments.

Keywords— Emerging Technologies, COVID-19, Infection Risk Assessment, Mobile app

Analysis and Prediction of Severity of United States Countrywide Car Accidents Based on Machine Learning Techniques

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Abstract—The number of vehicles and road transportation increases rapidly daily. Hence the frequency of road accidents and crashes also gradually increase with it. Analyzing traffic accidents is one of the essential concerns in the world. Due to the considerable number of casualties and fatalities caused by those accidents, taking necessary actions to reduce road accidents is a vital public safety concern and challenge worldwide. Various statistical methods and techniques are used to address this issue. Hence, those statistical implementations are used for multiple applications, such as extracting cause and effect to predict real-time accidents. In this study, a United States (US) Countrywide car accidents data set consisting of about 1.5 million accident records with other relevant 45 measurements related to the US Countrywide Traffic Accidents were used. This work aims to develop classification models that predict the likelihood of an accident is severe. In addition, this study also consists of descriptive analysis to recognize the key features affecting the accident severity. Supervised machine learning methods such as Decision tree, K-nearest neighbour, and Random forest were used to create classification models. The predictive model results show that the Random Forest model performs with an accuracy of 83.95% for the train set and 80.69% for the test set, proving that the Random forest model performs better in accurately detecting the most relevant factors describing a road accident severity.

Keywords— *classification, decision tree, k-nearest neighbour, random forest*

Impact of Innovation and R & D on Financial Performance of Telecommunication Sector in Sri Lanka

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Abstract—The intention of this research is to investigate and analyze how innovation affects organizational performance in the Sri Lankan telecommunication sector. Three variables were used to measure the innovation construct: product innovation, process innovation, and disruptive innovation. The moderating variable organizational culture is used to measure the moderating effect between the independent and dependent variables (organization performance). The findings of this study will enable enhancing the performance of the telecommunication sector. By examining the impact of innovation and R&D on the telecommunication sector in Sri Lanka, as well as organizational performance, this analysis will address the research gap in the field of telecommunication sector in Sri Lanka. There are six hypotheses available in research methodology that was tested. Three main telecommunication sector firms out of five telecommunication sector firms in Sri Lanka was selected to collect data. The selected three companies are Sri Lankan Telecom, Mobitel and Dialog Axiata PLC. The result of the analysis shows that organizational innovation has a positive relationship towards organizational performance. The moderating variable “organizational culture” does not show any moderating effect between independent and dependent variables. The telecommunication firms that are more into organizational innovation have scored high in organizational performance criteria. Organizational culture does not highlight a moderating impact on the independent and dependent variables.

Keywords—*Innovation, Financial Performance, Research & Development, Telecommunication Sector, Organizational Culture*

Evaluating the Inter-Service Communication on Microservice Architecture

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Abstract—Distributed computing concepts have proliferated with cloud computing concepts in the past decade. With the evolution in cloud computing, Microservice architecture has significantly become popular as a new architectural pattern and a software development architecture. Most enterprise software development has moved their monolithic software architecture to microservice-based architecture, as it can divide large applications into light-weighted, distributed components. However, this approach may be subject to certain downsides as well. With the modern convention, engineers have succeeded in achieving scalability and maintainability quality attributes and lack the performance attribute in terms of response time. This is because the microservice architecture has introduced inter-service communication over the network. The key challenge when developing a microservice-based application is choosing the correct inter-service communication mechanism to reduce the time taken when calling each service. This research has taken an experimental methodology to compare and contrast the most trending inter-service communication mechanisms. Industry-standard benchmark load test is run to collect quantitative data to evaluate the overall system performance in terms of response time. The testing observed that gRPC protocol performs well in terms of response time and throughput compared to the HTTP and Web Socket protocols.

Keywords— *Microservices, Inter-service communication, Performance, Latency*

Event Driven Share Price Forecasting based on Change based Impact Analysis

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Abstract—Investing in stocks is considered one of the riskiest options to invest due to regular unpredictable market fluctuations. It is difficult to forecast stock price variations due to this reason which makes investment or divestment decisions extremely challenging. This paper proposes a mechanism for share price forecasting by quantifying the impact of market externalities such as news events. We propose a novel multivariate approach that forecasts the behavior of stock prices — a projection modified for investor psychology and market features, more reliably compared to existing work. Our mechanism employs a strategy that models stock variations using a physical metaphor employing first-order derivatives of historical stock price and sentiment with respect to time. We do an extended forecast based on the sentimental impact on stock prices in response to an event using Kalman filtering, similarly to a trajectory of a physical object that is subject to a force. The proposed methodology achieves a significant accuracy of up to 97% for two-three days forecasts, which exceeds the forecast accuracy of related work.

Keywords— *Share Price Forecasting, Sentiment Analysis, Change Point Analysis, Kalman Filter, Twitter*

Escort - Natural Language Processing Based University Students Guidance System

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Abstract—Universities play a significant role in students' lives and aim to provide the best education, knowledge, and experience. However, university students face many difficulties during their university life including language, communication issues, and the inability to get proper guidance for education and career improvement. This paper proposes an approach to overcome these issues. With the help of Natural Language Processing (NLP), in this paper, several solutions are recommended for the mentioned issues. First, a chatbot helps to communicate with the university administration, where students can ask relevant administrative-related questions. A recommendation system is developed to provide solutions for their psychological issues. Another recommendation system is built for career guidance which will help students to identify the future career of their interest, and the provided mentors will be able to guide them. Another recommendation system identifies the performance of students in each module according to their performance level. The system recommends learning materials to improve their level. With these components, ESCORT – A university students' guidance system, will make students' life easier and more efficient.

Keywords— *Natural Language Processing, administration, psychology, career guidance, performance level, pre-processing*

IHI :– A Mobile Application for ADHD Analysis and Detection

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Abstract—Attention Deficit Hyperactivity Disorder (ADHD) is a common disorder, which can be identified mostly among children which often lasts till their adulthood. A person with ADHD would not be able to pay attention, would not think about consequences of their actions(impulsivity) and sometimes could be hyperactive (overly active). According to the statistical reports of ADHD Institute, worldwide prevalence of ADHD is ~2.2% overall (range, 0.1-8.1%) which has been estimated only within the children and adolescents (aged < 18 years) [1]. A person with ADHD could have troubles with socializing, making friends and may struggle with studies as well. It is stated that people with ADHD could often choose smaller rewards over bigger rewards considering only the time they have to spend on. A physical examination, series of interviews, reports from associates of the patient are some of the existing methodologies used to diagnose ADHD. Adult ADHD Self-Report Scale Symptom Checklist (ASRS), Barkley Adult ADHD Rating Scale - V, Brown ADD Scales (Adult), Conners' Adult ADHD Rating Scales (CARRS) and Copeland Symptom Checklist for Attention Deficit Disorders - Adult Version are some of the screening tools and checklist methods used currently. Above mentioned tools and methods mainly focus on adults. It is complicated to test children as they have certain behaviors at several ages that make symptoms of this disorder undistinguishable. The current methods of diagnosing have issues such as lack of concentration to the patient, difficulty to monitor child/adult under different environments, maintaining patient's records etc. We have developed a localized mobile application which includes questionnaire and gaming activities to identify and diagnose symptoms such as Hyperactivity, Impulsivity, Inattention and organizing disorders. This application is not restricted for adults as above-mentioned tools and methods that are currently being used. If we can identify these disorders as early as possible this would deliver many benefits to the children's growth and future.

Keywords— *ADHD children and adults diagnose, mobile application, DSM-5*

Automobile Product Ranking based on the Singlish Comments in Social Media Platforms

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Abstract—In today's world, many customers buy or choose products based on online reviews. The internet contains a vast collection of natural language. People share their subjective thoughts and experiences with one another in various social media platforms. Product reviews can be analyzed to determine how people feel about a particular product. In Sri Lanka, people widely use Singlish (Sinhala-English) to comment and give reviews on products, rather than a single pure language. Therefore in this research it has extracted data from social media platforms on various brands in the automobile industry and propose a system to rank the automobile brands in Sri Lanka based on the social media comments which are written on Singlish. When ranking products, it is not practical to rank products based only on the frequency of the products. Because a brand having the highest number of comments does not necessarily indicate that it has good market perception compared to other brands. In order to get an accurate overview, the study have considered both the people's sentiment towards the particular brand and the frequency of comments. When ranking the products research has done several rankings based on different aspects namely market value, country of origin and second hand market, vehicle performance, product features which people pay their most attention in the automobile industry and also an overall ranking considering all these aspects together. With that it is possible to identify which vehicle type or brand has the highest and lowest demand in the market, and the automobile manufacturer can get a good understanding where a particular product stands out comparative to other brands and apply their strategies accordingly. When implementing the ranking system 100000 social media comments were extracted and annotated. Convolutionary neural network was used to develop the main model, and out of the different methods tried to predict the sentiment as the part of the main model, random forest method gave a higher accuracy of 96.7 making it a more sophisticated combination.

Keywords— Singlish, automobile, product ranking, social media



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