ICTer 2022

Book of
Abstracts

22nd International Conference on Advances in ICT for Emerging Regions

ICTer 2022

30th November 2022 – 01st December 2022
http://www.icter.org/conference

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Proceedings of 22nd International Conference on Advances in ICT for Emerging Regions (ICTer 2022)

Conference Website: http://www.icter.org/conference/

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MESSAGE FROM THE DIRECTOR UCSC

We are delighted to have you join us for the 22nd International Conference on Advances in ICT for Emerging Regions (ICTer 2022), which will take place from 30th November to 1st December, 2022. The ICTer conference is hosted by the University of Colombo School of Computing (UCSC) with the support of local and international partners. For the last 22 years, the UCSC has been organizing an international conference which is titled "International Information Technology Conference (IITC)" since 1998 and later rebranded as ICTer from 2010. This year we will be organizing the ICTer Conference as a blended conference allowing participants to attend the conference physically or online. Based on the last two years' experience, the organizing committee is planning to host the conference as an open conference, allowing the public to watch the conference through YouTube webcasting. All the participants are invited to watch the last year conference proceedings at www.icter.org/conference. The physical conference will be held at the Prof. V. K. Samaranayake Auditorium, University of Colombo School of Computing.

The ICTer Conference has served as a forum for the dissemination of academic work from other universities, including those outside of Sri Lanka, as well as work that addresses pressing issues in developing regions conducted at the cutting edge of computing research and development. According to Google Scholar, publications in ICTer have accepted citations from other indexes throughout the most recent years (h-index and i10-index). The high standards of the ICTer conference are well known. Over the years, these standards have been raised by the UCSC, other institutions of higher learning, and the Sri Lankan IT sector.

The ICTer 2022 has been organized and supported by a committed team. I would like to take this opportunity to thank the conference co-chairs for their leadership as well as all of the committee members who are a part of the young academic team at the UCSC. I also like to express my gratitude to the session chairs, keynote speakers, paper presenters, and reviewers. In closing, I want to express my gratitude to all of our sponsors, without whose help this conference would not have been possible.

I hope ICTer 2022 conference is both fruitful and memorable.

Dr. Ajantha Atukorale, Director, University of Colombo School of Computing

MESSAGE FROM THE CONFERENCE CO-CHAIRS

It is our pleasure as the co-chairs to write this message to the 22nd International Conference on Advances for ICT for Emerging Regions (ICTer) this year. The ICTer 2022 conference will be held on 30th November and 1st December, 2022 as a hybrid event joining both in-person and online audiences together. ICTer 2022 is organised with technical co-sponsorship of IEEE Sri Lanka Section. This means, all the accepted full papers presented at the ICTer 2022 conference will be submitted to the IEEE Xplore digital library.

ICTer is the successor to the seminal International Information Technology Conference (IITC) held in Sri Lanka since 1998. The ICTer conference is a unique opportunity for researchers and practitioners alike to present research results and practical deployment in the Computer Science and Information Technology domains. Annually, academics, students, and researchers from various universities in Sri Lanka and around the world submit their papers to the ICTer conference.

This year, the conference consists of 10 specialised tracks on various topics, namely machine learning, physical computing, distributed computing, human computer interaction, applications of IT, industry R & D, information security, natural language processing, open track, and digital transformation and innovation. Among these tracks, the last one is dedicated to the theme of this year's Annual Research Symposium (ARS) of the University of Colombo, called "Digital Transformation and Innovative Approaches to Mitigate Challenges in the Higher Education Sector". In addition to research paper presentations, this year's event consists of 4 keynote speeches by distinguished speakers from various fields in computing, and pre- and post-conference workshops.

As the co-chairs of the ICTer 2022 conference, we would like to heartily thank our organising committee, the reviewers, authors and speakers, financial and technical sponsors, and everybody who has contributed to the success of this year's event.

Dr. Asanka Sayakkara & Dr. H. N. D. Thilini
Conference Co-Chairs, ICTer 2022

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KEYNOTE SPEAKERS

➢ KEYNOTE 1

Towards Privacy-Preserving Artificial Intelligence of Things (AIoT).
Professor Wen Hu
School of Computer Science and Engineering
University of New South Wales (UNSW).

➢ KEYNOTE 2

Full stack researcher: the last line of defense against the tyranny created by tech bros.
Dr. Primal Wijesekera
Research Scientist
ICSI - University of California, Berkeley.

➢ KEYNOTE 3

Smell, Taste, and Haptic Interfaces to Inspire a New Age of Experience Media.
Dr. Nimesha Ranasinghe
Assistant Professor at School of Computing and Information Science
University of Maine.

➢ KEYNOTE 4

Data-Driven Paradigm Shift: Evolution of Digital Transformation (DX) with Advances of ICT in Higher Education.
Professor K.P. Hewagamage
University of Colombo School of Computing.

CONFERENCE DAY 1 - AGENDA Wednesday, 30th November 2022 (Location: Vidya Jyothi Professor V. K. Samaranayake Auditorium, UCSC)	
07.30 AM	Registration
08.00 AM	Arrival of the Chief Guest and the other invitees
08.02 AM	Lighting of the Traditional Oil Lamp
08.05 AM	Welcome Address by the Co-Chairs of the 22nd International Conference on Advances in ICT for Emerging Regions (ICTer 2022)
08.10 AM	Address by the Director of UCSC, Dr. Ajantha Atukorale.
08.20 AM	Address by the Chief Guest, Senior Professor H.D. Karunaratne, the Vice Chancellor of the University of Colombo.
08.30 AM	Keynote 01: "Towards Privacy-Preserving Artificial Intelligence of Things (AIoT)" by Prof. Wen Hu, School of Computer Science and Engineering, University of New South Wales (UNSW).
09.30 AM	Sponsor Advertisement
09.40 AM	Refreshments
10.00 AM	Sponsor Advertisement
10.10 AM - 11.40 AM	Session 01 of the conference - Machine Learning Track
11.40 AM	Sponsor Advertisement
11.50 AM – 01:20 PM	Session 02 of the conference - Natural Language Processing Track
01.20 PM	Sponsor Advertisement
01.30 PM	Lunch Break
02.00 PM	Keynote 02: "Full stack researcher: the last line of defense against the tyranny created by tech bros" by Dr. Primal Wijesekera, Research Scientist, ICSI - University of California, Berkeley.
03.00 PM - 04.15 PM	Session 3 of the conference - Open Track
04.15 PM	Refreshments
04.30 PM	End of the first day of the conference

CONFERENCE DAY 2	
Thursday, 1st December 2022	
(Location: Vidya Jyothi Professor V. K. Samaranayake Auditorium, UCSC)	
08:00 AM	Registration
08:30 AM	Keynote 03: "Smell, Taste, and Haptic Interfaces to Inspire a New Age of Experience Media" by Dr. Nimesha Ranasinghe, Assistant Professor at School of Computing and Information Science, University of Maine.
09.30 AM	Sponsor Advertisement
09:40 AM	Refreshments
09.50 AM	Sponsor Advertisement
10.00 AM – 11.30AM	Session 4 of the conference - Applications of IT Track
11.30 AM	Sponsor Advertisement
11:40 AM – 01.05 PM	Session 5 of the conference - Open Track
01.05 PM	Sponsor Advertisement
01.15 PM	Lunch Break
01.45 PM – 02.40 PM	Session 6 of the conference - Machine Learning Track / NLP Track
02.40 PM	Keynote 04: "Data-Driven Paradigm Shift: Evolution of Digital Transformation (DX) with Advances of ICT in Higher Education" by Prof. K.P. Hewagamage, University of Colombo School of Computing.
03.40 PM	Sponsor Advertisement
03.50 PM	Awarding Ceremony
04.20 PM	Vote of Thanks by the Conference Co-Chair
04:30 AM	Refreshments

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Session 4: Applications of IT

Session 5: Open

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KEYNOTE SPEAKERS

Towards Privacy-Preserving Artificial Intelligence of Things (AIoT).

Professor Wen Hu

School of Computer Science and Engineering
University of New South Wales (UNSW).

Sensor-rich IoT systems are becoming ubiquitous in our lives, from smart wristbands with IMU, to smartphones with depth cameras, to low-cost embedded networked radars. These systems are providing very good alternative ways for human context detection. Yet, making the robust inference from the multi-modality raw sensor data to individual's context in the wild remains difficult. Furthermore, human context may consist of sensitive information, which needs to be protected from malicious attackers. In this talk, I will discuss my group's ongoing research on addressing some of these challenges with example applications in fitness, health and cyber security.

Full stack researcher: the last line of defense against the tyranny created by tech bros.

Dr. Primal Wijesekera

Research Scientist

ICSI - University of California, Berkeley.

The concept of a full-stack developer/engineer came into being a while back to save time, resource utilization, and, most importantly, money. Why not a full-stack researcher? Computer Science researchers have long been at odds at opposite ends of the stack with a need for compromise between user engagement, social impact, adoption, systems development, and technical contribution. It is slowly changing, but society needs it urgently. We live in one of the most polarized societies in recent times, and in every possible way, technology was a facilitator rather than the solution to the problem. Lack of holistic work is one critical contributing factor. We live in an era where domain specialists may be oblivious to their lack of understanding of the holistic picture. Furthermore, many with a far-reaching audience do not understand the things they spread. I will put forth the notion of a full-stack researcher, in which academics must be more holistic in their research. Academics must tell the world the importance of being truthful to the audience and presenting the complete picture. We owe that much to science.

Smell, Taste, and Haptic Interfaces to Inspire a New Age of Experience Media.

Dr. Nimesha Ranasinghe

Assistant Professor at School of Computing and Information Science

University of Maine.

When humans interact with the outside world or one another, all of the senses are engaged; a true conversation is considered a full sensory experience. From early ages to the present world, people desire multisensory experiences in every aspect of their lives. From trying different foods, going to different places to playing games in virtual reality, they continuously seek sensory stimuli to be a wholesome experience. Yet, the current technology lacks the inclusion of many essential sensory channels. This talk highlights several research works focusing on "Experience Media" that explore possibilities for novel multisensory interactive digital media technologies towards achieving total immersion in day-to-day digital interactions. This talk also emphasizes the need to look beyond the current 'age of information' and step into a new 'age of experience.'

Data-Driven Paradigm Shift: Evolution of Digital Transformation (DX) with Advances of ICT in Higher Education.

Professor K.P. Hewagamage

University of Colombo School of Computing.

Three stages of digitization, digitalization, and digital business model have built the foundation of Digital Transformation (DX). In fact, it is the main achievement of the Industry 3.0 revolution, which is reaching its end in a few years. The new era of Industry 4.0 has already started, and it will bring a new culture that will radically affect and influence every function in society. Simply, the culture, workforce, and technology, which are forces of transformation, may undergo another cycle of change with respect to the objective of a data-driven paradigm in the new era. Hence, the fourth dimension of transformation, which we name as the data-driven transformation, will be the governing principle for digitization, digitalization, and digital business model. The data-driven transformation is directly linked with several frontier technologies in ICT, namely Robotic Process Automation (RPA), Artificial Intelligence, Blockchain, Internet of Things, Cloud Computing, Virtual Reality, 3D Printing, Big Data and Data Science/Engineering, and so on. Technology provides opportunities to find solutions for problems/constraints in many processes. However, the success of solutions depends on the innovativeness of applying the technology to automate the process. Hence, the data-driven paradigm will become the architecture of those solutions.

A Stylometric Approach for Reliable News Detection Using Machine Learning Methods

A. D. L. Abeynayake, A. A. Sunethra, and K. A. D. Deshani

Department of Statistics Faculty of Science, University of Colombo
Colombo, Sri Lanka

Abstract—The rise of mass media and the Internet has resulted in a sudden surge in the spreading of news swiftly within the current society. Even though communication of information through online news has made people more informed of their surroundings, it has also caused the rise of a misinformed society. The characteristic which assists this cause has been the ineffectiveness of humans in distinguishing truthful and untruthful news. The untruthfulness of a news article can be determined by analyzing the content of the article for any untruthful or unreliable claims. Currently, this task is undertaken by two means. Namely, by manual fact-checking or by automated fake news detection. Even though in previous literature automation of fake news detection has been successful, we hold the stance that assessing the correctness of claims is a complex task that AI alone cannot solve satisfactorily at this point, and it demands human intervention which is too laborious. Therefore, this study identifies a model that can distinguish between reliable and unreliable news articles using stylometric features. The model introduced in the study can act as a filter in the fake news detection pipeline such that only the reliable articles are pushed to the endpoint of the pipeline. A novel dataset is introduced through this research for news reliability detection tasks consisting of news articles directed at Sri Lanka. The study demonstrates that stylometric features can be employed to predict the reliability of news articles. A Stacking Model attained the highest accuracy which stood at 79.05% in a space of 31 stylometric features.

Keywords—Fake News Detection, Stylometric Features, Stacking Classifier, Natural Language Processing

An Ensemble Methods based Machine Learning Approach for Rice Plant disease diagnosing

G.K.V.L.Udayananda, P.P.N.V.Kumara

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Even though the annual rice production decreases by 37% because of rice plant diseases still there isn't any proper application developed which can identify rice plant diseases accurately and instruct farmers to control the spreading of rice plant diseases. This might be solved by creating a software program for farmers that can diagnose rice plant illnesses and provide instructions to farmers to do treatments for those ailments. Convolutional Neural Networks, which are particularly efficient in picture recognition and classification, may be employed directly for this illness detection procedure. In this study, the author has created an ensemble model which can identify rice plant diseases accurately. This has been created by integrating VGG_16, Alex Net, and ResNet_50 models which has identified in the study[1]. Under this study, the author has evaluated the accuracies of all these three modules individually and he could able to get 98.50 %, 94.33 %, and 99.84 % for AlexNet, VGG_16, and ResNet_50 respectively. In this ensemble model, it considers confidence as a parameter and uses it to measure the accuracy of the predicted results of disease-affected rice plant leaves. This model will help farmers to identify rice plant diseases effectively.

Keywords: Convolutional Neural Networks, Diagnose plant illnesses, Recognition, Rice plant, Rice disease, Classification, Ensemble model

Multi-modal Deep Learning Approach to Improve Sentence level Sinhala Sign Language Recognition

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Sign language is used across the world for communication purposes within hearing-impaired communities. Hearing people are not well versed in sign language and most hearing-impaired are not good in general text, creating a communication barrier. Research on Sign Language Recognition (SLR) systems have shown admirable solutions for this issue. In Sri Lanka, machine learning along with neural networks has been the prominent domain of research in Sinhala SLR. All previous research is mainly focused on word-level SLR using hand gestures for translation. While this works for a certain vocabulary, there are many signs interpreted through other spatial cues like lip movements and facial expressions. Therefore, translation is limited and sometimes the interpretations can be misleading. In this research, we propose a multi-modal Deep Learning approach that can effectively recognize sentence-level sign gestures using hand and lip movements and translate to Sinhala text. The model consists of modules for visual feature extraction (ResNet), contextual relationship modeling (transformer encoder with multi-head attention), alignment (CTC) and decoding (Prefix beam search). A dataset consisting 22 of sentences used for evaluations was collected under controlled conditions for a specific day-to-day scenario (a conversation between a vendor and a customer in a shop). The proposed model achieves a best Word Error Rate (WER) of 12.70 on the testing split, improving over the single-stream model which shows a best WER of 17.41, suggesting a multi-modal approach improves overall SLR.

Keywords: Sign language, Sinhala Sign Language, Continuous Sign Language Recognition, Deep Learning, Multi-modal fusion

Employing Super Resolution to Improve Low-Quality Deepfake Detection

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Abstract—The rapid progress in deepfake content generation has now come to a point where it raises significant concerns about the implications for society. Therefore, a new challenge of detecting deepfakes arises to protect individuals from potential misuse. Even though introduced detection algorithms perform well on high-quality deepfakes, detecting low-quality deepfakes has been challenging. As a remedy, researchers try to feed more training data to increase detection ability. However, providing more data and processing them is not always feasible in a practical scenario. Thus, for the first time in this domain, we propose to employ super-resolution (SR) as a preprocessing step instead of feeding more data to improve low-quality deepfake detection. Extensive experiments were conducted on the FaceForensics++ deepfake dataset. Initially, three baseline models, Meso-4, MesoInception-4, and XceptionNet, were trained and tested on the dataset without any preprocessing mechanism. XceptionNet outperformed with 90.54% accuracy revealing deeper networks detect low-quality depfakes adequately. Then those baseline models were trained with SR preprocessing. To do that, we employed two SR networks, called VDSR and RESRGAN. RESRGAN+XceptionNet outperformed the previous baseline models by obtaining 96.05% accuracy, showing SR preprocessing usefulness in low-quality deepfake detection. Further experiments utilizing performance metrics, statistical tests, and visualization of activation maps showed that SR preprocessing is promising when applied to deepfake detection networks and detection algorithms experience a significant performance.

Index Terms—Deepfake, deep learning (DL), detection, low quality, super-resolution (SR)

Identification of Previously Unseen Asian Elephants using Visual Data and Semi-Supervised Learning

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This paper presents a novel method to identify unseen Asian elephants that are not previously captured or identified in available data sets and re-identify previously seen Asian elephants using images of elephant ears, leveraging a semi-supervised learning approach. Ear patterns of unseen elephants are learnt for future re-identification. To aid our process, elephant ear patterns are used as a biomarker to uniquely identify individual Asian elephant, each of which is attached a descriptor. The main challenge is to learn and use a clustering technique to identify new classes (i.e., elephants) in unlabelled elephant ear image sets and leveraging this data in verifying the labelled images. This study proposes a systematic approach to address the problem to uniquely identify elephants, where we developed: (a) a self-supervised learning approach for training the representation of labelled and unlabelled image data to avoid unwanted, bias labelled data, (b) rank statistics for transferring the models' knowledge of the labelled classes when clustering the unlabelled images, and, (c) improving the identification accuracy of both the classification and clustering algorithms by introducing a optimization problem when training with the data representation on the labelled and unlabelled image data sets. This approach was evaluated on seen (labelled) and unseen (unlabelled) elephants, where we achieved a significant accuracy of 86.89% with an NMI (Normalized Mutual Information) score of 0.9132 on identifying seen elephants. Similarly, an accuracy of 54.29% with an NMI score of 0.6250 was achieved on identifying unseen elephants from the unlabelled Asian elephant ear image data set. Findings of this research provides the ability to accurately identify elephants without having expert knowledge on the field. Our method can be used to uniquely identify elephants from their herds and then use it to track their travel patterns which is greatly applicable in understanding the social organization of elephant herds, individual behavioural patterns, and estimating demographic parameters as a measure to reducing the human-elephant conflict in Sri Lanka.

Keywords: Asian Elephants, Biomarkers, Semi-Supervised learning, Clustering, Identification, Visual descriptor

Show and Listen: Generating Music Based on Images using Machine Learning

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Music and images can be interpreted as arts of communicating emotions and feelings. Thereby, one can observe that there are instances where music and images are in a close association, such as an instance where background music is used to enhance the emotion depicted in a picture or video. A human composer would be able to compose such music by analyzing an image with the intention of sparking emotion in the subject within the context of the image. Thereby, the goal of this research is to develop a machine learning model which can perform the same task of composing a novel meaningful melody given an image. Inspired by image captioning using machine learning, the proposed architecture for the model involves using a Convolutional neural network (CNN) to extract image features and a Long short-term memory (LSTM) model to generate melodies. Following the model training, a subjective and objective evaluation was conducted and the obtained results indicated that the model performed well in accomplishing its goal. Naturally, though the model does not achieve perfection, it takes us one step closer to opening a wide range of possibilities for generating music from images using machine learning.

Keywords: Melody composition, Recurrent neural networks, Images, Music generation

Deep Learning based Hand-Drawn Molecular Structure Recognition and 3D Visualization using Augmented Reality

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Due to both false-positive structure identification and flaws in the predicted structures, chemical structure identification from documents remains a complex challenge. Current techniques rely on customized rules and subroutines that, although usually effective, recognition rates are insufficient and systematic improvement is difficult at certain times. Especially when it comes to the identification of hand-drawn Lewis Structures of molecules, most of these existing methodologies fail. Therefore, through this research, we present a system to identify a camera-captured, hand-drawn Lewis structure of a molecule using Machine Learning and Deep Learning concepts. Due to less availability of hand-drawn Lewis structures, we had to make our

own dataset and therefore the project was limited to 15 different hydrocarbons. Moreover, we provide the users with a mobile application that can visualize the identified molecule in a 3-D space using Augmented Reality. Our machine learning model details are available on the Github (https://github.com/MZJGroup/MoleAR)

Keywords: Augmented reality, Machine learning, Deep learning, CNN, Lewis structures, OCR

Applying deep learning for morphological analysis in the Sinhala language

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Morphological analysis is the field of linguistics that studies the internal structure of words. Sinhala is a morphologically rich language. Because of that, analysis of morphemes in a language like Sinhala is a complex task. Existing approaches for morphological analysis can separate into rule-based and data-driven. In this paper, we propose a deep learning approach (data-driven) to do the morphological analysis in the Sinhala language. Six different deep learning architectures were considered in this study and have compared the results against each other to identify the best performing architecture. In this study, two different scripts have been considered (Sinhala and Roman) to represent data. Among all these approaches, Sinhala script with bidirectional GRU as the deep learning architecture has provided the highest accuracy (87.96%) for morphological analysis in the Sinhala language. We have provided an algorithm based on the process of applying deep learning to the Sinhala language. From that, we have implemented a simple application to do the morphological analysis using deep learning. We considered several other experiments like predicting morphemes and definitions separately to check the behavior of deep learning with the morphological analysis in the Sinhala language. All these experiments provided more than 88% accuracy. These positive results prove that the deep learning approaches are promising in morphological analysis in the Sinhala language.

Keywords: Morphological analysis, Deep learning, Sinhala language, RNN, LSTM, GRU, Roman script, Sinhala script

A Hybrid Approach for Detection of Fake News in Sinhala Text

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The impact of technology on people's lives has grown continuously. The consumption of online news is one of the important trends as the share of population with internet access grows rapidly over time. Global statistics have shown that the internet and social media usage has an increasing trend. Recent developments like the Covid 19 pandemic have amplified this trend even more. However, the credibility of online news is a very critical issue to consider since it directly impacts the society and the people's mindsets. Majority of users tend to instinctively believe what they encounter and come into conclusions based upon them. It is essential that the consumers have an understanding or prior knowledge regarding the news and its source before coming into conclusions. This research proposes a hybrid model to predict the accuracy of a particular news article in Sinhala text. The model combines the general news content based analysis techniques using machine learning/ deep learning classifiers with social network related features of the news source to make predictions. A scoring mechanism is utilized to provide an overall score to a given news item where two independent scores – Accuracy Score (by analyzing the news content) and Credibility Score (by a scoring mechanism on social network features of the news source) are combined. The hybrid model containing the Passive Aggressive Classifier has shown the highest accuracy of 88%. Also, the models containing deep neural networks has shown accuracy around 75-80%. These results highlight that the proposed method could efficiently serve as a Fake News Detection mechanism for news content in Sinhala Language. Also, since there's no publicly available dataset for Fake News detection in Sinhala, the datasets produced in this work could also be considered as a contribution from this research.

Keywords: Fake News, Machine Learning Classifiers, Social Network Meta Data, Hybrid Approach

Improving Sinhala Hate Speech Detection Using Deep Learning

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Automatic Hate Speech Detection is a fine-grained sentiment analysis task that has been the focus of many researchers around the world. This has been a difficult task due to challenges such as the usage of native languages and distinct vocabularies, as well as the distortion of words. However,based on the findings of previous studies on Sinhala hate speech identification, this has proven to be more difficult for low resource languages like Sinhala. The effectiveness of pretrained embedding for Sinhala hate speech detection has not been investigated. We investigated several embeddings as well as frequency-based features, including bag of words, n-grams, and TF-IDF to address this shortcoming. We present results from several machine learning experiments, including deep learning experiments and transfer learning experiments on state-of-the art cross-lingual transformers. With an f1-score of 0.764 and a recall value of 0.788 in our study, the XLMR model outperformed other baseline algorithms and deep learning models.

Keywords: Hate speech, Deep learning, Word embedding, Sinhala language, Supervised Learning

Context Aware Back-Transliteration from English to Sinhala

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The Sinhala language is widely used on social media by using the English alphabet to rep resent native Sinhala words. The standard script of English language is Roman script. Hence we refer to Sinhala texts transliterated using English alphabet as Romanized-Sinhala texts. This process of representing texts of one language using the alphabet of another language is called transliteration. Over the time Sin hala Natural Language Processing (NLP) researchers have developed many systems to process native Sinhala texts. However, it is impossible to use the existing Sinhala text processing tools to process Romanized Sinhala texts as those systems can only process Sinhala scripts. Therefore these texts need to be transliter ated back using their original Sinhala scripts to be processed using existing Sinhala NLP tools. Translit erating texts backwards using their native alphabet is referred to as back-transliteration. In this study, we present a Transliteration Unit (TU) based back transliteration system for the back-transliteration of Romanized-Sinhala texts. We also introduce a novel method for converting the Romanized-Sinhala scripts into TU sequences. The system was trained using a primary data set and evaluated using an unseen portion of the same data set as well as a secondary data set which represents texts from a different context to the primary data set. The proposed model has achieved 0.81 in BLEU score and 0.78 in METEOR score on the primary data set while achieving 0.57 in BLEU score and 0.47 in METEOR score on the secondary data set.

Keywords: Transliteration, Back-transliteration, LSTM, Encoder-decoder, Transliteration-Unit.

Tamil Author Identification Using Convolutional Neural Network

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Author identification is one of the significant tasks in natural language processing (NLP) which identifies the author of a given text content. Text classification applications such as news classification and sentiment classification mostly rely on features extracted from the content or the topic of the content. Author identification, on the contrary generally depends on the features representing the writing style such as lexical, character level, syntactic and semantic features. In recent years, the performance of text classification approaches has been significantly improved by applying deep learning-based text representation. For the author identification task, a good amount of research has been done for English and other European languages whereas relatively less have been done for regional languages like Tamil. This paper describes such a study for the Tamil language. This study proposes a deep-learning model for author identification, which concatenates the conventional word-level features and automatic features learned by a convolutional neural network (CNN) with FastText pre-trained word vectors. As part of the study, a dataset for Tamil author identification was created and the proposed model was analysed. The proposed model obtained better performance compared with conventional or deep learning models.

Keywords: Deep learning, NLP, Tamil, Author Identification

Image Caption Generator for Sinhala Using Deep Learning

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In this study, for the image caption generation in the Sinhala language, we have implemented a Recurrent Neural Network based model consisting of an InceptionV3 model as an image feature extraction model and a Long Short Term Memory network for the language model by referring to the literature. The different variations of Sinhala versions of the Flickr8K and MS COCO datasets have been constructed and used to train experimental models. Evaluation of the generated captions has been done using both automated and manual approaches. The model trained on the MS COCO dataset with Google translated Sinhala captions has achieved the highest BLEU score of 0.592 and the highest METEOR score of 0.281. After doing the manual caption analysis, it was observed that there could be generated captions which could provide a good idea to the reader while having lower BLEU and METEOR scores.

Keywords: Sinhala, image, captioning, NLP, COCO, BLEU, METEOR

Building NLP Tools to Process Sinhala Text Data Written using English Letters

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Sri Lanka is a country where the Sinhala and English languages take a prominent place, but most people are not so fluent in the two languages when using digital platforms like social media. Although most of the Sri Lankans use Singlish. There is no proper application to translate the relevant language into the main two languages, Sinhala or English. The purpose of this research is to bring more attention of the researchers towards the sub varieties of Sinhala language, especially Singlish by bridging the gap between NLP tools available for processing textual data of main languages and their varieties. And each component focuses on translating Singlish text data into English, translating Singlish into Sinhala, sentiment analysis for Singlish text data and mapping emojis for Singlish tokens. There are language translation tools to translate many lan guages like Russian, Italian, Japanese into the English Language but there are no proper tools to translate the mainly used sub language in Sri Lanka; that is Singlish. Therefore, the proposed solution for the above problem is developing a Singlish to English Language Translation Model and removing slang words to allow NLP technologies created for English to be utilized to handle Singlish textual data. This NLP model shall have the capacity of translating Singlish words that are used on social media into English and if there are any slang words found during the translation, those words will be identified and removed. Translating the Singlish textual data into English would help the users to use other tools built to plagiarize, tools that are used to summarize and tools that are used to paraphrase English text.

Keywords: Machine learning, Natural Language Processing, Sentiment analysis, Feature Engineering, API facilities

Bandwidth-based Heavily Loaded Lightpath Protection for IP/MPLS-over-Optical Networks

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This paper addresses the problem of provisioning survivability/protection from component failures in IP/MPLS over-Optical Wavelength Division Multiplexing (WDM) networks. Particularly, it considers a promising multi-layer protection scheme proposed in the literature. The protection scheme has compulsory IP/MPLS layer protection for every request for guaranteed recovery. The scheme also includes optical layer protection for selected lightpaths only when they are 'heavily loaded' with equal or more number of traffic requests than a threshold value, and when enough resources are available (such lightpaths are referred to as 'number-based' heavy lightpaths). Such optical layer protection has benefits including bulk-recovery, short reroute-times, and reduced failure notifications. However, we find and illustrate that the number-based heavy lightpath protection in the existing scheme has potential drawbacks including bandwidth wastage. To address this issue, we propose alternative definitions of heavy lightpaths which are bandwidth based instead of pure number-based. The multi-layer survivability with the new bandwidth-based heavy lightpath protection could potentially reduce the bandwidth wastage. However, a challenge is that the new definitions could declare a large number of lightpaths heavy and the optical layer protection could consume more resources (therefore more blocking). To find the effectiveness of our proposal, we carry out extensive simulation based experiments. Our findings verify that our proposal has significantly reduced bandwidth wastage and, at the same time, the challenge it poses (blocking) is contained well within the acceptable range. They also show that our proposal's practical usage, in terms of the number of heavy lightpaths seen at any given time and the probability of successfully protecting a heavy lightpath, is significant compared to the existing scheme at low traffic loads, making it very effective for network providers.

Keywords: Survivability, Optical networks, Wavelength division multiplexing (WDM)

Modeling and Prediction of Pain Related Neural Firings Using Deep Learning

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This paper presents a novel approach of using deep learning to model and predict pain related neural firings using EEG data. This can be considered as a critical step towards finding a solution for identifying and evaluating pain when patients are incapable of self-reporting it or when the clinical observations are unobtainable or unreliable. In this context, deep learning is considered to be relevant for the advancement of neuroimaging methods in the learning of pain. However, there is a lack of deep learning models that are capable of differentiating between acute and chronic pain. This was done in three phases. 1) Feature extraction of EEG data using Petrosian Fractal Dimension (PFD) and Hjorth activity functions. 2) Source localization of neural firings to differentiate between acute and chronic pain. 3) Modeling and training a deep learning model for the prediction of the related pain according to the feature extracted neural firings. During this research, we identified that for chronic pain the back part of the brain has a significant activation and for acute pain the side area of the brain is more significantly activated. Further, our long short-term memory (LSTM) based prediction model achieved an accuracy of 91.29% for identification of related pain. The performance of the model was evaluated using precision, recall and F1 scores, where for acute pain it achieved scores of 0.90, 0.82, and 0.86 and for chronic pain scores of 0.86, 0.93, and 0.89 respectively. Findings of this research can be helpful in identifying and separating chronic and acute pain which would add a great advantage to the medical industry.

Keywords: Acute pain, Chronic pain, Deep learning, EEG, LSTM, Source Localization

A Deep Learning Approach to Predict Health Status Using Microbiome Profiling

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Abstract—The human microbiome consists of the microbes that live in and on our body and it plays an important part in our life helping in digestion, developing immunity, etc. There are mounting evidence that shows the relationship between the composition of the gut microbiome and the occurence of various diseases such as type 2 diabetes, colorectal cancer and liver cirrhosis. Machine learning approaches have been used to predict the likelihood of having such diseases using the microbial profile of an individual. In this paper, we explore a deep learning approach to predict health status of an individual utilizing their gut microbial profile. Health state prediction was performed using a dataset containing healthy and non-healthy raw shotgun stool metagenomics samples profiled at species and genera levels. The species level profiles outperformed the genera level profiles in terms of AUC giving a score of 0.957. The best performance for the deep learning approach recorded an AUC score of 0.98 for species level profiles when the sparseness in the datasets were removed. Further, the deep learning approach was able to outperform the state of the art approach.

Index Terms—deep learning, metagenomics, microbiome

Generating REST APIs using Meta-Design Paradigm for rapid development of Micro-service Architecture based applications

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The development of Business and Social Computing applications is a challenging task due to the fluidity of requirements. Often requirements evolve throughout the development process. Systems need to meet the needs of multiple user groups, sometimes with conflicting requirements. Thus the best option is to involve the users in the development process at a level they can participate as developers to benefit from their in-depth application domain knowledge. The Meta design paradigm is one of the best approaches for this. With the CBEADS (Component Based E Application Development and Deployment Shell) framework the applications can be designed in a few clicks, by specifying the application name, and then the functionalities. They have via use-cases, each use case consists of main functions that the user can perform such as view, create, update, and delete. So the users have the freedom to build things from scratch easily. So the API endpoints will be ready to test the system. This would help to identify the basic requirements. The newly designed application can be used easily as a prototype system too. Nowadays software development happens as rapid development. So the CBEADS framework is capable of bridging the gap for identification of clear requirements from the users and saving time by increasing the productivity of the developers.

Keywords: Meta Design, REST API, Micro services

Categorizing the IPv4 Address Space Based on Services Running on IPs

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This study aims to categorize the service types of IP addresses based on running services. The service types can be categorized into Proxy, VPN, Cloud, CDN, and Hosting. The reason for this classification is that by using these insights one can build better intrusion detection systems. For example, if the IP addresses of the daily users of the websites are mostly VPNs and proxies then owners can be aware of the traffic and IP addresses of the visitors. Another advantage is one can build better IP blacklists and understand the nature of the ASNs(Some ASNs contain more VPN IPs, and some contain more cloud IPs likewise).The data gathering was done using many methods such as Internet-wide scanning, ASN data collection, and Whois data collection. By using these techniques millions of IP addresses were collected. Many well-known cloud vendors have officially published their IP addresses and this study takes these published IP ranges as the ground truth. About 130,000 IP addresses were collected as the ground truth. By merging these ground truth IPs, with the datasets which are collected by various techniques, the final ground truth IP dataset was constructed. By using this dataset the most important features were identified and trained in various machine learning models. From these trained machine learning models Random Forest Classifier was chosen as the best classifier for this classification since it achieves 94.71% of accuracy and a 95% F1 score.

Keywords: IPv4, IPv4 Classification, VPN, Proxy, Cloud

Enhancing Source Camera Identification through Higher-order Wavelet Statistics

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In digital forensics, source camera identification (SCI) is an emergent problem that focuses on determining the camera that has been used to capture a given image. Unique characteristics of cameras, such as photo response non- uniformity (PRNU) noise, has been demonstrated to be useful in distinguishing between very similar cameras. Building on existing work, this study introduces a method to uniquely identify source cameras by using statistical features of PRNU noise embedded in images. Here, the PRNU noise is estimated by taking the difference between the camera output and a denoised image. Afterwards, higher order wavelet statistics extraction (HOWS) features are extracted to identify statistical relations between the images taken from the same camera. The proposed method is evaluated under 3 scenarios on the data collected from cameras of smartphones. When distinguishing between cameras from different brands and models, the proposed method produces an accuracy of 95%. In the case of identifying between cameras of different models of the same brand, an accuracy of 92.5% was achieved. In the extreme case of distinguishing between cameras of the same make and model, an accuracy of 85% was achieved. The results also indicate that the proposed method is robust against basic image manipulations.

Towards Improving Early Learning Capabilities of Students Through a Gamified Learning Tool

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There is a growing concern to find an effective teaching and learning methodology during a social distancing situation as well as to address the drawbacks in the current educational system of Sri Lanka for students in Key Stage 1. Gamification has proved to make a positive impact on the concentration level, motivation and educational capabilities of students. Although previous research has been successful in introducing various gamified tools, very few are available in the local language. In this study, a gamified learning tool named "Punchi Nanasala" was introduced targeting grade 1 and 2 students which focussed on the subjects; Mathematics, Sinhala language, and Environmental studies. The tool was developed in three prototypes using a UserCentered-Design approach. The experimental and control groups were given a pretest to measure their current knowledge capacity and a post-test to evaluate their knowledge capacity after the gamified treatment was given. The positive results obtained from the multiple evaluation techniques; Emotion detection, mouse click monitoring, performance analysis, interviews, and surveys suggested that the tool was successful as a learning approach

Index Terms— Gamification, Key Stage 1, Social Distancing, Pandemic, Distant learning, Remote evaluation techniques

An Augmented Reality-based Fashion Design Interface with Artistic Contents Generated Using Deep Generative Models

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Fashion design is an art that reshapes the designers' imagination into visible content which requires a significant amount of time and effort. The assistance provided by the available design tools are limited in the sense of visualizing and fitting of the generated cloth on the human body. We present, ARGAN – an Augmented Reality (AR) based Fashion Design system which is able to generate a new dress when a sketch and a theme image are provided as the input into a Controllable Generative Adversarial Network. Further, this system can visualize the generated virtual 2D apparel in realtime on a real human body using Augmented Reality. To the best of our knowledge, this work is the first attempt at utilizing Deep Generative Models (e.g. GANs) in an Augmented Reality prototype in fashion designing for generate creative fashion content in 2D and exploiting the possibility of Deep Generative Models to generate fashion designs align to a theme. Our findings show that the use of the ARGAN can support fashion designers' during their designing process.

Index Terms—Augmented Reality, Media Pipe, Deep Generative Models, Generative Adversarial Networks, Control GANs, Fashion Designs

Comprehensive Technology Readiness Adoption Model: A Combined Approach to Assessing Cloud Technology in Higher Education in Nigeria

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Higher education systems worldwide have undergone expansions in line with the increasing efficacy and prominence of cloud computing, leading to enhanced productivity, efficiency, and cost reduction. This study proposes a Comprehensive Technology Readiness Adoption Model in assessing the adoption of cloud computing services and evaluating its contribution to improving literacy levels in higher educational institutes in Nigeria. Primary data was obtained through a survey with a healthy number of samples across several institutions in Nigeria, with the aid of structural equation modeling analysis, the study surveyed 384 staff and students of higher institution in Nigeria. Using statistical techniques including variance-based structural equation modeling, artificial neural network, regression, factor analysis, and correlation, it was found that higher institutions in Nigeria have a positive perception of cloud computing as well as high levels of readiness for adoption. This finding leads to the recommendation that higher institutions in Nigeria should intensify efforts in making wider adoptions of cloud computing for all staff and students in educational settings. The devised model has proved to be effective and accurate as a tool for assessing broad elements concerning the adoption of computing technologies especially under the context of higher education in developing countries.

Keywords— Technology Adoption, Cloud Computing, Higher Education, Developing Countries

Identification of Road Surface Anomalies Using Crowdsourced Smartphone Sensor Data

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Road pavement anomalies can result in many negative effects such as damages to vehicles, poor ride quality, additional ride time and road traffic accidents. Therefore it is important to regularly monitor and maintain roads, according to the standards. The traditional methods of road anomaly detection are expensive, time-consuming, and require the supervision of experts. Crowdsourcing systems provide an inexpensive and robust solution to overcome these challenges in traditional approaches. This paper proposes a platform to identify and classify road anomalies from crowdsourced accelerometer smartphone data, adjusting to different vehicle speeds and other characteristics. The collected accelerometer data is preprocessed using noise filtering and reorientation techniques and the anomalies are identified through a fuzzy logic approach and further classified based on the anomaly severity using machine learning models. The results from the conducted experiments suggest that the proposed method is capable of successfully identifying and classifying anomalies from crowdsourced data.

Automated vehicle insurance claims processing using computer vision, natural language processing

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Traditional insurance claims processing systems are no match for the modern world due to the increasing population of vehicles and the resulting number of accidents. In this paper, the authors present a novel idea to automate the tedious processes in the insurance industry. The presented system consists of three main components namely, re-identify the make and model of the vehicle, identify the damaged automobile component, type, and severity, and compute an accurate repair estimate using damage component identification. Also, automate the documentation process by identifying the relevant fields in the voice input provided by the user. This ensures both the parties involved in this process will be benefited from the proposed system. Presented solutions were designed using the aid of Artificial Intelligence techniques, mainly CNN models and Natural language processing techniques.

Index Terms—Vehicle Insurance, CNN, NLP, AI, Damage Detection

Hastha: Online Learning Platform for Hearing Impaired

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Sign language is the primary means of communication for the hearing-impaired community. Introducing a learning platform can result in many ways to make learning more accessible for the hearing-impaired community of Sri Lanka. Although many approaches are being made to build such systems, the learning platform "Hastha" aims to provide a more interactive outcome with a component that converts YouTube videos to sign language and a Chatbot component that acts as an intermediary between a hearing-impaired user and a Google Search Engine.Furthermore, it includes a game-based learning platform and a gesture translation component from Sri Lankan to American Sign Language while the results are displayed to the users in the form of an animation. The proposed methodology is achieved by using Natural Language Processing, speech recognition, and machine learning techniques. This web-based application enables increased interaction between the student and the system making it an effective learning environment for the hearing impaired.

Index Terms—Sri Lankan Sign Language, online learning platform, Natural Language processing, Chatbot

Smart Driver Assistance for Traffic Sign, Pothole, Vehicle Malfunction, and Accident Detection

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Reducing ever-increasing road accidents is a big concern worldwide. Sri Lanka had the highest rate of road fatalities in the past few years, rapidly increasing daily. Among many factors, traffic signs, potholes, and vehicle mechanical malfunctions significantly impact road safety. Most accidents result from a lack of awareness, ignorance, and negligence of drivers. While many high-end vehicles are equipped with technologies such as intelligent road sign recognition systems and air suspension systems, most cars in the market only come with basic driving instruments. Therefore, there is a need for a universal driver assistance system that can be plugged into any vehicle to assist drivers in minimizing road casualties. To this end, this study discusses Neural Networks, Machine Learning and IoT technologies to develop an intelligent system that is capable of detecting and analyzing road signs, road potholes, vehicles' internal system malfunctions, and road accidents and notifying drivers in real-time and inform authorities such as hospitals and police stations to be aware of accidents to minimize further casualties. This portable device is based on a Raspberry Pi microprocessor. It uses a web camera, an onboard diagnostic tool (OBD) and an accelerometer to process traffic sign footage, vehicle sensor data and movement data of the vehicle. Yielded results showed that the proposed system was 90% accurate.

Index Terms - Driver Assistance, Machine Learning, Internet of Things (IoT), On-Board Diagnostic (OBD)

A High-interaction Physics-aware ICS Honeypot for Industrial Environments

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Industrial Control Systems (ICSs) are control systems that automate and control industrial processes. ICSs have a high-security risk since most of them are connected to the Internet for remote monitoring and controlling purposes. Compromising ICS can disrupt critical infrastructure supplies, such as water supply, power supply, transportation systems, and manufacturing systems. Programmable Logic Controllers (PLCs) are special computers used in ICSs. Many PLCs do not have built-in security systems. Many ICS application layer protocols are not designed with security in mind. Therefore, external security systems are needed to protect ICSs from cyber attacks. Identifying the vulnerabilities, malware, and attacking patterns is useful in designing defense-in-depth security systems for ICSs. Honeypots can be used for research purposes as a way of collecting data and can also be used to protect the systems from attackers. In this paper, we present a high-interaction physics-aware ICS research honeypot that has been extended to a production honeypot using Software Defined Networking.

Keywords—Industrial Control Systems, SCADA, Honeypot, Snort IDS

Optimize Kalman Filter For Smart Phone Location Tracking Using GNSS Measurements

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Point precise positioning(PPP) method allows the user to locate users with Global Navigation Satellite System under good condition. But this method is quite challenging to locate users when the user is in urban areas with obstacles. Other alternative solutions such as Real Time Kinematic solve these problems with differential measurements. In real world scenarios, raw GNSS measurements usually have noisy and uncertain data. The Kalman filter is a successful method to optimally update variables with indirect measurements. This research proposes the method to optimize Kalman filter based PPP to improve smartphone location tracking. Evaluation method showed that proposed method works well with approximately 3.0 meter accuracy and out performed base line model which is calculated using Weighted-Least-Square (WLS) solver.

Keywords: GNSS, Kalman Filter, Weighted Least Square, Android, Point Precise Positioning

A Dynamic Factor Approach to Forecasting the Index of Industrial Production of Sri Lanka

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The Index of Industrial Production (IIP) is a leading indicator used by economic forecasters to predict the overall economic activity of a country. However, no published studies up to date have analyzed and forecasted the IIP of Sri Lanka, which is the only measure of the nation's physical volume of production. On the other hand, the evolution of information technology has allowed researchers to access thousands of economic series with incredible ease. The usual time series models, such as the widely used Vector Autoregressive (VAR) model can only incorporate a limited number of variables due to the issue of scarce degrees of freedom. Limiting the VAR model to a selected number of variables results in the contamination of economic policy decisions. Dynamic Factor Models (DFMs) are a potential candidate to address this issue by incorporating all available information to the study. However, there is no literature on such applications on a small-scale economy such as Sri Lanka's to forecast future trends. Therefore, this research aims to follow a dynamic factor approach to forecasting the IIP of Sri Lanka. The objectives of this study are twofold: to explore the different associations between the IIP and other economic indicators, and to investigate how well data-rich DFMs perform compared to classical time series and Long Short-Term Memory networks (LSTMs) when forecasting the IIP. The model estimation was based on the sample from 2000 January to 2018 December and finally, twelve month out-of-sample forecasts were produced for the period until 2019 December. Twenty three monthly economic variables were considered. The results showed that DFMs, including Factor Augmented VAR (FAVAR) outperformed the traditional VAR, while LSTMs produced the best overall forecasts. Moreover, it was identified that investment imports, mineral and agricultural exports, Colombo Consumer Price Index (CCPI), electricity power consumption and gold price have a significant impact on the IIP.

Keywords: Index of Industrial Production (IIP), Dynamic Factor Models (DFMs), Factor Augmented VAR (FAVAR), Principal Component Analysis (PCA)

Analyzing the Evolution of Source Code to Predict Vulnerabilities

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Even though there are numerous prior studies concentrating on finding and forecasting vulnerability, the research community has less attention to the aftermath of vulnerability remedies represented in a code. Our primary goal was to understand better what happens to source code following vulnerability remediation via source code and repository analysis. For this research, primarily two distinct data sets were constructed. A dataset containing vulnerability fixes data and a dataset with the data related to the bug fixes. In this context, we have defined the vulnerabilities as the entries that are associated with Common Weakness Enumeration (CWE) entries. Accordingly, in our research, we examined the 80 most popular open-source javascript based repositories, which contained more than 401K commits, to conduct a timeline analysis based on vulnerability fixes an introductions. Based on these commits, we have extracted source files and generated corresponding Abstract Syntax Tree (AST) for each file. Following that, we have introduced a way to calculate an entropy value on AST and a simple algorithm to identify a significant instance based on that value. Moreover, we have shown that fixing a vulnerability in code makes a considerable change in the code AST than a bug fix by carrying out hypothesis testing. Additionally, we demonstrated that code churn significantly increases following the vulnerability fix.

Keywords: Software Security, Abstract Syntax Tree, Entropy, Vulnerability Analysis, Software Repository Mining

Supervising Plant Growth in a Greenhouse

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Abstract—Since the beginning of civilization, agriculture has played a significant part in the economy of a nation. Currently, as the population continues to increase at a rapid rate, arable lands are dwindling alongside urbanization. Even though farmers devote a substantial amount of time and effort to farming, environmental factors such as seasonal shifts can have a significant impact on the crop. Smart agriculture is implemented to boost the production of high-quality goods and address the lack of control over the farming process. The intelligent greenhouse technology proposed here is called "GSense," and it could boost plant productivity by managing the greenhouse's climate. In addition, this solution is useful for novices who are just beginning out in agriculture because it can make recommendations to its user. The execution of the solution is complemented by a mobile application and a desktop application via which the user may submit inputs and examine real-time sensor data.

Index Terms—IoT, Greenhouse, Automation, Machine Learning, NodeMCU , RaspberryPi

A generation of dataset towards an Anomaly-Based Intrusion Detection System to detect Denial of Sleep Attacks in Internet of Things (IoT)

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Abstract—In this digital era, Wireless Sensor networks (WSN), or else, Internet of Things (IoT) when these sensor networks are accessible via the internet, is a common and widely used technology. These tiny sensor nodes in these networks help to enhance and automate processes in various fields such as, smart homes and cities, healthcare, smart vehicular networks, Smart Grids and so on. Although this technology is widely used in many fields, these tiny devices are equipped with limited amounts of resources. Limited capacity of battery power is one of the major concerns with IoT when it comes to some specific applications. In addition to this, this limited battery capacity is vulnerable for power depletion attacks which can reduce the lifetime of these devices significantly. So, there is an urgent need of solid solution to preserve this battery power as much as possible. One proper solution for this is, a machine learning based intelligent intrusion detection system that can detect power depletion attacks against these IoT applications. However, the lack of a proper dataset to train and evaluate these machine learning models appears as a major obstacle for an intelligent intrusion detection system. So, in this paper, we are going to discuss how we can use COOJA simulator to generate a proper dataset that can be used to develop and evaluate machine learning models to detect Denial of Sleep attacks against Wireless Sensor Networks. Here, we are going to discuss 3 strategies (UDP flood attack, wormhole attack and externally generated legitimate request attack) to simulate Denial of Sleep attacks for WSNs, so that, any person can generate their own dataset according to their requirements. At the end of the paper, we have evaluated each strategy to deplete the power of the sensor nodes. Then, our conclusions are given. *Keywords—Internet of Things, Denial of Sleep attacks, Dataset, COOJA simulator*

tAssessee: Automatically Assessing Quality of Tea Leaves using Image Processing Techniques

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Sri Lanka is one of the well-known international's pinnacle tea exporters with a high global demand attracting millions of foreign exchanges, which strengthens the economy of the country. Despite the fact that tea brings a good source of for eign exchange, the tea industry lacks efficiency and effectiveness during the assessment of plucked tea leaves which compromises the significant quality of tea. While studies have revealed various factors affecting the tea quality, key factors are identified as the presence of tea diseases, pest attacks, the mixture of fresh and mature tea leaves, and the mixture of tea grades present in the tea sack. In this paper, we focus on automatically assessing the quality of tea leaves for a single tea leaf and bulk tea leaves before initiating the tea manufacturing process. The proposed tAssessee system allows the user to upload the image of a single tea leaf or bulk tea leaves to automatically assess four different quality factors of tea leaves such as disease, pest attack, freshness, and grade using Convolutional Neural Network based models and using various image processing techniques. This will assist the tea supervisors in the tea factories to automatically assess the quality of tea leaves where the manufacturing process can be segregated according to the quality of tea leaves and determine the pricing accordingly. Extensive experiments performed using the tea leaves images gathered in tea factories reveal that the proposed tAssessee system can assess the quality of single tea leaf and bulk tea leaves with the accuracy range of 87% - 98% and 91% - 100% respectively.

Keywords: CNN, Image Classification, Image Processing, Mask-RCNN, Tea Leaves

Graph Neural Network based Alzheimer's Disease Classification using Structural Brain Network

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Alzheimer's disease (AD) is a chronic, incurable disorder that worsens with time and requires early diagnosis in order to treat and manage AD patients. Diffusion MR imaging and structural brain networks provide a great amount of information about the brain that hasn't been thoroughly investigated before. Graph Neural Networks (GNN) are used to process and learn the graph data structure in deep learning. There hasn't been any research on using anatomical brain networks with GNN to identify AD so far. In this paper, an efficient GNN architecture is used to classify individuals into Cognitively Normal (CN) and AD subjects using anatomical brain networks as graphs. The input labelled structural brain graphs of CN and AD are used to categorize AD and CN individuals using this GNN architecture. The proposed method is tested using a dataset from the Alzheimer's Disease Neuroimaging Initiative (ADNI) research, which includes 100 CN and 62 AD subjects. The proposed system effectively demonstrates brain graph properties and provides a reliable Alzheimer's disease detection classifier. The deep learning system achieves a prediction accuracy of 97 percent, indicating that the proposed classification model is more resilient and perfect than the earlier methods. Our approach changes the way biomarkers of AD are detected and could provide clinicians with more confidence in automated AD diagnostic systems.

Keywords: Graph Neural Network, Alzheimer's Disease, Structural Brain Network.

An Analysis on Different Distance Measures in KNN with PCA for Android Malware Detection

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As Majority of the market is presently occupied by Android consumers, Android operating system is a prominent target for intruders. This research shows a dynamic Android malware detection approach that classifies dangerous and trustworthy applications using system call monitoring. While the applications were in the execution phase, dynamic system call analysis was conducted on legitimate and malicious applications. Majority of relevant machine learning-based studies on detecting android malware frequently employ baseline classifier settings and concentrate on selecting either the best attributes or classifier. This study examines the performance of K Nearest Neighbor (KNN), factoring its many hyper-parameters with a focus on various distance metrics and this paper shows performance of KNN before and after performing Principal Component Analysis (PCA). The findings demonstrate that the classification performance may be significantly improved by using the adequate distance metric. KNN algorithm shows decent accuracy and improvement of efficiency such as decreasing the training time After PCA.

Keywords: Android System Calls, K Nearest Neighbor, Principal Component analysis, Android Malware Detection

Differential Diagnosis of Cardiovascular Disease in Early Clinical Stage: Multi-Type Features Artificial Neural Network and Multi-Agent System Model

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Cardiovascular diseases (CVDs) are very common and one of the major life-threatening diseases in the current century. Being among these kinds of diseases, correct and in-time medical diagnosis is vital. The healthcare industries collect huge amounts of clinical data on their patient's daily basis. All of this clinical data contains hidden patterns that show the specific information which is very useful for effective decision-making processes. To provide suitable results and make effective decision processes on clinical data, we sought to compare advanced data mining techniques and machine learning algorithms for predicting the early stages of cardiovascular disease. Using data from cardiovascular patients' clinical history trials, electronic health records (EHR) can contain hidden patterns that show information about future cardiac surgery mortality risk. The connection of Artificial Intelligence (AI) for cardiovascular disease prediction for point of care diagnostic prominently revived here. This experiment proposed a system that evaluates the CVD Clinical Workflows with Multi-Agent System (MAS) based automated process that will analyze the patient's entire clinical history. The proposed architecture mainly has a neural network model and a multi-agent component. The accuracy rate of the Artificial Neural Network shows 73%. The multi-agent system successfully runs and handles the clinical workflow risk analysis and provides feedback for the physicians.

Keywords: Cardiovascular Diseases, Deep Neural Networks, Multi-Agent Systems, Electronic Health Records (EHR)

Aspect-based Sentiment Analysis on Mobile Application Reviews

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With the popularity of smartphones, mobile appli cation (A.K.A Mobile App) development has become a booming industry all across the world. One of the main hurdles that app developers are facing, is understanding users' needs and catering their products to satisfy the users. Though Users are one of the main stakeholders of the App development process it is harder to incorporate them into the requirement elicitation process. Numerous studies have shown that incorporating user reviews in the requirement elicitation process paves the way to a better understanding of user needs which, in turn, helps developers develop better apps that satisfy the targeted audience of the app. In this paper, we introduce a CNN-based approach to analyze user reviews using Aspect-based Sentiment Analysis (ABSA). The results show that our approach could achieve 87.88%, 93.75%, and 31.25% improvements in aspect category classification and 16.43%, 23.35%, and 3.72% improvements in aspect sentiment classification over the baseline results for AWERE dataset in productivity, social networking, and game domains respectively.

Keywords: Convolutional Neural Networks, Aspect Based Sentiment Analysis, Mobile App Reviews, Requirement Elicitation.

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