

**International Conference on Advances in
Computing and Technology (ICACT – 2018)**

*“Aligning Computing and Technology towards the 4th Industrial
Revolution”*

26th July 2018

Conference Proceedings

Chief Editors

Dr. S.R. Liyanage
Dr. R.A.T.P Rupasinghe
Dr. P.W Samarasekere

Faculty of Computing and Technology
University of Kelaniya
Sri Lanka
2018

©-Faculty of Computing and Technology, University of Kelaniya, Sri Lanka – 2018
International Conference on Advances in Computing and Technology (ICTACT- 2018)
“Aligning Computing and Technology towards the 4th Industrial Revolution” The sole
responsibility of contents of the papers are vested on the authors.

International Conference on Advances in Computing and Technology
Faculty of Computing and Technology
University of Kelaniya
Kelaniya
Sri Lanka
Tel/Fax : +94112912709
email : icact2018@kln.ac.lk
Web : <http://conf.kln.ac.lk/icact2018>

ISBN 978-955-704-088-2

Organizing Committee of the International Conference on Advances in Computing and Technology (ICACT- 2018)

Editorial Advisory Board

Professor D.M. Semasinghe, Vice Chancellor, University of Kelaniya

Professor N.P. Sunil Chandra, Chairman of the Research Council, University of Kelaniya

Editorial Board

Dr. Gamini Wijayarathna

Prof. Naomal Dias

Dr. Carmel Wijegunasekara

Dr. Chamli Pushpakumara

Dr. Dhammika Weerasinghe

Dr. Sidath Liyanage

Dr. Asanka Pallewatta

Dr. Thilini Rupasinghe

Dr. Laalitha Liyanage

Dr. Pradeep Samarasekere

Panel of Reviewers

Professor Suranga Nanayakkara

Dr. Omid Geramifard

Dr. Chintan Bhatt

Dr. Harsha Kumara

Dr. Chandana Karunatilake

Dr. Sanjeewa Karunatilaka

Professor Naomal Dias

Dr. Carmel Wijegunasekara

Dr. Chamli Pushpakumara

Dr. Gamini Wijayarathna

Dr. Dhammika Weerasinghe

Dr. Sidath Liyanage

Dr. Asanka Pallewatta

Dr. Thilini Rupasinghe

Dr. Laalitha Liyanage

Dr. Pradeep Samarasekere

Dr. Roshan Ragel

Dr. Raveendra De Silva

Dr. Kasun Hemachandra

Dr. Lahiru Wijenayaka

Auckland University, New Zealand

Grab Inc, Singapore

Charotar University of Science and Technology, India

Coventry University, UK

DEMACC College, Des Moines, Iowa, USA

Food and Drug Administration Authority, Maryland, USA

University of Kelaniya, Sri Lanka

University of Kelaniya, Sri Lanka

University of Kelaniya, Sri Lanka

University of Kelaniya, Sri Lanka

University of Kelaniya, Sri Lanka

University of Kelaniya, Sri Lanka

University of Kelaniya, Sri Lanka

University of Kelaniya, Sri Lanka

University of Kelaniya, Sri Lanka

University of Kelaniya, Sri Lanka

University of Peradeniya, Sri Lanka

University of Sri Jayewardenepura, Sri Lanka

University of Moratuwa, Sri Lanka

Sri Lanka Institute of Nanotechnology, Sri Lanka

Message from the Vice-Chancellor



It is with great pleasure that I extend my warm wishes for the 3rd International Conference on Advances in Computing and Technology (ICACT 2018) organized by the Faculty of Computing and Technology, University of Kelaniya. The resounding success of the last conferences organized by this new faculty must have provided tremendous impetus in extending the depth and the breadth of the coverage of the research discussions this year.

The theme adopted for this year, “Aligning Computing and Technology towards the 4th Industrial Revolution” is a timely theme which has attracted the attention within local as well as global context.

We are currently witnessing the 4th Industrial revolution which is a Digital Revolution, representing new ways in which technology becomes embedded within societies and even the human body. The 4th Industrial Revolution is marked by emerging technology breakthroughs in a number of fields, including quantum computing, robotics, artificial intelligence, nanotechnology, biotechnology, The Internet of Things (IoT), 3D printing and autonomous vehicles. Computing and Technology are the two key domains that makes a direct contribution to this Digital Revolution, especially in the context of Sri Lanka which has embarked on a journey to create a knowledge economy.

ICCACT 2018 organized by the Faculty of Computing and Technology, University of Kelaniya provides an excellent platform connecting these two key domains and thereby promote multi-disciplinary research that can contribute to the socio-economic development of Sri Lanka.

I am confident that the deliberations in this conference would not only contribute to the body of knowledge, but would also present innovative ideas that could be put into practice in the near future.

I wish every success for the conference.

Professor D M Semasinghe

Vice Chancellor, University of Kelaniya, Sri Lanka

Message from the Chairman of the Research Council, University of Kelaniya



It is with great pleasure that I issue this message on the occasion of the 3rd International Conference on Advances in Computing and Technology 2018 (ICACTION-2018) organized by the Faculty of Computing and Technology, University of Kelaniya.

I am very pleased to note that the academics and researchers of the Faculty of Computing and Technology are extremely motivated and involved in high quality multidisciplinary research with the aim of achieving national development goals of Sri Lanka

I hope that ICACTION-2018 will provide a platform for all the presenters and participants to present novel and latest developments in the fields of Computing and Technology, exchange of knowledge, share opinions from researchers, engineers, scientists, academia and industry and nurture international research collaborations.

Therefore, I wish to congratulate the Dean, staff and the organizing committee of the Faculty of Computing and Technology for organizing this international conference with the aim of improving research culture in the University and wish ICACTION-2018 every success.

Senior Professor N.P. Sunil Chandra

Chairman of the Research Council, University of Kelaniya, Sri Lanka

Message from the Dean, Faculty of Computing and Technology



It is a great pleasure to greet all attendees to the International Conference on Advances in Computing and Technology (ICACT 2018). The conference is organized by the Faculty of Computing and Technology (FCT) of the University of Kelaniya. The theme of this year's conference is Aligning Computing and Technology towards the 4th Industrial Revolution. This year's conference provides opportunity for computing and technology experts from Sri Lanka and abroad and focuses on how these fields address the challenging issues of 4th industrial revolution.

It is predicted that around 1.3 million industrial robots will be in service in factories around the world by end of this year. Someone has to program these robots to do the task assigned to them. Knowledge and experience in Artificial Intelligence, biotechnology and advance robotics will be required. Most of the high demand jobs will not be that attractive and new jobs will be created. Are we ready to face these challenges? I hope that this conference will play its role in enriching the participants' knowledge as well as encourage their contributions to national development through productive collaborations.

The FCT established in 2015 is the youngest faculty of the University of Kelaniya and the most vibrant with well qualified academics with proven track records in research and teaching. The aim of the faculty is to promote collaboration among diverse academic disciplines and empower academics, professionals and students to achieve the highest quality in their teaching and learning as well as research activities. For the 3rd consecutive year the FCT is able to hold ICACT 2018 due to the research conducive environment which is promoted by the Vice Chancellor, Chairman/Research Council, Deans, Heads of departments, academic and non-academic staff of the University of Kelaniya. I greatly admire their support and hope that it will continue throughout the years to come.

I would like to take this opportunity to express my gratitude to our sponsors for their support and contributions for the success of ICACT 2018. I also wish to thank the organizers and all who gave their time and effort for their diligent work. I trust that our international delegates will have a wonderful time in our paradise island, experience the warm hospitality and feast on our delectable cuisines. Finally, I wish all participants a productive conference and hope that you will seize the opportunity offered through ICACT 2018 to network and build new collaborations as well as to develop and expand each research to achieve the highest possible outcomes

Dr. Gamini Wijayarathna

Dean, Faculty of Computing and Technology, University of Kelaniya, Sri Lanka

Keynote Speaker



Professor Jagath Rajapakse, Nanyang Technological University, Singapore

BIOGRAPHY:

Jagath Rajapakse is Professor of Computer Engineering at the Nanyang Technological University, Singapore. He obtained M.S. and Ph.D. degrees from University of Buffalo, USA, and B.Sc.(Eng.) degree from University of Moratuwa, Sri Lanka. He had been a Visiting Professor to Massachusetts Institute of Technology (MIT), USA, and Visiting Scientist to Max-Planck Institute of Cognitive and Brain Sciences, Germany, and National Institute of Health, USA.

His current research interests are in brain imaging, computational systems biology, and deep learning. He has published over 300 peer-reviewed research papers in journals and conferences. He served as associate editor for IEEE Transactions on Neural Networks and Learning Systems, IEEE Transactions on Medical Imaging, and IEEE Transactions on Computational Biology and Bioinformatics. He is a Fellow of IEEE.

Plenary Speaker



Dr. Rangika De Silva, Head of Technology Transfer, Sri Lanka Institute of Nanotechnology (SLINTEC)

BIOGRAPHY

Dr. Rangika De Silva is the Head of Technology Transfer at Sri Lanka Institute of Nanotechnology (SLINTEC). He graduated from Monash University with a first degree in Mechanical Engineering and earned his doctoral degree (PhD) in the field of polymer nanocomposites, materials design and processing in 2015 from the same university. His research focuses on experimental and numerical modelling of reinforced polymer nanocomposites. As an early career-researcher, Dr De Silva has published over 15 peer-reviewed high impact journal articles with over 300 citations with an h-index and i-10 index of 10. He also has published a number of book chapters and conference proceedings. After earning his doctoral degree he moved back to Sri Lanka and joined SLINTEC in 2015 as a postdoctoral researcher. He is also a recipient of two NRC grants and an EPSRC-UK international grant. Rangika currently works as the editor of an Elsevier book titled “Particle-matrix interfaces”.

Abstract Table of Contents

Introducing Novel Classification Methodology to Detect Kidney Disease Patterns in Sri Lanka .	1
Mobile Telecommunication Customers Churn Prediction Model	2
The Impact of Soft Productivity Factors on Employee Turnover in IT Industry; A Case Study in Sri Lanka.....	3
Feature Extraction from Old Tamil Newspapers Using Histogram Minima	4
EduMiner- An Automated Data Mining Tool for Intelligent Mining of Educational Data.....	5
Programmatic Approach to Evaluate Affiliate Offers	6
Age and Gender Related Variations in Human EEG Signals	7
Decision Support for Diagnosing Thyroid Diseases Using Machine Learning.....	8
Virtual Airplay Drum Kit based on Hand Gesture Recognition.....	9
Study on Theory and Practice in Software Quality Assurance (With Special Reference to Information Technology Professionals in Colombo, Sri Lanka).....	10
A New Public Key Cryptosystem	11
Sinhala Character Recognition using Tesseract OCR.....	12
Security and Privacy Implications of Biometric Authentication: a Survey	13
Smart Iron Rack: Image Processing Approach to Iron Clothes Remotely	14
Development of Image Processing Algorithm for Vein Detection System	15
A Prototype P300 BCI Communicator for Sinhala Language	16
Hybrid Gene Selection with Information Gain and Multi-Objective Evolutionary Algorithm for Leukemia Classification.....	17
Air Pollution Monitoring System Using Arduino.....	18
Forecasting Monthly Ad Revenue from Blogs using Machine Learning	19
Mobile Biometrics: The Next Generation Authentication in Cloud-Based Databases.....	20
Deep Learning Based Student Attention Monitoring and Alerting System During a Lecture	21
Natural Language Processing (NLP) Techniques to Measure the Syllabus Coverage with the Final Exam Paper	22
Evaluation of Trustworthiness for Online Social Networks Using Advanced Machine Learning.....	23
Finite Element Method based Triangular Mesh Generation for Aircraft-Lightning Interaction Simulation.....	24
A Preliminary Investigation of Surface Bound Iron in Mica to Develop a Methodology Combined with Magnetism to Remove Contaminated Mica from Industrial Minerals	25
Solar Thermal Energy Harnessing Using a Parabolic Trough Concentrator	26

Investigation of the Impact of Clay as a Bulking Agent for Food Waste Composting at a Controlled Raised-up Temperature	27
Parameter optimization of the II-VI thin-film photovoltaic tandem solar cell model of MZO/CdTe and CdS/CIGS.....	28
Altered Brain Wiring in Alzheimer's: A Structural Network Analysis using Diffusion MR Imaging	29
Quadcopter based Surveillance System for an Industrial Environment	30
Investigation of the Degradation Processes Effect on the Properties of the Industrial Cutting Tool used in Packaging Process	31
Voltage Sag Compensation using Dynamic Voltage Restorers: A Performance Analysis	32
Technology Enabled Formative Assessment in Medical Education.....	33
An Initial Study on Understanding the Effect of Questions Structure on Students' Exam Performance	34

Introducing Novel Classification Methodology to Detect Kidney Disease Patterns in Sri Lanka

K. A. Ayesha Chathurangi^{a,1}, R. M. Kapila, Tharanga Rathnayaka^b

^a*Department of Computing and Information Systems, Sabaragamuwa University of Sri Lanka, Belihuloya, Sri Lanka*

^b*Department of Physical Sciences and Technology, Sabaragamuwa University of Sri Lanka, Belihuloya, Sri Lanka*

The healthcare sector has vast amount of medical data which are not properly analyzed and mined to discover useful information and interesting patterns. Applying data mining techniques on such domain can help medical practitioners to predict even the crucial diseases with ease. This study introduced a novel kidney disease classification methodology in Sri Lankan domain using data mining techniques. Basically there are two types of kidney diseases that can be found in Sri Lanka namely Chronic Kidney Disease (CKD) and Acute Kidney Disease (AKD). The aim of this work is building a model to predict whether a person has a risk on having a kidney disease or not and a model for CKD prediction. The data collected from 108 patients are used to train and test the models. Random Forest algorithm and a multilayered feed forward neural network were used to build the models. Result of this study is a modified Artificial Neural Network with 2 hidden layers to detect kidney disease which gives 0.80952 accuracy and a model with the combination of Random Forest algorithm and Artificial Neural Network with 3 hidden layers for CKD prediction which gives 0.81395 accuracy for testing data. The constructed models give high accuracy and minimum error rate when comparing with the other data mining algorithms.

Keywords: Data mining; Random Forest; Neural Network; Algorithm

¹ Corresponding author: K.A. Ayesha Chathurangi Tel.: +94-71-600-4258
E-mail address: ayesachathurangi1110@gmail.com

Mobile Telecommunication Customers Churn Prediction Model

L. L. G.Chathuranga^{a, 1}, R. M. Kapila Tharanga Rathnayaka^b, Hasitha Indika Arumawadu^c

^a*Department of Computing and Information Systems, Sabaragamuwa University of Sri Lanka, Belihuloya, Sri Lanka*

^b*Department of Physical Sciences and Technology, Sabaragamuwa University of Sri Lanka, Belihuloya, Sri Lanka ,*

^c*Dialog Axiata PLC, Colombo.*

The present Sri Lankan mobile industry is extremely dynamic, with new services, technologies, and carriers constantly altering the landscape. Then customers have more choices. So, Predict customer churn is one of the most challengeable target in the telecommunication industry today. The major aim of the study is develop a customer churn prediction model by considering some soft factors like monthly bill, billing complaints, promotions, hotline call time, arcade visit time, negative ratings sent, positive ratings sent, complaint resolve duration, total complaints, and coverage related complaints. This study introduces a Mobile Telecommunication customer churn prediction model using data mining techniques. In this study, three machine learning algorithms namely logistic regression, naive bayes and decision tree are used. Indeed, twenty attributes are mainly carried out to train these three algorithms. Furthermore, the back propagation neural network was trained to predict customer churn. Data set used in this study contains 3,334 subscribers, including 1,289 churners and 2,045 non-churners. According to the results, the trained neural network has two hidden layers with 25 total neurons. The proposed Artificial Neural Network result gives 96% accuracy for mobile telecommunication customer churn prediction. The estimated results suggested that the proposed algorithm gives high performances than traditional machine learning algorithm.

Keywords: Data mining; machine learning; Neural Network; Algorithm

¹ Corresponding author: L. L. G.Chathuranga; Tel.: +94-77-659-2307
E-mail address: chathurangagihan39@gmail.com

The Impact of Soft Productivity Factors on Employee Turnover in IT Industry; A Case Study in Sri Lanka

B. Aloka Anuradha Perera^{a,1}, R.M.Kapila Tharanga Rathnayake^b

^a*Computing and Information Systems, Sabaragamuwa University of Sri Lanka, Belihuloya, Sri Lanka*

^b*Physical Sciences and Technology, Sabaragamuwa University of Sri Lanka, Belihuloya, Sri Lanka*

Employee turnover has become one of major issues in IT industry in Sri Lanka. Employee turnover is deeply related with the productivity of an organization. Therefore the major purpose of this study is to examine how some selected soft productivity factors affect employee turnover in IT sector and introduce recommendations to reduce turnover rate. Eleven soft productivity factors were considered in the study and they were grouped as workplace environment and employees' capabilities and experience. The major data collection method used in the study was questionnaire survey and descriptive statistics were employed as well. Pilot testing was conducted before data collection and reliability of questionnaire was tested in order to filter the most valid questionnaire. The target population was IT employees who were employed in IT companies at the time. According to the results most employees were totally satisfied with the working place (73.3%) when there were good collaboration with team members (70.4%), no heavy workloads (75.3%), training and development programs (54.2%), when employees were provided with appropriate tools and development resources (70%) and encouraged to rest and refresh (60.9%). Good blend of different characteristic employees had been a motivation to retain in the organization (72.3%). It is concluded that good relationships and collaboration among employees and good blend of different characteristic team members are critical factors which support employee retention. Physical separation of team members has no significant effect on employee turnover if there are sufficient and efficient telecommunication facilities. Comfortable working conditions make employees less stressed and workload does not matter in such environments. When employees' experience level, skills, and capabilities are higher, they tend to leave organizations for better opportunities.

Keywords: Employee Turnover; IT industry; Working Environment; Employee Capabilities

¹ Corresponding author: B. Aloka Anuradha Perera. Tel.: +94-71-777-8088
E-mail address: alokaperera@gmail.com

Feature Extraction from Old Tamil Newspapers Using Histogram Minima

Shanmugalingam Kasthuri¹, Mahendrarajah Darsha, L.Ranathunga

Department of Information Technology, University of Moratuwa, Moratuwa, Sri Lanka

Archaeological records which provide information about the history of human cultures and past events. Newspapers can be considered as one of the main sources of gathering archaeological data. It can be seen that there exist only a few numbers of systems for the processing of old Tamil newspaper articles. An automated image processing system proposed as a suitable solution to the way of efficient and flexible searching approach, which can be used for old Tamil newspapers. In this paper is presented image processing technique to extract the features such as headlines and sub-headlines from old Tamil newspaper scanned images. Historical newspapers become damaged over time. The images of these newspapers become difficult to read the contents. The quality of the image improved by preprocessing techniques such as grayscale dilation, median filtering, and adaptive binarization. It helps to easily extract needed information on the image. Segment the article and identify the heading of the article will help to improve data manipulation. Feature extraction from old Tamil newspaper images followed these step processes; Horizontal smoothing is necessary to distinguish the paragraphs and empty space between each column; Vertical smoothing is implemented to distinguish between each paragraph and headlines; Logical AND operation combines the outcome of horizontal smoothing and vertical smoothing using AND operation; Height measurement of each block is followed by horizontal projection, that involves scanning of pixels through horizontal arrays to measure the black pixel density against index of each row by using horizontal histogram minima. This step identified horizontals breaking points of individual regions within an article. The four major horizontal regions are headlines, sub-headline, text, and graphics. The irregular block may contain images within texts. Vertical projection can be carried out to distinguish the images among text. In the evaluation process used fifty articles which have different format of paragraph arrangements and also include images. First, identified and got the count of regions manually. After that compared the result from identified regions and got the measurements. The region was identified with articles in the efficiency of 80.09%, headline extraction accuracy was 81.616%.

Keywords: archaeological records; image processing; headline extraction, histogram analysis.

¹ Corresponding author: Shanmugalingam Kasthuri. Tel.: +94-77-831-2321
E-mail address: s.shanshiya@gmail.com

EduMiner- An Automated Data Mining Tool for Intelligent Mining of Educational Data

K.T.S. Kasthuriarachchi^{a,1}, S.R. Liyanage^b

^aFaculty of Graduate Studies, University of Kelaniya, Dalugama, Sri Lanka
^bFaculty of Computing Technology, University of Kelaniya, Dalugama, Sri Lanka

Data mining is a computer based information system that is devoted to scan huge data repositories, generate information and discover knowledge. Data mining pursues to find out patterns in data, organize information of hidden relationships, structure association rules and many more operations which cannot be performed using classic computer based information systems. Therefore, data mining outcomes represent a valuable support for decisions making in various industries. Data mining in education is not a novel area but, lives in its summer season. Educational data mining emerges as a paradigm oriented to design models, tasks, methods, and algorithms for exploring data from educational settings. It finds the patterns and make predictions that characterize learners' behaviors and achievements, domain knowledge content, assessments, educational functionalities, and applications. Educators and non-data mining experts are using different data mining tools to perform mining tasks on learners' data. There are a few tools available to carry out educational data mining tasks. However, they have several limitations. Their main issue is difficulty to use by non- data mining experts/ educators. Therefore, an automated tool is required that satisfies the data mining needs of different users. The "EduMiner" is introduced to make important predictions about students in the education domain using data mining techniques. R studio, R Shiny, data mining algorithms and several key functionalities of Knowledge Discovery in Databases have been used in the development of "EduMiner". The functionalities of the tool are very user-friendly and simple for novice users. The user has to configure the tool and provide the appropriate inputs for parameters such as the data set, the algorithms used for mining in advance to obtain the results of the analysis. The pre-processing will be done to clean the data prior to starting the analysis. The tool is capable of performing several analytical tasks. They are; student dropout prediction, student module performance prediction, module grade prediction, recommendations for students/ teachers, student enrollment criteria predictor and student grouping according to different characteristics. Apart from these features, the tool will consist of an intelligent execution of data analysis tasks with real time data as a background service. Finally, the results of the analysis are evaluated and visualized in order to easily understand by the user. Users of education industry can achieve a valuable gain by this tool since, it would be very user friendly to handle and easy to understand the mining results.

Keywords: Data mining, Educational Data Mining, Knowledge Discovery in Data Bases, Automated tool

¹ Corresponding author: K.T.S. Kasthuriarachchi; Tel.: +94-77-358-5436
E-mail address: sanvithat85@gmail.com

Programmatic Approach to Evaluate Affiliate Offers

Gayan Weerakutti^a, Kapila T. Rathnayaka^b

^a*Department of Computing & Information Systems, Faculty of Applied Sciences, Sabaragamuwa University of Sri Lanka, Belihuloya*

^b*Department of Physical Sciences & Technology, Faculty of Applied Sciences, Sabaragamuwa University of Sri Lanka, Belihuloya.*

To facilitate affiliate publishers with information required to make more thoughtful decisions such as network selection, prior to start promoting an affiliate offer is significant. The present invention proposes a method to identify if an offer is a brokered offer or not and moreover if brokered, to identify how many levels that it is being brokered and who is brokering it. The proposed specification is mainly for the beneficial of the publisher. Publishers of a broker network only see cloaked URLs, rather than the actual URLs that derives from some parent network. Technically, when a user visits a URL of a brokered offer, he/she is being redirected to the offer URL of the immediate parent network. Redirection continues up until it reaches the merchant's website. Each subsidiary network in network chain will deduct an amount from the earnings payable to the publisher. Unless traced as done in the present invention, information about a network chain is not known to the publisher. So, to address the problem, the present invention takes URL to an offer as the only user input, and follows the redirects up until there is no more redirects to follow. These track URLs are then being mapped with their respective network. If the network for a track-URL is unknown, technologies such as WHOIS is being used to find a network with a domain matching the WHOIS record criteria of the track-URL. It is being concluded that, a publisher should either choose the origin or the closest preceding sibling to the origin if they are to make more revenue out of a lead. Only the specification is provided herein, but one skilled in the art is free to make an implementation out of this invention, to help publisher disclose information about an affiliate network chain.

Keywords: Affiliate offers; Affiliate networks; Broker networks; URL Redirecti

Age and Gender Related Variations in Human EEG Signals

H.B.A.C. Pradeep, R.G.N. Meegama¹

*Apple Research and Deveopment Centre, Department of Computer Science, Faculty of Applied Sciences
University of Sri Jayewardenepura, Gangodawila, Sri Lanka*

There is a significant amount of research focused on discovering the functional behavior inside the human brain and methods to collect brain waves with respect to age. However, due to the lack of research using data-mining and pattern extraction methodologies on such data streams, we may be losing important features from human brain wave pattern data. The proposed research is aimed at collecting different kinds of brain wave patterns from different age categories of human beings and analyzing the correlation between the wave patterns of individuals. All the EEG data were taken from publically available and trusted data sources. The data from 22 subjects, five males and 17 females, within the age range from 3 to 22 years and were recorded with 256Hz and 16-bit resolution. We used FP1 and F7 channels as our main data sources for comparing and classification purposes. In the first phase, we applied a filtering process to clean the EEG data set of young male and female subjects to extract the hidden patterns. As EEG signals are acquired as a continuous stream, we use the sliding dot product or sliding inner product of two wave forms while searching for a long signal for shorter, known feature which is referred to as cross correlation. A correlation function is a function that gives the statistical correlation between random variables. In our research, the correlation between two signal forms (data sets) was used to measure the similarity between two wave forms. Subsequently, the cross correlation between all data pairs was calculated to find hidden relationships between each data group. In the sampling process, We ignored the first 256 data samples which was captured during 1s - 2s time period to compensate for possible errors added to the main brain wave during head movements and early adjustments. Using cross correlation diagrams, we observed similarity of brain wave signals between 11 year male and 22 year female subjects having a peak value of 3.5597e.

Keywords: brain waves; cross correlation; neurophysiology; EEG signals

¹ Corresponding author: R.G.N. Meegama; Tel.: +94-11-275-8912
E-mail address: rgn@sjp.ac.lk

Decision Support for Diagnosing Thyroid Diseases Using Machine Learning

W. K. D. Jayamini^a, H. D. Weerasinghe^{b,1}

^a*Department of Statistics and Computer Science, University of Kelaniya, Kelaniya, Sri Lanka*

^b*Department of Computer Systems Engineering, University of Kelaniya, Kelaniya, Sri Lanka*

Diagnosis of thyroid disorders using two machine learning techniques was studied in this research. Multilayer Perceptron Neural Network with Back-propagation algorithm and Random Forest algorithm were the two algorithms used to build the models for classifying the thyroid diagnosis classes; Hyperthyroidism, Hypothyroidism, Normal. Models were developed with different structures by changing the relevant parameters and the outcomes of the developed models were compared with each other. For developing different neural networks, parameters such as the number of hidden layers, number of neurons in hidden layers and learning rates were changed. For developing different random forest models, parameters such as the number of features per tree and the number of trees in forest were changed. Those models were trained and tested using two different datasets of thyroid diagnosis (Dataset 1 and Dataset 2) which have different attributes that are related to diagnosing thyroid diseases. The models were tested using 10-fold cross-validation while the models were compared and evaluated using the measures Accuracy (%), Mean Absolute Error, Root Mean Squared Error, TP rate, FP rate, Precision and Recall. In diagnosing thyroid disease, both the algorithms performed well. Multilayer Perceptron Neural Network with Back-propagation algorithm performed well for Dataset 1 with an accuracy of 96.7442% and Random Forest algorithm performed well for the Dataset 2 with a mean accuracy level of 98.4915%.

Keywords: Decision Support; Thyroid Disease Diagnosis; Back-propagation; Random Forest

¹ Corresponding author: H. D. Weerasinghe; Tel.: +94-77-801-1033
E-mail address: darshawk@gmail.com

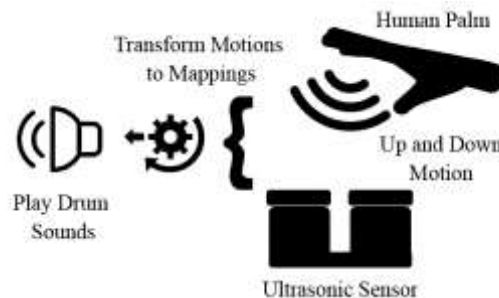
Virtual Airplay Drum Kit based on Hand Gesture Recognition

D. S. Dias^{a,1}, M. D. R. Perera^a

^a*Department of Computer Science, University of Sri Jayewardenepura, Gangodawila, Sri Lanka.*

In the music industry, a drum kit plays a vital role in the production of masterpiece musical melodies. It is also one of the instruments that is in greatest demand by youngsters who are passionate in learning and practicing music. But acquiring a typical drum kit is become a difficult task because of its high cost as well as it requires a large storage space to hold. This research is targeted in examining the possibility of engineering a cost-effective solution to build a portable drum kit. In this approach, ultrasonic sensors are used in order to identify hand gestures. Ultrasonic sensor is used to measure the distance to an obstacle using the theories of sound reflectance. The obstacle in this scenario is the human palm. When the palm of the human is moved up and down above the ultrasonic sensor, mimicking the typical actions of playing a drum kit, the changes in distances to the palm are mapped to corresponding drum sounds using a sound generation algorithm. This algorithm is further optimized in such a way that it yields an optimal consistency in readings, regardless of the typical issues of the low cost ultrasonic sensor such as noise, low accuracy of distance readings and random loss of signal. The solution was tested with the feedback of the general audience and it yielded satisfactory results, in achieving our goal. In conclusion, this approach could be well used in reaching our goal based on over 75% of positive feedback (rated very good and good) received. But in order to improve its accuracy and efficiency, more expensive and more accurate distance sensors such as high precision ultrasonic sensors or infrared sensors could be used. The portability, the low cost of engineering, and yet the deliverance of acceptable level of quality of music, could be identified as the unique key point of this research.

Keywords: virtual; airplay; drum kit; hand gesture



¹ Corresponding author: D. S. Dias; Tel.: +94-77-308-9692
E-mail address: dulan@ieee.org

Study on Theory and Practice in Software Quality Assurance (With Special Reference to Information Technology Professionals in Colombo, Sri Lanka)

N. W. K. D. V. P Opatha¹

Department of ICT, University of Vocational Technology, Ratmalana, Sri Lanka

A software product is developed or engineered by a set of professionals, and they support and maintain it over a long period of time. Software Quality Assurance (SQA) plays an imperative role in achieving high quality software. SQA process should be carried out from the inception of the project till its maintenance. This research is expected to study the gap between the theories and practical approaches related to SQA by refereeing to Information Technology (IT) professionals in software firms in Colombo, Sri Lanka. Further, it was aimed to explore the differences in SQA activities performed, and perception of IT professionals related to testing and SQA, while identifying the reasons to have/not to have a separate SQA section. The study was conducted as a descriptive study, and the selected sample size was 40. Major reasons identified for not having the SQA section were, the company being small scale with few projects (47.1%) and to reduce the cost (29.1%). The Activities that are performed by companies with a separate SQA section and without a separate SQA section are far too different. Testing programs and retesting them after correction were most popular among both types. The companies enriched with SQA section performed various other activities apart from testing. A significant proportion of the respondents (50%) were not even aware of the SQA standards, and among them, the largest proportion (82%) did not have a separate SQA section. In considering the perception of the professionals with regard to SQA and testing, there is a significant difference among both groups. Furthermore, largest proportion (39%) of the professionals agreed that more up-to-date knowledge regarding the entire process is required, which can cover all the activities and scenarios, while having the presence of SQA from the very beginning to the end of the project. Finally, having a separate SQA section would greatly benefit the companies, and it will contribute to improve the quality, with enriched set of activities. A gap truly exists in between what is emphasized in theories and the way they have been implemented practically in SQA.

Keywords: Colombo; Software Development; Software Quality Assurance ; Testing

¹ Corresponding author: N. W. K. D. V. P Opatha; Tel.: +94-78-318-0189
E-mail address: v.opatha@gmail.com

A New Public Key Cryptosystem

W. D. M. G. M. Dissanayake¹

Department of Computer Engineering, Faculty of Engineering, University of Peradeniya, Sri Lanka

In this paper a new CCA secure public key cryptosystem is presented. The introduced cryptosystem is simple and based on the factorization problem. The cryptosystem has two public keys and two private keys. Therefore two encryption algorithms and two decryption algorithms are in this system. Here, we hide the message in a matrix. This situation makes a difficult puzzle for adversaries. In this method, the public encryption key is (e, r, n) , e and r are any prime numbers greater than 2 and less than n , n is a product of two large prime numbers. The decryption key is (d, s, n) . d and s are multiplicative inverses of e modulo $\phi(n)$ and r modulo $\phi(n)$ respectively. We should select another integer g ($< 2m$) and set the message m and g in a $2 * 2$ matrix X as the determinant of X is odd. We encrypt the determinant of the matrix by raising it to the e th power modulo n . We also have to send g for the decryption. g is encrypted by raising it to the r th power modulo n . When we decrypt the first ciphertext by raising it to another power d modulo n and the second ciphertext by raising it to another power s modulo n , we can find the message m . For an example, let $p = 7, q = 11, e = 23, r = 29$. Then, $n = pq = 7 \times 11 = 77, \phi(n) = 60$. Then for the private keys, $d = 47$ and $s = 29$. Let the message, $m = 30$ and $g = 7$. Then, $X = \begin{pmatrix} 30 & 7 \\ 1 & 2 \end{pmatrix}$. From the encryption equations, $C_1 \equiv [\text{determinant}(X)^e] \text{ mod } n \equiv 53^{23} \text{ mod } 77 \equiv 58$ and $C_2 \equiv [g^r] \text{ mod } n \equiv 7^{29} \text{ mod } 77 \equiv 63$. The decryption equations are $\text{Determinant}(X) \equiv [C_1^d] \text{ mod } n \equiv 58^{47} \text{ mod } 77 \equiv 53$ and $g \equiv [C_2^s] \text{ mod } n \equiv 63^{29} \text{ mod } 77 \equiv 7$. Then, using $2m - g = \text{Determinant}(X)$, we can find $m = 30$. If we use the fast exponentiation algorithm then the computational complexity of the cryptosystem is in polynomial time. The proposed cryptosystem is OW-CCA2 secure and also can use any standard security model to increase the security.

Keywords: public key cryptosystem; RSA cryptosystem; El-Gamal cryptosystem; IND security.

¹ Corresponding author: W.D.M.G.M. Dissanayake; Tel.: +94-76-883-8365
E-mail address: maheshi14d@gmail.com

Sinhala Character Recognition using Tesseract OCR

Manisha U.K.D.N.^a, Liyanage S.R.^b

^a*Department of Computer Systems Engineering, Faculty of Computing and Technology, University of Kelaniya, Sri Lanka.*

^b*Department of Software Engineering, Faculty of Computing and Technology, University of Kelaniya, Sri Lanka.*

In Sri Lanka, there are many fields that uses Sinhala scripts, such as newspaper editors, writers, postal and application processes. In these fields there have only a scanned or printed copies of Sinhala script, where they have to enter them manually to a computerized system, which consumes much time and cost. The proposed method was consisted of two areas as image pre-processing and training the OCR classifier. In Image pre-processing, the scanned images were enhanced and binarized using image processing techniques such as grayscale conversion and binarization using local thresholding. In order to avoid distortions of scanned images such as water marks and highlights was removed through the grayscale conversion with color intensity changes. In the OCR training, the Tesseract OCR engine was used to create the Sinhala language data file and used the data file with a customized function to detect Sinhala characters in scanned documents. OCR engine was primarily used to create a language data file. First, pre-processed images were segmented (white letters in black background) using local adaptive thresholding where performing Otsu's thresholding algorithm to separate the text from the background. Then page layout analysis was performed to identify non-text areas such as images, as well as multi-column text into columns. Then used detections of baselines and words by using blob analysis where each blob was sorted using the x-coordinate (left edge of the blob) as the sort key which enables to track the skew across the page. After the separation of each character, then labeled manually into Sinhala language characters. By using the Sinhala language data file into OCR function, it returns the recognized text, the recognition confidence, and the location of the text in the original image. By considering the recognition confidence of each word it is possible to control the accuracy of the system. The classifier was trained using 40 characters sets with 20 images from each character and tested using over 1000 characters (200 words) with variations of font sizes and achieved approximately 97% of accuracy. The elapsed time was less than 0.05 per a line with more than 20 words, which was a higher improvement than a manual data entering. Since the classifier can be retrained using testing images, it can be developed to achieve active learning.

Keywords: Optical Character Recognition; Computer Vision; Image Processing; Image Segmentation

Security and Privacy Implications of Biometric Authentication: a Survey

D. S. Wijenayake^{a,1}

^aDepartment of Computer Systems Engineering, University of Kelaniya, Sri Lanka

In today's world, biometric authentication is used by a wide range of gadgets and systems to verify user identification and access control. Even though biometric authentication is more secure when compared to traditional authentication methods, it itself is not completely hack-proof as any technology can always be hacked and exposed. Protecting user biometric data is a key security challenge in this field. In case a hacker steals any biometric information such as fingerprints, voice waves, etc. from a user, the hacker can effortlessly access all the systems that the original user has access to, which is a serious security concern. Biometric information is unique and it is even impossible to change as passwords, to block someone using it. This is the most vital drawback of biometric authentication. Therefore, the aims of this paper, are to find, understand and propose remedies to the security and privacy shortcomings of the latest biometric authentication methods. The outcome of the critical evaluation taken place in this research, results that several limitations are there in the recent researches. The lack of generalizations (testbeds and participants of the studies were limited to selected geographical areas when compared to the whole populations of the testbeds/users of the world), fewer experiments, and lack of usability/privacy requirements are among them. The paper suggests solutions/future research directions for the many of aforementioned limitations, such as, implementing indicators which depict the strength of biometric authentication methods' security, rehashing of the studies with different populations via the internet, improving current research-based biometric authentication applications to support multimodal (using of two or more biometrics to authenticate)/continuous authentication, ensuring trust and privacy of users, etc. In conclusion, with the competition among major players in the electronic device market, research-based biometric authentication methods will be rapidly implemented in the real world. To ensure the protection of sensitive data, mobile interfaces should be improved, researchers are highly encouraged to reproduce and critically evaluate others' researches, and the security and privacy of biometric authentication should be maintained without compromising usability. Then only it would be a challenge to hackers to exploit the biometrics.

Keywords: Security and Privacy; Biometric authentication; Multimodal authentication

¹ Corresponding author: D.S. Wijenayake; Tel.: +94-70-274-0836
E-mail address: dswijenayake20360@gmail.com

Smart Iron Rack: Image Processing Approach to Iron Clothes Remotely

Y. W. Thilini M.Yatanwala^a, D. S. G. L. D Liyanaarachchi^{b,1}

^aDepartment of Computer Systems Engineeirng, University of Kelaniya, Kelaniya, Sri Lanka

^b Department of Information Technology, Sri Lanka Institute of Information Technology, Malabe, Sri Lanka

Ironing process is a repeated manual task carried out by people daily. Conventional ironing methods always require significant amount of physical user interaction which is time consuming. As a solution, a research has been carried out to implement a smart iron rack with a mobile application that enables user to remotely perform the ironing process. As illustrated in figure below, the device connects with the mobile application through Wi-Fi and performs many tasks including hanger detection, wrinkle detection in cloths, identification of steam irons' water levels and sending notifications to user. Iron rack consists of 5 hangers and a wide angle camera that moves along the horizontal beam to detect the clothes. When the user specifies a hanger number, the camera moves to the hanger position to check the availability of the cloth. Afterwards, the steam irons attached to the beam move vertically to iron the both sides of clothes. If the hanger number is not specified, the clothes on all five hangers will be ironed. The availability of the cloth on a particular hanger is detected using template matching algorithms in image processing. SIFT (scale-invariant feature transform) algorithm captures all interesting points of the hanger and shape of the hanger is taken as a key measure to decide the existence of the cloth. Raspberry-pi device which is mounted to micro controller, processes the images in order to determine the level of wrinkles in the outfit before and after the ironing process. "Grabcut" algorithm with localize Gaussian Mixture Model(GMM) is used to classify the foreground and background pixels in order to extract only the cloth from its background. Canny edge detection algorithm is used with (100,200) double thresholds to determine the number of wrinkle pixels in the cloth. The system was tested with 100 outfits made in cotton and silk materials. The accuracy of the system was tested in two stages. System could be able to achieve 0.80 F1 score for detecting clothes on hangers and 0.71 F1 score for detecting wrinkles in the clothes. "Smart iron rack" is a cost effective solution which is capable of remotely ironing 5 clothes at a time.

Keywords: image processing; wrinkle detection; template matching; iro

¹ Corresponding author: D.S.G.L.D Liyanaarachchi; Tel.: +94-71-159-4436
E-mail address: tmyatanwala@kln.ac.lk

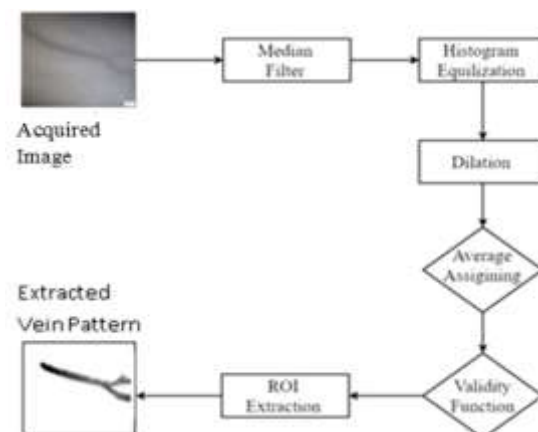
Development of Image Processing Algorithm for Vein Detection System

T. G. Wanniarachchi ,R. T. P. Tharushika, W. S. P. Panthaka

^a Department of Electrical and Information Engineering, Faculty of Engineering, University of Ruhuna, Hapugala, Galle, Sri Lanka

The process of obtaining intravenous access, vein puncture is an everyday invasive procedure in medical settings. A major problem faced by the nurses today is difficulty in accessing veins for intravenous drug delivery and other medical situations. Hence a vein detection device which can clearly show veins is a useful biomedical engineering application. The accessibility to existing devices are limited due to their high costs. When considering patients admitted into hospital wards, the nurses have to struggle with majority of them to access a peripheral venous line. The probability of it is as high as 80% depending on the condition of the patient and the location of the hospital. Although a peripheral vein can be accessed in a single attempt, in a substantial number of patients the attending nurse needs multiple attempts to insert the needle successfully. Excessive vein puncture are both time and resource consuming events, which cause anxiety, pain, and distress in patients, or can, lead to severe harmful injuries. Therefore it is a significant problem in emergency rooms and during a hospital stay. This research deals with the design and development of low-cost non-invasive subcutaneous vein detection system based on near infrared imaging. In here our priority is focused for development of image processing algorithm to extract vein pattern from a acquired near infrared image. Vein detection system uses an infrared light source (740 nm) to illuminate veins in hand. A snapshot of the region is taken by the modified visible light camera to IR region and it is subjected to existing image processing techniques and author's validity function. Finally the extracted vein pattern is used to project back to the skin of the patient.

Keywords: Vein puncture; Vein detection; Near-infrared imaging



A Prototype P300 BCI Communicator for Sinhala Language

U. K. D. N. Manisha^a, S.R. Liyanage^{b*}

^a *Department of Computer Systems Engineering, Faculty of Computing and Technology, University of Kelaniya, Sri Lanka*

^b *Department of Software Engineering, Faculty of Computing and Technology, University of Kelaniya, Sri Lanka.*

A Brain-Computer Interface (BCI) is a communication system which enables its users to send commands to a computer using only brain activities. These brain activities are generally measured by ElectroEncephaloGraphy (EEG), and processed by a system using machine learning algorithms to recognize the patterns in the EEG data. The P300-event related potential is an evoked response to an external stimulus that is observed in scalp-recorded electroencephalography (EEG). The P300 response has proven to be a reliable signal for controlling a BCI. P300 speller presents a selection of characters arranged in a matrix. The user focuses attention on one of the character cells of the matrix while each row and column of the matrix is intensified in a random sequence. The row and column intensifications that intersect at the attended cell represent the target stimuli. The rare presentation of the target stimuli in the random sequence of stimuli constitutes an Oddball Paradigm and will elicit a P300 response to the target stimuli. Emotive EPOC provides an affordable platform for BCI applications. In this study a speller application for Sinhala language characters was also developed for Emotiv users and tested. Classification of the P300 waveform was carried out using a dynamically weighted combination of classifiers. A mean letter classification accuracy of 84.53% and a mean P300 classification accuracy of 89.88% was achieved on a dataset collected from three users.

Keywords: Brain computer interfaces, EEG, P300 Speller

Hybrid Gene Selection with Information Gain and Multi-Objective Evolutionary Algorithm for Leukemia Classification

M. N. F. Fajila

Department of Mathematical Sciences, Faculty of Applied Sciences, South Eastern University of Sri Lanka, Sri Lanka

Leukemia is a bone marrow cancer with various subtypes such as Acute Myeloid Leukemia and Acute Lymphoblastic Leukemia which require expertise to be identified. Morphological and histological appearances can be used to identify diseases. Yet, precise identification of subtypes is a difficult task. Therefore, subtype detection is a crucial part in prognosis. In this study, a hybrid gene selection approach Information Gain-Multi-Objective Evolutionary Algorithm (IG-MOEA) is proposed to identify Leukemia subtypes. Microarray data consists of thousands of genes where all are not corresponding to disease. Irrelevant and redundant genes have high impact on worst classification performance. Hence, IG is initially applied to preprocess the original datasets to remove irrelevant and redundant genes. Then, further MOEA is used to select a smaller subset of genes for perfect classification of new instances. Gene subset selection highly influences the classification. Further, the subsets selected intern is influenced by the algorithm used for gene selection. Moreover, informative subset of genes can be used efficiently for perfect prediction. Thus, selecting the appropriate algorithm for subset selection is important. Hence, MOEA is used in the proposed study for subset selection. The performance of proposed IG-MOEA is compared against the Information Gain-Genetic Algorithm (IG-GA) and Information Gain-Evolutionary Algorithm (IG-EA). Three Leukemia microarray datasets were used to evaluate the performance of the denoted approach. Remarkably, 100% classification was achieved for all the three datasets only with few informative genes using the proposed approach.

Keywords: Classification; Gene Selection; Microarray and Multi-Objective Evolutionary Algorithm

Air Pollution Monitoring System Using Arduino

U.Mohamed Rishan¹

Department of ICT South eastern uinversity of Sri lanka, Maradan kadawala, Sri Lanka

Arduino based Air pollution system is presented. Air pollution monitoring is old but very useful concept in day to day life. The level of air pollution has increased with times by lot of factors like the increase in population, industrialization, increased vehicle use and urbanization. Air pollution will directly affecting health of population. However the fresh air is necessary for all human being. Actually air pollution monitoring started from early using traditional way but the most sophisticated computer has been used to monitor the air quality. However in this project I am going to make an IOT based air pollution system using Arduino this will monitor the air quality accurately. The main objectives of this project to develop low-cost and ubiquitous sensor networks to collect real time data of urban environment. This air pollution system is connected with internet and we can monitor the air quality over the web server using internet. The alarm also embedded with this system that will trigger when the air quality goes down beyond a certain level, this means there are sufficient amount of harmful gases are present in the air like CO₂, alcohol, and NH₃. It will display the air quality in PPM on the LCD display and as well as on webpage so that we can monitor it very easily. In this IOT project, you can monitor the pollution level from anywhere using your computer or mobile devices.

Keywords: Internet of things, air pollution, air monitoring system, Arduino

¹ Corresponding author. U.Mohamed Rishan
E-mail address: rishan@seu.ac.lk

Forecasting Monthly Ad Revenue from Blogs using Machine Learning

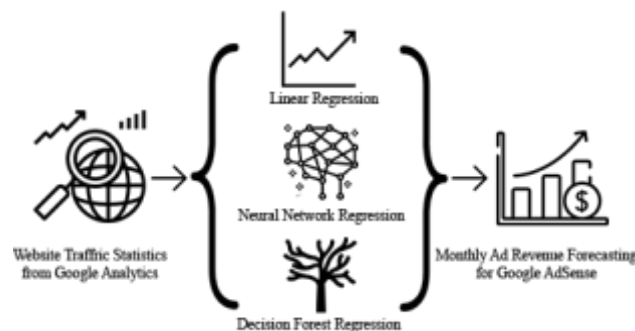
D. S. Dias^{a,1}, N. G. J. Dias^b

^a*Department of Computer Science, University of Sri Jayewardenepura, Gangodawila, Sri Lanka*

^b*Department of Computer Systems Engineering, University of Kelaniya, Dalugama, Sri Lanka*

Blogs emerged in the late 1990s as a technology that allows Internet users to share information. Since then, blogging has evolved to become a source of living to some and a hobby to others. A blog with rich content and regular traffic could easily be monetized through a number of methods. Affiliate marketing, Google AdSense, offering courses or services, selling eBooks and paid banner advertisements are some of the methods in which a blog could be monetized. There exists, a direct relationship on the revenue that can be generated through any of the above methods and the traffic that the blog gets. Google AdSense is the leader in providing ads from publishers to website owners. All bloggers or blogging website owners who have monetized their blogs, attempt to maximize their revenue by publishing articles in hope that it will generate the targeted revenue. On the other hand, bloggers or blogging website owners that hope to monetize their blog will be greatly benefitted if there was a way to forecast the monthly ad revenue that could be generated through the blog. But there exists no tool in the market that can help the bloggers forecast their ad revenue from the blog. In this research, we are looking at the possibility of finding an appropriate machine learning technique by comparing a linear regression, neural network regression and decision forest regression approaches in order to forecast the monthly ad revenue that a blog can generate to a greater accuracy, using statistics from Google Analytics and Google AdSense. As conclusion, the Decision Forest Regression model came out as the best fit with an accuracy of over 70%.

Keywords: forecasting; ad revenue; blogs; machine learning;



¹ Corresponding author. D. S. Dias; Tel.: +94-77-308-9692
E-mail address: dulan@ieee.org

Mobile Biometrics: The Next Generation Authentication in Cloud-Based Databases

Chintan Bhatt ^a, S.R. Liyanage^b

^a Charotar University of Science And Technology, India.

^bFaculty of Computing and Technology, University of Kelaniya, Sri Lanka

In this period of data innovation, cell phones are generally utilized around the world for fundamental correspondences, as well as an apparatus to manage anyplace, whenever data. These situations require a high security level for individual data and protection assurance through individual distinguishing proof against un-approved use if there should be an occurrence of robbery or fake use in an organized society. At present, the most received technique is the check of Personal Identification Number (PIN), which is risky and won't not be anchored enough to meet this prerequisite. As is represented in a review (Clarke and Furnell, 2005), numerous cell phone clients view the PIN as badly arranged as a secret key that is sufficiently confounded and effortlessly overlooked and not very many clients change their PIN frequently for higher security. Subsequently, it is liked to apply biometrics for the security of cell phones and enhance dependability of remote administrations. As biometrics intends to perceive a man utilizing special highlights of human physiological or conduct attributes, for example, fingerprints, voice, confront, iris, stride and mark, this verification technique normally gives an abnormal state of security. Expectedly, biometrics works with particular gadgets, for instance, infrared camera for securing of iris pictures, increasing speed sensors for step obtaining and depends on expansive scale PC servers to perform ID calculations, which experiences a few issues including massive size, operational many-sided quality and greatly surprising expense. Adding a wireless dimension to biometric identification provides a more efficient and reliable method of identity management across criminal justice and civil markets. Yet deploying cost-effective portable devices with the ability to capture biometric identifiers – such as fingerprints and facial images – is only part of the solution. An end-to-end, standards-based approach is required to deliver operational efficiencies, optimize resources and impact the bottom line. While the use of mobile biometric solutions has evolved in step with the larger biometrics market for some time, the growing ubiquity of smartphones and the rapid and dramatic improvements in their features and performance are accelerating the trend. This is the right time to take a closer look at mobile biometrics and investigate in greater depth how they can be used to their potential. Consolidated with cutting edge detecting stages can identify physiological signals and create different signs, numerous biometric strategies could be executed on phones. This offers an extensive variety of conceivable applications. For example, individual protection assurance, versatile bank exchange benefit security, and telemedicine observation. The utilization of sensor information gathered by cell phones for biometric ID and verification is a rising boondock that must be progressively investigated. We review the state-of-the-art technologies for mobile biometrics in this research.

Keywords: Biometric, Cloud Computing, Information, Mobile, Wireless, Security.

Deep Learning Based Student Attention Monitoring and Alerting System During a Lecture

Narayani Vettivel, Vyshnavi Ravindran¹, Narmadha Jeyaratnam, Sagara Sumathipala

Faculty of Information Technology, University of Moratuwa, Sri Lanka

Mindfulness is the ability to fully aware and focuses on the present moment. For students, it is essential to pay full concentration during the lectures. Staying focused while studying is vital for the better performance of any student. In this study, focuses on developing a deep learning-based attention monitoring and alerting system. The proposed system monitors attention of students during a lecture and gives an alert when attention is diverted. The study used mainly three aspects namely Heart Rate Variability, Brain Waves and Facial Expressions to capture the attention level of students while attending a lecture. By using three different aspects, it is expected to overcome the limitations of each aspect. Each aspect is further divided into several parameters, and most significant parameters that respond to the loose of students' concentration was chosen using principal component analysis to train the deep neural network to measure the students' concentration level. As the parameters cannot be able to label accurately with concentration, study used an unsupervised learning methodology and it considers the concentration drifting moment as an anomaly and detect it by deducing the pattern of the parameters. When the concentration drops below the threshold system will alert the user. The preliminary experiments reveal how the Facial Expressions, Heart Rate Variability and Brain Waves change with students' concentration.

¹ Corresponding author: Vyshnavi Ravindran Tel.: +94-77-902-6329
E-mail address: rvysh93@gmail.com

Natural Language Processing (NLP) Techniques to Measure the Syllabus Coverage with the Final Exam Paper

A. G. K. S. Dharmapriya¹, J. R. K. C. Jayakody

Computer and information systems, Wayamba University of Sri Lanka, Kuliyaipitiya, Sri Lanka

Exam questions usually play a pivotal role in the education and it is the main assessment technique to evaluate the Intended learning Outcome (ILO). The main Intention of the subject syllabus is to cover the ILO. If the syllabus is not covered effectively through the exam questions, it is a challenging task to identify whether students have acquired and enhance the necessary skills and the knowledge which are specified in the given ILO. Therefore the preparation of the exam papers and its evaluation plays an important role in education to improve the performance of the students. Having appropriate level of exam questions which covers the entire syllabus is a time consuming, tedious and challenging work for the instructors. Therefore this research work was done with the view of setting up effective question paper to measure the depth of the syllabus coverage. Further, Identification of the students' knowledge level was an output. Natural Language Processing (NLP) techniques such as tokenization, stop word removal, non-alpha numeric word removals and tagging were used to process the contents and questions. NLP with NLTK and cosine similarity with TF-IDF (term frequency inverse document frequency), TF-IDF variations and semantic similarity algorithms were developed to generate a unique set of rules to identify the best syllabus coverage contents for exam questions. Rule based set of logics were developed to classify the exam questions under different syllabus topic. Based on the experiment output, evaluators and instructors can redesign their exam paper. 72 exam questions were used as the initial dataset. Final evaluation was done based on the total value generated from TF-IDF, TF-IDF variations, TF-IDF with cosine similarity and semantic similarity.

Keywords: Natural language processing, Cosine similarity with TF-IDF, TF-IDF variations, Semantic similarit

¹ Corresponding author. Tel.: 071-724-8167
E-mail address: krishanisudharshi@gmail.com

Evaluation of Trustworthiness for Online Social Networks Using Advanced Machine Learning

Hansi Mayadunna^{a,1}, Lakmal Rupasinghe^b

^a*Department of Information Technology, Sri Lanka Institute of Information Technology, Malabe, Sri Lanka.*

^b*Department of Computer Science and Networking, Sri Lanka Institute of Information Technology, Malabe, Sri Lanka.*

The trustworthiness of online users has become a current issue in the field of social computing with the rapid popularity of online social networks. The evaluation of trust in social networks has been widely used in situations such as friend – recommendation, e- commerce and access control systems. For sharing and exchanging of information between the trusted users only trustworthiness of the user needs to be determined. One of the key requirements in trust applications is recognizing the trustworthy actors in the network. In the proposed research, a general trust framework will be introduced to calculate the node trust values for social network users by applying machine learning methods. Some selected features of social network are used as the training feature and the measurement whether there is edge between nodes used as label information. Secondly, a training model will be used to calculate the node trust value. Then a recommendation algorithm will be used to calculate node trust score. Finally, the simulation is used to verify the performance of suggested method. For the simulation of experimentation, data from an adaptive social network will be used. The emergence of online social networking (OSN), like Facebook, Twitter, Instagram are allowed people to build and maintain social relationship over the internet. Currently, a large number of users around the globe are connected to the online social networks for sharing and exchanging information. Online social networking is a common platform for communication and sharing different type of information. The popularity has increased of such social networks that have millions of connected users. In online social network, it is important to determine which user gets access to the information related to the user. Information related to trustworthiness of other users can help a user to take decisions about information exchange, sorting and filtering of information. The method will help in building more confidence about using social network among users. Protection of information from untrusted user is crucial aspect in social network. The method enables maintenance of the user privacy and confidentiality by finding trustworthiness of user.

Keywords: Trust; Social networks; Advanced machine learning

¹ Corresponding author. Hansi Mayadunna; Tel.: +94-71-053-0575
E-mail address: hansimayadunna@gmail.com

Finite Element Method based Triangular Mesh Generation for Aircraft-Lightning Interaction Simulation

K.Vinotha, S.Thirukumaran¹

¹Department of Physical Science, Vavuniya Campus of the University of Jaffna, Vavuniya, Sri Lanka

Lightning is a natural electrical discharge process. Most common lightning strike is Cloud-to-Ground. It occurs when the negative charges accumulated at the bottom of the thundercloud traverse towards the ground to neutralize its charges with the positive earth charges induced due to the thundercloud and electrons travels along the lightning channel. The statistics shows that the commercial aircrafts directly struck by lightning strikes that are under the thundercloud once a year on average. The study of electromagnetic threat due to lightning strikes is important for flight safety and restructuring the aircraft design to mitigate direct lightning effects on the physical material of the aircraft causing damages and indirect effects on the navigation systems in it. The prime objective of this paper is to find the electric field distribution around the aircraft conductor in free space conditions under lightning scenario. For the simulation, the flash of the cloud-to-ground lightning is represented as a wave equation. Finite element method is applied to solve the wave equation for identifying potential distribution and exclusively to electric field calculations. Each of the triangular finite elements are considered and the potential at any nodes within a typical element are obtained. The equation $E = -\nabla V$ represents the relationship between electric potential and electric field which is used to determine the electric field distribution around the aircraft surface by a numerical derivative evaluation technique from the electric potential distribution already obtained. This paper presents an aircraft-lightning interaction simulation under the thundercloud and above the ground by generating two dimensional triangular mesh using finite element method. Significant electric field distribution is observed at the sharp end points of the aircraft. Due to higher radiated electric field, the aircraft-lightning interaction may result in an adverse impact on the aircraft navigation systems and cause damage to its structures. The simulation results would be very useful for studying lightning impact on the aerial vehicles struck by the cloud-to-ground lightning. During the simulation, it was assumed that an aircraft surface is a good conductor and the effects of material properties are left for future studies.

Keywords: Finite Element Method; Aircraft-Lightning Interaction; Triangular Mesh Generation

¹ Corresponding author: S. Thirukumaran; Tel.: +94-77-757-0208
E-mail address: thiruvks@gmail.com

A Preliminary Investigation of Surface Bound Iron in Mica to Develop a Methodology Combined with Magnetism to Remove Contaminated Mica from Industrial Minerals

K. L. M. Dassanayake^a, S. A. S. Subasingha^a, S. Wijesinghe^{b,1}

^aLanka Minerals and Chemicals (Pvt) Ltd., Avissawella, Sri Lanka

^bDepartment of Applied Computing, Faculty of Computing and Technology, University of Kelaniya, Sri Lanka.

Sri Lanka is a country rich with industrial minerals. Mica is one of readily available industrial mineral which belongs to a group of sheet silicate (phyllosilicate) contained Aluminum (Al), Iron (Fe), Magnesium (Mg), Potassium (K), Sodium (Na) etc. as abundant elements. Mica could be easily identified by its unique flaky structure. The most common types of mica in Sri Lanka are phlogopite (blackish brown) and biotite (brownish ash). Kuruwita, Balangoda, Haputhale and Mathale areas are well-known for Mica deposits in Sri Lanka to date. If we consider the industrial use of mica, it has been frequently used in paint industry to produce exterior paints due to its ability to create a protective coating against the extreme weather conditions like rain and ultraviolet light. Mica is a good electrical insulator and a good thermal conductor also mica powder is used as a glitter to decorate pots. Although Mica is useful when it's present as the pure mineral, a huge lose is caused in mineral industry when it is contaminated with other industrial minerals such as Calcite, Dolomite, and Kaolin. The presence of mica in trace amounts in other minerals reduces the quality of the products like in paint, ceramic and glass industries which use the above stated industrial minerals as raw materials. Therefore, the objective of the current study is to develop a methodology to remove contaminated mica form other industrial minerals although it's present in trace levels. Herein, we have investigated about the content of surface bound Iron in mica that can be used to develop a technique combined with magnetism. As the initial stage of the procedure, surface bound iron percentages of phlogopite and biotite were determined by using UV-visible spectroscopy at 510 nm wavelength. Analysis was carried out according to the Beer-Lambert law by using a previously calculated factor from Fe²⁺ standards. Average surface bound iron percentage for phlogopite yield to be 0.36 (± 0.02) % while that the percentage for biotite was 0.62 (± 0.01) %. According to the results observed, it seemed that these percentages of iron on outer structure of mica may be attracted to a strong magnetic field. Thus it can be concluded that surface bound iron content can be used to separate contaminated industrial minerals. Currently, further studies are being conducted using high performance techniques such as XRF to gain more insight into this.

Keywords- Contaminated-mica; industrial minerals; surface-bound iron; magnetism

¹ Corresponding author: S. Wijesinghe
E-mail address: chamalika89@gmail.com

Solar Thermal Energy Harnessing Using a Parabolic Trough Concentrator

P D C Kumara ^{a, b, 1}, M P S Viraj^b, S K K Suraweera^b, H H E Jayaweera^b, A M Muzathik^c,
T R Ariyaratne^b

^a*Institute of Technology, University of Moratuwa, Katubedda, Sri Lanka*

^b*Department of Physics, University of Colombo, Colombo*

^c*Department of Mechanical Engineering, South Eastern University of Sri Lanka, Oluvil, Sri Lanka*

This paper reports the results of a study carried out in the development of a solar thermal energy harnessing plant using a parabolic trough concentrator. In the field of energy production one of the most concerned factors today is the air pollution, and it is linked with carbon and sulphur emissions from burning of fossil fuels. It is estimated that the global fossil fuel consumption will increase by 48% by 2040. In this context the Solar energy is still considered as the most prominent clean source of energy. Parabolic trough concentrator (PTC) is the most mature and commercially proven technology among the other solar thermal energy harnessing methods. The objective of this study is to design and develop a high efficiency PTC using locally available technologies and materials. The first Sri Lankan PTC thermal energy plant having dimensions of 4.5 m × 4.8 m and an aperture area of 22.3 m² has been successfully constructed under this project and are in operation at the University of Colombo. Solar mirror films (3M 1100) pasted on stainless steel sheets are used as parabolic reflectors and they are mounted on Unplasticized Polyvinyl Chloride profiles clamped on a Galvanized Iron structure. A heat transfer fluid (Mobil Therm-605) is used to transfer the harnessed energy from PTC to the secondary energy conversion modules such as steam generator. When designing the mechanical structure, effect of the wind load was taken in to account in order to achieve the maximum stability and precision-focusing. The maximum daytime wind speed of the location of interest is around 8.3 m s⁻¹ and the calculated maximum wind load and torque were found to be 3.19 kN and 3.64 kNm respectively for a gust factor of 1.53. The structural design was optimized using a computer simulation to bring the maximum stress below the yield point, and when stress is 23.72 MPa the total deformation was found to be 1.12 mm which does not affect the focusing significantly. The concentration ratio of the plant is 1:66 and it lies well within the range of the corresponding parameter (1:30 and 1:80) available for commercial plants. The focusing efficiency of the system is 79% which is also on par with the values available for commercial plants. However, the overall efficiency of solar thermal utilization is found to be 28.7%, hence the thermal capacity of the power plant is 5 kW. Improvements are underway to reduce the heat loss from the receiver tube. It is estimated that the overall efficiency of the system can be increased up to 65% to 70% by using evacuated glass receiver tubes.

¹ Corresponding author. P D C Kumara ;Tel.: +94-71-156-2255
E-mail address: pdc_kumara@phys.cmb.ac.lk

Investigation of the Impact of Clay as a Bulking Agent for Food Waste Composting at a Controlled Raised-up Temperature

M. D. S. B. Jayawardana^{a,1}, Y. Milani^b, C. D. Silva^b, S. Wijesinghe^c

^a*Department of Chemistry, Faculty of Science, University of Kelaniya, Sri Lanka.*

^b*Material Technology Section, Industrial Technology Institute, Colombo 07, Sri Lanka.*

^c*Department of Applied Computing, Faculty of Computing and Technology, University of Kelaniya, Sri Lanka.*

In agriculture, the nourishing and substantial quality of soil can be upgraded through transfiguring organic matter in food waste into humus like substance, which is called food waste composting. This is very important as food waste leads to cause odor and pollute the environment. The moisture content (MC), nitrogen content, C/N ratio and aeration in the compost material can be altered through various bulking agents used during the process. The usage of these bulking agents enhances the biodegradation of food waste and transformation of it into effective compost. Therefore, the entire composting process relies on the indispensable role of the bulking agents. Thus, this study was ultimately aimed to evaluate the influence of using clay as the bulking agent for food waste composting at a controlled high temperature (500C). Here a controlled raised-up temperature was used to lead rapid activation of thermophilic microbes. A consecutive five-day study was carried out to analyze the fluctuations of PH, MC and organic matter content (OMC) by preparing composting feedstock using clay as the bulking agent in four different weight percentages (0%, 5%, 10% and 25%). Using a Scanning Electron Microscope (SEM) surface morphology of the samples was analyzed at the initial stage and after five days composting. The analysis of physical parameters was evident that the organic matter was effectively converted to compost at 500C as all the parameters followed the corresponding gradual fluctuations which are presented at the quality compost production. According to the results, no effect was found from clay to control the PH of the composting process of food waste samples. With the increasing of clay percentage there was no significant change of PH was noticed compared to the blank waste sample. With the increment of the clay percentage of the composting feedstock, initial MC was dropped. Furthermore, by the increasing of the clay content of the samples MC was highly reduced. Similarly, OMC was also drastically decreased with the upswing of clay percentage. According to the observations, it can be concluded that clay has been acted as a good bulking agent to food waste composting. At this elevated temperature Food waste composting process had shown a significantly improvement. Presently, further studies are being carried out to further optimize the percentage of clay for food waste composting process at elevated temperature.

Keywords- food-waste composting; bulking agents; clay; controlled-high temperature

¹ Corresponding author: M. D. S. B. Jayawardana
E-mail address: samjithuok@gmail.com

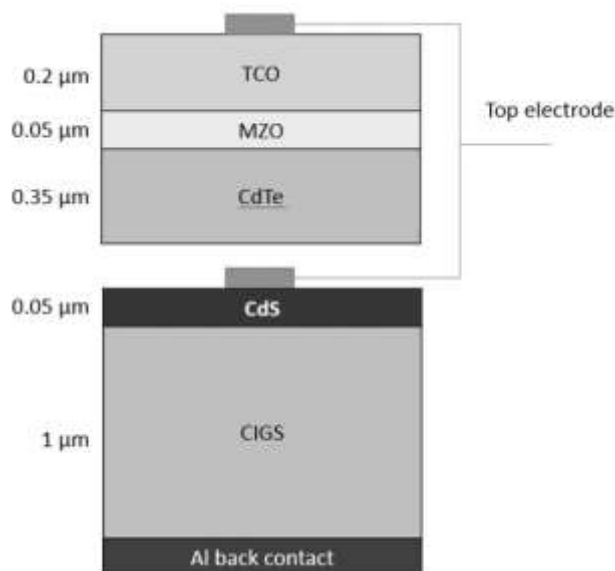
Parameter optimization of the II-VI thin-film photovoltaic tandem solar cell model of MZO/CdTe and CdS/CIGS

D. R. Ratnasinghe¹ and M. L. C. Attygalle

^a*Department of Physics, Faculty of Applied Sciences, University of Sri Jayewardenepura, Sri Lanka.*

In this simulation model we have constructed a photovoltaics tandem device with a top cell of window layer n-MZO (Mg doped ZnO), with an absorber layer of (II-VI) thin-film of p-CdTe and the bottom cell with window layer n-CdS and thin absorber layer of (II-VI) p-CIGS. Photovoltaic properties of CdTe/CIGS tandem solar cell have been studied by the Solar Cell Capacitance Simulator (SCAPS-1D) software. The thicknesses of n-CdS, p-CIGS, and the p-CdTe layers have been varied to improve the tandem solar cell device parameters such as open circuit voltage, short circuit current, fill-factor and the device efficiency. All the numerical simulations were conducted with one sun illumination condition with AM1.5G solar spectrum without any light trapping methods. In this simulation, we have observed 1.37 V open circuit voltage, 24.5 mA/cm² short circuit current, 85.9 fill factor and the highest efficiency value of 28.8493%. In this study we have presented a model of a tandem solar cell structure which can be used to enhance the performance of existing solar cells with the least material usage.

Keywords: SCAPS-1D, Tandem solar cell, Photovoltaics, AM1.5g



¹ Corresponding Author: D. R. Ratnasinghe ; Tel.: +94-75-262-8475
E-mail address: dinuka@sjp.ac.lk

Altered Brain Wiring in Alzheimer's: A Structural Network Analysis using Diffusion MR Imaging

Jeyasuthan Mahadevan^{a,1}, Nagulan Ratnarajah^b, Ruwan. D. Ranaweera^c

^a*Postgraduate Institute of Science, University of Peradeniya, Sri Lanka*

^b*Department of Physical Science, Faculty of Applied Science, Vavuniya Campus of the University of Jaffna, Sri Lanka*

^c*Department of Electrical and Electronic Engineering, Faculty of Engineering, University of Peradeniya, Sri Lanka*

Alzheimer's disease is a chronic neurodegenerative disorder and the most common form of dementia. It is characterized by cortical atrophy and disrupted anatomical connectivity as white matter fibre tracts lose axons and myelin degenerates. Biomarker tests are crucial to identify the early stages of the disease. It is currently a key priority in Alzheimer's research to develop neuroimaging biomarkers that can accurately identify individuals in any clinical stage of the disease. Magnetic resonance imaging (MRI) can be considered the preferred neuroimaging examination for Alzheimer's disease because it allows for accurate measurement of the 3-dimensional volume of brain structures. Diffusion Magnetic Resonance Imaging (DMRI), one of the methods, provides insights into aspects of brain anatomy that could never previously be studied in living humans. A comprehensive study of structural brain network in Alzheimer's has been developed using diffusion MR imaging and graph theory algorithms, that can assess the white matter connections within the brain, revealing how neural pathways damaged in Alzheimer's disease. A range of measurements of the network properties were calculated and the pattern of the community structure and the hub regions of the network were inspected. Global measures of efficiencies, clustering coefficients and characteristic path length confirms the disrupted overall brain network connectivity of Alzheimer's. Relatively the same pattern of hub regions is preserved in Alzheimer's, however, non-hub regions are affected, which indicates disease alters the internal pattern of the network especially the community structure. Modular analysis confirms this alteration and produces a different modular structure and increased number of modules in Alzheimer's. Regional connectivity measures also indicated this change and the measures demonstrated the network centrality shifted from right hemisphere to left in Alzheimer's. The knowledge gained from this study will support to find the strong imaging biomarkers of the Alzheimer's disease.

Keywords: Alzheimer's disease, brain network, Diffusion MR imaging, graph theory algorithms

¹ Corresponding author: Jeyasuthan Mahadevan; Tel.: +94-77-404-8942
E-mail address: jeyasuthanm.rad@gmail.com

Quadcopter based Surveillance System for an Industrial Environment

G. B. H. P Gamlath, Udaya Dampage¹, H. P. M. Y. Hewawasam, C. S. W. Midigaspe,
H. M. S. U. Herath

Kotelawala Defence University, Sri Lanka

The protection of industrial infrastructure is a growing concern within industrial environments. Utilization of humans for efficient surveillance and security monitoring in a large area is inefficient since humans generally fail to maintain the concentration for longer periods of time and also due to cost involvement in employing sufficient human labor. A system architecture and design for a perimeter security system to address the aforesaid issue for large industrial facilities such as airports, seaports, logistic storage complexes and military establishments was being developed as the outcome of our research. It employs an integrated multisensory system to detect, assess and track perimeter intrusions. These sensors are integrated together into a standalone system that acquire, on processing and analyzing the probability of possible threat scenarios ignoring nuisance alarms. Upon finalizing an acquired threat, a quadcopter is autonomously dispatched to the location using an advanced location identification system, which will prioritize the locations according to the severity of threat whilst also alerting the security staff. On reaching the location, the quadcopter provides a real-time video feed while maintaining the focus on the detected target. This system is designed to operate on 24/7 in all-weather condition. A command and control center provides situational awareness to facilitate the security personnel responsible for monitoring and managing incidents. Due to the outcomes of this research, human security personnel will be provided with more relaxation in order to facilitate them to focus on tasks which demand cognitive skills. The proposed method will enhance the surveillance capacity of an installation as well as the rapid deployment capability ultimately leading to an efficient and effective security system with adequate defense in depth which is not found in conventional security systems.

Keywords: Quadcopter; Perimeter Security; Surveillance; Sensor Network

*

¹ Corresponding author. Udaya Dampage
E-mail address udayadampage@ieee.org

Investigation of the Degradation Processes Effect on the Properties of the Industrial Cutting Tool used in Packaging Process

Alina Voloshyna¹, Svitlana Romaniuk

Department of Material Science, Kharkiv Petro Vasylenko National Technical University of Agriculture, Kharkiv, Ukraine

The paper investigates the metal structure carbide inhomogeneity of the cutting tool made from high-alloy steel, used in industrial process of packaging candies, after its service life period. The chemical composition of steel is current: C - 2.2%, Si - 0.4%, Mn - 0.35%, Cr - 12.12%, Fe - 84.8%, Mo - 0.12%. The increased content of carbon and chromium leads to the formation of an amount of special doped carbides in the composition structure. Accordingly to the X-ray diffraction analysis, it was detected that the type of carbides conforms to Cr₇C₃. The amount of carbides and their size were determined with the computer program ThixometPro. As indicated by the metallographic analysis of the separate zones of the tool, the size and the number of special doped carbides differ in the images of the metal structure. Therefore, the structure of the middle part and at the edge of the operating surface were comparatively analyzed. The total amount of carbides in the middle part of the tool structure equals 14.4% of the metal matrix and reaches 8.15% at the edge of the operating surface. The structural inhomogeneity and the presence of large doped carbides were detected in the middle zone, wherein, the share of small carbides is 20.8% of the total volume of the carbide phase. There is a lack of large special carbides and the area of 69.2% carbides is not exceeding 4.75 μm at the distance up to 100 μm from the edge of the working surface. Moving further from the edge, the area and volume of carbides increase. The carbide inhomogeneity along the cross-section occurs as a result of doped carbides crushing under the stresses action during the service life. From the working surface edge to the depth dispersed carbides are lining up at an angle of 45°, forming centers of crack initiation. In virtue of the analysis, it is recommended to apply an additional hardening by the PVD method to stabilize the operating surface layer under the deformation.

Keywords: carbide inhomogeneity; special carbides; doped carbides

¹ Corresponding author: Alina Voloshyna; Tel.: +38-067-372-5000
E-mail address: Voloshkinaaa@gmail.com

Voltage Sag Compensation using Dynamic Voltage Restorers: A Performance Analysis

K. M. P. C. B. Senevirathne, A Jayasundera, K. A. Ariyawansa, P. G. Abeynayake,
Udaya Dampage¹

Kotelawala Defence University, Sri Lanka

Voltage sags are considered to be one of the most severe and frequent power disturbances occurring in the power system. The electronic devices used today are very sensitive to power quality, any disturbance in the power supply will negatively affect end user equipment. In order to overcome these voltage sags, implementation of a dynamic voltage restorer (DVR) has been proposed to compensate for voltage sags. Hence this technology can provide power regulation as well as power quality improvement. Electric vehicle (EV) batteries, connected in a vehicle-to-grid (V2G) system, act as the power source to the DVR, offering feasibility as well as mobility in delivering energy, thereby making it an ideal choice for energy storage used for improving power quality. This paper presents a simulation, using MATLAB, on the performance of a Dynamic Voltage Restorer (DVR) which utilizes energy from the batteries of Electric Vehicles (EV) as its power source.

Keywords: Power Quality; Voltage Sag; Voltage Correction; EV Battery; Vehicle-to-Grid Technology; Dynamic Voltage Restorer.

*

¹ Corresponding author. Udaya Dampage
E-mail address udayadampage@ieee.org

Technology Enabled Formative Assessment in Medical Education

P. Youhasan^{a,1}, A. R. M. Sanooz^b

^a*Department of Medical Education & Research, Eastern University, Sri Lanka.*

^b*Department of Clinical Sciences, Eastern University, Sri Lanka.*

Technology enabled assessment is a novel pedagogical approach which has emerged into Medical educational practice. The main aim of formative assessment is to drive learning through constructive feedback. Kahoot is a free, real-time, game based, Web2.0 learning platform which is widely accepted to conduct formative assessment. The aim of this study was to explore the students' perception on using Kahoot as a formative assessment tool at Eastern University Sri Lanka. A total number of 61 third year medical students participated in this cross sectional descriptive study following a pharmacology formative assessment conducted via Kahoot. The student perceptions on Kahoot experience was evaluated by a self-administered questionnaire which consisted 10 perception statements. The participants asked to rate the statements by using 5-point Likert scale, ranging from 1 (Strongly disagree) to 5 (Strongly agree). Descriptive statistics was computed to present students' perception. This study revealed that most of the students (83.6%) felt happy with Kahoot experience in conducting the formative assessment and (95.1%) of them recommended Kahoot for formative assessment in future. Majority of the participants (>90%) agreed or strongly agreed that Kahoot increases the focus on subjects, provides fun during learning, motivates to learn and is an effective method for active learning and providing feedback. The general outcome shown in this study derived from the students gives Kahoot a place as a tool to enhance the learning and to provide feedback. The free availability, feasibility, the technical simplicity and the enjoyable attitude from the students towards this application make this as a practical tool in Technology Enabled Assessment.

Keywords: Formative assessment; Technology-Enhanced-Assessment; Kahoot; Pharmacology

¹ Corresponding author. P.Youhasan Tel.: +94-77-656-2333
E-mail address: youhasanp@esn.ac.lk

An Initial Study on Understanding the Effect of Questions Structure on Students' Exam Performance

S. Wijesinghe¹, K.P.C. Irosha, Thilini Rupasinghe

Department of Applied Computing, Faculty of Computing and Technology, University of Kelaniya, Sri Lanka.

The main challenge in evaluating students' performance is creating effective assessments which appraises students' learning rather than their memory power and the practice. According to education theories, creative and carefully designed assessments can clearly evaluate the degree of learning in students. "Scaffolding" which refers to the degree to which a question guides the student through the problem-solving process is a widely used method in aiding students' learning and conceptual understanding and assessing students' performance in Science and Technology education. The objective of the current study was to understand the impact of exam question structure on the performance of first year undergraduates specifically focusing on understanding the effect of scaffolded questions. In the current Sri Lankan science education context, there is only a limited number of research studies that are available which provides an insight into the relationship between students' performance and question features. Current study which was designed to address this issue was conducted as a part of the Chemistry for Technology course at the Faculty of Computing and Technology, University of Kelaniya, Sri Lanka. In this study, two different structures of the same questions were given to students as a part of an in class quiz. First one was a direct question and the second version (scaffolded question) included the same question in a step by step manner and in the latter version, students had to answer several steps to solve the problem. Marks obtained for the two versions were averaged and compared to investigate whether there is any significance of the structure of the questions towards the performance of students. Average mark for the scaffolded question was 82(± 20) and the direct question was 71(± 35). According to the results, it was clear that the students meet a considerable difficulty in the understanding the direct questions and the scaffolding of questions results in an increase of the performance of students. According to preliminary data, it can be concluded that scaffolding of questions preferentially assist students performance at examinations and surface features such as the structure of the question can play a key role in students' performance at the examinations. Further studies are currently being conducted to understand whether there is any specific correlation between the improvement in performance as a consequence of scaffolding with the gender, school district and students' English literacy.

Keywords: Assessment; Higher Education; Learning Process; Scaffolding

¹ Corresponding author: S. Wijesinghe: Tel.: +94-71-112-8504
E-mail address: chamalika89@gmail.com

