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The 12th International Conference
on Advances in Information Technology

29th June – 1st July 2021, Bangkok, Thailand

Book of Abstracts

Intelligence and Innovation for
Digital Business and Society



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PREFACE

The 21st century has witnessed an accelerated development of various information and communication technologies. At the same time, there have been a lot of efforts to utilize these information technologies for providing innovative and non-precedent services to the divergent demands of end users. Also, there are widespread applications of various information and communication technologies to different business, services and social sectors such as green convergence, next generation broadcasting and media, mobile convergence, financial technologies, healthcare, and several other smart applications. This year the core theme of the conference is “Intelligence and Innovation for Digital Business and Society,” focusing on the digital disruption of the ICT technologies and their impact on several business aspects and the society in general. IAIT2021 aims to be a unique global event for the researchers, academics and industry professionals and bring all of them under one roof for interaction and dissemination of information regarding the latest developments and applications in the emerging ICT centric applications for a futuristic digital business and society.

The 12th International Conference on Advances in Information Technology: IAIT2021 is being organized from 29th June to 1st July 2021 by the School of Information Technology, King Mongkut’s University of Technology Thonburi (SIT-KMUTT), Bangkok, Thailand. For the second time in a row the COVID-19 pandemic has forced us to conduct this conference in a fully online format. IAIT2021 will publish 39 high quality research papers, including 4 papers belonging to the special session of JSCI (Joint Symposium on Computational Intelligence) organized in co-operation with the IEEE-CIS (Computational Intelligence) Thailand Chapter.

This year IAIT2021 received a total of 83 submissions from 15 countries across the globe. A stringent peer-review process was followed, ensuring that 39 high quality submissions were accepted for publication (acceptance rate of 46.98%), with an average number of more than 3 reviews per paper. Our reviewers are spread across 23 different countries. All the presented papers will be published in the ACM ICPS series.

The entire IAIT2021 organizing committee would like to sincerely thank all the keynote speakers, invited speakers, authors, reviewers, program committee members, and all the supporting staff, without whose help and efforts we wouldn’t have been able to organize this event. Our special thanks also go to the entire team at ACM for their constant help and support. We hope that IAIT will continue to be a leading platform for knowledge dissemination and sharing that will be beneficial for this society.



June 29, 2021

SCHEDULE

8.30 – 8.55	Open Ceremony	
9.00 – 10.00	Keynote Speaker Prof. Himanshu Thapliyal Department of Electrical and Computer Engineering, University of Kentucky, Lexington, KY, United States Topic: Energy and Cybersecurity Constraints in Smart Systems	
Session 1: Machine Learning & Data Visualization Session Chair: Dr. Ashish Ghosh, Indian Statistical Institute, Kolkata, India		Session 2: Human-machine Analytics & Computer Vision for Healthcare Session Chair: Dr. Chakrinda Nukoolkit, King Mongkut's University of Technology Thonburi, Bangkok, Thailand
10.30 – 10.55	Interactive Online Configurator via Boolean Satisfiability Modeling (#7) Tao Tao and David Plaisted	10.30 – 10.55 Color blind: Can you sight? (#5) Ngan V.T. Nguyen, Vinh The Nguyen and Tommy Dang
10.55 – 11.20	Interactive Qualitative Data Visualization for Educational Assessment (#34) Huyen N. Nguyen, Caleb M. Trujillo, Kevin Wee and Kathleen A. Bove	10.55 – 11.20 Visualizing Developing Nations Health Records: Opportunities, Challenges and Research Agenda (#33) Afarefuna Umejaku and Tommy Dang
11.20 – 11.45	Computing Resource Estimation by using Machine Learning Techniques for ALICE O2 Logging System (#12) Juthaporn Vipatpakpaiboon, Vasco Chibante Barroso and Khajonpong Akkarajitsakul	11.20 – 11.45 Link Prediction for Biomedical Network (#60) Chau Pham and Tommy Dang
11.45 – 12.10	Phytochemicals as potential inhibitors for novel coronavirus 2019-nCoV/SARS-CoV-2: a graph-based computational analysis (#48) Monalisa Mandal	11.45 – 12.10 HMaViz: Human-machine analytics for visual recommendation (#4) Ngan V.T. Nguyen, Vung Pham and Tommy Dang
Lunch		
13.15 – 13.45	Invited Speaker Ms. Pornthip Kongchun COO and Co-Founder at Jitta, Thailand Topic: Managing Startup through a Crisis of Pandemic: A Case of Thailand	
Session 3: Applications of Deep Learning Session Chair: Dr. Tomasz Mszczyski, A*STAR - Agency for Science, Technology and Research, Singapore		Session 4: Robotics, Intelligent systems, and Applications of IoT Session Chairs: Dr. Chinnapong Angsachotmetee (Prince of Songkla University, Thailand) & Dr. Monalisa Mandal (Xavier University, Bhubaneswar, India)
14.00 – 14.25	Deep Learning for Bibliographic Catalogue Assisting System (#9) Suthathip Maneewongvatana and Aiplak Suntornacane	14.00 – 14.25 Investigation of SIFT and ORB descriptors for Indoor Maps Fusion for the Multi-agent mobile robots (#61) Ming-Hsien Chuang and Kanjanpan Sukvichai
14.25 – 14.50	An Application of Evaluation of Human Sketches using Deep Learning Technique (#40) Sarayut Thibhohdee and Waporn Vyanon	14.25 – 14.50 Urban Flood Management: Bangkok Survey (#74) Narongrit Waraporn, Vajirasak Vanija, Montri Supattatham, Olarn Rojanapornpun, Nannapat Termak and Piraporn Sirisawatthana
14.50 – 15.15	Precipitation Nowcasting Using Deep Learning on Radar Data Augmented with Satellite Data (#68) Wilom Tosiri, Nutnaree Kheawritikul, Patamawadee Leepasomboon, Natnapat Gaviphatt, Hidetomo Sakano, Peerapon Yateekul	14.50 – 15.15 Robust Adaptive Beamforming using Desired Signal Steering Vector Estimation and Variable Loading (#39) Raungrong Suleesathira
15.15 – 15.40	Augmented Reality with Mask R-CNN (ARR-CNN) inspection for Intelligent Manufacturing (#22) Tawatchai Perdpunya, Siranee Nuchitprasitchai and Puchadee Boonrawd	15.15 – 15.40 A DEVELOPMENT OF PERSONALITY RECOGNITION MODEL FROM CONVERSATION VOICE IN CALL CENTER CONTEXT (#49) Nakorn Srinarong and Janjao Mongkolkevin



June 30, 2021

8.30 – 9.30	Keynote Speaker Prof. Irwin King Department of Computer Science & Engineering, The Chinese University of Hong Kong Topic: Graph Embedding	
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Session 5: Virtual Reality, Neural Networks and Time-series Data Session Chair: Dr. Tuul Triyason, King Mongkut's University of Technology Thonburi, Bangkok, Thailand		Session 6: Image Processing & AI Session Chair: Dr. Sansanee Auephanwiriyakul, Chiang Mai University, Chiang Mai, Thailand
10.30 – 10.55	ViLSTM: Visual Explainable LSTM for Multivariate Time Series (#13) Tommy Dang, Huyen Nguyen and V.T. Ngan Nguyen	10.30 – 10.55 Open source disease analysis system of cactus by artificial intelligence and image processing (#36) Kanlayanee Kweesinsakul, Siranee Nuchitprasitchai and Joshua Pearce
10.55 – 11.20	OutViz: Visualizing the Outliers of Multivariate Time Series (#32) Jake Gonzalez and Tommy Dang	10.55 – 11.20 Afghanistan Vehicle Number Plate Detection and Recognition Using Image Processing and Convolutional Neural Networks (#56) David Hamdard and Worarat Krathu
11.20 – 11.45	Real-time Sound Visualization via Multidimensional Clustering and Projections (#16) Nhat Le, Ngan V.T. Nguyen and Tommy Dang	11.20 – 11.45 The 3-dimensional Plant Organs Point Clouds Classification for the Phenotyping Application based on CNNs. (#59) Kanitha Rungruam, Kanjanapan Sukvichai and Teera Phatpormnant
11.45 – 12.10	SkeletonVR: Educating Human Anatomy Through An Interactive Puzzle Assembly (#31) Jake Gonzalez, Chau Pham, Afarefuna Umejaku, Juanita Benjamin and Tommy Dang	11.45 – 12.10 Multi-Class Primary Morphology lesions Classification Using Deep Convolutional Neural Network (#50) Naqibullah Vakili, Worarat Krathu and Nongnuch Laomaneerattanaporn
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13.15 – 13.45	Invited Speaker Dr. Julia Neidhardt The E-Commerce Research Unit, TU Wien, Austria Topic: Digital Humanism	
Session 7: Cybersecurity & Network Management Session Chair: Dr. El-Sayed M. El-Atfy, King Fahd University of Petroleum and Minerals, Saudi Arabia		Session 8: Deep Learning, Natural Language Processing and Text Mining Session Chair: Dr. Pital Setthawong, Assumption University, Bangkok, Thailand
14.00 – 14.25	A Privacy Preservation Model for RFID Data-Collections is Highly Secure and More Efficient than LKC-Privacy (#43) Surapon Riyana and Noppamas Riyana	14.00 – 14.25 Unsupervised Segmentation of Non-Intersecting Manifolds (#54) Subhadip Boral, Suredha Dhar and Ashish Ghosh
14.25 – 14.50	A model of Cyber Threat Information Sharing with the Novel Network Topology (#42) Jari Hautamaki and Timo Hamalainen	14.25 – 14.50 Sentiment Polarity Classification using Minimal Feature Vectors and Machine Learning Algorithms (#55) Nwan Wattanakrungraj, Nichapat Pingo and Sasiporn Tongman
14.50 – 15.15	A Study of Effect of Architectural Design on Quality of Service of a Live Streaming Application with Multiple Endpoints over LTE Network (#53) Charif Prapawit and Chinnapong Angsachotmetee	14.50 – 15.15 Exploiting Multilingual Neural Linguistic Representation for Sentiment Classification of Political Tweets in Code-mix Language (#65) Rajkumar Kannan, Sridhar Swaminathan, Chulipom Anutanya and Vaisnavi Saravanan
15.15 – 15.40	Assuring long-term operational resilience in a pandemic: Lessons learned from COVID-19 (#8) Stefan Hofbauer and Gerald Quichmayr	15.15 – 15.40 Web Components Template Generation from Web Screenshot (#20) Pattana Anunphop and Prabhas Chongthitvatana



July 1, 2021

8.30 – 9.30	Keynote Speaker Prof. Simon Fong The Computer and Information Science Department, the University of Macau, Macau Topic: Machine Learning at its Best for Novel Applications	
9.45 – 10.45	Keynote Speaker Prof. Susmita Ghosh Department of Computer Science & Engineering, Jadavpur University, Kolkata, India Topic: Big Data and Cognitive Computing	
Session 9: Technology Management & Data Privacy Session Chair: Dr. Sotarat Thammabosadee, Mahidol University, Bangkok, Thailand		Session 10: JSCI (Special Session) Session Chair: Dr. Kuntipong Woraratpanya, King Mongkut's Institute of Technology Ladkrabang, Bangkok, Thailand
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		12.15 – 12.40 Building Energy Consumption Forecasting: A Comparison of Gradient Boosting Models (#78) Abinash Bassi, Anika Shenoy, Arjun Sharma, Hanna Sigurdson, Connor Glossop and Jonathan H. Chan
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Interactive Online Configurator via Boolean Satisfiability Modeling

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ABSTRACT

Manufacturing companies widely use interactive configurators to specify product variants. These variants are created from different combinations of individual components. Constraints are usually imposed as relations between components to rule out invalid product configurations. The configurator and its underlying algorithm ensure the product specified by the user satisfies all constraints. We provide a method that models the online configurator as a series of highly parallelizable boolean satisfiability problems (SAT). Our methodology is facilitated by state-of-the-art tools such as the Microsoft Z3 theorem prover. Additionally, we confirm that the configurator problem is NP-complete. Hence, using SAT solving is not only natural but canonical.

KEYWORDS

Configurator, satisfiability, parallel computing, user experience, Z3

Interactive Qualitative Data Visualization for Educational Assessment

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ABSTRACT

Data visualization accelerates the communication of quantitative measures across many fields, including education, but few visualization methods exist for qualitative data in educational fields that capture both the context-specific information and summarize trends for instructors. In this paper, we design an interface to visualize students' weekly journal entries collected as formative educational assessments from an undergraduate data visualization course and a statistics course. Using these qualitative data, we present an interactive WordStream and word cloud to show the temporal and topic-based organization of students' development during instruction and explore the patterns, trends, and diversity of student ideas in a context-specific way. Informed by the Technology Acceptance Model, we used an informal user study to evaluate the perceived ease of use and usefulness of the tool for instructors using journal entries. Our evaluation found the tool to be intuitive, clear, and easy-to-use to explore student entries, especially words of interest, but might be limited by focusing on word frequencies rather than underlying relationships among the student's ideas or other measures in assessment. Implications and challenges for bridging qualitative data for educational assessment with data visualization methods are discussed.

KEYWORDS

WordStream, interactive data visualization, qualitative data, formative educational assessments, learning analytics, Technology Acceptance Model

Computing Resource Estimation by using Machine Learning Techniques for ALICE O² Logging System

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ABSTRACT

Resource estimation is a technique used to estimate computing resources of a system based on historical data and make the system more efficient. There are many researchers who apply machine learning to estimate the computing resources and fulfill their problems. The European Organization for Nuclear Research (CERN) is currently developing a new logging system for A Large Ion Collider Experiment detector (ALICE) based on the Elastic Logstash Kibana (ELK) software stack. Beat which is a data shipper installed on the First Level Processor (FLP) nodes will receive the log data and transfer these to Logstash, a data preprocessing pipeline. It ingests the data and sends the ingested data to Elasticsearch which is a search and analytics engine. The difficulty of this work is about how to handle the large cluster which in future, the number of nodes may increase or decrease, and the number of services in the machine likewise. To make the system more reliable and adaptable to change, a regression model can be used to estimate and plan the number of resources for Logstash. In this paper, we use Metricbeat to get the historical computing metrics of machines from Logstash. In order to find an appropriate regression model, we applied different machine learning algorithms including random forest regression, multiple linear regression, and multi-layer perceptron. The efficiency of these models is measured and compared using coefficient of determination, mean absolute error (MAE) and mean squared error (MSE). The experimental results show that our random forest regression model can outperform the others in both the tuned and not tuned models for estimating CPU, memory and disk space. However, in terms of the training time, the multiple linear regression model spends less time due to the lower number of parameters and lower complexity of the model.

KEYWORDS

ALICE, CERN, Regression, Resource Estimation, Resource Planning, Machine Learning; Multiple Linear Regression, Random Forest Regression, Multi-Layer Perceptron

Image Phytochemicals as potential inhibitors for novel coronavirus 2019-nCoV/SARS-CoV-2: a graph-based computational analysis

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ABSTRACT

Coviruses (CoVs) are a group of infectious viruses that causes the regular cold to more extreme illnesses like Middle East Respiratory Syndrome (MERS-CoV), Severe Acute Respiratory Syndrome (SARS-CoV) and epic Covid (nCoV) is another strain that has been recently recognized in people. There is an urgent need for the development of effective prevention and treatment strategies for 2019-nCoV/SARS-CoV-2 outbreak. Reducing the clinical trial period of existing as well as new drugs, the phytochemicals present in natural products would be helpful to get a quick treatment solution for this pandemic. Here computationally some of the effective phytochemicals are identified for treating Covid. Publicly available databases have been used for collecting the phytochemicals and their interacting genes and Corona virus interacting genes. Then a bipartite graph has been built with two sets of inputs; one set is the set of phytochemicals and the second set is the set of viruses. Then the eigen vector centrality which is the measure of most influential node in a graph has been calculated for each phytochemical. We found four such phytochemicals having the top four eigen vector score. Then again, all possible cliques from the bipartite graph have been calculated and it has been seen that the same top four phytochemicals are present in almost all the bicliques. Then finally these top four phytochemicals have been validated using.

KEYWORDS

Bipartite Graph, Phytochemicals, Coronavirus, Biclique, Eigencentality

Color blind: Can you sight?

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ABSTRACT

Virtual 3D conferences are emerging communication channels as a substitution for face-to-face fashion due to the advancement of technologies and the covid-19 pandemic. Current efforts focus on bringing contents into 3D virtual space while delivering them to the color vision deficiency have not been taken into account. To alleviate the stated issue, this paper presents a prototype for colorblind people to simulate the same experience as normal ones. Our method helps users: 1) understand the presented content through adjusted color filtering in such a way that similar colors can be differentiated by the brightness, 2) apparently-identical colors can be varied by the color transformation. Our proposed prototype is demonstrated through three use cases setup in three conditions such as traffic lights, fruit color differentiation, and graph reading in a virtual meeting room. A pilot study conduct with 29 participants shows that our proposed method can improve color differentiation and accuracy for color-blind.

KEYWORDS

Color Blind, Color filter, Virtual Reality

Visualising Developing Nations Health Records: Opportunities, Challenges and Research Agenda

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ABSTRACT

The benefits of effectively visualizing health records in huge volumes has resulted in health organizations, insurance companies, policy and decision makers, governments and drug manufactures' transformation in the way research is conducted. This has also played a key role in determining investment of resources. Health records contain highly valuable information; processing these records in large volumes is now possible due to technological advancement which allows for the extraction of highly valuable knowledge that has resulted in breakthroughs in scientific communities. To visualize health records in large volumes, the records need to be stored in electronic forms, properly documented, processed, and analyzed. A good visualization technique is used to present the analyzed information, allowing for effective knowledge extraction which is done in a secured manner protecting the privacy of the patients whose health records were used. As research and technological advancement have improved, the quality of knowledge extracted from health records have also improved; unfortunately, the numerous benefits of visualizing health records have only been felt in developed nations, unlike other sectors where technological advancement in developed nations have had similar impact in developing nations. This paper identifies the characteristics of health records and the challenges involved in processing large volumes of health records. This is to identify possible steps that could be taken for developing nations to benefit from visualizing health records in huge volumes.

KEYWORDS

Visualisation, Health records, Developing Nations

Link Prediction for Biomedical Network

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ABSTRACT

Network datasets are seen ubiquity in many fields, such as protein interactions, paper citation, and social networks. While some networks are well-defined, many others are not. For example, the interactions of proteins in cancer pathways are still studied by system biologists and medical researchers. Therefore, one of the primary analytic tasks to perform on these networks is link prediction, where we desire to reveal some unknown relationships with certain levels of confidence. In this paper, we carry out some experiments on network datasets in the biomedical domain using state-of-the-art Graph Neural Networks. The results show that entity's values facilitate graph-based models to perform well on uncovering latent relationships in biomedical research and potentially be extended on other application domains.

KEYWORDS

Biomedical pathway, link prediction, graph neural network

HMaViz: Human-machine analytics for visual recommendation

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ABSTRACT

Visualizations are context-specific. Understanding the context of visualizations before deciding to use them is a daunting task since users have various backgrounds, and there are thousands of available visual representations (and their variances). To this end, this following research goals: (1) to automatically generate a number of suitable representations for visualizing the input data and present it to users as a catalog of visualizations with different levels of abstractions and data characteristics on one/two/multi-dimensional spaces (2) to infer aspects of the user's interest based on their interactions (3) to narrow down a smaller set of visualizations that suit users analysis intention. The results of this process give our analytics system the means to better understand the user's analysis process and enable it to better provide timely recommendations.

KEYWORDS

Datasets, neural networks, gaze detection, text tagging

Deep Learning for Bibliographic Catalogue Assisting System

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ABSTRACT

Academic libraries play a major role in providing the information and resources to support formal and informal learning. In order to provide the circulation service, librarians have to deal with the cataloguing process after acquisition. Cataloguing has been a major workload process that requires the intellectuals of librarians. With different experiences of the librarians and the complexity of the content, the quality of cataloguing information and the time spending is out of control. This study developed a catalogue assisting model to reduce the bottleneck of assigning subject access fields in bibliographic records which presumed as the most difficult task in the cataloguing process. The Neural Network models were built by applying the words appearing in the title and table of contents of bibliographic records as the input and predict the list of suggested subjects. The performance of the models was evaluated through the value of precision, recall, and the percentage of bibliographic records that correctly assigned at least 1 subject. The experimental results suggested that combining the suggested subject list obtained from the title word and table of content word models provides better results than using only an individual model.

KEYWORDS

Machine learning, Neural networks, Specialized information retrieval

An Application of Evaluation of Human Sketches using Deep Learning Technique

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ABSTRACT

This research is a study of the evaluation of full-body sketches and the principle of the Human Pose Estimation using the OpenPose library, a method to detect 18 keypoints on a human structure. The dataset used in this research was drawing sketches of 22 firstyear students, each of whom drew three drawings of three models. Detected keypoints are calculated to determine the angle and distance between keypoints, which provides 26 features. These features were modeled using ANN for predicting the grades of drawings classified as good, moderate, poor, with parameters tuned to find optimal values and evaluating the model performance using accuracy.

KEYWORDS

Artificial Neural Network, human pose estimation, human skeleton

Precipitation Nowcasting Using Deep Learning on Radar Data Augmented with Satellite Data

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ABSTRACT

Precipitation nowcasting with a physics-free deep learning method is assumed to open new avenue of weather prediction. However, it is limited to regions where ground-based weather radars can operate for nowcasting. We propose an improved deep learning precipitation prediction by integrating the precipitation data from Japan Aerospace Exploration Agency (JAXA)'s Global Rainfall Watch (GSMAP) with the precipitation data from WEATHERNEWS Co., Ltd., which provides precipitation data with Type C Doppler radars that detect precipitation in the atmosphere. It has been demonstrated that our proposed method can improve precipitation data coverage areas and the efficiency of precipitation nowcasting by the proposed deep learning technique in many extreme weather cases, i.e., typhoons.

KEYWORDS

Precipitation Nowcasting; U-NET; deep learning; data-fusion; convolutional neural network.

Augmented Reality with Mask R-CNN (ARR-CNN) inspection for Intelligent Manufacturing

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ABSTRACT

The machine is the main factor that is used to manufacture products in factories. It has been developed to work with high efficiency as a smart machine to enter the production of Industry 4.0 era. Therefore, the inspection and maintenance of machinery must be developed accordingly, but most of the factory problems still operate as before and there are data delays for analysis, evaluation and preventive maintenance. This research focuses on solving machine inspection problems by presenting models that apply Augmented Reality technology that uses Object Detection and Marker techniques on real world machines with Mask R-CNN algorithm while connecting everything in the virtual world to allow Inspector to perform intelligent inspections. In this research, we will demonstrate the working process of the presented model and the real machine data preparation process in the factory to train the model to learn and clearly taken back to installation and testing on Inspector mobile devices. With this model, we combine this method with Computer Vision to provide the system with instant precision tracking and detection. This research result provides the accuracy of the search and is acceptable to the user which they selected the machines and images for us to use to do all the new trained dataset and we randomly selected an image in there to do a test dataset and put it back to use with precision without any real world change.

KEYWORDS

Additional Keywords and Phrases: Augmented Reality, industry 4.0, Smart maintenance, Object Detection, Mask R-CNN

Investigation of SIFT and ORB descriptors for Indoor Maps Fusion for the Multi-agent mobile robots

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ABSTRACT

There are many applications for creating an indoor map by a single robot already. However, to increase the performance and the robustness, a multi-agent robot system is needed especially for large area of working space such as a factory. Multi-Agent Robot System (MAR) could increase productivity and flexibility while working in a dynamic environment because it is modular and can work simultaneously. When it combines with Simultaneous Localization and Mapping (SLAM) technology, it can explore and discover the indoor environment cooperatively and simultaneously. The main issue of a MAR is how to combine maps from robots correctly. Each robot creates its map with different initial poses and path planning. In this research, we will focus on algorithms of map merging. SIFT and ORB descriptors are selected along with some image processing technique, and the proposed approach including the algorithms is verified by general benchmark map data. The results will be shown and discussed. Then, the proposed approach will be deployed into a real robot platform based on Robot Operating System (ROS). Experiments will be conducted to prove the feasibility and the limitation of the proposed approach in the real-world scenario.

KEYWORDS

Robotics, Multi-Agent, SLAM, Map Merging, ROS

Urban Flood Management: Bangkok Survey

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ABSTRACT

Nowadays, Completeness of flood management by the city authority has been limited. The requirement from the city, residents, and city staffs must be integrated with the digital technology disruption and the global climate change in order to design the flood management platform with its comprehensiveness. The survey from experts of flood management team was conducted. The result of the survey incorporated with the modern flood prediction models such as rain model, canal and sewer model, water over flow model, water gate and pump simulation and warning system were proposed. In order to gain the social responsibility of community, the city community platform for flood events must include the resident enable system and city staff enable system.

KEYWORDS

Urban Flood Survey, Open Data, City Community Platform, ML

Robust Adaptive Beamforming using Desired Signal Steering Vector Estimation and Variable Loading

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ABSTRACT

It is known that the desired signal steering vector error, the number of signal samples and the input signal to noise ratio (SNR) are crucial factors to the adaptive beamforming performance. In the presence of steering vector mismatch or lack of samples or strong desired signal, the minimum variance distortionless response (MVDR) beamformer can generate the distorted mainbeam with high sidelobe levels. Diagonal loading of the sample covariance matrix is a widespread technique to provide robustness against such cases. However, there is a tradeoff between the robustness improvement and interference and noise cancellation capability to determine a proper value of loading. Rather than a fixed loading as the diagonal loading, variable loading can provide more robust and protect the rising sidelobe levels in the presence of mismatch. To remedy the effect of mismatch, the presumed desired signal steering vector is utilized to estimate its actual one. The estimation is done by the max/min optimization of the array output power. Then, an algorithm to create the robust MVDR beamformer against the desired signal steering vector mismatch is presented by using the estimated desired signal steering vector and variable loading. Simulation results show that the proposed method has significantly beam pattern improvement when the error due to the steering vector mismatch, small number of signal samples and high input SNR exist.

KEYWORDS

Antenna array, Adaptive beamforming, Diagonal loading, Direction of arrival, Steering vector mismatch, Variable loading

A DEVELOPMENT OF PERSONALITY RECOGNITION MODEL FROM CONVERSATION VOICE IN CALL CENTER CONTEXT

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ABSTRACT

A call center is an important communication channel between a business and its customers. The call center staffs are responsible for resolving customer problems and fulfilling their needs. It is undeniable that customer satisfaction can be increased if personalized services relating to their characteristics such as personality are provided. Researches are suggesting that a person's personality can be recognized from his/her conversational voice. Thus, a machine learning model that recognizes each customer's personality from one's conversational voice in a call center would enable the cell center to give that one appropriate response. This study focuses on developing a personality recognition model to predict each MPI (Maudsley Personality Inventory) personality dimension from each conversational voice. The MPI personality dimension includes E-scale (representing extraversion and introversion) and N-scale (representing neuroticism and stability). Audio files of conversational voice were collected from 92 volunteers instructed to make conversation in the simulated call center context. Logistic regression, LinearSVC, Random forest, and Artificial neural networks were used in the modeling process. The result shows that the model generated by using Artificial neural networks has the best performance on predicting the E-scale. The model has the positive predictive value (Introversion prediction) and the negative predictive value (Extraversion prediction) equal to 0.71 and 0.75, respectively. No model shows satisfying performance on neuroticism and stability prediction. This study shows a piece of evidence that extraversion and introversion in MPI, which have implications in businesses, can be effectively recognized from each person's conversational voice made through call centers. The model can be beneficial in many business applications such as call center management, personalized product offering, and personalized advertisement.

KEYWORDS

Call center, Personality recognition, Machine Learning, The Maudsley Personality Inventory

VixLSTM: Visual Explainable LSTM for Multivariate Time Series

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ABSTRACT

Neural networks are known for their predictive capability, leading to vast applications in various domains. However, the neural network model's explainability remains enigmatic, especially when the model comes short in learning a particular pattern or features. This work introduces a visual explainable LSTM network framework focusing on temporal prediction. The hindrance to the training process is highlighted by the irregular instances throughout the whole architecture, from input to intermediate layers and output. Interactive features support users in customizing and rearranging the structure to obtain different network representations and perform what-if analysis. To evaluate our approach's usefulness, we demonstrate the application of VixLSTM on the various datasets generated from different domains.

KEYWORDS

Neural Networks, Deep Learning Scatterplot, Time Series Visualization

OutViz: Visualizing the Outliers of Multivariate Time Series

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ABSTRACT

This paper proposes OutViz, a dual view framework for representing and filtering multivariate time series data to highlight abnormal patterns in a dataset. The first view of the proposed visualization incorporates a parallel coordinate chart that allows the user to analyze the scores of features extracted from a dimensionality reduction density-based clustering outlier detection algorithm to determine why a particular time series is predicted to be an outlier. Also included on the parallel coordinates chart is an outlier score rank axis that allows the user to select a range of time series data to be filtered and displayed on the second view of the framework. The second view of our proposed framework uses a multi-line chart to represent how each time series variable changes over a range of time. Each time series is represented as a line with the position on the horizontal axis representing a point in time, while the vertical axis encodes the data value. Use cases using real-world multivariate time series data are demonstrated to show the advantages of using the proposed framework for data analytics as well as some findings uncovered while using OutViz on life expectancy data from 236 countries between the year 1960 and 2018, and carbon dioxide emissions data from 210 countries between the year 1960 and 2016.

KEYWORDS

Outlier Detection, Dimensionality Reduction, Density-based Clustering, Parallel Coordinates

Real-time Sound Visualization via Multidimensional Clustering and Projections

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ABSTRACT

Sound plays a vital role in every aspect of human life since it is one of the primary sensory information that our auditory system collects and allows us to perceive the world. Sound clustering and visualization is the process of collecting and analyzing audio samples; that process is a prerequisite of sound classification, which is the core of automatic speech recognition, virtual assistants, and text to speech applications. Nevertheless, understanding how to recognize and properly interpret complex, high-dimensional audio data is the most significant challenge in sound clustering and visualization. This paper proposed a web-based platform to visualize and cluster similar sound samples of musical notes and human speech in real-time. For visualizing high-dimensional data like audio, Mel-Frequency Cepstral Coefficients (MFCCs) were initially developed to represent the sounds made by the human vocal tract are extracted. Then, t-distributed Stochastic Neighbor Embedding (t-SNE), a dimensionality reduction technique, was designed for high dimensional datasets is applied. This paper focuses on both data clustering and high-dimensional visualization methods to properly present the clustering results in the most meaningful way to uncover potentially interesting behavioral patterns of musical notes played by different instruments.

KEYWORDS

Sound visualization, Principal Component Analysis, Multivariate Clustering, Mel-Frequency Cepstral Coefficients, t-distributed Stochastic Neighbor Embedding, Human Speech Recognition

SkeletonVR: Educating Human Anatomy Through An Interactive Puzzle Assembly

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ABSTRACT

This paper proposes SkeletonVR, a VR puzzle assembly application, to facilitate the education of the human skeletal system. With the use of motion-tracked controllers, the application allows users to grab and assemble bones within the virtual environment to learn about the location and orientation of the different bones within a human skeleton while also educating them on the names of the bones being interacted with. We aim to bring a new experience to users by providing an interactive and immersive environment that makes learning more intriguing while also providing different difficulty modes to keep users engaged and challenged. We further discuss students' feedback in a VR class to identify the limitations of our approach and evaluate its usefulness. While aiming at human anatomy, our interactive puzzle assembly application can be extended to other research and application domains such as chemical compound structure assembly and structure-based drug design.

KEYWORDS

Human Anatomy, Interactive Puzzle Assembly, VR for Education, Skeletal System, Oculus Rift

Open source disease analysis system of cactus by artificial intelligence and image processing

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ABSTRACT

There is a growing interest in cactus cultivation because of numerous cacti uses from houseplants to food and medicinal applications. Various diseases impact the growth of cacti. To develop an automated model for the analysis of cactus disease and to be able to quickly treat and prevent damage to the cactus. The YOLO algorithm technique was used to analyze cactus diseases automatically distributed into six groups: 1) anthracnose, 2) canker, 3) lack of care, 4) aphid, 5) rusts and 6) normal group. Data training and testing with YOLOv5S model resulted in a precision of 89.7% and an accuracy (recall) of 98.5%, which is effective enough for further use in a number of applications in cactus cultivation. This model could be further developed into a program for analyzing cactus disease.

KEYWORDS

Cactus disease, Disease detection, YOLO, AI

Afghanistan Vehicles Number Plate Detection and Recognition Using Image Processing and Convolutional Neural Networks

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ABSTRACT

Although numerous research studies have been conducted concerning automatic vehicle number plate detection and recognition, various presented automated number plate recognition systems are devised for specific countries where number plates follow standard patterns. However, such systems cannot be applied in Afghanistan because of the different designs and the language. Moreover, due to the cursive nature, writing direction, and shape variation of the Pashto characters, the segmentation of words into isolated characters is a more complicated task. Hence, the Pashto optical character recognition is a less developed area. To date, no research study has been conducted for Afghanistan number plate detection and recognition. The details on the Afghanistan number plate include character, numbers, and each province's name. The paper presents the study of its type attempting to detect the number plate from the vehicle image and then recognize the province's name, characters, and numbers on the number plate. In particular, the new method incorporating four core steps. The first step is number plate detection applying canny edge detection based on user-defined thresholding and extracts the number plate involving several image processing techniques. The second phase is number plate adjustment using Randon transform-based techniques. The third stage is number plate segmentation isolating each character, number, and province name on the number plate using a scanning approach. The final step employs a convolutional neural network to classify the number plate's alphanumeric characters and provinces' names. In addition, two datasets have been created: the dataset for alphanumeric characters contains 2800 images of 14 classes, and the dataset for provinces' names contains 6800 images of 34 classes. The proposed models present 99.93 percent accuracy for provinces' names classification and 98.93 percent for alphanumeric characters' classification.

KEYWORDS

Afghanistan Number Plate (NP) Detection, Pashto Language

The 3-dimensional Plant Organs Point Clouds Classification for the Phenotyping Application based on CNNs.

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ABSTRACT

The rice breeding produces the high-throughput via a genotyping technology. It can rapidly test and analyze on a large number of samples while the performance of phenotypic evaluation is still very low because of the manually evaluation. Therefore, this is the main barrier retarding the new rice varieties development. This research is aimed to develop a method for classifying plant organs from 3D point cloud in order to analyze plant morphology or architecture automatically. The rice plant was scanned with a 3D laser scan machine. The points in the cloud were reduced by the skeleton skimming method because the number of points in each cloud group is too large. Thus, it is necessary to preprocess before importing into neural networks for classification. The PointNet was selected as the 3D classifier in this research. The first experiment was conducted in order to evaluate the proposed method. The result showed that the proposed method can classify rice organs, regardless of rice varieties, with accuracy of 87.04%. Then, the second experiment was conducted in order to obtain the accuracy of the network for each rice variety to demonstrate the influence of rice cultivars in the classification due to their different shapes. The results showed that the SPRLR, which had large numbers of leaves and yield, has the lowest accuracy of 51.61% while the other varieties with the greater leaf and panicle distribution have a much better accuracy. The Nieow dum had 91.16% accuracy while Jae hwa, Kaow lueng and Kam had 89.06%, 86.52% and 75.22% accuracy respectively

KEYWORDS

3D Data, Point Cloud, Classification, PointNet

Multi-Class Primary Morphology lesions Classification Using Deep Convolutional Neural Network

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ABSTRACT

Skin diseases are becoming the most prevalent health concern among all nations worldwide. Recognition of skin lesion, abnormal change usually caused by disease or infection in the skin is the first step in diagnosing skin diseases. In dermatology, morphology skin lesions occur due to the disease process's direct result and indicate categorizing a skin lesions' structure and appearance. In this work, we focus on primary skin lesion classification, particularly early-stage detection, and present a deep learning approach to classifying images containing skin lesions, macule, nodule, papule, plaque pustule, Wheal, and Bulla. We used well known pre-train Resnet50 deep model with a transfer-learning paradigm. On our image dataset, Experimental results show a sensitivity value of 0.854 on 7 classes.

KEYWORDS

Skin disease, Convolution neural network, Detection, ResNet-50, Transfer learning, Deep model, Primary lesions.

A Privacy Preservation Model for RFID Data-Collections is Highly Secure and More Efficient than LKC-Privacy

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ABSTRACT

RFID is a smart label technology that is used in several real-life applications such as inventory management, asset tracking, personnel tracking, controlling access to restricted areas, ID badging, supply chain management, counterfeit prevention (e.g., in the pharmaceutical industry), and smart farming. Generally, the data collection of RFIDs consists of the users' visited locations and their visiting time, so called as trajectory datasets. Aside from applications, trajectory datasets can also be released for public use. For this reason, they could lead to being privacy violation issues. To address these issues in trajectory datasets, LKC-Privacy is proposed. Unfortunately, in this work, we demonstrate that LKC-Privacy still has a serious vulnerability that must be improved. To rid the demonstrated vulnerability of LKC-Privacy, a privacy preservation model is proposed in this work. Furthermore, the proposed mode is evaluated by extensive experiments. From the experimental results, they indicate that the proposed model is highly secure and more efficient than LKC-Privacy.

KEYWORDS

Privacy preservation models, Anonymization models, Trajectory datasets, and High-dimensional datasets.

A model of Cyber Threat Information Sharing with the Novel Network Topology

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ABSTRACT

The digitized environments are particularly vulnerable to various attacks. In such a situation of a security attack, detecting and responding to attacks require effective actions. One of the most significant ways to improve resilience to security attacks is to obtain accurate and timely situational aspect of the security awareness. The efficient production and utilization of situation information is achieved by sharing information with other actors in the information sharing network quickly and reliably without compromising the confidential information of one's own organization. At the same time, it should also be possible to avoid a flood of irrelevant information in the sharing network, which wastes resources and slows down the implementation of security measures. In our study, we have investigated how security-related information can be shared online as efficiently as possible by building a security information sharing topology based on the two most widely used network optimization algorithms. In the article, we present a model of an information sharing network, in which three different parameters have been used to optimize the network topology: the activity level of organization, the similarity of information systems between different actors and the requirement for the level of information privacy generally in the organization.

KEYWORDS

Cyber security, Situation Awareness, Security Information Sharing

A Study of Effect of Architectural Design on Quality of Service of a Live Streaming Application with Multiple Endpoints over LTE Network

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ABSTRACT

The number of streaming service providers has been increasing dramatically every year. Hence, users may prefer to publish their stream to multiple service endpoints simultaneously to increase visibility. However, most service providers prefer to monopolize their services. Hence, a study of a suitable architectural design of a streaming service that supports multiple streaming endpoints has not gained lots of attention. In this study, the effect of adopting different architectural design on developing a live streaming service over LTE network which can supports multiple streaming endpoints are investigated. Two major designs are selected which are a multipoint control unit based architecture, and a non-multipoint control unit based architecture. The results suggest that a multipoint control unit architecture has an advantage over a non-multipoint control unit based architecture on keeping overall average streaming end-to-end delay to be minimum., while a fluctuation in an end-to-end delay occurs in a non-multipoint control unit based architecture in our experiment testbed. The results, discussions, and suggestions on future studies are given at the end of this study.

KEYWORDS

Streaming Architecture, Multiple Endpoints Live Streaming, Multipoint Control Unit, LTE Network

Assuring long-term operational resilience in a pandemic: Lessons learned from COVID-19

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ABSTRACT

The COVID-19 pandemic has shown that some companies have been prepared for the pandemic in terms of crisis management, but other companies have not been prepared at all. The dependency of a company on third-party provider is even bigger in a pandemic situation. Operational resilience must be assured for third-party providers, who are supporting the company in delivering critical business processes. In a pandemic, the risk is much bigger that a third-party provider is having economical or employee-related issues, for example financial problems or loss of staff so that the provider will not be able to support the company on the same level as before the pandemic or cannot support the company at all. To assure operational resilience within a company, it is needed to first identify the critical IT assets and critical processes within the company. Only then it is possible to protect these IT assets and assure the business continuity of the critical business processes. Results described in this paper are based on practical experiences gained during the COVID-19 crisis.

KEYWORDS

COVID-19, operational resilience, risk management, controls, BCM, KRI

Unsupervised Segmentation of Non-Intersecting Manifolds

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ABSTRACT

Manifold learning has been an important research area as from literature it is evident that patterns in most real-life data sets can be embedded in low-dimensional space while maintaining the original structure of high-dimensional space. This work concentrates on one of the major research areas of manifold learning, which is the segregation of manifolds where more than one non-intersecting manifolds are present. The proposed method presents a solution to the problem by detecting the number of manifolds in a dataset using the Laplacian graph matrix and segregate the manifolds using agglomerative clustering. Eventually, locally linear embedding has been used for dimensionality reduction of every individual manifold in such a way that manifolds remain segregated and also holds the original global structure. The proposed method achieves finer results when applied on benchmark synthetic data sets *SCurve*, *SwissRoll*, *Helix* and real-life datasets *COIL-20*, *optical digit recognition*, *att_faces*, *extended Yale Face Database B*. While the state of the art methods fails to detect the number of manifolds in a dataset, the proposed method not only eclipses the performance of them but also carry the separable structure in the lower dimensional space.

KEYWORDS

Manifold learning, unsupervised learning, manifold segmentation, Laplacian Graph matrix, agglomerative clustering, dimensionality reduction

Sentiment Polarity Classification using Minimal Feature Vectors and Machine Learning Algorithms

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ABSTRACT

Recently, social media users can comment as texts to describe their opinions. These texts can be analyzed to classify them into either positive or negative attitude. Feature vectors for representing the texts must be designed and prepared before building a classifier. Generally, texts are represented by vectors of weights or frequencies of terms that appear in the text. The length of the feature vector is equal to the number of terms in the dictionary derived from the possible words in all texts. The large amount of words in dictionary leads to the high dimensional vector for representing text and bring about the long processing time to training and testing the text classification models. This paper, the low-dimensional vectors, V8D, were proposed for representing the texts. The set of positive and negative words including the words of negation which have the significant meanings were considered as information to create these vectors. Four machine learning algorithms to solve the classification problem, i.e., k-Nearest Neighbors, Naïve Bayes classifier, Artificial Neural Networks and Support Vector Machine, were applied to classify the opinion texts. By experimenting on eight data sets with various domains, the proposed V8D vectors were compared with the traditional TF-IDF vector in term of the predictive correctness. The experimental results show that representing text as our V8D vector for opinion text classification can provide the best efficiency in both of space usage and processing time.

KEYWORDS

Sentiment Analysis, Text Classification, Feature Extraction, Machine Learning

Exploiting Multilingual Neural Linguistic Representation for Sentiment Classification of Political Tweets in Code-mix Language

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ABSTRACT

Social media is more and more utilized by people around the world to express their feelings and opinions in the kind of short text messages. Twitter has been a rapidly growing microblogging social networking website where people express their opinions in a precise and simple manner of expressions. It has also become a platform for governmental, non-governmental and individual opinions and policy announcements. Detecting sentiments from tweets has a wide range of applications including identifying the anxiety or depression of individuals and measuring the well-being or mood of a community. In addition, the sentiment classification becomes complex when the tweet is written in codemix language which is a mix of two different languages. The main objective of this paper is to classify tweets written in mix of Tamil and English language into positive, negative, or neutral. This is achieved by fine tuning a Pretrained Multilingual text representation model as well as Deep Learning transformers. The proposed approach is experimented with large scale of tweets collected for societal issues in India. We also provide a comparative study of different Machine Learning and Deep Learning models. The proposed architecture based on neural linguistic representation provides significant accuracy in classifying both Tamil and Codemix tweets.

KEYWORDS

Sentiment Analysis, MBERT, Multilingual Language Processing, Natural Language Processing

Web Components Template Generation from Web Screenshot

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ABSTRACT

AI-driven automation is the game-changer in this decade. The one concept that belongs to this domain is to simulate human working processes by using machine learning. An adaptation of this knowledge in web development is popularized topic in the web developer society. Moreover, Web Components, the new paradigm in software engineering practices in web development, becomes the new standard defined by World Wide Web Consortium (W3C). It is an essential building block for modularizing large and complex web applications into smaller pieces and then presenting them via the web browser on the user's computer or mobile. We combine knowledge between Computer Vision (CV) with deep learning and Web Components developer framework together to train the machine to recognize bounding boxes and category labels for each object of interest in an image. This paper introduces the methodology to automatically generate a website by neuron network model composite with many small web components. Our work's best result has a validation loss of 1.873, which can recognize the web object and transform it into the Web Components Template by React web framework..

KEYWORDS

Web components, Deep Learning, RetinaNet, Computer Vision

Privacy Preservation Techniques for Sequential Data Releasing

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ABSTRACT

Privacy violation is a serious issue that must be considered when datasets are released for public use. To address this issue, a well-known privacy preservation model, l-Diversity, is proposed. Unfortunately, l-Diversity is generally proposed to address privacy violation issues in datasets that are focused on performing one-time data releasing. For this reason, l-Diversity could be inadequate to preserve the privacy data if datasets are dynamic and released at all times. To rid this vulnerability of l-Diversity, a new privacy preservation model for sequential data releasing to be proposed in this work, so called as ϵ -Error and l-Diversity. Aside from privacy preservation constraints, the complexity and the data utility are also maintained in the privacy preservation constraint of the proposed model

KEYWORDS

Anonymous models, Privacy preservation models, Dynamic datasets, Re-publication datasets

A Study of Relationship Between Music Streaming Behavior and Big Five Personality Traits of Spotify Users

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ABSTRACT

Personality Traits are important customer insights for business. Persuasive messages in advertising campaigns are more effective when customized to fit the customers' personalities. Researches suggested that music preference can reflect personality traits. However, those studies collected music listening history by using self-report of which the data obtained can be incomplete. This research aims to increase the completeness of music listening data by conducting a study on the three-month music streaming history of volunteers recorded automatically by Spotify. The eight audio features of each song (Acousticness, Danceability, Energy, Instrumentalness, Liveness, Speechiness, Valence, and Tempo) were extracted using Spotify's Application Programming Interface. The averages of these features calculated from songs in the music streaming history of each volunteer were used to represent his music preference. Pearson's Correlation method was employed to analyze relationships between the Big 5 Personality Traits and the music preference of 40 volunteers. The result shows a positive correlation between Openness-to-Experience and Liveness, a positive correlation between Extraversion and Acousticness, and a negative correlation between Extraversion with Energy and Speechiness. Agreeableness shows a positive correlation with Tempo. Instrumentalness is the only song feature that has a positive correlation with Neuroticism.

KEYWORDS

Music Streaming, Big Five, Personality Trait, Music Preference, Audio Features

Human Factors in Cybersecurity: A Scoping Review

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ABSTRACT

Humans are often considered to be the weakest link in the cybersecurity chain. However, traditionally the Computer Science (CS) researchers have investigated the technical aspects of cybersecurity, focusing on the encryption and network security mechanisms. The human aspect although very important is often neglected. In this work we carry out a scoping review to investigate the take of the CS community on the human-centric cybersecurity paradigm by considering the top conferences on network and computer security for the past six years. Results show that broadly two types of users are considered: expert and non-expert users. Qualitative techniques dominate the research methodology employed, however, there is a lack of focus on the theoretical aspects. Moreover, the samples have a heavy bias towards the Western community, due to which the results cannot be generalized, and the effect of culture on cybersecurity is a lesser known aspect. Another issue is with respect to the unavailability of standardized security-specific scales that can measure the cybersecurity perception of the users. New insights are obtained and avenues for future research are presented.

KEYWORDS

Human factors, Culture, Cybersecurity, Theory

Learning from Others: A Data Driven Transfer Learning based Daily New COVID-19 Case Prediction in India using an Ensemble of LSTM-RNNs

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ABSTRACT

Day is fast becoming a critical necessity globally to mitigate the burden on various health systems. In a densely populated country like India which has currently the second highest number of infections and limited medical support, it is a need for the authorities to know the statistics beforehand to address these issues more effectively. In this article, a data driven transfer learning based model is proposed that takes into account the conditions of different countries which have witnessed the COVID-19 infection. We have taken four countries to be the source domain for transfer learning scenario namely, the United States of America, Spain, Brazil and Bangladesh. We have pre-trained four different LSTM-RNN models with each of the country's data and have re-trained (fine tuned) each of the models using only a very small portion of Indian data on COVID-19. Predictions of these four models are averaged to get the actual prediction. It is seen that such an ensemble model outperforms all the compared models and accurately predicts even the daily cases. This may be due to the fact that the four LSTM-RNNs used here could successfully take into account the diversities of conditions. As India is a diverse nation with variety of climates, it makes more sense to incorporate such transfer learning techniques.

KEYWORDS

LSTM-RNN, Transfer learning, Ensemble learning, COVID-19 prediction

Particle Size Estimation in Mixed Commercial Waste Images Using Deep Learning

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ABSTRACT

We assessed several state-of-the-art deep learning algorithms and computer vision techniques for estimating the particle size of mixed commercial waste from images. In waste management, the first step is often coarse shredding, using the particle size to set up the shredder machine. The difficulty is separating the waste particles in an image, which can not be performed well. This work focused on estimating size by using the texture from the input image, captured at a fixed height from the camera lens to the ground. We found that EfficientNet achieved the best performance of 0.72 on F1-Score and 75.89% on accuracy.

KEYWORDS

Deep Learning, Computer Vision, Waste Management, Mixed Commercial Waste, Size Estimation

Improving the Robustness of a Convolutional Neural Network with Out-of-Distribution Data Fine-Tuning and Image Preprocessing

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ABSTRACT

Deep convolutional neural networks trained on readily available datasets are often susceptible to decreases in performance when executing tasks on new data from a different domain. Making models generalize well on data in a new domain is the task of domain adaptation. Recently, a simple method, known as ODIN, for identifying out-of-distribution (OOD) images in a dataset was proposed by Liang et al. in 2016. This paper proposes fine-tuning an image classifier using OOD images detected in the ideal training set to improve its ability to classify real-life images from a different domain. This work aims to investigate the effectiveness of such a technique, as well as image preprocessing methods like background removal and image cropping, at increasing the robustness of a ResNet50v2 baseline image classifier in the context of a multi-class classification task. It was observed that fine-tuning with OOD images identified by ODIN consistently increased the model's performance and that a combination of cropping images and fine-tuning with OOD images resulted in the greatest increase in the model's performance.

KEYWORDS

Domain adaptation, Out-of-distribution, ODIN, Interest point and salient region detection, Object localization, Multi-class classification.

Building Energy Consumption Forecasting: A Comparison of Gradient Boosting Models

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ABSTRACT

Building energy consumption forecasting is essential for improving the sustainability of buildings in the context of addressing climate change. Accurate building load predictions are useful for energy efficient building design selection and demand-side management initiatives. Using historical building energy consumption data has allowed researchers to develop machine learning models to improve the accuracy of such predictions, beyond inefficient traditional approaches otherwise used by the building sector. This work examines gradient boosting machine learning models, namely LightGBM, CatBoost, and XGBoost, for the purpose of comparing their performance on a select dataset. These gradient boosting models are popular in Kaggle machine learning contest solutions but have not been compared formally for the application of building energy consumption predictions. This work applies the three gradient boosting algorithms to a synthesized dataset for a large office building in Chicago. Preliminary results from the presented comparison demonstrate that XGBoost performs better than LightGBM and CatBoost when trained on the selected dataset.

KEYWORDS

Energy consumption forecasting, gradient boosting, machine learning, LightGBM, CatBoost, XGBoost

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