
BIG DATA
SUMMIT
2
High Performance Computing
& Artificial Intelligence Empowering Data Analytics
co-locate with PRAGMA 35 Meeting
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3 – 6 October 2018 | Venue: Sains@USM, Persiaran Bukit Jambul, Penang, Malaysia

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FOREWORD

Professor Datuk Dr. Asma Ismail, FASc.
Vice-Chancellor
Universiti Sains Malaysia

Assalamualaikum and Good Day,

The term 'Big Data' has been around for some time now. The 'Big Data' concept surfaced resulting from the increased amounts of data available ever since the digital era started. All these data and information that have been collected especially from the use of the Internet and technology requires an efficient data storage system. Seeing that the digital realm is evolving together with the increasingly large amounts of data, we can no longer rely on previously-practised ways of storing data in small quantities. We are not only moving towards accommodating bigger storage repositories but also on how to manipulate and programme computers in order to provide advantages across many different areas.

Data that are being generated at this moment represent the past and present and at the same time can foretell future outcomes of a situation. Some processes in Big Data include comparing different data to create relationships, building models from the collected data, running simulation, data tweaking, etc. which are done in an automated manner to cater to a specified or defined problem. This is where 'analytics' plays a role, such as using Artificial Intelligence or A.I. and machine learning to make sense of all the data. Many sectors such as healthcare, transportation, business, etc. are already exploring the benefit of data analytics.

This paradigm shift has led to an increase in the demands for powerful data analysing tools. With powerful data tools, data can be analysed effectively, hence increasing the ability to describe, predict and prescribe outcomes based on the available data. That is why we are now moving towards an ecosystem that utilizes large resources and amounts of data along with effective analytics.

The 2018 Big Data Summit 2 is co-located with the PRAGMA 35th Meeting and is a satellite event to the Big Data Week Asia held in Kuala Lumpur. This Summit focuses on empowering existing data analytics with the advantages of High Performance Computing and Artificial Intelligence. This is part of the efforts to provide a common platform for the Asia Pacific communities in Big Data where recent works can be shared and international collaboration opportunities can be explored. Through such efforts, it is hoped that future potentials in data analytics can be further uncovered and which would benefit many different areas.

Therefore, I would like to thank the people who have worked hard to realise this event, particularly the School of Computer Sciences and the National Advanced IPv6 Centre at USM in collaboration with the PRAGMA community as well as the industry players within Malaysia. All of these parties have made a big effort in making the summit a platform where activities to explore the Big Data field can take place. I sincerely hope that this Summit will turn out to be beneficial and fruitful to the delegates and participants, and able to open up doors for future collaborations on research and innovations among them.

FOREWORD

Professor Dr. Ahamad Tajudin Khader
Dean
School of Computer Sciences
Universiti Sains Malaysia

Assalamualaikum and Good Day,

Big Data. Initially, the term refers to the size and complexity of the data itself that traditional data processing softwares are insufficient equipped to manage. But over the years, the term refers more to the use of predictive analytics, user behaviour analytics and others to extract valuable data from such huge data repositories. Everyone is aware of the benefits of having big data but there is no specific method that fits all user goals. It can be seen in today's scientists, business managers, healthcare practitioners and even governments that there are difficulties in effectively utilizing big data in their daily activities.

It is easy to invest in big data projects but utilizing big data is hard and complex. Hence, more recent research on improving big data usage and analytics has begun emerging. The ability to describe, predict and prescribe outcomes based on existing data is the very essence in building an ecosystem that supports large data resources through effective analytics methods. This is where today's Big Data Summit 2 which is co-located with PRAGMA 35th Meeting and is a satellite event to the Big Data Week Asia held in Kuala Lumpur, focuses on improving existing data analytics through the use of High-Performance Computing and Artificial Intelligence. By integrating the two areas, a more comprehensive and automated analytics approaches could be integrated into existing big data applications. By providing a common platform such as this Summit for the EU and SEA communities in Big Data to share their recent works and explore international collaboration opportunities, it is hope that further enhancements to the area could be produced for the benefit of many areas.

Hence, I commend the effort made by the people who worked hard to realise this event particularly the team from the School of Computer Sciences and the National Advanced IPv6 Centre in collaboration with the PRAGMA community. It is also hope that these Summit would be an advantageous platform for researchers to identify strategies and challenges that not only focuses on the area of Big Data, but also in other research areas. This can be seen in some of the projects ideas that would be introduced throughout the summit. I sincerely hoped that by the end of this Summit, we all would be able to come together will be able to initiate collaboration on research and innovation among the participants presence here today.

Thank you.

FOREWORD

Dr. Nurul Hashimah Ahamed
Hassain Malim & Dr. Gan Keng Hoon
Chair & Co-Chair
Big Data Summit 2 (2018)

Greetings!

We welcome you to the Big Data Summit 2: HPC & AI Empowering Data Analytics (BDS2) held October 3–6, 2018 in Penang, Malaysia. As a premier event in the field, BDS2 provides a collaborative platform for reporting the latest developments in the research and application of High Performance Computing and Artificial Intelligence. Big Data Summit was first held in 2016, with the collaboration with CONNECT2SEA.

This year, we welcome the PRAGMA delegates and proudly present the summit as a jointly event with the 35th PRAGMA meeting. This setting allows all the participants to take advantage on the networking opportunities that could be leveraged from the PRAGMA community of practice that spans through the Pacific Rim. Although it is only in its second installment, BDS2 has already witnessed significant growth in its participations. The summit has attracted numerous abstract submissions from both academia and industries from our calls for poster presentation as well as project speakers. Spanning from tracks of big data, AI, HPC to data analytics, the summit will show case a total of 44 posters comprising of late-breaking results, technical descriptions, student projects etc., 11 project demonstrations and 8 exciting project talks with partnering opportunities. Apart of that, we are also proud to announce that the summit has attracted a total of 130 participations from PRAGMA members, academics and industries.

Internally, BDS2 is a collaborative effort between three divisions in USM i.e. the School of Computer Sciences, National Advanced IPv6 Center (NAv6) and Nexus (Sciences). Hence, we wish to thank the many people who have contributed their time, energy, and creativity to support this year's summit. Our thanks go first to all our patrons, presenters, speakers and delegates. Next, we would like to warmly thank the technical reviewers who devoted much of their time to review submissions and provide the comprehensive and constructive reviews. We would also like to thank the keynotes and invited speakers for their invaluable contribution and for sharing their vision in their talks. As for our partners, MDEC and PRAGMA, as well as our sponsors, Vitrox, Silverlake, Hilti, Fusionex, Novorient, Intel and Sophic, this summit would like to thank you for your generous and kind supports. And lastly, to our team of organizing committee, this summit would not be possible without the excellent work of yours.

Once again, we welcome you to this wonderful event and hope that our exciting programs will further stimulate the research and networking in the areas of big data. Enjoy the summit!

FOREWORD

Shava Smallen &
Shinji Shimojo
Co-Chairs
PRAGMA Steering Committee

Greetings!

We would like to welcome everyone to the PRAGMA 35 workshop, HPC and AI empowering Data Analytics. The Pacific Rim Application and Grid Middleware Assembly, PRAGMA, is an open, grass-roots, international organization that makes cyberinfrastructure accessible, easy to use, and useful for long-tail-of-science communities to advance their science and address societally important problems. Through active participation and contributions of all members, PRAGMA focuses on how to make these new and rapidly changing CI technologies usable by these communities of scientists, within a trusted envelop of shared, easy-to-use computer and data resources and fosters new generations of researchers.

PRAGMA workshops are held twice a year and are an opportunity to share progress with one another and plan our future activities. We are very happy to partner with the Big Data Summit 2 and explore opportunities for future collaboration. We would like to acknowledge the work of the PRAGMA Program Committee, in particular its Chair Dr. Nurul Malim, and the Big Data 2 Summit Committee members for their careful planning of this event. Our thanks as well to our gracious hosts at Universiti Sains Malaysia as well as MDEC and the sponsors, namely Vitrox, Silverlake, Hilti, Fusionex and Novorient. Also, a thank you to all of our participants for the excellent posters and demonstrations and our Expedition and Working Group chairs for leading discussions that help us define our future activities and directions. We encourage everyone to participate in the breakout sessions and provide us feedback that may improve future workshops and collaborations.

Finally, we thank all participants for attending and we encourage everyone to participate, identify activities for collaborations, engage others in those ideas for future projects, and provide us feedback that may improve future workshops and collaborations.

BIG DATA SUMMIT 2 (BDS2)

Programme Objectives

The Big Data Summit 2 (BDS2): HPC & AI Empowering Data Analytics co-locating with PRAGMA 35 Meeting is a continuity of Big Data Summit (BDS) 2016 which was held on 5–6 May 2016 at Hotel Bangi Putrajaya in collaboration with CONNECT2SEA.

BDS2 is co-located with PRAGMA 35 and is a satellite event to Big Data Week Asia that is held in Kuala Lumpur on 2 – 9 October 2018 hosted by Malaysia Digital Economy Corporation (MDEC). As such, this summit is more focused and specific to the applications of HPC and AI for Data Analytics with the following objectives:

- To enlighten Malaysian Researchers the impact of HPC & AI progression in empowering (transforming) analytics
- To highlight recent works on HPC & AI (e.g. Deep Learning) throughout the globe
- To provide a platform for International collaboration to Malaysian researchers via PRAGMA network

Program Theme

"HPC and AI: Empowering Data Analytics"

Data analytics and insights are fueling innovation across scientific research, product and service design, customer experience management, and process optimization. The trend has emerged from generating insights (descriptive analytics) to predicting future trends (predictive analytics). Four years ago, we never would have thought data analytics could evolved to prescriptive analytics in a near future. Prescriptive analytics involves decision making based on viable solutions to a problem and the impact of considering a solution on future trend. Certainly, its a massive and complex solution with tremendous data points to begin with. High Performance Computing (HPC) accelerates innovation in diverse areas - ranging from molecular chemistry to genome sequencing, energy exploration, and financial trading. Its capabilities to support real-time analytics with in-memory computing; big data analytics; and simulation and modelling empowered users to execute compute- and data-intensive workloads quickly and accurately. Artificial Intelligence (AI) is the foundation for cognitive computing, an approach that enables machines to mimic the neural pathways of the human brain to analyze vast datasets, make

decisions in real time, and even predict future outcomes. Predictive analytics with AI are core capabilities required by data-driven organizations looking to gain competitive advantage with their digital transformation initiatives. Over the last several years, the computing community witnessed the convergence of HPC and AI in predictive analytics. Predictive analytics with AI applications are expected to execute increasingly difficult tasks and forecast evolving trends to solve some of the world's biggest scientific, engineering, and technological problems. These "high-performance computation" requires support of an advanced technology solution. HPC environments is a good foundation for AI. By aggregating computing power to handle data-intensive tasks, HPC provide the extreme levels of scalability, performance, and efficiency required by these complex applications.

The intertwined future of HPC and AI is changing the analytics landscape. Its accelerating analytics towards prescriptive analytics. As more powerful purposely-built HPC solutions (e.g DGX by Nvidia) being developed and new AI applications that took advantage of these infrastructures e.g. Deep Learning, this accelerated analytics pushes us towards prescriptive analytics. Although limited, but such applications are already on the way. Google's self-driving car is a perfect example of prescriptive analytics. It analyzes the environment and decides the direction to take based on data. It decides whether to slow down or speed up, to change lane or not, to take a long cut to avoid traffic or prefer shorter route etc. In this way, it functions just like a human driver by using data analysis at scale. While AI applications, such as machine learning and deep learning, are transforming industries across the globe, HPC technologies works silently behind-the-scenes to empower AI applications. The HPC infrastructure enables AI applications to handle high-performance workloads, such as advanced analytics. HPC are now becoming the engine of AI. Hence, any progression in AI or HPC will definitely empowered (transformed) analytics. Therefore, this summit is a platform for Malaysian and International researchers to showcase their efforts in both fields of supporting analytics and to seek collaboration opportunities, international and local.

PACIFIC RIM APPLICATION AND GRID MIDDLEWARE ASSEMBLY (PRAGMA)

The Pacific Rim Application and Grid Middleware Assembly (PRAGMA) is an international, distributed community of practice for technology and approaches that supports the long tail of science, namely enabling small- to medium-sized international groups, to make rapid progress in conducting research and education by providing and developing international, experimental cyberinfrastructure. To realize this mission, PRAGMA's current activities include four interrelated activities:

- Fostering international "scientific expeditions" by forging teams of domain scientists and cyberinfrastructure researchers who develop and test information technologies that are needed to solve specific scientific questions and create usable, international-scale, cyber environments;
- Developing and improving a grassroots, international cyberinfrastructure for testing, computer science insight and, advancing scientific applications by sharing resources, expertise and software;
- Infusing new ideas by developing young researchers who gain experience in cross-border science and by extending engagements with strategic partners;
- Building and enhancing the essential people-to-people trust and organization developed through regular, face-to-face meetings - a core foundation of PRAGMA's success.

PRAGMA's community of practice comprising individuals and institutions from around the Pacific Rim that actively collaborate and meet-up to discuss progresses, issues and concerns by groups. PRAGMA meetings are held twice a year in its distributed communities countries. Malaysia had been the host for the 15th meeting in 2008. This summit is intended to co-locate with the 35th PRAGMA meeting to take advantage on the networking opportunities that could be leveraged from the PRAGMA community of practice that spans through the Pacific Rim.

PRAGMA Expeditions

PRAGMA forges collaborative, multidisciplinary teams to address scientific questions of high societal impact. These questions define and drive PRAGMA's technology development efforts. There are three current expeditions:

- Biodiversity: Understanding adaption in extreme environments.
- Limnology: Predicting impact of eutrophication on lake ecosystem services.
- ENT: Creating and utilizing an Experimental software-defined Network Testbed.

PRAGMA Working Groups

The goal of PRAGMA's Working Groups is to identify activities for international collaborations and engage others in those ideas for future projects. The current PRAGMA Working Groups are described below:

- **Resources and Data**: Investigates current technology trends and evaluates their potential beneficial impact on applications from PRAGMA's applications. Current projects include the PRAGMA Cloud Testbed, the Experimental Networking Testbed, Open Data Platform, Containers/Kubernetes, GPUs/Machine learning, and Monitoring.
  Chairs: Nadya Williams (University of California, San Diego), Hsiu-Mei Chou (National Center For High-Performance Computing)

- **Telescience**: Making and improving access to or use of remote equipment (e.g., tiled-display walls or sensors). Current application areas of the group include environmental monitoring and traffic flow.
  Chairs: Shinji Shimojo (Osaka University, Fang-Pang Lin (National Center For High-Performance Computing)

- **Biosciences**: Creating stable infrastructure to perform computational genomics analyses with a focus on rice breeding and integrating technologies to create an infrastructure to advance the screening of potential compounds to combat infectious diseases
  Chairs: Jason Haga (National Institute Of Advanced Industrial Science And Technology)

At the beginning of the PRAGMA workshop, Working Group updates will be given by the chairs. It is followed by two breakout sessions where attendees will have an opportunity to dive deeper into topics, discuss new project ideas, have an open discussion, and set goals for the next workshop. At the end of the workshop, the Working Group chairs will summarize the results of the discussions to everyone.

KEYNOTE & INVITED SPEAKERS

Keynote 1
Dr. Dzaharudin Mansor
National Technology Officer
Microsoft Malaysia

Title: Democratizing AI

Abstract: As we transition into another industrial revolution, AI, in conjunction with the 3rd and 4th Platforms, has become a key technology megatrend that is poised to further accelerate the 4th Industrial Revolution. AI is not a new technology, but one that which become significant due the lowering cost of computing and storage by hyper-scale cloud, access to huge amounts of data and tools that has made applying AI and Data Science simpler and more productive; in short Democratization of AI. It is the author's opinion there is an urgency to make AI a mainstream in education and a core skill for everyone that deals with science and technology for work or and research.

Dr. Dzaharudin Mansor is the National Technology Officer ("NTO") for Microsoft Malaysia. As the NTO, Dzahar drives the engagement with key national technology stakeholders, which include academics, policy makers & advisors, and interest groups with the intention to builds trust while contribute to national development. Dr Dzahar joined Microsoft in 2005 and has more than 33 years of professional experience in ICT and telecommunications. He started his career as a lecturer at the department of Computer Science, La Trobe University, and moved on to as a R&D engineer at Telecom Australia Research Laboratories in Melbourne. On returning to Malaysia, he joined Celcom as a R&D manager, and left the company as the Vice President for R&D, Intelligent Network and IT divisions. He subsequently worked at HP in Singapore and other technology companies in R&D, operations, business, as well as leadership positions.

He also presently holds, and has held, several associate positions including as an Adjunct Professor at IIUM, a councillor at PIKOM and academic advisor at several public and private universities. In 2010, he had the honour of leading the Business Services Economic Transformation Program (ETP) Labs that has been one of the key initiatives by the Malaysian Government to transform Malaysia into a developed nation by 2020. He is a senior member of IEEE. Dr. Dzahar received a First Class Honors Degree in Computer Systems Engineering from Monash University, Australia in 1985, and subsequently awarded Australian University Graduate scholarships to completed his PhD in Computer Science in 1988. In 1985, he was awarded the Digital Award for Computer Engineering, the University Tasmania award for achieving top 10 position in HSC, and the MCE Top Student Award at MCKK in 1979.

Dr. Dzahar is passionate about technology, where he works closely with academia and research on topics such as Software Engineering, Computer Architectures, Cyber Security, Telecommunications, Data Science and AI. He aspires to contribute towards the nation's Digital Economy initiative.

KEYNOTE & INVITED SPEAKERS

Keynote 2
Dr. Jason Haga
Cyber-Physical Cloud Research Group
The National Institute of Advanced Industrial Science and Technology (AIST), Japan

Title: Immersive Visualization and Analytics for Understanding Large-scale Datasets

Abstract: Today, data is accumulating at an unprecedented rate and is expected to reach tens of zettabytes by the year 2020. These troves of big data can provide significant value to all sectors of society, especially research activities. However, the sheer amount of data is creating significant challenges to data-intensive science. To address this challenge, the visualization and analysis of data requires an interdisciplinary effort and next generation technologies, specifically interactive environments that can immerse the user in data and provide tools for data analytics. Several types of immersive technologies are becoming a viable, innovative solutions for a wide variety of applications. To highlight this concept, this keynote will showcase scalable high-resolution display technologies, virtual reality, and augmented reality technologies for data-intensive applications through different application examples. These applications explore how combinations of 2D and 3D representations of data can support and enhance data-intensive efforts using these new technology platforms. This presentation is designed to inspire any research community looking for novel data visualization solutions.

Dr. Jason Haga is currently a member of the Cyber-Physical Cloud Research Group in the Information Technology Research Institute of The National Institute of Advanced Industrial Science and Technology (AIST). For over 20 years, Dr. Haga has focused on multidisciplinary research. Past research includes the design and implementation of biomedical applications for grid computing environments and tiled display walls. He also has collaborated with cultural heritage institutions to deploy novel interactive exhibits to engage the public in learning. Current projects of interest include immersive visualization of data and user experience/user interface for data intensive applications. He is actively involved with the Pacific Rim Application and Grid Middleware Assembly (PRAGMA) community, where he leads the Biosciences working group and has mentored over 70 students from around the world. Dr. Haga is continuing this mentorship effort at AIST by leading an international internship program that strategically positions AIST as an international hub for computer science research training. With over 14 years of global collaborative efforts with technologists and domain scientists in the PRAGMA community, he continues to look for interdisciplinary research opportunities connecting scientists to advance research on a global scale. Dr. Haga earned a PhD in biomedical engineering from the University of Tennessee, Memphis and did postdoctoral work at UC San Diego. He currently lives in Tsukuba, Japan.

KEYNOTE & INVITED SPEAKERS

Keynote 3
Prof. Dr. Rosni Abdullah
Director
National Advance IPv6 Centre
Universiti Sains Malaysia

Title: Big Data and Artificial Intelligence Meet Biology

Abstract: Donald Knuth in an interview with Computer Literacy Bookshops (CLB) on 7th December, 1993 said, "Biology easily has 500 years of exciting problems to work on". After 25 years, we are witnessing an exciting era of data explosion in biology where biological data from various data sources is growing at an exponential rate. There is now demand for new approaches and techniques to manage, organize and analyze this massive amount of data. In this talk, we will present an overview on big data and artificial intelligence, how both technologies are poised to solve the challenges in Big Biology.

Rosni Abdullah is a Professor in Parallel Computing at the School of Computer Sciences, Universiti Sains Malaysia (USM) and is one of the national pioneers in this field. She obtained her PhD in April 1997 from Loughborough University, United Kingdom specializing in the area of Parallel Numerical Algorithms. Both her Bachelors degree and Masters degree in Computer Science were obtained from Western Michigan University, Kalamazoo, Michigan, U.S.A. in 1984 and 1986 respectively. She has served as Dean of the School of Computer Sciences at Universiti Sains Malaysia (USM) from 2004 to 2012, after having served as its Deputy Dean (Postgraduate and Research) since 1999. She is also the Head of the Parallel and Distributed Processing Research Group at the School since its inception in 1994. Her research areas include Parallel and Distributed Computing, Parallel Numerical Algorithms and Parallel Algorithms for Bioinformatics. 20 PhD students have graduated under her supervision. She has led more than 20 research grants including 2 European Union grants and 2 Intel grants, and has published more than 100 papers in journals and conference proceedings. She is currently the Director of the National Advanced IPv6 Center (Nav6), a center of research excellence in USM that focus on Cybersecurity and Internet of Things (IoT).

KEYNOTE & INVITED SPEAKERS

Keynote 4
Dr. Fang-Pang Lin
National Center for High Performance Computing, NARLabs Taiwan

Title: HPC in Applications of Big Data and IoT

Abstract: High performance computing (HPC) has been developed in order to achieve extreme scale modeling for high-resolution floating-point solutions on traditional challenge of big science such as high energy physics, astronomy, brain science, molecular structure and turbulence … etc. The international competition on whose machine is the fastest is only getting harsher and more intense nowadays. Yet, with the rising of optical networks, 4G/5G wireless networks and the advance of smart and connected end devices ranging from sensors, mobile phones, data collected has been in exponential growth. To understand the data is usually not what traditional HPC concerns. The modern machine learning technology, e.g. deep learning, requires only lower resolution floating point solutions. It is easy to find the analogy between data observed from the galaxy and the data from the sensors that deployed around the world. Compute power, however, is still the key to solutions of Big Data (BD) analytics. In this talk, the previous efforts in NCHC on applications of BD and IOT will be introduced and it will be used to explain why our new peta-scale machine needs to converge both HPC and BD for both modeling physics and learning from data.

Dr Fang-Pang Lin is the Senior Research Fellow at National Center for High Performance Computing and Joint Appointment Professor at National Central University of Taiwan. He is one of the key developers for developing the national cyber-infrastructure of Taiwan, namely Knowledge Innovation National Grid. He co-founded the Global Lake Ecological Observational Network and Global Coral Reef Environmental Observational Network. His major research focuses on cyberinfrastructure for long term environmental and ecological observation. Recent development includes Taiwan Earth Science Observatory Knowledgebase, EU FP7 Fish4Knowledge collaboration, real-time wide area flood monitoring and government big data. The efforts also lead to US-East Asia collaborations to enable transnational cyberinfrastructure applications, which based on shared software defined systems applying to issues on disaster management, environmental monitoring and simulation, and smart cities. Dr. Fang-Pang Lin obtained his PhD in University of Wales at Swansea, UK. He worked in Rolls-Royce University Computing Center in Oxford University for his postdoctoral research. He joined NCHC in Oct., 1997 and has been working in numerical simulation and software engineering regarding application integration. He was the winner of 2006 Outstanding Achievement Award in Science and Technology, the Executive Yuan of Taiwan.

KEYNOTE & INVITED SPEAKERS

Invited Talk 1
Dr. Ryousei Takano
Information Technology Research Institute
The National Institute of Advanced Industrial
Science and Technology (AIST), Japan

Title: ABCI: An Open Innovation Platform for Advancing AI Research and Deployment

Abstract: ABCI is an open innovation platform with world-class computing resources of 0.55 AI-EFLOPS / 37 PFLOPS (DP) for AI research and development. Through industry and academia collaboration, Algorithms, Big Data, and Computing Power are leveraged in a single common public platform. ABCI rapidly accelerates the deployment of AI into real business and society. ABCI is ranked at number 5 in the June 2018 TOP500 supercomputer ranking and the operation starts from August, 2018.

Ryousei Takano is a research group leader of the Information Technology Research Institute, the Institute of Advanced Industrial Science and Technology (AIST), Japan. He received his Ph.D. from the Tokyo University of Agriculture and Technology in 2008. He joined AXE, Inc. in 2003 and then, in 2008, moved to AIST. His research interests include operating systems and distributed parallel computing. He is currently exploring a highly efficient data center for AI and Big Data processing, and an operating system for heterogeneous accelerator clouds.

KEYNOTE & INVITED SPEAKERS

Invited Talk 2
Prof. Dr. Renato J. Figueiredo
Department of Electrical and Computer Engineering
University of Florida, USA

Title: On Lakes and Clouds: A Retrospective on the PRAGMA/GLEON Lake Expedition

Abstract: The PRAGMA Lake Expedition is an interdisciplinary collaboration with GLEON (The Global Lake Ecological Observatory Network) that is advancing the current understanding of the effects of climate change and eutrophication (i.e., increased nutrient pollution of nitrogen and phosphorus, leading to increased plant growth) on harmful algal blooms in lakes. Since its inception in 2014, the lake expedition has brought together computer scientists and lake ecologists (faculty, graduate, and undergraduate students) to address science questions using state-of-the-art (yet easy to use) cyber-infrastructure. In particular, the team has successfully developed and deployed GRAPLEr, a novel system that combines open-source technologies developed by PRAGMA (IP-over-P2P, IPOP overlay virtual networks) and leveraged from other projects (HTCondor high-throughput computing) to provide a user-friendly platform to execute hundreds of thousands of lake model runs from a user's familiar R/R-Studio desktop environment in cloud computing infrastructures (including PRAGMA-Cloud). More recently, the lake expedition is investigating approaches that allow small computing devices (sensor gateways) deployed in the field, at the network's "edge", to connect to the cloud infrastructure via software-defined overlays. The talk will provide a retrospective on the lake expedition activities, with a summary of techniques, technologies and lessons learned along the way.

Renato J. Figueiredo is a Professor at the Department of Electrical and Computer Engineering of the University of Florida. Dr. Figueiredo received the B.S. and M.S. degrees in Electrical Engineering from the Universidade de Campinas in 1994 and 1995, respectively, and the Ph.D. degree in Electrical and Computer Engineering from Purdue University in 2001. From 2001 until 2002 he was on the faculty of the School of Electrical and Computer Engineering of Northwestern University at Evanston, Illinois, and from 2012 to 2013 he was a visiting researcher at Vrije Universiteit, the Netherlands. His research interests are in the areas of virtualization, distributed systems, overlay and software-defined networks, cloud and edge computing, and their applications in support of computational science in domains including lake ecology, bio-diversity, and smart and connected communities. Dr. Figueiredo's research team leads the IPOP (IP-over-P2P) open-source overlay virtual network project.

KEYNOTE & INVITED SPEAKERS

Invited Talk 3
Nadya Williams
Research Scientist
San Diego Supercomputer Center
University of California, San Diego, USA

Title: Toward the Global Research Platform

Abstract: From biomedical data to particle physics, today nearly all research and data analysis involves remote collaboration. In order to work effectively and efficiently on multi-institutional projects, researchers depend heavily on high-speed access to large datasets and computing resources. To meet the needs of researchers in California and beyond, the National Science Foundation (NSF) in the United States has awarded a five-year, $5 million grant to fund the Pacific Research Platform (PRP). The PRP's data-sharing architecture, with end-to-end 10-100Gbps connections, enables region-wide virtual co-location of data with computing resources. The PRP establishes a science-driven high-capacity data-centric network, enabling researchers to move data between labs and collaborators' sites, supercomputer centers or data repositories without performance degradation. Today, dozens of top universities and research centers are doing work across a broad range of data-intensive research projects that will have wide-reaching impacts on science and technology worldwide in the areas of cancer genomics, galaxy evolution research, and climate modeling. In this keynote, Nadya Williams will provide an overview of the PRP and it's architecture and describe a few use cases that describe how scientists are leveraging the PRP to help them achieve their scientific goals.

Nadya Williams is a Research Scientist at the San Diego Supercomputer Center at UC San Diego. She served as a functional lead in the design, specification and evaluation of software architectures for the scientific computing environments focusing on high performance, hight throughput and virtual environments for PRAGMA and NBCR projects at UCSD. She is actively involved with PRAGMA since 2007 where she now leads Resources and Data working group. Nadya has years of global collaborative experience working with the scientists from Europe, PRAGMA and other communities. She recently joined the technical team for the Pacific Research Platform where she continues to work in the area ofvirtualization, distributed applications and cloud computing to provide a computational science support to the domain scientists. Nadya earned an M.S. in Oceanography and an M.S. in Computer Science.

KEYNOTE & INVITED SPEAKERS

Invited Talk 4
Kamal Hisham Kamaruddin
Head of Operation
MYREN Network Sdn. Bhd.

Title: Enabling Global HPC Collaboration through MYREN and NSRC

Abstract: Collaboration is key in this age of research and education both local and at international level. I will give an introduction for MYREN as the National Research & Education Network (NREN) in Malaysia and Network Startup Research Center (NSRC), an organization based at University of Oregon. This talk will highlight efforts to improve the network capabilities and engineering setup at R&E organization around the world, particularly our recent joint effort during PRAGMA35 and Big Data Summit 2 to MYREN technical community.

Graduated from Sheffield Hallam University, UK in Bachelor of Computing (Networks & Communications), Kamal Hisham Kamaruddin is currently the Head of Operation at Malaysia MYREN. Kamal has been with MYREN since its inception in 2005 and instrumental in developing MYREN2, MYREN3 network and all its sub projects to get Polytechnics, Community Colleges and Teaching Hospitals connected to MYREN. He is the Governor for Malaysia in an Asia- Europe collaboration project – Trans Eurasia Information Network (TEIN) connecting Research & Education Network (REN) in Asia Pacific to Europe. He is also a Steering Committee member for Asi@Connect project, a successor project for TEIN4.

Kamal is actively promoting REN best practices in the area of network design, security and network operation both locally in Malaysia and in the region particularly in the ASEAN region. He continues to assist network engineers from MYREN user community in Malaysia and voluntarily runs technical workshops for MYREN user groups.

PROGRAMME SCHEDULE OF BDS2

Big Data Summit 2 2018
(3-6 October 2018)

Day 1 – 3rd October 2018, Wednesday		Venue
TIME	**PROGRAM**	
0830-0900	Registration	Lobby Auditorium Murad Muhammad Noor
0900-0915	Welcoming & Introduction to Big Data Summit 2 • Dr. Nurul Hashimah Ahamed Hassain Malim *Chair*, Big Data Summit 2 • Dr. Gan Keng Hoon *Co-Chair*, Big Data Summit 2	Auditorium Murad Muhammad Noor
0915-0930	Introduction to PRAGMA Shava Smallen *Interim Co-Chair*, PRAGMA	Auditorium Murad Muhammad Noor
0930-1010	**KEYNOTE 1:** DEMOCRATIZING AI Dr. Dzaharudin Mansor Microsoft Malaysia	Auditorium Murad Muhammad Noor
1010-1030	COFFEE BREAK (Sponsored by HILTI)	Lobby Ground Floor
1030-1110	**KEYNOTE 2:** (PRAGMA) IMMERSIVE VISUALIZATION AND ANALYTICS FOR UNDERSTANDING LARGE-SCALE DATASETS Dr. Jason Haga National Institute of Advanced Industrial Science and Technology (AIST), Japan	Auditorium Murad Muhammad Noor
1110-1310	**Project Speaker Slots**	Auditorium Murad Muhammad Noor

1110 – 1130	[BS01] Reliability Assessment Framework using Test-Defect Coverage Analytics Model *Dr. Sharifah Mashita Syed Mohamad, Universiti Sains Malaysia*
1130 – 1150	[BS02] Type-2 Fuzzy Systems and the Variations in the Uncertain Environments *Dr. Nur Syibrah Mohd Naim, Universiti Sains Malaysia*
1150 – 1210	[BS03] Data Mining System to Detect Finger Motion in Offline Handwriting Forgery *Dr. Loh Wei Ping, Universiti Sains Malaysia*
1210 – 1230	[BS04] Strategic Cyber Threat Intelligence Using External Unstructured Data *Mr. Kew Yoke Ling, KewMann*
1230 – 1250	[BS05] Fiber Tractography using Grid Computing *Dr. Anusha Achuthan, Universiti Sains Malaysia*
1250 – 1310	[BS06] Can I Trust You? Towards Modelling Trust at Zero Acquaintance *Dr. Syaheerah Lebai Lutfi, Universiti Sains Malaysia*

1310 -1410	BUSINESS LUNCH (Sponsored by VITROX)	Lobby Ground Floor
1410-1450	**KEYNOTE 3:** BIG DATA AND ARTIFICIAL INTELLIGENCE MEET BIOLOGY Prof Rosni Abdullah National Advance IPv6 Centre, Universiti Sains Malaysia	Auditorium Murad Muhammad Noor
1450-1530	**KEYNOTE 4:** (PRAGMA) HPC IN APPLICATIONS OF BIG DATA AND IOT Dr. Fang-Pang Lin National Center for High-Performance Computing, NARLabs, Taiwan	Auditorium Murad Muhammad Noor
1530-1610	**Project Speaker Slots** 1530 – 1550: [BS07] Data Science Analytics for Manufacturing and Supply Chain *Dr. Umi Kalsom Yusof, Universiti Sains Malaysia* 1550 - 1610: [BS08] Interfacing Chatbot with Data Retrieval and Analytics Queries for Decision Making *Dr. Gan Keng Hoon, Universiti Sains Malaysia*	Auditorium Murad Muhammad Noor
1610-1630	COFFEE BREAK (Sponsored by HILTI) + POSTER SESSION NETWORKING	Lobby Auditorium Murad Muhammad Noor
1630 -1805	Poster Session (Please refer to BDS2 poster listing)	Lobby Auditorium Murad Muhammad Noor
1830 -2030	PRAGMA Welcoming Reception (PRAGMA members + BDS2 Committee only)	Clubhouse

Day 2 – 4th October 2018, Thursday		**Venue**
TIME	**PROGRAM**	
0830-0900	Registration Arrival of the Vice Chancellor, USM	Lobby Auditorium Murad Muhammad Noor
0905-1015	**Opening Ceremony** National & USM Anthem Prayer Recitation Welcoming Speech by Prof. Ahamad Tajudin Khader, Main Patron BDS2 & Dean, School of Computer Sciences Speech by Dr. Peter Arzberger, Founder, The Pacific Rim Application and Grid Middleware Assembly (PRAGMA) Opening Speech by Prof. Datuk Dr. Asma Ismail Vice Chancellor, Universiti Sains Malaysia Video Presentation Group Photo	Auditorium Murad Muhammad Noor

1015-1035	COFFEE BREAK (Sponsored by Fusionex)	Lobby Ground Floor
1035-1100	PRAGMA Welcoming Statement Shava Smallen	Auditorium Murad Muhammad Noor
1100-1130	**INVITED TALK 1:** (PRAGMA) ABCI: AN OPEN INNOVATION PLATFORM FOR ADVANCING AI RESEARCH AND DEPLOYMENT Dr. Ryousei Takano National Institute of Advanced Industrial Science and Technology (AIST) Japan	Auditorium Murad Muhammad Noor
1130-1200	**INVITED TALK 2:** (PRAGMA) ON LAKES AND CLOUDS: A RETROSPECTIVE ON THE PRAGMA/GLEON LAKE EXPEDITION Prof. Dr. Renato J. Figueiredo University of Florida	Auditorium Murad Muhammad Noor
1200-1300	PRAGMA Working groups and Expedition updates	Auditorium Murad Muhammad Noor
1300-1400	BUSINESS LUNCH (Sponsored by Silverlake)	Lobby Ground Floor
1400-1500	PRAGMA Working Groups (WG) Breakouts 1: Resources WG + Cyberlearning WG Telescience WG Data/Geo/Bioscience WG	 Auditorium B Main Board Room Seminar Room 3
1500-1530	PRAGMA Lightning Talks Chair: Wassapon Watanakeesuntorn	Auditorium Murad Muhammad Noor
1530-1600	COFFEE BREAK (Sponsored by Fusionex) POSTER SESSION NETWORKING	Lobby Auditorium Murad Muhammad Noor
1600-1630	PRAGMA Poster Session (Please refer to PRAGMA 35 poster listing)	Lobby Auditorium Murad Muhammad Noor
1630-1730	PRAGMA Demo Session 1 Session Chair: Assoc Prof. Dr. Kohei Ichikawa	Auditorium Murad Muhammad Noor

1630 – 1645	[PD01] Integrating PRAGMA-ENT and Inter-Cloud Platform using Dynamic L2VLAN Service *Kohei Ichikawa, Atsuko Takefusa, Yoshiyuki Kido, Yasuhiro Watashiba and Susumu Date*
1645 – 1700	[PD02] Extending SDN Networks from Cloud-to-Edge using Virtual Private Networks with Peer-to-Peer Overlay Links *Kensworth Subratie and Renato Figueiredo*
1700 – 1715	[PD03] Analysis of Load Balancing Performance on Cluster Computing with PROXMOX VE *Andi R. Darsono*
1715 – 1730	[PD04] Performance Comparison of Load Balancing using Honeybee and Threshold Algorithm *Aditya Efrian, Sri Chusri Haryanti, Sri Puji Utami and Ridho Yanevan Pratama*

1750-2245	**CONFERENCE DINNER** Butterworth 4 & 5, Holiday Inn, Batu Feringghi 1750 Departure from SAINS@USM 1900 Bus Arrival at Holiday Inn, Batu Feringghi Participant can walk around or prepare for prayers 1945 Participants take place in ballroom 2000 VIP Arrival 2010 National & USM Anthems 2015 Appreciation Speech by Chair of Big Data Summit 2 Dr. Nurul Hashimah Ahamed Hassain Malim 2025 Speech by Vice Chancellor Universiti Sains Malaysia Prof. Datuk Dr. Asma Ismail 2035 Dinner & Performances 2135 PRAGMA Appreciation Session Shava Smallen & Dr. Peter Arzberger 2200 Adjourn – Night market walk 2245 Buses departure to Equatorial Hotel & sains@usm	Holiday Inn, Batu Feringghi

Day 3 – 5th October 2018, Friday		**Venue**
TIME	**PROGRAM**	
0900-0930	**INVITED TALK 3:** (PRAGMA) TOWARD THE GLOBAL RESEARCH PLATFORM Nadya Williams San Diego Supercomputer Center University of California San Diego	Auditorium Murad Muhammad Noor
0930-1000	**INVITED TALK 4**: ENABLING GLOBAL HPC COLLABORATION THROUGH MYREN AND NSRC Kamal Hisham Kamaruddin MYREN Network Sdn. Bhd.	Auditorium Murad Muhammad Noor
1000-1020	PRAGMA Wide Mentoring Update Chair: Dr. Jason Haga	Auditorium Murad Muhammad Noor
1020-1040	COFFEE BREAK (Sponsored by Novorient) + NETWORKING	Lobby Ground Floor
1040-1210	PRAGMA Demo Session 2 Session Chair: Dr. Yoshiyuki Kido 1040 – 1055 [PD05] EDISON Data Platform for Computational Science Data *Jaesung Kim, Jeongcheol Lee, Sunil Ahn and Jongsuk Lee* 1055 – 1110 [PD06] Web-based Compute-Data Research Environment for Aircraft Airfoil Aerodynamics *James Junghun Shin, Kumwon Cho and Jonsuk Ruth Lee* 1110 – 1125 [PD07] Mobile-based Augmented Reality for Sundanese Alphabets Education *Muhammad Reza Aditya, Resskytha Sari, Adri Nursimarsiyan and Nova Eka Diana* 1125 – 1140 [PD08] Tuberculosis (TB) Disease Interactive Map in Jakarta Capital Special Region *Nuraisah and Ummi Azizah Rachmawati*	Auditorium Murad Muhammad Noor

	1140 – 1155	[PD09] Neuro Data Platform for Neuroscientist *Nurul Hashimah Ahamed Hassain Malim, Jafri Malin Abdullah, Sharifah Aida Sheikh Ibrahim, Nurfaten Hamzah, Ariffin Marzuki Mokhtar, Putra Sumari, Ahamad Tajudin Khader and Muhammad Jaziem Mohamad Javeed*	
	1155 – 1210	[PD10] Deep Learning Classification for Liver Disease *Andi Batari Ahmad and Nova Eka Diana*	
1210-1445	LUNCH and PRAGMA Steering Committee Meeting		Auditorium B Lobby Ground Floor
1445-1630	PRAGMA Working Groups (WG) Breakouts 2: Resources WG + Cyberlearning WG Telescience WG Data/Geo/Bioscience WG		Auditorium B Main Board Room Seminar Room 3
1630-1645	COFFEE BREAK (Sponsored by Novorient) + NETWORKING		Lobby Ground Floor
1645-1730	CLOSING CEREMONY • PRAGMA Best Poster Award & Student Presentation • PRAGMA Working groups wrap-up • PRAGMA 35 Wrap up by Shava • Video presentation • Invitation to PRAGMA 36 in Korea • Big Data Summit 2 Poster Award • Big Data Summit 2 wrap up by Prof. Dr. Rosni Abdullah, Director, National Advanced IPv6 Centre, USM		Auditorium Murad Muhammad Noor Auditorium Murad Muhammad Noor
1800-2030	PRAGMA Dinner (PRAGMA members & BDS2 committees only) 1800: Bus Departure to Bangkok Tomyam 1845: Dinner 2030: Bus Departure to Equatorial Hotel		Bangkok Tomyam Sunway Tunas

Day 4 – 6th October 2018, Saturday

TIME	**PROGRAM**
0830-1700	Excursion – (PRAGMA member only) Pick-up point: Equatorial Hotel 0830 Participants gather at Equatorial Hotel 0845 Bus Departure from Equatorial Hotel to Penang Hill 0915 Arrival at Penang Hill 1200 Departure from Penang Hill to Esplanade 1245 Arrival at Esplanade (Lunch) 1400 Departure to Penang Heritage Trail 1600 Departure from Penang Heritage Trail to Equatorial Hotel & airport

BDS2 POSTER LISTING

Poster Presentation	
Poster ID	**Title and Author**
BP01	Towards Large-scale Text Annotation for Sentiment Analysis using Semi-supervised Deep Learning *Vivian Lay Shan Lee, Gan Keng Hoon*
BP02	Big-spatial Data Pre-processing Framework towards Flood Assessment *Ahmed Ndanusa, Zulhairi Dahalin, Azman Ta'a*
BP03	Data Analytics of Malaysia's Most Influential Entities in Social Media for Commercial Purpose *Yasmin M Yacob, Tong Hau Lee*
BP04	Low Resolution to High Resolution Video Surveillance Image Enhancement Using Deep Learning *Muhamad Faris Che Aminudin, Shahrel Azmin Suandi*
BP05	Classification of Manufacturing High Dimensional Data Using Deep Learning-based Approach *Mohd Nor Akmal Khalid, Umi Kalsom Yusof*
BP06	Copy-Move Forgery Detection Using Convolutional Neural Networks *Arfa Zainal Abidin, Azurah A. Samah, Hairudin Abdul Majid, Saleha Safie, Muhamad Faiz Misman*
BP07	Cognitive-based Approach for Business Intelligence *Herison Surbakti, Azman Taa*
BP08	iFR: A New Framework for Real Time Face Recognition with Machine Learning *Syazwan Syafiqah Sukri, Nur Intan Raihana Ruhaiyem*
BP09	Automatic Liver Tumor Detection using Deep Learning: Triplanar Convolutional Neural Network Approach *Chung Sheng Hung, Gan Keng Hoon, Anusha Achuthan, Mandava Rajeswari*
BP10	Selection Drought Index Calculation Methods Using ELECTRE (Elimination and Choice Translation Reality) *Addy Suyatno Hadisuwito, Fadratul Hafinaz Hassan*
BP11	Deep Bayesian for Opinion-Target Identification *Omar Al-Janabi, Cheah Yu-N, Nurul Hashimah Ahamed Hassain Malim*
BP12	The Effect of Vocal Cues on Trust at Zero Acquaintance *Deborah Ooi, Syaheerah Lebai Lutfi*

BP13	EEG Channels Selection Using Hybridizing Flower Pollination and β-Hill Climbing Algorithm for Person Identification *Zaid Alyasseri, Ahamad Tajudin Khader*
BP14	Exploring Whole-Brain Functional Networks of Music-Linguistic from Rhythmic Quranic Recitations and Language Proficiency *Mas Syazwanee Shab, Muzaimi Mustapha, Aini Ismafairus Abd Hamid, Amiri Ab Ghani, Nidal S. Kamel*
BP15	Parallel Text Acquisition and English-Malay Machine Translation *Tan Tien Ping, Yin Lai Yeong, Gan Keng Hoon, Siti Khaotijah Mohammad*
BP16	Characterizing Compute-Intensive Tasks as a Factor of Network Congestion *Norfazlin Rashid, Umi Kalsom Yusof*
BP17	A Hyper-heuristic based Artificial Bee Colony Algorithm for the Traveling Salesman Problem *Choong Shin Siang, Wong Li Pei*
BP18	The Application of Machine Learning in Classifying Potential Vector Borne Disease Awareness *Abrar Noor Akramin Kamarudin, Zurinahni Zainol, Nur Faeza Abu Kassim*
BP19	Supersymmetry Feature Decomposition for Classification Purpose *Nu'man Badrud'din*

PRAGMA POSTER LISTING

Poster Presentation	
Poster ID	**Title and Author**
PP01	Mobile-based Augmented Reality for Sundanese Alphabets Education *Muhammad Reza Aditya, Resskytha Permata Sari, Adri Nursimarsiyan and Nova Eka Diana*
PP02	Deep Learning Classification for Liver Disease *Andi Batari Ahmad and Nova Eka Diana*
PP03	Application of Deep Learning and Fingerprint Modeling Methods to Predict Cannabinoid and Cathinone Derivatives *Widya Dwi Aryati, Gerry May Susanto, Muhammad Siddiq Winarko, Heru Suhartanto and Arry Yanuar*

PP04	Building Smart City Datasets with Crowdsourcing for Safe Direction in Bangkok, Thailand *Manassanan Boonnavasin, Suchanat Mangkhangjaroen and Prapaporn Rattanatamrong*
PP05	A Network Performance Measurement in a Low-Cost Containerized Cluster System *Thitiwut Chamornmarn, Vasaka Visoottiviseth and Ryousei Takano*
PP06	A Prototype of Collaborative Augment Reality Environment for HoloLens *Dawit Chusetthagarn, Vasaka Visoottiviseth and Jason Haga*
PP07	Analysis of Load Balancing Performance on Cluster Computing with Proxmox VE *Andi Rasuna Dharsono and Sri Chusri Haryanti*
PP08	Performance Comparison of Load Balancing using Honeybee and Threshold Algorithm *Aditya Efrian, Sri Chusri Haryanti, Sri Puji Utami Atmoko and Ridho Yanevan Pratama*
PP09	Data-centric Modeling of Gainesville Businesses *Michael Elliott, Erik Bredfeldt, Matthew Collins, Renato Figueiredo, Mark Girson, Amardeep Siglani, Lila Stewart and Jose Fortes*
PP10	Performance Analysis of GTX 980 GPU on Colon Histopathology Images Training Based on Convolutional Neural Network *Toto Haryanto, Aniati Murni, Kusmardi Kusmardi, Li Xue and Suhartanto Heru*
PP11	Dengue Hemorrhagic Fever Disease Data Clustering Based on Interactive Map in Special Region Jakarta Capital *Brian Hogantara and Ummi Azizah Rachmawati*
PP12	Curating Target-Activity Information for Nadi Compounds Based on CHEMBL using Similarity Searching *Muhammad Jaziem Mohamed Javeed, Aini Atirah Rozali, Siti Zuraidah Mohamad Zobir, Habibah Abdul Wahab and Nurul Hashimah Ahamed Hassain Malim*
PP13	Design AR application using the tiled display walls *Jidapa Kongsakoonwong, Jason Haga and Boonsit Yimwadsana*
PP14	Decision Support System based on Interactive Map of Measles and Rubella Data in Jakarta *Pravin Kumar, Elan Suherlan and Ummi Azizah Rachmawati*
PP15	RNA-seq transcriptome profiling of Desmos chinensis: revealing the molecular basis of petal evolution in the custard apple family Annonaceae *Amy Wing-Sze Leung, Sangtae Kim and Richard Mark Kingsley Saunders*

PP16	Computational Fluid Dynamics Study of Wind Environment in Urban Areas *Chun-Ho Liu, Wai-Chi Cheng, Wenye Li, Ziwei Mo, Zhangquan Wu, Lillian Y.L Chan, W.K. Kwan and Hing Tuen Yau*
PP17	Enhancing MedThaiSAGE: Decision Support System using Rich Visualization on SAGE 2 *Jarernsri Mitrpanont, Wudichart Sawangphol, Supakorn Silapadapong, Suthivich Suthinuntasook, Wichayapat Thongrattana and Jason Haga*
PP18	Tuberculosis (TB) Disease Interactive Map in Jakarta Capital Special Region *Nuraisah and Ummi Azizah Rachmawati*
PP19	Digital Poster Management application on a SAGE2-based Multiple Display system *Prakritchai Phanphila, Vasaka Visoottiviseth, Jason Haga and Ryousei Takano*
PP20	Machine learning for processing image data for disaster management *Parintorn Pooyoi, Jason Haga and Worapan Kusakunniran*
PP21	Room Auto Controlling Based on Occupant Body Condition Using Arduino and Raspberry Pi *Ahmad Sabiq, Nova Eka Diana, Debita Febriana and Sri Chusri Haryanti*
PP22	Criminality Linguistics Detection on Social Networks Through Personality Traits *Saravanan Sagadevan, Nurul Hashimah Ahamed Hassain Malim, Nurul Izzati Ridzuwan and Muhammad Baqir Hakim Mohammad Bashir*
PP23	Performance Comparison of Dynamic Load Balancing Algorithm for Indonesian e-Health Cloud *Ridho Yanevan Pratama, Aditya Efrian, Sri Chusri Haryanti and Sri Puji Utami*
PP24	Using UAV images for smart agriculture to monitor rice paddy with artificial intelligence *Ming-Der Yang, Hui Ping Tsai, Yu-Chun Hsu and Cloud Tseng*
PP25	rEDM Code Acceleration with ABCI Supercomputer *Wassapon Watanakeesuntorn, Kohei Ichikawa, Jason Haga, Gerald Pao, Erik Saberski*

BDS2 PROJECT ABSTRACTS

[BS01] Reliability Assessment Framework using Test-Defect Coverage Analytics Model

S. M. Syed-Mohamad[1,*], M. H. Husin[1], W. M. N. W. Zainon[1]

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Keywords: Software Analytics, Software Testing, Visual Analytics, Software Reliability

Software testing is a process by which quality of the software under test can be identified. Information collected during testing such as defect models is used to decide whether a piece of software is ready to be released. An early process was to freeze the software code to prevent further additions to the software functionality and then test it. Any defects revealed by the testing process were then fixed and retested. The rate of detection and fixing of outstanding defects and the overall decline in the number of outstanding defects with respect to time or testing effort indicates the level of reliability and this has led to various software reliability growth models [1]. However, these depended on being able to hold the code steady for a fixed period in order to observe the growing reliability. The emergence of incremental development in its various forms such as Agile and DevOps requires a different approach in determining the readiness of the software for release [2]. This approach needs to predict how reliable the software is likely to be based on continuous-planning tests, not defect growth and decline. Continuous testing and automation are a key aspect of rapidly evolving software which results in continuous stabilization throughout the development process. Yet, there has been little formalization of quality assurance practices that support decision making for software developed using the contemporary software practices. The ultimate goal of this research project is therefore to establish an integrative reliability assessment framework, driven by metrics and analytics-based insight.

There is a positive correlation between coverage and failures [3]. The more coverage, the greater the chances for a defect to be detected. Yet, test coverage should not be the main indicator to test effectiveness [4]. These and, possibly other factors can be used to predict differing levels of test coverage for different parts of software under test. Therefore, Test-Defect Coverage Analytics model (TDCAM) is proposed to assist decision-making about quality of software, in particular related to reliability assessment. TDCAM integrates test coverage and defect coverage related metrics into a visual form, enabling users to observe the information. Test coverage measures the amount of testing performed by a set of tests (a test suite). It includes gathering information about which parts of a program are actually executed when running the test suite. It is used to gauge the effectiveness and completeness of testing and indicates reliability [1]. Currently, TDCAM focuses on code coverage, in which it measures the degree of testing of the source code. An example of the measure of control flow is branch coverage which is the percentage of branches that have been exercised by a test suite. The second data element of TDCAM is defect coverage. Defect coverage is the fraction of defects detected by a test suite during testing. In our study, the defect coverage provides defect related metrics such as number, types and severity of defects.

A case study on Apache POI, an open source project, has been conducted to validate the proposed model, visualized in a bubble chart, as depicted in Figure 1. The x- and y-axes represent test coverage (in branch unit) and defect coverage (defect numbers), respectively. The bubble size represents severity of defects. Based on this empirical study, the "xssf" component contains the most high severity or critical defects compared to other components. Testing team may strategize their testing effort to focus on any critical functions and resolving the defects.

Our future work is to extend TDCAM to become a suite of test analytics tool with support from artificial intelligence and visualization techniques. A more focused test effort can be achieved by using algorithms to automatically optimize test cases, for instance, tests that cover a recurring issue making it ideal for optimization. The new proposed framework will give a significant impact on how software stakeholders can make an informed decision about quality and deliver reliable software releases at higher velocities which the modern society is increasingly relying upon [5].

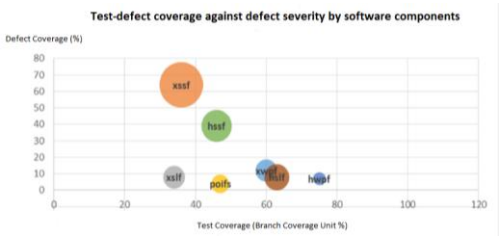

Fig. 1. Test-defect coverage metrics mapped against severity of defects

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Authors Biographies

SHARIFAH MASHITA SYED-MOHAMAD is a senior lecturer at the School of Computer Sciences, USM. Her research interests include software analytics, software reliability and testing, empirical software engineering, agile development and software metrics and measurement.

MOHD HEIKAL HUSIN is a senior lecturer at the School of Computer Sciences, USM. His research interests include e-government technology, Web 2.0, social media adoptions, project development management and software testing approaches.

WAN MOHD NAZMEE WAN ZAINON is a senior lecturer at the School of Computer Sciences, USM. His research interests are at the intersection of Visual Computing and software engineering with focus on software reuse, requirement engineering practices, visual data mining and multimedia information retrieval.

[BS02] Type-2 Fuzzy Systems and the Variations in the Uncertain Environments

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Keywords: type-2 fuzzy sets, interval type-2 fuzzy sets, general type-2 fuzzy sets, intuitionistic fuzzy sets

Fuzzy system utilises set theory in a mathematical form to represent vagueness of parameters by using fuzzy set representation. In fuzzy system, the basic idea is that statements are not merely 'true' or 'false' since partial truth is also accepted by introducing a degree of membership from 0 to 1 in a fuzzy set (Uzokaa et al., 2011). It is much closer to human thinking and natural language by providing an effective means of capturing the approximate, inexact nature of the real world.

Type-2 Fuzzy Sets

Fuzzy sets have tremendously developed over the years. Firstly, in 1998, Karnik and Mendel proposed Type-2 Fuzzy Logic System (T2FLS) based on Type-2 Fuzzy Sets (T2FS), which was proposed by Zadeh (1975). Nowadays, the Interval Type-2 Sets (IT2FS) are the common application of type-2 fuzzy sets. It has shown to be very powerful in handling the uncertainties when compared to Type-1 Fuzzy Sets (T1FS, conventional fuzzy sets since 1975). Recently, several researchers have started to explore the application of General Type-2 Fuzzy Sets (GT2FS) and systems. Wagner and Hagras (2010) first introduced GT2FS, which is one of the advanced extensions of the type-2 fuzzy sets to capture high level of uncertainties.

In simple terms, general type-2 comprehends an *n*th number of interval fuzzy set simultaneously rather than just an interval (interval type-2) during fuzzification. The conventional type-1 fuzzy set handles a single fuzzy value, whilst the interval type-2 fuzzy set defines an interval type-2 fuzzy value to measure the uncertainties. Apart from this, fuzzy sets have developed in many ways to interpret uncertainties, such as intuitionistic fuzzy set, which takes both membership and non-membership values of fuzziness. In 2014, Naim and Hagras have proposed Intuitionistic Interval Type-2 Fuzzy Sets.

Type-2 Fuzzy System

However, Mendel and John (2002) stated that the type-2 fuzzy sets are more difficult to use and understand than the type-1 fuzzy sets; hence, their use is not yet widespread. Researchers had difficulties to make type-2 fuzzy sets easy to use and understand with the aim that they would be widely used. This statement generalises the interval type-2 fuzzy sets (IT2FS) and it was stated 5 years ago. It is known now that the application of the general type-2 system (GT2FS) are minimal since Wagner and Hagras proposed Zslices in 2010. In the literature, we found that when utilising the general type-2 fuzzy sets, the complexity of the system increases in order to evaluate the higher level of uncertainties. Several works on the general type-2 applications have been done in clustering and classifier problems (Golsefid and Zarandin (2016), Rakshit et al. (2016)). The remaining works mainly published results on the FLS (tuning general type-2 parameters) and the mathematical operators (Zhai and Mendel (2011), Almaraashi et al. (2016)).

The Application of Type-2 Fuzzy System

Currently, my research interest is to adapt type-2 fuzzy theories into any potential application in fuzzy environments. The focus of my research plan is to learn the basic system, finding the problem and simultaneously applying the system to generate the optimised output. Several fuzzy type-2 applications such as in the intelligent environments (intelligent lighting for reading) and social surveys (postgraduate surveys) have been done. Moreover, secondary datasets and expert opinions from clinicians have been acquired to diagnose new baby born condition (collaboration with Prof Jonathan Garibaldi, University of Nottingham) to study the level of uncertainties in type-1 and type-2 fuzzy theories. The results show that by increasing number of experts/decision makers (also increasing the data volume), general type-2 fuzzy system outperformed interval type-2, intuitionistic interval type-2, and type-1.

Different real-world applications using higher-ordered fuzzy system such as science maritime, ambient intelligent in smart home laboratory for elderly and higher voltage insulator have been investigated. Collaborations have been established in different application areas such as to predict index deprivation in household, predict performance and health index from the students' database, and currently learning fuzzy rule-based from the sensor signal to recognise human activity.

The aim is to expand the potential of implementing type-2 fuzzy sets in big data analytics in many important application areas. The result is expected to improve the conventional system and decision-making techniques to provide a system that able to mimic groups of human decision.

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Syibrah Naim is a senior lecturer at School of Computer Science, Universiti Sains Malaysia since 2016. Syibrah completed her Ph.D. at University of Essex, her master and undergraduate studies at Universiti Malaysia Terengganu. Her research interests are type-2 fuzzy sets, fuzzy logic, fuzzy decision-making, and optimisation. She has higher interest to adapt higher-ordered fuzzy theories into any potential application in fuzzy environments.

[BS03] Data Mining System to Detect Finger Motion in Offline Handwriting Forgery

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Keywords: Data Mining, Finger Motion, Offline Handwriting, Classification, Forgery

Abstract

Introduction: Every individual has their own unique handwriting characters which may differ by line quality, spacing (line or spaces between character and word), height, width and size of letters, pen lifts and separations, connection strokes, beginning and ending strokes, unusual letter formation, shading (pen pressure), slant, baseline habits, flourishment, and embellishments and diacritic placement.

Problem Statement: It is difficult to judge the genuine or fraudulent nature of handwritten documents on the visual inspection basis. In the pasts, the offline handwriting classification was determined solely based on the handwriting pattern recognition [1]-[4]. The offline handwriting forgery issues are still unsolvable as the counterfeiters' tricky attempts on offline handwriting forgery are not properly understood. In particular, there was no work that predicts handwriting patterns from the finger motions.

Objectives: Therefore, this study aims to integrate finger motion captures into offline handwriting data pattern detection with specific goals (i) to recognize finger motion features to classify similar handwriting patterns, (ii) to develop a data mining system that detects offline handwriting patterns characterized by finger motion (iii) to analyze and compare the differences between genuine and forged offline handwritings.

Method: A total of 30 subjects was tasked to write the phrase "Sphinx of black quartz, judge my vow" using their dominant hands with a provided Pilot G2 05 gel ink rollerball pen for two repetitions; under 60 fps video capture using 16 MP sports camera. The handwritings were executed on a desk at 0.74 m height (elbow height) with a sheet of survey form on it.

Data analysis was conducted at two-phase data mining analyses: data pre-processing (video-image-numeric transformation, numeric data screening) and handwriting feature classification using the J48 algorithm on 10-fold cross-validation mode aided by the WEKA tool. The initial phase analysis translated the raw data into 15 attributes: writing time, three-finger (thumb, middle, index) coordinates, pen-grip angles, and phrase length in two replicates; and phrase inclination, demographic data (gender, handedness). The second phase analysis grouped data by similar handwriting patterns (phrase length, inclination angle) with the rule-reasoning relationship application. The Neuroph OCR (Optical Character Recognition) system in Java language was developed to recognize handwriting characteristics (phrase length and inclination angle) on different class patterns. The capability of the developed system will be tested on Aspects of Consistency Level (ACL).

Results: Findings show consistent classification accuracies on the handwriting inclination angle using Tree classifier algorithms. The classification accuracy that was trained on the J48 algorithm could achieve 98% with the thumb angle being the most discriminant feature. A system which includes the finger motion features (three-finger coordinates) data to identify offline handwriting patterns is to be developed.

Conclusion: This paper reports an ongoing sustainable research in developing a data mining system to detect finger motion for distinguishing the offline handwriting patterns. The experiment data collection with its analyses was completed at the data mining level. The findings from the data classification level were obtained and significant finger motion attribute was identified. A system was developed from Neuroph OCR (Optical Character Recognition) to recognize handwritten letters and characters. Further efforts were required to compare between the genuine and forged online handwritings and to integrate finger motion data into the system. This study contributes to the advancement of data analytics via an automated process for forensic handwriting examination in the cyber-security industry. Future extended works may involve the Division of Commercial Crime Investigation Department, Royal Malaysia Police and potential software development company to support the system implementation and testing.

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Authors Biographies

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[BS04]Strategic Cyber Threat Intelligence Using External Unstructured Data

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Keywords: Cyber Threat Intelligence, Cybersecurity, Robotic Process Automation, Natural Language Processing, Unstructured Data

Purpose

Cyber threats are continuously evolving, and represent potential threats to national security. With the increasing number and variety of cyber threats, cyber security analysts face multiple challenges in obtaining the required data and performing the necessary analysis to detect, monitor and respond to such threats in a timely manner. The goal of this project was to automatically acquire, process and analyze cybersecurity news from external online sources, enabling cyber security analysts to perform data exploration and discovery through a series of dashboards, resulting in actionable insights and enhancing their ability to formulate the right strategies to respond to possible cyber threats.

The project was a research and development collaboration between CyberSecurity Malaysia (project owner and subject matter expert), KewMann (consultant and solution developer) and UTM Skudai (through Cyber Threat Intelligence Lab, Faculty of Computing). The scope of the project consisted of Threat Actors Landscape, Global Cyber Attack Landscape, Terrorism Events in South East Asia and South China Sea Conflict News Landscape.

Method

Multiple software robots were designed and configured to acquire unstructured data from specified cybersecurity online news websites and news aggregators through Robotic Process Automation (RPA). The collected data then underwent text pre-processing in preparation for further text analysis, which involved extensive use of Natural Language Processing (NLP) techniques (Schatz, Bashroush, & Wall, 2017). Text preprocessing was first conducted to clean and structure the collected texts, which included tokenization, stemming, text duplication removal and filtering of irrelevant content. Term frequency–inverse document frequency (TFIDF) (Ramos, 2013) was then applied to extract relevant keywords, while customized Name Entity Recognition (NER) was used to obtain security-related information such as dates, persons (i.e. threat actors), methods (i.e. cyber-attacks), organizations (i.e. industry verticals) and locations.

Text analytic techniques enabled cyber threats profiles to be visualized based on best practices set out by Tufte, Goeler, & Benson (1990), leading to strategic insights on cyber-attacks and threat actors against specific industry verticals. This allowed important questions to be addressed accurately and in a timely manner:

- What are the main cyber threats against each industry vertical?
- What are the impacts of specified cyber threats to target victims?
- What are the cyber threats trends for specified time periods?
- Do threat actors change their tactics?
- How do these cyber threats impact our national cyber security?

Results

The cyber threat landscape Overview consists of a composite visualization of the number of occurrences of cyber security news in the last 30 days by category (Threat Actors, Cyber Attack Methods, Terrorism Events, and South China Sea Conflict News). Data from each category was then visualized based on time series or geo-location, allowing cyber security analysts to discover any trends or patterns within the collected data. Full-text search and filtering capabilities were implemented so that cyber security analysts could easily locate data points of interest and perform data drill-down where required. As a result, the analysts were able to visually analyze the data, detect specific events, and monitor entities of interest (people, groups, companies, industries, methods and locations). For future works, deep learning techniques will be employed, particularly Recurrent Neural Networks (RNN), to extract knowledge and hidden patterns once a sufficiently large volume of security-related news has been collected,

Conclusion

This project demonstrated that automatic processes can be applied to data acquisition and analysis, greatly reducing the time and effort between obtaining the raw data and useful end-user interactions, allowing actionable insights to be derived in a timely manner.

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Authors Biographies

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Kew Yoke Ling is the founder and executive director of KewMann, a regional big data and behavioral science company. KewMann helps organizations predict and influence human behaviors through cutting-edge big data technologies, and provides consulting services to government agencies, financial services, telco and other large organizations. Yoke Ling has a Degree (Hons) in Computing from Staffordshire University, UK and Postgraduate Diploma of Chartered Institute of Marketing (CIM), UK.

[BS05] Fiber Tractography using Grid Computing

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Keywords: Brain, Diffusion Tensor Imaging, Cerebral Small Vessel Disease, Tractography

Introduction

Cerebral small vessel disease (SVD) plays a major role in dementia, stroke and ageing (3,4). The SVD is a pathological process that affects the small vessels of the brain. It has been highly associated with cognitive disorders, and disturbances in mood and gait. In clinical practices, Diffusion Tensor Imaging (DTI) is widely used as neuroimaging marker of cerebral SVD. DTI enables the visualization of the brain microstructural connectivity. This microstructural connectivity is constructed through fiber tracking (tractography) of the white matter tracts. Figure 1 shows an example of whole brain tractography. Generally, a whole brain tractography consists of 100,000 to 1,000,000 fiber tracts.

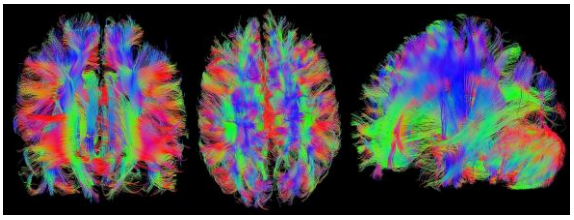

Figure 1: Whole Brain Tractography.

Visualization and quantification of white matter tracts is a very crucial step to assess the severity of SVD. The knowledge on the number of tracts between related brain structures will be a useful insight on the disease. Thus, the past decade has seen tremendous research efforts on the development of various tractography solutions (2). However, the tractography process is known to use high computing resources and time. Hence, most of the tractography solutions could not be made applicable in clinical practice.

Proposed Framework

In this work, it is planned to take advantage of grid computing in the tractography process to assist timely clinical assessment. The overall proposed framework is illustrated in Figure 2. This framework consists of three main phases, namely (i) DTI Preprocessing, (ii) Anatomical Localization and (iii) Tractography.

The first phase involves data format conversion, motion correction, brain extraction and data preparation. This phase is required to ensure the dataset is available in a suitable format for the tractography phase.

The fiber tracts may be grouped accordingly in reference to the anatomical brain structure or its functionality. In this work, fiber tracts are clustered into group based on its anatomical location. This is because fiber tracts originating from a similar anatomical location may carry a similar functionally. This similarly meaningful fiber tracts may form a fiber bundle. Hence, the second phase concentrates on localizing the major anatomical brain structures such as subcortical structures, frontal lobe and corpus callosum. Each anatomical structure will be used as starting point for tractography of similarly meaningful fiber bundles.

Then, in the third phase, it is proposed to perform tractography in a grid computing environment. Each of the anatomical structure will be used as the starting point. The tractography originating from a corresponding anatomical structure will be directed to one Central Processing Unit (CPU). A group of starting points will require multiple CPUs, which will form a grid computing environment.

A work by Lee and Kim performed tractography starting from multiple seed voxels in parallel instead of sequentially using multiple Graphical Processing Unit (1). However, in their work, the seed selection does not correspond to any anatomical structure that corresponds to a target functionality. Hence, in this proposed work, it is modeled to first localize the anatomical regions that corresponds to a meaningful fiber bundles and then construct its tractography in the grid computing manner.

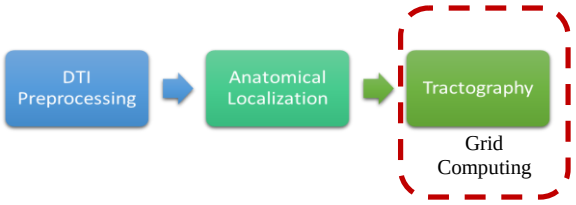

Figure 2: Proposed Whole Brain Tractography.

Research Contributions

The main challenge in this work in on the localization of anatomical structures that can produce meaningfully similar fiber bundles. Research effort in this work will focus at the anatomical localization phase. Besides that, research into parallelizing the tractography and finally merging the multiple fiber bundles into a whole tractography will also be given attention.

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[BS06] Can I Trust You? Towards Modelling Trust at Zero Acquaintance

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Keywords: Facial expression, Gesture, Trust modelling, Zero Acquaintance, Voice

Introduction

Much research has already been carried out in this field of affective computing. Research trying to identify emotions from face, gesture and voice are abounding in number, each with their own specific outcomes. However, there is one area that has yet to be looked into. Trust. Can you trust me? Will you trust what I am going to present? Will you trust that I will deliver? How did I make you trust me? These are the questions we are seeking to answer through our work thus far. Why is this important, you may ask?

Commercial dealings would never happen as neither party would trust the other enough to deliver what they have promised. E-commerce would never grow. Relationships would not last long and more often than not end up in arguments or conflict. Even in a classroom setting, students would have a hard time believing the things taught by the teacher if they lack trust in the teacher. Similarly, teachers would have a hard time teaching the students if they don't trust that the students would readily absorb all that has been given. This situation is especially prevalent in online tutoring, where there is a lack of personal connection between teacher and student. If technology was able to accurately measure how "trustworthy" the teacher is, the teachers could then take steps to improve themselves in that area. For example, the teachers could speak with more authority, or lower their voices to a more gentle tone. Maybe smile more, or smile less. Such feedback would prove invaluable to improve the teaching and learning process.

In recent years, several researches have been conducted on the factors that determine trustworthiness. Particularly, many studies have shown the significance and importance of voice in perceived trustworthiness. For instance, from a medical perspective, a research has found that audio communication shows a more significant emergence of trust as compared to text chat. Yet another investigation has studied facial features and identified that men with greater facial width were more likely to exploit the trust of others and that people were more likely to trust male counterparts with narrow rather than wide faces. This study attempts to model trust using machine learning methods towards achieving a larger effort in building synthetic agents that that can gauge trust, especially when in a learning domain.

As of this moment, this gargantuan task is still in its early stages. We have identified the modality (cues) that would used to mine features of trust - face, voice and gesture. Cues through expressions conveyed via these sources would be analysed and quantified into a machine readable form, using image and voice processing technologies. A model would be constructed using a machine learning methods.

Method

To carry out this investigation, a total of 120 different video samples have been obtained from the OMG-Emotion behaviour dataset (Barros et al., 2018). Each of these video samples will be cropped to form a 10 second long video clip. To investigate the effect of facial features and gestures on trustworthiness, each video clip will be muted and subjected to analysis by using a video data analysis software.

Each participant in this study will be asked to rate the trustworthiness of 5 different video clips. The participant will submit their ratings via a simple online assessment indicating the amount of trust they would place in the speaker. Two different sets of participants will rate how much they trust the speaker -- the first set is based on face and gesture of the speaker in the videos that are muted, and the second only based on vocal cues in a set of voice clips extracted from the above mentioned videos.

The characteristics of each video clip will also be analysed, along with the ratings from the participants. This will be analysed by using a correlation matrix to determine the features that have a significant impact on perceived trustworthiness.

Expected Results

The potential outcomes of this investigation are plentiful. In addition to precisely measuring the sole impact of facial features and gestures, as well as pitch or speech rate on perceived trustworthiness, this investigation would also be able to identify the effects of the semantic content by analysing the difference in trustworthiness rating from one original audio clip and another. The outcomes are truly endless and at the very least, a relationship is hoped to be identified between facial features, gestures and voice characteristics and perceived trustworthiness.

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[BS07] Data Science Analytics for Manufacturing and Supply Chain

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Keywords: Data analytics, industry 4.0, manufacturing, supply chain, big data, internet of things, artificial intelligence, cyber physical system.

Background and Motivation

The paradigm of research had moved from empirical, theoretical, simulation and to currently exploration of data or data-driven (Hey *et al.*, 2009). The cycle of a research is supported by its data, from data capture and data curation to data analysis and data visualization. However, good tools for both data curation and data analysis are still lacking.

Since the advent of "big data", lots of research efforts have devoted themselves to this new research topic, and most of them focus on social or commercial mining (Lee *et al.*, 2014). However, those researches mostly focus on 'human-generated data' instead of 'machine-generated data', which include machine controllers, sensors, and manufacturing systems. The latter leads to the emergent of industrial big data that leads to predictive analytics in manufacturing, in realizing the demand of Industry 4.0.

In addition, under the Industry 4.0 concept, astounding growth in the adoption of information technology and social media networks has increasingly influenced consumers' perception on product innovation, quality, variety and speed of delivery (Zhong *et al.*, 2017) in supply chain. As such, data analytics provide an opportunity to the supply chain management through service innovation that transparent throughout the product lifecycle; enabling to adapt to the market requirements that are highly customizable and very tractable demands.

Data Science and Analytics in Manufacturing and Supply Chain

A unified information grid based on the recent developments of the Internet of things (IoT) framework and the emergence of sensing technology have created a tightly connected systems and humans, which further populates the big data environment of the industry. In today's competitive business environment, big data, cloud computing and advance analytics are the necessary framework to systematically process data for intelligent decision-making (Lee *et al.*, 2014).

Cyber Physical System (CPS) and service innovations are two inevitable trends for manufacturing industries. On one hand, CPS are automated systems that enable communication of the operations of the physical reality using computing infrastructures, utilizing networked devices (Jazdi 2014). On the other, service innovations that laid the foundation for Product Service System (PSS), in the form of software and embedded intelligence, are integrated into the industrial products and systems (Lee *et al.*, 2014).

CPS goes with the trend of having information and services everywhere at hand encompassing the communication activities and infrastructures such as Internet of things (IoT), Internet of Services (IoS) and Internet of People (IoP) (Hermann *et al.*, 2016). Manufacturing systems are able to monitor physical processes, create a "digital twin" (or "cyber twin") of the physical world, and make smart decisions through real-time communication and cooperation with humans, machines, sensors, and so forth (Zhong *et al.*, 2017). This enables all physical processes and information flows to be available across holistic manufacturing supply chains, small and medium-sized enterprises, and large companies.

PSS involves electronics and tether-free intelligence that intertwine predictive technologies with intelligent algorithms to predict, manage and optimize autonomously product performance and product services. This enable the product to be uniquely identified for its entire life cycle as an active entity where self-aware and self-maintenance can be performed; thus, encourage transparency among manufacturers, supply chains, and customers (Lee *et al.*, 2014). This fundamentally changes how the manufacturing operates, from reactive to proactive operations and ultimately predictive operating models.

Achieving these feats require certain underpinning technologies to allow problems to be solved and adaptive decisions to be made with minimum human involvement. Artificial intelligence (AI) allows such features by learning and reasoning that ultimately realize a connected, intelligent, and ubiquitous industrial practice (Zhong *et al.*, 2017). In tandem with the industry 4.0 framework, AI-enabled technologies with advanced data analytical capabilities, would realize a prognostic-monitoring system that can derive competitive advantage in design, monitoring, control, planning and execution level of both the manufacturing and supply chain.

Opportunities and Outlooks

With big data environment and emergent of industry 4.0, the prognostic-monitoring system is the major prospect for the realization of an industry-wide revolution. It would involve advanced analytical tools and AI-enabled technologies that "proactively" materialize data-driven modeling, big data analytics, data-enabled prediction, smart design and prototyping, real-time information sharing and monitoring, and collaborative decision making (Zhong *et al.*, 2017).

Data-driven modelling and data-enabled prediction would drive the quality, efficiency and agility of the manufacturing through knowledge and insights gained from the data deluge. Real-time information sharing and collaborative decision making would augment the cognitive ability of humans while complement limitations of the machine. Smart design and prototyping would enable the creation of more industry-wide value added processes and services (Lee *et al.*, 2014; Zhong et al., 2017).

Nevertheless, materializing the intelligent factory of the future, through the prognostic-monitoring system with respect to industrial settings, remain a huge challenge which requires a collaborative effort by scientist, researcher, and practitioner.

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[BS08] Interfacing Chatbot with Data Retrieval and Analytics Queries for Decision Making

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Keywords: Chatbot, Information Extraction, Unstructured Texts, Natural Language Parsing, Structured Retrieval

Motivation

Conventional data analytics process uses dashboard with tables, charts, summaries, search tool in projecting its analysis outcome to its user with the goal of enabling discovery of useful information, suggesting conclusions etc. to support decision-making [1][3]. Such decision-making mechanisms can be improved further by using natural language interface in the dashboard components, e.g. using natural language keywords to search the sales performance of a product. Motivated by the needs to enable a user friendlier interaction with analytics outcome, this project proposes a natural language chatbot who can assist in the role of decision making by delivering information of dashboard components with human like conversational pattern.

From User Intent to Data Retrieval and Analytics

The process of data analytics started from data cleansing, transforming, modeling data and finally delivering the processed data to the user. The data to be accessed is communicated using dashboard via visual and information lookup tools. The needs of better mechanism to communicate analytics data with user [2] can be seen from the rapid development of many commercialized business intelligence or analytics dashboard (e.g. Sisense, Kautilya BI, Wizdee Natural Language BI, Pentaho etc.) on the market.

From data retrieval to analytics, current interaction between users and the system can be improvised with the usage of human like conversational chat agent. To connect the two ends between user input and business data, the intent posed by the user must be able to be interpreted to a corresponding business logic. The business logic decides how data will be accessed and manipulated before it is sent back as response to user.

Chatbot Scenario

A scenario of chatbot usage in data retrieval and analytics is shown in Figure 1. A question, i.e. "what is the sales increment for second quarter compare to first" was posed by the user to check the sales of his company. Although the information needs are clearly stated using standard question-type language, its corresponding business logic is complex. The intent of finding out about "increment" requires data retrieval process to obtain the sales amount of two quarters, followed by an increment function to perform calculation on the difference between the quarters.
An example translated intent, i.e. from natural language intent to its corresponding actionable statements for data interfaces (e.g. SQL, SOLR query) and functional interfaces (e.g. APIs calls) are as follows.

Data interface
SELECT 'period', SUM('sales_amount') FROM SALES WHERE 'period' = "1Q" or 'period' = "2Q" GROUP by 'period';

Functional interface
function difference_values(pre_value, post_value) return array(status_increase_decrease, diff_percentage, diff_value)

From the above example, although the desired result is to have the chatbot to inform the user that sales has increased; there could be other variant of outcomes that partially satisfy the information needs, e.g. display both sales of Q1 and Q2 (see example response in Figure 1), letting user to figure out the increment.

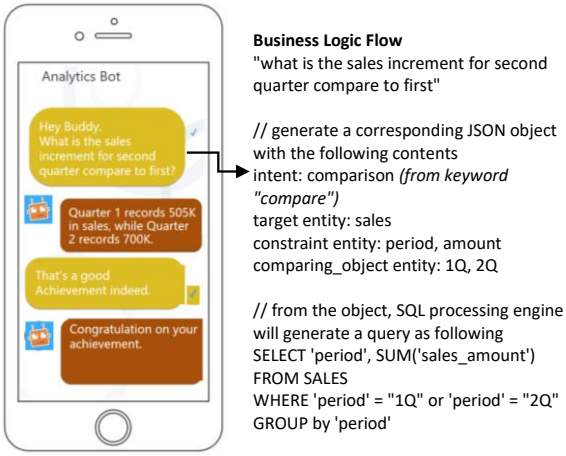

Figure 1: Example of chatbot conversation in data retrieval and analytics scene.

Project Prospect

In conclusion, the uniqueness of the work lies in connecting natural language with data accessing interface for analytics and decision making. This project covers several areas of research and development such as data storage and retrieval, domain analytics specification, natural language conversational modelling and query transformation. Prospective collaborators include dashboard solution providers, HPC centers and relevant interested parties.

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BDS2 Poster Abstracts

[BP01] Towards Large-scale Text Annotation for Sentiment Analysis using Semi-supervised Deep Learning

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Keywords: Data annotation, Sentiment classification, Semi-supervised learning, Deep learning

Background

Sentiment classification is a task of classifying an opinion text as expressing a positive or negative sentiment. In general, methods used in sentiment classification can be divided into two groups, lexicon-based methods and machine learning-based methods. In both methods, fully annotated corpora are required in evaluation stage and model training stage respectively. Along with the success of deep learning application in many other domains, researchers in sentiment classification also following in their footsteps (Nogueira et al. 2014; Kim 2014). However, it takes tremendous amount of time, cost and effort to build high quality fully annotated corpora. Semi-supervised learning is proposed by the researchers with the aim to minimize time and cost in creating a fully annotated corpus. Semi-supervised learning is a method that make use of a combination of labelled data and unlabelled data. In recent past year studies, researchers made efforts in exploring semi-supervised deep learning models in performing sentiment classification and they offer good results (Dai and Le 2015; Guan et al. 2016).

Motivation

In this internet era, massive amount of user generated data makes unlabeled data inexpensive and easy to acquire. To avoid the time consuming and expensive process of labelling massive amount of data without compromising model performances, semi-supervised learning appears as the most promising method to use. While many studies promote an optimistic view that unlabeled data is useful in improving model performances in semi-supervised learning (Nigam et al. 2000; Dai and Le 2015), yet there are also publications reported that adding unlabeled data reducing accuracy of the model (Zhang et al. 2015; Iosifidis and Ntoutsi 2017; Levatić et al. 2017). Therefore, researchers are motivated to add in only the informative unlabeled instances that have positive impacts on the model performances. Also, model trained in semi-supervised methods tends to produce unbalanced output without any constraints on data proportion (Iosifidis and Ntoutsi 2017; Levatić et al. 2017). In extreme cases, the classifier will classify all the unlabeled data into one of the classes which is undesirable.

In this work, we will focus on the document level sentiment classification. Compared to aspect level or sentence level sentiment classification, document level classification is more difficult as it is highly subjective and often contain variables of opinions. Hence, rule-based method has difficulties in capturing the variations of how opinions are presented in reviews (Guan et al. 2016). With the accessibility of large amount of data, deep learning serves as an encouraging solution with its ability in modelling the classifier. Whereas in semi-supervised deep learning, it is essential to select the unlabeled data subset with care and to apply appropriate constraints on data class proportions with the intentions of producing a good accuracy learner. To this end, we proposed to address following three problems: (1) demand of extensive labelling in supervised deep learning sentiment classification (2) unravel characteristics of unlabeled data that have positive impacts in classifier performances (3) tendency of bias propagation in semi-supervised methods.

Method

To address the first problem, two popular semi-supervised methods self-learning and co-learning will be explored and compared. For deep learning models, we proposed to use sophisticated types of recurrent neural network (RNN) based models which free from exploding gradient problem in modelling representations for sentiment classification. The idea to use RNN models is because it can learn long-term knowledge, the knowledge that does not change much overtime, and does not suffer high model complexity as RNN shares same parameters across whole learning process (Lai et al. 2015; Chen et al. 2016).

As for the second problem, we will find out the text features that are significant to classify an opinionated text. Our hypothesis is that by labelling the text that are sentiment relevance, we can improve the accuracy of classification. Subjective statements refer to internal state of a person which cannot be directly observed. In contrast, objective statements expressed factual information. But a subjective statement does not always contain opinion and an objective statement might express an opinion.

Lastly, for the third problem, we will review on previous works in balancing class proportion of unlabeled data to reduce bias propagation of model. There are three groups of approaches in tackling the issue: data level approaches, algorithmic level approaches and cost-sensitive approaches. Methods under these three categories will be explored and analyzed.

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[BP02] Big-spatial Data Pre-processing Framework towards Flood Assessment

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Keywords: Flood causative factors, Flood vulnerability, GIS

Introduction

Floods are the most common natural hazards in the world, leading to severe havocs on both lives and properties. Assessing flood vulnerability and its related risks has long been identified as an important approach for the formulation of policies as well as strategies aimed at mitigating the impacts resulting from any potential flooding events. Therefore, in this research, a framework that integrates multiple, heterogenous and voluminous spatial data sets was developed to obtain the required insights or knowledge that can efficiently aid in flood vulnerability assessment for proper mitigating measures.

Significance

Currently, some studies propose the use of structural means, such as dams and dikes as employed in Malaysia, Netherlands, Ngeria as well as the Sponge City in China (Sang & Yang, 2017),(Abdul Mohit & Mohamed Sellu, 2017),(Baghel, 2014),(Olukanni, Adejumo, & Salami, 2016), for flood mitigation, however, these measures have overly not been efficient due to the current climate change. While some have adopted topographical spatial data set for flood vulnerability assessment, as in the case of Nigeria (Ikusemoran, Kolawole, & Martins, 2014). Nonetheless, mitigating these risks are neither uniquely the product of structural systems, nor are they efficiently assessed by concentrating homogenous non-structural factors alone without considering the multiple flood causative factors (FCFs) to derive a holistic insight on geomorphological features of the Earth. This is because, the use of homogenous and scanty features is constrained in revealing other FCFs, such as topography, hydrology and vegetation of the study area. Therefore, to address these limitations, a framework based on heterogenous FCFs is developed to have a holistic insight on the geomorphological contents of the study area.

Method

In addressing the aforementioned limitations, Figure 1 below gives an illustrative approach.

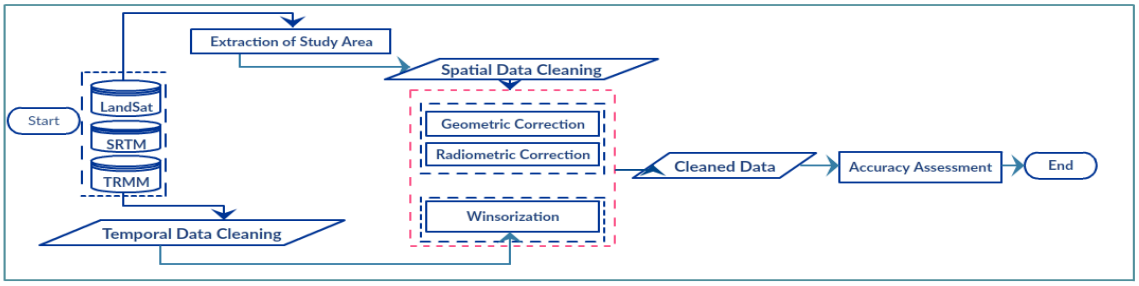

Figure 1: Big-SPAPFA Flowchart

As illustrated by this procedural flowchart in Figure 1, the derivation of the framework is from the formulation of big spatial data, which were pre-processed from various sources and of varied forms. Precisely, the map representing the study area was clipped from LandSat-8, SRTM and TRMM. After this initial stage, the output was corrected geometrically and radiometrically to have corresponding outputs depicting the hydrological, topographical and vegetal contents of the study area. The accuracy of the final output was assessed using flood inventory and other GIS means.

Results

From the approaches employed in the preceding section, flood vulnerability maps and their corresponding regional severity was classified based on the pre-processed multiple FCFs, which eventually produced the Big-SPAPFA framework as illustrated in Figure 2.

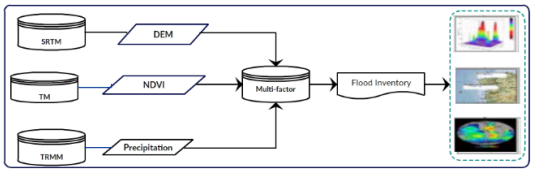

Figure 2: Big-SPAPFA Framework

From the above Figure, various FCFs were used to map out regional flood vulnerability and the corresponding levels of severity.

Conclusion

Flood risk assessment and mapping approach which classifies floodplains, are required in flood mitigation and proper decision-making. Thus, Big-SPAPFA framework was developed using multiple flood causative factors. Ultimately, the accuracy and the reliability of the framework was ensured using a decadal flood inventory.

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[BP03] Data Analytics of Malaysia's Most Influential Entities in Social Media for Commercial Purpose

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Keywords: data analytics, prediction, social media, key-influencer

Abstract

The social media agents such as Facebook and Twitter are powerful tools to capture pools of interest, sentiment and preference of the social media users. Thus, the agents are extremely useful for commercial purpose. Analyses of influential people were conducted in Sina Weibo [1], the most popular social media platform in China and, Facebook [2]. Meanwhile, [3] performed predictions of Sina Weibo users. [4] determined influential actors in Twitter. However, to date, no work was conducted to determine key-influencer for Malaysian scope. This work is to determine Malaysia's most influential entities in social media for commercial-related purpose. The entities in this study include people and business organizations. This study is significant because it can benefit marketer as the influential entities become the market-movers that may affect the fans' buying decision making. The key-influencers can bring much more impact on the products that they promote due to their higher popularity. Thus, a lot of profit will be earned by company as the more the followers get to see the products, the more the business opportunities.

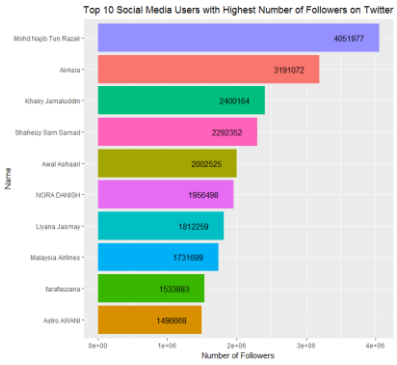
This work analyzed Malaysians 10 most influential entities as business and marketing key-influencer. On top of that, analysis and predictions of number of followers gained for a specified period of time for the influential entities were determined. Two sets of 10,000 data were collected within a duration of one month; April 2018 and, covered social media users in Malaysia. The data sets were acquired from Followerwonk and Twitter API which were obtained via a subscription of US$29 per month.

In order to determine Malaysia's 10 most influential entities, the Twitter data were imported to R Studio and edited from comma characters. Then, bar chart was plotted and listed 10 entities with the highest number of followers in ascending order. In order to determine number of followers gained in a month, 2 data sets were imported and cleaned from comma characters. Ten entities with the highest number of followers were selected from each data set and then merged. Bar chart was plotted based on the number of differences of number of followers of the two merged data sets.

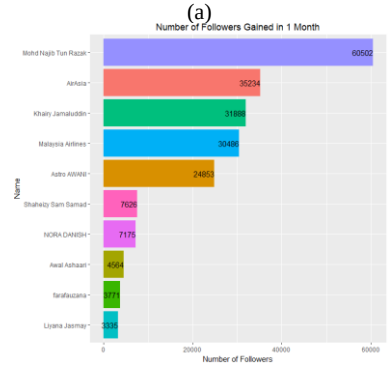
In order to predict number of followers gained, 100 tweets for each most influential entity was imported via Twitter API. Average number of retweets of each entity was calculated and the results were combined in a data frame. Then, the data frame was merged with the data set. Later, suitable attributes were determined via correlation plot and employed to be executed in linear regression function. If the result is satisfactory, then the output is considered as a good prediction.

As shown in Figure 1(a), Dato' Seri Najib Tun Razak has the highest number of followers followed by Khairy Jamaluddin. Air Asia as business organization was ranked second of the entities with 3,191,072 followers in April 2018. The former prime minister also topped in the number of followers gained in April 2018. Air Asia and Khairy Jamaluddin came in second and third, respectively in the mentioned category in Figure 1(b).

Astro AWANIis predicted to have the highest number of followers gain with 1,468,834 new followers. The prediction results are based on the targeted average number of retweets. In summary, data analytics is a powerful analysis tool to aid the market brand compared to local brand traditional marketing way.



(a)



(b)

Figure 1 Bar chart of (a) Malaysians top 10 influential entities, (b) number of follower gained in each influencer in April 2018

	Full Name	Followers	Targeted Average Number of Retweets	Fit	Predict Gain
1.	Mohd Najib Tun Razak	4,051,977	548	4,176,046	124,069
2.	Air Asia	3,191,072	259	3,397,839	206,767
3.	Khairy Jamaluddin	2,400,164	308	3,187,847	787,683
4.	Shaheizy Sam Samad	2,292,352	101	2,335,525	43,173
5.	Awal Ashaari	2,002,525	104	2,347,877	345,352
6.	NORA DANISH	1,956,498	101	2,335,525	379,027
7.	Liyana Jasmay	1,812,259	188	2,693,747	881,488
8.	Malaysia Airlines	1,731,699	101	2,347,877	616,178
9.	Astro AWANI	1,496,668	254	2,965,502	1,468,834

Table 1 Prediction of number of followers gained in April 2018

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[BP04] Low Resolution to High Resolution Video Surveillance Image Enhancement Using Deep Learning

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Keywords: Deep Learning, Convolutional Neural Network, Image Enhancement

Abstract

Surveillance cameras are widely used in this age to help improving the security and surveillance. The abundant of surveillance cameras and its placement cause variation in image quality captured by the camera because not all surveillance cameras have the same quality. These factors would affect the overall image quality capture by the surveillance camera. The low-quality surveillance camera usually has low-resolution image and this would cause problem for face recognition. The low-resolution (LR) image usually is pixelated and the person face is hard to be identified. Face recognition requires a good-quality image to extract all the features but with low-resolution image, there is fewer information that can be extracted. Therefore, image enhancement that able to improve the quality of LR image could improve the overall surveillance cameras system.

The propose method to enhance the LR image is by employing deep convolutional neural network (CNN). Based on research by Kim et al. (2015), the LR image can be enhanced by utilizing the end-to-end relationship of CNN and reconstruct the image using Super Resolution approach. In this research, SCface database is used as training sample because it contains a good-quality image (mugshot) and low-resolution image (camera variation) (Grgic et al., 2011). Low-resolution to High-resolution (LR-to-HR) Network is trained using mugshot image as a good-quality image reference for the network. The depth of network influences the performance. The mugshot image is trained using 25 convolutional layer between each layer contain rectified linear unit as activation function as shown in Figure 1. The 25 layers show the most optimum choice considering training time and its performance.

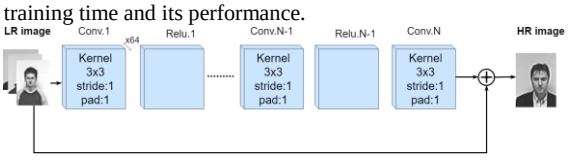

Figure 1: The architecture of LR-to-HR Network.

The trained LR-to-HR Network reconstructed the surveillance image based on the learned parameter in the last residual layer. The reconstruct image can be defined as:

$$\hat{I}_{HR} = F(I_{LR}) \quad (1)$$

where I_{LR} is the LR image and $\hat{I}_{HR}$ is the reconstructed high-resolution image based on the last residual layer F. F is the last layer in the architecture in this case, F is the 25th convolution layer. The aim of LR-to-HR Network is to reconstruct I_{LR} as similar as $\hat{I}_{HR}$ based on the residual layer that are trained with mugshot image. The network is trained using base learning rate of 0.1 and gradually decreases by factor of 10 overtime. To avoid exploding gradient dynamic gradient clipping is introduced using $-\frac{\theta}{\alpha}, \frac{\theta}{\alpha}$, where α is the current learning rate and θ is the gradient. As the learning rate decrease, the gradient clipping also changes. This make gradient clipping more dynamic and prevent the exploding gradient.

LR-to-HR Network is tested using surveillance image and the enhanced image is analyzed using Peak-Signal to Noise Ratio (PSNR) and Structural Similarity Index (SSIM). PSNR and SSIM are method to assess image quality. PSNR quantifies the noise in the image based on the pixel difference between two images (Hore and Ziou, 2010). SSIM evaluates the image quality based on three visual impacts; luminance, contrast, and structure (Wang et al., 2004). The results of LR-to-HR Network are shown in Table 1, 2, and 3.

Table 1 : Comparison between original images with mugshot images.

PSNR(dB)/SSIM			
	Distance 1	**Distance 2**	**Distance 3**
Cam 1	10.140/0.246	10.432/0.3036	10.661/0.3137
Cam 2	10.173/0.2517	10.204/0.3025	10.217/0.3223
Cam 3	10.584/0.2599	10.517/0.3038	10.297/0.3288
Cam 4	9.552/0.2356	9.433/0.2915	9.288/0.3097
Cam 5	8.630/0.2346	8.617/0.2740	8.555/0.2550
Cam 6	9.185/0.2947	9.979/0.3122	9.866/0.3412

Table 2: Comparison between enhanced images with mugshot images.

PSNR(dB)/SSIM			
	Distance 1	**Distance 2**	**Distance 3**
Cam 1	10.810/0.2635	10.686/0.3251	10.813/0.3418
Cam 2	10.403/0.2678	10.401/0.3214	10.366/0.3504
Cam 3	10.782/0.2738	10.679/0.3238	10.428/0.3577
Cam 4	9.796/0.2631	9.601/0.3204	9.412/0.3467
Cam 5	9.048/0.2511	8.975/0.2971	8.860/0.2953
Cam 6	9.856/0.3220	10.856/0.3560	10.264/0.3600

Table 3: Difference between enhanced image and original images.

PSNR(dB)/SSIM			
	Distance 1	**Distance 2**	**Distance 3**
Cam 1	0.67/0.018	0.254/0.022	0.152/0.0281
Cam 2	0.23/0.016	0.197/0.019	0.149/0.0281
Cam 3	0.198/0.014	0.162/0.020	0.131/0.029
Cam 4	0.244/0.028	0.168/0.0289	0.124/0.037
Cam 5	0.418/0.017	0.358/0.023	0.305/0.04
Cam 6	0.671/0.027	0.877/0.044	0.398/0.019

The results show there is improvement after the image is enhanced using LR-to-HR Network based on PSNR and SSIM values. The higher PSNR value and the closer SSIM value to 1 meaning that the better the image quality.

The proposed LR-to-HR Network shows that it capable to enhance the low resolution image by utilizing deep learning to learn required parameters to reconstruct the image based on the good-quality image. The pixelated image is smoothen out using this approach, and this would help in analyzing the image further.

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[BP05] Classification of Manufacturing High Dimensional Data Using Deep Learning-based Approach

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Keywords: Industry 4.0, big data analytics, high dimensional data, classification, machine learning and deep learning-based.

Background and Motivation

In recent years, manufacturing equipment are equipped with sensors to facilitate real-time monitoring of the production process (Tello *et al*., 2018). This provides an opportunity to perform quality control by predicting which manufactured products are at risk of being defective. Traditionally, defect was recognized by human experts inspecting each wafer. However, the size of electronic chips has decreased over time and is currently ≈65 nm, while wafers are becoming larger. A typical wafer may carry 1500–3000 chips, making expert evaluation impractical (Kim *et al*., 2016).

Recent adoption of information technologies in the manufacturing sector have prompted the emergence of the "smart factory" that employs an advanced information technologies such as the Internet of Things (IoT), the cloud, big data analytics and cyber-physical systems. The concept of a smart factory was introduced in the Hannover Fair 2011 with the vision of Industry 4.0. The concept affects most manufacturing activities such as demand forecasting, production planning and control, scheduling, inventory and logistics management (Kim *et al*., 2016).

A predictive analytics system that identifies defects in products before they are finalized, or even shipped, can result in significant savings for the manufacturer (Maurya, 2016). However, predicting defect in manufactured products is a challenging machine learning task due to the rarity of such failures in modern manufacturing processes. As such, the product defects can be predicted by classifying such rarity as data points with binary classes.

Classification is an important task of knowledge discovery in databases and data mining. Classification modelling is to learn a function from training data while makes as few errors as possible when being applied to data previously unseen (Sun *et al*., 2007). With the emergence of "big data", many classification algorithms in manufacturing are facing challenges, even though they used to be successful in different fields. High-dimensional data have been ubiquitous in various fields, such as biomedicine, cancer diagnosis using DNA data, and image classification (Yin and Gai, 2015).

Classification of High Dimensional Data

Classifying high dimensional data poses a challenge for classification due to the following two factors (Erfani *et al*., 2016): (i) Exponential search space – The number of potential feature subspaces grows exponentially with increasing input dimensionality. (ii) Irrelevant features – A high proportion of irrelevant features effectively creates noise in the input data, which mask the true class of the data. The challenge is to choose a subspace of the data that highlights the relevant attributes or features known as "curse of dimensionality" (Yin and Gai, 2015).

As was reported by Kim *et al*. (2016), most of the features of high-dimensional data are irrelevant to the target feature and the proportion of relevant features. Finding relevant features simplifies learning process and increases classification accuracy. Classification performance could severely degenerate if the learning methods directly implemented on high-dimensional or small sample data sets.

Alternatively, a deep learning model is one of the methods that can circumvent the challenges of feature extraction and has achieved a commanding lead on the state-of-the-art for solving high dimensional data. In recent years, interest in deep learning models have triggered due to several factors: (i) the availability of much larger training sets with labeled examples; (ii) powerful GPU implementations, making the training of very large models practical and (iii) better model regularization strategies (Xie *et al*., 2017). These factors enabled the training of truly deep learning models. In addition, deep learning models can learn to recognize high-level features by themselves.

Deep Learning and Future Outlooks

The layers of deep learning networks have escalated from several to hundreds in just few years when applied to large amount of data with more abstract and expressive representations (Xie *et al*., 2017). However, simply stacking more layers onto current architectures is not a reasonable solution, which incurs vanishing gradients by the time it reaches the end of the network.

Looking from another perspective, the classification problem is actually a dynamic process where the context is important although the input may be static (Kim *et al*., 2016). To utilize this information, a top-down (or feedback) connections that propagate the input downwards can be found in deep belief networks (DBNs). Deep belief networks (DBNs) are multi-layer generative models that learn one layer of features at a time from unlabeled data (Erfani *et al*., 2016). DBNs perform non-linear dimensionality reduction on very large data sets and learn high-dimensional manifolds from the data. As such, a novel classification model based on a prominent deep learning and DBNs model which addresses high-dimensional data would potentially provide high predictive accuracy with practical computational efficiency.

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[BP06] Copy-Move Forgery Detection Using Convolutional Neural Networks

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Keywords: copy-move, video forgery, deep-learning, video tampering, video forensic, convolutional neural networks

Video is widely used as supporting evidences and historical records in various field as an entertainment industry, video surveillance, medical imaging, military, legal evidence, political videos, video tutorials, advertisements, etc. (Gavade & Chougule, 2015; Pandey, Singh, & Shukla, 2016). Unfortunately, the growth of user friendly and easy-to-use multimedia editing tools, the editing or tampering video sequence has become easier and faster without leaving any noticeable traces of the tampering operations. The result of the tampering has become a serious social security event (Rocha, 2011). Therefore, effective detection of video tampering is of great importance for digital video forensics which is the main focus of this study. Copy-move video forgery is classified under spatial tampering attack which is a typical video tampering that needs to be done on all related frames to tamper some regions due to the correlation between frames (Chen et al., 2012). Although many forgery detection techniques have been proposed till date, there is still less study focusing on video copy-move forgery detection. The difficulty on tampering detection is due to the original and tampered region might be having the same artifacts or the forged area undergo geometric transformations and retouching (Sitara & Mehtre, 2016). Deep learning (DL) is a particular kind of machine learning that accomplish significant ability and flexibility by learning using the concept of nested hierarchy, with each concept defined in relation to simpler concepts. In this study, we investigate and develop the deep learning method used on features extraction which helps to reduce the computational time. DL provides a novel approach to the identification of features for the forged regions, which inherently represent characteristics of the forged regions appearing in the dataset. Thus, this method greatly saves time and energy to find new features from a set of videos. Although some DL methods have been implemented in video forgery detection, only a few have been studied for video copy-move forgery. The successful of DL in producing the excellent prediction results depend on the right architecture because of every architecture has their strengths and limitations. DL architecture is including the development of pre-training layers and training layers, back propagation for parameters optimization and regularization. The goal of DL architecture is to find the optimal parameters in each layer. Therefore, by choosing right architecture with the right type of data can boost the result analysis. Hence in this on-going study, a method in Deep Learning, ConvNet are proposed to detect video copy-move forgery. ConvNet is one of the deep learning method which capable to extract features instead of using the handcrafted feature. The network will extract the most suitable feature and output in the form of feature map. The performances of the proposed method will be measured using classification accuracy, specificity and sensitivity. The measured performance will be compared with previous method on video copy-move forgery by using SULFA dataset. Recently, video forensics in particular video forgery detection has emerged as an indispensable research field. Our ongoing study has identified that video forensics still presents many unexplored research issues, due to many factors such as peculiarities of video signals with respect to images and the wider range of possible alterations that can be applied on this type of digital content. Thus the research field offers a lot of additional research work and potential future works that can be done in collaboration with other researchers. We welcome partnership opportunities from other research institutes, industry and government.

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[BP07] COGNITIVE-BASED APPROACH FOR BUSINESS INTELLIGENCE

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Keywords: Business Intelligence, Cognitive-based Approach, Data Analytics, Tacit Knowledge, Unstructured Data

Purpose of study

Business intelligence (BI) plays key role to empowering the data and knowledge within the organization and uses extract, transform, and load (ETL) functions to capture, transform, and integrate the structured and unstructured data into a structured data warehouse (DW). Noticeably, the tacit knowledge in a higher institution, especially in libraries department contains huge of information and knowledge arises from the librarian inspiration and experiences during exploring solutions to the various problems (Sihui and Xueguo, 2016). This situation has resulted multiple data sources in the institutions often contradict each other, and cause poor outcome in data analysis. Therefore, this study introduced an enhanced BI framework with cognitive-based approach to systematically manage this problem.

Significance of study

Cognitive-based approach is a technique that ideally suited for the capturing tacit knowledge from among the massive data available these days. Moreover, the current BI system not be able to capture the data from the human skills and experiences due to the limitation of its framework (Bakar and Ta'a, 2014). Therefore, the BI framework produced from this study will helps developers to manage tacit knowledge in data analytics efficiently.

Research method

This research has investigated the limitations of BI framework in capturing various data types to identify the problem in handling the tacit knowledge for data analysis. The proposed model for managing tacit knowledge was adapted from Knowledge Information Data (KID) and cognitive approach model that proposed by Sato and Huang (2015). The approaches are able to develop a new data centric model that works with traditional structured data as well as unstructured data including video, image, and digital signal processing. The design will be used as the method to develop the cognitive-approach for capturing tacit knowledge and combines with the cognitive analytics to make the tacit knowledge as codified data source in a BI system.

The Business Intelligence Framework

Tacit knowledge can enrich the data analysis process. The form of tacit knowledge need to be converted as the codify data according to the ability of BI framework in processing the available data. The use of cognitive as an advanced approach to capture and extract tacit knowledge by elaborating the methods of predictive analytics, stochastic analytics, and cognitive computing in BI system. Thus, the new BI framework can be illustrated as shown in **Figure 1**. Furthermore, to convert the tacit knowledge to be a codify data or explicit knowledge, the cognitive approach will be needed such as cognitive mapping and cognitive analytics process. The converted tacit knowledge will be stored in the repository as the available data to re-use by instantiation, interpretation, and assimilation cycle process as shown in **Figure 2**.

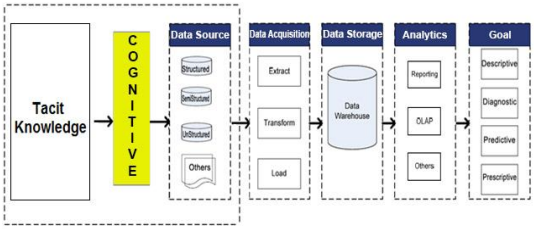

Figure 1. BI Framework Using Cognitive Approach

The proposed model of BI framework has been developed by adapting KID model for data cycle and cognitive analytics to capture and extract tacit knowledge as shown in Figure 2.

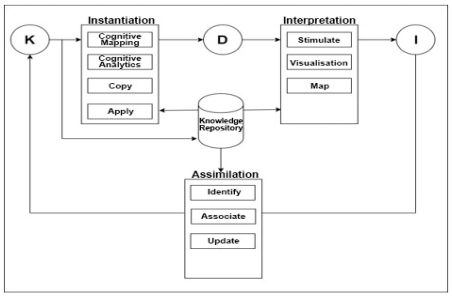

Figure 2. The KID model used in BI Framework

Conclusion

Cognitive system is the process of replicating the human thought processes in a computerized system or a model. Thus, the new approach for data analytics can be achieved by having the tacit knowledge to be analyzed in BI system. This research will assess the technique in capturing tacit knowledge, such as cognitive mapping technique, convert the captured tacit knowledge into unstructured data using cognitive analytics method, and absorb the incoming data as well as update knowledge as it happens by human tasks using the KID method. Thus, the captured tacit knowledge as mostly presented in unstructured data can be used in BI system for data analysis successfully.

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[BP08] iFR: A New Framework for Real Time Face Recognition with Machine Learning

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Keywords: Face Recognition, Machine Learning, Tensorflow, Deep learning, Eye blink detection

Abstract

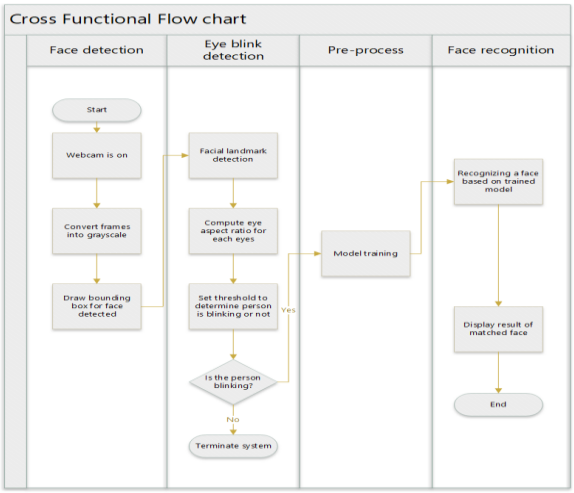
Face authentication has a significant usage in various applications. The trend of using face identification technology to unlock screen in smartphones shows a good acceptances of face authentication as a viable security measure. Other than security purposes, face authentication can be used for taking the attendance. Although we have fingerprint option to take the attendance, there are some flaws that we can highlight such as fingerprint can be contaminated and hygienic issue could arise as fingerprint is a contact-based authentication.

This research is carried out to study about deep learning and Tensorflow framework which are implemented in developing a real time face recognition. As deep learning is using gradient-based optimization, Tensorflow is especially suitable for it [1]. Apart from that, we also want to eliminate spoofing by using eye blink detection. We use eye blink detection to differentiate between real face and photo attack. In average, a normal person will blink 15-20 times per minute which is a person blinks in every four seconds. Besides, we intent to develop a system without human intervention as machine learning is capable to learn things and make decision by itself with the given data.

This system starts with face detection, eye blink detection and face recognition. In face detection phase, we are using pre-built classifier which is Haar cascade classifier from OpenCV in Python language to detect a face. We use two classifiers which are *haarcascade_eye.xml* and *haarcascade_frontalface_alt.xml.* The accuracy of face detected will be handled by *scaleFactor* parameter. The lower the *scaleFactor*, the face detection will be less accurate and vice versa. A bounding box will be drawn around the face(s) detected.

Next is eye blink detection. In this phase, we make use of OpenCV and dlib in Python language. Eye blink detection process starts with facial landmark detection to localize the eyes in given frame from video stream (webcam). Then, eye aspect ratio (EAR) for each eye is computed. It gives us a singular value, relating the distance between the vertical eye landmark points to the distances between the horizontal eye landmark points. To determine a person is blinking or not, threshold is set where EAR will remain approximately constant when the eyes are open and will rapidly approach zero during a blink, then increase again when the eyes are open. The system will terminate if the face is detected but eye blink is not detected. For early stage, we set a time constraint for the system to detect eye blink of the face detected. If the time constraint is exceeded, then the system will not proceed to recognition phase.

The process is followed by recognition phase. This is where deep leaning in Tensorflow framework is applied. We use a pre-trained model, FaceNet [2] to build the face recognition network in this system. In FaceNet model, the triplet loss is calculated for training. Triplet loss is about minimizing the distance between an anchor and a positive which both have the same identity and maximizing the distance between an anchor a negative which both have different identity. For our training data, we use CASIA Face Image Database Version 5.0 which has 2500 color facial images of 500 subjects. This dataset has typical variations which include illuminations, poses, expressions, eye-glasses and imaging distance. Apart from that, we also use Labeled Faces in Wild (LFW) as our benchmarks in recognizing face [3]. During the training process, the faces are aligned using Multi-task Convolutional Neural Networks (MTCNN) [4] to identify detect and align the faces by making eyes and bottom lip appear in the same location on each image.



Deep learning is the leading subset of artificial intelligence currently been discussed among researches and developers. Thus, this system is developed to take the advantage of latest technology to improve the previous system [5]. In this research study, we are mainly focusing on developing a system that is not hardware-dependent and that is why we emphasize on implementing deep learning and eye blink detection in this system. As our future work, we will focus on twin problem which is one of the challenging problems in face recognition.

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[BP09] Automatic Liver Tumor Detection using Deep Learning: Triplanar Convolutional Neural Network Approach

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Keywords: Deep Learning, Triplanar Convolutional Neural Network, Liver Tumor Detection

Introduction

Convolutional Neural Networks (LeCun et al., 1990) have recently demonstrated successes in computer vision tasks such as classification, segmentation and object recognition (LeCun et al., 2015), (Greenspan et al., 2016). This study proposed Triplanar Convolutional Neural Network (ConvNet) for automatic liver tumor detection in Computed Tomography (CT) images. The Triplanar ConvNet incorporates three different views of liver tumor, namely axial, sagittal and coronal planes extracted based on center voxel of interests (VOI) to classify liver tumor and healthy liver in the Liver CT dataset obtained from MICCAI 2008 Liver Tumor Grand Challenge (4 training, 6 test images) and MICCAI 2017 Liver Tumor Segmentation Challenge (LiTS) (131 training, 70 test images) in 512x512 image resolution. Liver tumor is the second major causes of cancer death for 745,000 patients (World Health Organization, 2014) and 788,000 patients (World Health Organization, 2015) worldwide. In clinical routine, CT image is the most commonly used modality for evaluation, surgery planning and progression evaluation of liver tumor. However, challenges arise in segmenting liver tumor from liver tissues such as low-contrast, variation of sizes and irregular shapes. In this study, we overcome these limitations using Triplanar ConvNet to automatically detect liver tumor based on the discriminative features learnt from three orthogonal views of liver tumor and healthy liver.

Background

A variety of algorithms including level-set, graph-cuts, morphological operations, SVM and AdaBoost have been developed for liver tumor classification and segmentation tasks. However, the approach employed depend on hand-crafted features, the needs of user interactions and the algorithms performance highly depend on the correct parameters during extraction and selection of features. Inspired by the improved accuracy of Triplanar ConvNet shown in medical imaging diagnosis work carried out in knee cartilage segmentation, anatomical brain segmentation, lung nodule classification and lymph node detection, we evaluated Single-view ConvNet and Triplanar ConvNet for liver tumor segmentation.

Methodology

Fig. 1 and **Fig. 2** illustrate Single-view and Triplanar ConvNet respectively. Single-view ConvNet consists of 2 Conv. layers, 2 Max-pooling layers and fully-connected layer. Triplanar ConvNet is built from three ConvNet architectures and accepts three streams of inputs (1st input: Axial; 2nd input: Sagittal; 3rd input: Coronal). The three views are subsequently merged using Merge layer (**Fig.2**) to extract learnable representation at the final layer.

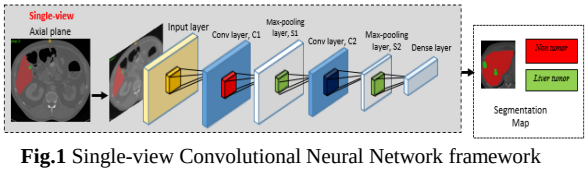

Fig.1 Single-view Convolutional Neural Network framework

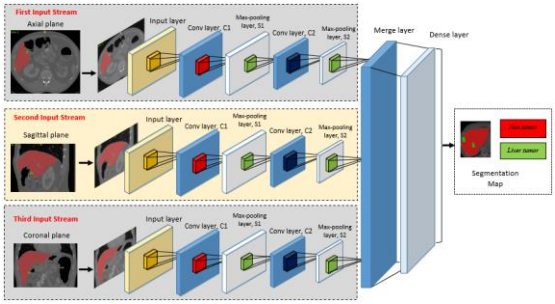

Fig.2 Triplanar Convolutional Neural Network framework.

Findings and Discussion

We trained Single-view and Triplanar ConvNet using GPU Tesla K40 acceleration with 2880 cores. We used patches of 17x17 pixels as the recommended optimum input dimension (Li et al., 2015) extracted from the CT volumes for our ConvNet approaches. As observed from the preliminary results (**Table 1**), the initial findings of 5.5% accuracy improvement observed from 50 epochs to 300 epochs in the training dataset are promising to demonstrate the use of Triplanar views in gaining additional insights and comparative evaluation for liver tumor segmentation in future work.

Table 1. Preliminary Evaluation Results

Methods	Trainable Params	Accuracy Improvement	Training epochs	Runtime (average)
Triplanar	29474	~95% to ~97.5%	50 to 300	8s 17μs* per epoch
Single-view	9826	~90% to ~92%	50 to 300	2s 58μs* per epoch

Acknowledgement

The authors would like to thank National Supercomputing Computer, Singapore (https://www.nscc.sg). The computational work for this article was done on resources of the National Supercomputing Computer, Singapore.

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** 1 Microseconds (μs) = 1.0×10-6 Seconds*

[BP10] Selection Drought Index Calculation Methods Using ELECTRE (Elimination and Choice Translation Reality)

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Keywords: Drought Index, Electre, Calculation Methods, KBDI

Drought index is an important measurement to monitor a forest from potential fires. In most cases, forest fires occur because the forests have a high drought index. One of the causes of the high drought index is a low rainfall condition. Drought is a recurring natural hazard characterized as having below normal precipitation over an extended period of time ranging from months to years (Dai, 2011).

This research to find out the suitable methods to calculate the drought index in a tropical forest. The Taman Hutan Rakyat Suharto, District of Kutai Kartanegara, East Kalimantan, Indonesia will be chosen as the case study as it is one of the tropical forest. Also, the Taman Hutan Rakyat Suharto are among the tropical forest with high risk in suffers from forest fire. The outcome of this study is that the recommended alternative becomes a reference in calculating the drought index in the tropical forest.

Comparison between methods has also been done by Homdee, (2016) and Jain, (2015). (Homdee, Pongput and Kanae, 2016) conducted a comparison the performance of three climatic drought indices to characterize drought trends in the Chi River basin in Northeast Thailand. Initially, the drought assessment was conducted using the Standardized Precipitation Index (SPI), a precipitation-based index, and the Standardized Precipitation Evapotranspiration Index (SPEI), an index taking into account the difference between precipitation and potential evapotranspiration (PET). (Jain *et al*., 2015) did research to compare Standardized Precipitation Index (SPI), Effective Drought Index (EDI), statistical Z-Score, China Z-Index (CZI), Rainfall Departure (RD), Rainfall Decile based Drought Index (RDDI) for their suitability in drought prone districts of the Ken River Basin. Based on our knowledge both studies compare the results, not the elements of the method.

In this paper we will compare seven types of drought index calculation methods which are also known as 'alternatives'. There are (1) the Palmer Drought Severity Index (PDSI; Palmer, 1965), (2) Keetch-Byram Drought Index (KBDI; Keetch et al., 1968), (3) Bhalme and Mooley Drought Index (BMDI), (4) the Standardized Precipitation Index (SPI; McKee et al., 1993), (5) Effective Drought Index (EDI), (6) The McArthur Forest Fire Danger Index (MFFDI) and (7) the Standardized Precipitation Evapotranspiration Index (SPEI; Vicente-Serrano et al., 2010).

The method used to compare seven alternatives is the ELECTRE (Elimination and Choice Translation Reality) algorithm. The electre algorithm uses a matrix calculation basis using five variables which are also known as 'criteria' referenced in the decision. There are (1) calculation period, (2) the type of data needed for calculation, (3) the complexity of the formula used, (4) suitable for use in the tropical forests, and (5) the type of calculation result scale. Rating suitability of each alternative on each criteria, rated 1 to 5 with the provisions of 1 for 'Very bad score', 2 for 'Bad score', 3 for 'Enough score', 4 for 'Good score', and 5 for 'Very Good score'. For example, decision makers give preference weights as W = [5, 3, 4, 4, 5].

ELECTRE consists of seven steps: (1) Normalization decision matrix; (2) Weighted matrix normalized; (3) Determine the set of concordance and discordance index; (4) Calculate the matrix of concordance and discordance; (5) Determine the dominant matrix of concordance dan discordance; (6) Determine of agregat the dominant matrix; (7) Elimination of less favourable alternative.

The calculation results show that an alternative elimination matrix that has a value of 1 is the element e65 and e26. The e65 element means that the 6th alternative (MFFDI) is more recommended than the 5th alternative (EDI). Whereas the e26 element means that the 2nd alternative (KBDI) is more recommended than the 6th alternative (MFFDI). So it can be concluded that the 2nd alternative (KBDI / Keetch-Byram Drought Index), the most recommended alternative to calculate drought index at The Taman Hutan Rakyat Suharto.

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[BP11] Deep Bayesian for Opinion-target identification

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Keywords: Deep Learning, Bayesian Inference, Opinion Mining, opinion-target

Purpose

The purpose of this work is to seek if the Deep Learning models can be adapted to improve the performance of Bayesian nonparametric model. The nonparametric Stick Breaking process potently has infinite number of components. It is proposed to identify the opinion-target in opinion mining task. Nonparametric model is powerful to determine the number of topics from the data. The given data are the documents and the components are the distributions of terms that reflect the topics (or "clusters"). Implementing nonparametric model on huge data requires multiple passes through all data and it's interactable for large scale application (Wang, Paisley, & Blei, 2011). To improve the divergence with large scale of data (or "big data"), a deep learning algorithm is being proposed to be integrated as sampling algorithm into the nonparametric Stick Breaking process.

Background

Nonparametric Bayesian models like Stick Breaking process is a powerful model for unsupervised analysis of grouped data(Guo, Pan, & Cai, 2017). Stick Breaking process is applied to document collections, it's provide a nonparametric topic model, where document is viewed as group of observed opinion-target (or "words"), and components are (presented as topics) distribution over words. Unlike normal/traditional clustering, Stick Breaking process infer the number of topics from the data. However, Bayesian probabilistic model allows very flexible interaction with the observed points of the data. It is mainly concerned with insight and learning from the data. The Stick Breaking process is inherently experience the Bayesian. Where it is a joint distribution of hidden variables Z and observed variables X as shown in the equation 1:

$$\mathrm{P}(\mathrm{Z},\mathrm{X}) \qquad 1$$

Inference about unknown/hidden variable is through the posterior, the conditional distribution in equation 2 gives the observations.

$$\mathrm{P}(\mathrm{Z}|\mathrm{X}) = \frac{\mathrm{P}(\mathrm{Z},\mathrm{X})}{\mathrm{P}(\mathrm{X})} \qquad 2$$

The Posterior inference or the denominator of the posterior is intractable, and much research is dedicated to developing an inference algorithm to tackle this deficiency(The, et al. 2006) (Zhuolin, et al, 2014). Variational Inference has been recently developed (Wang et al., 2011) to draw the samples from the posteriors. E.g. fit a distribution (e.g. normal distribution) to the posterior turning a sampling problem into an optimization problem. Unfortunately, when it is come the implementation of the variational inference on the Machine Learning problems e.g. clustering algorithms, it faces inadequacies. Such as, it's often play second fiddle with posterior inference in terms of accuracy and scalability. However, we have proposed the deep learning mechanism to confront this issue as elaborated in the next section.

Method

The Deep Bayesian is the prior distributions on the weight. We tend to put normal distribution over the weights to improve the performance of the Bayesian nonparametric model while it's infer the posterior of hidden variables.

Generally, Deep learning uses many heuristics to train huge data and perform perfect prediction with highly sophisticated models (Silver et al., 2016). Neural network is a parametrized function, where the parameters are the weights and biases of the neural network. From a statistical point of view, neural networks are efficient non-linear function approximators and representation learners. While mostly used for classifications, and they have been extended to unsupervised learning with AutoEncoders to estimate multimodal distribution (Kingma & Welling, 2013).

However, as has been stated in the background, to infer the opinion-target (or "word") in hidden variable, a posterior inference approximation is required. In this work we propose deep learning to infer the posterior by denoting the weight of neural network as the posterior.

Conclusion

The performance of nonparametric probabilistic models has attracted many researchers because it infers the topics (or "clusters") based on the given data. It is unlike the parametric/traditional clustering that is required to specify the number of cluster in advance. Yet, the deficiency of nonparametric models experiences the Bayesian posterior inference, where these posteriors are intractable in when it's conducting massive amount of data. This deficiency generated because the sampling algorithms are required high number of iteration to produce better inference. And that leads into inaccurate clustering and time consuming. To improve the posterior inference a deep learning is proposed to represent the weights in the neural network as posterior in the nonparametric Stick Breaking process.

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[BP12] The Effect of Vocal Cues on Trust at Zero Acquaintance

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Keywords: Vocal Cues, Prosody, Trust, Zero Acquaintance, Voice

Trust is essential in many human relationships. In fact, trust is vital wherever risk, uncertainty, or interdependence exist. Without trust, education in general would be much more difficult as the students would lack trust in their teachers and vice versa. Trust is necessary to maximise learning in a teacher-student relationship. Furthermore, trustworthiness can be gauged in a zero-acquaintance situation. Zero acquaintance is a situation in which perceivers make judgments about targets they are given no opportunity to interact with. Intuitive judgments at zero acquaintance are proven to be strong predictors of the performance of teachers, salespeople, and other professionals.

In recent years, several researches have been conducted on the factors that determine trustworthiness. Particularly, many studies have shown the significance of voice in perceived trustworthiness. For instance, a research has found that verbal exchanges between a neonatal-care nurse and mother greatly influences a woman's confidence. Another research supports that fact by indicating that audio communication shows a more significant emergence of trust than text chat.

Despite recent few research works that analysed the effect of various vocal cues (e.g., phonetic segmentation, speech rates, and fundamental frequency(f0)) on trustworthiness, research addressing the factors of trustworthiness at zero acquaintance is scarce and limited. Especially, we are still far from consensus regarding the direction of association between different vocal features ---in particular, speech rate and fundamental frequency (f0)--- and trustworthiness. Thus, there is a need to investigate deeper into this area and this paper plans to do just that. Furthermore, this paper also aims to identify the characteristics that different ethnics in Malaysia base their judgement of trustworthiness on.

Method

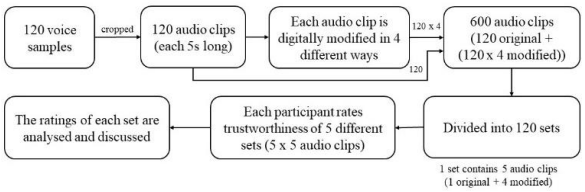

Figure 1: A general overview of the investigation flow

To carry out this investigation, 120 different voice samples have been obtained from the OMG-Emotion behaviour dataset (Barros et al., 2018). Each of these voice samples will be cropped, acoustically-analysed and digitally manipulated in 4 different ways, namely increasing and decreasing the rate and f0 respectively. The extent to which it will be manipulated is based on previous research conducted by Trouvain et al. (2006) and Smith et al. (1975). This will result in the formation of 600 audio clips, which are then divided into 120 sets respectively. Figure 1 shows a graphical representation of the overall methodology used in this investigation. In this manner, the semantic content of the audio clips within each set are completely identical and controlled, hence enabling the researcher to more clearly identify the impact of rate and f0 on trustworthiness ratings.

Each participant in this study will be asked to rate the trustworthiness of 5 different sets on a scale of 1 to 10 (1 being least trustworthy and 10 being most trustworthy). Since Peninsular Malaysia consists of 3 main ethnic groups, namely Malay, Indian and Chinese, this research will also include participants from all these races. The ratings given by each ethnic group will be recorded and analysed accordingly. Each set will be rated 3 times, one from each ethnic group. The participants will submit their ratings via a simple online assessment indicating the amount of trust they would place in the speaker.

Albeit a traditional approach, the assessment method will be able to investigate the reasons behind perceived trustworthiness of an individual. A more conventional approach such as the trust game is not applicable to this study as the responses obtained might be affected by the attitudes of the sender and receiver (whether they are risk taking individuals, cautious individuals, etc).

Finally, the ratings of each set are analysed. Firstly, the effects of rate and f0 on the trustworthiness ratings, as compared to the original will be analysed. This scope of analysis will be termed ``intra-set''. Within each set, the correlation between speech rate, f0 and the trustworthiness ratings will be analysed by using a correlation matrix. The difference in ratings between each ethnic group will also be evaluated and examined.

Next, the effects of the semantic content of the audio clips will also be analysed. This can be carried out by investigating and comparing the ratings between sets. Characteristics such as number of pauses, stutters and non-lexical conversation sounds (filler sounds) such as “um”, “uh”, and “hmm” will be taken into consideration. The correlation between these characteristics and the trustworthiness ratings will be analysed. This scope of analysis will be called “inter-set''. The results will be accurately documented, analysed and discussed.

Expected Results

By manipulating only the f0 and speech rate of each audio clip and grouping the audio clips into sets of 5, the semantic content (what is being said), as well as all the other paralinguistic effects such as pauses will be controlled. Hence, the effects of those characteristics will be nullified, enabling the research to be conducted solely on speech rate and f0. Having 600 audio clips (120 sets) to analyse will provide a wide and broad sample size to enable evaluation from a variety of different aspects. Hence, the potential outcomes of this investigation are plentiful. In addition to precisely measuring the sole impact of pitch or speech rate on perceived trustworthiness, this investigation would also be able to identify the effects of the semantic content by analysing the difference in trustworthiness ratings from one original audio clip and another. Furthermore, given sufficient participants from each ethnic group, the difference in characteristics of perceived trustworthiness based on ethnic groups (if any) will be identified. The outcomes are truly endless and at the very least, a relationship is hoped to be identified between voice characteristics and perceived trustworthiness.

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[BP13] EEG Channels Selection Using Hybridizing Flower Pollination and β-Hill Climbing Algorithm for Person Identification

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Keywords: EEG, Biometric Authentication, Feature selection, Flower pollination algorithm, β-hill climbing

abstract

Recently, electroencephalogram (EEG) signal present a great potential for a new biometric system. Several studies showed that EEG presents uniqueness features, universality, and natural robustness to spoofing attacks. The EEG signals represent the graphical recording of the brain electrical activity which can be measured by placing electrodes (sensors) in various positions of the scalp. This paper proposes a new method for EEG channels selection that maximizes the accuracy recognition rate, which is measured by means of the radial basis function kernel support vector machine (RBF-SVM) classifier. The proposed method using a hybridizing meta-heuristic method based on binary flower pollination algorithm (FPA) and β-hill climbing (FPA-βhc) for reducing the required electrodes (channels) while maintaining accuracy rate performance. The EEG autoregressive with three different coefficients have been used as features extraction. The (FPA- βhc) is tested using a standard EEG signal dataset, namely, EEG motor movement/imagery dataset. The experimental results show the proposed approach can make use of less than a half of the number of channels while maintaining recognition rates up to 96%, which is crucial towards the effective use of EEG in biometric applications. It is worth mentioning that the proposed method can achieve results that are better than the state-of-the-art ones, as well as we draw future directions towards the research area.

Proposed Method

This section provides a discussion of the proposed methodology of the hybridizing flower pollination and β-hill climbing algorithm for person identification. The proposed method (FPA-βhc) framework run through four phases where the result of each phase is an input to the consecutive one. The four phases are presented in Figure 1.

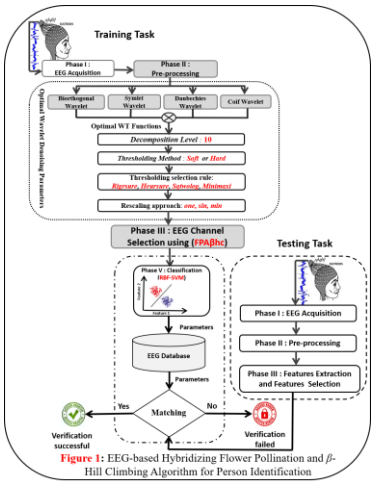

Figure 1: EEG-based Hybridizing Flower Pollination and β-Hill Climbing Algorithm for Person Identification

Results and Discussion

Figure 2 shows the comparison based the convergence rate between the proposed method (FPA-βhc) and standard (FPA). It is clear to observe that the hybridization method (FPA-βhc) achieve better than standard FPA algorithm where it is achieved recognition rates up to 96%.

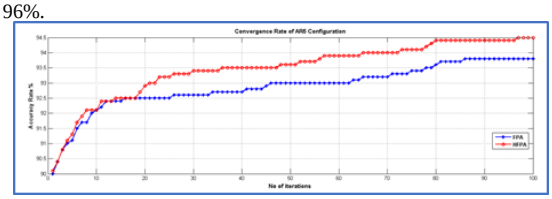

Figure 2 Convergence rate of the proposed method and FPA.

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[BP14] Exploring Whole-Brain Functional Networks of Music-Linguistic from Rhythmic Quranic Recitations and Language Proficiency

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Keywords: Rhythmic Quranic recitations, Language proficiency, fMRI, Functional networks

Introduction

Prior research to extend our understanding of neural bases underlying music and language input typically used songs to feature the two cognitive domains. Manifesting related properties with music, Quranic recitation can be considered in the same perspectives. By manipulating either the linguistic or musical dimensions (or both) of Quranic recitation and studying their interconnection, it is possible to get further insight regarding neural networks that are fundamental to music and language cognition.

Background and Objective

Quranic verses have been synonymously recited in melodious and rhythmic ways in Muslim cultures. Despite expressing both combination of music and language, neuroimaging studies using Quranic stimulations focused exclusively on the musical elements [1-3] while very little addresses the language impact [4-5], meaning, the musical and linguistic components of Quranic stimuli are studied on separate basis. Employing functional magnetic resonance imaging (fMRI) recordings as measured by the blood-oxygenation-level-dependent (BOLD) signal fluctuations, this study seeks the neural foundation for melodic, rhythmic recitation of Quranic verse when integrated with subjects' language proficiency level.

Methods

Thirty (N=30) healthy, Muslim subjects will be divided into two groups: native Arabic speakers, n=15, and non-native Arabic speakers, n=15 with inclusion and exclusion criteria. The determination of Arabic language proficiency among the subjects will be done by administering the Basic Inventory of Natural Languages to assign them as native or non-native speakers. Seven modes of listening will be presented as auditory stimuli; pre-test resting condition, three Quranic recitations (*Ayatul Kursi* verse in *Murattal Asim*, *Murattal Susi* and *Tarannum Asli* styles, with each characterized by distinctive *qiraat*, tempo and accentuation), two non-Quranic stimuli (Arabic news and Arabic poem) and post-test resting condition. Each stimulus will be given in random order. Imaging data of the subjects will be acquired using a 3-Tesla MRI scanner at Hospital USM (HUSM). Following preprocessing, the functional images will be registered to Montreal Neurological Institute (MNI) standard human brain template. Functional neural networks will be extracted and distinguished by applying the Independent Component Analysis (ICA). Resulting spatial maps (indicative of brain region's activation and functional connectivity strength) from SPM12 and MATLAB software will be used to test for groups' differences. Applying Bonferroni test, the result will be considered significant at $p<0.05$.

Anticipated Result

Different functional neural networks will be manifested, among them, plausibly: language network, default mode network, attention network, working memory network, attention network, emotional network and etc., with each corresponding to a distinct set of neural substrates. Diverse spatial distributions and activation patterns may be exhibited between:

(i) Native Arabic speakers and non-native Arabic speakers
(ii) Quranic and non-Quranic stimuli
(iii) Different styles of Quranic verse recitations

Significance

By investigating functional connectivity during auditory task, by unbiased whole-brain and data-driven approach, it is hoped that different networks bearing significant importance in learning can be delineated. Understanding the interconnection can aid in outlining theoretical foundations of music-language processing at brain level from the manipulation of music properties (rhythm, melody, tempo) and language proficiency, as demonstrated by *huffaz* (those who have completely memorized the Quran), and from application view, in improving the outcomes of learning and listening-related tasks.

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[BP15] Parallel Text Acquisition and English-Malay Machine Translation

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Keywords: Parallel Text Acquisition, Statistical Machine Translation, Neural Machine Translation

Introduction

Machine Translation (MT) is a process of translating text from a source language (for example English) to a target language (for example Malay) using a software. MT provides the convenience of translation that is fast and at a low cost to consumers, and the quality of the translation produced are improving. Two state-of-the-art MT architectures are Statistical Machine Translation (SMT) and Neural Machine Translation (NMT). SMT modeling translations by extracting the statistics from text corpora. On the other hand, NMT learns translation patterns using a neural network architecture. Both approaches create a translation model from translation examples for a pair of languages, which is known as parallel text. A parallel text consists of aligned bilingual phrases or sentence pairs that are translation of each other. Usually, the bigger the parallel text corpus, the better the quality of the translation produced.

Parallel Text Acquisition

We collected an English-Malay PArallel Text (EMPAT) corpus. This corpus consists of parallel text for training and testing. The parallel text for training was extracted from bilingual dictionaries, theses, and articles. The testing part on the other hand was extracted from news articles and exam questions.

A bilingual dictionary contains many of translation examples that can be a good resource for building a parallel text corpus. An OCR was first used to scan dictionaries. Normally, the translation examples are in a particular order. Thus, regular expressions can be applied to extract these sentences. In some cases, language identification algorithm has to be used to separate the sentences. One way to determine the language of a sentence is by using n-gram language model. Spelling correction were also carried out. This were done using minimum edit distance and n-gram model. Another source to acquire English-Malay parallel sentences is theses and articles. In Malaysia, it is customary in many journals and theses to have the abstract to be written in Malay and English. In addition, an abstract from an article also contain many recent terms from different domains that are useful in translation. Thus, the abstract of these documents provides another source for us to extract English-Malay parallel text. The other source where English-Malay parallel text can be found is in the abstract of a document. The theses produced by Universiti Sains Malaysia and journal articles were downloaded from an open access repository web site using web crawlers. These documents were from various fields such as social science, humanities, business, computer science, engineering and so forth. The title and abstract were identified using keywords. The text was segmented based on sentence, and some pre-processing was performed such as separating the punctuations from words and converting uppercase letters to lowercase letters. The last step is to align the sentences in the English abstract file to the corresponding sentence in the Malay abstract file automatically using an alignment algorithm. This was done because the sentences in both languages are not necessarily in the same order. In addition, not every sentence in the abstract was translated. The BleuAlign tool (Sennrich & Volk, 2010) was used for aligning the sentences. The reference translation was generated using an initial SMT. BleuAlign will then find the target language sentence that have the highest BLEU score for each reference translation.

For testing a MT, a different set of parallel text test was collected. The tests evaluate MTs in both the news and computer science domain. For news domain, parallel text was extracted from MalaysiaKini news portal that produces news in English and Malay. Most of the news generated by this portal contains passages and sentences that are similar. To match English and Malay news sentences, the BleuAlign sentence alignment algorithm was applied. For testing MT on a specialized domain, we extracted sentences in the computer science domain from the exam questions of the School of Computer Sciences, Universiti Sains Malaysia. These examination papers are a good source for building a parallel text corpus because the exam questions exist in bilingual since the year 2000.

Experiments and Results

We manage to collect more than 300 thousand English-Malay parallel sentences for training. About 250 thousand pairs from bilingual dictionaries and 70 thousand pairs from thesis and articles. On the other hand, 200 thousand and 70 thousand parallel sentences for testing were extracted from news and computer science domain respectively. We randomly selected 4 thousand sentences for testing on SMT and NMT. Moses toolkit (Koehn, et al., 2007) was used to build the English-Malay SMT. A Malay text corpus (Tan, et al., 2009) with about 870 MB was used to build a Malay 4-grams language model using SRILM (Stolcke, 2002). The NTM has a bidirectional encoder-decoder LSTM architecture with attention mechanism (Bérard, et al., 2016). The BLEU score for SMT was higher compared to NMT in the news domain. The baseline SMT obtained a BLEU score of 48.35, while the BLEU score for the baseline NMT is only 39.31. The usage of a language model in SMT was the reason why SMT obtained a very high BLEU score in the news domain. The BLEU score for computer science domain are comparable at 21.13 and 21.21 for SMT and NMT respectively.

Acknowledgement

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[BP16] Characterizing Compute-Intensive Tasks as a Factor of Network Congestion

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Keywords: computation congestion, cloud data centre, network congestion, characterization of computation congestion.

Purpose of Study

The purpose of this study is to characterize computation congestion in a cloud network. The result will answer the question, "What are the network metrics that can reflect the occurrence of computation congestion in a cloud data centre?"

Background and Motivation

Congestion in high capacity networks (e.g. cloud data centres) has long been a matter of interest in research. To manage congestion, we must know the factors that might contribute towards it. Generally, researchers assumed that the factors of congestion are mostly caused by link utilizations, such as insufficient bandwidth or inefficient routing of packets through its respective paths. However, another possible factor of congestion is expected in cloud data centres, namely *compute-intensive tasks*; too many of these tasks may lead to *computation congestion* (Wang, Almeida, Blackburn, & Crowcroft, 2016).

To simply explain the scenario, we could describe the network flow as akin to traffic on a highway; the number of lanes is analogous to bandwidth while tolls are comparable to network nodes. Congestion is usually thought to be caused by insufficient lanes, and the solution has been by adding more lanes to occupy larger number of vehicles (i.e. add more bandwidth for larger amount of data passage) or by distributing the traffic to less occupied lanes (i.e. network load balancing or congestion control mechanism). What if the congestion happens because of the delay in the toll? Adding more lanes, instead of speeding up the process at the toll, would not help reduce congestion. It is also possible that the lanes seem available (due to the large lane capacity), but processes are jam-packed at the toll. Since current methods of identifying congestion does not differentiate the cause, it is imperative that we find a way to do so.

Computation Congestion in Cloud Data Centres

As mentioned earlier, in order to manage congestion, the characteristics of the congestion factor must be known. In the case of managing computation congestion, we should be able to identify when it happens or about to happen. Theoretically, computation congestion might occur when there is a surge of compute-intensive tasks at a certain point. Hence, it is reasonable to say that we need to have a performance metric based on those tasks, where we ask "how many tasks are too many?"

Currently, few research are done to address the issue of computation congestion, particularly the mechanism of identifying it. In proposing a proactive congestion control mechanism, Wang et al. (2016) estimated the probability of computation congestion by monitoring CPU usage, memory usage, execution rate and request arrival rate; the estimation was based on assumptions that the tasks are Poisson processes, and the queue length of task requests are similar to a simple M/M/1-Processor Sharing queuing system.

Besides using pure assumptions, some researchers have embarked in analysing the behaviour of real workload to predict congestion (Beaumont, Eyraud-Dubois, & Lorenzo-Del-Castillo, 2016; Liu et al., 2017). Real data analysis are now possible with the release of *Google Cluster Trace*, a set of production-run cloud computing workload data consisting of 12 583 machines, with approximately 600 000 jobs and 20 million tasks which was collected for 29 days. This data trace discloses some of the scheduling complexities that affect Google's workload, including the variety of job types, complex scheduling constraints on some jobs, mixed hardware types, and inaccurate user estimation of resource consumption (Reiss, Wilkes, & Hellerstein, 2011). It is believed that the onset of computation congestion can be detected by characterizing compute-intensive tasks in the data trace.

Proposed Methodology

Analysis will be done on Google Cluster Trace, taking into account the task usage of CPU, memory, disk, and network. According to (Chen & Katz, 2010), only CPU and memory are constrained resources. Thus, it is highly likely that the metrics to be chosen are task duration in seconds, CPU usage in cores, and memory usage in gigabytes. The characterization of the workload will then be derived using statistical profiling, such as time series and k-mean of several performance metric. The graph produced during job launches during the workload is observed and compared to the graph during job drops. A job launch is defined as the interval during which we first see a task belonging to the job, while job drops may be an indicator of congestion on the node.

Conclusion

From the analysis, it is anticipated that a specific pattern would indicate the occurrence of computation congestion, most possibly from CPU usage, memory usage and disk allocation. The pattern would help to identify a threshold value for each field and subsequently be used as the metric to characterize computation congestion caused by compute-intensive tasks.

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[BP17] A Hyper-heuristic based Artificial Bee Colony Optimization for the Traveling Salesman Problem

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Keywords: swarm intelligence, bio-inspired metaheuristic, evolutionary algorithm, combinatorial optimization, Choice Function.

Research Background and Objective

Bees' foraging behaviour has been computational realized as algorithms to solve various optimization problems [1-3]. The Artificial Bee Colony (ABC) algorithm [1] is a well-known bee-inspired algorithm. In the ABC algorithm, a food source represents a solution to the optimization problem in the search space, and the nectar amount of the food source represents the fitness of that solution. ABC defines three types of bees: employed, onlooker, and scout bees. An employed bee looks for new food sources around the neighbourhood of the food source that it previously visited. An onlooker bee observes dances and selects a relatively better food source to visit. A scout bee searches for new food sources randomly. ABC is initially proposed to solve optimization of mathematical test functions with a unique neighbourhood search mechanism [1].

Recently, ABC is modified to solve combinatorial optimization problems, e.g. the Traveling Salesman Problem (TSP) [4]. However, its neighbourhood search mechanism cannot be directly applied for this set of problems. Instead, the employed and onlooker bees are prescribed with one or more perturbative heuristics to produce new solutions. These heuristics are problem-specific, for instance, the perturbative heuristics for TSP include insertion, swap, inversion, etc. In view of the large availability of heuristics, the question concerning the selection of a particular heuristic has been posed. This leads to the studies on hyper-heuristics.

A hyper-heuristic is a high-level automated methodology for selecting heuristics [5, 6]. The heuristics to be selected in a hyper-heuristic are known as the low-level heuristics (LLHs). In this study, a hyper-heuristic, i.e. Modified Choice Function (MCF) [7], is integrated in the ABC algorithm to select the perturbative heuristics deployed by the employed and onlooker bees. The proposed model is denoted as MCF-ABC.

The Proposed Model

MCF-ABC is an ABC variant with ten LLHs. It consists of four phases: initialization, employed bee phase, onlooker bee phase, and scout bee phase. The initialization and scout bee phase of MCF-ABC is similar with that of the ABC variants in [4]. In the employed and onlooker bee phases, a bee is aided by MCF to select an appropriate LLH. MCF evaluates the performance score, F of each LLH using three measurements, i.e. f_1, f_2, and f_3. f_1 represents the recent performance of each LLH; f_2 reflects the dependencies between consecutive pairs of LLHs; f_3 records the elapsed time since the last execution of an LLH. For each neighbourhood search, an LLH with the largest F score is selected. After each neighbourhood search, the generated solution is improved using a local search. Then, a greedy acceptance method is applied to decide whether to accept the new solution. After that, the F score of each LLH is updated. More details of MCF-ABC can be found in [8, 9].

Results and Findings

MCF-ABC is evaluated using 64 TSP instances. The aim of solving a TSP is to find a route that leads a person to visit each city once and only once and to return to the starting city with the minimum total cost. On average, MCF-ABC solves the 64 instances to 0.055% from the known optimum within approximately 2.7 minutes. To examine the effectiveness of MCF-ABC, it is compared with a Random-ABC model which uses the same sets of LLHs and a random selection strategy. The results show that, MCF-ABC statistically outperforms Random-ABC. Moreover, comparison studies among the state-of-the-art algorithms ascertain the competitiveness of MCF-ABC.

Conclusion

The Artificial Bee Colony (ABC) algorithm is a popular bee-inspired optimization algorithm. When ABC is used to solve combinatorial optimization problems, single or multiple perturbative low-level heuristics (LLHs) are adopted as its neighbourhood search mechanism. When there are multiple LLHs, the selection of these LLHs has a significant impact on the performance of ABC. In this study, we propose the use of a hyper-heuristic, i.e. Modified Choice Function (MCF), to guide the selection of the LLHs in ABC. The comparisons indicate that MCF-ABC is competitive among the state-of-the-art algorithms.

Many problems in the Big Data domain, e.g. feature selection, clustering, and error minimization, can be framed as combinatorial optimization problems. For future work, MCF-ABC can be adapted to solve these problems.

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[BP18] The Application of Machine Learning in Classifying the Vector Borne Disease Awareness

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Keywords: classification, vector borne disease, human behavior

Abstract

This study compares the classification algorithms' performance on the awareness of mosquito-borne viral disease outbreak based on the human factors (awareness, knowledge, attitudes and practices). The classification will be done by using several machine learning algorithms (Naïve Bayes, Support Vector Machine, Decision Tree, Artificial Neural Network and Logistic Regression) to predict the awareness of dengue risk among the community. The results will be compared to select the best machine learning algorithm in supporting the initial design of a personalized educational program.

The Internet is one kind of instrument to hold the lifelong learning among the communities. This includes the vector-borne disease (VBD) awareness campaign, especially the dengue fever. Although such campaigns are always seen on television, the rate of dengue outbreak is constantly increasing each season (Boonchutima, Kachentawa, Limpavithayakul, & Prachansri, 2017). This indicates that the awareness level among the communities are still questionable. They might not fully aware of their responsibility and need to increase their knowledge regarding the vital issue. Current VBD outbreak prediction system did not include human awareness into accounts (Kesorn et al., 2015). Constructed predictive model through search queries, environment, and climate factors does not solve the real issue comprehensively due to the exclusion of human factors. A new method which involves human behavior and education to the current prediction system can provide a heuristic solution in VBD prevention.

An initial online survey was carried out with 171 individuals of the Malaysian public aged 13 years old and above. The self-administered structured questionnaire covers all aspects of demographic profile, self-assessment whether they have the awareness of dengue or not, and questionnaire regarding mosquitoes breeding sites, mosquito's prevention method and mosquitoes biting time. The machine learning algorithms are tested on 13 features of human awareness, knowledge, attitudes and practices such as cleanliness, waste management, clogged drains and stagnant water management, aerosol spray/mosquito repellent usage, long-sleeved shirt and long pant bright in color usage, mosquitoes breeding site, and mosquitoes bite time (Gyawali, Bradbury, & Taylor-Robinson, 2016; Aung et al., 2016). Fivefold cross-validation technique was utilized in the present investigation for the training and testing. The algorithms were performed by using WEKA, a data mining application developed by Waikato Environment for Knowledge Analysis.

Out of 171 respondents, 86% declare that they are aware of the mosquitoes from breeding in their area. It is found that the Support Vector Machine algorithm outperform other machine learning algorithms for predicting human awareness with 88.3% correct classification. It is followed by Decision Tree (86.55%), Logistic Regression and Naïve Bayes algorithm (85.96%), while the Artificial Neural Network at 85.38%.

An effective prediction model of VBD awareness among citizens is vital in a personalized e-learning program to highlight the risk of contracting dengue and increase their knowledge about dengue prevention and treatment. Hence, this research proposes to use the SVM algorithm to construct a predictive model for dengue awareness using human behavior parameters and the newly discovered variable, the knowledge of mosquito breeding sites and mosquitoes' bite time which has never been used in any existing predictive models.

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[BP19] Supersymmetry Feature Decomposition for Classification Purpose

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Keywords: Machine learning, feature decomposition, classification, supersymmetry, particle physics

Machine learning for classifying data is gaining popularity in many fields but has yet to be seen as clear in improving particle detection in particle physics. It provides the ability to classify high dimensional data such as the supersymmetry (SUSY) event based on the dataset's list of features. In an attempt to enhance the analysis, the features were engineered in this research by using feature decomposition alongside two methods of machine learning algorithm: Random Forest and Artificial Neural Network. Feature decomposition is also a type of data compression as it reduces the dimensionality of the dataset. Different combination of numbers of features and feature decomposition types are tested for both of the algorithms. Therefore, the accuracy and precision of the classification for both algorithms is compared with and without feature decomposition to observe its effect on the data classification. For the artificial neural network algorithm, different activation function and different training ratio are also being tested to observe the effect of the feature decomposition on different parameter. The overall result obtained refuted the initial hypothesis, showing that both accuracy and precision with feature decomposition are lesser than without. Conclusively, the compression of supersymmetry data by dimension reduction is not feasible in classifying the dataset as it decreases its accuracy and precision.

Purpose

1. To develop neural network classifier model for the supersymmetry dataset.
2. To develop feature engineering code for the supersymmetry database and compare the machine learning with and without feature engineering.
3. To compare the accuracy of the supersymmetry classification with and without feature engineering.
4. To check for consistency of the classification for artificial neural network algorithm.

Background

Particle physics simulation in finding new exotic particles produces enormous amount of data and machine learning techniques have yet to be seen as clear in improving the simulation. Therefore, feature decomposition is used to compress the size of the data with intention it could improve the classification of the dataset.

The research was intended to compare the accuracy and precision of supersymmetry classification simulation with and without feature decomposition to give insights into the effect of feature decomposition to the classification of supersymmetry data.

Method

Computations were performed on a Linux based computer with an AMD Ryzen 7 octa-core processor, a 16GB NVIDIA GTX1070 graphics processor, and 32GB of RAM. All codes were written using PyCharm IDE software and Python 3.6.1 programming language with Anaconda library packages Keras neural network library.

Dataset used was mini supersymmetry dataset from Machine Learning Repository of University of California, Irvine (UCI) consisting of 100,000 data and 18 features (dimensions). The dataset has of about 46% of positive examples and the rest is negative examples.

The classification of the dataset was being done and compared by using two types machine learning algorithms – random forest (RF) classifier and artificial neural network (ANN). Random forest classifier is one of the learning algorithms, and ANN is Keras' neural network for simple deep learning. Both classifier codes were developed without feature decomposition first and the result was the base reference for comparison to the result with feature decomposition. 8 types of feature decomposition were paired with respective count of 18 numbers of features of supersymmetry to find the ideal number of features needed to get the highest accuracy for random forest algorithm. While for ANN, the 8 types of feature decomposition were paired with 6, 12 and 18 number of features respectively to observe the effect of feature decomposition on the accuracy of the learning. The accuracy and precision between both classifiers were compared with and without feature decomposition.

Results

Both classifier algorithm of random forest (RF) and artificial neural network (ANN) without feature decomposition (FD) output higher accuracy than when all types of feature decomposition are used. The accuracies and precisions dropped when feature decomposition or higher training data was used. Both classifiers are consistent throughout repetition of the simulations.

Even without feature decomposition, both algorithms output a fairly similar accuracy. This could be expected since the dataset is sufficiently large to be fed for both of the machine learning. Although ANN outputs higher accuracy, the minor difference of 0.1452% in accuracy between the two algorithms is noticeable but less significant.

Although some of the result showed that feature decomposition could increase the accuracy of the classification, it also showed that it could decrease the accuracy and precision either slightly or drastically. Nevertheless, the increases were insignificant, and the precision dropped from when no feature decomposition is used.

The precision overall is reduced after feature decomposition, except for some combination of feature decomposition, activation function and number of features yet their accuracy remains decreased regardless.

From both of RF and ANN results, it can be observed that there was no significant increase (by 3% or more) regardless of feature decomposition used and regardless of number of features chosen. On the contrary, almost all feature decomposition reduces the accuracy and precision of the machine learning for both algorithms. Although there are some that have higher accuracy, it is considered to be insignificant in comparison with the reference result of without feature decomposition. The difference in accuracies in repeated simulations was less than 1% concluded that the ANN classifier algorithm of this research is consistent.

Conclusion

The overall results from this research showed that feature engineering by feature decomposition decreases the classification accuracy for both random forest and artificial neural network classifier. Early hypothesis that feature engineering will at least increase the accuracy deemed to be wrong in this case; because of the dimension reduction by the decomposition. Not only the reduce in accuracy, but the precision also diminishes as features were being decomposed. This shows that each feature in the supersymmetry dataset are important as they are not redundant, or in other words they are independent and non-derivative of each other. Therefore, all and each feature should be considered when classifying the supersymmetry dataset or other feature engineering techniques have to be devised.

PRAGMA 35 POSTER ABSTRACTS

[PP01] Mobile-based Augmented Reality for Sundanese Alphabets Education

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Abstract

In 2017, the Indonesian Ministry of Higher Research and Education reported that the smartphone user in Indonesia had achieved about 25% of the total citizen or about 65 million people. This trend is beneficial to utilize smartphone for promoting traditional cultures in Indonesia, especially to the teenagers that are steadily moving forward to modern culture. This research aims to build an Android-based application with an augmented reality feature to enhance the experience of learning traditional Indonesian heritage, especially traditional alphabets. CARIOSAN is a mobile application with the purpose to preserve the Sundanese alphabets and prevent it from extinction. The main features in the application are AR-based Sundanese alphabets recognition, Rarangken information, Sundanese alphabets writing canvas, and quiz feature to assess user understanding of the Sundanese alphabets. We interviewed 35 respondents for measuring the usability, the easiness of use, the information coverage, the interface, and the novelty of the application. The results showed that the developed application was highly useful and interactive in providing the essential information of Sundanese alphabets although with a novelty score only above 50 percent.

[PP02] Deep Learning Classification for Liver Disease

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Abstract

Liver disease is one of the top ten diseases with the highest mortality rate in Indonesia, with the increasing rate of one percent per year. Type of liver disease most attacking Indonesian people is Hepatitis. According to Basic Health Research (Riskesdas) 2013, Hepatitis had a prevalence number of 1.2 percent that was double than the prevalence in 2007. There are some methods to diagnose the liver disease such as enzymes pattern analysis, excretion, metabolism, electrophoresis and serologic test. This research focused on diagnosing the liver disease based on enzymes pattern using Deep Learning approach. We used Indian Liver Patient Dataset (ILPD) from UCI Machine Learning Repository with a total of 583 data (416 positives and 167 negatives) to build the classification model, with the training and testing rate of 0.7 and 0.3, respectively. We conducted a preprocessing step for the training data using Synthetic Minority Over-sampling Technique (SMOTE) with the percentage rate of 0.5 to balance the positive and negative class. Experiment results reveal that the created model can classify liver disease with the accuracy, sensitivity, and specificity rate of 0.89882, 0.84, and 0.9225 percent, respectively.

[PP03] Application of Deep Learning and Fingerprint Modeling Methods to Predict Cannabinoid and Cathinone Derivatives

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Abstract

In recent years, new psychoactive substances (NPS) have rapidly emerged in market purportedly as "legal" alternatives to internationally controlled drugs, with the potential to pose serious health risks. 21 of 56 NPS were found as cannabinoid derivatives in 2016 in Indonesia. From 2013 to 2018 there was an increasing number of cathinone derivatives, 30 compounds in 2013 and 89 compounds in 2018. Artificial intelligence (AI) has become a tool for data processing and is applied for object recognition such as human pose and image classification. The purpose of this study is to apply and gain the best AI method to classify new cannabinoid and cathinone derivatives by comparing deep learning method and fingerprint modeling method. The pharmacophore modeling was used as the reference method.This study compared deep learning and fingerprint modeling methods. Both methods were compared with pharmacophore modeling as the reference method. Physicochemical property descriptor will be used as learning parameters for the deep learning method. The two models produced by each method will be used to classify new cannabinoid substances. As for the cathinone substances, the structure was transformed into a fingerprint form. This method was also compared with pharmacophore modeling as the reference method. Compared to the pharmacophore modeling method, the deep learning method for cannabinoids classification showed the higher accuracy and Cohen Kappa scores respectively (0,8958 and 0,396) and (0,8622 and 0,68) for pharmacophore modeling. Pharmacophore modeling in the classification of cathinone derivatives showed accuracy (91.11%) and Cohen Kappa scores (0.708). However, fingerprint modeling gave accuracy (71.8%) and Cohen Kappa (0.637). These results conclude that the deep learning method with descriptor is a better instrument to be used for cannabinoid classification compared to pharmacophore modeling, but fingerprint modeling showed lower accuracy than pharmacophore modeling in cathinone classification.

[PP04] Building Smart City Datasets with Crowdsourcing for Safe Direction in Bangkok, Thailand

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Abstract

There could be many problems when there is population living together in cities. For examples, crime, robbery, attack and snatch. Having a crime map that can mark potential risk places or areas can help you avoid directions that not safe. Unfortunately, there is no such open data to create the crimp map for public in Thailand. This project presents our effort in building a smart city dataset with crowdsourcing to collect information about unsafe or risky to crime places/areas in Bangkok area. We first crawl crime scene information from online news. Using only information from news has limits because we can only get the cases reported to the polices and those that they. Officially announced. So, we need more data from active citizen by crowdsourcing. The newly developed dataset will be used to draw points, lines, and appropriate shapes on the map. After that directions from a source to a destination of user selection can be provided with the avoidance of the risky area (if possible) or some warning information will be provided along with the direction. Our main challenges are (1) how to build a successful crowdsourcing that fits Thai people's nature and yield quality data collection, (2) once data is collected both from crowdsourcing and news crawling, how can we turn them into correct latitude and longitude, and (3) how to generate route direction to avoid the unsafe areas on the map. We present our preliminary result based on the inputs achieved from a user survey and a prototype mobile application with Google Map API, called Happy Map. We hope this application can help people to have happy and safe travel in Bangkok, Thailand.

[PP05] A Network Performance Measurement in a Low-Cost Containerized Cluster System

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Abstract

This poster demonstrates the network performance in a low-cost containerized cluster system which consists of five Raspberry Pi computers. We use Kubernetes for managing cluster resources and executing containers on it. The NodePort service mechanism forwards external traffic to a corresponding container running on a worker node. We have conducted two experiments micro benchmark with iperf and an application benchmark with the Apache benchmark. The reasons of these experiments are measuring the performance of Kubernetes networking topologies and also finding the limitation and durability of network functions in Kubernetes. The first experiment measures TCP goodput with four possible communication patterns: intra-node, inter-node, external with forwarding, and external without forwarding. The second experiment measures HTTP request processing throughput using the Nginx web server and the Apache benchmark with six different container deployment configurations.

[PP06] A Prototype of Collaborative Augment Reality Environment for HoloLens

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Abstract

The interest in augmented reality (AR) and virtual reality (VR) for a variety of applications has surged in recent years. Although these technologies provide new ways to interact and understand information, often the experience is limited to a single person. To address this limitation, we implemented the concept of spatial anchors from Microsoft using Holotoolkits to create a collaborative AR environment for a HoloLens application. The collaborative environment can work through the server in Holotoolkits running with the Unity platform. Preliminary results of our collaborative AR environment were demonstrated using a disaster management application that can be shared in the HoloLens as a proof-of-concept application. The concept of our application can be implemented in a variety of use-cases to provide greater collaborative understanding including an indoor navigation system that shares user's view point in HoloLens. In the future, this environment will be used to visualize, explore, and understand large datasets in data-intensive science research from a variety of disciplines.

[PP07] Analysis of Load Balancing Performance on Cluster Computing with Proxmox VE

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Abstract

This research aims to examine the performance of load balancing for a cluster. Load balancing is a solution for a large access load and minimizes downtime in serving requests from users. Load balancing distributes loads of traffic evenly to the servers with particular algorithms. In this research, the server for load balancing cluster is implemented using LVS topology via direct routing and use round-robin algorithm on Proxmox VE for load balancing. Proxmox VE is in charge of dividing virtual resource servers into four virtual environments, two nodes as load balancing clusters and two nodes as web servers. The results of research conducted with loads of 250, 500 & 1000 users show that load balancing system reduces the maximum response time up to 4165 ms with 0% of packet loss, compared to utilization of single server with the maximum response time up to 7269 ms and 22.48% packet loss. The load balancing system for clusters also manages to failover with an average value of downtime 16.6 seconds.

[PP08] Performance Comparison of Load Balancing using Honeybee and Threshold Algorithm

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Abstract

Cloud computing is currently developing rapidly. Load balancing technique is very crucial to balance the load in the cloud. Load balancing is needed to distribute dynamic workload across resources in the cloud. CloudAnalyst can be used to simulate load balancing algorithm in cloud. One advantage of CloudAnalyst is it applies a GUI. We implement Honeybee and Threshold algorithms into CloudAnalyst. We examine Honeybee and Threshold algorithms implementation for Indonesian e-Health cloud model. There are 4 data center and 34 users based on the number of regions and provinces in Indonesia. Two data center selection policies are used, i.e. closest data center and optimized response time policy. The average response time is investigated for different user data sizes. The simulation result shows that Threshold algorithm gives average response time that is faster than the Honeybee. Nevertheless, Honeybee algorithm delivers better performance for data size smaller than 80 bytes, and Threshold algorithm tends to give smaller response time for data size 100 bytes.

[PP09] Data-centric Modeling of Gainesville Businesses

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Abstract

The purpose of this research is to investigate the extent to which data collected by the City of Gainesville can be used to model local business success and to improve our understanding of how the city's public services can influence that success. The scope of data utilized in this study includes, but is not limited to, business location, age, crime rate, local and national economic growth, utility consumption, and compliance with city regulations. To supplement publicly available data, a survey was conducted of local business owners to assess their own perceived success, which factors drove or inhibited that success or lack thereof, as well as how experiences with the City of Gainesville may have affected their businesses. Extensive analysis is performed with the considered data in order to identify potential correlations with local business success. We explore data trends across previous years and geographically map a snapshot of recent data to subsections of the city. However, meaningful conclusions are at times hindered by both missing information and the lack of any direct means of matching entities across separate datasets. There is a wide range of actions the City of Gainesville can take to facilitate the advancement of its own data infrastructure to make it robust enough to support practical applications and modeling. Measures can be taken to increase the integrity and usability of existing datasets, while future data collection could benefit from enhanced specificity, common identifiers, and more rigorous data verification process. We are looking for collaboration opportunities with researchers who are engaged in similar initiatives in other cities and data scientists interested in modeling business lifecycles.

[PP10] Performance Analysis of GTX 980 GPU on Colon Histopathology Images Training Based on Convolutional Neural Network

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Abstract

Cancer diagnose based on the histopathology images is still become challenges recently. The variation of images, high resolution of images, different pattern of cell on the images have potential tend to miss-classification. Convolutional neural network has widely used in image processing with its ability to extract and classify an object. Applying CNN on high resolution of images cause cost intensive in training process. For that, Graphics Processing Unit (GPU) has important role to increase the speed-up. However, the problem in GPU is the size limitation of memory. This research focus on the way to utilize the GPU memory in the training of CNN architecture. For training CNN architecture, NVIDIA GTX-980 are accelerated by customize CUDA memory allocation from cnmem library. The parameter of cnmem are chosen from 0.6, 0.8, 1, 2 and 4 experimentally and the best value will be used to the next training. To enrich the dataset, augmentation such as rotation, zoom, shear and flip are conducted. Some optimization technique are applied experimentally to determine the best model to classify two classes of cancer, benign or malignant. We use image variation from 32x32, 64x64, 128x128, 180x180 and 200x200 in this research. While training, number of batch-size is selected experimentally from 10, 20, 50, 100 and 150. According to the research, enabling cnmem with parameter 1 is selected as the best value. The 200x200 images show the most significant efficiency of GPU performance when training CNN. Speed-up are measure by comparing training time of GTX-980 with CPU core i7 machine from 16, 8, 4, 2 cores and the single core. The highest speed-up GTX-980 obtained with enabling cnmem are 4.49, 5.00, 7.58, 11,97 and 16.19 compare to 16, 8, 4, 2 and 1 core processor respectively.

[PP11] Dengue Hemorrhagic Fever Disease Data Clustering Based on Interactive Map in Special Region Jakarta Capital

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Abstract

Dengue fever is an infection caused by the dengue virus. The virus spread by Aedes aegypti mosquito. Patients who are infected have symptoms such as fever, accompanied by a headache, pain in muscles and joints, until spontaneous bleeding. This research aims to develop an interactive map that is presenting data with web media to obtain spatial information easily. The interactive map uses clustering to process the data from the Jakarta Health Service Office. Clustering is a method of data analyzing, which aims to group data with similar characteristics to the same 'region' and the data with different characteristics to the 'other area'. This method separates the values of health indicators into a few groups which have significant value difference among groups. The result of this research can be used by the policy maker in Jakarta to reduce the spread of the disease and to decrease the mortality of the patient of dengue fever. The interactive map also can be used for a decision-making system for the government based on data dengue fever in Jakarta. This research can help the government and society to take action related to a characteristic of Jakarta areas that have a lot of cases of dengue hemorrhagic fever.

[PP12] Curating Target-Activity Information for Nadi Compounds Based on CHEMBL using Similarity Searching

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Abstract

Natural products are generally considered as a rich source of biologically active substance. In the period of 20 years (1981-2002), Food and Drug Administration (FDA) has claimed 5% of the 1031 new chemical entities (NCE) approved as drugs are natural products and other 23% are natural-product-derived molecules. In Malaysia, natural products are collected and stored in a database known as Natural Product Discovery (NADI). However, the natural compounds in this database has not been classified in their respective activity classes yet. Curating the target-activity of NADI database is the focus of this study. It requires few methods and a database for reference. A publicly available database, CHEMBL, is used in this study as it covers a broad range of curated and annotated data. Importantly, a curated linkage between indexed 2D chemical structures and biological targets is provided. However, it is impractical to screen all the compounds randomly because it will be time-consuming and computationally expensive. Simplest approach used in virtual screening (VS) known as similarity searching (SS) technique which is also widely used in drug discovery process is implemented to perform the screening task of NADI and CHEMBL. The results from the similarity searching method is used to discover the compounds with highest similarity value in ChEMBL with the query compound in NADI. It will be then fed as input to pattern matching process in order to determine the target-activity for NADI. If there is no target-activity information of certain compounds in ChEMBL, the target-activity in NADI will be defined as undetermined. Compounds with target-activity information will be a reference for the query NADI compounds. At the end of this study, our aim is to create a statistic based on NADI target activity information. Out of thousand compounds in NADI, few should be able to be assigned to the target-activity reported in ChEMBL database that stores millions of compounds. The finding from this study will be beneficial for those who are conducting studies in drug discovery field.

[PP13] Design AR application using the tiled display walls

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Abstract

Data visualisation plays an important role in understanding data through different graphical representations of the data. However, newer technologies have expanded data visualization beyond a single computer screen and paper printouts. Often these traditional technologies lack context and can reduce the efficiency of understanding the data by the user. Hence, it is necessary to develop visualization approaches that facilitate understanding and exploration of data in an easy manner by the user. One of technologies that can help us to add context to the information is augmented reality (AR). This technology has become very popular recently as a means to add context to data objects and allow users to interact spatially with the information. This paper uses the new ARKit tool to develop an AR application that creates virtual information layers that are superimposed over data objects in the physical world. The user can interact with the layers and manipulate the data to generate better understanding. Our proof-of-concept AR application will be demonstrated with a tiled display walls. In the future, the concept of our application can be applied to developing a dynamic AR application for data intensive science.

[PP14] Decision Support System based on Interactive Map of Measles and Rubella Data in Jakarta

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Abstract

Indonesia is implementing a program towards the elimination of measles, with efforts to perform case-based measles surveillance (CBMS) that confirmed by a laboratory. In line with the plan of measles elimination, rubella control through the monitoring of rubella also implemented by integrating with measles surveillance. This study aims to develop a decision support system based on an interactive map that can be used to assist the Jakarta Health Department in monitoring and to search for measles and rubella data in Jakarta Special Capital Region. This system is a form of effort that helped the Jakarta Health Department in monitoring patients with measles and rubella and evaluate the spread of measles and rubella located in the Jakarta Special Capital Region. This study uses the software development methodology, comprising the steps of a literature study, data collection, data preparation, system design, system implementation, and testing. The results show that more than 80% of users agree that the system is easy to understand and user-friendly, leading, and unconventional. The system performance is quick, and the features in the system already support the decision correctly. The map is interactive, and 70% stated that the information is complete and informative.

[PP15] RNA-seq transcriptome profiling of Desmos chinensis: revealing the molecular basis of petal evolution in the custard apple family Annonaceae

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Abstract

Although petals are not homologous within flowering plants different types of petals might nevertheless share a deep homology at the molecular level. Sepal and petal differentiation has evolved independently in the family Annonaceae and some core eudicots, with the development of "bract-like" and "stamen-like" petals, respectively. Little is known of the molecular control of floral development in the non-model family Annonaceae. In order to better understand floral developmental genetics of the family, we profiled the transcriptome of a representative species, Desmos chinensis, during its floral development using a high throughput RNA-seq technique. Floral organ and leaf samples at developing and mature stages were obtained for transcriptome sequencing. Over 200GB of Illumina data was generated using the HiSeq2000 platform. All downstream bioinformatics work was performed on the High Performance Computing cluster HPC2015 supported by the Information technology service of The University of Hong Kong. In total, 22,112 assembled transcripts (c. 80% transcriptome completeness) were recovered using de novo assembly. The transcriptome was annotated and characterized based on publicly available databases. Downstream expression level estimation and gene ontology enrichment analysis suggested that a large proportion of D. chinensis transcripts are responsible for defense, with some expressed strongly in sepals. Metabolism related transcripts, including those responsible for glycolysis, were found to be up-regulated in mature petals. 52 complete homeotic MADS-box gene transcripts were obtained from the floral and leaf transcriptome with the aid of the draft genome of a closely related species. The orthology of these putative MADS-box transcripts were validated using phylogenetic analyses, OrthoMCL and UniProt annotation.

[PP16] Computational Fluid Dynamics Study of Wind Environment in Urban Areas

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Abstract

Economic activities and industrialization unavoidably lead to degrading wind environment and elevating pollutant concentrations in urban areas. Buildings, skyscrapers and infrastructures in metropolises collectively form complicated urban morphology in which the dynamics is different from that in the atmospheric boundary layer (ABL) aloft. Under this circumstance, the conventional (meso-scale) meteorology models would not be fully applicable to diagnose the problems in details. Engineering computational fluid dynamics (CFD), such as OpenFOAM, is commonly used to tackle the problems in refined micro-scale. The protocol of using building information for OpenFOAM CFD studies in the city ventilation perspective is reported in this paper. Detailed information of buildings and terrain is collected from the Lands Department, The Hong Kong Special Administrative Region (HKSAR). The digital maps are threedimensional (3D) spatial data of the HKSAR territory that include buildings (commercial and residential), infrastructure (roads and bridges) and natural terrain (mountains and slopes) for land assessment, engineering visualization and air ventilation analysis, etc. The 3D geometric models are available in virtual reality modeling language (VRML) format. In this paper, we use one of the HKSAR downtown areas as an example to demonstrate the solution protocol. The digital models in the files are divided into tile basis so MeshLab is used to assemble and convert the VRML files to STL format. The STL files of building information are then merged with the OpenFOAM mesh generation utility blockMesh and are discretized by snappyHexMesh to 3D unstructured meshes. The mesh generatorsnappyHexMesh uses the triangulated surface geometries in the STL files to generate 3D meshes, approximating the solid surfaces. It also refines the surfaces iteratively to morph the buildings by split-hex meshes to the facades and ground in high spatial resolution. Additional layers of refined spatial resolution are fabricated as well to improve the accuracy of near-wall-flow calculation. The STL model of downtown HKSAR areas, which is reduced in scale approximately 1:300, is discretized into over 5 million hexahedral cells for subsequent CFD calculation.

[PP17] Enhancing MedThaiSAGE: Decision Support System using Rich Visualization on SAGE 2

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Abstract

For several years, the Routine to Research (R2R) Organization has gathered medical research project data in Thailand and transformed it into a valuable knowledge resource to improve healthcare services and help healthcare policy makers to construct policies. However, the large amount of historical data creates a challenge to understand this information.To address this problem, MedThaiVis has been proposed to serve as a tool to visualize this complex data. In addition, MedThaiVis has been extended to operate on complex data in Scalable Amplified Group Environment (SAGE2), called MedThaiSAGE. This platform can help users to understand the data, gain insights into the complex data, and provide a better comprehensive view for exploration. SAGE2 is the platform that allows us to execute a visualization on scalable, high-resolution, display walls. Furthermore, MedThaiSAGE has been developed as a Decision Support System based on Association Rules, which is exploited to help healthcare policy makers to see the relevant set of rules and help in developing policy. However, these two applications perform independently. Therefore, we proposed and implemented an approach to integrate these two applications in order to enhance their capability. In order to integrate Extended MedThaiVis and MedThaiSAGE, there are three main issues that were overcome: (1) data integration, (2) communication and cooperative workflow between the two applications, and (3) fully support on SAGE2. In conclusion, our approach can help users to explore overview and insights of R2R data and increase the capability of healthcare policy makers.

[PP18] Tuberculosis (TB) Disease Interactive Map in Jakarta Capital Special Region

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Abstract

Tuberculosis (TB) is a disease that is easily contagious and can attack various organs of the body, especially the lungs. This disease can cause complications to cause death for the sufferer if not appropriately treated. Currently, Indonesia is in the top six countries with the newest TB cases and is ranked second with the most cases of TB patients in the world. Prevention can be done, among others, by conducting regular visits to community homes to ensure that their place of residence has proper sanitation by established health standards. It is necessary to map problems in each region to ensure what diseases are now spreading in the area. This study aims to monitor Tuberculosis in the Special Capital Region of Jakarta, especially East Jakarta, by using interactive maps to facilitate the DKI Jakarta Health Office in monitoring the control of Tuberculosis for action and prevention. This research use SDLC methodology, which consisted of the stages of system analysis, system design, system implementation, and system testing. The data used is from the Health Service Office of Jakarta Region. This interactive map-based tuberculosis information system in the particular area of the capital Jakarta is a form of business that can help the community and is expected to be useful for its users.

[PP19] Digital Poster Management Application on a SAGE2 based Multiple Display System

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Abstract

Digital posters are an impressive presentation media that can replace paper postersused at technical conferences. An organizer of such events requires effective managementof multiple digital posters and multiple monitors. This paper proposes a digital postermanagement system on a multiple display environment. To control multiple monitors we employ SAGE2 technology, which is middleware for collaborative working in highresolution that allows multiple users to simultaneously control the display of the samemonitor from browsers. Managing multiple monitors is designed using the main SAGE2screen to manage and control other SAGE2 screens. We have implemented a costeffective multiple display system using Raspberry Pi computers. For digital posters, we have extended a PDF viewer to support automatic page advancing with an arbitraryinterval. Also, we have developed a SAGE2 multiple monitor application that can be usedto control the PDF viewer presentation on multiple SAGE2 displays. The currentimplementation can manage and control what should be shown on each SAGE2 display.Future work includes implementing a PDF uploading function and evaluating the performance and effectiveness in a real exhibition environment.

[PP20] Machine learning for processing image data for disaster management

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Abstract

Natural disasters are an important global problem affecting many different countries. In Japan, a public website was made available to provide a variety of data from different sensors throughout the country. This data includes information about river water levels, rainfall levels, and snowfall level. Moreover, this information includes CCTV cameras positioned along the river, which provide photos of the river conditions in real-time. This provides users with information on the current status of the river, but does not provide any additional information and the user is left to process the information and make decisions. The goal of this project is to improve the usability of this CCTV image data through image processing with machine learning. Convolution Neural Network is one of the most popular machine learning algorithms. As a first step to provide more information from the camera images, we implemented this framework to detect snow in the camera images. using a modified form of the transfer learning VGG19 model. This model was trained with images that were positive for snow and negative for snow. The results confirmed that it can detect snow areas on the ground in image. However, in some images had false positives because it classified a clouds as snow. Because of this, we implemented post-processing to correct the false positives and improved the accuracy of the classification. Future work will extend the classification from a binary (i.e. yes or no snow) to a more quantitative measure of the amount of snow in the images.

[PP21] Room Auto Controlling Based on Occupant Body Condition Using Arduino And Raspberry Pi

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Abstract

A cozy room should adjust its environment based on the condition of its occupants since it will indirectly affect the moods and body conditions of people inside. This study aims to develop a system for monitoring the human body condition using paired sensors on the Arduino Lilypad. The system will send the sensors data to the Raspberry Pi 3 via Bluetooth to automatically control the electronic device inside the room based on the occupant body condition. The developed system will automatically turn on or turn off the electronic device when the body temperature or the heart rate is higher than the specified threshold value.

[PP22] Criminality Linguistics Detection on Social Networks Through Personality Traits

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Abstract

As text messaging became a mainstream form of communication among online users, cyber-criminal activities such as cyber bully and cyber harassing are more often executed through such platforms. However, linguistic markers in the text messages often act as fingerprints in revealing the characters of the culprits who hide behind the anonymity provided by internet. Presently, most of the text-based cybercriminal studies directly dives into linguistic analysis rather than exploring through the psychology-personality aspects that acts as one of the root causes to the presence of criminality. Therefore, this study attempts to investigate the criminality contents in tweets messages through the point of view of personality trait that advocates criminal behaviour and its representation towards languages measured through sentiment valences. Furthermore, most of the recent studies in personality detection domain used Big 5 Personality Model and Automatic personality Recognition (APR) technique to examine the personality of social networks users. As an alternative, this study intended to incorporate the Three Factor Personality Model (PEN) traits especially Psychoticism that widely has been applied to evaluate the personality of criminals and employed an Automatic Personality Perception (APP) method to guide the identification of sentiment seed terms that associated to PEN model traits. We have collected English and Malay language messages tweets messages and annotated based on sentiment valences identified through literature reviews. This study proposed a methodology to make comparisons among Naïve Bayes (NB), Sequential Minimal Optimization (SMO), K-Nearest Neighbour (KNN), J48 and ZeroR classifier as a baseline based on the Chi Square feature selection and 10-fold cross validation. Our Machine Learning comparison showed that NB classifier outperformed other classifiers while KNN performed worst among them.

[PP23] Performance Comparison of Dynamic Load Balancing Algorithm for Indonesian e-Health Cloud

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Abstract

The popularity of cloud computing has been growing - including the use of cloud computing in healthcare, as commonly called e-health cloud. The increasing number of cloud computing users has driven the selection of an effective load balancing algorithm. This study has examined the performance of load balancing algorithms for a cloud. The cloud is Indonesian e-health cloud using Particle Swarm Optimization (PSO) and Ant Colony Optimization (ACO) algorithms for load balancing. We used CloudAnalyst simulator, a cloud computing simulator that applies a GUI. Before running the scenario, PSO and ACO algorithms are added on CloudAnalyst. The simulation is done for a cloud model with the number of users and data centers that adopt the need of part of e-health cloud in Indonesia. 42 users were taken based on the number of cities, while for 6 data centers were taken from 6 provinces on the Java Island. The data center selection use optimized response time policy. The average response time and the average data center processing time are investigated for different requests per user and data sizes. The results show that the ACO algorithm provides a lower response time and data center processing time compared to using the PSO algorithm for load balancing on the cloud.

[PP24] Using UAV images for smart agriculture to monitor rice paddy with artificial intelligence

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Abstract

Rice is the staple food for over half of the world's population. Especially in Asia, rice is central to the food security (FAO 2014). Therefore, a smart rice paddy monitoring system is urgently needed to ensure a sustainable rice production. With the intention to develop a smart rice paddy monitoring system, the present project uses a huge amount of environmental data as the basis for the development of an artificial intelligent (AI) agricultural cultivation support system integrating unmanned aerial vehicle (UAV) surveillance. Meanwhile, a standard operating procedure (SOP) of the UAV field monitoring system will be established in order to combine field monitoring networks and cloud-based image processing techniques. Three major highlights are 1) establishing a UAV agricultural multi-source image database, 2) implementing a variety of image analyses combining AI techniques for growth monitoring, yield prediction, crop moisture content evaluation, damage assessment, and disease monitoring, and 3) establishing a UAV cloud-based platform to combine functions of UAV image analysis and expert advice support system. Overall, the present study is expected to provide a valuable basis for smart agriculture development and to benefit both farmers and management agencies in agriculture cultivation and management in Taiwan and further southeast Asia countries.

[PP25] rEDM Code Acceleration with ABCI Supercomputer

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Abstract

The rEDM code is the R package which written on C++ and R programming language. The rEDM package is a collection of methods for Empirical Dynamic Modeling (EDM). In this work, we try to optimize and accelerate the code by using CUDA. We aim to run this program on the AI Bridging Cloud Infrastructure (ABCI) in AIST, Japan. We use the dataset of zebrafish neural brain for running with the rEDM code from UCSD, USA. This is collaboration project of NAIST, AIST and UCSD.

PRAGMA 35 DEMO ABSTRACTS

[PD01] Integrating PRAGMA-ENT and Inter-Cloud Platform using Dynamic L2VLAN Service

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Abstract

Effective sharable cyberinfrastructures that allow researchers to freely perform their research experiments on the environment are fundamental for collaborative research in widely distributed environments. This demo will introduce an integration of an international Software-Defined Networking testbed (PRAGMA-ENT) and an Inter-Cloud platform (Virtual Cloud Provider) using a dynamic VLAN service (NSI). Using these services and infrastructures, we can dynamically design and deploy our own research testbed in the Inter-Cloud environment with an on-demand manner. In the talk, we present the overview of these services and introduce some applications on the testbed.

[PD02] Extending SDN Networks from Cloud-to-Edge using Virtual Private Networks with Peer-to-Peer Overlay Links

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Abstract

While solutions to many challenges posed by IoT lie at the network's edge, they cannot forego services available in the cloud which has over a decade of research and engineering to be leveraged. To bridge this gap, hybrid approaches in networking that account for characteristics of both edge and cloud systems are necessary. On cloud data centers, significant progress has been made on applying Software Defined Networking (SDN) to address networking challenges such as scalability, addressing, virtualization, and traffic engineering; administrators are now well-versed at managing data center SDN deployments in enterprise systems. However, the applicability of SDN in edge networks has not yet been thoroughly investigated. I will demonstrate a hybrid system that incorporates SDN software switches and overlay networks to build a dynamic layer 2 virtual network connecting hosts across the edge (and in the cloud) with links that are peer-to-peer Internet tunnels. These tunnels are terminated as subordinate devices to SDN switches and seamlessly enable the traditional SDN functionalities such that cloud and edge resources can be aggregated.

[PD03] Analysis of Load Balancing Performance on Cluster Computing with PROXMOX VE

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Abstract

This research aims to examine the performance of load balancing for a cluster. Load balancing is a solution for a large access load and minimizes downtime in serving requests from users. Load balancing distributes loads of traffic evenly to the servers with particular algorithms. In this research, the server for load balancing cluster is implemented using LVS topology via direct routing and use round-robin algorithm on Proxmox VE for load balancing. Proxmox VE is in charge of dividing virtual resource servers into four virtual environments, two nodes as load balancing clusters and two nodes as web servers. The results of research conducted with loads of 250, 500 & 1000 users show that load balancing system reduces the maximum response time up to 4165 ms with 0% of packet loss, compared to utilization of single server with the maximum response time up to 7269 ms and 22.48% packet loss. The load balancing system for clusters also manages to failover with an average value of downtime 16.6 seconds.

[PD04] Performance Comparison of Load Balancing using Honeybee and Threshold Algorithm

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Abstract

Cloud computing is currently developing rapidly. Load balancing technique is very crucial to balance the load in the cloud. Load balancing is needed to distribute dynamic workload across resources in the cloud. CloudAnalyst can be used to simulate load balancing algorithm in cloud. One advantage of CloudAnalyst is it applies a GUI. We implement Honeybee and Threshold algorithms into CloudAnalyst. We examine Honeybee and Threshold algorithms implementation for Indonesian e-Health cloud model. There are 4 data center and 34 users based on the number of regions and provinces in Indonesia. Two data center selection policies are used, i.e. closest data center and optimized response time policy. The average response time is investigated for different user data sizes. The simulation result shows that Threshold algorithm gives average response time that is faster than the Honeybee. Nevertheless, Honeybee algorithm delivers better performance for data size smaller than 80 bytes, and Threshold algorithm tends to give smaller response time for data size 100 bytes.

[PD05] EDISON Data Platform for Computational Science Data

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Abstract

This paper demonstrates the EDISON-DATA platform, which provides a way to easily publish, preserve, share, and analyze computational science data. While the data is explosively generated from computational science field, research on a computational science platform that provides a way to utilize and analyze the data is still an early stage. One of the main issues in the computational science data platform is addressing the diversity and heterogeneity of data. Our platform provides customized pre-processing services by data type to extract metadata consistently and provides methods to analyze the metadata. Sharing and reusing computational science data can avoid duplication of calculation time and cost. In addition, it is also possible to obtain new knowledge by analyzing the constructed data through artificial intelligence methods. This platform was developed to support multi-disciplinary data. To test this platform's functionality and applicability, we select the computational science data in the material field as a pilot. We have constructed about 100,000 material simulation data on our platform. Based on this data, we will describe the platform's main functionalities such as data management, data analysis, and data property prediction service based on artificial intelligence.

[PD06] Web-based Compute-Data Research Environment for Aircraft Airfoil Aerodynamics

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Abstract

Manufacturers in the aircraft industry need appropriate and efficient analysis frameworks to develop reliable wings their design and manufacturing stages. Particularly two dimensional airfoils are basic shape design elements in this technical area. In order to tackle the field technicians' or engineers' feeling difficulties on high performance computing simulation, then we developed a cyber-infrastructural and web-based research environment. The first notable point of this demo presentation is that a computer simulation environment was embodied in the web based framework. It includes some essential computing elements such as automatic mesh generation, airfoil shape parametrization, and high-fidelity flow solver. This framework enables simulation-runners not to install any software with easy access, and then complications were eliminated to consider computationally not professionally trained users who work in the manufacturing fields. One more remarkable point is that this framework employed machine learning driven tools for the aerodynamic performance inferences by machine learning techniques with training and testing the dataset from the high-fidelity flow simulations. The comparison between flow solver simulations and machine learning inferences showed that some methods ranked higher accuracy and others were not. It was concluded that this virtual airfoil research environment will help engineering designers and researchers conduct quicker decision and analysis.

[PD07] Mobile-based Augmented Reality for Sundanese Alphabets Education

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Abstract

In 2017, the Indonesian Ministry of Higher Research and Education reported that the smartphone user in Indonesia had achieved about 25% of the total citizen or about 65 million people. This trend is beneficial to utilize smartphone for promoting traditional cultures in Indonesia, especially to the teenagers that are steadily moving forward to modern culture. This research aims to build an Android-based application with an augmented reality feature to enhance the experience of learning traditional Indonesian heritage, especially traditional alphabets. CARIOSAN is a mobile application with the purpose to preserve the Sundanese alphabets and prevent it from extinction. The main features in the application are AR-based Sundanese alphabets recognition, Rarangken information, Sundanese alphabets writing canvas, and quiz feature to assess user understanding of the Sundanese alphabets. We interviewed 35 respondents for measuring the usability, the easiness of use, the information coverage, the interface, and the novelty of the application. The results showed that the developed application was highly useful and interactive in providing the essential information of Sundanese alphabets although with a novelty score only above 50 percent.

[PD08] Tuberculosis (TB) Disease Interactive Map in Jakarta Capital Special Region

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Abstract

Tuberculosis (TB) is a disease that is easily contagious and can attack various organs of the body, especially the lungs. This disease can cause complications to cause death for the sufferer if not appropriately treated. Currently, Indonesia is in the top six countries with the newest TB cases and is ranked second with the most cases of TB patients in the world. Prevention can be done, among others, by conducting regular visits to community homes to ensure that their place of residence has proper sanitation by established health standards. It is necessary to map problems in each region to ensure what diseases are now spreading in the area. This study aims to monitor Tuberculosis in the Special Capital Region of Jakarta, especially East Jakarta, by using interactive maps to facilitate the DKI Jakarta Health Office in monitoring the control of Tuberculosis for action and prevention. This research use SDLC methodology, which consisted of the stages of system analysis,system design, system implementation, and system testing. The data used is from the Health Service Office of Jakarta Region. This interactive map-based tuberculosis information system in the particular area of the capital Jakarta is a form of business that can help the community and is expected to be useful for its users.

[PD09] Neuro Data Platform for Neuroscientist

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Abstract

The University hospital (namely Hospital Universiti Sains Malaysia) holds a large collections of Neuroimaging data from various neuroimaging machines. A collaborative effort on compiling and making use of these data work was initiated by a centre called P3Neuro (now is part of Department of Neurosciences, School of Medical Sciences) where the School of Computer Sciences was engaged to develop a platform that is not only aimed at hosting the data but also to develop potential tailored diagnostic tools that could help the medical practitioners in their diagnosis decision makings. Since August 2017, the collaborative project has achieved its first two milestones i.e. data pre-processing pipeline and initial data storage and retrieval mechanism. Whilst, there is still a long way to go, this demo is intended to present the updates on on-going data pre-processing pipeline and also the initial data storage schema. This is followed by the next phase planning on the analytics and visualization of these data.

[PD10] Deep Learning Classification for Liver Disease

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Abstract

Liver disease is one of the top ten diseases with the highest mortality rate in Indonesia, with the increasing rate of one percent per year. Type of liver disease most attacking Indonesian people is Hepatitis. According to Basic Health Research (Riskesdas) 2013, Hepatitis had a prevalence number of 1.2 percent that was double than the prevalence in 2007. There are some methods to diagnose the liver disease such as enzymes pattern analysis, excretion, metabolism, electrophoresis and serologic test. This research focused on diagnosing the liver disease based on enzymes pattern using Deep Learning approach. We used Indian Liver Patient Dataset (ILPD) from UCI Machine Learning Repository with a total of 583 data (416 positives and 167 negatives) to build the classification model, with the training and testing rate of 0.7 and 0.3, respectively. We conducted a preprocessing step for the training data using Synthetic Minority Over-sampling Technique (SMOTE) with the percentage rate of 0.5 to balance the positive and negative class. Experiment results reveal that the created model can classify liver disease with the accuracy, sensitivity, and specificity rate of 0.89882, 0.84, and 0.9225 percent, respectively.

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