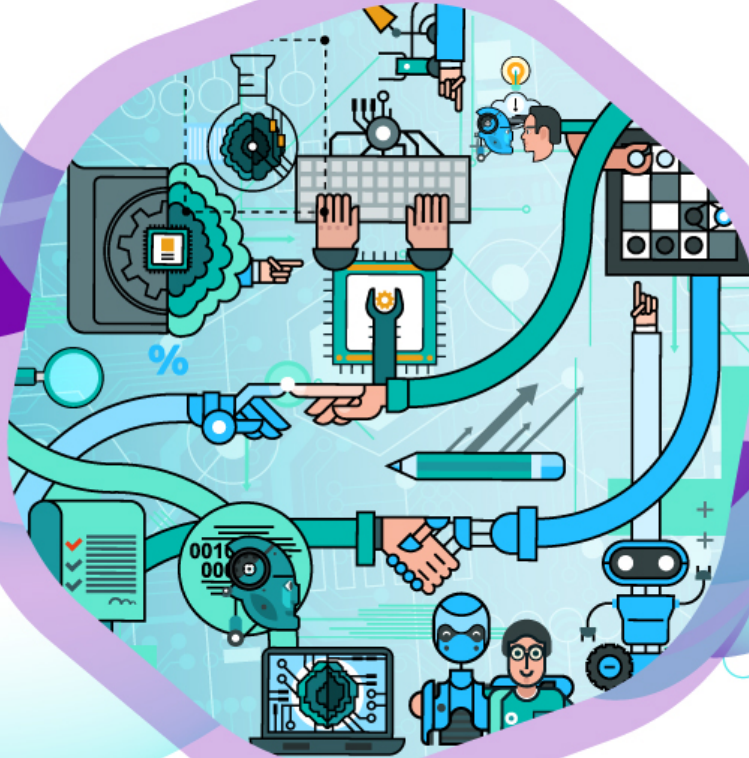


The 23rd International Conference on Information
Integration and Web Intelligence (**iiWAS2021**)

The 19th International conference on Advances
in Mobile Computing & Multimedia Intelligence (**MoMM2021**)



Editors:

Eric Pardede, Maria Indrawan-Santiago, Pari Delir Haghighi,
Matthias Steinbauer, Ismail Khalil, Gabriele Kotsis

iiWAS2021&MoMM2021**PROCEEDINGS**

Eric Pardede, Maria-Indrawan Santiago, Pari Delir Haghighi
Matthias Steinbauer, Ismail Khalil, Gabriele Kotsis (eds.)

iiWAS2021 & MoMM2021

**The 23rd International Conference on Information Integration
and Web Intelligence (iiWAS2021)**

and

**The 19th International conference on Advances in Mobile
Computing & Multimedia Intelligence (MoMM2021)**

30 November – 1 December 2021
Linz, Austria



**Association for
Computing Machinery**



The Association for Computing Machinery
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PREFACE

This proceeding includes the combination of papers presented at the 23rd International Conference on Information Integration and Web Intelligence (iiWAS2021) and the 19th International conference on Advances in Mobile Computing & Multimedia Intelligence (MoMM2021).

Both conferences were held virtually from 29 November to 1 December 2021, with the hosts managing the conference from the campus of JKU in Linz, Austria. The year 2021 was the second year that we all had to deal with the challenges and restrictions presented by COVID-19 but with mass vaccinations across the world, there are signs of hope for holding face to face conferences next year.

While keeping the acronym this year, iiWAS2021 has changed a part of the title from 'Web Application and Services' to 'Web Intelligence'. This follows the trend of research and development in our field. A large number of papers focused on advanced machine learning and data mining techniques, intelligence in recommender systems and social networks, big data management and utilization, and novel e-applications. Some established research topics such as semantic web and information retrieval have also been presented with new approaches and for new applications.

MoMM2021 had a global participation with papers submitted from the five continents. This year's papers were focused on modern topics of mobile and multi-modal sensing, IoT, and deep learning and AI applications. Accepted papers presented novel solutions to deal with real world problems of fraud detection, cyber-risk management, crisis management, smart retailing and microgrids.

The continuity iiWAS and MoMM conference series are because of the continuous and generous support of its participants over the years, even during this challenging time. We cannot express our gratitude enough to our dedicated authors, renowned program committee members, session chairs, organizing and steering committee members, and student volunteers. We also would like to sincerely thank our distinguished keynote speakers, Prof Gill Dobbie from the School of Computer Science, the University of Auckland, New Zealand for her talk on Machine Learning in Healthcare, and Prof Won Kim from Gachon University, South Korea for his talk on AI-BigData Convergence.

This year, iiWAS and MoMM are proud to host the first World AI-BigData Convergence (ABC) Forum, in which seven world-renowned speakers from both academia and industry discuss the issues and problems surrounding the vision of Artificial Intelligence (AI) and Big Data confluence and propose ground-breaking solutions with a full awareness of potential benefits and risks.

This volume is a good summary of our research during tumultuous times of 2020/2021. It is inspiring how we can keep on doing our creative and innovative work even with the limitation of direct social interaction. We hope you enjoy the conferences and the papers and we are looking forward to welcoming you again next year, in person with optimistic expectations.

Eric Pardede
Maria-Indrawan Santiago
Pari Delir Haghighi

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Keynotes Speakers

AI-BigData Convergence (ABC)

Prof. Won Kim

Distinguished Professor and AI Vice President of Gachon University, Korea

Abstract

In this keynote, I would like to share my vision for the convergence of AI and Big Data, which I will call the “ABC” to make it easy to remember. It is an initiative that can propel the current smart data processing to the next level.

The ABC vision is based on advancing both AI and Big Data through promotion of a fuller use of data, and a symbiotic relationship between AI and Big Data. The fuller use of data means the use of higher quality data and multimodal data for both AI and Big Data. The symbiotic relationship means to advance AI and Big Data by leveraging each other.

The initiative can significantly enhance the performance (both accuracy and speed) of ML/DL; significantly broaden the scope of data science applications, and enhance the productivity in developing such applications; and enhance the quality of data, and lead to a better maintenance of the data to serve as input to ML/DL model training and validation.

This ABC initiative will require participation by a robust segment of the Big Data and ML/DL communities, including researchers, data scientists, application developers, open source developers, and hardware designers.

In this keynote, I will outline an initial scope of the R&D for the ABC Initiative that merits attention from the community.

Machine Learning in Healthcare

Prof. Gill Dobbie

School of Computer Science, University of Auckland, New Zealand

Abstract

My vision is that, through the application of machine learning, our research will be better positioned to help solve some of the major global issues facing the world today and in the future. We are currently on a journey as a community, developing a myriad of novel methods for solving problems but there is still a translational gap between the development of novel methods and their application in society.

The term machine learning was coined in 1959, over 60 years ago, and the number of publications in the area is increasing substantially every year with over 100,000 in 2021 alone. We are developing new methods that are smarter, faster and more accurate, but what impact are we having outside our own research community?

Many of us demonstrate that our proposed method's accuracy is better than a benchmark on synthetic data sets under various conditions with different parameter settings, and then show that the method also performs well in the real world in a case study on real world data sets. How do we bridge the gulf between our research community and the communities where we could make a real difference?

We have been working towards taking the next step, working with healthcare experts to understand their problems and where our research can have an impact in their domain.

In this keynote, I will discuss some of our projects in the area, and highlight lessons learned and challenges.

World - A B C - Forum

World AI-Big Data Convergence (ABC) Forum

Abstract

In this 2021 first Annual World AI-BigData Convergence (ABC) Forum, seven world-renowned speakers from both academia and industry will discuss the issues and problems surrounding the vision of Artificial Intelligence (AI) and Big Data confluence and propose ground-breaking solutions with a full awareness of potential benefits and risks.

The objective of this World Forum is to explore the current status and R&D opportunities and issues in the convergence (or confluence) of AI and BigData from a data centric perspective. The objective of the ABC initiative, as defined by Prof. Won Kim in his keynote for iiWAS-2021, is to help propel the current smart data processing to the next level. The ABC vision is based on advancing both AI and Big Data through fuller uses of data and through AI and big data leveraging each other. The fuller uses of data include the use of higher quality data and multimodal data for both AI and Big Data.

Due to the large number of speakers and the importance of what they have to offer, we will organize the World Forum into two sessions over two days: four speakers on November 29, and three speakers on November 30. Please join us in what we expect will be a very informative, productive, and exciting Forum.

World ABC Forum Organization

- Prof. Won Kim, AI Vice President of Gachon University, South Korea
- Prof. Woong-Kee Loh, School of Computing, Gachon University, South Korea (*Forum Moderator*)

World ABC Forum Speakers

Mining Hidden Structures from Massive Unstructured Text

Prof. Jiawei Han, University of Illinois at Urbana-Champaign, USA

Abstract

The real-world big data are largely dynamic, interconnected, and unstructured text. It is highly desirable to transform such massive unstructured data into structured knowledge. Many researchers rely on labor-intensive labeling and curation to extract knowledge from such data. Such approaches, however, are not scalable. We envision that massive text data itself may disclose a large body of hidden structures and knowledge. Equipped with pretrained language models and text embedding methods, it is promising to transform unstructured data into structured knowledge. In this talk, we introduce a set of methods developed recently in our group for such an exploration, including joint spherical text embedding, discriminative topic mining, taxonomy construction, text classification, and taxonomy-guided text analysis. We show that data-driven approach could be promising at transforming massive text data into structured knowledge.

Deep Knowledge from Shallow Data: Machine Learning on Wearables Data for Medical Insights into Chronic Conditions

Prof. Jaideep Srivastava, University of Minnesota, USA

Abstract

There has been a recent epidemiological transition in the leading causes of death, from acute infectious diseases to chronic, non-communicable diseases, with an estimated cumulative output loss of over \$47 trillion in the next two decades. There is increasing realization that healthcare needs to become more proactive and preventive. Conventional therapy model is episodic and reactive, with care provided when an event like a clinic or hospital visit happens. Next increment of patient data is collected upon the next clinic/hospital visit, and the patient history, augmented with the latest increment of data, is used for deciding the course of action.

With patient information being collected only upon hospital/clinic visits, a barrier to proactive healthcare is the lack of visibility of the patient's status for the long stretch of time in-between visits. The rising popularity and functionality of wearable devices, e.g., watches from Apple, Fitbit, etc., makes them the perfect tool for ubiquitous sensing to fill in this gap. Hence, an important component of the NIH's implementation of the Precision Medicine Initiative is to collect data from bio-metric and physiological sensors, such as wearable devices and mobile phones. For wide-spread and longitudinal data collection, health science is moving towards the use of wearable devices. The monitoring of people during their daily life can provide valuable insight into the behavioral patterns related to various chronic conditions.

Continuous sensing generates large amounts of big multi-modal data. A major drawback of the emerging scenario, however, is that medical professionals can get completely overwhelmed with the new data which can be very large scale and being new is not well understood. Without a set of tools which can help make sense of this data, it will remain largely unused. Scalable machine learning techniques have the potential to address this dilemma by providing insights from this massive data with varying levels of guidance required, i.e., unsupervised, semi-supervised, and supervised learning. For example, automated actigraphy can allow sleep disorder screening based on data from wearable devices; enabling proactive and early detection of sleep disorders like obstructive sleep apnea (OSA), a condition which affects over 22 million Americans, and if left untreated can lead to choking as well as severe neurological and cardiac conditions.

The novel analytical power provided by machine learning can translate simple monitoring into medical knowledge discovery. These devices provide a platform for an affordable widespread population screening, diagnosis, prognosis, monitoring of patients on therapy, and impending therapy non-adherence. In this talk we draw upon examples from sleep science and medicine, intensive care, and diabetes monitoring to illustrate how improvement can be achieved in treatment decisions and therapy management programs, to empower clinicians, therapy program managers, and patients, towards more proactive healthcare.

AI and BigData for Molecular Diagnostics, a Seegene's Approach

Dr. Kyungoh Min, Seegene, Inc., South Korea

Abstract

Molecular diagnostics is the rapidly developing area of medicine that investigates human, viral and microbial genomes. With the novel corona virus afflicting every corner of the world, the PCR (Polymerase Chain Reaction) technology which is used for its diagnosis has become a common term. In this technology, oligonucleotide reagents are used that can help detect the existence of target pathogens in the sample by identifying and amplifying with them.

Seegene's proprietary multiplex techniques enable rapid operation of such detection process. In this talk, how Seegene is using computing technologies in designing reagents for such purpose is presented. Technologies such as machine learning as well as big data are currently investigated to improve the quality of the 'in silico' system the company is building.

AsterixDB Meets Machine Learning

Prof. Michael J. Carey, University of California at Irvine, USA

Co-contributors: Ian Maxon and Phanwadee (Gift) Singthong (UC Irvine)

Abstract

In the last few years, the field of data science has grown rapidly as businesses have adopted statistical and machine learning techniques to help drive their analyses and decision-making. Scaling data analyses to large volumes of data today typically involves the use and management of distributed frameworks; this can pose technical challenges for data analysts and reduces their productivity. This talk will briefly describe two ways in which the AsterixDB project has been working to alleviate this issue. The first is the development of AFrame (and now PolyFrame), a data analytics library that provides the data scientists' familiar interface, Pandas Dataframe, but that transparently scales out the evaluation of analytical operations via a backend database system. This enables AFrame to leverage database management facilities (such as indexes and query optimization in AsterixDB) so that users can analyze large volumes of database-resident data as though it were "small data". The second is the provision of Python user-defined function (UDF) support in AsterixDB's SQL++ query language. This enables machine-learned models, such as models trained using ScikitLearn or PyTorch, to be deployed as functions that can be called like other functions in SQL++ queries and thus applied in parallel to large volumes of data by AsterixDB's parallel query engine.

AI-Powered Network Security

Prof. Elisa Bertino, Purdue University, USA

Abstract

Networks are today a critical infrastructure. Their resilience against attacks is thus critical. Protecting networks requires a comprehensive security life cycle and the deployment of different protection techniques. To make defenses more effective, recent solutions leverage AI techniques. In this talk, we first discuss relevant directions for AI-based protection techniques, according to a security life cycle. We then present an overview of Polisma, a framework to learn access control policies from data; such an approach is critical to enable zero-trust architecture (ZTA). Polisma is based on a pipeline of different techniques to learn attribute-based access control (ABAC) rules from logs of access control decisions and potential context information obtained from external sources (e.g., LDAP directories). Polisma, combines data mining, statistical, and machine learning techniques to learn access control rules that can then be easily understood by end-users, auditors, systems administrators. We have experimentally evaluated Polisma using two datasets (real and synthetic). Experimental results show that Polisma is able to generate ABAC policies that accurately control access requests.

Applying Deep Learning to New Vision Sensors for Extreme Imaging Conditions

Prof. Yong Ju Jung, Gachon University, South Korea

Abstract

Recent deep learning-based approaches have shown outstanding performance in generating visually plausible image contents for various low-level vision tasks, such as image super-resolution, inpainting, colorization, high dynamic range imaging, and multi-image fusion. The deep learning approaches allow us to overcome the limitations of conventional image sensors while taking photos in extreme shooting conditions, such as low-light, high dynamic range, and fast motion.

In this talk, I will summarize recent deep learning-based approaches that can be applied to computational photography and imaging. I will introduce two new methods inspired by human vision, which enable us to design new types of cameras for better imaging quality. I will discuss a novel concept of peripheral vision sensor which uses deep image colorization

techniques to provide better low-light shooting performance than conventional Bayer cameras. I will also discuss a depth sensing approach that uses deep stereo matching algorithms with stereo event streams captured by event-driven vision sensors. Experimental results have shown that the proposed deep learning models can provide better imaging performance and hence allow development of such new imaging devices.

Towards Trustworthy Data Science

Prof. Jian Pei, Simon Fraser University, British Columbia, Burnaby, Canada

Abstract

We believe data science and AI will change the world. No matter how smart and powerful an AI model we can build, the ultimate testimony of the success of data science and AI is users' trust. How can we build trustworthy data science? At the level of user-model interaction, how can we convince users that a data analytic result is trustworthy? At the level of group-wise collaboration for data science and AI, how can we ensure that the parties and their contributions are recognized fairly, and establish trust between the outcome (e.g., a model built) from the group collaboration and the external users? At the level of data science eco-systems, how can we effectively and efficiently connect many participants of various roles and facilitate the connections among supplies and demands of data and models?

In this talk, I will brainstorm possible directions to the above questions in the context of an end-to-end data science pipeline. To strengthen trustworthy interactions between models and users, I will advocate exact and consistent interpretation of machine learning models. Our recent results show that exact and consistent interpretations are not just theoretically feasible, but also practical even for API-based AI services. To build trust in collaboration among multiple participants in coalition, I will review some progress in ensuring fairness in federated learning, including fair assessment of contributions and fairness enforcement in collaboration outcome. Last, to address the need of trustworthy data science eco-systems, I will review some latest efforts in building data and model marketplaces and preserving fairness and privacy. Through reflection I will discuss some challenges and opportunities in building trustworthy data science for possible future work.