

# ICBAA 2017

## eProceedings of INTERNATIONAL CONFERENCE ON **BIG DATA APPLICATIONS** IN AGRICULTURE

### *"FROM NURSERY TO FIELD"*

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**eProceedings of the**  
**INTERNATIONAL CONFERENCE ON BIG**  
**DATA APPLICATIONS IN AGRICULTURE**  
**(ICBAA2017)**  
**“From Nursery to Field”**

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**PROCEEDINGS INTERNATIONAL CONFERENCE ON BIG DATA  
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**“From Nursery to Field”**

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## **FOREWORD BY MINISTER OF SCIENCE, TECHNOLOGY & INNOVATION MALAYSIA**



Distinguished Guests and Participants,

Advances in information and communication technology (ICT) have led to tremendous leap in the volume of data that can be captured, transmitted and stored. For example, the size of data handled five years ago was a few dozen terabytes. Nowadays, it has expanded by 1000X reaching petabyte level. The powerful digital technologies that are available enable utilization of the information inherent in these massive amounts of data offering solutions to complex biological and non-biological problems and opening new opportunities for exploration. In agriculture, big data offers farm and plantation managers access to explicit information and decision making capabilities not thought of before. However, the eventual impact of big data within the agricultural sector will require organizational innovations to embrace and keep pace with the rapid development in the digital technologies.

This conference which provides the avenue for experts to present their experience on big data applications in agriculture from the nursery until management of crops in the field is timely. Global climate change in recent years has resulted in many environmental uncertainties and worsening threat of pests and diseases. Big data in the form of 'omics data, field monitoring data and remote sensing data will provide better precision in producing new cultivars, managing agricultural inputs, diagnosing stresses and predicting crop performance in the field. Sharing of data is becoming essential in certain situations. In such cases due respect should be given to data ethics which promote data protection and prevention of wrong use of data. Big data is part and parcel of the forth industrial revolution where the agriculture sector will be transformed through adoption of the digital technologies. In the foreseeable future, field monitoring can be done from afar, while crop management can be performed remotely or with the help of robotic technology.

The Ministry of Science, Technology and Innovations, Malaysia strongly supports research that enhances human capital development in big data applications and the adoption of digital technologies in general. These technologies will be part of our country's strategic direction as their adoption and applications in an innovative way are critical for future growth and economic development of the country. I am very delighted to be part of this important conference. I wish all participants a fruitful conference ahead. I thank the organizer for inviting me to officiate it.

**DATUK SERI PANGLIMA WILFRED MADIUS TANGAU**

## **FOREWORD BY VICE CHANCELLOR**



Assalamualaikum W.B.T dan Salam 1 Malaysia

I wish to extend a warm welcome to all distinguished guests, speakers and participants from Malaysia and abroad to the International Conference on Big Data Applications in Agriculture (ICBAA2017). ICBAA2017 is the first event at Universiti Putra Malaysia (UPM) jointly organized by two prominent universities in the agricultural fields, UPM and Wageningen University and Research, the Netherlands.

The conference with the theme 'from nursery to field', aims to provide exposure to researchers and students, detailing on knowledge-guided crop management which offers solutions to various inherent problems in crop production. The uniqueness of agriculture is that, it integrates human activities, machineries, soil, the environment and many other contributing factors in crop production. Hence, diverse and large volume of data are generated, making data management becoming more complex. Digital technologies will enable farmers and plantation managers to manage and analyze the big data from various sources for perfecting insights. As such it broaden the analytics and predictive capability for better field management and crop productivity.

UPM being the premier institution of higher education in the field of agriculture and related sciences in this region, will continue to work together with world leading universities for advancing agricultural research in order to address food security and sustainability issues and promote prosperity through agricultural activities. UPM is continuously improving its significance to the academic, industry and social communities. We are proud that in the QS Ranking 2017/2018, UPM was ranked at 229<sup>th</sup> world's best university. In terms of subjects, UPM is ranked 100 world's best in Agriculture and Forestry, Engineering (Chemical), and Engineering (Mechanical, Aeronautical and Manufacturing) by QS World Ranking 2017.

I hope that this conference will provide an avenue for a stimulating discussion among local and international researchers as there are immense knowledge and experience that exist among the speakers and participants. My utmost sincere appreciation to the Minister of Science, Technology and Innovation, Yang Berhormat Datuk Seri Panglima Wilfred Madius Tangau who has kindly consented to officiate and address our conference and launch the book entitled "Crop Improvement: Sustainability through Leading-edge Technology" edited by UPM's Professors. I wish to thank all organizing committee members from Malaysia, and the Netherlands for their excellent collaborative efforts.

Thank you and best wishes.

**"With Knowledge We Serve"**

**PROF. DATIN PADUKA DATO' DR. AINI IDERIS, FASc.**

## **FOREWORD BY ICBAA2017 CHAIRPERSON**



Assalamualaikum Warahmatullahi Wabarakatuh and Greetings,

I wish to extend a warm welcome to distinguished guests and participants of the International Conference on Big Data Applications in Agriculture (ICBAA2017): “From Nursery to Field”. As the chairperson leading the organization of ICBAA2017, I discovered that it was quite challenging to stage this inaugural conference as it involves diverse disciplines including the biosciences, ICT and engineering. Nevertheless, the tremendous support obtained from members of the industry, academia and scientists gave us the drive to stage an event that may serve as an important gathering for scientists in the future to discuss on the applications of big data to move forward the agriculture sector.

The participants will be able to listen to presentations from experts from world renowned universities at this conference. The presence of many researchers from the plantation industry provides an excellent opportunity for university scientists to explore potential industry-academia collaboration. I strongly encourage the early career scientists to make efforts to expand their networking and seek training prospects particularly related to digital technologies.

A new book published by Springer International Publishing entitled *Crop Improvement: Sustainability through Leading-edge Technology* will be launched during the opening ceremony. As the lead editor of the book, I take this golden opportunity to convey my deep appreciation to my co-editors, Prof. Dr. Ho Chai Ling from UPM and Prof. Carol Wagstaff from University of Reading, UK and authors from Malaysia and other countries for their brilliant and informative chapters. We also hope to capture the important and main findings from ICBAA2017 in another book for future reference by scientists worldwide with the support of Springer.

I wish to convey my deep appreciation to the Honourable Minister of Science, Technology and Innovation Malaysia, Yang Berhormat Datuk Seri Panglima Wilfred Madius Tangau for gracing the occasion. I highly appreciate the excellent contributions of our keynote, plenary and oral speakers, session chairs, poster presenters, participants and sponsors. I am grateful to the Vice Chancellor of UPM for her strong support in making this conference a success. The contribution of the management team and staff of UPM from the Institute of Plantation Studies and the other faculties is highly appreciated. I wish to thank the organizing committee members for the high level of motivation and commitment that they have shown in staging this event.

**“With Knowledge We Serve”**

**PROF. DATIN DR. SITI NOR AKMAR ABDULLAH**



## ORGANIZERS

### MAIN ORGANIZER:



### CO-ORGANIZER:



## **ORGANIZING COMMITTEE**

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## **CORPORATE PROFILE**

### **About Universiti Putra Malaysia, Malaysia**



Universiti Putra Malaysia (UPM) is one of the public universities holding the research university (RU) status in Malaysia. UPM started as the School of Agriculture in 1931 which was located on a 22-acre piece of land in Serdang and offered two programs: a three-year diploma program and a one-year certificate course in Agriculture. In 1947, the school was declared the College of Agriculture Malaya by Sir Edward Gent, the Governor of the Malayan Union. The establishment of Universiti Pertanian Malaysia came about when the College of Agriculture in Serdang merged with the Faculty of Agriculture, University of Malaya. With the first intake of 1,559 students, Universiti Pertanian Malaysia had its first academic session in July 1973 in the three central faculties and one basic division: the Faculty of Veterinary Medicine and Animal Sciences, Faculty of Forestry, Faculty of Agriculture, and a Division of Foundation Studies. In the early 80s, UPM extended its area of studies to include the field of Science and Technology (S&T). In 1997, the name Universiti Pertanian Malaysia was changed to Universiti Putra Malaysia by the former Prime Minister, Tun Dr. Mahathir Mohammad, as a strategic gesture to portray the status of UPM as a centre of higher education capable of providing various fields of studies, especially in science and information technology, which facilitate national development in the new millennium. The transformation of UPM makes the university today having impressive modern facilities and a dynamic approach on teaching and research with proud heritage of quality services and achievements. In the QS Ranking 2017/2018, UPM was ranked at 229<sup>th</sup> world's best university. In terms of subjects, UPM is ranked 100 world's best in Agriculture and Forestry, Engineering (Chemical) and Engineering (Mechanical, Aeronautical and Manufacturing) by QS World Ranking 2017. As an institution, it carries an illustrative legacy of the history in agricultural education and research in Malaysia. UPM is the birthplace of agriculture intellectuals who shape Malaysia's agricultural development and at the same time produce human capital in ensuring the continuity of economic development, especially in the agricultural sector.

## **About Wageningen University, the Netherland**



Wageningen University, part of Wageningen University & Research, is the only university in the Netherlands that specifically focuses on the theme 'healthy food and living environment'. The university do so by working closely with governments and the business community. The research and education are based on a fundamental scientific approach and accordingly strongly geared toward application in practice. This is achieved through the close collaboration between different fields of expertise including both natural and social sciences. This allows Wageningen University to obtain an integrated approach of actual societal themes, such as: climate change, unhealthy lifestyles, the continued pressure on our natural environment and animal welfare. Wageningen University's researchers are active around the globe, and the university hosts students from over 100 countries. The university's mission is to explore the potential of nature to improve the quality of life. Wageningen University is a part of Wageningen University & Research. Wageningen University & Research consists of Wageningen University and several research institutes. Wageningen University & Research has locations throughout the Netherlands. Many teachers, professors and employees work on the Wageningen Campus. Both Wageningen University's research and education are highly acclaimed. Student numbers have increased significantly over the last years. In 2013 students ranked Wageningen as the best university in the Reference Guide for Higher Education in the Netherlands for the ninth year in a row. The top quality of research at Wageningen University is crowned with the university's position within the top 6 of the important citation indexes of its domain.

## **About Institute of Plantation Studies, UPM**



Institute of Plantation Studies (IKP) gathers UPM researchers of different expertise under one roof. This enhances cooperation and focus on helping various issues and challenges faced by the plantation sector in Malaysia. The focus of IKP is not limited to oil palm and rubber plantations but covers also other crops such as cocoa, pepper and coconut. IKP works closely with government and private agencies related to the plantation sector. The main activity of the IKP is to provide postgraduate training in agronomy, agricultural engineering, biotechnology, precision agriculture, plant protection, economic and policies. This will help to ensure that the country's plantation industry remain competitive in this challenging era. IKP organizes seminars and workshops to highlight new ideas and technologies that can be used by the plantation sector. IKP also emphasizes on fundamental research that will increase the understanding of a product or technology developed for the benefit of the plantation industry and smallholders. This helps in enhancing technology adoption and sustainable practices in the plantation industry.

## KEYNOTE SPEAKERS

### BIOGRAPHY KEYNOTE SPEAKER 1

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#### **Dr. Sharifah Shahrul Rabiah Syed Alwi** **FELDA Global Ventures R&D Sdn Bhd**

Dr. Sharifah Shahrul Rabiah is the CEO and VP for Felda Global Ventures (FGV) Research and Development Sdn. Bhd. She is responsible for the entire upstream R&D for FGV group. She has a PhD in plant molecular biology and has been involved in oil palm R&D for over 20 years.

### ABSTRACT

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#### **From Bioinformatics to Geoinformatics: Big Data in Oil Palm R&D**

Felda Global Ventures through its R&D Cluster utilizes cutting-edge technologies to enhance operational performance and commercial production of all its agri-products. Our strategy to produce high yielding planting material utilizes both bioinformatics and geoinformatics. Building on the oil palm genome, we develop in-house capabilities to analyse genomics data coming from a wide range of sequencing technologies including PacBio Smart Sequencing. We build our own visualization capabilities in the form of database called ElaeisBase with the objective of hosting biological data for navigating the genome for downstream analyses. This system is then linked to our FGV Integrated Breeding System or FIBS that carry various modules to support the activities of oil palm breeding. The modules include ortet selection, mother palm selection, agronomy and crop protection base study, molecular breeding, QC and statistical tools for analysis. Data coming from our molecular tests are consolidated into FIBS and ElaeisBase to allow for more meaningful analysis. We have also accumulated large amounts of agronomic and environmental data. This, in combination with our genetic-based data will allow for development of models for data-driven operational decision to optimize yield and boost revenue. This will lead to reduction in operational expenses, crop failure due to plants being planted in unsuitable location identified from their genetic data (eg. drought tolerance) and environmental impact (nutrient run-off).

## BIOGRAPHY KEYNOTE SPEAKER 2

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### **Assoc. Prof. Dr. Wataru Takeuchi** **University of Tokyo, Japan**



Dr. Wataru Takeuchi is currently an Associate Professor at Institute of Industrial Science (IIS), The University of Tokyo, Japan. He obtained Bachelor degree in 1999, Master degree in 2001, and a Ph.D. degree in 2004 at Department of Civil Engineering, Faculty of Engineering, The University of Tokyo, Japan. He has worked at IIS as a Postdoctoral fellow from 2004 to 2006, a Visiting Assistant Professor at Asian Institute of Technology (AIT), Thailand from 2007 to 2009 and a Director of Japan Society for Promotion of Science (JSPS), Bangkok office, Thailand from 2010 to 2012. He serves as a senior policy analyst of council science and technology and innovation, cabinet office, government of Japan from 2017 to 2019. He has been a regular member of Japan Society of Photogrammetry and Remote Sensing, Remote Sensing Society of Japan and American Geophysical Union.

## ABSTRACT

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### **Supporting Efficient Management of Oil Palm Plantation using Remote Sensing (RS), Unmanned Aerial Vehicle (UAV), Geographic Information System (GIS) and Global Navigation Satellite System (GNSS)**

This paper describes an approach to detect oil palm trees in Malaysia using Unmanned Aerial Vehicle (UAV) images. Malaysia is the world's second largest palm oil producer. Oil palm expansion and replanting can contribute to deforestation, biodiversity loss and a range of social issues. Ensuring successful oil palm management and replanting requires an effective monitoring program to collect information regarding the status of young trees. UAV imagery is low-cost alternative to field-based assessment, but it requires the development of image processing methods to easily and accurately extract the required information. In this paper, regarding tree detection, template matching and Local Maximum Filtering were tested on one representative plot and based on the better performance of Local Maximum Filter on that plot, this approach was applied in to the whole study area. The accuracy of detection was assessed through precision, Recall and F-measure and respectively are 0.7, 0.84 and 0.74. Height of tree as a parameter which changes consistently throughout its life was estimated in whole area and then distribution of height was assessed in the rest part of paper. Based on the height distributions, the most probable area which have older trees were introduced in order to replanting.

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