



***The 8<sup>th</sup> International Conference on Information and Communication  
Technology for Embedded Systems***

*Abstracts*

*May 7-9, 2017*

*Bangsaen Heritage Hotel, Chonburi Beach, THAILAND*

*Organized by*

*Department of Electrical Engineering, Kasetsart University  
Sirindhorn International Institute of Technology, Thammasat University  
National Electronics and Computer Technology Center, NSTDA  
Tokyo Institute of Technology*

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❧ **CONFERENCE AT-A-GLANCE** ❧

<b>Time</b>	<b>Conference Room A</b>	<b>Conference Room B</b>
<b>Sunday, May 7, 2017</b>		
13.00-13.30	Register	
13:30-14:30	Invited Talk (Dr. Hiroki Nakahara)	
14:30-14:50	Coffee Break	
14:50-16:10 (1.20 hr)	Session 1A (4) Communications	Session 1B (4) Tracking/Localization
<b>Monday, May 8, 2017</b>		
9:00-10:20 (1.20 hr)	Session 2A (4) Image Processing	Session 2B (4) Classification
10:20 – 10:40	Opening Ceremony	
10:40 -11:00	Coffee Break	
11:00-12:00	Keynote Speech (Dr. Takamichi Nakamoto)	
12:00 -13:15	Lunch	
13:15-14:00	Invited Talk (Dr. Phumin Kirawanich)	
14:00-14:20	Coffee Break	
14:20-15:40 (1.20 hr)	Session 3A (4) Data analysis	Session 3B (4) Control
15.40-16.25	Invited Talk (Dr. Sharon Tulabadi)	
18:00-21:00	Banquet	
<b>Tuesday, May 9, 2017</b>		
8:40-10:00 (1.20 hr)	Session 4A (4) Design/Implementation	Session 5 (4) Short papers
10:00-11:00	Keynote Speech (Dr. Kosin Chamnongthai)	
11:00-11:15	Coffee Break	
11:15-12:00	Poster session	
12:00-13:00	Lunch	





## Message from the Honorary Chairs

We are honored and pleased to welcome all conference attendees to the 8th International Conference on Information and Communication Technology for Embedded Systems (IC-ICTES). The conference is held at the beautiful Bangsaen Heritage Hotel in Chonburi province, Thailand, from May 7 – 9, 2017. This conference is a great venue for all researchers, academia, and students, who are interested embedded system designs, development of new hardware or software-related theories and techniques in embedded systems, and information and communication technology, to present and exchange cutting-edge results. It is also a great opportunity to make new friends and meet up with old friends since we have organized this conference every year since 2010.

I would like to take this opportunity to thank our sponsors, keynote and invited speakers, reviewers, authors, and especially, the organizing committee for making this conference a success, and am eagerly looking forward to a constructive and fruitful few days of conference with all attendees.



Chongrak Wachrinrat  
President of Kasetsart University

ICICTES 2017 Honorary Chairs:

Akinori Nishihara, Tokyo Institute of Technology  
Chongrak Wachrinrat, President of Kasetsart University  
Hiroaki Kunieda, Tokyo Institute of Technology  
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Somkit Lertpaithoon, Rector of Thammasat University



## Message from General Chairs

On behalf of the Organizing Committee, I would like to extend to all of you our warmest welcome to the International Conference on Information and Communication Technology for Embedded Systems (ICICTES). ICICTES has been jointly organized by the key members working in the field of ICT and Embedded Systems from Kasetsart University, National Electronics and Computer Technology Center, Sirindhorn International Institute of Technology, and Tokyo Institute of Technology.

Recently Thailand and Japan has collaboration on graduate study in the field of automotive engineering (AE), information and communication technology for embedded systems (ICTES), sustainable energy and resources engineering (EnvE), and soon to have new curriculum on Rail Transportation. I would like to thank all the members for their dedication and hard work to make this truly successful international conference.



Omjai Saimek  
Vice President of National Science and  
Technology Development Agency (NSTDA)

ICICTES 2017 General Chair

Manabu Okumura, Tokyo Institute of Technology  
Omjai Saimek, Vice President of NSTDA  
Peerayuth Charnsethikul, Kasetsart University  
Somnuk Tangtermsirikul, SIIT, Thammasat University



## Message from the International Advisory Chairs

As the representative of the ICICTES 2017 International Chairs, I would like to express congratulation to the success of the arrangement of the Eight International Conference on Information and Communication Technology for Embedded Systems (ICICTES). We are happy to have attracted 40 excellent papers from Canada, China, India, Japan, Pakistan, South Korea, Sri Lanka, and of course Thailand. In addition, we are fortunate to have a number of distinguished keynote speakers and invited speakers that will clearly add a high note to this important event. This conference provides great opportunity for researchers to exchange their knowledge and experiences related to embedded systems. On behalf of all of the participants of all countries, I would like to congratulate general chairs, technical program chairs and organizing members for their success in arranging this conference. I sincerely hope that all of you enjoy this remarkable event.



Akinori Nishihara  
Professor Emeritus of Tokyo Institute of Technology

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Akinori Nishihara, Tokyo Institute of Technology  
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Tsang-Yi Wang, National Sun Yat-sen University

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***Keynote Speech***

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## Machine Olfaction for Internet of Things

Takamichi Nakamoto

Institute for Innovative Research, Tokyo Institute of Technology

### Abstract

Machine olfaction is a human interface in terms of olfaction. It includes odor sensing system and olfactory display. A tiny module of odor sensing system aimed for IoT (Internet of Things) is introduced. An odor sensing module for IoT is not available even if many sensors can be connected to the internet. Moreover, a gadget called an olfactory display is presented. An olfactory display works like an actuator in the chemical field. The small-size olfactory display has been developed. Many tiny olfactory displays connected to the internet can be used to keep the environment comfortable. Additionally, deep learning technique related to olfaction is presented at the conference.

### Biography



Takamichi NAKAMOTO received his B.E. and M.E. degrees in 1982 and 1984, respectively, and his Ph.D. degree in electrical and electronic engineering from Tokyo Institute of Technology, Tokyo, Japan. He worked for Hitachi in the area of VLSI design automation from 1984 to 1987. In 1987, he joined Tokyo Institute of Technology as a Research Associate. In 1993, he became an Associate Professor with the Department of Electrical and Electronics Engineering, Tokyo Institute of Technology. From 1996 to 1997, he was a Visiting Scientist at Pacific Northwest Laboratories, Richland, WA, USA. He is currently a Professor with Laboratory for Future Interdisciplinary Research of Science and Technology, Institute of Innovative Research, Tokyo Institute of Technology. He is interested in odor sensing system, olfactory display and human interfaces.

## A Design and Implementation Method of Automatic Tonsillitis Monitoring and Detection System

Kosin Chamnongthai  
King Mongkut's University of Technology Thonburi

### Abstract

Tonsillitis is one of vital diseases causing Ischemic heart disease, chronic obstructive pulmonary disease, and kidney diseases, which mark top 10 of death cause. The tonsillitis also leads to pneumonia, which is estimated that many children are recently taken to an appropriate health provider. Bacteria and viruses entering the body often cause it. Ordinarily, bacteria and viruses entering the body via mouth and nose are filtered in the tonsil, and white blood vessels of immune system within the tonsils destroy viruses and bacteria by producing inflammatory cytokines, which lead to fever. To prevent and cure the tonsillitis, people, especially children and elderly need tonsil monitoring and tonsillitis detection periodically done by expert medical doctors. Due to shortage of medical doctors, an automatic expert system for monitoring and detecting tonsillitis at home is really required to develop in compact size and low power consumption.

In this talk, an automatic tonsillitis monitoring and detection system aiming personal usages practically requires mobility, compact size, and light weight with reliable functions. This talk explains and discusses a design and implementation method of automatic tonsillitis monitoring and detection system. In this method, pipeline concept is essentially utilized for data transmission among processes, and parallel concept is employed in the feature extraction processed in an appropriate number of blocks divided in a tonsillitis image. The performance of proposed method is evaluated by experiments done by our design prototype software and hardware systems, with 159 tonsillitis samples, the results show 96.4% and 91.8% accuracy respectively.

### Biography



Kosin Chamnongthai currently works as professor at Electronic and Telecommunication Engineering Department, Faculty of Engineering, King Mongkut's University of Technology Thonburi (KMUTT), and also serves as president elect of ECTI Association (2016-2017). He served as editor of ECTI e-magazine during 2011-2015, associate editor of ECTI-CIT Trans during 2011-2016, associate editor of ECTI-EEC Trans during 2003-2010, associate editor of ELEX (IEICE Trans) during 2008-2010, and chairman of IEEE COMSOC Thailand during 2004-2007.

He has received B.Eng. in Applied Electronics from the University of Electro-communications, Tokyo, Japan in 1985, M.Eng. in Electrical Engineering from Nippon Institute of Technology, Saitama, Japan in 1987, and Ph.D. in Electrical Engineering from Keio University, Tokyo, Japan in 1991. His research interests include computer vision, image processing, robot vision, and signal processing. He is a senior member of IEEE, and a member of IPSJ, TRS, IEICE, TESA, ECTI, AIAT, and EEAAT.

*Invited Talk*

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# A Short-Time Implementation for a High-Performance Binarized Deep Convolutional Neural Network on an FPGA

Hiroki Nakahara

Department of Information and Communications Engineering, Tokyo Institute of  
Technology

## Abstract

A pre-trained convolutional deep neural network (CNN) is a feed-forward computation perspective, which is widely used for the embedded systems, requires highly power and area efficiency. Also, with a rapid growth of the CNN techniques, a short time-implementation is a mandatory. In this talk, I introduce a binarized CNN on an FPGA which treats only binary 2-values (+1/-1) for the inputs and the weights. In this case, the multiplier is replaced into an XNOR circuit instead of a dedicated DSP block. For hardware implementation, using binarized inputs and weights is more suitable. Additionally, I show the optimization techniques for the binarized one for the FPGA implementation. Next, I propose a framework for an FPGA realization of the binarized CNN by using a high-level synthesis. Our developed framework supports a modern CNN frameworks, such as a Caffe, Theano, TensorFlow, and Chainer. Thus, we can implement the high-performance CNN on the FPGA with a short time. Finally, I show the comparison of the conventional implementations, then, introduce the applications using the binarized CNN on the FPGA.

## Biography



Hiroki NAKAHARA received the B.E., M.E., and Ph.D. degrees in computer science from Kyushu Institute of Technology, Fukuoka, Japan, in 2003, 2005, and 2007, respectively. He has held faculty/research positions at Kyushu Institute of Technology, Iizuka, Japan and Kagoshima University, Kagoshima, Japan. Now, he is a Senior Assistant Professor at Ehime University, Japan. He was the Workshop Chairman for the

23<sup>rd</sup> International Workshop on Post-Binary ULSI Systems (ULSIWS) held in Bremen, Germany in 2014. Also, he has served the Program Chairman for the 8th International Symposium on Highly-Efficient Accelerators and Reconfigurable Technologies (HEART) held in Bochum, Germany in 2017. He received the 8th IEEE/ACM MEMOCODE Design Contest 1st Place Award in 2010, the SASIMI Outstanding Paper Award in 2010, IPSJ Yamashita SIG Research Award in 2011, the 11st FIT Funai Best Paper Award in 2012, the 7th IEEE MCSoc-13 Best Paper Award in 2013, and the ISMVL2013 Kenneth C. Smith Early Career Award in 2014, respectively. His research interests include logic synthesis, reconfigurable architecture, digital signal processing and embedded systems. He is a member of the IEEE, the ACM, and the IEICE.

## **An EMC Management for Railway System Assurance**

Phumin Kirawanich

Department of Electrical Engineering, Mahidol University

### **Abstract**

This work describes the life cycle-approach EMC management to control the overall EMC of the MRT Purple Line project, one of the extensive urban rail transit projects in Bangkok area with a large number of electrical equipment interfaces following integration of M&E subsystems. Cooperation and coordination across all disciplines through key EMC activities are also discussed at each project development phase to guarantee the success of a large-scale project EMC assurance. The positive system integration test results of electromagnetic emissions from the whole railway system under EN 50121-2 criteria confirm an effective systematic EMC management process.

### **Biography**



Phumin Kirawanich received the M.S. and Ph.D. degrees in electrical engineering from the University of Missouri, Columbia, in 1999 and 2002, respectively. From 2002 to 2007, he was with the Power Electronics Research Center and the High Power Electromagnetic Radiation Laboratory, University of Missouri, as a Postdoctoral Fellow. From 2007 to 2008, he was with the Department of Electrical and Computer Engineering, University of Missouri, as a Research Assistant Professor. Since 2008, he has been a Faculty Member with the Department of Electrical Engineering, Mahidol University, Salaya, Thailand, as an Associate Professor. For practical professional experiences, he is an EMC consultant coordinating EMC matters at system level across all subsystems and establishing EMC compliance of the whole railway. Projects under his consultancy include the MRTA Purple Line, the SRT Red Line, and the BTS Green Line Upgrade and Extensions. His research interests include pulsed-power technology for biomedical and agricultural applications, terahertz-pulse generation, electromagnetic and semiconductor physics computation, and railway EMC.



## Crowdfunding and Creative Embedded Systems Platforms

Sharnon Tulabadi  
Gravitech Co., Ltd.

### Abstract

Crowdfunding becomes popular for profit entrepreneurial ventures in wide-range application projects, including embedded systems products and services. Many creative embedded devices, which were favorite among students, software developers or inventors, were initiated from crowdfunding projects. In this presentation, innovation-based embedded systems products funded from Kickstarter are presented, for example, “RuuviTag” - Open-Source Bluetooth Sensor Beacon, “Durio Sound” - a DAC for Raspberry Pi that let you enjoy a dynamic ultimate sound quality, “Naked Pi B+” - a customizable engraved transparent case for Raspberry Pi B+. The experience in making ideas to reality by crowdfunding and its benefit are also presented at the conference.

### Biography



Sharnon Tulabadi received his Ph.D. degree in Electrical Engineering from University of Nevada Reno, USA, in 2013. He worked for General Electric (GE), USA as a Senior Manufacturing Engineer from 2000 to 2009 and for University of Nevada Reno as an Assistant Professor from 2009 to 2013. In 2006, he found Gravitech USA with a concept for making electronics easy for anyone to use in the Do-It-Yourself projects.

The company expanded to Thailand in 2013. The core business is a Hardware Startup Incubator. Which provide DIY Electronic tools, training, crowdfunding, manufacturing service and marketplace for Makers and Startups. His company has opened several Makerspaces called Home of Maker to help incubate many hardware startup projects and successfully funded on the Kickstarter.

Session 1A : Communications

Date: Time May 7, 2017 (Sunday) : 14:50 - 16:10

Venue Room A

### 1A.1 Experiments for Element Spacing on a 2 by 2 Patch Antenna Array

*Authors:*

Kirote Arpanutud<sup>1a</sup>, Denchai Worasawate<sup>1b</sup>, La-or Kovavisaruch<sup>2c</sup>, Kazuhiko Fukawa<sup>3d</sup>

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National Electronics and Computer Technology Center, Pathumthani, Thailand<sup>2</sup>.

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*Abstract:*

This paper presents the comparison between the calculated and measured radiation patterns of a two by two patch antenna array with three different element spacings. The optimum element spacing for a specific grating lobe level is obtained by the proposed optimization process. The optimization goal is to obtain narrowest steering beams with a desirable grating lobe level. The larger element spacing lead to narrower beam width. In this paper, the desirable grating lobe is either less than -10dB or at -3dB levels and the main lobe is not less than -3dB. The patch antenna array is fabricated and measured in an anechoic chamber. The measured results are compared with the calculated ones. The measured and calculated patterns are similar at main lobe but both patterns are different around grating lobe area.

### 1A.2 Design of Flexible Triple-layer Folded Dipole Antenna on Curved Surface for WBAN

*Authors:*

Charinsak Saetiaw

*Affiliation:*

Department of Electronics and Telecommunication Engineering, Rajamangala University of Technology Isan Khon Kaen Campus, Thailand.

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*Abstract:*

This article presents the results of using flexible folded dipole by stacking techniques to automatically adjust the matching frequency. The designed triple-layer (3L) antenna provides the folded dipole antenna with flexibility to efficiently work with the human body part that mostly like curved surface. The flexible triple-layers folded dipole (3L-FFD) antenna can increase the length of all layer of the antenna to be automatically adjusted. The effective length of the 3L-FFD antenna can be expanded as the actual antenna's length by two, four, six and eight sliding points when compared to the former multilayer dipole antenna design. The proposed design will decrease the amount of layers of the folded dipole antenna; only three-layers still can extend the whole antenna's length as well as the multilayer dipole antenna (four-layers and five-layers). The results displayed that the resonance frequency improvement of the antenna was more stable. The 3L-FFD antenna is created for functioning at 2.45GHz with WBAN.

Session 1A : Communications

Date: Time May 7, 2017 (Sunday) : 14:50-16:10

Venue Room A

### **1A.3 Multilevel Grey-Scale Visual Coding for Data Transmission from LCD Screens to Android Smartphone Cameras**

*Authors:*

Pradab Yamsang<sup>a</sup>, Witthawas Pongyart<sup>b</sup>, Pisit Vanichchanunt<sup>c</sup>

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*Abstract:*

In this paper, a multilevel grey-scale visual coding scheme is proposed for data transmission from LCD screens to Android smartphone cameras. A computer equipped with an LCD screen acts as a data transmitter whereas the smartphones with cameras perform the task of receivers. The multilevel modulation of light intensities allows each visual symbol or dot to carry more number of bits, thus increasing the data rate. However, varying characteristic of smartphone cameras especially from the auto exposure function and the auto white balance function significantly interfere the symbol detection of smartphones. With the aid of pilot symbol insertion, the appropriate decision levels for the symbol detection can be effectively evaluated at the receiver without disabling the auto exposure function or the auto white balance function of cameras. To avoid the effects of saturation and nonlinearity in the detection, the brightness of the LCD should be kept between 20% and 80%. Besides, the lowest intensity level of the grey-scale coding should be higher than a threshold otherwise the receiver cannot effectively sense the present of the data transmission from the LCD screen.

### **1A.4 Implication of anchor placement on performance of UWB real-time locating system**

*Authors:*

Charuwalee Suwatthikul, Witsarawat Chantaweksomboon, Supatra Manatrinon, Krit Athikulwongse, Kamol Kaemarungsi

*Affiliation:*

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*Abstract:*

Recently, real-time locating system (RTLS) with centimeter accuracy using radio frequency signal is available for commercial deployment with the use of ultra-wideband (UWB) technology. One of the commercial UWB real time locating systems in the market now is DecaWave's DW1000 IC which utilizes two-way-ranging (TWR) mechanism to measure accurate distance between an anchor and a tag. Then, a trilateration algorithm with distances from three or more anchors is used to calculate the tag's location. It is recommended that, to improve the accuracy of the system, a clear view between all anchors must be provided. This work presents a performance study of commercial UWB RTLS evaluation kits in two different anchor placement scenarios. In the first scenario, each anchor was provided a clear communication path between each other while in the latter some direct communication paths between the anchors were obstructed by concrete pillars. The evaluation kits were configured to allow maximum range and data rate. Intuitively, the first scenario should perform much better than the latter. However, the experiments showed the contrary in some situations. Moreover, the overall performance, in terms of error distances and R95 values, of the first scenario did not outperform significantly as expected.

Session 1B : Tracking / Localization

Date: Time May 7, 2017 (Sunday) : 14:50-16:10

Venue Room B

### **1B.1 Real-Time Robust Human Tracking based on Lucas-Kanade Optical Flow and Deep Detection for Embedded Surveillance**

*Authors:*

Quang Dao Vu<sup>1</sup>, Sun-Tae Chung<sup>2</sup>

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*Abstract:*

Object tracking is one of the most important functions in surveillance systems, especially in the system with Pan/Tilt/Zoom Camera. In this paper, we propose a real-time robust human tracking method for embedded surveillance. The proposed human tracking method tracks human objects based on Lucas-Kanade (LK) optical flow algorithm [1], rectifies tracking error due to accumulation or object missing by readjusting tracked human object bounding boxes periodically. Human localization information is obtained from a reliable deep learning-based human. It also handles occlusion by combination of LK information and human detector information. In order to achieve fast and robust processing, computationally light but reliable human detector is developed based on YOLOv2 object detector [2] model. Through experiments in comparison with other state-of-the-art tracking methods, it is shown that the proposed human tracking method operates fast and reliably with occlusion handling, and that performs better than or comparable to others.

### **1B.2 A Face Tracking Method using Dominant Orientation Templates and Pose Estimation**

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*Abstract:*

This paper proposed a method for face tracking and pose estimating by combining two algorithms, namely, the dominant orientation templates (DOT) [1] and the pose from orthography and scaling with iterations (POSIT) [2]. The concept of DOT is measuring the similarity between an input image and a reference image by matching from gradient orientations between a set of dominant image orientations and a set of dominant template orientations. The DOT algorithm is fast and accuracy as studied in [1]. The POSIT algorithm estimates 3D pose of an object and finds the rotation matrix and the translation vector of the object. To apply the DOT algorithm to face tracking, we selected four important face features which are left eye, right eye, nose, and mouth from different postures of a face. The gradient orientations are, then, extracted from these face features and these gradient orientations are combined to create the gradient orientation templates. We use these templates for locating the four face features on the face image. The positions of all face features are input to the POSIT algorithm where the face rotation matrix and transition vector in 3-D is estimate. The experimental result show the propose method can get satisfactory result.

Session 1B : Tracking / Localization

Date: Time May 7, 2017 (Sunday) : 14:50-16:10

Venue Room B

### **1B.3 Accurate Human Localization for Automatic Labelling of Human from Fisheye Images**

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*Abstract:*

Deep learning networks like Convolutional Neural Networks (CNN) shows successful performances in many computer vision applications such as image classification, object detection, and so on. For implementation of deep learning networks in embedded system with limited processing power and memory, deep learning network may need to be simplified. However, simplified deep learning network cannot learn every possible scenes. One realistic strategy for embedded deep learning network is to construct a simplified deep learning network model optimized for the scene of the installation place. Then, automatic training will be necessitated for commercialization.

### **1B.4 Performance evaluation of AOA, TDOA and hybrid methods for geolocation of interference in urban areas**

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*Abstract:*

The spectrum monitoring station which controlled by public authorities for management and monitoring the use of radio frequencies to ensure communications can continue to be consistently and thoroughly free from interference. By the rapid development of wireless broadband communication technology resulting interference issues from many transmitters or even the receivers as well. Including, economic growth and expansion of the city as a result to makes the traditional spectrum monitoring system AOA (Angle of Arrival) efficiency and accuracy decreased significantly. High buildings in urban areas give the multipath signals that have influence to determine the interference emissions. Therefore, this presentation mention of the spectrum monitoring system TDOA (Time Difference of Arrival) to be used in combination with AOA to monitoring and geolocation of interference emissions. Main propose of this research is using remote monitoring station and spectrum monitoring software to precision test of AOA, TDOA and hybrid methods to evaluate the efficiency, accuracy and find the right way to implement. By the best results from the experiment that TDOA and hybrid methods can bring for monitoring and geolocation of interference emissions in urban areas.

Session 2A : Image Processing

Date: Time May 8, 2017 (Monday) : 9:00-10:20

Venue Room A

### **2A.1 Tukey's Biweight Constrain Function For A Surrogate Image Enlargement Based On SISR Algorithm Using High Spectrum Estimation**

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Kornkamol Thakulsukanant<sup>a</sup>, Vorapoj Patanavijit<sup>b</sup>

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*Abstract:*

Consistently, the classical image enlargement algorithm is a scientific analytical method for producing a better refined resolution image that is frequently required for advanced digital image processing (DIP) from a single lower resolution image that is frequently acquired from digital camera embedded system. Because of its less computation calculation, the Single-Image Super-Resolution (SISR) that analytically applied for a single lower resolution image is one of the worldwide effective Super Resolution-Reconstruction (SRR) algorithms thus this paper proposes the image enlargement based on the SISR algorithm using high spectrum estimation and Tukey's Biweight constrain function. In general, the performance of this SISR algorithm is hinge on up to three parameters (b, h, k) however there are burdensome for determining these optimized values for these parameters (b, h, k). In order to solve this problem, the Tukey's Biweight constrain function, which is hinge on merely single parameter (T), contrary to three parameters like the classical constrain function, is engaged in the SISR algorithm. By examining on 14 benchmark images, which are profaned by considerable noise forms, in scientific analytical scrutinizing sector, the novel SISR algorithm illustrates that there is efficiently and effortlessly in parameter setting process but the performance of the novel SISR algorithm (with single parameters) is nearly equal to the original SISR (with three parameters). Due to greatly time reduction in the parameter setting process, this novel SISR algorithm is more advisable for real-time applications.

### **2A.2 Optic Disk Segmentation in Retinal Images Using Active Contour Model based on Extended Feature Projection**

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*Abstract:*

Accurate localization and segmentation of an optic disk (OD) is an important problem in the analysis of abnormality conditions such as optic disk shrinking/swelling, pale optic disk and glaucoma. Hence, this paper proposes an automated fast and accurate OD localization and segmentation technique. In this work, OD localization is performed using the extended feature projection method (EFP) based on retinal vessel orientation and average intensity variance. Multiple OD candidate locations, obtained from OD localization technique (EFP), are used as the initialization points of the active contour model to detect the OD boundaries. Next, we use a decision tree based on the OD features such as the area of vessels, the brightness and the entropy to select the final OD candidate. The proposed technique has been tested on STARE dataset to evaluate comparative studies on the localization and segmentation of OD in retinal images. The accuracy of the OD localization is 90.12% with an average computing time of 13 seconds per image. The performance of the OD segmentation in terms of sensitivity is 74.62 % and positive predictive value is 60.22% with an average computing time of 20 seconds per image. The proposed approach improves the accuracy of conventional feature projection method by 12.34% and runs as quickly as the conventional one.

Session 2A : Image Processing

Date: Time May 8, 2017 (Monday) : 9:00-10:20

Venue Room A

### **2A.3 Identification of inpainted satellite images using Evolutionary Artificial Neural Network (EANN) and K-nearest Neighbor (KNN) Algorithm.**

*Authors:*

Luqman Ali<sup>1a</sup>, Teerasit Kasetkasem<sup>1b</sup>, Thitiporn chanwimaluang<sup>2</sup>, Faisal Ghaffar Khan<sup>3</sup>, Hiroki Nakahara<sup>4</sup>

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*Abstract:*

Now a day's recognition of satellite image authenticity has received too much attention due to the invention of various remote sensing image inpainting algorithms. Satellite image forgery can be referred as a technique in which fake satellite image is generated by the creation and alternation of new image contents. This paper proposes an algorithm for the identification of inpainted remote sensing images. The proposed algorithm is the connection of two major processes: feature extraction followed by use of classifiers based on k-nearest neighbor's algorithm (KNN) and evolutionary artificial neural networks algorithm (EANN) separately. The proposed algorithm can efficiently identify whether a satellite image is inpainted or not. The experimental results reveal that the proposed method has better performance with faster speed for various kind of satellite inpainting images.

### **2A.4 Text Similarity Approach for SNOMED CT Primitive Concept Similarity Measure**

*Authors:*

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*Abstract:*

For the biomedical ontologies, Concept Similarity Measures (CSMs) become important in order to find similar treatments between diseases. For the ontology primitive concepts, they do not have enough definitions because they are partially defined in the ontology so one way to find the similarity between primitive concepts is to apply textual similarity methods between concept names. But existing textual similarity methods cannot give correct similarity degrees for all concept pairs. In this paper, we propose a new primitive concept name similarity measure based on natural language processing to get a better result in concept similarity measure in terms of noun phrase construction analysis. We conduct experiments on the standard clinical ontology SNOMED CT and make the comparison between our proposed method and existing two approaches against human expert results in order to prove our proposed similarity measure give correct and nearest similarity degree between primitive concepts.

Session 2B : Classification

Date: Time May 8, 2017 (Monday) : 9:00-10:20

Venue Room B

## 2B.1 Eye State Recognition Using the Hamming Distances of Eye Image Intensities

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*Abstract:*

Eye state recognition is still challenging in the field of computer vision. Many researchers have reported that their methods can work well with frontal face views, but not with variations of head poses. Some have described that their methods deal effectively with head pose problems, but the systems are complex to implement and consume a lot of processing time. In this paper, a novel method of eye state recognition is presented in order to overcome the head pose and time complexity problems. Moreover, the system which can be simply divided into two main steps is easy to implement. The idea is to use machine learning algorithm to localize eye regions, and then classify eye states according to the summation of many Hamming distances. The Hamming distance is computed between two observed eye image intensities which stay next to each other along the vertical axis. Since eye opening always scores higher than eye closing, this enables eye states to be distinguish correctly. There are two databases are used for evaluating the proposed method, and the experimental results show that more than 98% of accuracy can be achieved, with time complexity of 14 milliseconds, for a single 384 by 286 resolution image.

## 2B.2 Text Detection and Recognition on traffic panel in roadside imagery

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*Abstract:*

Text recognition has revolutionized the world of image processing and intelligent transportation system (ITS). It opened several possibilities to traditional ITS concept. Advancement in text recognition has made it possible to implement text recognition in ITS. Traffic panel text recognition, a real time application is considered as a key addition to the revolution in modern ITS. This research aims at developing real time application for traffic panel text recognition for English and Thai. Text recognition in this paper is based on Support vector Machine (SVM), KNN and maximally stable extremal regions (MSER). Traffic panel are extracted based on visual appearance. Based on traffic panel background, color mask is applied to remove non text candidates. Multi-level MSER is used for segmentation. Raw pixel value of segmented character is used as feature vector. This system is trained for English and Thai language and then tested on roadside images of traffic panels. The results of different kernels are compared with each other to select best possible kernel for SVM. SVM results are then compared with KNN to find best classifier for this problem. The result shows that proposed system is robust and performs well in challenging environment.



Session 2B : Classification

Date: Time May 8, 2017 (Monday) : 9:00-10:20

Venue Room B

### 2B.3 Neural Network based Bed Posture Classification enhanced by Bayesian Approach

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*Abstract:*

This paper describes bed posture classification by using a Neural Network model for elderly care. Data collected from a sensor panel (composed of piezoelectric sensors and pressure sensors), which is placed under a mattress in the thoracic area, we use Neural Network for posture classification. Bayesian approach is used for estimating the likelihood of consecutive postures. The sensing data are normalized into a range of 0 to 1 by the unity-based normalization (or feature scaling) method for eliminating the bias between the different types of sensors. Also, the accumulated signal data in one second time slots (120-inputs set) can improve the coverage of the trained model. The results from Neural Network and Bayesian network estimation are combined by the weighted arithmetic mean. Our proposed technique is applied to elderly patient data with five different postures i.e., out of bed, sitting, lying down, lying left, and lying right. This resulted in 91.50% accuracy when the proportion of coefficient for Neural Network and Bayesian probability is 0.3 and 0.7 respectively.

### 2B.4 RGB-D Classification using Feature Selection on the Combination of Different Features

*Authors:*

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*Abstract:*

To improve the classification performance in object recognition, many different features have been created from various techniques. However, these features may be redundant or irrelevant to implement the classification model. So, feature selection is considered one of the important tools that can be employed to select a subset of relevant features for specific model. In this paper, we applied feature selection method to form a new subset of features obtained from different feature extraction algorithms so that we can improve the object's classification performance. In the experiments, we demonstrated the use of filter method and wrapper methods for RGB-D object dataset and the results were promising.

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Session 3A : Data analysis

Date: Time May 8, 2017 (Monday) : 14:20-15:40

Venue Room A

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### 3A.1 Bankruptcy Prediction using Data Mining Techniques

*Authors:*

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*Abstract:*

This paper discusses the application and benefits of data mining techniques to construct prediction models in the field of corporate bankruptcy. It analyzes a dataset of 120 companies using different data mining techniques. Findings show that neural network is recommended as the best model to predict corporate bankruptcy. Findings also show that the proper use and selection of data mining techniques help to enhance the prediction accuracy of the models. Financial organizations can significantly benefit from using these prediction models as they allow them to anticipate the status of businesses in the future and make decisions accordingly.

### 3A.2 Median-Difference Window Subseries Score for Contextual Anomaly on Time Series

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*Abstract:*

Anomaly detection in time series is one of exciting topics in data mining. The aim is to find a data point which is different from the majority, called an anomaly. In this paper, a novel anomaly score called Median-Difference Window subseries Score (MDWS) is proposed with its algorithm and the recommended window size for detecting the contextual anomalies on time series data. It is computed as the subtraction of the middle point with the median of all data points within the current window. The proposed MDWS algorithm is implemented as the median-update of the current window subseries to maintain the linear time complexity. Two anomaly thresholds are set as the mean plus/minus three standard deviation for extracting the anomalies. Furthermore, the suitable window size for detecting anomalies is investigated and suggests that it should be smaller than the seasonal period. The experimental results show that the MDWS has the highest accuracy performance on the benchmark datasets from Yahoo comparing with others existing anomaly detection methods.

Session 3A : Data analysis

Date: Time May 8, 2017 (Monday) : 14:20-15:40

Venue Room A

### 3A.3 A Study of Support Vector Machines for Emotional Speech Recognition

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*Abstract:*

In this paper, efficiency comparison of Support Vector Machines (SVM) and Binary Support Vector Machines (BSVM) techniques in utterance-based emotion recognition is studied. Acoustic features including energy, Mel-frequency cepstral coefficients (MFCC), Perceptual linear predictive (PLP), Filter bank (FBANK), pitch, their first and second derivatives are used as frame-based features. Four basic emotions including anger, happiness, neutral and sadness in Interactive Emotional Dyadic Motion Capture (IEMOCAP) database are selected for training and evaluating in our experiments. The best accuracy of emotional speech recognition is 58.40% in average from SVM with polynomial kernel. Energy features combination with FBANK, pitch and their first and second derivatives features are the most suitable for computing utterance feature. Binary Support Vector Machines (BSVM) techniques show accuracy improvement in some emotions, such as sadness and happiness emotion.

### 3A.4 Robust Regression in Extrinsic Calibration between Camera and Single Line Scan Laser Rangefinder

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*Abstract:*

This paper presents an improvement for error reduction of the cost function for non-linear optimization of extrinsic parameters estimation between single line scan LiDAR and RGB camera. The non-linear optimization utilizes a least square scheme by assigning equal weights to all LiDAR measurement points. With robust regression, we used all LiDAR measurement points and removed RANSAC outlier removal with a weighting scheme dependent on the defined geometric constraint. The methods aim to minimize the error from the inaccuracy of the LiDAR measurement points using robust regression with M-estimator. The methods are tested with 100 random trials with noise magnitude from 5 to 40mm and a 10 percent chance of outliers of 3 times the normal noise magnitude. The results show that M-estimator is more resistant to noise than current state of art.

Session 3B : Control

Date: Time May 8, 2017 (Monday) : 14:20-15:40

Venue Room B

### 3B.1 Feedback Linearization-Based PI controller for Continuous pH Process System

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*Abstract:*

This research proposes a study of Nonlinear Feedback Linearization-Based PI controller for a continuous pH process system. We control the pH by filling in a reactor tank with wastewater and sodium hydroxide (NaOH) 1.25% by-weight. The system then keeps track of the pH to the desired values. However, since the system is inherently nonlinear and highly sensitive to uncertainty disturbances, it is not easy to achieve the desired results with rapidness and accuracy. In this paper, a nonlinear model is built taking the case of overflow reaction. The controller is designed based on feedback linearization in the inner control loop as a technique to transfer the system into a linear one, with Proportional - Integral (PI) Controller in the outer control loop. From the simulation results, the proposed Nonlinear Feedback Linearization-Based PI controller scheme has good steady state and satisfactory dynamic tracking performance.

### 3B.2 A Case Study in Micro Grid using Adaptive Enhanced Linear Exponential Smoothing Technique

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*Abstract:*

This paper analyzes and compares the performance of discrete time series power smoothing techniques utilized with an energy storage system in Mea Sariang micro grid system in Thailand to mitigate PV power fluctuation. A new smoothing technique so-called "Adaptive enhanced linear exponential smoothing (AELES)" is studied and compared with other techniques. PowerFactory-DigSILENT is employed to verify the performance of the studied techniques. A 22kV fluctuation at the point of common coupling, where the PV power plant is connected, is analyzed in cases of with and without ESS. The simulation result indicates that AELES has an ability to mitigate the voltage fluctuation at the observed bus bar. Moreover, the appropriate power and energy capacities of energy storage for the studied micro grid are determined.

Session 3B : Control

Date: Time May 8, 2017 (Monday) : 14:20-15:40

Venue Room B

### **3B.3 An Effective Approach for Improving Responsiveness of Total Bandwidth Server**

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*Abstract:*

As a result of increasing in diversity and complexity, real-time embedded systems have to deal with both periodic and aperiodic tasks. In such systems, it is expected that response time of aperiodic tasks is as short as possible. Total Bandwidth Server (TBS) is one of effective task scheduling algorithms for a mixture of periodic and aperiodic tasks. As a successor to TBS, Adaptive TBS (ATBS) is an algorithm where TBS is enhanced with prediction of execution times. Virtual release advancing (VRA) is an additional technique for TBS to shorten response time of tasks and Enhanced VRA (EVRA) is the extended version of VRA with lightweight complexity. In this paper, combination of ATBS and EVRA is examined to further improve the responsiveness of TBS. Simulation results show that the combination can reduce response times by up to 25% compared with TBS under heavy loads, while maintaining the schedulability and relatively low time complexity of the system.

### **3B.4 Design of the Multi-tasks Multi-processors System for an Underwater Robot**

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*Abstract:*

An underwater robot is widely used in many industries. The posture control of the robot is important since it makes a robot able to move in hard environment with stability and achieve precise motion following the desired trajectories. The designed underwater robot consists of 8 custom made thrusters in order control all robot state variables and make the motion achieve 6 Degrees-Of-Freedom. Robot hardware is separated into several hulls. Multi-processors design is implemented for robot hardware because it reduces complexity of wiring and it is easy to maintenance and future modification. Each processor has specific jobs with multi-tasks software approach in order to guarantee real-time response. Master Slave communication is used for communication between processors via RS485. Discrete Proportional Integral and Different (PID) controller is used as the robot posture controller. The experiments are conducted and all the robot controller gains are tuned. The experimental results show that robot can achieve real-time operation by using the designed multi-tasks multi-processors system and the proposed controller can control robot postures with robustness.

Session 4 : Design/Implementation

Date: Time May 9, 2017 (Tuesday) : 8:40-10:00

Venue Room A

#### 4.1 Design and Implementation of MEAN Stack-based Scalable Real-time Digital Signage System

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*Abstract:*

Most of conventional DSS (Digital Signage System) have been built based on LAMP framework. Recent researches have shown that MEAN stack framework is simpler, more flexible, faster and more suitable for web-based application than LAMP framework. In this paper, we propose a design and implementation of MEAN stack-based scalable real-time digital signage system (SR-DSS), which supports handling real-time tasks like urgent/instant messaging, system status monitoring and so, efficiently in addition to conventional digital signage CMS tasks. The architecture of the proposed digital signage system, SR-DSS is described and design and implementation issues are clarified in more detail. Through testing, it is observed that SR-DSS operates smoothly and shows better throughput performance compared to a well-known open source LAMP-based digital signage system Xibo, but it is also observed that we need more extensive testing and improvement for securing reliability.

#### 4.2 Adaptive Pulse Charger For Li-Ion Batteries

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*Abstract:*

In this paper, an Adaptive Pulse Charge System (APCS) for Li-ion batteries is proposed to improve the charge performance by pulse charging with most suitable frequency and duty. To evaluate the performance of proposed method, a prototype is designed and implemented with a 600 mAh Li-ion battery. Compared with standard Constant Current - Constant Voltage (CC-CV) method, proposed APCS has improved the charge speed by 13.7 %, while charge efficiency has improved by 3.1 %. With comparison to Variable Duty Pulse Charge (VDPC) system of 500 Hz and 1100 Hz, the proposed system has improved the charging speed by 3.8 %, 8.8 % and charge efficiency by 2 % and 2.3 % respectively. The results show that the APCS can adaptively provide the most suitable pulse based on the state of the battery for best charging speed and charge efficiency.

Session 4 : Design/Implementation

Date: Time May 9, 2017 (Tuesday) : 8:40-10:00

Venue Room A

### 4.3 MicroPython-based Educational Mobile Robot for Computer Coding Learning

*Authors:*

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*Abstract:*

This article presents a prototype of educational mobile robotic platform based on MicroPython library system, which enables robot control with Python language programming. Moreover, this robotic platform supports a visual programming environment called Blockly to develop a program, which is very simple and similar to an intuitive jigsaw puzzle. Both Python and Blockly are simple coding tools for first-time learner who are interested in programming learning. The proposed mobile robot utilizes a modular design which is based on the simple block snapping without any wiring. The robot contains a brain module, which is the main processor of the system. Other modules are simple sensors and the body module, which acts as a hub between the brain and sensor modules. The robot is arranged such that it is easy-to-use and simple enough to set up in minutes.

### 4.4 Cauldron: A Real-Time Pictorial Compositional Tool in VR for Visual Artist

*Authors:*

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*Abstract:*

This paper describes the development of an immersive VR application that lets visual artists quickly visualize and prototype their pictorial design ideas in virtual environments. First, the design requirements are outlined and then the implementation of the application prototype in Unreal Engine 4 is explained. We perform preliminary user tests and discuss the feedback, as well as further improvements and usage scenario of the software.

Session 5 : Short papers

Date: Time May 9, 2017 (Tuesday) : 8:40-10:00

Venue Room B

### 5.1 Implementation of a ball-riding robot controller using FreeRTOS

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*Abstract:*

Ball-riding robot impresses humans because of its characteristic. It can attract young children to study in engineering field in the future. Euler-Lagrange is simply used to describe the robot dynamics. The DC motor dynamic equation will complete the precise robot dynamics equation. The real robot is made by aluminum. Inertia moment unit information is fused and used to obtain robot's leaning angles. Robot is designed for further improvements, therefore; robot hardware and also software must be flexible as much as possible. Robot is controlled by using ARM-Cortex M3 embedded controller with FreeRTOS. Tasks are carefully designed to guarantee robot performance. The LQR+I controller is used in the research in order to satisfy the necessary robot balancing conditions.

### 5.2 Performance of Subcarrier Multiplexing Transmission over Multimode Fiber at Low-Frequency Passbands

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*Abstract:*

Multimode fibers have been used for transmitting a signal with a high data rate in a short distance. By utilizing the 3-dB modal bandwidth of the fiber, the achieved data rate depends on the distance. It has been shown that instead of transmitting the signal over the 3-dB modal bandwidth of the fiber, many signals can be transmitted over the frequency-selective passbands at the higher frequencies using subcarrier multiplexing in order to increase the total data rate. In this paper, the passbands at low frequency, which have been shown to be more predictable than those of high frequency, are adopted as channels for transmitting many subcarrier signals. The performance of the transmitted subcarrier signals in terms of their eye diagrams is considered. Using 6 passbands at low frequency, it is shown that the total data rate of the transmission can be increased by the factor of 3 comparing to that obtained from the 3-dB modal bandwidth.

### 5.3 Deep Neural Network For Short-Term Electricity Load Forecasting

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*Abstract:*

Deep neural network has become more popular in the forecasting areas in the last decade. In this paper, we present a short-term electricity load forecasting technique using deep neural network to achieve higher accuracy for daily forecasts. The proposed technique is tested with every 30 minutes data for 24 hours from the Electricity Generating Authority of Thailand (EGAT). The data from 1<sup>st</sup> May 2012 to 31<sup>st</sup> May 2013 is cleaned and used as one year training data set. The data from 1<sup>st</sup> Jan to 31<sup>st</sup> Dec 2013 is used as one year testing data set. The data cleaning is to identify and remove calendar holidays, bridging holidays, and outliers. The accuracy of load forecasting is evaluated by mean absolute percentage error (MAPE). Two forecasting structures, i.e., 1-period and 48-periods structures are tested and compared by using the proposed model. The results show that 1-period forecasting structure give more accurate than 48-periods forecasting structure.



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Session 5 : Short papers

Date: Time May 9, 2017 (Tuesday) : 8:40-10:00

Venue Room B

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#### 5.4 The Operation of Provincial Electricity Authority's SCADA

*Authors:*

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*Abstract:*

The Provincial Electricity Authority, PEA in Thailand is a government enterprise under the Ministry of Interior. The authority's responsibility is primarily concerned with the generation, distribution, sales and provision of electric energy services to the business and industrial sectors as well as to the general public in provincial areas, with the exception of Bangkok, Nonthaburi and Samut Prakran provinces. PEA has developed and applied modern technology to electricity supply and distribution dispatching system for improving efficient, reliability and quality of service. PEA has implemented the Supervisory Control and Data Acquisition (SCADA) and the Distribution Management System (DMS) technologies in its central distribution system for remote distribution control. Fault isolation and system restoration (FISR) is a one function of DMS. The function detail is minimize the interruption duration to customers. FISR quickly locates and automatically isolates the faulted area as well as restore the power to the customers who are not in the faulted location. This paper will survey the operation of the user that using SCADA and DMS (SNC-Lavalin and PSI products, DNP3.0 protocol). In addition, the benefits of further improvement of the system and the example of operation on fault isolation and system restoration (FISR) function is proposed.

Poster Session

Date: Time May 9, 2017 (Tuesday) : 11:15-12:00

### P.1 Knowledge Management in Data Center Project Management

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*Abstract:*

Data center is comprised of at least 16 systems. Each system requires each knowledge area, most of explicit knowledge of data center is referred from theories, codes, best practices, standards, regulations, site references, and case studies, while implicit knowledge of data center is undocumented but it is informed of personal practices, experience, intelligence, and certifications. Synergy both explicit and implicit knowledge needs tool such as technology enhanced learning (TEL) for integration all knowledge areas of data center project management (DCPM) and organization infrastructure for support. This paper explores methods of postmortem interval and bounded rationality and 10 data center projects as case study as used in qualitative research method. This paper proposes data center project phases (DCPP) as a spiraling process flow of interactions between explicit and implicit knowledge since traditional project management (PM) and knowledge management (KM) models have failed to address the problems of personal and team knowledge during data center project lifecycle.

### P.2 A Subpixel Classification Algorithm Based on a Random Forest Approach

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*Abstract:*

There are two main approaches to deal with classifying a mixed pixel in remote sensed images, namely, super-resolution mapping and sub-pixel classification. In this paper, we address the problem of sub-pixel classification using a set of random forests. Here, a random forest is trained to estimate a class proportion of only one land cover class. Thus, there are equal number of random forests as the number of land cover class. Then, the best combination is carried out based on the maximum a posteriori criteria.

### P.3 Image Processing Based Detection & Classification of Blood Group Using Color Images

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*Abstract:*

Domain of image processing is progressing a lot and has achieved tremendous milestones. Image processing is helping in many ways for the researchers to achieve their goals especially in security and medical fields. Detection of blood group in disaster or remote areas where expert is unavailable is challenge. In this paper we have proposed a system which will detect blood group using image processing techniques. Steps to detect the type of blood group using image processing techniques are discussed. Successful results have been obtained and accuracy of the proposed system is optimal.

Poster Session

Date: Time May 9, 2017 (Tuesday) : 11:15-12:00

**P.4 Analysis of Energy Consumption Mode from Various Embedded System Application**

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*Abstract:*

Domain of image processing is progressing a lot and has achieved tremendous milestones. Image processing is helping in many ways for the researchers to achieve their goals especially in security and medical fields. Detection of blood group in disaster or remote areas where expert is unavailable is challenge. In this paper we have proposed a system which will detect blood group using image processing techniques. Steps to detect the type of blood group using image processing techniques are discussed. Successful results have been obtained and accuracy of the proposed system is optimal. Embedded system is often deployed under tight constraint in term of resource and power consumption. Dynamic voltage and frequency scaling (DVFS) is widely implemented to manage energy consumption and system performance by scaling processor clock frequency and supply voltage accordingly to system workload. Nevertheless, Real-time system behavior is arbitrary which require different energy models to analyze energy consumption so efficient DVFS can be achieved. In this paper, we had analyzed various energy models from different system behavior, architectures and concerned factors to obtain suitable system-task level energy model for our target system. Once energy model for target system is derived, optimal frequency for system-task can be calculated. System-task is considered to be on software layer; therefore, dynamic frequency scaling algorithm can be flexible and easier to develop with suffice information, and it can enable convenient migration to other supported hardware.

**P.5 On the Multi-resolution Image Land Cover Mapping Using Deep Learning**

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Watsana Bupphawat<sup>1a</sup>, Teerasit Kasetkasem<sup>1b</sup>, Preesan Rakwatin<sup>2</sup>, Itsuo Kumazawa<sup>3</sup>, Thitiporn Chanwimaluang<sup>4</sup>

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*Abstract:*

In this paper, we proposed a strategy for land cover mapping of images with different resolutions based on deep learning technique, namely Convolutional Neural Network. Since the remote sensing image consists of various objects which different sizes, combining data from different images with difference resolutions yield higher accuracy. We expect to use multi-resolution to describe relationship between object at different resolution to select appropriate training sample. The QUICKBIRD satellite image data covered a part of Kasetsart University was used for evaluation. Experimental result showed that the best strategy is to use lower resolution image for separate pixels into pure and mixed pixels, then a pure pixels are classified at low resolution and mixed areas should be classified by using data from both low and high resolutions.