

# **IEEE WORKSHOP ON GEOSCIENCES & REMOTE SENSING**

### **Faculty of Engineering Auditorium** Universiti Putra Malaysia 8 - 9 November 2016

### THEME:

Remote Sensing for Sustainable Environment

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# INTRODUCTION

There has been tremendous increase of earth observation (EO) applications stemming from recent developments in advanced remote sensing technologies. This workshop is aimed at providing a forum for IEEE Geoscience & Remote Sensing (GRSS) members to share knowledge and experience on recent developments and advancement in geosciences and remote sensing technologies, particularly in the context of Remote Sensing for Sustainable Environment.

### CHAIRMAN'S WELCOME ADDRESS



### Prof. Dr. Koo Voon Chet

Multimedia University, Melaka

Welcome to the IEEE Workshop on Geoscience and Remote Sensing 2016 (IWGRS2016), the 4th in series of conference that is organized by the IEEE Malaysia Section Geoscience and Remote Sensing Society (GRSS) Chapter.

The IWGRS is our yearly event, aimed at providing a forum for IEEE GRSS members to share knowledge and experience on recent development and advancement in geosciences and remote sensing technologies, particularly in the context of earth observation, disaster monitoring and risk assessment for sustainable development. This year, the IWGRS consists of a distinguished keynote lecture by international expert, 20 full papers, and a practical workshop on *LiDAR technology*.

We are indebted to the organizing committee headed by Associate Professor Dr. Biswajeet Pradhan, reviewers, our honored keynote speaker, Mr. Atsushi Murakami from Japan, and all volunteers. They deserve much credit for the time and effort put in to ensure the success of the conference. Without their relentless efforts, this conference would not be possible. Last but not least, we would like to express our appreciation to all the authors for their willingness to share their latest research and innovations. We hope you all will enjoy the conference!

#### PROF. Ir. DR. KOO VOON CHET

#### Chairman

IEEE Malaysia Section Geoscience and Remote Sensing Society (GRSS) Chapter

# **CO-CHAIRMAN'S WELCOME ADDRESS**



### Assoc. Prof. Dr. Biswajeet Pradhan

Dept. of Civil Engineering Universiti Putra Malaysia

On behalf of the IEEE Geoscience and Remote Sensing Society (GRSS) Malaysia Chapter, I warmly welcome you to Universiti Putra Malaysia for the IEEE Workshop on Geosciences and Remote Sensing 2016! IWGRS 2016 is a 2-day event that brings together researchers, scientists, engineers and academics across the country to discuss, network and showcase recent advances in the field of geoscience and remote sensing. This workshop provides participants the opportunity to learn the basics of airborne laser scanning (ALS) data processing in ArcGIS software with some practical applications. It is our belief that the scope of this year's workshop will provide an interesting technical program which will further enhance our knowledge on sustainable environmental and resource management. You are all cordially invite to join the workshops on ALS data processing, keynote speeches, and paper presentation.

Wishing you all a wonderful and pleasant IWGRS 2016 gathering!

Do feel free and enjoy every moment of the event!

Assoc. Prof. Dr. Biswajeet Pradhan

Co-Chairman

3

# **SPONSORSHIP & ORGANIZATION**

IEEE Workshop on Geoscience & Remote Sensing 2016 (IWGRS2015) is sponsored and organized by the following parties:

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# **PROGRAMME SCHEDULE**

### DAY 1: 8 NOVEMBER 2016 (TUESDAY)

Time	Agenda
8:00 - 8:30 am	Arrival and registration of participants
8:30 - 9:00 am	LIGHT REFRESHMENT
9:00 - 12:00 pm	Practical Workshop Session I (LiDAR Training)
12:00 - 2:00 pm	LUNCH BREAK
2:00 - 5:00 pm	Practical Workshop Session II (LiDAR Training)

### Programme Session Chairman (Day 2)

Morning session: Assoc. Prof. Dr. Zulkiflee Abd Latif Afternoon session: Assoc. Prof. Dr. Helmi Zulhaidi Mohd Shafri

# **PROGRAMME SCHEDULE**

### DAY 2: 9 NOVEMBER 2016 (WEDNESDAY)

Time	Agenda
8:15 - 8:45 am	Arrival and registration of participants and guests
9:00 - 9:10 am	Opening Ceremony:
	Opening Duá
	Negaraku ánd Putra Gemilang recitation
9:10 - 9:15 am	Opening Address by Head, Dept. of Civil Engineering
	Assoc. Prof. Ir Dr. Raizal Saifulnaz Muhammad Rashid
9:15 - 9:20 am	Welcoming Remark by the President, IEEE Malaysia
9:20 - 10:00 am	Key Note Lecture by Mr Atsushi Murakami, Japan
10:00 - 10:10 am	Brief on Remote Sensing & GIS in UPM By
	Assoc. Prof. Dr Biswajeet Pradhan & Helmi Z. M. Shafri
10:10 - 10:30 am	TEA BREAK
10:30 - 1:00 pm	Paper Presentation (Morning Session)
1:00 - 2:00 pm	LUNCH BREAK
2:00 - 5:45 Pm	Paper Presentation (Afternoon Session)
5:45 - 6:00 pm	Closing Remarks / vote of thanks

### **OPENING ADDRESS**



### Assoc. Prof. Ir Dr. Raizal Saifulnaz Muhammad Rashid

(Head, Dept. of Civil Engineering, UPM)

It gives me a great pleasure to welcome you all to the "IEEE Workshop on Geosciences and Remote Sensing 2016" here at the Faculty of Engineering, Universiti Putra Malaysia. It is an opportune time to renew contacts and discuss issues of mutual interest with representatives from geospatial related institutions and industries across the country and beyond.

It is gratifying to note that the agenda of the workshop covers a wide range of very interesting aspects relating to sustainable environmental and resource management using Remote Sensing and GIS technologies. We are aware of the tremendous efforts made, and the large investment in funds and scientific effort by government and institutions in advancing our understanding of the earth, its resources, and use. Naturally, a thorough knowledge of the behaviour of our mother Earth and the extra-terrestrial environment and the impact of human activities, positive and negative, are of fundamental importance. We are, therefore, only too anxious to hear our distinguished colleagues report on their recent research developments in their various fields of expertise.

I would like to wish you, on behalf of the Dean of the Faculty of Engineering, UPM, a wonderful IWGRS-2016 conference gathering.

#### Assoc. Prof. Ir. Dr. Raizal Saifulnaz Muhammad Rashid

Head, Department of Civil Engineering

Universiti Putra Malaysia



# **KEY NOTE SPEAKER**



### Mr. Atsushi Murakami

Associate Director Sales and marketing Department IHI Aerospace, Japan

#### Trend of Earth Observation Satellite and Launch Vehicle for Small Satellite

We present the current trend of small satellite, especially for the earth observation satellite. Earth observation satellite is used for disaster management. We explain how the satellite is used for the mitigation of disaster. And we explain how micro satellite is effective for earth observation.

And we will introduce the small satellite launcher Epsilon Launch Vehicle. We introduce the overview of Launch Vehicle, Epsilon LV is 3 stages, fully solid proper ant rocket.

# **PRESENTATION SCHEDULE**

### **MORNING SESSION**

Time	PAPER PRESENTATION (MORNING SECTION)
10:30 - 10:45 am	<ul><li>Speaker 1: Mustafa Ridha Mezaal</li><li>Paper: Detecting Imprevious Surface from Worldview-3 Data Using Pixel Based Approach</li></ul>
10:45 - 11:00 am	Speaker 2: Masayu Norman
	Paper: Preliminary evaluation of different OBIA classifiers for roofing conditions discrimination
11:00 - 11:15 am	Speaker 3: Ernieza Suhana Mokhtar
	Paper: Prediction of Water Surface Level in Flooded Areas Using Integrated IFSAR and Hydraulic Data
11:15 - 11:30 am	Speaker 4: Goma Ahmed
	Paper: Prediction of land use change in Seremban for the next twenty years using CA Markov model
11:30 - 11:45 am	Speaker 5: Kar Men Chan
	Paper: Spatiotemporal monitoring of urban development in the Klang Valley
11:45 - 12:00 pm	Speaker 6: D. Perianman
	Paper: Monitoring tropical storm severity using lightning electro- magnetic remote sensing
12:00 - 12:15 pm	Speaker 7: Yosi Nuki Fitra Pratama
	Paper : Remote sensing approach and geographic information sys- tems for studying surface run off coefficient : Case study at Keduang Sub-Watershed, Wonogiri District, Central Java)
12:15 - 12:30 pm	Speaker 8: Nor Suhaili Mansor
	Paper: Analyzing the influences of urban development to well-being (Crime) using spatial analyst tools
12:30 - 12:45 pm	Speaker 9: Jalal Ibrahim
	Paper: Smartphones in Mecca area: Positioning availability and accuracy analysis
	(11)

# **PRESENTATION SCHEDULE**

### **AFTERNOON SESSION**

Time	PAPER PRESENTATION (MORNING SECTION)
2:00 - 2:15 pm	Speaker 10: Maher Ibrahim Sameen
	Paper: A novel GIS-based model for automatic identification of road geometry in vector data
2:15 - 2:30 pm	Speaker 11: Mohammed Oludare Idrees
	Paper: Structural and Geomorphological Analysis of Gomantong Cave Formation Using 3D Terrestrial Laser Scanning Survey
2:30 - 2:45 pm	Speaker 12: Tombayu Amadeo Hidayat
	Paper: Reconstruction of volcanic morphology using DEM and SAR data to estimate bulk volume of the lost materials
2:45 - 3:00 pm	Speaker 13: Syabeela Syahali
	Paper: An Improved Remote Sensing Backscattering Model for the Identification of Scattering Mechanisms in Sea Ice and Snow Layers
3:00 - 3:15 pm	Speaker 14: Sheriza, M. R.
	Paper: Vegetation indices for mangrove health assessment
3:15 - 3:30 pm	Speaker: 15: Emeka Jude Okoli
	Paper: Geomorphic characterization of lake bed using open source bathymetric data: Case study of Lake Superior, North America
3:30 - 3:45 pm	Speaker 16: Bahareh Kalantarghorashi Harandi
	Paper: A SURF-based Appraoch for Automatic Ground Control Points Selection for UAV and LiDAR Images Registration
3:45 - 4:00 pm	Speaker 17: Omer Saud Azeez
	<b>Paper:</b> Application of fuzzy logic and GIS to provide geospatial solutions for displaced people in Al-Anbar



# PRESENTATION SCHEDULE

### AFTERNOON SESSION (CONT.....)

Time	PAPER PRESENTATION (MORNING SECTION)
4:30 - 4:45	Speaker 18: Kusuma Wardani Laksitani
pm	Paper: Application of Landsat 8 OLI Satellite Imagery For Identification of Trophic State in Gajah Mungkur Reservoir, Central Java, Indonesia
4:45 - 5:00	Speaker 19: Hossein Mujadadi Razeei
pm	<b>Paper:</b> Quantitative assessment of GIS_based probability flood model with flood hydrologic inundation model in klang river of Damansara catchment
5:00 - 5:15	Speaker 20: Yaakob Mansor
pm	Paper: Calibration of Lightweight Thermal Imaging Sensor (TIRS) for Palm Oil Monitoring Using Hexacopter

#### Detecting Impervious Surface from Worldview-3 Data Using Pixel Based Approach

#### Mustafa Ridha Mezaal, Biswajeet Pradhan\*, Helmi Zulhaidi Mohd Shafri, Maher Ibrahim Sameen

Department of Civil Engineering, Faculty of Engineering, University Putra Malaysia (UPM), 43400 Serdang, Selangor, Malaysia.

**Abstract** - Absence of spectral library of condition roofing makes detection of roofs is quite difficult. Detecting of roof material with their conditions and road network (impervious surface) is most important task due to their impact to environment condition and quality. Wherefore, first objective of this research was to develop spectral library for roof condition and road network from worldview-3 image by using Pixel Purity Index (PPI). Second objective was conduction by applied spectral angle mapper algorithm based on spectral analysis to detect roofing materials and road network the overall accuracy of spectral angle mapper algorithms come out to be (92.19%), third objective was using decision tree classifier to detect roofing materials with their condition and road network by extracted. The overall accuracy achieved by decision tree come out to be (95%).

Keyword: worldview-3 image, End-member selection, Spectral angle mapper Decision Tree.

#### Preliminary Evaluation of Different OBIA Classifiers for Roofing Conditions Discrimination Using World-View 3

#### Masayu Normanab, Helmi Zulhaidi Mohd Shafria, Biswajeet Pradhana, Thamer Ahmed Mohameda

<sup>a</sup>Department of Civil Engineering, Faculty of Engineering, Universiti Putra Malaysia (UPM), 43400 Serdang, Selangor, Malaysia

<sup>b</sup>Department of Surveying Science & Geomatics, Faculty of Architecture, Planning & Surveying, Universiti Teknologi MARA (Perlis), 02600 Arau, Perlis, Malaysia

**Abstract** - The implications of roofing materials towards the urban environment significantly depend on the quality of roof runoff. Consequently, the current study intends acts as a preliminary phase in order to evaluate the accuracy of roofing materials classification based on the surface conditions. The utilization of multispectral remote sensing, namely, World-View 3 with 0.3-meter spatial resolution allows the extraction of voluminous information. Furthermore, four types of dissimilar roofing materials with different levels of surface conditions were selected, namely, concrete, metal, asbestos, and polycarbonate. Therefore, the classification of roofing surface conditions process has been implemented using an object-based analysis (OBIA) and the Taguchi method was purposely applied in obtaining the optimum parameters of segmentation. Interestingly, this research explored the usage of three different advanced classifier algorithms of the support vector machine (SVM), the random forest (RF) and the nearest neighbor (NN) to select the most significant classifier for roofing conditions classification. The results depict that the support vector machine (SVM) provides the highest percentage of accuracy with 88.42% compared to others. The final outcome is the roofing materials' map that shows different types of roofing materials with different conditions (new or old) used in partially Universiti Putra Malaysia (UPM) main campus and surrounding Serdang urban area.

Keywords: Roofing surface conditions, OBIA, Taguchi method, machine learning



#### Prediction of Water Surface Level in Flooded Areas Using Integrated IFSAR and Hydraulic Data

#### Ernieza Suhana Mokhtar<sup>1,2</sup>, Biswajeet Pradhan<sup>1,\*</sup>, Abd Halim Ghazali<sup>2</sup>, Helmi Zulhaidi Mohd Shafri<sup>1</sup>

<sup>1</sup>Department of Civil Engineering, Faculty of Engineering, University Putra Malaysia,

<sup>2</sup>Department of Surveying Science & Geomatics, Faculty of Architecture, Planning and Surveying,

Universiti Teknologi MARA Perlis, Malaysia

**Abstract** – Discharge and water level are the main parameters required in hydraulic modelling for flood area estimation. However, lack of availability of the aforementioned data makes the simulation of inundation areas during flood disasters calculated imprecisely. Furthermore, several discharge equation models need ground truth observation, which will incur time, cost on rental equipment and labour requirement involved. The discharge calculated by Bjerklie's model is tested on integrated IFSAR DEM with surveyed data. The accuracy of the predicted water depth is measured based on the root-mean square error (RMSE) and Relative Error (RE). Additionally, historical flood marks were also used for data verification. Results indicate that the integration of IFSAR and in-situ observed data covered only at the channel is able to enhance the water level prediction. In addition, the suggested methodology will help the less-developed countries facing the problems to retrieve the hydraulics and hydrology data and will be able to model the flood extent with the limited data available.

Keywords-Discharge, Water Level, IFSAR, Flood Inundation, Bathymetry Data

#### Spatiotemporal Monitoring of Urban Development in the Klang Valley

### Chan Kar Men<sup>1</sup>, Tuong Thuy Vu<sup>2</sup>

<sup>1, 2</sup>School of Geography, University of Nottingham, Semenyih 43500, Malaysia Email: <sup>1</sup>karmen.chan@hotmail.com, <sup>2</sup>tuongthuy.vu@nottingham.edu.my

**Abstract** — Urbanization is an inevitable process that needs to be managed in an effective manner. Monitoring urban landscape changes can reveal what is occurring in the urban ecosystem. Big data analytics are vital in understanding complex landscapes such as an urban environment. The aim of this paper is to present a framework to assess the urban landscape from a bird's eye view. Spatiotemporal analyses were carried out using landscape metrics to describe urban landscape structures at different parts of the Klang Valley. Landscape ecological approach was applied to understand the impacts of urban development.

Keywords - Urban development, remote sensing, landscape metrics, and directional analysis



#### Prediction of Land Use Change in Seremban for the Next Twenty Years Using CA Markov Model

#### Goma Bedawi Ahmed1<sup>a</sup>\*, Abdul Rashid M. Shariff<sup>a</sup>, Maher Milad M Aburas<sup>b</sup>

<sup>a</sup>Geospatial Information Science Research Center (GISRC), Faculty of Engineering, University Putra Malaysia (UPM), 43400 Serdang, Selangor, Malaysia.

<sup>b</sup>Faculty of Environmental Study, University Putra Malaysia

**Abstract**— Ecosystem has been effected because of changes from agriculture to other areas, Land use change models are tools to support the analysis of the causes and consequences of land use dynamics. Land use and land cover change (LUCC) has been recognized as an important driver of environmental change on all spatial and temporal scales. The primary objective of this paper is to monitor and analyse the present and future agriculture situation of Seremban state and its surrounding, Nigri Sembilan (Malaysia). the CA model was applied to simulate the dynamic spatial patterns of changes explicitly. The agriculture land use change from 2000 to 2010 was modelled using the CA–Markov model for calibration to compute optimal transition rules and to predict future agriculture land for oil palm and Rubber. In validation process, the model was validated using Kappa index statistics which resulted in overall accuracy more than 85 %. Finally, based on transition rules and transition area matrix produced from calibration process, the future land use changes of 2020 .2030 and 2040 were predicted and mapped. The findings of this research showed reasonably good performance of employed model. The model results demonstrate that the study area is change very rapidly especially in the recent decade. Furthermore, this rapid change expansion results in remarkable continuous decrease of agriculture lands.

Keywords - Land use change; Cellular automata; Markov chain; seremban

#### Monitoring Tropical Storm Severity Using Lightning Electromagnetic Remote Sensing

<sup>1</sup>D. Periannan, <sup>1</sup>M. R. Ahmad, <sup>1</sup>M. H. M. Sabri, <sup>2</sup>M. R. M. Esa, <sup>3</sup>H. Zhang, 3G. Lu, <sup>4</sup>E. Williams, <sup>5</sup>V. Cooray, 1M. Z. A. A. Aziz

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<sup>3</sup>Chinese Academy of Sciences, China

<sup>4</sup>Massachusetts Institute of Technology (MIT), Cambridge, MA, USA

<sup>5</sup>Department of Engineering Science, Uppsala University, Sweden

**Abstract:** In this paper, we are presenting a preliminary result correlating the negative NBE occurrence with a tropical hailstorm event happened on June 3rd 2016 in area surrounding Bukit Jalil Kuala Lumpur. A comprehensive study on NBE occurrence in tropical region and higher latitude can be found in (Ahmad et al., 2015). Figure 1 shows the evolution of the storm by tracking the NBE rate in 5 minutes interval. The negative NBE rates are illustrated by the red bar while the positive NBE rates are illustrated by the blue bar. The storm started at around 8:20 am (UTC) and producing hails around 10:30 am (labelled as hails in Figure 1). Notice that the negative NBE rate reaches the maximum at around 10:30 am with 16 negative NBEs recorded when the hails were reported to hit the ground. Obviously, the occurrence of hails can be predicted one and a half hour before it happened as we see the increasing trend of negative NBE rate between 9 and 10:30 am. In the full paper, we will presenting and discussing more results based on CAPPI and RHI radar scans showing the specific condition of the hailstorm when the hails were produced.



#### Remote Sensing Approach and Geography Information Systems for Studying Surface Run-off coeffcient : Case : Keduang Sub-Watershed, Wonogiri District, Central Java

Yosi Nuki Fitra Pratama<sup>1</sup>\*, Totok Gunawan<sup>1</sup>

<sup>1</sup>Departement of Geographic Information Science, Faculty of Geography,

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**Abstract** - Keduang sub-watershed is one of the watershed where being the part of the Gajah Mungkur Reservoir Catchment Area. The Government assign this watershed became of the one critical watershed with various problems. Problems that occur in the watershed Keduang may be indicated by some hydrological processes that showing an anomalies. One of Identification to know the problem is the approach followed by surface runoff. Surface runoff is a problem that occurs due to rainfall higher than soil infiltration capability in case of continuously then cause flooding. Surface runoff can be approached quantitatively using surface runoff coefficient (C). One method that can be used to calculate the value of C is the Cook's Method. This method uses a physical characteristic parameter watershed that affect the incidence of surface runoff. Some of these parameters are land use, soil type, slope, and a current density. The physical parameters can be extracted using remote sensing and processed using geographic information systems in order to save costs, time, and energy. Remote Sensing imagery that used is Landsat 8 OLI recording of 2015 year. The results of the study showed that Keduang watershed has runoff coefficient of 71.64%, this indicates that 100% of the rain which fell in the watershed Keduang amounted to 71.64% will be a runoff.

Keywords- Surface Runoff Coefficient; Remote Sensing; Geography Information Systems; Keduang Watershed

#### Analyzing the Influences of Urban Development to Well-being (Crime) Using Spatial Analyst Tools

Nur Suhaili Mansor<sup>1</sup>, Helmi Zulhaidi Mohd Shafri<sup>1</sup>, Biswajeet Paradhan<sup>1</sup> and Shattri Mansor<sup>1</sup>

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**Abstract** — this article evaluates the urban development using satellite imagery and spatial distribution of the physical structural plan. It measures and analyses the relationship between urban development and well-being in Sungai Petani urbanizing area. Specifically, it generates a spatial model to identify and predict the urban well-being trend in the future. In this research, remote sensing and GIS applications are used to analyze the data.

keywords - urban, crime, well-being, GIS, Remote sensing



#### Smartphones in Mecca Area: Positioning Availability and Accuracy Analysis

Jalal Ibrahim Al-Azizi and Helmi Zulhaidi Mohd Shafri

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**Abstract** — Many smartphone navigation technologies and applications have been developed to address the difficulties faced by Muslim pilgrims while performing Hajj and/or Umrah. However, little attention has been paid to the positioning availability and accuracy of smartphone devices in the Mecca area. This study examined the quality of positioning data provided by smartphones in the Mecca area. The processing methodology involved the development of a smartphone application for recording navigation observations in the National Marine Electronics Association format in the Mecca area during Umrah. The observations were analyzed using applications written with MATLAB® software. The test results proved that smartphones are capable of providing meter-scale positioning accuracy in the Mecca area. Thus, the findings established the possibility of using smartphones for positioning in Hajj and Umrah navigation applications, and they can be used to provide better understanding for smartphone developers and users of the accuracy, limitations, and potential of positioning applications for use during Hajj and Umrah.

Keywords - Navigation, positioning, smartphone, NMEA

#### A novel GIS-based Model for Automatic Identification of Road Geometry in Vector Data

#### Maher Ibrahim Sameen, Biswajeet Pradhan\*, Mustafa Ridha Mezaal

Department of Civil Engineering, Faculty of Engineering, Universiti Putra Malaysia, Selangor, Malaysia \*Email. <u>biswajeet24@gmail.com</u> (Corresponding author)

**Abstract**—A number of geospatial applications such as road safety assessment, car navigation, and updating digital road maps usually require road geometry information. In this research, a new model based on geographic information system (GIS) was proposed to automate the process of identifying road geometry in vector polyline data. The proposed model first, applies a Bezier interpolation to smooth the polylines for better cartographic representation. Then, the polylines were converted into raster data at 0.5 m spatial resolution. This data conversion enabled to convert the polylines to a set of points. After that, three geometry predictors were estimated from the set of points, point density, length of a line segment, and a cumulative angle between five consecutive points. Finally, the geometry predictors were used to predict the road geometry using three classification methods namely support vector machine (SVM), decision tree (DT), and logistic regression (LR). Results showed that the proposed model can efficiently and accurately identify road geometry in vector data. Overall accuracies of the three classification methods were 87.4%, 89.7%, and 87.2%, respectively.

Keywords-road network; road geometry; horizontal curves; GIS; vector data



#### Structural and Geomorphological Analysis of Gomantong Cave Formation Using 3D Terrestrial Laser Scanning Survey

Mohammed Oludare Idrees<sup>1</sup>, Biswajeet Pradhan<sup>1\*</sup>, Manfred F. Buchroithner<sup>2</sup>,

Helmi Zulhaidi Mohd Shafri<sup>1</sup>

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<sup>2</sup>Institute of Cartography, Dresden University of Technology, Helmholtzstraße 10, 01062 Dresden, Germany

**Abstract**—Sedimentary rocks are formed as horizontal stratigraphic rock layers. But under stress, tectonic deformation occurs causing folding and separation or break (fracture) in the rock formation. On the surface, these points of separation permeates weakly acidic rainwater to infiltrate and slowly dissolves out the limestone which become enlarged enough to form caves. Understanding the degree to which the deformation features influence the distribution and formation of cave network cannot be precisely determined from the traditional field data collection on the surface. Here we investigate the relationship between the structural geology of Gomantong hill and the development of the cave channels using 3D model derived from laser scanning survey. The laser scanning data provides detail and accurate data for geometric analysis in 3D. Specifically, the distribution of passage network indicates a characteristic near-vertical and radial faults that trend northward, northwest and east-west at dip angles between 120 and 270. Also, there is evidence of east-west bedding of the sedimentary layers revealing outline of the folding. The findings show that the strike, dip and bedding influenced the cave formation and its network pattern.

Keywords—cave; terrestrial laser scanning; 3D model; geomorphology; geology; Gomantong

#### A SURF-based Approach for Automatic Ground Control Points Selection for UAV and LiDAR Images Registration

Bahareh Kalantarghorashi Harandi, Shattri bin Mansor, Alfia Abdul Halin,

#### Helmi Z. M. Shafri

Dept. of Civil Engineering, Faculty of Engineering, University Putra Malaysia, 43400 UPM, Serdang, Malaysia

**Abstract**—Multisource remote sensing data provide synthesized information which supports many applications including land cover mapping, urban planning, water resource management, natural hazards, and GIS modelling. However, to properly use multisource remote sensing images, proper registration which depends on accurate ground control points (GCPs) selections is necessary. SURF (Speeded-Up Robust Features) is one of the common feature-detection algorithms as it is invariant to scaling, blur and illumination and partially invariant to rotation and view point changes. This study evaluates the performance of SURF for GCPs selection for UAV and LiDAR images. In addition, edge detection methods such as Sobel and Canny are examined for feature matching between the UAV and LiDAR images. With regards to image registration, band 3 (red channel) seems to produce the most accurate and practical results. On the other hand, the use of the Sobel and Canny filters have increased feature dimensionality of SURF and produces low accuracy for feature matching.

Keywords—Image registration; UAV images; LiDAR; SURF; Feature based.



#### Reconstruction of Volcanic Morphology using DEM and SAR Data to Estimate Bulk Volume of the Lost Materials

Tombayu Amadeo Hidayat<sup>\*1,2</sup>, Asep Saepuloh<sup>1,2</sup>, Ketut Wikantika<sup>1,2</sup>

<sup>1</sup>Center for Remote Sensing (CRS) – Institut Teknologi Bandung, Jalan Ganesha 10, Bandung 40132 Indonesia <sup>2</sup>Faculty of Earth Sciences and Technology – Institut Teknologi Bandung , Jalan Ganesha 10, Bandung 40132 Indonesia

**Abstract** - This paper presents a method to estimate the bulk volume of the lost volcanic products at three supereruptions: Toba, Sunda and Tambora volcano, by reconstructing the original morphology using Digital Elevation Model (DEM) and Synthetic Aperture Radar (SAR) data. The DEM was processed to produce several derivative products, such as ridge and valley maps, planèze, and elevation profiles. Ridge and valley maps were used to extract planèze, which is assumed to represent the original morphology of stratovolcanoes. Elevation profiles were analyzed to estimate the summit height. The SAR polarimetric image was also processed to produce the RGB color composite image presenting the ground surfaces, and then overlaid to the reconstructed surfaces. Based on the aforementioned parameters, the reconstructed stratovolcano can be generated. The additional volume from the reconstructed surface is then calculated, to estimate the bulk volume. The calculated bulk volume of the lost materials for Toba, Sunda, and Tambora eruptions are 165.7, 20.2, and 60.8 km3, respectively. The volume is crucial to estimate the magnitude of the collapse caldera following the ancient eruptions.

Keywords - Supereroption; supervolvano; DEM analysis; suface reconstruction; SAR

#### **Vegetation Indices for Mangrove Health Assessment**

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**Abstract** - This paper attempts to review the application of remote sensing technology for mangrove health assessment. One of the most valuable forest at the coastal area is mangrove forests. Mangroves are economically and environmentally important for maintaining global conservation. Increase in population for example is putting high pressure in coastal areas which led to conversion of many mangrove areas to other usages including infrastructure, aquaculture, rice and salt production. The conversion effects water quality hence, increase pressure to mangroves trees. The health of mangrove can be assessing by employing spectral remote sensing indices. Remote sensing technology is a very important techniques for assessing land degradation at coastal environment. This paper discussed potential of remote sensing indices in assessing mangrove health with examination of various cases studies utilized temporal and various remote sensing satellites data.



#### Application of Fuzzy Logic and GIS to Provide Geospatial Solutions for Displaced People in Al-Anbar Province, Iraq

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**Abstract**— A large number of people in middle east have been displacing from their cities to safer cities due to effects of recent wars. Thus, emergency plans for damaged urban areas in these countries are very important to provide necessary services for citizens and for displaced people. Military operations have destroyed a large number of houses in affected areas thus the people who lost their properties they need urgent solutions. The decision making tools of geographic information system (GIS) is necessary to find effective geospatial solutions for the mentioned problems. This study develops suitability site maps based on fuzzy logic for development of urban areas in Al-Anbar region, Iraq. The methodology of this research consists of several steps. First, a geodatabase containing six thematic layers, landuse, road, powerline, power transformation plant, water treatment plant, and topography. After that, several factors were derived and prepared in GIS that contribute to the site selection of development of urban areas. Second, these factors were reclassified based on their importance for the targeted goal. Then, the reclassified factors were converted into membership functions represented by a continuous raster ranged from 0 to 1. Finally, the factors were overlaid by the fuzzy logic algorithm to produce the suitability map for the study area. The produced suitability maps can help decision makers to take effective and rapid actions to cure the crises of shifted people.

Keywords-geospatial modelling; displaced people; fuzzy logic; GIS; suitability analysis

#### Calibration of Lightweight Thermal Imaging Sensor (TIRS) for Palm Oil Monitoring Using Hexacopter

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**Abstract** — A small and lightweight hexacopter was accomplished at the Geospatial Information Science Research Centre (GISRC), Universiti Putra Malaysia and Universiti Kuala Lumpur, Institute of Aviation Technology (UniKL MIAT). The development of UAV includes components and system integration such as a propeller, motor, Electronic Speed Control, Flight controller, Transceiver Receiver, GPS, telemetry, battery system and Mission Planner software. System assembly includes hardware frame assembly, soldering, propeller balancing, cabling fabrication, wire crimping, electronics assembly, transmitter/receiver setting and battery charging system. The UAV system of gross weight 1.83 kg is equipped with an uncooled thermal sensor weight 0.35 kg, for accurately collecting and analyzing variations of temperature. The advantages of this sensor are low power consumption, smaller size and mostly low-cost compared to big or cooled TIRS. An experimental temperature calibration infrared using thermal MobIR 8 TIRS imagery sensor in the  $8 - 14 \,\mu$ m regions were conducted using a low-cost calibration upwelling water thermo-sensor and also a commercial blackbody source. Furthermore, we show thermal data observed by the flight control system of the UAV. Radiant results for the maximum, minimum and ambient temperature of Jenderam site thermal images also calculated.

Keywords- Blackbody; Payload; Radiant; UAV; Thermal; TIRS; Upwelling; Uncooled

#### Quantitative Assessment of GIS Based Probability Flood Model With Flood Hydrologic Inundation Model in Klang River of Damansara Catchment

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**Abstract** - Floods in tropical countries such as Malaysia have taken many attentions for any flood mitigation plan. Geographic Information system (GIS) has brought a new era for geospatial flood modelling. However, in terms of flood occurrence there are some other important hydraulic parameters which cannot be measure by current GIS-based geostatistical models such as river behavior, return period, hydrograph the flow and etc. This research attempts to integrate the GIS-based Random Forest (RF) probability model with hydraulic 2D high resolution sub-grid (HRS) inundation model to obtain more informative results. Twelve related conditioning factors generated as dependent parameters and 310 single flood inventory points recorded in 2006 were used to process the flood probabilistic FR model. Besides, Hourly stream flow for the year of 2006 in four water level stations inside the basin was consider to run unsteady flow analysis to simulate the flood inundation depth. Furthermore, Using Interferometric Synthetic Aperture Radar (IFSAR) image with the pixel size of 5 meter as well as Worldview3 satellite imagery were utilized to extract Digital Elevation Model (DEM) and Land use. Finally, a correlation assessment and cross validation of these two models has been conducted to quantify the morphology of flood probability.

Keywords: GIS, RF, Unsteady flow, IFSAR, DEM, Conditioning factors, 2D HRS model

#### Geomorphic Characterization of Lake Bed Using Open Source Bathymetric Data: Case study of Lake Superior, North America

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**Abstract** - Little has been reported on the hydro-geomorphology of the bathymetric and terrain of Lake Superior bed. The lake is the largest of the Great Lakes in North America. This study evaluates the morphometry and its influence on the geological characteristics of the lake bed and the immediate surrounding to reveal local topographic variability of the landform under the water. Using the open source 3-arc seconds digital elevation model obtained from NOAA, geomorphometric analysis of the lake bed was done to accurately estimate the volume of water in the lake relative to flooding and recharge. Furthermore, other derivatives including slope, surface roughness, Topographic Position Index (TPI) and profile were obtained for geomorphometric characterization of the bed with respect to the geological setting and sediment deposition in the Lake to support the current management drive.

Keywords: Lake Superior, bathymetry, remote sensing, geomorphology, GIS



#### An Improved Remote Sensing Backscattering Model for the Identification of Scattering Mechanisms in Sea Ice and Snow Layers

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**Abstract** - In this paper, we study the effect of incorporating the advanced integral equation model (AIEM) to a backscattering model for an electrically dense medium such as sea ice and snow layer. The dense medium was modelled as a layer embedded with randomly distributed dielectric spherical scatterers, and covered on top and bottom by irregular rough surfaces, characterized by roughness spectrum of exponential correlation function. The close spacing effects of the scatterrers were taken into account by considering the modified phase matrix for Mie scatterers based on the dense medium phase and amplitude correction theory (DM-PACT). Previously, the surface scattering on top and bottom rough surface was modelled using the original integral equation model (IEM) accounting for both single and multiple surface scattering. In this paper, a newer version of IEM which is the AIEM is proposed to be used in the model for the surface scattering calculation to improve the total backscattering coefficient, since AI-EM provides more accurate prediction in surface scattering. The backscattering coefficient of this medium was calculated by applying the radiative transfer theory which was solved iteratively up to the second order. The three major scattering mechanisms in the model are direct surface scattering, surface-volume scattering up to the second order and volume scattering. Comparisons are to be made between theories to study the effect of incorporating AIEM for like and cross-polarized return. Its effect on each scattering mechanism will also be investigated and the analysis will be presented. Comparisons will also be made with field measurement results in polar regions to validate the backscattering model. Preliminary studies show that the model proposed here may be able to improve the total backscattering coefficient calculation of sea ice and snow layers.

#### Application of Landsat 8 OLI Satellite Imagery For Identification of Trophic State in Gajah Mungkur Reservoir, Central Java, Indonesia

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**Abstract**— The water quality in a reservoir affected by climatological factors, physical factors, and artificial factors of human activities control its nutrients availability and its trophic states. The method to identify these states commonly require large resources and time consuming due to detail water sampling needed to analyze the trophic parameters. The purposes of this study are 1) assessing the Landsat 8 OLI capabilities to obtain parameters that are used to assess its trophic state; 2) identifying and mapping the trophic state based on parameters derived from Landsat 8 OLI; 3) evaluating the results of the mapping and the benefits of remote sensing imagery for identification its trophic state. Identification of trophic state based on Carlson's Trophic State Index (TSI) (1997) which covers water clarity, total phosphorus, and chlorophyll-a. The models were developed based on an empirical formula of regression between measurements in the field and the pixel values of Landsat 8 OLI imageries. The best model is built on the highest value towards coefficient of determination (R2). The results show that R2 values of water clarity, total phosphorus, and chlorophyll-a are 0.813, 0.268, and 0.584 respectively. TSI calculation ranges from 36.77 to 80.18. The dominant trophic states are mild and moderate eutrophication. The evaluation of the mapping based on RMSE are 0.15 m. 54.16 mg/m3, and 3.26 mg/m3 for water clarity, total phosphorus, chlorophyll-a accordingly. It is concluded that Landsat 8 OLI is able to provide information of trophic state parameters with a concern that the model has to be carefully selected and adjusted with the various condition of the image quality, accuracy and acquisition time during image information extraction.

Keywords- Gajah Mungkur Reservoir; Landsat 8 OLI; Regression; TSI; Trophic State

24

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### LOCATION MAP

### Workshop Venue

### Faculty of Engineering Auditorium, UPM

GPS Coordinate

### Latitude: N 3.006156

### Longitude: E 101.719914



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