THE INTERNATIONAL ASSOCIATION OF CHINESE PROFESSIONALS IN GEOGRAPHIC INFORMATION SCIENCES (CPGIS)

The 27th International Conference on Geoinformatics

CPGIS 2019

Conference Theme: Remote Sensing and Big Social Data

1-3 July & 4-7 July (Field trips), 2019

Sydney, Australia

Final Program

Organizer:

International Association of Chinese Professionals in Geographic Information Sciences (CPGIS)

Co-organizers:

CPGIS Sydney

Advantage Group Australasia

Conference Sponsors:

Advantage Group Australasia

Beijing PIESAT Information Technology Co., Ltd (航天宏图)

Program Overview

1 - 7 July 2019, Sydney, Australia

Venue: Hilton Hotel Sydney

1 July	2 July	3 July	4-7 July
	8:00 - **Registration Opens**		
	8:30 – 9:00 **Openning Ceremoney**	**8:30 – 10:30** **Session 3** **GIS & Planning**	Field Trips (Tickets are needed)
	9:00 – 10:20 **Keynote Session 1** **(2 * 40 minutes each)**		
	10:20 – 10:40 Morning Tea Break		
	10:40 - 12:40 Session 1 **Social Sensing, GIS and** **Transportation**	10:40 – 12:40 Session 4 **Remote Sensing of Physical** **Environments & Urban** **Environments**	
	12:40-13:30 Lunch break		
15:00 – **18:00** **Registration** **Opens**	**13:30 – 15:30** **Keynote Session 2 (3 * 40** **minutes each)**	13:30 – 15:30 Session 5 & 5a **Remote Sensing of Urban** **Environments**	
	15:30 – 15:50 Afternoon Tea Break		
	15:50 – 17:50 Session 2 **Remote Sensing of Physical** **Environments**	15:50 – 18:10 Session 6 & 6a **GIS Modeling and WebGIS**	
	Break		
	Conference Bus Departs at 18:10	Walking to Gala Dinner Venue	
18:00 – **20:30** **Welcome** **Reception** (Marble Bar, Hilton Hotel)	18:30 – 22:00 **Keynote Speech** **Panel Discussion** **Awards Session** **CPGIS Awards** **GARF Awards**	19:00 – 23:00 **Panel Discussion** **Conference Gala Dinner**	

Conference Venue

The conference venue is at the Sydney Hilton Hotel, 488 George Street, Sydney (opposite the Queen Victoria Bilding – QVB and Town Hall train station). (See http://www.hiltonsydney.com.au/).

Papers will be presented in the Level 2, Rooms 4.

Conference Registration

Registration Location:
    Go to Level 2 – in front of Rooms 4.

The registration desk opens:
- • 1 July 2019 3:00 PM - 6:00 PM
- • 2 July 2019 8:00 AM - 4:00 PM

Conference Reception and Lunches/Breaks

The welcome reception will be held on 1 July 2019 from 6:00 PM – 8:30 PM at the Marble Bar below the Hilton Hotel, Sydney. All participants are welcome.

During tea and lunch breaks, tea/coffee/refreshments/lunch will be served near the conference room.

The special session will be held on 2nd July
The conference gala dinner will be held on 3rd July.

General Information

Conference Dates
1 – 3 July 2019

Field Trip Dates
4 – 7 July 2019

Official Language
The official language of the conference is English.

Name Tags
Please ware your name tag all the time during the conference.

Visitor's Information

Most information about travel to and in Australia can be found from http://www.sydney.com/

CPGIS 2019 International Steering Committee

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Penggen Cheng	East China University of Technology, China
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Hui Lin	Chinese University of Hongkong, Hong Kong, China
Huiping Liu	Beijing Normal University, China
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Haigang Sui	Wuhan University, China
Daniel Sui	University of Arkansas, USA
Tao Tang	State University of New York - College at Buffalo, USA
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CPGIS 2019 Program Committee

Conference Chair
Changshan Wu   President of CPGIS, University of Wisconsin-Milwaukee, USA

Co-Chairs
Jianya Gong   Director of BOD of CPGIS, Wuhan University, China
Hui Lin   Chinese University of Hongkong, Hong Kong, China

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Local Conference Committee

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David Tien
Chair, Conference Coordination Committee
IEEE NSW Section
Australia

Conference Local Chair
Lihua Zhao
CPGIS Sydney
Australia

Local Arrangement Chairs
Conference Venue:
Amy Doherty, Anna Plotnikova
Hilton Hotel Sydney, Australia

Conference Chairman's Message

Welcome to the 27th International Conference on Geoinformatics in the beautiful Sydney, Australia! The Geoinformatics conference series was initiated by the International Association of Chinese Professionals in Geographic Information Sciences (CPGIS) in 1992. This international conference series has provided a unique forum for exchanging novel ideas and cutting-edge knowledge on geographic information sciences and technologies among GIS professionals worldwide.

This year, 2019, marks the 27th anniversary of CPGIS. We welcome traditional topics in GIScience and also encourage papers on new and emergent themes including: Big GeoData, Remote Sensing, GIScience of the Internet of Things, Geospatial Semantic Web, Sensor Geomatics, Geosimulation Modeling, Mobile Computing, Mobile Behaviour, Complex Networks, Online Social Media, Cyber Computing, Events and Process, and Critical GIS to address societal issues, such as climate change, smart cities, precision medicine, urban mobility, crime analysis, migration, disaster, and environmental sustainability.

Participants are welcome to submit papers to two peer-reviewed journals: "Advancements of GIS in the New IT Era" at Annals of GIS (CPGIS flagship journal) and "Integrating Remote Sensing and Social Sensing" at Remote Sensing.

Welcome to Sydney, and enjoy!

Professor Changshan Wu
President of CPGIS, University of Wisconsin-Milwaukee
USA

Keynote Speech and Paper Presentation Guidelines

Each keynote speech has 40 minutes, including 30 minutes for speech time and 10 minutes for questions and answers.

Each oral presentation has 15 minutes, including 12 minutes for presentation time and 3 minutes for questions and answers.

The session room is equipped with a computer and a projector. For oral presentations, the presenters should load up their presentation files to the room computer 10 minutes before the session begins, or they can use their own laptop computers. The authors should arrive at the session room and report to the Session Chairperson at least 5 minutes before the session begins. Each author is to prepare a 20-50 words brief biography and give it to the Session Chairperson before the session begins.

Session Chairperson

The Session Chairperson should check in the presenters and collect their biographies 5 minutes before the session begins. The chairperson is required to mark those presenters absent to the session.

The 27th International Conference on Geoinformatics

Monday, 1st July 2019	
15:00 – 18:00	**Registration Opens**
18:00 – 20:30	**Welcome Reception** (Marble Bar, Hilton Hotel)

The 27th International Conference on Geoinformatics

Tuesday, 2nd July 2019	
8:30 – 9:00	**Openning Ceremoney**
9:00 – 10:20	**Keynote Session 1 (40 minutes each) Chairman:** Changshan Wu **Geo-Social Sensing for Urban Study and Social Management** Prof. Jianya Gong *School of Remote Sensing and Information Engineering, Wuhan University Wuhan, China* **Geographic Language Evolution and Human Geographic Studies** Prof. Hui Lin *The Chinese University of Hong Kong, Hong Kong, China*
10:20 – 10:40	**Tea/Coffee Break**
10:40 – 12:40	**Presentation Session** 1 **Social Sensing, GIS and Transportation** **Chairman:** Xun Shi **Paper ID: C-11053** The Missing Parts from Social Media Enabled Smart Cities: Who, Where, When, and What *Yihong Yuan, Yongmei Lu, Edwin T. Chow, Chao Ye, Abdullatif Alyaqout, and Yu Liu* *Texas State University, USA* **Paper ID: C1105** Visualized Analysis of Short and Long-Distance Human Mobility on the Qinghai-Tibetan Plateau with Crowd Sourcing Data *Jun Xu, Chinese Academy of Sciences, China*

	Paper ID: C1107 Research on Quality Evaluation Method of OpenStreetMap Road Network Data Based on Remote Sensing Image *Haigang Sui, Wuhan University, China* **Paper ID: C11048** Intelligent processing of social sensing data to assist rapid disaster response and mitigation *Jibo Xie, Chinese Academy of Sciences, China* **Paper ID: C11013** Modeling of Communicable Disease Transmissions with Real Human Mobility and Disease Data *Meifang Li, Yu Liu, Xia Li, Xun Shi* *Dartmouth College, USA* **Paper ID: C11029** MindReader: A Knowledge-graph-aware Personalized Travel Recommendation System *Jialing Gao, Feng Lu, Peiyuan Qiu, Chinese Academy of Sciences, China* **Paper ID: C11046** Evaluation of Comprehensive Transport Superiority in the Core Area of Changsha-Zhuzhou-Xiangtan Urban Agglomeration Based on Big Data *Jun Fang, Chaokui LI, Wentao Yang, Keyan Xiao, Qinglan Zhou* *Hunan University of Science and Technology, China* **Paper ID: C11035** Flow-weighted Graph Convolution Recurrent Network for Short-term Traffic Speeds Forecasting *Jun Cao, Xuefeng Guan, Na Zhang, Huayi Wu* *Wuhan University, China* **Paper ID: C11062** Extracting Road Turns And Intersections From Low Frequency GPS Trajectory data *Caili Zhang, Longgang Xiang, Wuhan University, China*
10:40 – 12:40 **2 July 2019**	
12:40 – 13:30	**Lunch break**
13:30 – 15:30	**Keynote Session 2 (40 minutes each) Chairman: Qiming Zhou** **Spatial Prediction and Laws of Geography** Prof. A-Xing Zhu *Department of Geography, University of Wisconsin-Madison* *Madison, Wisconsin, USA* **Smart Data for Connected Gardens** Denise Ora *Executive Director* *Botanic Gardens & Centennial Parklands*

	Remote Sensing and Predicting Earth's Water: Progress, Challenges and Opportunities Prof. Yang Hong *Peking University, Beijing, China*
15:30 – 15:50	**Afternoon Tea/Coffee Break**
15:50 – 18:05 2 July 2019 **15:50 – 17:50** 2 July 2019	**Presentation Session 2: Remote Sensing of Physical Environments** **Chairman:** Qiming Zhou **Paper ID: C1103** Hydrological droughts measurement using GRACE satellite solution *Aihong Cui, Jianfeng Li, Qiming Zhou, Guofeng Wu, Qingquan Li* *Hong Kong Baptist University, China* **Paper ID: C11016** Study on Coordinative Observation Technology for High Altitude Barrier Lakes *Xin Zhang, Chinese Academy of Sciences, China* **Paper ID: C11023** The Continuous Monitoring and Instant Service Method for Flood Events under the Sensor Web Environment *Wenying Du, Nengcheng Chen, Wuhan University, China* **Paper ID: C11052** GIS Application in Watershed Processes Study *Shixiong Hu, Mengya Jia* *East Stroudsburg University of PA, USA* **Paper ID: C11056** UAV-based high spatial resolution monitoring and estimation of soil moisture status in a grape vineyard *Tao Tang, Michael Radomski and Michael Stefan* *State University of New York - College at Buffalo, USA* **Paper ID: C11057** Urban flood risk assessment and zoning in road environments: a case study of the Chang-Zhu-Tan Urban Agglomeration, China *Shuang Yao, Nengcheng Chen, Chao Wang, Wenying Du* *Wuhan University, China* **Paper ID: C11025** Mapping 10-m forest type area in Southern China with temporal-spatial-spectral features derived from Sentinel-2 time series images on the Google Earth Engine *Kai Cheng, Juangle Wang, Chinese Academy of Sciences, China*

	Paper ID: C1102 Population Spatial Distribution Geo-simulaton in the Future to Support Beijing General Urban Planning (2016-2035) Based on CA-Markov Model *Fang Liu, Weilun Sun* *Beijing University of Civil Eng. & Architecture, China*
17:50 – 18:30	Break **Conference Bus Departs at 18:10**
18:30 – 22:00 2 July 2019	**Keynote and Panel Discussion Sessions, Award Function Dinner** **Keynote Speech (40 minutes)** Prof. Daniel Sui Professor of Geography Vice Chancellor for Research and Innovation University of Arkansas, USA **Panel Discussion Session (40 minutes)** Topic: GIS in Higher Education **Chairman:** Professor Yongmei Lu, Texas State University, USA **Awards Session** **CPGIS Awards** **Chairman:** Professor Hui Lin, The Chinese University o Hong Kong **GARF Awards** **Chairman:** Chris Tsioulos, Director CMT Architects Australia

Wendesday, 3rd July 2019

8:30 – 10:30 3 July 2019	**Session 3: GIS and Planning** **Chairman：**Junxiang Zhu **Paper ID: C1101** BIM/GIS Integration for Web GIS Based Bridge Management *Junxiang Zhu*, *Yi Tan, Xiangyu Wang, Jun Wang* *Curtin University, Australia* **Paper ID: C11015** Urban Expansion Simulation and Scenario Analysis in Major Cities of Central Asia *Jing Qian, Qiming Zhou, Xi Chen, Shuhong Peng, Bo Sun* *Chinese Academy of Sciences, China* **Paper IDs: C11020** Based on the energy analysis of cultivated land resource sustainable utilization evaluation in Wuhan city *Lin Zhu, Huazhong Agricultural University, China* **Paper IDs: C11022** The amenity value of of lake landscape in urban residential areas：estimates from a hedonic pricing model for Donghu *Rongxuan Yang* *Huazhong Agricultural University, China* **Paper ID: C11065** The Spatial Pattern Study on Catering Industry based on Open Source Big Data in Beijing Central Urban Area *Li Mei, Peking University, China* **Paper IDs: C11027** Spatial-temporal Evolution and Influence Factors of Service Industry of Country-Level in Henan province from 2006 to 2016 *Hejia Fan* *East China Normal University, China* **Paper IDs: C11030** Estimating Ground PM2.5 Concentration Using Spatial Varying Coefficient (SVC) Model *Huangyuan Tan, Yumin Chen, Jingyi Zhang, Jiping Cao, Tao Fang* *Wuhan University, China* **Paper IDs: C11031** Analysis of spatial disparities in health care accessibility: the comparison between the central part of two typical cities in China *Meijie Chen, Yumin Chen, Fenglan Luo, Liheng Huang, Jiaxing Liao* *Wuhan University, China*

	Paper IDm: C11032 Exploring the Spatial Segregation of New Migrants Based on Activity Space: A Big Data Approach *Qili Gao, Yang Yue; Qingquan Li* *Wuhan University, China* **ID: C-11063** A reconstruction method based on homonymy point index table of three views *Hongrui Zhao, Wenjia Wu, Dongming Huang* *Tsinghua University, China* **Session 3a: ICITA** **Chairman:** Errol Chopping **Paper ID: ICITA-12011 (invited paper)** Automated Seismic Data Processing using Deep Learning Networks *M. Deriche, H. Nuha, M. Alfarhan, M. Mohandes, A. Maalej* *King Fahd University of Petroleum and Minerals, KFUPM, Saudi Arabia* **Paper ID: ICITA-12012** A Concentric Cyber Security Zone Model *Christopher J. Pavlovski, Kheli Koh, Leslie Nagy, and Andrew Gontarczyk* *Commonwealth Bank of Australia / Cyber Security, Australia* **Paper ID: ICITA-12009** User's Intention to Purchase Mobile Games Application from Consumption Value Perspective *Ili Hawa Ahmad, Ab Razak Che Hussin, and Norshidah Mohamed* *Prince Sultan University, Saudi Arabia* **Paper ID: ICITA-12010** An Analysis of Evaluation Metrics of GANs *Ili Hawa Ahmad, Ab Razak Che Hussin, and Norshidah Mohamed* *King Khalid University, Saudi Arabia* **ID: ICITA-12013** Surface Region Decomposition for B-rep Model *Dong Yan, Xu Jing, and Li Mei* *University of Shaoxing, China*
10:30 – 10:40	**Tea/Coffee Break**
	Session 4: Remote Sensing of Physical & Urban Environments **Chairman:** Huiping Liu **Paper IDs: C11044** Calculated River Flow Attenuation Base of Ungauged Catchments in the Taklamakan Desert *Juan Wang, **Huiping Liu*** *Beijing Normal University, China*

10:40 – 12:40 **3 July 2019**	**Paper IDs: C11061** BeiDou satellite navigation simulation system on the CesiumJS virtual globe platform *Xinlan Chen, East China Normal University, China* **Paper IDs: C11041** Remote Sensing Classification Method of Vegetation Based on Mountain Altitude Belts *Junyao Zhang, Yonghui Yao, Dongzhu Suonan* *Chinese Academy of Sciences, China* **Paper IDs: C11058** How deeply the vegetation physiology effects due to increasing CO2 impact the terrestrial future hydrologic cycle over China? *Gaoyun Shen, Nengcheng Chen, Zeqiang Chen, Wei Wang* *Wuhan University, China* **Paper ID: C1108** A new dmsp/ols night time light data desaturation method based on NDBI and MNDWI *Yuqian Wang, Chengpeng Huang, Kuan Qian, Xiaolong Li, Yongbin Tan and Penggen Cheng* *East China University of Technology, China* **Paper ID: C11012** A Study on the Spatial-temporal Pattern and Future Development Trend of Anthropogenic Heat Emission in Jiangsu Province *Lingyan Weng, Xugao Han* *Nanjing University Jinling College, China* **Paper ID: C11014** Facade feature extraction method for buildings from three-dimensional point cloud data assisted by optical images *Yongzhi Wang, Yuqing Ma, A-xing Zhu, Hui Zhao, Sijing Zhu* *Jiangxi University of Science and Technology, China* **Paper ID: C-11018** Spatial analysis of light pollution at street scale with LJ1-01 nighttime light remote sensing and mobile big data *Bo Sun, Qiming Zhou, Yang Zhang, Peng Wang* *Chinese Academy of Sciences, China* **Paper ID: C11067** The research of support vector machine (SVM) based on particle swarm optimization in remote sensing image classification *Yi Zhang, East China Normal Universit,y China*

	Paper ID: C11028 Statistical downscaling simulation of precipitation in the data-scarce Tianshan Mountains, northwest China based on the Earth system data products *Mengtian Fan, Jianhua Xu, East China Normal University, China*
12:40 – 13:30	Lunch break
13:30 – 15:30 **3 July 2019**	**Session 5: Remote Sensing of Urban Environments** **Chairman:** Qinghua Guo & Changshan Wu **Paper ID: C1106** Understanding urban habitability in a 3D perspective based on Mobile Lidar data *Jing Zhang, **QinghuaGuo**, Xiliang Sun, Yanjun Su* *Chinese Academy of Sciences, China* **Paper ID: C11037** Research on coupling and integrating Model-3 models for Air Pollution Simulation *Lingshan Wang, Min Chen, Yongning Wen, Songshan Yue* *School of Geography Nanjing Normal University, China* **Paper ID: C11021** Evaluation of the urban landscape structures and dynamics of Hawassa City, using satellite images and spatial metrics approaches, Ethiopia *Berhanu Terfa* *Wuhan University, China* **Paper ID: C11054** Semi-Automatic Image Classification based on Transfer Learning *Haiping Yang* *Zhejiang University of Technology, China* **Paper ID: C11055** A two-step scheme for mapping regional high resolution urban impervious surface *Min Huang, Nengcheng Chen, Xiang Zhang* *Wuhan University, China* **Paper ID: C11019** Urban land use classification from very high resolution remote sensing imagery *Changshan Wu, University of Wisconsin-Milwaukee, USA* **Paper ID: C11049** Unsupervised Representation Learning with GANs for Remote Sensing Images *Wenxuan Liu, Huayi Wu, Wuhan University, China*

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	Paper ID: C11050 Statistical distribution of nonzero spatial autocorrelation parameter of a Simultaneous Autoregressive Model and its applications *Qing Luo, Daniel A. Griffith, Huayi Wu* *Wuhan University, China*
15:30-15:40	After tea/coffee break
15:40 – 18:10 **3 July 2019**	**Presentation Session 6: GIS Modeling and WebGIS** **Chairman:** Cheng-Zhi Qin **Paper ID: C1104** Automatically selecting environmental covariates for geographical variable mapping based on existing application cases – Taking digital soil mapping domain as example **Cheng-Zhi Qin**, *Peng Liang, A-Xing Zhu* *Chinese Academy of Sciences, China* **Paper ID: C11064** Research on vector tile map construction with data equalization principle *Mei Li, Ying Su, Ning Zhi, Yanxin Sun, Shanjun Mao* *Peking University, China* **Paper ID: C11066** Mining Applications and Techniques from GIS Articles *Li Yu, Li Qian, Caihong Deng, Zhipeng Dong* *National Science Library, Chinese Academy of Sciences, Beijing, China* **Paper ID: C11038** Preliminary Study on Network Collaboration Mode Oriented to Geographic Modeling and Simulation *Yuchen Lu, Yongning Wen, Zaiyang Ma* *School of Geography Nanjing Normal University, China* **Paper ID: C11039** A Parallel Computing Paradigm for Geo-analysis Models in the Distributed Web Environment *Ming Wang, Min Chen, Songshan Yue* *School of Geography Nanjing Normal University, China* **Paper ID: C11036** Research on the Construction Method of the Service-Oriented Web-SWMM System *Dawei Jiao, Min Chen, Yongning Wen, Songshan Yue* *School of Geography Nanjing Normal University, China*

15:40 – 18:10 3 July 2019	**Paper ID: C11068** Permutation-test-based Clustering Method for Detection of Dynamic Patterns in Spatio-temporal Datasets *QiLiang Liu, Wenkai Liu, Jianbo Tang, Min Deng, Yaolin Liu* *Department of Geo-informatics, Central South University, Changsha, Hunan, China* **Paper ID: C11024** Knowledge-based Interactive Workflow Engine of Collaborative Geographic Simulation *Yuting Chen, Hui Lin* *The Chinese University of Hong Kong, China* **Paper ID: C11034** Multi-granular POIs identification from trajectories using hierarchical GMM-RF model on Web Map Service Platforms *Guangsheng Dong, Rui Li, Huayi Wu, Ru Li* *Wuhan University, China* **ID: C-11043** Comparative study on the mountain elevation effect of the Tibetan Plateau and the Alps and their implications for alpine tree lines *Dongzhu Suonan, Yonghui Yao, Junyao Zhang* *Chinese Academy of Sciences, China* **ID: C-11091** Influence of short wave albedo on soil surface temperature of bare farmland: a case study from Nanyang Basin, China *Pengcheng Qi, Rui Li, Shixiong Hu, Yan Cui* *Nanyang Normal University, China*
18:10 – 19:00	**Break** **Walking to the Gala Dinner Venue takes about 5 minutes**
19:00 – 23:00	**Panel Discussion Session 2 (40 minutes each)** **Chairman:** Professor Xun Shi, Dartmouth College, USA **Topic:** "Big" data and "small" data in geospatial analysis. **Conference Gala Dinner**

Thursday – Sunday, 4 – 7 July 2019
Field Trips
Detail in Special Field Trips *(Tickets are required)*

Kaynotes details:

(Listed according to the alphabet of the last name)

Geo-Social Sensing for Urban Study and Social Management

Prof. Jianya Gong
School of Remote Sensing and Information Engineering, Wuhan University
Wuhan, China

Abstract:

This presentation introduces the conception of Geo-Social Sensing, Geo-Social sensors including internet (social media), smartphone, navigation device, video surveillance, wearable device, the technologies for spatiotemporal data processing, Geo-social sensing applications in urban and environment study, social management system based on Geo-social sensing, finally, gives some conclusions.

Biography of Professor Jianya Gong:

Prof. Jianya GONG is Academician of Chinese Academy of Science, Dean of school of Remote Sensing Information Engineering, Wuhan University, China.

He studied as a PhD candidate at Wuhan Technical University of Surveying and Mapping，and Technical University of Denmark during the time period of 1988 – 1992 and got his Ph.D in 1992

Up to now Prof. Gong has experienced several professional careers in different countries. He worked as a lecturer at Department of Surveying and Mapping, East China Geology College from 1982 to 1988, and an Associate Professor at Department of Photogrammetry and Remote Sensing, Wuhan Technical University of Surveying and Mapping, from 1992 to 1995, and worked as a visiting professor at Department of Geography, University of Massachusetts, Boston, USA over the time period Oct.,1995 - Feb.,1996. He has been a Changjiang Chair professor, Deputy Director and Director at the State Key Laboratory of Information Engineering in Surveying, Mapping and Remote Sensing, Wuhan Technical University of Surveying and Mapping and Wuhan University from 1996-2016, and during that time period, he was invited as a visiting professor to work at Department of Surveying and Land Information, Hong Kong Polytechnic University from Mar.,1998 to Sep.,1998, a visiting professor to work

at Department of Geography and GeoInformation Science in George Mason University from Nov. 2008 to Feb. 2009.

Prof. Gong has been active in organizing international academic exchange. He was a secretary of ISPRS Commission III over the time period Sept., 1990 – July, 1992, a secretary of ISPRS Commission VI over the time period July, 1992 – July, 1996, a chair of Working Group of ISPRS WG IV/2(Federal Database and Interoperability) over the time period July, 2000 – July, 2004, a chair of Working Group of ISPRS WG VII/5(Multi Temporal Data Processing and Change Detection) and a co-chair of Academy Commission of ISPRS XXI Congress over the time period July, 2004 – July, 2008, a member of Working Group (Geographical Information Service) of ISO/TC211 over the time period May, 2003 - Nov., 20012, a chair of Working Group of ISPRS WG IV/4(Virtual Globes and Context-Aware Visualization) over the time period July, 2008- July, 20012. He was the president of the commission VI of ISPRS from July, 2012 to July, 2016, and the president of CPGIS from Aug. 2017 to July. 2018. He is a secretary general of Asia GIS Association from 2013.

His research interests include geospatial data structure and data model, geospatial data integration and management, geographical information system software, geospatial data sharing and interoperability, Photogrammetry, GIS and remote sensing application. He has undertaken 40 research projects and published 12 books and more than 500 scientific papers. He got the Dolezal Award of ISPRS, and 6 national awards and more than 10 other awards in China. The citations of his papers are more than 20,000.

Kaynotes details:

Remote Sensing and Predicting Earth's Water: Progress, Challenges and Opportunities

Prof. Yang Hong
Peking University
Beijing, China

Abstract:

The global water cycle is driven by a multiplicity of complex processes and interactions between and within the Earth's atmosphere, lands, oceans, biosphere and human societies across space-time scales. Remote Sensing BIG DATA has enabled global hydrologic sciences to extend the range and scale of observations and to couple cross-disciplinary understanding for improved predictions and better societal benefits. This presentation briefly overviews the progresses, challenges, and opportunities of integrating multi-source (in-situ, remote sensing, analysis) data science techniques for global and regional water studies, with particular focus on global precipitation measurement, validation and applications.

Brief Biography of Professor Yang Hong:

Yang Hong received his Bachelor and Master degree from Peking University, and PhD of Hydrology and Remote Sensing from the University of Arizona. After years' research scientist at NASA Goddard, he has been an endowed Chair Professor and/or Adjunct Professor in several Universities. He has transdisciplinary research interests with synergy at the interface of remote sensing technology, water, weather, and climate, with 300+ journal articles (H-index 50+ and 12,000+ citation) in these areas.

Kaynotes details:

Geographic Language Evolution and Human Geographic Studies

Prof. Hui Lin
Hong Kong Chinese University
Hong Kong

Abstract: In this so-called big data age, we have seen the rapid change of the geographic language from spatial representation and spatial statistics to spatial modeling and simulation. This change has been promoted after various data collection platforms were developed from space and sky to ground networks. Increasing data sources and the changing geographic language have helped human geographers to identify new angles to view the world and to study the socio-economic, political, and cultural geographic issues.

Biography of Professor Hui Lin:

Prof. Dr. Hui Lin is Chen Shupeng Professor of Geoinformation Science and director of the Institute of Space and Earth Information Science, The Chinese University of Hong Kong. He graduated from Wuhan Technical University of Surveying and Mapping in 1980, receiving his Master of Science degree from Chinese Academy of Science in 1983 and Master of Arts degree from University at Buffalo in 1987 respectively. Dr. Lin received his Ph,D. from University at Buffalo in 1992. Dr. Lin currently serves as the director of Hong Kong Base of National Remote Sensing Center of China, vice chairman of the China National Committee of International Society of Digital Earth. His major research interests are radar remote sensing, virtual geographic environments (VGE), spatially integrated humanities and social sciences. He has published over 300 academic journal papers and co-authored 12 books. Dr. Lin was the founding president of CPGIS.

Kaynotes details:

Title: Smart Technology and Big Data for Connected Gardens

Denise Ora
Executive Director
Botanic Gardens & Centennial Parklands

Abstract:
Four years ago an opportunity presented itself to the Gardens to look at innovative technology through Smart Nodes to provide solutions in a digital age to the large open spaces. While these form the open space technology lynchpin for the Gardens, the opportunity to improve public space lighting and to program it to support events means that the area continues to remain relevant and leads to greater activation of the space for the people of Sydney. Ultimately by placing remote lighting control in the hands of the people on the ground means that the lighting needs, whether in an emergency, for an event or any other activity, is responsive to the situation.

The implementation of smart lighting technology at the Royal Botanic Gardens has been driven through a combination of factors, namely, the character of the site, the age of the assets, the ongoing costs to pay for power for the site and an opportunity to partner with private enterprise to deliver multi outcomes from single structures

Biography of Denise Ora:
Ms Ora's background is in strategic marketing, economic development, planning and place making. She is a graduate of the Australian Institute of Company Directors (AICD), a Graduate in Business Law and is currently completing a Master of Business Law.

Denise has extensive experience working in both complex commercial and regulated government cultural institutions of national significance, both here and in the UK. Prior to her appointment as Executive Director, Denise was responsible for driving the strategic program for the Botanic Gardens & Centennial Parklands, leading the award-winning major capital infrastructure program across 1100 hectares, including delivery of The Ian Potter Children's WILD PLAY Garden at Centennial Parklands, the spectacular horticultural display centre 'The Calyx' at Royal Botanic Gardens Sydney and the Moore Park Master Plan. Denise was also

instrumental in the successful integration of the Botanic Gardens and Centennial Parklands operations.

Denise is the first woman appointed as Executive Director to the Royal Botanic Gardens in its 203-year history. The Royal Botanic Garden Sydney, Domain, Centennial Parklands, Australian Botanic Garden Mount Annan and Blue Mountains Botanic Garden Mount Tomah receives over 40 million visitors annually.

"It is a privilege to be the first woman to lead these iconic spaces. Our parklands and gardens are not only precious but essential for the improvement and quality of life of our community," said Denise.

"Our challenge is to not only cater for today but plan for future population and visitation growth over coming decades – and I am excited to take on that challenge. I will lead BGCP into the future, fostering a customer centric, commercially astute and innovative agency that interfaces effectively between communities and public and private entities whilst focussing on - and not forgetting the core attributes of what we are as an organisation - science, conservation, horticulture, education, sport and recreation."

Kaynotes details:

Title: Speculations on the Future of GIScience

Prof. Daniel Sui
Professor of Geography
Vice Chancellor for Research and Innovation
University of Arkansas, USA

Biography of Professor Daniel Sui:

Professor Daniel Sui is an internationally renowned researcher who has conducted ground-breaking work in the interdisciplinary use of geographic information science to solve problems in diverse areas such as urban planning, environmental science and public health. He has also played key administrative leadership roles in research, education and interdisciplinary programs.

He earned a Bachelor of Science in geography and a Master of Science in remote sensing and geographic information systems from Peking University in Beijing, China. He received his Doctor of Philosophy in geography from the University of Georgia in Athens. He is an internationally renowned researcher in the area of GIS-based spatial analysis and modelling for urban, environmental and public health applications.

He served as division director for the Social and Economic Sciences Division in the Directorate of Social, Behavioural and Economic Sciences at the National Science Foundation and as an Arts and Sciences Distinguished Professor at The Ohio State University.

Currently he oversees research administration, research compliance, the planning and optimization of research space and shared instrumentation, interdisciplinary research centres, undergraduate research and the University of Arkansas Press.

Kaynotes details:

Spatial Prediction and Laws of Geography

Prof. A-Xing Zhu
Department of Geography, University of Wisconsin-Madison
Madison, Wisconsin, USA

Abstract: Spatial prediction is one of the most important spatial analytical tasks for geographers and anyone who conducted analysis related to phenomena of spatial variation because it provides the needed information on spatial variation with a discrete set of field observations. Currently spatial prediction is based on either the First Law of Geography or the statistical principle or the combination of these two. These existing theories for spatial prediction require the set of samples to be over certain size with special distributions as well as the relationships extracted from the samples to be spatially stable (stationary). These requirements render existing techniques unsuitable for spatial prediction over large and complex geographic areas at high spatial resolution which is a norm for geographic analysis in this digital era. This paper first examines utilities of the existing Laws of Geography and the statistical principles for spatial prediction and then presents a new thinking about spatial prediction based on a different geographic principle (one may refer to it as the Third Law of Geography) which focuses on the similarity of geographic configuration of locations. Under this principle, prediction of spatial variation can be made on the basis of the similarity of geographic configurations between a sample and a prediction point. This allows the representativeness of a single sample to be used in prediction, in contrast to an explicit relationship from an entire sample set. A set of case studies (ranging from soil mapping, landslide susceptibility mapping, to wildlife susceptibility mapping) on the topic of spatial prediction, sampling improvement, uncertainty quantification and bias mitigation show that spatial prediction based on the new principle does not require samples to be over specific size nor to be of a particular spatial distribution to achieve a high quality prediction. The prediction uncertainty associated with spatial prediction based on the new principle is more indicative to quality of the prediction, thus more effective in allocating error reduction efforts and in mitigating spatial bias in sampling. These properties are particularly important to spatial prediction in geospatial big data science where more than often sample sets are not as representative as expected. This finding suggests that the new theory provides the possibility of transforming spatial prediction to meet the need of this new digital era.

Key words: Spatial prediction; Law of Geography; Third Law of Geography, sampling, uncertainty, spatial big data.

Biography of Professor A-Xing Zhu:

Prof. A-Xing Zhu is a full professor at the Department of Geography, the University of Wisconsin-Madison where he teaches courses on GIS and physical geography, currently serves as the Editor-in-Chief for Annals of GIS. He is also an adjunct professor at Institute of Geographic Sciences and Natural Resources Research, Chinese Academy of Sciences and an endowed professor at the School of Geography, Nanjing Normal University.

He obtained his Bachelor degree from the Department of Geography, Beijing Normal University, Beijing, China in 1983 and his Master's in Geography from the University of Calgary in 1987, Canada, and his Ph.D. degree from the Department of Geography, University of Toronto, Canada, in 1994.

His research interests are GIS/Remote Sensing techniques, fuzzy logic, artificial intelligence methods, and their application in spatial prediction and watershed modeling. Recently, he has developed a research interest in high performance computing and cloud computing for geographic analysis. His work in this area was showcased in February of 2003 at a congressional briefing on the role of geographic information science and technology in meeting the nation's scientific, economic and social needs.

He is the recipient of the following awards: The Manasse Chair Professor, the Hamel Faculty Fellow award, and the Vilas Associate Award from University of Wisconsin-Madison; Service Excellence Award and Education Excellence Award from the International Association of Chinese Professionals in Geographic Information Sciences; Integraph Award for best scientific paper in spatial data standards from the American Society for Photogrammetry and Remote Sensing

He has published 2 books, over 300 research articles and 3 invention patents. He has obtained over $20 million (US dollar equivalent) of research funding.

Invited paper

ID: ICITA-12011

Automated Seismic Data Processing using Deep Learning Networks

M. Deriche, H. Nuha, M. Alfarhan, M. Mohandes, A. Maalej

King Fahd University of Petroleum and Minerals, KFUPM, Saudi Arabia

Abstract — A crucial task in seismic reflection is to identify seismic events such as salt bodies with high precision. Traditionally, this was accomplished by visual inspection from human experts. Such approach, however, is manpower intensive when dealing with large volumes of data and is subject to bias. With recent progress in deep learning (DL) networks and computational power, numerous efforts have been put in developing robust machine learning techniques for seismic events detection, compression, noise removal, etc. In this paper, we discuss the use of deep learning methods for two problems in seismology, namely, compression of seismic data and salt dome bodies delineation.

First, we present a data compression approach for seismic data using Deep Belief Nets (DBN) predictors and entropy encoding. A DBN with multiple hidden layers is pre-trained using Restricted Boltzmann Machines (RBMs) to obtain good initial weights. The DBN is further trained in a supervised fashion with target outputs using back-propagation to achieve more precise predictions. The residual signals are optimally quantized to achieve high Signal to Noise Ratio (SNR).

Next, we show how deep learning networks can be used to effectively delineate salt domes in seismic images. By considering salt dome classification as a semantic segmentation problem, we propose to use a convolutional neural network. In particular, we propose to combine the Unet with the ResNet for segmenting salt bodies in a seismic image. Our work shows that deep learning techniques can learn the most important attributes for accurately segmenting salt domes and other seismic events.

Index Terms—Seismic data, deep learning, compression, salt dome detection.

Panel Discussion details:

Panel Discussion Topic: GIS in Higher Education

Chairman: Prof. Yongmei Lu
Texas State University, USA

Topic Introduction: Although GIS has been taught in China and western countries, there are a vast variety of teaching in the GIS field. This panel will discuss the objectives and learning goals of GIS education in high educational institutions.

Panel Discussion Topic: "Big" data and "small" data in geospatial analysis.

Chairman: Prof Xun Shi
Dartmouth College, USA

Topic Introduction: Data used in contemporary geospatial analysis have been extending to two extremes. On the one hand, "big" data become increasingly available; new concepts, theories, methodologies, and technologies have been increasingly emerging to accommodate and utilize them. On the other hand, "small" data, referring to detailed, precise, individualized, and even personalized data that are available only in a limited amount, have also been emphasized in studies equipped with new methodologies and technologies. In the social science aspect, a typical example of "big" data is the population flow data compiled from public transportation data, taxi data, mobile phone data, and social media data. An example of "small" data is the individual behaviour data collected through field investigation, interview, and/or voluntary participation. In the physical science aspect, examples of "big" data may include satellite images, DEMs, and their derivatives, as well as data collected through extensively distributed sensors. "Small" data may refer to detailed described soil pedons and "cases" given by soil scientists based on their tacit knowledge. Interactions between studies using "big" data and "small" data, as well as integration of "big" data and "small" data, lead to direction of great potential, but also impose challenges. This panel intends to discuss the understanding and handling of "big" data and "small" data in various applications, their potentials, and challenges.

Presentation Abstracts:

ID: C-1101

BIM/GIS Integration for Web GIS Based Bridge Management

Junxiang Zhu, Yi Tan, Xiangyu Wang, Jun Wang

Curtin University, Australia

Abstract — Integration of Building Information Modeling (BIM) and Geographic Information System (GIS) can benefit both the Architecture, Engineering and Construction (AEC) domain, and the geospatial industry. For GIS, BIM is an ideal source of three dimensional (3D) building information that can be used in the study of the smart city, green building, big data, etc. The underlying data transformation from Industry Foundation Classes (IFC) to shapefile enables GIS to use the rich building information. However, this transformation is difficult due to the different methods used by IFC and shapefile for solid modeling. IFC represents solid 3D models in five ways, including boundary representation (Brep), swept solid, constructive solid geometry (CSG), clipping and mapped representation, while shapefile only uses Brep. Also, the use of different coordinate systems also contributes to the transformation issue. Among all the five solid modeling methods used by IFC, Brep and swept solid are the most often used two methods. Compared with Brep, the transformation of swept solid is more problematic. Apart from the coordinate system transformation issue, each type of profile for swept solid defined in IFC has to be properly interpreted and converted. This paper develops algorithms to interpret the commonly used profiles of swept solid for the transformation of swept solid into Brep. A bridge model is used to validate the proposed method. Based on the transformed bridge model, a Web GIS based bridge management system is developed to demonstrate a possible usage of this technique.

ID: C-1102

Population Spatial Distribution Geo-simulaton in the Future to Support Beijing General Urban Planning (2016-2035) Based on CA-Markov Model

Fang Liu, Weilun Sun

Beijing University of Civil Eng. & Architecture, China

Abstract — The dynamic process of urban population spatial density development is a complex social and economic phenomenon which nature, geography, social economy and policy system influence and determine. This study, to support the "Beijing General Urban Planning (2016-2035)", in which the pop upper value in six central districts (the permanent residential population) and ten surrounding districts and counties are strictly controlled till 2020 and 2035, a population spatial distribution geo-simulation considering inter-generational needs method is proposed. The research tools are CA-Markov model as a system dynamics mode, and the data-set of China's kilometer grid population in 2005, 2010 are used for simulation. The inter-generational needs weight map is obtained from the generation structure and geographical information vector files: hospital, primary school, residential building, shopping mall, urban main road, and so on all municipal facility information. The simulation time starts from 2015, meanwhile as a reference for application validation of predicting model, and the end year is 2035 with five-year step. The experiment shows that there is good correlation between the predicted map and the demographic statistics spatialization data-set from(http://www.resdc.cn/) with correlationship of 0.997 and slope value of 1.03. This paper establishes an improved pop distribution yearly change simulation model under policy scenario considering the inter-generational needs.

ID: C-1103

Hydrological droughts measurement using GRACE satellite solution

Aihong Cui, Jianfeng Li, Qiming Zhou, Guofeng Wu, Qingquan Li

Hong Kong Baptist University, China

Abstract — Many indices based on GRACE have been built but they seldom quantify the water deficit in different time scales which also show the accumulative effect of water change. We use the RL-05 GRACE solution from the University of Texas Center for Space Research, the high-resolution precipitation and temperature grids come from the gridded Climatic Research Unit (CRU) Time-series (TS) dataset. Here we establish a new GRACE-derived index (SGI) based on probability density function. And investigate the effect of climate change on dry and wet areas by establishing a new index based on GRACE (SGI), and then compare the drought trends with the meteorological index SPI and SPEI in the spatiotemporal scale from April 2002 to January 2017. The results shows the SGIs can show the temporal and accumulative spatial distribution of drought and flooding in global scale, and they show the same trend and good correlation with SPI and SPEI especially when time scale is greater than 9 month, and the time lag among them is about 1 to 2 months. The GRACE-derived index have the potential to detect dryness and wetness condition in a selected period.

ID: C-1104

Automatically selecting environmental covariates for geographical variable mapping based on existing application cases – Taking digital soil mapping domain as example

Cheng-Zhi Qin, Peng Liang, A-Xing Zhu

Chinese Academy of Sciences, China

Abstract — There are a large number of possible environmental covariates for geographical variable mapping. Currently, the selection of a few and proper environmental covariates among them for applications of geographical variable mapping is still depended on either users' sufficient domain knowledge or some statistical algorithms. The statistical algorithms could be automatic, however data-intensive, compute-intensive, and also with plenty of excess data preparation work of both every possible environmental covariates and field samples in the application area. This situation makes geographical variable mapping in real applications far from easy-to-use, especially for those non-expert users without sufficient domain knowledge. This study aims to develop an efficient method to automatically select environmental covariates for applications of geographical variable mapping. The tacit knowledge on selecting environmental covariates for applications of geographical variable mapping implicitly contained in existing application cases. Such knowledge could be used through a case-based method to support the automatic selection of environmental covariates for geographical variable mapping in new applications.Taking digital soil mapping (DSM) as example domain for this study, we designed a case-based method to formalize existing DSM application cases and apply the case-based reasoning to them, so to automatically select DSM environmental covariates for new-coming DSM applications. A total of 191 DSM cases were extracted from 56 peer-reviewed articles and saved into a DSM case base. This case base was used to evaluate the performance of the proposed method through a leave-one-out experiment. Evaluation results showed that the proposed method can effectively select environmental covariates for new-coming DSM applications. Meanwhile, the proposed method can also provide the prediction uncertainty to indicate the reliability of each environmental covariate recommended for a new-coming DSM application. The performance of the proposed method was mainly affected by the limited size of DSM case base.

ID: C-1105

Visualized Analysis of Short and Long-Distance Human Mobility on the Qinghai-Tibetan Plateau with Crowd Sourcing Data

Jun Xu

Chinese Academy of Sciences, China

Abstract — The Qinghai-Tibetan Plateau is a special region in China and in the world for its unique natural landscape and distinctive culture. Disclosing the interaction of the plateau with other places in China is helpful in the economic development and ecological environment protection on the plateau. The population travel between cities is an important aspect of spatial interaction and can disclose the attractiveness of cities. We use passenger travel data from the website of Tencent Location Big Data to analyze the short and long distance human mobility on the Qinghai-Tibetan Plateau. We collected the everyday passenger travel data among Chinese cities in 2017 and group travels between cities by month. Since the different natural and human characteristics on the plateau, we redeem that the interactions among cities on the plateau as short-distance interactions and the interactions between cities on the plateau and non-plateau regions as long-distance interactions. We construct web-based visualization of the moving populations between cities of Qinghai and Tibet and other provinces in China so that the short-distance and long-distance human mobility can be easily explored. By visual exploration, we find that the cities on the plateau have different patterns of short and long-distance human mobility. Some cities have more short-distance human mobility and other cities have more long-distance human mobility. To find the cities with same patterns of human mobility and their spatial distributions, we use construct travel vectors of cities. The passenger numbers from a city to other cities on the plateau are used to construct the short-distance travel vector and the passenger numbers from a city to non-plateau regions are used to construct the long-distance travel vector. Then, the cosine similarities between travel vectors are calculated and cities are grouped by the similarities. For the short-distance human mobility, there are four groupsof cities: (1) Xining; (2) Changdu, Lhasa; (3) Shigatse, Shannan, Nakchu, Ali, Nyingchi; (4) Haidong, Haixi, Haibei, Yushu, Hainan, Huangnan, Golog. For the long-distance human mobility, there are three groups of cities: (1) Ali; (2) Shannan, Changdu, Lhasa, Shigatse, Nyingchi; (3) Golog, Huangnan, Xining, Haibei, Haidong, Haixi, Nakchu, Yushu.

ID: C-1106

Understanding urban habitability in a 3D perspective based on Mobile Lidar data

Jing Zhang, QinghuaGuo, Xiliang Sun, Yanjun Su

Chinese Academy of Sciences, China

Abstract — Urban streets are the most concentrated areas of human activities. The collaboration between street three-dimensional elements with urban habitability has been a popular topic in recent years. Studies show that the landscape indices of streets influences human's perception. Three-dimensional structure is the basics of landscape. However, ground surveys are time-consuming and expensive to perform over large-scale areas, and the street image-based classification can't represent the real three-dimension elements. The emerging LIDAR technology can quantitatively analyze urban settings by obtaining the 3d structured spatial parmeters in detail, not only by shape itself but also with many meaningful landscape indices such as Elousure Index and 3D biomass. This study used Mobie Lidar System to get the real three-dimensional parmeters and proposed LiDAR-based 3D landscape indices for urban habitability. Experiments performed in Jingzhou city of Hebei (China) showed that these three-dimensional parmeters and the landscape indices matched very well with the actual situation and they reflected human's perception of streets .Our study could provide researchers and urban planners insightful understanding of the urban habitability in a 3D perspective.

ID: C-1107

Research on Quality Evaluation Method of OpenStreetMap Road Network Data Based on Remote Sensing Image

Haigang Sui

Wuhan University, China

Abstract — OpenStreetMap(OSM) road network data is an open source road network data created, edited, managed and maintained by a large number of public users. The advantages of OSM road network data has are freely available, wide coverage and near real-time with a wealth of social attributes information included. It is rapidly becoming an important supplement to professional geographic information. However, since it is spontaneously uploaded by public volunteers, its credibility has many uncertainties. In view of the current OSM data quality evaluation method, either the reference data is difficult to obtain, or the reference data is out-of-date. This paper uses the corresponding remote sensing image as the evaluation reference data of OSM road network. Firstly, the remote sensing image of the corresponding period of the OSM road network is obtained, and the image is registered with the OSM road network vector. Secondly, the road network is extracted by using the convolutional neural network model U-Net, and the extracted result is refined to obtain the road network skeleton. Thirdly, after matching and comparing the road network skeleton with the OSM road network, the quality information of the OSM road network data is obtained quantitatively. The experimental results show that the proposed method has better currency and reliability than the traditional method, and provides a new perspective for the quality evaluation of OSM road network data. Keywords: OpenStreetMap; quality evaluation; remote sensing imagery

ID: C-1108

A new dmsp/ols night time light data desaturation method based on NDBI and MNDWI

Yuqian Wang, Chengpeng Huang, Kuan Qian, Xiaolong Li, Yongbin Tan and Penggen Cheng

East China University of Technology, China

Abstract — Abstract: The intensity of night time light (NTL) reflects social economic activity of human beings. Recently, NTL intensity information could be obtained by remote sensing techniques, and be used in many fields including economics, population, urbanization, ecological environmental protection, etc. DMDP/OLS NTL is one main data source of night light remote sensing. It is easily acquired, long time series data, highly sensitive and avoiding from the influence of light shadow. These advantages encourage successful applications of DMDP/OLS in many fields. However, due to the drawback of OLS, the intensity would be saturated in the center of urban zone, which seriously restricts the performance of DMDP/OLS. In the core zone of most Chinese key cities (commonly provincial capital), the intensity of NTL is saturated. In this paper, the correlation between the NTL of DMDP/OLS and land cover in the unsaturation region is analyzed. Then two indexes including modified normalized difference water index (MNDWI) and normalized difference building index (NDBI) are introduced to correct NTL of saturated region. NDBI image could show the details of cities' core zone and be positive related with NTL. MNDWI image could indicate water regions in cities' core zone and efficiently restrain NTL of cities' water regions. Furthermore, MNDWI and NDBI are very stable along seasons. The validity of this method is verified by the regression analysis between the NTL and Chinese Gross Regional Product (GRP) of provinces from 2001 to 2013. The comparative experiments of GRP prediction using original NTL or corrected NTL shows that desaturation preprocess of DMDP/OLS data would efficiently promote the accuracy of regression analysis.

ID: C-11012

A Study on the Spatial-temporal Pattern and Future Development Trend of Anthropogenic Heat Emission in Jiangsu Province

Lingyan Weng, Xugao Han

Nanjing University Jingling College, China

Abstract — Objective: Jiangsu being a large province with huge population and powerful economic forces, the quantity of anthropogenic heat discharged is enormous. Hence, it is of great academic and social value to carefully study the emission and spatial distribution of anthropogenic heat in Jiangsu and to rationally estimate the future development trend of anthropogenic heat and how it changes over time, especially in the aspect like coordinating development of ecological environment and economy, reasonable urban planning and efficient adaption of climate changes in Jiangsu and greater area of Yangtze river delta. Background: It is the expansion of city and energy consumption in global areas that results in the thermal temperature near the earth's surface, in different spatial and temporal dimension, being affected by anthropogenic heat, by which the local and even the regional climate are influenced. The relation between anthropogenic heat emission and the effect of urban heat island has been concerned widely. Data: The data of energy consumption and population of prefecture-level cities of Jiangsu province is from Jiangsu statistical yearbook published by statistics bureau of Jiangsu province from 2001 to 2016. Methodology: The work of this paper includes: (1) applying the sources-list method to estimate the quantity of anthropogenic heat emission and conducting a time series analysis of it, (2) discussing the spatial pattern of anthropogenic heat emission of Jiangsu province by using the Getis-Ord Gi* of ArcGIS 10.2 in the typical year of 2000, 2005, 2010, 2015, (3) establishing a time-series prediction model and GM (1, 1) model and predicting the variation trend of anthropogenic heat in Jiangsu of the future. Result and Discussion: In Jiangsu, the annual average quantity of anthropogenic heat emission increases from 0.843 W.m2 to 2.723 W.m2 from 2000 to 2015, mainly discharged from the departments of industrial activities, transportation and living consumption, which accounts for 80% of the total emission. The areas with high quantity of anthropogenic heat emission increase unceasingly and differentiate themselves from each other in a pattern of increasing from northern to central and to southern area of Jiangsu. The annual average emission would reach 5.6 W.m2 till 2025 according to the prediction.

ID: C-11013

Modeling of Communicable Disease Transmissions with Real Human Mobility and Disease Data

Meifang Li, Yu Liu, Xia Li, Xun Shi

Dartmouth College, USA

Abstract — Information about individual activities is critical in spatiotemporal modeling of communicable diseases. Lack of individual level data, however, has hampered the development of such modeling. The recent increasing availability of "big data" of human mobility provides the opportunity and possibility of deriving information about individual activities from such data. In this study, we explored an approach of retrospectively deriving patients' trip trajectories from aggregated call detail records (CDR) of mobile phone data, so as to estimate the chance of interaction between two patients and further the likelihood of transmission between them. The case study is about the dengue fever epidemic in 2013 in Guangzhou City, China. Our attempt on integrating real "small data" of patients with real "big data" of people mobility flows has resulted in realistic trip trajectories of patients, which should be helpful to improving the accuracy in detecting spatiotemporal patterns in disease transmissions. The approach has a general value in modeling vector-borne diseases and other types of communicable diseases.

ID: C-11013a

Modeling of Communicable Disease Transmissions with Real Human Mobility and Disease Data

Meifang Li, Yu Liu, Xia Li, Xun Shi

Sun Yat-sen University, China

Abstract — Information about individual activities is critical in spatiotemporal modeling of communicable diseases. Lack of individual level data, however, has hampered the development of such modeling. The recent increasing availability of "big data" of human mobility provides the opportunity and possibility of deriving information about individual activities from such data. In this study, we explored an approach of retrospectively deriving patients' trip trajectories from aggregated call detail records (CDR) of mobile phone data, so as to estimate the chance of interaction between two patients and further the likelihood of transmission between them. The case study is about the dengue fever epidemic in 2013 in Guangzhou City, China. Our attempt on integrating real "small data" of patients with real "big data" of people mobility flows has resulted in realistic trip trajectories of patients, which should be helpful to improving the accuracy in detecting spatiotemporal patterns in disease transmissions. The approach has a general value in modeling vector-borne diseases and other types of communicable diseases.

ID: C-11014

Facade feature extraction method for buildings from three-dimensional point cloud data assisted by optical images

Yongzhi Wang, Yuqing Ma, A-xing Zhu, Hui Zhao, Sijing Zhu

Jiangxi University of Science and Technology, China

Abstract — Facade features represent segmentations of building surfaces and can serve as a building framework. Extracting facade features from three-dimensional (3D) point cloud data (3D PCD) is an efficient method for 3D building modeling. The 3D PCD of buildings is unstructured, and the features directly extracted from the 3D PCD often exhibit low geometrical continuity. Two-dimensional (2D) optical images, which can be mapped to the real-world scale according to the 3D PCD, contain substantial amounts of geometric and textural structural information. This information can be used to describe the spatial distribution and internal variation of image elements. By applying statistical analysis to the structural information of adjacent areas, the marching directions of information, such as line segments, can be determined efficiently in the feature extraction process, and these directions are very important for improving the accuracy of feature extraction. Therefore, introducing the structural information contained in 2D optical images to the process of feature extraction of building facades from 3D PCD should be feasible and effective.

ID: C-11015

Urban Expansion Simulation and Scenario Analysis in Major Cities of Central Asia

Jing Qian, Qiming Zhou, Xi Chen, Shuhong Peng, Bo Sun

Chinese Academy of Sciences, China

Abstract — Cities are the core part of the socio-economic development and ecological protection in arid regions. They are not only showing the economic and social development, but also reflecting the

impact of human activities on the ecosystem. Many studies have been focused on the urbanization process and urban expansion over the coastal areas of the world. However, the researches about the urban expansion and simulation in the arid regions are limited, especially in Central Asia. As the typical oasis cities over Central Asia, they are located in the arid region of Eurasian hinterland. This study focuses on five major cities namely: Astana, Almaty, Tashkent, Ashgabat and Bishkek, the current and former capital of Kazakhstan, Uzbekistan, Tajikistan and Kyrgyzstan. These five cities have been experienced substantial changes after the disintegration of the Soviet Union over past 35 years. Depopulation and imigration (including relocation of capital city) have caused great influences on these cities. This study focus on investigating how the major historical event affecting the development of the cities as well as the urban expansion process and the future developments. Land cover classification and change detection are built up using random forest (RF) model under the Google Earth Engine (GEE) environment. Urban expansion and influence factors are analyzed. Simulation and scenario analysis are obtained using Conversion of Land Use and its Effect (CLUE) model. The major results show that RF model is worked well in the simulation and validation using the Landsat Thematic Mapper (TM) data and the classification map of the five cities during 1990-2017. Urban land cover change models could be applied to simulate the possible future state of the land, and also to explore land cover change scenarios which can provide the scientical support for policy makers. The CLUE model has the capbility to simulate multiple land-use types simultaneously through the dynamic competition between land-use types and to predict the future development of cities.

Study on Coordinative Observation Technology for High Altitude Barrier Lakes

Xin Zhang

Chinese Academy of Sciences, China

Abstract — Barrier lakes are lakes formed by storing water in valleys, river valleys or riverbeds after being blocked by landslide, earthquake and other factors.When the water is stored to a certain extent, it may burst in case of strong earthquake or rainstorm, resulting in large-scale flood disasters.In order to ensure the safety of people's lives and property in the downstream, it is necessary to monitor the barrier lake. However, it is quite difficult and time-consuming to manually monitor the barrier lake in high altitude areas due to harsh climate and steep terrain. With the development of earth observation technology, remote sensing monitoring has become one of the main ways to obtain observation data. Compared with a single satellite, multi-satellite remote sensing cooperative observation has more advantages.Monitoring with multi-temporal and multi-platform remote sensing satellites can obtain a variety of observation data and key information in time,scientifically judge the situation of the barrier lake and make reasonable prediction. In this study, a cooperative observation and analysis model for barrier lakes in high altitude areas based on the integration of "space-air-ground" is proposed, which takes into account the observation frequency, spatial resolution, spectral range, output sub-meter level and other factors, combines remote sensing data with field observation data and historical auxiliary data to meet the two application requirements of conventional observation and emergency situations. The model gives early warning of risks based on accurate acquisition of dynamic data of research area's water resources, water ecological environment and water quality status, providing decision-making basis and data support for dynamic supervision and emergency response in the region. Finally, The Sarez Lake, which located at an altitude of 3,263 meters in the middle of Pamirs Plateau and formed by the 1911 earthquake, is selected as the research area. In this study, the coordinated observation of the sub-meter to 10-meter scale is realized, the changes in the water level over the past 2 decades in this area is analyzed, and the effectiveness of this technical method is verified. The results show that: (1) The range of water level changes is not apparent and remains at a stable level; (2) Unless there is a strong earthquake or rainstorm, the possibility of Lake Sarez bursting is small under normal circumstances; (3) Lake Sarez will remain stable in the future, but it is still necessary to set up an early warning system and carry out remote sensing monitoring in the region.

ID: C-11018

Spatial analysis of light pollution at street scale with LJ1-01 nighttime light remote sensing and mobile big data

Bo Sun, Qiming Zhou, Yang Zhang, Peng Wang

Chinese Academy of Sciences, China

Abstract — Light pollution in cities threatens human health and causes changes in biological rhythm which will lead to an increasing risk for various diseases. Considering urban inner structure and function zones, nighttime light has influences to different degrees at different districts or blocks. Undeniably light pollution on residential areas will directly result in human health problems. To analyze the impact of city light on residential areas at night time, mobile big data and Luojia1-01 (LJ1-01) high spatial resolution nighttime light remote sensing data have been employed. The recognition of urban function zones benefit from the integration of remote sensing and mobile big data. The former provides urban structural information, while the latter provides population distribution and human behavior characteristics. A case study of Shenzhen city in the Guangdong-Hong Kong-Macao Great Bay Area has been conducted. Data mining techniques including classification and clustering analysis have been adopted for extraction of urban structure and function zones. Accordingly, light pollution information from LJ1-01 has been analyzed for residential areas at a street scale. The results are of great significance to the study on distribution of population and residential areas, division of urban function zones, assessment of human settlement environment, abatement and control of nighttime light pollution for a smart and health city.

ID: C-11019

Urban land use classification from very high resolution remote sensing imagery

Changshan Wu

University of Wisconsin-Milwaukee, USA

Abstract — Land use classification has been a difficult problem for remote sensing communities. Remote sensing techniques have been effective in distinguishing urban land covers, as signals from remote sensing are material dependent. Land uses, however, are associated with human interventions, and thereby prohibiting effective classifications with remote sensing imagery. This paper reviews the literature of urban land use classification, and argues the integration of big data and artificial intelligence in urban land use classifications.

ID: C-11020

Based on the energy analysis of cultivated land resource sustainable utilization evaluation in Wuhan city

Lin Zhu

Huazhong Agricultural University, China

Abstract — Abstract: Research purposes:As the essence of the land,cultivated land resources is the basic resources of agricultural production and even national economy sustainable development and sustainable utilization of cultivated land resources evaluation studies provide a basis for effective utilization and protection of arable land. Research methods:Based on this,this study will be able to value

indicators used in the study of sustainable utilization of cultivated land,using building energy analysis theory of cultivated land sustainable utilization evaluation index,can expand the value of application. Emergy refers to a product or service of direct and indirect investment in the process of forming an effective energy,energy analysis method to value as the benchmark,convert the energy of different kinds,do not compare to the unified standard,and considering the environment,resources,and people in the role and contribution of economic activities, in order to make a comprehensive analysis and evaluation in ecological economic system.The results showed that the first Wuhan City 2003 - 2013 area of cultivated land is decreasing, the decline of cultivated land is mainly for the national infrastructure area, other infrastructure covers an area and other, the largest share of national infrastructure.Second,The total input value of the cultivated land use system is basically a steady upward trend, which can update the organic value and the non-renewable industrial auxiliary energy value.Third,Emergy output of cultivated land ecosystem was the largest in 2003 and 2004. The total value output decreased greatly from 2004 to 2005, while the general trend from 2005 to 2013 was slowly increasing.Last,the cultivated land in Wuhan City emergy yield generally low, low efficiency,operating efficiency is not high,the value of arable land can use intensity in the growing trend,the system stability index is not high,the automatic control system, regulation and feedback We need to be strengthened.

ID: C-11021

Evaluation of the urban landscape structures and dynamics of Hawassa City, using satellite images and spatial metrics approaches, Ethiopia

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Abstract — The study deals with the analysis of urban expansion and land transformation of Hawass City using remote sensing data and landscape metrics during the last three decades (1987–2017). Remote sensing data from Various multi-temporal satellite images viz., TM (1987), TM (1995), ETM+ (2005) and OLI (2017) were used to examine the urban expansion, growth types, and spatial isolation within the urban landscape to develop an understanding of the trends of built-up growth in Hawassa City, Ethiopia. Landscape metrics and built-up density were employed to analyze the pattern, process, and overall growth status. The area under investigation was divided into concentric circles with a consecutive circle of 1 km incremental radius from the central pixel (Central Business District) for analysis. The result exhibited that the built-up area had increased by 541.32% between 1987 and 2017and an extension growth types (more than 67 %) was observed. The major growth took place in north-west direction followed by the north direction in a haphazard manner during 1987–1995 period, whereas predominant built-up development was observed in south and southwest direction during 1995–2017 period. Landscape metrics result revealed that the urban patches density, total edge, and edge density increased, while mean nearest neighbors' distance decreased showing the tendency of sprawl.

ID: C-11022

The amenity value of of lake landscape in urban residential areas：estimates from a hedonic pricing model for Donghu

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Abstract — The purpose of this study is to provide a scientific basis for decision makers to coordinate the relationship between the protection of Donghu ecological resources and economic development by measuring the amenity value of Donghu, and to minimize the negative impacts associated with urbanization.The research method is to apply hedonic price model to construct the functional

relationship between the housing prices and the distance of Donghu and calculate the the spatial influence radius of the Donghu base on the distance price elasticity. The results show that 1)The greening rate, the distance to the park and the distance to the Donghu landscape have a significant impact on the housing prices, indicating that the buyers prefer the residential housing with good surrounding environment. 2) The impact of Donghu on housing prices is reduced by the increase in distance, and the spatial influence radius of the Donghu on the surrounding housing prices is 3.5 km. 3)The paper divides the spatial influence radius of the Donghu into three distance layers: 1km, 1-2km, and 2-3.5km,the increment per unit area of each distance circle layer is 1413.34 yuan/m2, 603.50 yuan/m2, 169.94 yuan/m2, respectively, the first layer contains more amenity value of ecological landscape, and the amenity value of Donghu which be capitalized in the housing prices is 6.338 billion. In conclusions, The amenity value measured by the Hedonic Price Model not only confirms the importance of the Donghu landscape to the public, but also provides scientific information for real estate developers, and policy makers provide useful information for regional-scale land use planning and land taxation.

ID: C-11023

The Continuous Monitoring and Instant Service Method for Flood Events under the Sensor Web Environment

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Abstract — Flood events occur frequently around the world, and have been causing devastating effects on the industrial productions and people's lives. Continuous monitoring and instant service is of great significance to improving the coping and responding efficiency of flood events. However, existing flood studies focus on the discrete cross-sectional monitoring and lagging service, hindering the effective management and decision-making of flood events. To resolve the abovementioned problems, this paper adopted the way of dividing the flood process into the four phases of mitigation, preparedness, response, and recovery, set detection rules for different phases, and proposed the process-based flood detection and service (PFD&S) method. PFD&S is able to determine different flood phases based on the detection rules and provide the corresponding services according to the flood phases. PFD&S is sensor web - based, and it is composed of the four layers of the sensor layer, the data access layer, the flood detection layer, and the flood service layer, and the last three layers is the core of this paper. The sensor layer is to provide the data source, and it is composed of flood sensors, i.e., rain gauges, and water level gauges, etc. The data access layer is responsible for accessing heterogeneous flood sensors, and it consists of the Access Adapter (to transform the sensor metadata and observations into standard formats) and Sensor Observation Service (SOS, to insert sensors and observations into the database). The flood detection layer is used to filter the sensor observations from the data access layer based on the detection rules and make judgment on the flood phases. It includes the detection rules and Sensor Event Service (SES) (to filter the observations), SOS-SES-Feeder (middleware of SOS and SES and to deliver observations from SOS to SES), the processing unit (to determine the flood phases), and the Web Notification Service (to notify the flood service layer). The flood service layer could provide phase adaptive services, and the services include water level prediction, flood warning, and flood statistics. The PFD&S prototype was designed and implemented by adopting the idea of the PFD&S method. Huanghan basin (Hubei, China), was selected as the experimental area, and two flood events occurring during July 2016 were taken to validate the proposed PFD&S method and prototype. The results demonstrated that the proposed PFD&S method and prototype could instantly implement the flood phase determination and provide the corresponding services in 2.7 minutes.

Knowledge-based Interactive Workflow Engine of Collaborative Geographic Simulation

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Abstract — Background: Global change and sustainable development research are the frontier of international geoscience in the 21st century. In response to this global issue, it is required to integrate human social activities into the unified framework of global change and sustainable development research, in which their mutual relations and functional mechanisms should be figured out. This brings about several challenges in the research: 1) The complexity of geographic problem calls for experts from different domains to contribute their knowledge for collaborative research; 2) A large amount of geographic resource like heterogeneous data and models are needed to be effectively organized and utilized; 3) The lack of geospatial workflow version control method makes it difficult to reproduce the geographic experiment. Objectives and Methodology: For the simulation and the analysis concerning with the interaction between global climate change and human activities, this paper designs and proposes three methods to meet above challenges: 1) Putting forward a knowledge-driven hierarchical scenario modeling method based on the theory of knowledge engineering. The logic structure of this method is formed from three stages including concepts modeling, instance modeling and algorithms modeling. 2) Constructing an interactive workflow engine of geographic problem solving process for multi-role geographic collaboration. The key steps for designing, executing and monitoring, as well as sharing and reusing of the workflow are described in detail. 3) Proposing a geographic experiment version management method drawing on the concept of version tree to enable the experiment reproducibility and expandability. Result and Discussion: On the basis of methods mentioned above, according to the characteristics and life cycle of geographic problem solving process, this paper build up a "data - model - visualization - simulation - analysis" integrated Virtual Geographic Environment (VGE) framework. Taking the national crop yield simulation and evaluation as a case study, the integration framework provides a visual scenario modeling environment, a collaborative simulation and analysis environment, and an open decision-making environment for the simulation process of crop yield under the impact of human-environment interaction.

Mapping 10-m forest type area in Southern China with temporal-spatial-spectral features derived from Sentinel-2 time series images on the Google Earth Engine

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Abstract — Mapping high resolution forest type covering large areas accurately and rapidly is of great importance for addressing the global forest sustainable development. Accurate forest type characterizations at medium-resolution (10-30m) have remained an ongoing challenge, especially over large areas. This paper put forward a method for forest type classification using spectral-spatial-temporal (SST) features derived from Sentinel-2 time series images for the years 2016 to 2018 in southern China. Specially, multi-year spring and autumn Sentinel-2 data composites were used to derive the spectral and spatial features, all images from 2016 to 2018 were used to extract temporal features based harmonic method. Combined with DEM and Synthetic Aperture Radar (SAR) Sentinel-1 data, the classification results were evaluated using both pixel-based and object-based random forest (RF) classifications implemented on the GEE platform. The results revealed the superiority of the object-based approach relative to the pixel-based classification for forest type mapping. An overall accuracy of 85.28% and a Kappa coefficient of 0.80 were achieved with the SST features using an object-based

RF classifier, wherein all forest classes and non-forest classes were correctly identified with accuracies beyond 80%, respectively. In addition, the importance assessment of features indicates that spectral features contribute the most to the forest type classification, followed by spatial features and temporal features. This study represents an important step toward large-scale forest type and land cover mapping using SST features derived from Sentinel-2 time series data, and provides an understanding of feature priority in forest type classification.

ID: C-11027

Spatial-temporal Evolution and Influence Factors of Service Industry of Country-Level in Henan province from 2006 to 2016

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Abstract — With the adjustment of the global industrial structure, the service industry has become the main driving force for economic modernization and an important indicator of economic growth gradually. Based on the statistical analysis and ESDA method, this paper explored the spatial and temporal disparities and influence factors of service industry in Henan province on county scale. The results show that: (1) The service industry in Henan Province developed rapidly, and the development gap between Henan province and the international average increased first and then reduced from 2006 to 2016; (2) The absolute difference of service industry of county-level in Henan province continued to expand, and the relative difference fluctuated unsteadily; (3) The development level of service industry in most counties were lower than the average level of the whole province in 2006, 2011 and 2016, accounting for 69.05%, 76.19% and 75.61% respectively; (4) H-H and L-L type areas were concentrated in Zhengbianluo area and the eastern region respectively. H-H type area was shrinking continuously and has been transformed from concentration to separation; (5) The added value of per capital service industry was positively correlated with the level of urbanization, the degree of economic openness and the ability of science and education. Based on the above analysis, it is suggested that Henan Province should accelerate the development of service industry in the agglomeration area and focus on the construction of Zhengbianluo economic corridor. At the same time, the development of underdeveloped areas should not be neglected.

ID: C-11028

Statistical downscaling simulation of precipitation in the data-scarce Tianshan Mountains, northwest China based on the Earth system data products

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Abstract — Precipitation in mountains is an important source of water supply and an important hydro-climate variable in the arid regions of northwestern China. However, the precipitation data in the mountains of northwestern China are scarce because of the rare meteorological observation stations, which results in the errors of hydrological forecast. Therefore, adopting an effective method to obtain high-precision precipitation data in the mountains of northwestern China is an important problem to be solved. Selecting the Tianshan Mountains of northwest China as a target, this paper developed a statistical downscaling method based on the Earth system data products to address this issue. For downscaling simulation of the precipitation in the data-scarce mountains, we fitted the nonlinear regression model monthly and rectified it by bilinear interpolation. The accuracy of the model was verified by the observed precipitation in 24 meteorological observation stations, and the coefficient of determination ($R2 = 0.713$) and Nash–Sutcliffe efficiency coefficient ($NSE = 0.709$) indicated the

good performance of our model. By using the model, we obtained the high-precision and high-resolution precipitation dataset from February 2000 to February 2018 in Tianshan mountains with a spatial resolution of 1km×1km. By analyzing the precipitation dataset, we found that precipitation is more in summer and less in winter. Its spatial pattern is that precipitation is the most in the Middle Tianshan and it in the West Tianshan is more than that in the East Tianshan, and it in the north slope is more than that in the south slope. In the past 18 years, precipitation presents a slow upward trend with an increase of 21mm per decade. In addition to the effects of local climate, the Arctic Oscillation in summer and the North Atlantic Oscillation in previous winter are the key factors in inducing precipitation to increase in Tianshan mountains on the global scale.

ID: C-11029

MindReader: A Knowledge-graph-aware Personalized Travel Recommendation System

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Abstract — Since trip-planning is a time-consuming task, there is always a need for a system that can recommend tourist locations to match the tourists' interests from a potentially overwhelming set of choices. The personalized travel recommendation systems can admirably fulfill the requirement, which considers tourists' historical sequences of visited attractions and makes recommendations based on their potential preferences. However, current travel recommendation systems usually suffer from the sparsity of tourist-location interactions and the cold start problem. To alleviate these limitations, researchers have proposed incorporating side information into recommendation, such as social networks, comments, images. Among a variety of side information, knowledge graph (KG), which contains fruitful facts and connections about things and concepts so as to represent the real world as a directed heterogeneous graph, has caused great attention and reaction in the field of research on artificial intelligence. Therefore, we propose MindReader, a novel knowledge-graph-aware personalized travel recommendation system, which also takes spatiotemporal distribution patterns of travel behaviors into full consideration. Our system models the propagation of interest on the knowledge graph referring the ideas of collaborative filtering and knowledge graph embedding in the way that the two tasks are jointed into unified training framework, and outputs the probability of the tourists' visiting the non-arrival attractions finally. We employ Gaussian Mixture Model to describe the polycentric geographic distribution of travel behavior, and utilize Attention Mechanism to model periodicity and consecutiveness. Owing to lack of a professional travel knowledge graph, we extract the related subgraph from common KGs and attributes information about scenic spots from travel social sharing website, so as to construct a minitype domain specific KG for our recommendation system. Results show that our knowledge-graph-aware personalized recommendation system is able to predict tourists' preferences to an unknown tourist location precisely, and generate better recommendations compared to other state-of-the-art travel recommendation systems.

ID: C-11030

Estimating Ground PM2.5 Concentration Using Spatial Varying Coefficient (SVC) Model

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Abstract — China is facing with severe air pollution problems, especially fine particulate matter (PM2.5), in the rapid development. Ordinary interpolation is hard to reveal the characteristics of distribution of PM2.5 concentration for distribution of monitoring stations resulting in poor

interpolation accuracy. Simple linear regression often neglects spatial correlation among geographical objects. In this paper, with Yangtze River Delta region as study area, to capture the spatial varying coefficients, we use spatial varying coefficient (SVC) model to estimate ground PM2.5 concentration and take remote sensing data such as AOD, NDVI, DEM and meteorological data and social data like density of road network and factory as independent variables. Model comparison covered spatial varying coefficient model (SVC), eigenvector spatial filtering model (ESF) and global multiple linear regression (GMLR), the result shows that SVC model has a better performance than ESF and GMLR model. The annual SVC model explains 78.2% of the variability in PM2.5 concentrations, 10.3% and 22.2% more than the ESF and GMLR model respectively. To further analyze the characteristics of YRD region's PM2.5 concentration distribution, the annual PM2.5 concentration distribution map are illustrated.

ID: C-11031

Analysis of spatial disparities in health care accessibility: the comparison between the central part of two typical cities in China

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Abstract — In recent years, the easiness for people to get health care service is receiving a growing concern. To analyze the disparity of health care accessibility would help evaluate the fairness of health care resources distribution, which is important for a balanced social and economic progress. Therefore, in this paper we put forward a new method based on ANOVA in analyzing the spatial difference of accessibility. This method could determine whether the differences between regions in study area are significant. A spatial lag model is applied to filter out the influence of spatial autocorrelation and the KD2SFCA model is used under 24 different thresholds for accessibility calculation. We choose two typical cities in China: Beijing and Wuhan as study area to compare the disparity character of health care service distribution within. The results show that the health care resources are equally distributed in central Beijing in all 24 thresholds. However, under the threshold from 25 minutes to 40 minutes the health care accessibility within central Wuhan shows significant difference within districts. Our study hopes to provide some new insights into the spatial difference analysis for accessibility.

ID: C-11032

Exploring the Spatial Segregation of New Migrants Based on Activity Space: A Big Data Approach

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Abstract — Socio-spatial segregation based on income inequality is an important social issue. Particularly, the segregation and integration issue of migrants have been received wide attentions because most of them have lower economic status. Rather than focusing on residential space of migrants, this study investigates new migrants' daily activity space and the disparities with two settled income groups. This study uses transport modes as the proxy for different income groups, and identifies new migrants, settled low- and middle-income (LMI) residents and high-income (HI) residents from two types of big data (public transit smart card data and vehicle plate recognition data). This study examines activity space from multiple dimensions: (1) activity distribution (2) activity intensity (3) activity extensity (4) activity diversity and (5) exposure to activity space. Through a case study of Shenzhen, the biggest migrant city in China, results show that new migrants are well integrated with settled LMI residents and segregate with HI residents. By examining the geographic distribution of daily activities,

new migrants and settled LMI residents have presented similar distribution patterns for both regular activity locations (e.g., home and workplace) and less regularly visited activity locations and different from HI residents. By investigating activity intensity, activity extensity and activity diversity, we find that new migrants have similar number of frequently visited activity locations, travel territory and exhibit a similar level of activity diversity with settled LMI residents. In contrast, HI group has a larger activity extensity and more diverse activities on average. We further compared the intra-group exposure and inter-group interaction potential in individual activity space, which also suggests that new migrants have strong interaction potential with settled LMI residents and little interaction with HI group. These findings provide a solid evidence that socio-segregation exists between different socioeconomic groups. Our findings have implications for facility urban resources planning and public transport planning for a more diverse and equal society.

ID: C-11033

A Multimodal Learning Method for Domain Topics Classification in OGC Web Map Services

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Abstract — In the last decade, Web Map Service (WMS) has become a popular geospatial data sharing standard, and hundreds of thousands of WMS layers have been published from thousands of providers. It could provide researchers with valuable datasets across various scientific domains. However, there is no specific metadata element to clarify its domain topics in the standard, which is important for efficient and effective data discovery. There have been some methods proposed to automatically identify layers' domain topics. However, to the best of my knowledge, all of them only considered layers' textual descriptions (e.g. title, keywords, abstract) which are sometimes incomplete or insufficient for domain topics identification. In fact, WMS layers consist of textual description, maps, and legends. Each of them contains some useful information for layer content understanding. Therefore, this paper proposes a multimodal learning method to incorporate both textual description and visual content to improve the domain topic classification accuracy. Firstly, we summarize and identify fourteen popular domain topics by literature review. Secondly, some transfer learning based methods and Natural Language Process (NLP) based methods are used to train basic classifiers on visual and textual contents separately. Finally, a systematic method is devised to combine their results for domain topics classification. To validate the effectiveness of the proposed method, we developed a web-based collaboration platform with interactive graphical user interface (GUI), and thousands of layers are manually labeled by users from our research group. We performed experiments on the labelled samples and compared with a textual description-based method, and results showed that our method could significantly outperform it.

ID: C-11034

Multi-granular POIs identification from trajectories using hierarchical GMM-RF model on Web Map Service Platforms

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Abstract — With the proliferation of Internet usage, Web map service platforms (WMSPs) such as Google Maps, OpenStreetMap, and MapWorld (Tianditu) facilitate location queries and path planning. While users get geographic information through WMSPs, their access processes are recorded in the logs of the platform and can be utilized to trace users' trajectories and mine users' points of interest (POIs). There are many researches on the method of trajectory semantic point extraction for GPS in a single granularity. However, the spatial structure of the user's trajectory is similar to a multi-granular pyramid,

which is the data organization structure of web map tile service (WMTS). These existing methods cannot be applied to multi-granular POIs identification of user's trajectory on WMSP. Therefore, we proposed a hierarchical Gaussian Mixture Model and Random Forest model (hierarchical GMM-RF) to detect POIs of user's trajectory on WMSP, which includes three steps. Firstly, to simplify the trajectories in the form of continuous surface feature generated by user acquiring data taking the browser as the window, which is different from the other trajectories with point feature, we constructed a spatiotemporal cube to reduce the dimension of the trajectory from surface feature to point feature by convolution sampling. Secondly, the noise filtering was realized by combining the median filtering of the time dimension and outlier detection of the spatial dimension. Thirdly, since spatial aggregation of track points is closely related to the layer, in another word, the observation level determines whether it is clustered or not, we proposed a hierarchical Gaussian Mixture Model (GMM) clustering algorithm to construct a multi-branches tree recursively describing the multi-granularity spatial structure of the trajectory. Then we used Random Forest (RF) model to detect the POIs of the user's trajectory from the multi-branches trees. Finally, experiments using real-world trajectory data from MapWorld log files were conducted for evaluations of the proposed approach. This research will help to understand the behavior patterns and needs of users in WMSP.

ID: C-11035

Flow-weighted Graph Convolution Recurrent Network for Short-term Traffic Speeds Forecasting

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Abstract — Predicting large-scale traffic speeds in urban areas is a key part of Intelligent Transportation Systems (ITS). Accurate traffic speed forecasting can help improve transportation dispatching and guide urban travelling. This task is challenging due to the complexity of spatial and temporal dependencies among traffic conditions of the road network. Existing convolution-based approaches mostly capture the spatial correlations between the predicted road and its K-order adjacent roads by locally or globally convolution operation. However, they neglect the influence levels of different adjacent roads to the predicted road, and differences between impacts from upstream and downstream roads. In this paper, we propose the Flow-weighted Graph Convolution Recurrent Network (FGCRN) to forecast short-term traffic speeds of the road network. Specially, Graph Convolution Network (GCN) weighted by traffic flow volume is utilized to capture the spatial features from upstream roads and downstream roads separately. Then the two features are fused and fed into Long Short-Term Memory (LSTM) to extract the temporal dependencies of the traffic dynamics. Experiments on real traffic datasets in Chengdu, China, demonstrate that the proposed model achieves competitive performances compared with the other state-of-the-art methods.

ID: C-11036

Research on the Construction Method of the Service-Oriented Web-SWMM System

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Abstract — Research on the Construction Method of the Service-Oriented Web-SWMM System Abstract: On a global scale, with the acceleration of urbanization and the continuous expansion of cities, the problem of urban flooding has become increasingly prominent. An increasing number of experts and scholars have begun to focus on this phenomenon and build corresponding models to solve the problem. The Storm Water Management Model 5 (SWMM5) is a dynamic rainfall-runoff simulation model developed by the US Environmental Protection Agency (EPA); this model simulates urban flooding and drainage well and is widely favored by researchers. However, the use of SWMM5 is relatively cumbersome and limited by the operational platform, and these factors hinder

the further promotion and sharing of SWMM5. Based on the OpenGMS platform, this study first encapsulates, deploys and publishes SWMM5 and further builds a web service page for the model and implements Web-SWMM for network services. With Web-SWMM, users can conveniently use network data resources online and call SWMM5 to carry out calculations, avoiding the difficulties caused by the localized use of SWMM5 and enabling the sharing and reuse of SWMM5. Keywords: urban flood simulation; SWMM; Web-SWMM; model; service

Research on coupling and integrating Model-3 models for Air Pollution Simulation

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Abstract — The problem of air pollution is becoming more and more serious. How to use air quality numerical models to simulate and predict various pollution sources has become an urgent problem to be solved in current air pollution forecasting area. At present, Model-3, the third generation air quality model developed by the US EPA, is widely used in air pollution prediction. It requires different modules to simulate related air pollution processes, and the input/output data of each model are complex and interrelated that hinder usage the model. So it is important to integrate the required models for air pollution simulation research. Starting from the convenient usage of Model-3 model, this study couples and integrates The Weather Research and Forecasting Model (WRF), the Sparse Matrix Operator Kernel Emission System (SMOKE) and The Community Multiscale Air Quality Modeling System(CMAQ). The study uses meteorological prediction data and pollution source emission data as input data, simulates physical and chemical changes in the atmosphere, calculates the concentration of various pollutants in the simulated area to predict pollution sources, simplifies complex processes of multiple modules, and reduces the threshold for the use of the models.

Preliminary Study on Network Collaboration Mode Oriented to Geographic Modeling and Simulation

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Abstract — Introduction In order to solve the comprehensive geographic problems with complex processes and mechanisms, gathering experts from different domains for collaborative geographic analysis, model building and process simulation become trend in geographic research by the development of computer networks. However, it is still a lack of collaborative strategies and tools to support geographic problem solving. Research methods This paper focuses on the problems related to geographic modeling and simulation for collaborative geographic problems solving, and explores the collaborative solutions for discussion and analysis of geographic model building and simulation. Result A series of collaborative modeling and simulation tools are designed, and a collaborative geographic problem-solving platform is built. Users can participate in the discussion, modeling and simulation of geographic problems by registering and login. Analysis and discussion For multi-user communication and real-time collaboration, this paper chooses WebSocket technology to show the operation process to other users in real time while using tools. In addition, for multi-user simultaneous operation, lock mode is adopted to solve the problem of operation mutual exclusion. The above technology solves the problem of data transmission and display, improves the efficiency and ensures the stability of transmission. Conclusion The research strengthens the cooperation and exchanges among experts from different regions and fields, and provides a preliminary scheme for multi-experts to solve the comprehensive and complex geographic problems.

ID: C-11039

A Parallel Computing Paradigm for Geo-analysis Models in the Distributed Web Environment

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Abstract — Geo-analysis models are the abstraction and expression of the geographical process and geographical phenomena in the real world. To date, there are many geo-analysis models have been created in various disciplines. With the arrival of the big data era, long model calculation time and huge data volume hinder geo-analysis models sharing and usage. As one of effective solutions for model running, urgent for parallel computing of geo-analysis models is increasingly. However, the heterogeneity of the geo-analysis models makes the parallelization solution which based on model source code full of challenges. How to satisfy the need of parallelization without changing the geographic analysis model is an urgent problem. The rise of distributed computing framework and distributed storage framework in cloud computing technology has brought new development opportunities. Through studying the adaptability of various distributed parallel frameworks in the cloud computing environment for the geo-analysis model, this paper aims to design a distributed parallel solution to explore the key issues in distributed research such as parallel computing, resource scheduling, and cluster dynamic expansion in model running. This paper use RLS90 model as case to show the distributed parallel solution we provide in this paper can support the application of geo-analysis model in distributed parallel environment, and further promote the sharing and reuse of geographic analysis models in the network.

ID: C-11041

Remote Sensing Classification Method of Vegetation Based on Mountain Altitude Belts

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Abstract — Abstract: Vegetation is an important component of the environment and the remote sensing classification of vegetation has become a research hotspot in recent years. At present, in the process of extracting the information of mountain vegetation, we normally get samples of classification by manual operation, which is time-consuming and inefficient when the research area is large. In addition, the selection of samples is also a key problem that restricts the automation extraction of vegetation information. The distribution of vegetation is closely related to climate, topography and soil, and has certain horizontal and vertical zonal laws. According to the mountain altitudinal belts of vegetation, the altitude ranges of different vegetation types and their spatial adjacent relations can be obtained. In order to improve the accuracy and efficiency of sample selection, taking Taibai Mountain as the experimental area, this paper uses the data of altitudinal belts of Taibai Mountain vegetation, high-resolution remote sensing image (GF1/ZY3) and 1:10000 digital surface model (DSM) to classify. Firstly the terrain constraint factor with altitudinal belts information of vegetation is constructed to assist in automatic selection of samples, then object-oriented method is adopted to extract vegetation information. The study shows that the application of altitudinal belts information to classification can effectively improve the accuracy and efficiency of mountain vegetation classification.

ID: C-11043

Comparative study on the mountain elevation effect of the Tibetan Plateau and the Alps and their implications for alpine tree lines

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Abstract — Mountain effect not only has a significant impact on climate, but also has a far-reaching impact on the geo-ecological pattern, especially on the importance of the vertical distribution and structural types of mountain areas, which has been recognized by geographers and geobotanists. At present, a large number of related studies mainly focus on the quantification of mountain effect, but lack of comparative study of different mountain effects. Based on the collected Meteorological Observational data, the temperature data of Qinghai-Tibet Plateau and Alps based on MODIS surface temperature estimation, forest line data and DEM data. First estimate the temperature using the Geographically weighted regression (GWR) method. This paper makes a comparative analysis of the distribution height of isotherms of the coldest month and the hottest month in the Qinghai-Tibet Plateau and Alps, and the temperature difference and the distribution law of forest line at the same latitude and altitude to explore the mountain elevation effect and influence of the two mountains. The results show that: 1) At the same latitude and altitude, the temperature of the Qinghai-Tibet Plateau is basically higher than that of the Alps, especially in the summer half year. 2) The monthly isotherm altitude of the Qinghai-Tibet Plateau and the Alps increases gradually from the eastern margin to the interior, and the monthly isotherm altitude of the Qinghai-Tibet Plateau is higher than the altitude of the Alps isotherm, especially that of the hottest month in the Qinghai-Tibet Plateau, which is 2000-3000m higher than the interior of the Alps, and that of the coldest month is 1 500 m higher than the interior of the Alps. 3) The mountain body effect makes the temperature inside the mountain body higher than that outside at the same altitude, which results in that the height of the forest line in the two mountains is higher than that in the marginal areas, and the height of the forest line in the Qinghai-Tibet Plateau is higher than that in the Alps. The temperature, the height of isotherm and the distribution law of forest line at the same latitude and elevation in the two mountainous areas indicate that the mountain effect and its influence on the Qinghai-Tibet Plateau are stronger than those on the Alps.

ID: C-11044

Calculated River Flow Attenuation Base of Ungauged Catchments in the Taklamakan Desert

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Abstract — The Taklamakan Desert serves as an indicator of global climate change, and the changes in river flow directly impact the local natural environment, irrigation, and water diversion. It is important to study the attenuation base of desert rivers to maintain the integrity of the surrounding ecosystems. Therefore, there is an urgent need to increase the precision of information on and deepen our understanding of the attenuation bases of desert rivers. This study presents a new method of rapidly assessing river flow by coupling unmanned aerial vehicle (UAV) and ground-based monitoring. Here, a UAV was used to calculate river course cross sections with high-resolution stereoscopic images. The results showed that the cross sectional area and hydraulic slope of the river were obtained by the UAV. Combined with ground-based water level monitoring and river bed topography, the flow rates of river sections were estimated. The calculated results were consistent with the measured data and the accuracy was > 85%. Combined with satellite remote sensing, the results showed that the base of runoff attenuation in the lower reaches of the Hotan River is ~40%. Coupled UAV and satellite remote sensing

technology can provide technical support for the study of surface runoff in desert rivers within ungauged basins. The method used in this study to calculate river flow can better our understanding of basin river flow, and provide an important reference for river flow monitoring worldwide.

Calculated River Flow Attenuation Base of Ungauged Catchments in the Taklamakan Desert

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Beijing Normal University, China

Abstract — The Taklamakan Desert serves as an indicator of global climate change, and the changes in river flow directly impact the local natural environment, irrigation, and water diversion. It is important to study the attenuation base of desert rivers to maintain the integrity of the surrounding ecosystems. Therefore, there is an urgent need to increase the precision of information on and deepen our understanding of the attenuation bases of desert rivers. This study presents a new method of rapidly assessing river flow by coupling unmanned aerial vehicle (UAV) and ground-based monitoring. Here, a UAV was used to calculate river course cross sections with high-resolution stereoscopic images. The results showed that the cross sectional area and hydraulic slope of the river were obtained by the UAV. Combined with ground-based water level monitoring and river bed topography, the flow rates of river sections were estimated. The calculated results were consistent with the measured data and the accuracy was > 85%. Combined with satellite remote sensing, the results showed that the base of runoff attenuation in the lower reaches of the Hotan River is ~40%. Coupled UAV and satellite remote sensing technology can provide technical support for the study of surface runoff in desert rivers within ungauged basins. The method used in this study to calculate river flow can better our understanding of basin river flow, and provide an important reference for river flow monitoring worldwide.

Evaluation of Comprehensive Transport Superiority in the Core Area of Changsha-Zhuzhou-Xiangtan Urban Agglomeration Based on Big Data

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Abstract — In the context of China's new urbanization, the size of the core cities continues to expand. The core city and surrounding towns gradually developed into an integrated urban agglomerations. Integrated transport network with multiple modes of transportation already runs through each node between cities. Time-space accessibility and traffic demand across cities presents new features. With the development of the IoTs and information technology, time and space big data in the transportation industry can be collected in real time. How to use the big data technology to effectively assist the dynamic management and analysis of the comprehensive traffic of urban agglomerations has become a hot issue in the relationship of traffic management departments. The traditional method of evaluating the transport superiority has been unable to meet the needs of the rapid development of comprehensive traffic in urban agglomerations in the new period. There is an urgent need to promote the integration and innovation of big data technology in the field of transportation. Based on big data, a new urban agglomeration traffic advantage evaluation method suitable for the current status quo is urgently needed to be studied. In this paper, the research area is the core area of Changsha-Zhuzhou-Xiangtan urban agglomeration. The Static source data including basic geographic information data, comprehensive transportation network, traffic statistics data, etc. The dynamic source data includes real-time traffic monitoring data, GPS trajectory data, ticket flow data, VGI data, network location big data, etc. Aiming at the densely correlated spatial pattern of the core area of Changsha-Zhuzhou-Xiangtan urban

agglomeration, using small-scale township administrative divisions as the analysis unit, combining multi-source spatio-temporal big data and comprehensive traffic information, a new method of dynamic evaluation of comprehensive transport superiority areas based on big data is proposed. First, standardize processing of multi-source heterogeneous traffic data, unify spatial benchmarks, and perform assimilation of space-time scales. Further, the static and dynamic information is combined to perform dynamic extraction of important traffic nodes and the expression of associated spatiotemporal features. In order to overcome the subjective factors of traditional traffic dominance indicators, three indicators of comprehensive road network density, important traffic node proximity and comprehensive traffic accessibility are selected. The weight assignment and index calculation are carried out separately, and a new comprehensive data evaluation model based on big data is constructed. This method was experimentally verified in the core area of Changsha-Zhuzhou-Xiangtan urban agglomeration, and a real and reliable traffic advantage area result map was obtained.

ID: C-11048

Intelligent processing of social sensing data to assist rapid disaster response and mitigation

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Abstract — In the big data era, crowd-sourced data has been used for disaster response in many major disasters happened in recent years such as Earth quake, Hurricane, Flood, etc. Social sensing is a new concept in GIS study area proposed to describe the usage of social media data which contains near real-time and vital disaster information hidden in the abundance of user-generated text messages, news, pictures or videos. But it is a hard work to collect, filter, extract and understand disaster information of social media to help disaster mitigation. And the current disaster response system still need to be enhanced by using intelligent algorithms to extract useful information from social sensing data. In our research project, we proposed to use nature language processing and deep learning for intelligent processing of disaster information from social media for disaster response and mitigation. And we are developing a social media based disaster information system to detect disaster loss and sentimental analysis.

ID: C-11049

Unsupervised Representation Learning with GANs for Remote Sensing Images

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Abstract — With the development of the satellite sensor techniques, high resolution remote sensing images are becoming increasingly available. In order to make full use of the image information, supervised learning methods, such as Decision Trees and Convolutional Neural Networks (CNNs), play more important roles in remote sensing image processing. However, due to the limited amount of the labeled data, supervised models are always difficult to implement. Different form most existing works, we combine Generative Adversarial Networks(GANs) and spatial pyramid model to learn an unsupervised model. First, a remote sensing image data augmentation method is designed for producing more training images. Then, the Deep Convolutional Generative Adversarial Network (DCGAN) was built to form a discriminative model D, the feature extractor, and a generative model G. This network often loses the spatial context information. To provide a good descriptor for overall scene interpretation, especially for retaining the multiscale spatial layout structure, spatial pyramid pooling has been employed in this GAN model. We apply our method on two challenging high resolution remote sensing image data sets: UC-Merced dataset with 21 categories and NWPU-RESISC45 dataset with 45 classes. All the experiment results show that the proposed model provide competitive results compared to the state-of-the-art methods.

Statistical distribution of nonzero spatial autocorrelation parameter of a Simultaneous Autoregressive Model and its applications

Qing Luo, Daniel A. Griffith, Huayi Wu

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Abstract — This paper focuses on the spatial autocorrelation parameter ρ of the simultaneous autoregressive model, and furnishes its sampling distribution for nonzero values, for two regular square (rook and queen) tessellations as well as a hexagonal case with rook connectivity, using Monte Carlo simulation experiments with a large sample size. The regular square lattice directly relates to increasingly used, remotely sensed images, whereas the regular hexagonal configuration is frequently used in sampling and aggregation situations. Results suggest an asymptotic normal distribution for estimated ρ. More specifically, this paper posits functions between ρ and its variance for three adjacency structures, which makes hypothesis testing implementable and furnishes an easily-computed version of the asymptotic variance for ρ at zero for each configuration. In addition, it also presents three examples, where the first employed a simulated dataset for a zero spatial autocorrelation case, and the other two used two empirical datasets—of these, one is a census block dataset for Wuhan (with a Moran coefficient of 0.53, allowing a null hypothesis of, e.g., $\rho=0.7$) to illustrate a moderate spatial autocorrelation case, and the other is a remotely sensed image of the Yellow Mountain region, China (with a Moran coefficient of 0.91, allowing a null hypothesis of, e.g., $\rho=0.95$) to illustrate a high spatial autocorrelation case.

GIS Application in Watershed Processes Study

GIS Application in Watershed Processes Study
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Abstract —The Brodhead watershed drains an area of about 285 square miles in Northeastern Pennsylvania, emptying into the Delaware River. Major floods in the past years and rapid urbanization processes brought great changes in the river morphology, and created many new bank erosion sites. Private property, public infrastructure and wetlands face major threats due to the bank failures. It is critical to locate the potential bank erosion sites for future management. This study aims to predict the bank stability index based on GIS data layers and field investigation. The preliminary analyses indicate that the major controlling factors for bank failures in this region include flow velocity (substituted by riverbed slope), river valley slope (substituted by terrain stability index), bank materials (substituted by a ratio between clay and sand), soil wetness, stream channel sinuosity, riparian vegetation cover, and ratio between impervious surface and total area of watersheds. The bank stability index of over 300 sites with a 250-meter-interval along the tributaries has been collected in six sub-watersheds with Pfankuch-Rosgen Channel Stability Evaluation Method. Data from three sub-watersheds are used to develop a statistical model between bank erosion and its controls. The above-mentioned factors contribute to 78% of the bank stability index. This model is also used to predict the bank stability index in other three sub-watersheds. The results show that the bank stability index can be estimated by this statistical model with a reasonable accuracy and this model could be a good GIS-based tool for watershed management.

Keyword: Stream bank stability, human impact, GIS，watershed process, flood

ID: C-11053

The Missing Parts from Social Media Enabled Smart Cities: Who, Where, When, and What

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Abstract — In recent decades, Social Network Sites (SNS), such as Facebook and Twitter, have attracted users worldwide by providing a means to communicate and share their daily lives. Meanwhile, the wide spread use of smart phones, which are equipped with sensors that allow users to instantly locate themselves, has brought another crucial aspect to this development: location. Previous studies have used location-based social media (LBSM) as potential resources to characterize social perceptions of place and model human activities in various smart city applications. However, similar to other types of big (geo) data, LBSM data may have critical sampling biases. If LBSM data are applied to decision-making in smart city services, such as emergency response or transportation, it is essential to understand the biases of such data in order to justify policies or management practices. This study aims to examine the biases of LBSM data from various perspectives, including but not limited to those of spatial, temporal, sociodemographic, and semantic. A series of empirical cases will be provided to support the examination of such biases and their impacts on smart city applications. This paper will further discuss the strategies to improve the efficiency of LBSM data in smart city services through incorporating different public data. The results will provide valuable inputs for understanding how LBSM biases manifest themselves in various applications in urban planning and policymaking.

ID: C-11054

Semi-Automatic Image Classification based on Transfer Learning

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Abstract — Land cover/use types extracted from high spatial resolution satellite images are widely applied in various fields, such as urban planning, ecological monitoring, and disaster assessment. In this paper, we exploit historical labels in image classification through the object-based transfer learning method. Training samples selected from the historical labels, together with the manually labeled samples, are used in this approach. The multispectral ZY3 images are used in the experiments. Results show the effectiveness of the proposed method, which provides some insight into labeling time reduction in the process of land cover/use classification.

ID: C-11055

A two-step scheme for mapping regional high resolution urban impervious surface

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Abstract — Urban impervious surface is usually a man-made landscape which prevents water infiltrating into the soil. Mapping high resolution impervious surface has been aroused wide attentions for urban studies, such as detailed modeling of urban ecosystem. Using high resolution remote sensing imagery can generate high resolution impervious surface map naturally. However, high resolution imagery is not suitable for large area mapping. Due to small cover area for a high resolution image, it needs a large amount of image which brings high cost. Nevertheless, the Medium resolution imagery are mainly for free, such as Landsat and Sentinel, and widely used for land use land cover mapping. In reality, for large continuous pervious surface areas, there should be no difference in mapping from

medium resolution imagery and high resolution imagery, where it is enough for medium resolution imagery rather than high resolution imagery. In area with obvious or suspected feature of impervious surface, it comes the need for high resolution imagery to delineate impervious surface and pervious surface subtly. In real regional area, the percentage of impervious surface would be extremely low. Taking Wuhan city as an example, area of Wuhan is 8569.2 km2 in the 2017 statistics. But area of impervious surface is 628.11 km2, only covering 7.33% surface of Wuhan. That triggers inspiration to propose a novel two-step scheme for mapping regional high resolution urban impervious surface using both medium and high resolution remote sensing imagery. The core of idea is two steps: 1) coarse impervious surface classification using medium resolution imagery in total study area; 2) refined impervious surface extraction using high resolution imagery in the coarse impervious surface area detected from step1. This scheme makes respective advantages in medium and high resolution imagery complementary to each other, ensures quality and saves costs at the same time in mapping large area urban impervious surface. The scheme in this research will be implemented in Wuhan city using Landsat 8 as medium resolution image source, and GaoFen2 as high resolution image source. Additionally, with the join of more spectral information from medium resolution imagery, it is hopeful to further reduce the confusion between impervious surface and land cover, and therefore obtain higher mapping accuracy.

UAV-based high spatial resolution monitoring and estimation of soil moisture status in a grape vineyard

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Abstract — Drone or UAV based RGB and thermal infrared remote sensing is rapidly becoming a useful tool for monitoring crop and soil water status for precision farming. Thermal infrared sensor can quickly determine the surface temperature of crops and soils, while high resolution RGB or color images allow to build detailed digital surface elevation models. The objectives of this study are: 1) flying unmanned helicopter to collect large foot-print RGB and Infrared aerial images during the growing season; and 2) producing high resolution digital surface models (DSM) and color imagery mosaics to help farmers to predict soil moisture status in the study vineyard. The vineyard is located in Eden Valley, Erie County, New York, USA. A total of four field aerial surveys were conducted during the grape growing season of 2018 from May to August. Both RGB mosaic maps and DSMs of the study vineyard were processed. A comprehensive soil moisture prediction index (SMPI) model was proposed in this research based on previously published model of normalized difference water index (NDWI, Xie, C. et al. 2016) and model topographic wetness index (TWI, Lei, S. et al. 2016). This model combines factors both of the radiant reflection properties by moisture bearing surface and vegetation and the micro-topographic positions in the field. The digital maps of SMPI show that the low moisture content areas are mainly concentrated in the northeast part of the farm during May. The low moisture stress intensity decreased, but the distribution of relative low moisture content areas increased from May to June and from June to July. The drone remote sensing predictions are coincident with those ground sample tests. In addition, digital imagery maps can also provide distribution information of soil moisture stress in the study area.

ID: C-11057

Urban flood risk assessment and zoning in road environments: a case study of the Chang-Zhu-Tan Urban Agglomeration, China

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Abstract — Flood has been a high frequency natural disaster that severely threatens people's lives and social developments worldwide. The transportation plays a key role in urban development, however road elements in the transportation are vulnerable to flood. There are many analyses in different scenarios of urban flood risk assessment, but few in road risk zoning. Therefore, the study proposed a Road Risk Zoning Model (RRZM), which was applied to the flood risk assessment and zoning in the Chang-Zhu-Tan Urban Agglomeration (CZTUA), China. The RRZM involves three steps. Firstly, we used the Soil Conservation Service (SCS) model based on the rainfall and land use type to obtain submerged depth by floods. The Analytical Hierarchy Process (AHP) method considering four basic road data was used to obtain the degree of road importance as well. The results of the above two parts were used to represent the road vulnerability. Secondly, based on the flood hazard factors and the exposure factors of hazard-affected bodies, the grade of urban flood risk was evaluated based on the Back Propagation Neural Network (BPNN) which was optimized by the Immune Genetic Algorithm (IGA). Thirdly, the results of flood risk assessment in road environment were calculated by formulas in the RRZM with the road vulnerability and the flood risk grade. We analyzed the spatial characteristics of flood risk with the urban flood risk zoning maps. The results showed that the spatial distributions of flood risk and the extents of road damage varied remarkably in different cities. Changsha was the most vulnerable city by flood in the CZTUA. Some zones were affected more seriously with their location in Xiangjiang river basin plain with high road density and urbanization level. The vulnerable road sections from the most serious flood risk zones identified in the maps carried more traffic volume than others. Once these sections were damaged by floods, the whole city would suffer great loss. Therefore, corresponding measures need to be taken with different flood risk zoning levels to reduce the loss. By comparing with existing methods, it was found that the RRZM effectively reflected the spatial characteristics of flood risk in road environment. The RRZM, as flexible as it is, can also be adapted to different regional characteristics by adjusting its parameters. In sum, it provides a new perspective for urban flood risk assessment and disaster response decision.

ID: C-11058

How deeply the vegetation physiology effects due to increasing CO2 impact the terrestrial future hydrologic cycle over China?

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Abstract — It is typically thought that hydrological change is affected by precipitation changes, however researchers have proved that precipitation changes as well as mean temperature changes contributed little on future hydrologic cycle. It is worth mentioning that vegetation physiology has a dominant influence on future terrestrial hydrologic response. This study aims to quantify how such vegetation [CO2] effects influence future hydrological variable responses over China. This experiment was conducted by multi Earth System models (ESM) ensemble from the idealized single-forcing Couple Model Intercomparison Project Phase 5 (CMIP5) experiments with [CO2] increasing at a rate of 1% per year, either (1) in the atmospheric model only, that is, acting as a greenhouse gas but not seen by the leaves; (2) in the vegetation model only, that is, prescribing radiatively transparent CO2 in the atmosphere; or (3) in both. Simulation (1) is called ATMO (esmFdbk1 in CMIP5 terminology). Simulation (2) is called PHYS (esmFixClim1 in the CMIP5 terminology), and simulation (3) is referred to as CTRL (1pctCO2 in the CMIP5 terminology). In all three simulations, CO2 is increased by 1%

each year for 140 years starting from preindustrial levels in 1850 for CanESM2, IPSL5A-LR, and MPI-ESM-LR and in 1860 for HadGEM2-ES. These idealized runs differ from the more common CMIP5 Representative Concentration Pathway 8.5 (RCP 8.5), an emission scenario from 2005 and 2010 that includes prescribed changes in land use and land cover scenarios, as well as aerosol and ozone forcing. All ESMs used here model the terrestrial carbon cycle, which allows LAI to vary in the simulations. Daily data are available for six models: bcc-csm1-1, CanESM2, CESM1-BGC, GFDL-ESM2M, HadGEM2-ES, and NorESM1-ME. For most of the models only one ensemble member is available— r1i1p1 in the CMIP5 terminology—so that we consider only one ensemble member per model. This study indicates that the physiological effects mainly impacts the future hydrologic cycle over China with the increasing CO2, while the control of precipitation and temperature is weak in general.

ID: C-11061

BeiDou satellite navigation simulation system on the CesiumJS virtual globe platform

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Abstract — In this paper, we implement the visualization of BeiDou navigation satellites on the CesiumJS virtual globe and integrate orbit determination of navigation satellites, orbit prediction and tracking and forecasting of ground station. Our ultimate goal is to build a BeiDou satellite navigation simulation system from two parts: spatial data and ground control. We combine the TLE data and the Simplified Perturbations Model (SGP4) to generate satellite orbit data, and use the PyEphem library to calculate the track of sub-satellite points. We record satellite position information using the new text language CZML. We combine Server-Sent Event (SSE) technology with CZML's unique streaming mechanism to visualize satellite trajectories and sub-satellite points. The system has four major functional modules, namely visualization of satellite orbit and sub-satellite points, orbit determination of navigation satellites, orbit prediction and tracking and forecasting of ground station. Users can view two-dimensional icons, three-dimensional models, annotations, trajectories and other information of satellites, so that users can set the satellite status displayed on the interface. The BeiDou satellite navigation simulation system on the CesiumJS virtual globe platform which has rich visual information and strong interactivity helps display the status information of BeiDou satellite in a more vivid and scientific way.

ID: C-11062

Extracting Road Turns And Intersections From Low Frequency GPS Trajectory data

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Abstract — Road Turns and intersections are the important component of road, without these points, all the applications about road will provide wrong responses. Therefore, in our method, we extract both turns and intersections. There have been a lot of studies about the extracting of road turns and intersections, however these studies are most bases on high frequency, high precision data sets and often face the difficulty of tuning parameters. So this study proposes a novel method for extracting road turns and intersections from GPS Trajectory data to deals with lower accuracy, lower sampling frequency and difficult parameter adjustment problems. Firstly, in order to makes the result more close to the real positions of the turns, we extract the the reverse intersections of turning points, then use the improved density peak clustering algorithm to extract the candidate points , Finally, PCA was used to prune the pseudo candidates points which landed on the road to identify the turns and intersections。 Experiments are performed to demonstrate the increased accuracy and this method can solve the above problems we mentioned.

ID: C-11063

A reconstruction method based on homonymy point index table of three views

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Abstract — In the process of three-dimensional reconstruction of sequence images, mismatching points are inevitable for feature matching due to the complexity of matching conditions. Moreover, when the angle between the polar lines is small, coordinates calculated by homonymy points may also have large errors. To eliminate mismatching points, a three-view constraint method is adopted in this paper. Every three sequence images are regarded as a reconstruction unit. The first and third images are respectively matched with the second, and the polar lines on the second view are simultaneously calculated. According to the principle of polar geometry, the two polar lines should intersect at the homonymy point in the second view. Otherwise, if the offset is greater than the threshold, the match will be treated as a mismatch. To solve the problem resulting from a small angle, we establish an index table of homonymy points according to the matching result of each three-view unit. Each row of the table represents a feature point, and each column represents a view. The table records in which images each point appears, and then the three-dimensional coordinates of a point can be calculated based on the information of multiple views. We designed simulation data and actual data experiments to reconstruct 3D point cloud. As shown in experiments, the three-view constraint method and the homonymy index table effectively improve the accuracy and robustness of the reconstruction results. It can be concluded that the proposed method achieved increasing homonymy of the feature points of multiple successful matches and multiple view information can effectively avoid error amplification caused by a small angle..

ID: C-11064

Research on vector tile map construction with data equalization principle

Mei Li, Ying Su, Ning Zhi, Yanxin Sun, Shanjun Mao

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Abstract — Traditional vector map tiles are widely used for WebGIS applications, such as OpenStreetMap. A series of small vector tiles covering the map extent evenly and tiles of multiple map scales are created before the map was requested. According to the research finding, the factors affecting the efficiency of vector tile map are the tile partition, tile organization and tile rendering. Once the map features are non-uniform distributed, the traditional method has some problems such as low efficiency of map rendering, and the longer system loading. Aiming at the above problems, this paper analyzes the process of partition and rendering of vector tiles and proposes a method of constructing non-uniform vector tiles based on data equalization method. The method constrains the feature number of tiles to ensure the relative balanced feature distribution during the tile partitioning. Unlike the tradition vector tile division method, the algorithm stops dividing the tiles when the number of map features is less than the threshold. That means the map tiles with dense-feature area are more than the tiles with sparse-feature area. In this paper, the loading efficiency of uniform vector tiles, simplified uniform vector tiles and non-uniform tiles based on data balancing method are compared in the the experiments. An example dataset is original data size of 356 MB and 137 map layers. The experiments prove that the loading time of non-uniform vector tiles runs twice faster than the simplified uniform vector tiles, and the research result greatly improve the end-user's experience.

The Spatial Pattern Study on Catering Industry based on Open Source Big Data in Beijing Central Urban Area

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Abstract — The extracting and application of spatiotemporal methodologies in dealing with big spatiotemporal data has opened new doors to urban system studies. Catering industry is a typical representative of urban tertiary sector. Therefore, it is of great importance to adopt appropriate spatiotemporal methods to study the spatial layout of urban system through open source catering data. Spatial clustering, as one of the most import methods in spatiotemporal data mining, has been widely applied in many field such as spatial point pattern analysis. However, traditional clustering algorithms has some shortcomings in dealing with mass data with uneven density distribution. For example, K-means algorithm is too time-consuming to process a large number of data points, and DBSCAN algorithm is not ideal for clustering data sets with changeable density distribution. Therefore, this article adopts a powerful spatial clustering algorithm-CFSFDP (Clustering by Fast Search and Find of Density Peaks) to study the geographical clustering characteristics of restaurants in Beijing central area on the basis of open source catering data from Dianping.com. At the same time, the article also uses the network bivariate K-function method to analyze the factors that affect the spatial distribution pattern of restaurants, such as population distribution, economic development level, traffic convenience and residential areas, in order to provide useful reference for the study of government urban planning and business geography. The result reveals that the catering industry in the urban area of Beijing is imbalanced, which generally presents the characteristics of multi-center spatial distribution and the degree of agglomeration of restaurants decreases with the increase of the distance from the center of the city to the outside. It also shows the trend of circling around CBD (central business district), tourist attractions and residential areas as well as extends along the traffic axis.

Mining Applications and Techniques from GIS Articles

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Abstract — Since it was put forward in the 1960s, Geographic Information System (GIS) has developed into an interdisciplinary and widely used discipline, which has the characteristics of comprehensive disciplines, complex research objects, and rapid updating methods. How can researchers quickly view the current state of the field, locate the frontier research issues, track the advanced technologies? These become the primary problems for every researcher to carry out scientific research. International academic journals are the main platforms for researchers to understand, publish and communication achievements. However, massive academic articles are published each year in the fields of GIS and related disciplines, which makes researchers easily fall into the quagmire of literature retrieval. Automatically extracting applications and technologies from articles and screening the important knowledge are conducive to quickly grasp the development trend of disciplines and help researchers to select research topics. This paper provides a semi-supervised neural network model to extract applications and technologies from articles. Firstly, we collect the keywords of articles as the seeds and expand these keywords by the bootstrapping method as well as control the quality of additional keywords using a scoring function. Secondly, we assign labels (application or technology) to each keyword by the pattern matching method and build the annotation corpus. Finally, we train a neural network model (LSTM-CRF) based on this annotation corpus and identify new applications and technologies. In the experiment, we take the articles of 8 core international academic journals of GIS from 2009 to 2018 as samples, 3652 articles in total. The proposed method identified 6989 applications and 4361 technologies, the mean accuracy is 91% by

manual evaluation. Besides, the top 20 phrases are displayed by frequency statistics, which reveals the research themes in the field of GIS for the last 10 years.

ID: C-11067

The research of support vector machine (SVM) based on particle swarm optimization in remote sensing image classification

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Abstract — As the basis of remote sensing image application, the classification of ground objects is of great significance in the application and analysis of remote sensing images. In view of the fact that support vector machine (SVM) is unable to determine the optimal parameter combination in the application of image classification and easy to fall into local optimum, the accuracy of ground object classification results is then affected. Aiming at solving this problem, in this paper, a particle swarm optimization (PSO) is implemented to select and optimize the parameters of support vector machine. Each particle in the algorithm represents a possible solution to a problem. The intelligence of solving the problem can be realized through the simple behavior of the individual particles and the information interaction within the group. This paper, taking Chongming island of China as the research area, compared theaccuracy variation of SVM classification before and after optimization by using Sentinel-2A images. In addition, classification results from SVM and new integrated classifier random forest (RF) are analyzed and evaluated. The research shows that the proposed method not only has a higher classification accuracy than the traditional SVM method, but the classification accuracy is superior to the random forest classification. This method has a strong ability to identify the types of land cover and be used for regular change detection and planning management of agricultural land.

ID: C-11068

Permutation-test-based Clustering Method for Detection of Dynamic Patterns in Spatio-temporal Datasets

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Abstract — Massive spatio-temporal data have been collected from the earth observation systems for monitoring the changes of natural resources and environment. To find the interesting dynamic patterns embedded in spatio-temporal data, there is an urgent need for detecting spatio-temporal clusters formed by objects with similar attribute values occurring together across space and time. Among different clustering methods, the density-based methods are widely used to detect such spatio-temporal clusters because they are effective for finding arbitrarily shaped clusters and rely on less priori knowledge (e.g. the cluster number). However, a series of user-specified parameters is required to identify high-density objects and to determine cluster significance. In practice, it is difficult for users to determine the optimal clustering parameters; therefore, existing density-based clustering methods typically exhibit unstable performance. To overcome these limitations, a novel density-based spatio-temporal clustering method based on permutation tests is developed in this paper. High-density objects and cluster significance are determined based on statistical information on the dataset. First, the density of each object is defined based on the local variance and a fast permutation test is conducted to identify high-density objects. Then, a proposed two-stage grouping strategy is implemented to group high-density objects and their neighbors; hence, spatio-temporal clusters are formed by minimizing the inhomogeneity increase. Finally, another newly developed permutation test

is conducted to evaluate the cluster significance based on the cluster member permutation. Experiments on both simulated and meteorological datasets show that the proposed method exhibits superior performance to two state-of-the-art clustering methods, i.e., ST-DBSCAN and ST-OPTICS. The proposed method can not only identify inherent cluster patterns in spatio-temporal datasets, but also greatly alleviates the difficulty in selecting appropriate clustering parameters.

ID: C-11069

Using Deep Learning and Machine Learning to Improve Text-based Data Processing

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Abstract — Urban informatics is becoming an increasingly important domain in the past few years. Data resources and volume for urban are increasingly diversified and larger. Internet-based data is becoming a norm for collecting urban related data. One of such data types is the millions of messages sent to municipal managers for complaining, commenting, and suggestions. Such messages are invaluable for the communication between citizens and municipal managers, and the responses to the messages require urban analyses, such as location and tracking. By analyzing key information such as the subject content, spatial location, and location of the email, we can discover whether the major problems in the city and the migration problems over time have been resolved. However, processing such large number of messages become a tedious job. For example, a secretary can only process approximately 100 messages per day. This paper uses deep learning and natural language processing to mine and analyze the messages in a semi-automation process. The content of the messages is cut and digitized by natural language processing technology, and the digitized text content is modeled by convolutional neural network through deep learning technology. Finally, the messages can be automatically classified into a variety of topics, automatically analyzing the problem of the city. It greatly improved the efficiency of analyzing city information.

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Influence of short wave albedo on soil surface temperature of bare farmland: a case study from Nanyang Basin, China

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Abstract — This study aims to investigate the relationship between soil surface temperature (SST) and short wave albedo (SWA) for bare farmland in Chinese Nanyang Basin. It can provide certain scientific basis for agricultural practices in this region in periods of sowing and seedling. After spring crops were harvested and before summer crops grow tall, the soil is exposed to satellite sensor, and its attributes (SST and SWA) can be estimated through remote sensing, which allows us to study straightforwardly the relationship between them. The results shows that the average SST of the bare farmland samples (i.e the homogeneous pixels which VC is below 0.2) is 317.31K, and the standard deviation 2.40K. It shows that there is strong negative correlation between SST and SWA (Controlling vegetation coverage, the partial correlation coefficient between SST and SWA is -0.537) . The above results reveal that SWA has significant influence on SST of bare farmland. The SST represents the average temperature of certain depth of soil. Therefore, it is implied that the SWA affects the incoming radiation energy and then soil temperature and in turn, the plant activities such as seed germination and seedling growth. Furthermore, because that the farmlands with different SWA absorb solar radiation in different quantities, their evaporation intensity may be have obvious difference, which means different water consume.

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User's Intention to Purchase Mobile Games Application from Consumption Value Perspective

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Abstract — The growth of the video games industry has been largely contributed through the sales of digital content, subscriptions, games applications and mobile games. While prior literature debated on user's acceptance, adoption and use of mobile games, few actually deal with gaining insights into user's behavioral intention to purchase mobile games. Based on the gap in the literature and advancement in technology, the present research seeks to model user's intention to purchase mobile games application using the Consumption Value Theory. The research discusses the research framework and research propositions development.

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An Analysis of Evaluation Metrics of GANs

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Abstract — Generative adversarial networks (GANs) have gained significant attention in recent years. A number of GAN variants have been proposed and have been utilized in many applications. Despite a large number of applications and developments in GANs, few works have studied the metrics that evaluate GANs' performance. In this paper, we present a comprehensive analysis of the most commonly used evaluation metrics for measuring the performance of GANs. We discuss their definitions of by explaining them mathematically and analyzed their pros and cons in the context of GANs. Based on our analysis, we observe that defining an appropriate metric for evaluating GAN's performance is still an open problem, not only for fair model comparison but also for understanding, improving, and developing generative models. Overall, this study suggests that the choice of feature space in which to compute various metrics is crucial. In addition, it is suggested to create a code repository of evaluation metrics that enable the conduct of a comparative empirical and analytical studies of available measures for benchmarking models under the same conditions using more than one metrics in the future.

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A Concentric Cyber Security Zone Model

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Abstract — The traditional layered security zone model accommodates varying levels of trust, which separate the Internet and the private network security zones. While cloud and virtualization has altered the way in which Internet facing applications may be deployed, the layered zone model has remained intact. In this paper, a concentric security zone model is introduced based upon microsegmentation. The approach offers discrete zones for related applications giving a more granular and flexible security model.

Index Terms— Cyber Security Cloud, Security Zone Model.

ID: ICITA-12013

Surface Region Decomposition for B-rep Model

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Abstract — A method of surface region decomposition for B-rep model is presented. The concepts of convex plane, concave plane and hybrid plane are introduced in order to deal with whether the plane should be divided into a convex or concave region. According to whether the concavity of region is unchanged after combining of two surfaces, an edge classification standard is proposed to divide an edge into an inner edge, outer edge or undetermined edge. A series of algorithms such as the rough division of region, the closure of outer edge, CChain (CLoop) decomposition and inner loop decomposition are proposed. We find that surrounded type and outer-crossing type structures exist for intersecting CChains (CLoops), and the processing method based on the minimum number of regions for surface decomposition is discussed. Examples of surface decomposition for typical polyhedral models and curved surface models are given, and the effectiveness of the method is verified.

Index Terms — B-rep model, surface decomposition, 3D model retrieval.

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Simultaneous Polarimetric Measurements Using Interrupted Sampling
LFM Pair Radar Signal

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Abstract — In this paper, a novel radar signal called the interrupted sampling linear frequency modulation (LFM) pair is proposed for simultaneous polarimetric measurements (SPM). By alternately interrupted sampling modulation on the LFM signal, the ideal orthogonality between the signals of two polarization channels can be obtained in the time domain. Simulation results demonstrate the validity of the proposed method.

Index Terms — Interrupted sampling modulation; Simultaneous polarimetric measurements; Linear frequency modulation signal; Radar signal processing.

A Novel Micro-Doppler Curve Extraction Method for Space Targets

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Abstract — Micro-Doppler Curve extraction is usually the first step in the space target discrimination procedure. In this paper, the genetic algorithm-general parameterized time-frequency transform (GA-GPTF) method is proposed to obtain the micro-Doppler curves of space targets from the time-frequency distribution (TFD). The anechoic chamber experiment results demonstrate the validity of GA-GPTF.

Index Terms — Scattering center; Time-frequency analysis; Space target discrimination.