



HAL
open science

Computer and Computing Technologies in Agriculture XI

Daoliang Li, Chunjiang Zhao

► **To cite this version:**

Daoliang Li, Chunjiang Zhao. Computer and Computing Technologies in Agriculture XI. Springer International Publishing, AICT-546, 2019, IFIP Advances in Information and Communication Technology, 978-3-030-06178-4. 10.1007/978-3-030-06179-1 . hal-02111509

HAL Id: hal-02111509

<https://inria.hal.science/hal-02111509v1>

Submitted on 26 Apr 2019

HAL is a multi-disciplinary open access archive for the deposit and dissemination of scientific research documents, whether they are published or not. The documents may come from teaching and research institutions in France or abroad, or from public or private research centers.

L'archive ouverte pluridisciplinaire **HAL**, est destinée au dépôt et à la diffusion de documents scientifiques de niveau recherche, publiés ou non, émanant des établissements d'enseignement et de recherche français ou étrangers, des laboratoires publics ou privés.



Distributed under a Creative Commons Attribution 4.0 International License

Editor-in-Chief

Kai Rannenber, Goethe University Frankfurt, Germany

Editorial Board

TC 1 – Foundations of Computer Science

Jacques Sakarovitch, Télécom ParisTech, France

TC 2 – Software: Theory and Practice

Michael Goedicke, University of Duisburg-Essen, Germany

TC 3 – Education

Arthur Tatnall, Victoria University, Melbourne, Australia

TC 5 – Information Technology Applications

Erich J. Neuhold, University of Vienna, Austria

TC 6 – Communication Systems

Aiko Pras, University of Twente, Enschede, The Netherlands

TC 7 – System Modeling and Optimization

Fredi Tröltzsch, TU Berlin, Germany

TC 8 – Information Systems

Jan Pries-Heje, Roskilde University, Denmark

TC 9 – ICT and Society

David Kreps, University of Salford, Greater Manchester, UK

TC 10 – Computer Systems Technology

Ricardo Reis, Federal University of Rio Grande do Sul, Porto Alegre, Brazil

TC 11 – Security and Privacy Protection in Information Processing Systems

Steven Furnell, Plymouth University, UK

TC 12 – Artificial Intelligence

Ulrich Furbach, University of Koblenz-Landau, Germany

TC 13 – Human-Computer Interaction

Marco Winckler, University Paul Sabatier, Toulouse, France

TC 14 – Entertainment Computing

Matthias Rauterberg, Eindhoven University of Technology, The Netherlands

IFIP – The International Federation for Information Processing

IFIP was founded in 1960 under the auspices of UNESCO, following the first World Computer Congress held in Paris the previous year. A federation for societies working in information processing, IFIP's aim is two-fold: to support information processing in the countries of its members and to encourage technology transfer to developing nations. As its mission statement clearly states:

IFIP is the global non-profit federation of societies of ICT professionals that aims at achieving a worldwide professional and socially responsible development and application of information and communication technologies.

IFIP is a non-profit-making organization, run almost solely by 2500 volunteers. It operates through a number of technical committees and working groups, which organize events and publications. IFIP's events range from large international open conferences to working conferences and local seminars.

The flagship event is the IFIP World Computer Congress, at which both invited and contributed papers are presented. Contributed papers are rigorously refereed and the rejection rate is high.

As with the Congress, participation in the open conferences is open to all and papers may be invited or submitted. Again, submitted papers are stringently refereed.

The working conferences are structured differently. They are usually run by a working group and attendance is generally smaller and occasionally by invitation only. Their purpose is to create an atmosphere conducive to innovation and development. Refereeing is also rigorous and papers are subjected to extensive group discussion.

Publications arising from IFIP events vary. The papers presented at the IFIP World Computer Congress and at open conferences are published as conference proceedings, while the results of the working conferences are often published as collections of selected and edited papers.

IFIP distinguishes three types of institutional membership: Country Representative Members, Members at Large, and Associate Members. The type of organization that can apply for membership is a wide variety and includes national or international societies of individual computer scientists/ICT professionals, associations or federations of such societies, government institutions/government related organizations, national or international research institutes or consortia, universities, academies of sciences, companies, national or international associations or federations of companies.

More information about this series at <http://www.springer.com/series/6102>

Daoliang Li · Chunjiang Zhao (Eds.)

Computer and Computing Technologies in Agriculture XI

11th IFIP WG 5.14 International Conference, CCTA 2017
Jilin, China, August 12–15, 2017
Proceedings, Part II

Editors

Daoliang Li
China Agricultural University (CAU)
Beijing, China

Chunjiang Zhao
National Research Center of Intelligent
Equipment for Agriculture (NRCIEA)
Beijing, China

ISSN 1868-4238 ISSN 1868-422X (electronic)
IFIP Advances in Information and Communication Technology
ISBN 978-3-030-06178-4 ISBN 978-3-030-06179-1 (eBook)
<https://doi.org/10.1007/978-3-030-06179-1>

Library of Congress Control Number: 2018965408

© IFIP International Federation for Information Processing 2019

This work is subject to copyright. All rights are reserved by the Publisher, whether the whole or part of the material is concerned, specifically the rights of translation, reprinting, reuse of illustrations, recitation, broadcasting, reproduction on microfilms or in any other physical way, and transmission or information storage and retrieval, electronic adaptation, computer software, or by similar or dissimilar methodology now known or hereafter developed.

The use of general descriptive names, registered names, trademarks, service marks, etc. in this publication does not imply, even in the absence of a specific statement, that such names are exempt from the relevant protective laws and regulations and therefore free for general use.

The publisher, the authors, and the editors are safe to assume that the advice and information in this book are believed to be true and accurate at the date of publication. Neither the publisher nor the authors or the editors give a warranty, express or implied, with respect to the material contained herein or for any errors or omissions that may have been made. The publisher remains neutral with regard to jurisdictional claims in published maps and institutional affiliations.

This Springer imprint is published by the registered company Springer Nature Switzerland AG
The registered company address is: Gewerbestrasse 11, 6330 Cham, Switzerland

Preface

Agricultural information technology has become an important means for developing modern agriculture. In order to promote the academic exchange and cooperation of ICT in Agriculture, from 2000 to 2016, the National Engineering Research Center for Information Technology in Agriculture (NERCITA), China Agricultural University (CAU), and related organizations hosted eight events in the International Symposium on Intelligent Information Technology in Agriculture (ISIITA) series and ten events in the International Conference on Computer and Computing Technologies in Agriculture (CCTA) series, which provided a platform for the exchange of information on and ICT in agriculture between global scholars.

Since 2015, the Internet of Things, big data, robots, and precision farming have entered a stage of agricultural applications. Artificial intelligence (AI) has gradually penetrated the agriculture field and promoted the development of intelligent agriculture, which is characterized by “information perception, quantitative decision-making, intelligent control, precision input, and personalized services.” To exchange experiences and share the state of the art as well as successful application cases of ICT in intelligent agriculture, ISIITA and CCTA were merged into the International Conference on Intelligent Agriculture (ICIA). The ICIA will be held every two years (odd year), and the co-sponsors and conference venue are also selected according to applications.

ICIA 2017 focused on four topics: Internet of Things and Big Data in Agriculture, Precision Agriculture and Agricultural Robot, Agricultural Information Services, and Animal and Plant Phenotyping for Agriculture. The newest theories, viewpoints, technologies, products, and applications were extensively presented. Practical experiences in innovation and applications in intelligent agriculture were shared among experts from different countries.

We selected the 100 best papers among the 282 papers submitted to CCTA 2017 for these proceedings. All papers underwent two reviews by members who are from the Special Interest Group on Advanced Information Processing in Agriculture (AIPA), IFIP. In these proceedings, creative thoughts and inspiration can be discovered, discussed, and disseminated. It is always exciting to have experts, professional, and scholars with creative contributions getting together to share inspiring ideas and to accomplish great developments in the field.

I would like to express my sincere thanks to all authors who submitted research papers to the conference. Finally, I would also like to express my sincere thanks to all speakers, session chairs, and attendees, both national and international, for their active participation and support of this conference.

Organization

Organizers

China National Engineering Research Center for Information Technology in
Agriculture (NERCITA), China
China Agricultural University (CAU), China
China National Engineering Research Center of Intelligent Equipment for Agriculture
(NERCIEA), China
Branch of Agricultural Information Processing, International Federation
for Information Processing (IFIP TC5.14)
Chinese Association of Artificial Intelligence (CAAI), China
Chinese Society of Agricultural Engineering (CSAE), China
Chinese Society for Agricultural Machinery (CSAM), China
Informatization Branch, China Agricultural Mechanization Association (CAMA),
China
Committee of Information Technology, China Agro-technological Extension
Association (CAEA), China
Technology Innovation Strategic Alliance for Agricultural Internet of Things Industry
(TISA-AITI), Beijing, China
Beijing Society for Information Technology in Agriculture (BSITA), China
Key Laboratory of Information Technology in Agriculture, Ministry of Agriculture,
China
Sino-US Cooperative Technology Center of Agricultural Aviation, China
Beijing Key Laboratory of Digital Plant, China

Sponsors

Department of Science, Technology and Education, Ministry of Agriculture (MOA),
China
Department of Market and Economic Information, Ministry of Agriculture (MOA),
China
Department of International Cooperation, Ministry of Science and Technology
(MOST), China
Jilin Provincial Agricultural Commission, China
Jilin Provincial Department of Science and Technology, China
Changchun Municipal Government, China
Beijing Association for Science and Technology, China
Beijing Academy of Agriculture and Forestry Sciences, China

Organizing Committee

Chunjiang Zhao	China National Engineering Research Center for Information Technology in Agriculture, China
Nick Sigrimis	Agricultural University of Athens, Greece
Yanbo Huang	Crop Production Systems Research, USDA-ARS
Youhong Sun	Jilin University, China
Zhang Yuejie	Jilin Agricultural University, China

Academic Committee

Maohua Wang	China Agricultural University (CAU) and Chinese Academy of Engineering, China
Jiulin Sun	Institute of Geographic Sciences and Natural Resources Research, Chinese Academy of Sciences and Chinese Academy of Engineering, China
Deyi Li	61st Institute of the General Staff Headquarters of Chinese People's Liberation Army and Chinese Academy of Engineering, China
Xiwen Luo	South China Agricultural University, Chinese Academy of Engineering, China
Xuegeng Chen	Institute of Agricultural Machinery, Xinjiang Academy of Agricultural and Reclamation Science and Chinese Academy of Engineering, China
Yu Li	Jilin Agricultural University, Chinese Academy of Engineering, China
Luquan Ren	Jilin University, Chinese Academy of Sciences, China
Fangquan Mei	Agricultural Information Institute, Chinese Academy of Agricultural Sciences (CAAS), China
Chunjiang Zhao	China National Engineering Research Center for Information Technology in Agriculture, China
Daoliang Li	College of Information and Electrical Engineering, China Agricultural University, China
Xinting Yang	China National Engineering Research Center for Information Technology in Agriculture, China
Liping Chen	China National Engineering Research Center of Intelligent Equipment for Agriculture, China
Yong He	College of Biosystems Engineering and Food Science, Zhejiang University, China
Yan Zhu	College of Agriculture, Nanjing Agricultural University, China
Dongjian He	College of Mechanical and Electronic Engineering, Northwest A&F University, China
Chengliang Liu	Shanghai Jiao Tong University, China
Hanping Mao	Institute of Agricultural Engineering, Jiangsu University, China

Haiye Yu	College of Biological and Agricultural Engineering, Jilin University, China
Shijun Li	College of Information Technology, Jilin Agricultural University, China
Guifen Chen	College of Information Technology, Jilin Agricultural University, China
Nick Sigrimis	Agricultural University of Athens, Greece
Kuanchong Ting	Zhejiang University, China/University of Illinois at Urbana-Champaign, USA
Manuel Berenguel	University of Almeria, Spain
Jose Fernando Bienvenido	University of Almeria, Spain
Rajiv Khosla	Colorado State University, USA
Zhang Qin	Washington State University, USA
Yanbo Huang	Crop Production Systems Research, USDA-ARS
Wesley Clint Hoffmann	Aerial Application Technology Group, USDA-ARS
Jens Leon	University of Bonn, Germany
Thomas Rauschenbach	Fraunhofer-IOSB, Advanced Systems Technology Branch (AST), Germany
Daniela Baganz	Leibniz Institute of Freshwater Ecology and Inland Fisheries, IGB, Germany
Sun-Ok Chung	Chungnam National University, Republic of Korea, Korea
Naoshi Kondo	Kyoto University, Japan
Noboru Noguchi	Hokkaido University, Japan
Ning Wang	Oklahoma State University, USA
Naiqian Zhang	Kansas State University, USA
Frederic Baret	French National Institute for Agricultural Research, France

Additional Reviewers

Chunjiang Zhao	China National Engineering Research Center for Information Technology in Agriculture, China
Daoliang Li	College of Information and Electrical Engineering, China Agricultural University, China
Xinting Yang	China National Engineering Research Center for Information Technology in Agriculture, China
Yong He	College of Biosystems Engineering and Food Science, Zhejiang University, China
Chengliang Liu	Shanghai Jiao Tong University, China
Zhenbo Li	College of Information and Electrical Engineering, China Agricultural University, China
Yingyi Chen	College of Information and Electrical Engineering, China Agricultural University, China
Yaoguang Wei	College of Information and Electrical Engineering, China Agricultural University, China

Qingling Duan	College of Information and Electrical Engineering, China Agricultural University, China
Longqing Sun	College of Information and Electrical Engineering, China Agricultural University, China
Chunhong Liu	College of Information and Electrical Engineering, China Agricultural University, China
Weizhong Yang	College of Information and Electrical Engineering, China Agricultural University, China

Secretary General

Xiaohong Du
Xia Li
Ming Li
Hongru Wang
Han Zhang

Contents – Part II

Research and Application of Spark Platform on Big Data Processing in Intelligent Agriculture of Jilin Province	1
<i>Siwei Fu, Guifen Chen, Shan Zhao, and Enze Xiao</i>	
Summary of Agricultural Drought Monitoring by Remote Sensing at Home and Abroad	13
<i>Meng Wang, Tao Liu, Shouzhen Ling, Xueyan Sui, Huimin Yao, and Xuehui Hou</i>	
Research and Application of 3D Visualization Plug-in Integration with ArcGIS.	21
<i>Yinglun Li, Guifen Chen, and Dongxue Wang</i>	
Growth and Spectral Characteristics of Grassland in Response to Different Soil Textures.	31
<i>Xiaochun Zhong, Junchan Wang, Liu Tao, Chengming Sun, Zhemin Li, and Shengping Liu</i>	
Soil Moisture Estimation by Combining L-Band Brightness Temperature and Vegetation Related Information.	45
<i>Yuanyuan Fu, Chunjiang Zhao, Guijun Yang, and Haikuan Feng</i>	
Study on Precision Fertilization Model Based on Fusion Algorithm of Cluster and RBF Neural Network	56
<i>Shan Zhao, Guifen Chen, Siwei Fu, and Enze Xiao</i>	
Study on Three-Dimensional Data Acquisition of Crop Grains	67
<i>Zetao Yu, Weiliang Wen, Xinyu Guo, and Xianju Lu</i>	
An Agricultural Habitat Information Acquisition and Remote Intelligent Decision System Based on the Internet of Things	75
<i>Ze Lin Hu, Yi Gao, Miao Li, Hua Long Li, Xuan Jiang Yang, and Zhi Run Ma</i>	
Comprehensive Evaluation of Soil Fertility in Yanzhou District Based on Principal Component Analysis	86
<i>Qiuting Zhang and Xia Geng</i>	
Advances in Monitoring Soil Nutrients by Near Infrared Spectroscopy	94
<i>Yan Wang, Bei Cui, Yanhua Zhou, and Xiudong Sun</i>	

Microwave Mixing Technique for Nondestructive Measurement of Moisture Content of Particulate Agricultural Products	100
<i>Chenxiao Li, Yanlei Xu, He Gong, Yuanyuan Liu, and Qian Song</i>	
China’s Wine Import Industry: An Economic Analysis of Influencing Trade Factors.	109
<i>Yu Hu, Wei Ma, Ruimei Wang, Huan Song, Weisong Mu, Dong Tian, and Jianying Feng</i>	
Three - Dimensional Visualization of Soil Nutrient Evolution in Maize Precision Operation Area Based on ArcGIS	119
<i>Enze Xiao, Guifen Chen, Shan Zhao, and Siwei Fu</i>	
Characteristics of the Warming Trend During Winter Wheat Growing Seasons in Jiangsu Province of China	127
<i>Xiangying Xu, Xinkai Zhu, Wenshan Guo, Chunyan Li, and Jinfeng Ding</i>	
Estimation of Leaf Nitrogen Concentration of Winter Wheat Using UAV-Based RGB Imagery.	139
<i>Qinglin Niu, Haikuan Feng, Changchun Li, Guijun Yang, Yuanyuan Fu, Zhenhai Li, and Haojie Pei</i>	
New NNI Model in Winter Wheat Based on Hyperspectral Index	154
<i>Wang Jianwen, Li Zhenhai, Xu Xingang, Zhu Hongchun, Feng Haikuan, Liu Chang, Gan Ping, and Xu Xiaobin</i>	
Fruit Trees 3D Data Acquisition and Reconstruction Based on Multi-source	162
<i>Sheng Wu, Boxiang Xiao, Weiliang Wen, Xinyu Guo, and Long Liu</i>	
Comparison of Remote Sensing Estimation Methods for Winter Wheat Leaf Nitrogen Content	173
<i>Chunlan Zhang, Fuquan Tang, Heli Li, Guijun Yang, Haikuan Feng, and Chang Liu</i>	
Design and Implementation of the Wheat Population Nutrition Detection System	185
<i>Lei Shi, Qiguo Duan, Mingyang Xiong, Juanjuan Zhang, Lihong Song, and Xinming Ma</i>	
Hyperspectral Estimation Methods for Chlorophyll Content of Apple Based on Random Forest.	194
<i>Haojie Pei, Changchun Li, Haikuan Feng, Guijun Yang, Mingxing Liu, and Zhichao Wu</i>	
Improving Design of a PVDF Grain Loss Sensor for Combine Harvester.	208
<i>Liming Zhou, Yanwei Yuan, Junning Zhang, and Kang Niu</i>	

Maize Precision Farming Parallel Management Technology and Its Application in Northeast China	218
<i>Xianju Lu, Xinyu Guo, Jiangchuan Fan, Sheng Luo, Yufa Song, and Chunwei Li</i>	
Research on Vegetation Ecologic Quality Index of Rocky Desertification in Karst Area of Guangxi Province Based on NPP and Fractional Vegetation Cover Since 2000	225
<i>Xin Yang, Haihong Huang, Shuan Qian, and Hao Yan</i>	
Estimation of Leaf Nitrogen Content of Winter Wheat Based on Akaike's Information Criterion	231
<i>Haojie Pei, Haikuan Feng, Fuqin Yang, Zhenhai Li, Guijun Yang, and Qinglin Niu</i>	
Monitoring of Winter Wheat Biomass Using UAV Hyperspectral Texture Features	241
<i>Chang Liu, Guijun Yang, Zhenhai Li, Fuquan Tang, Haikuan Feng, Jianwen Wang, Chunlan Zhang, and Liyan Zhang</i>	
Reconstruction and Body Size Detection of 3D Sheep Body Model Based on Point Cloud Data	251
<i>Yanqing Zhou, Heru Xue, Chunlan Wang, Xinhua Jiang, Xiaojing Gao, and Jie Bai</i>	
Research on Irrigation System of Limited Water Supply for Soybean Crops in Shanxi Province	263
<i>Lantao Ye, Yangren Wang, Qing Liu, and Sida Wang</i>	
Development and Application of Hyperspectral Remote Sensing	271
<i>Huimin Xing, Haikuan Feng, Jingying Fu, Xingang Xu, and Guijun Yang</i>	
Study on Spatial Distribution Characters of Rubber Yield and Soil Nutrients in Guangba Farm of Hainai Province	283
<i>Bei Cui, Wenjiang Huang, Huichun Ye, and Qimin Cao</i>	
The Environment Intelligent Monitoring and Analysis for Enclosed Layer House with Four Overlap Tiers Cages in Winter	292
<i>Hualong Li, Miao Li, Junying Li, Kai Zhan, and Xianwang Liu</i>	
Research and Realization of Winter Wheat Yield Estimation Model Based on NDVI Index	301
<i>Zhichao Wu, Changchun Li, Haikuan Feng, Bo Xu, Guijun Yang, Zhenhai Li, Haojie Pei, and Mingxing Liu</i>	
Study on Vegetation Classification Based on Spectral Knowledge Base	310
<i>Peng Liu, Jingcheng Zhang, Bin Wang, Xuexue Zhang, and Kaihua Wu</i>	

Hyperspectral Estimation of Nitrogen Content in Winter Wheat Leaves Based on Unmanned Aerial Vehicles	321
<i>Liu Mingxing, Li Changchun, Feng Haikuan, Pei Haojie, Li Zhenhai, Yang Fuqin, Yang Guijun, and Xu Shouzhi</i>	
Quantification of Root Anatomical Traits in RGP Transgenic Maize Plants Based on Micro-CT	340
<i>Xiaodi Pan, Liming Ma, Ying Zhang, Jinglu Wang, Jianjun Du, and Xinyu Guo</i>	
Effects of Exogenous Gamma-Aminobutyric Acid on Absorption and Regulation of Ion in Wheat Under Salinity Stress	347
<i>Xiaodong Wang, Hongtu Dong, Peichen Hou, Hang Zhou, Lulu He, and Cheng Wang</i>	
Development of Portable Dynamic Ion Flux Detecting Equipment	358
<i>Peichen Hou, Cheng Wang, Xiaodong Wang, Aixue Li, Peng Song, Bin Luo, Ye Hu, and Liping Chen</i>	
Study on Intelligent Monitoring Technology for Composting of Agricultural and Livestock Wastes	368
<i>Hualong Li, Miao Li, Xuanjiang Yang, Zelin Hu, Zhirun Ma, and Xianwang Liu</i>	
Optimization and Simulation of Fertilizer Guide Device Parameters Based on EDEM Software	377
<i>Hai Ding, Xiaofei An, Guangwei Wu, Liwei Li, and Qingzhen Zhu</i>	
Development of an Automated Guidance System for Tracked Combine Harvester	389
<i>Fangming Zhang, Wenbin Wu, and Yunfei Zhu</i>	
Research on the Internet of Things Platform Design for Agricultural Machinery Operation and Operation Management	400
<i>Qian Zhou, Jiandong Jiang, Zhangfeng Zhao, Jiang Zhong, Bosong Pan, Xiao Jin, and Yuanfang Sun</i>	
Understanding the Consumer Satisfaction of the “Last-Mile” Delivery of E-Business Services	411
<i>Shujun Liu, Yan Li, Jingqi Huang, and Xin Zhao</i>	
The State of Motion Stereo About Plant Leaves Monitoring System Design and Simulation	419
<i>Jiangchuan Fan, Xinyu Guo, Chuanyu Wang, Xianju Lu, and Sheng Wu</i>	
Research on Agricultural Scientific and Technological Information Dissemination System Based on Complex Network Technology	432
<i>Hang Chen, Guifen Chen, Ying Zhang, and HongJun Gu</i>	

An Illumination Invariant Maize Canopy Structure Parameters Analysis Method Based on Hemispherical Photography	440
<i>Chuanyu Wang, Xinyu Guo, and Jianjun Du</i>	
Application of DBSCAN Algorithm in Precision Fertilization Decision of Maize	453
<i>Yang Li, Guowei Wang, Yu Chen, Yang Jiao, Haijiao Yu, and Guogang Zhao</i>	
Location and Recognition Fruit Trees Based on Binocular Stereo Vision	460
<i>Xueguan Zhao, Yuanyuan Gao, Songlin Wang, Xiu Wang, Pengfei Fan, and Qingcun Feng</i>	
The Realization of Pig Intelligent Feeding Equipment and Network Service Platform	473
<i>Weihong Ma, Jinwei Fan, Chunjiang Zhao, and Huarui Wu</i>	
Improvement of Regional Spatial Interaction Based on Spatial Traffic System Accessibility: A Case Study in Shandong Province, China	485
<i>Yu Zhang, Shouzhi Xu, Fengguang Kang, and Shihua Yin</i>	
Research on the Key Techniques of Semantic Mining of Information Digest in the Field of Agricultural Major Crops Based on Deep Learning	496
<i>Hao G. J. M. Gong, Yunpeng Cui, and Ping Qian</i>	
COPS: A Real-Time Cross-Domain Object Part Segmentation System	508
<i>Xueqing He</i>	
Author Index	517

Contents – Part I

Quinoa Traceable System Based on Internet of Things.	1
<i>Guowei Wang, Yu Sun, Jing Chen, Yang Jiao, Chuanhong Zhang, Haijiao Yu, Chan Lin, and Guogang Zhao</i>	
Research and Application of Safety Management for Virtual Desktop in Colleges and Universities	9
<i>Haifeng Jia and Guifen Chen</i>	
Philosophical Principles of Data Discovery.	24
<i>Quan Wu, Min Liu, Juanying Sun, Weijie Jiao, Shuanghua Tao, Xiaochen Li, Xue Han, and Lijuan Jia</i>	
Fast Analysis of Maize Kernel Plumpness Characteristics Through Micro-CT Technology	31
<i>Meng Shao, Ying Zhang, Jianjun Du, Xiaodi Pan, Liming Ma, Jinglu Wang, Dennis Böhmer, and Xinyu Guo</i>	
Automated Counting of Sex-Pheromone Attracted Insects Using Trapped Images.	40
<i>Wenyong Li, Meixiang Chen, Ming Li, Chuanheng Sun, and Lin Wang</i>	
Study of Machine Learning Based Rice Breeding Decision Support Methods and Technologies	54
<i>Yun-peng Cui, Jian Wang, Shi-hong Liu, En-ping Liu, and Hai-qing Liu</i>	
A Bayesian Network Model for Yellow Rust Forecasting in Winter Wheat.	65
<i>Xiaodong Yang, Chenwei Nie, Jingcheng Zhang, Haikuan Feng, and Guijun Yang</i>	
Soil Organic Carbon Prediction Using Vis-NIR Spectroscopy with a Large Dataset	76
<i>Yang Shi, Rujing Wang, and Yubing Wang</i>	
Research on High Resolution Remote Sensing Image Classification Based on Convolution Neural Network	87
<i>Wenwen Gong, Zhuqing Wang, Yong Liang, Xin Fan, and Junmeng Hao</i>	
Computer Vision and Feeding Behavior Based Intelligent Feeding Controller for Fish in Aquaculture.	98
<i>Chao Zhou, Kai Lin, Daming Xu, Chuanheng Sun, Lan Chen, Song Zhang, and Qiang Guo</i>	

Multi-scale 3D Data Acquisition of Maize	108
<i>Weiliang Wen, Xinyu Guo, Xianju Lu, Yongjian Wang, and Zetao Yu</i>	
Remote Sensing Monitoring of Drought Based on Landsat8 and NDVI-Ts Characteristic Space Method.	116
<i>Shouzhen Liang, Tao Liu, Zhen Chen, Xueyan Sui, Xuehui Hou, Meng Wang, and Huimin Yao</i>	
Curve Fitting Derivative Method and Its Application in Mouse Growth	126
<i>Zhihua Li and Xin Zhao</i>	
Spatial Structure Change Analysis of Cultivated Soil Nutrients in Urban Fringe of North China	134
<i>Shiwei Dong, Yuchun Pan, and Bingbo Gao</i>	
Evaluation and Mapping of Rice Flood Damage Using Domestic Remotely Sensed Data in China	143
<i>Huifang Wang, Xiaoyi Fang, Wei Guo, Yonghong Liu, Qingzu Luan, Shuo Zhang, and Yanhu Gao</i>	
Estimating Leaf Carotenoid Concentration of Ginger in Different Layers Based on Discrete Wavelet Transform Algorithm	152
<i>Qinhong Liao</i>	
Ecological Footprint Model of Cultivated Land Based on Ecosystem Services in Beijing	159
<i>Hui Guo, Di Wu, Lei Fa, Shunxiang Pei, Xuebing Xin, Shumin Ma, Sha Wu, and Shiwei Dong</i>	
Numerical Simulation of the Effects of Design Parameters on the Performance of Tractor Powered Flail Choppers	170
<i>Zhiqiang Zhang, Hongwen Li, Allen D. McHugh, Jin He, Qingjie Wang, Caiyun Lu, Wenzheng Liu, and Sun Nina</i>	
Design and Implementation of Water Spectrum Observation System for Aquaculture Pond	194
<i>Yinchi Ma, Wen Ding, Yonghua Qu, and Xiande Zhao</i>	
Chlorophyll Fluorescence Measurement: A New Method to Test the Effect of Two Adjuvants on the Efficacy of Topramezone on Weeds	206
<i>Jinwei Zhang, Ortrud Jäck, Alexander Menegat, Gen Li, and Xiu Wang</i>	
Wheat Growth Process 3D Visualization Research Based on Growth Model . . .	217
<i>Hailong Liu, Shuqin Li, Yeping Zhu, Shengping Liu, and Shijuan Li</i>	
Research on Information Integration Method of Agricultural Products Producing and Managing Based on Knowledge Graph.	232
<i>Xiang Sun, Huarui Wu, Peng Hao, and Qingxue Li</i>	

A 3D Canopy Reconstruction and Phenotype Analysis Method for Wheat . . .	244
<i>Boxiang Xiao, Sheng Wu, Xinyu Guo, and Weiliang Wen</i>	
Detection of Young Green Apples in Orchard Environment Using Adaptive Ratio Chromatic Aberration and HOG-SVM.	253
<i>Xia Xue, Zhou Guomin, Qiu Yun, Li Zhuang, Wang Jian, Hu Lin, Fan Jingchao, and Guo Xiuming</i>	
Detection of Overlapped Apples in Orchard Scene Using Improved K-means and Distance Least Square	269
<i>Xia Xue, Zhou Guomin, Qiu Yun, Li Zhuang, Wang Jian, Hu Lin, Fan Jingchao, and Guo Xiuming</i>	
Application of Growth Curve in Agricultural Scientific Research	285
<i>Zeng-hui Wang, Yan-jun Zhao, Yang Liu, and Dong-yan Huang</i>	
The Study of the Work Parameters of the Corn Harvester Cutter.	293
<i>Zeng-hui Wang, Yan-jun Zhao, Yang Liu, and Dong-yan Huang</i>	
Test Device of Soil Outline and Compactness Distribution on Seedbed Based on Sensors	302
<i>Caiyun Lu, Liwei Li, Zhijun Meng, Xiu Wang, and Qingjie Wang</i>	
Study the Spatial-Temporal Variation of Wheat Growth Under Different Site-Specific Nitrogen Fertilization Approaches.	316
<i>Bei Cui, Wenjiang Huang, Xiaoyu Song, Huichun Ye, and Yingying Dong</i>	
Classification Method Research of Fresh Agaricus Bisporus Based on Image Processing	333
<i>Fengyun Wang, Jiye Zheng, Lei Wang, Wenjie Feng, and Luyan Niu</i>	
A Study About Searching Behavior of Scientific Data User Based on Educational Background and Retrieval Capability.	341
<i>Guilan Zhang, Jian Wang, Guomin Zhou, Jianping Liu, Fei Gao, and Caoyuan Wei</i>	
A Review on the Soil Moisture Prediction Model and Its Application in the Information System	352
<i>Wengang Zheng, Lili Zhangzhong, Xin Zhang, Caiyuan Wang, Shirui Zhang, Shijun Sun, and Hongfei Niu</i>	
Application of Image Segmentation Technology in Crop Disease Detection and Recognition	365
<i>Leilei Deng, Zhenghao Wang, and Hui Zhou</i>	

Research and Realization on the Performance Testing Tool of Web Application	375
<i>Huarui Wu and Huaji Zhu</i>	
Operation Area Measurement Based on Trajectories of Agricultural Machinery	384
<i>Chang Ren, Yanwei Yuan, Liwei Yang, Junning Zhang, Yangchun Liu, Chengxu Lv, and Bo Zhao</i>	
Analysis of Influential Factors of Social Satisfaction in Food Industry	395
<i>Zhiyu Lai, Xinyao Zhu, Chenyue Jin, Mingxin Li, and Yan Qi</i>	
Abnormal Identification of Swine Flu Clinical Characteristics Based on Body Temperature and Behavior	404
<i>Duo Wang, Ying Xu, Qifeng Liu, Yue Lou, Chaorong Luo, and Changji Wen</i>	
Hierarchical Denoising Method of Crop 3D Point Cloud Based on Multi-view Image Reconstruction	416
<i>Lei Chen, Yuan Yuan, and Shide Song</i>	
Non-invasive Edge Detection of Leaves Based on Order Morphology	428
<i>Yanlei Xu, Qi Zhang, Chenxiao Li, Xindong Wang, and Xiaotian Meng</i>	
Development and Test of GNSS/IMU-Based Speed Measurement Device for Agricultural Machinery	440
<i>Weiqliang Fu, Shupeng Hu, Changhai Luo, You Li, Shuxia Guo, and Junxiang Zhang</i>	
Farmland Weed Species Identification Based on Computer Vision	452
<i>Shengping Liu, Junchan Wang, Liu Tao, Zhemin Li, Chengming Sun, and Xiaochun Zhong</i>	
Remote Monitoring and Control System for Aquarium Based on Mobile Communication Platform	462
<i>Wen Ding, Yinchu Ma, and Jinjing Zhang</i>	
Effects of the Factors on Maize Yield Under Drip Irrigation Under Film	468
<i>Hongzheng Shen, Yangren Wang, Xinrui Fan, Hao Wang, and Yonglin Li</i>	
An Amperometric Glucose Microbiosensor for Real-Time Measurements in Plants	476
<i>Ye Hu, Cheng Wang, and Aixue Li</i>	
Field Information Recommendation Based on Context-Aware and Collaborative Filtering Algorithm	486
<i>Zhili Chen, Chunjiang Zhao, and Huarui Wu</i>	

Research on the Current Situation and Development of Intelligent Precision Fertilizer Technology	499
<i>Wu Yan and Wang Fan</i>	
The Design and Analysis of Self—Balancing Adjustment Implement Leveling Control System	507
<i>Qingfeng Yang, Yehua Shang, Siyu Liu, Fujie Zhang, Yue Cong, Weiqiang Fu, Rui Pan, and Chunjiang Zhao</i>	
Research on Automatic Steering Control System of Full Hydraulic Steering Tractor	517
<i>Shupeng Hu, Weiqiang Fu, You Li, Yue Cong, Yehua Shang, and Zhijun Meng</i>	
Design of Farmland Information Acquisition System Based on LoRa Wireless Sensor Network	529
<i>Qiulan Wu, Chuanqi Zhao, Yong Liang, Dalei Zhang, and Junmeng Hao</i>	
Multi-sensor Array Based Fire Monitor for Cotton Pile	540
<i>Chenrui Bai, Junning Zhang, Chengxu Lv, Liguang Wei, Liming Zhou, and Bo Zhao</i>	
Author Index	555