

# The 4th International Symposium on System and Software Reliability(ISSSR 2018)

## 会议日程

日期	时间	活动			
6月21日	8:30:-9:30	<b>报到</b> 电子科技大学图书馆-百学堂			
6月21日	9:30-10:00	<b>领导致词</b> 电子科技大学图书馆-百学堂 主持人: <b>Eric Wong</b> 大会历史与发展 ( <b>Eric Wong</b> ) 本届会议技术报告 ( <b>Liang Luo</b> ) <b>照相</b>			
	10:00-12:00	<b>特邀报告</b> Speech1: <b>Dr. Jeff Voas</b> Title: Networks of 'Things' Speech2: <b>Dr. Yuanshun Dai</b> Title: Reliability Modeling for Large-Scale Computing System			
	12:00-13:30	<b>午餐</b>			
	14:30-15:50	<b>Track1</b>	<b>Track2</b>	<b>Track3</b>	
		光影厅	天韵厅	▽厅	
	15:50-16:00	<b>休息</b>			
	16:00-17:30	<b>Track1</b>	<b>Track2</b>	<b>Track3</b>	
		光影厅	天韵厅	▽厅	
18:00-19:30	<b>晚餐</b>				
6月22日	9:30-10:30	<b>Track4</b>	<b>Track5</b>	<b>Track6</b>	<b>Track7</b>
		百学堂	光影厅	天韵厅	▽厅
	10:30-10:40	<b>休息</b>			
	10:40-11:30	<b>Track4</b>	<b>Track5</b>	<b>Track6</b>	<b>Track7</b>
		百学堂	光影厅	天韵厅	▽厅
11:30-12:00	<b>闭幕式</b> 主持人: <b>Eric Wong</b>				
12:00-13:30	<b>午餐</b>				

● 时间段提醒:

6月21日上午 8:30 - 12:00

6月21日下午 14:30 - 18:00

6月22日上午 9:30 - 12:00

● 校内路线提醒:



## 分组报告（第一天）

6月21日下午 14:30 - 18:00

**Track1 (主持人: )**

1.1	A Secure and Reliable Smart Home Guoping Wang.
1.2	Sequenced Switch Migration for Balancing Controller Loads in Large-scale Software-Defined Networking Lan Yao, Tao Hu and Julong Lan.
1.3	The meter management system based on the Internet of things Zhongxing Huo, Yongjie Yang and Yuelan Ji.
1.4	Data acquisition and processing system under hydrogen sensor Shimin Wang, Yongjie Yang and Junjiao Zhang.
1.5	Wearable Wireless Calling System in Hospital Based on ZigBee Sheng Li, Yongjie Yang and Junjiao Zhang.
1.6	A Unified Framework for Bug Report Assignment Yuan Zhao, Tieke He and Zhenyu Chen.
1.7	Automation Control System of Nuclear Track Membrane Research and Design Yunjie Li, Yanyu Wang and Dan Mo.

**Track2 (主持人: )**

2.1	Program Disturb Research and Error Avoidance Algorithm Design of 3D-TLC NAND Flash Memory Yang Xiaoshan, Zhu Ligu, Zhang Qicong, Zhang Meng, Wu Fei and Zhang Wei.
2.2	Formal Process Virtual Machine for Smart Contract Verification Zheng Yang and Hang Lei.
2.3	Formal Analysis and Verification of Timing and Resource Adaptability for Internetware Zhongqun Wang, Jun Li and Qi Xia.
2.4	Formal Verification of Helicopter Automatic Landing Control Algorithm in Theorem Prover Coq Chen Xi and Chen Gang.
2.5	A Study of Applying Fault-Based Genetic-Like Programming Approaches to Automatic Software Fault Corrections Chia-Hao Lee, Chin-Yu Huang and Tzu-Yang Lin.
2.6	Survey of Software Trustworthiness Measurement Validation Hongwei Tao and Yixiang Chen.
2.7	Using Cross-Entropy Value of Code for Better Defect Prediction Xian Zhang, Kerong Ben and Jie Zeng.
2.8	From Predicate Testing to Identify Fault Location for Safety-Critical Software Yong Wang.

**Track3(主持人: )**

3.1	Bayesian Reliability Analysis of Exponential Distribution Model Under a New Loss Function Haiping Ren and Shigang Chao.
3.2	Data complexity analysis for software defect detection Ying Ma, Yichang Li, Junwen Lu, Peng Sun and Xiatian Zhu.
3.3	Fuzzy AHP based comprehensive evaluation for smart grid in energy internet system Ying Ma, Yichang Li, Shunzhi Zhu, Nan Qin, Guang Zhao and Chao Huang.
3.4	STAMP-based Hazard Analysis for Computer-controlled Systems Using Petri Nets Danjiang Zhu, Shuzhen Yao and Chonghao Xu.
3.5	Prioritizing-based Message Scheduling for Reliable Unmanned Aerial Vehicles Ad hoc Network Jun Li, Ming Chen, Fei Dai and Huibing Wang.
3.6	Innate-adaptive response and memory based artificial immune system for dynamic optimization Weiwei Zhang, Menghua Zhang, Weizheng Zhang and Yinghui Meng.
3.7	Hierarchical Bayesian Reliability Analysis of Binomial Distribution Based on Zero-failure Data Shixiao Xiao and Haiping Ren.
3.8	A Solution to Make Trusted Execution Environment More Trustworthy Kun Xiao and Lei Luo.

## 分组报告（第二天）

6月22日上午9:30 - 12:00

### Track4(主持人: )

4.1	Visual Simulation Model of Highline Cable during Alongside Replenishment for Solid Cargo Weicheng Lun, Qun Li and Hongtao Hou.
4.2	A reliability-based preventive maintenance methodology for Projection Spot Welding Machine Ulugbek Fayzimatov, Buyun Sheng, Zheng Xiao and Ismael Toure.
4.3	Low Complexity Texture Video Coding for Multi-view videos System Reliability Shuru Liu, Shuaichao Wei and Qiuwen Zhang.
4.4	A modeling approach combining with performance and reliability for Mobile Cloud System Han Xu, Xun Guo, Xiwei Qiu, Sa Meng and Haiqing Wang.
4.5	Software Trustworthiness Metric Model Based on Component Weight Dujuan Huang, Yanfang Ma, Mengyue Wang and Haiyu Pan.
4.6	Reliability Simulation in Cloud Computing System Sa Meng, Xiwei Qiu, Liang Luo, Han Xu and Meilian Lei.
4.7	A Markov Error Propagation Model for Component-Based Software Systems Zijing Tian, Yichen Wang and Pengyang Zong.
4.8	Research and Development of Blockchain Security Zengyu Cai, Du Chunfeng, Yong Gan, Jianwei Zhang and Xuhui Wang.

### Track5(主持人: )

5.1	Feature Extraction of Gearbox based on Order Analysis of Instantaneous Angular Speed Lin Liang , Zhe Lei , Maolin Li ,Xiangwei Kong.
5.2	An Image Encryption Method Based on Hill Matrix and Dynamic DNA Encoding Xuncaizhang.
5.3	Grain Ration Consumption Forecasting based on Multivariate Regression Model Combined with Gliding Data Barycenter Chunhua Zhu and Jiaojiao Wang.
5.4	Video Indexing and Retrieval Based on Key frame Extraction Wenshi Wang, Huang Zhang-Qin, Weidong Wang, Shuo Zhang and Rui Tian.
5.5	Rate control Algorithm for Multiview Video Coding based on human visual characteristics Tao Yan, Hui Wen, Hang Xu and Qiuwen Zhang.
5.6	Measuring Surface Area of Leaf based on Multi-angle Images Weizheng Zhang, Weiwei Zhang, Yan Liu, Guoqing Li and Qiqiang Chen.
5.7	Learning to Predict Price Based on E-commerce Online Auction Machine

	Xiaohui Li, Hongbin Dong, Xiaowei Wang and Shuang Han.
5.8	An Improved Text Sentiment Analysis Algorithm Based on TF-Gini Songtao Shang, Yong Gan and Huaiguang Wu.
5.9	An Improved Tensor Decomposition Model for Recommendation System Wenqian Shang, Kaixiang Wang and Junjie Huang.

**Track6(主持人: )**

6.1	GOIL-Apo: Enhancing Subcellular Localization Prediction of Apoptosis Proteins by ensembling SVMs with random under-sampling Xiao Wang, Xiaohe Li, Hui Li, Hongwei Tao and Rong Wang.
6.2	User-group-based Method for Cold-start Recommendation Jing He, Shuo Yuan, Yi Xiang and Wei Zhou.
6.3	Research on active braking of electronic brake booster facing intelligent automobile Jian Wu, Pengcheng Chen, Jian Zhao and Rui He.
6.4	A novel multi-label predictor for identifying multi-functional types of human membrane proteins Xiao Wang, Guoqing Li, Weiwei Zhang and Hongwei Tao.
6.5	Understanding the similarity of log revision behaviors in open source software Xu Niu, Shanshan Li, Zhouyang Jia, Shulin Zhou, Wang Li and Xiangke Liao.
6.6	Calibration and Imaging of CT System Parameters Yuping Li, Xianhong Xu and Zhe Lyu.
6.7	Solution Generation through an Approach of Hybrid Intelligence and Creativity Basing on an Investment Portfolio Case Qinyun Liu, Hongji Yang and Cheng Chung Chu.
6.8	Performability Modeling for Cloud Service With Check-pointing Mechanism Considering Hardware and Software Failures Xiwei Qiu, Liang Luo, Sa Meng, Xiaochuan Tang,
6.9	Remote Sensing Image De-noising Algorithm Based on Elite Atomic Union Dictionary Learning Xiaodong Yu, Hongbin Dong, Tian Xia, Xiaohui Li

**Track7(主持人: )**

7.1	Application of An Improved Grab Cut Method in Tongue Image Segmentation Liu Bin, Hu Guangqin and Zhang Xinfeng.
7.2	Fast depth level range determination algorithm for 3D-HEVC system application Hanqing Ding, Wei An, Tao Yan and Qiuwen Zhang.
7.3	Coding Method for HEVC System Based on Homogeneity Region Classification Analysis Qiuwen Zhang and Kunqiang Huang.
7.4	Research on parallel volume rendering algorithm of volume mineralization model based on GPU Bin Ma, Yaohe Liu and Hyder Abbas.

7.5	Autonomic Cloud Resource Allocation Method Based on LS-SVM and Virtual Allocation Chenyang Zhao and Junling Wang.
7.6	Fast 3D-HEVC Coding Based on Support Vector Machine Hanqing Ding, Shuaichao Wei, Yan Zhang and Qiuwen Zhang.
7.7	A Hierarchical Caching Decision Algorithm for Content-Centric Network Zengyu Cai, Xuhui Wang, Jianwei Zhang and Chunfeng Du.
7.8	Research on the Cache Replacement Algorithm of Universal Network Based on Cooling Mechanism Yuan Feng, Lu Wang, Jianchun Li, Chunfeng Du and Jianwei Zhang.
7.9	A Method Encoding coordinates on Paper for Digitizing Hand-writing Qingcheng Li, Gm Zheng, Ye Lu and Heng Cao.

## 大会主持人

### W. Eric Wong

The University of Texas at Dallas, USA



W. Eric Wong received his M.S. and Ph.D. in Computer Science from Purdue University, West Lafayette, Indiana, USA. He is a Full Professor, the Director of International Outreach, and the Founding Director of Advanced Research Center for Software Testing and Quality Assurance (<http://paris.utdallas.edu/stqa>) in Computer Science at the University of Texas at Dallas (UTD). He also has an appointment as a guest researcher at the National Institute of Standards and Technology, an agency of the U.S. Department of Commerce. Prior to joining UTD, he was with Telcordia Technologies (formerly Bellcore) as a senior research scientist and the project manager in charge of Dependable Telecom Software Development. Professor Wong is the recipient of the 2014 IEEE Reliability Society Engineer of the Year. He is also the Edit-in-Chief of the IEEE Transactions on Reliability. His research focuses on helping practitioners improve software quality while reducing production cost. In particular, he is working on software testing, program debugging, risk analysis, safety, and reliability. Professor Wong has published more than 180 papers and edited 2 books.

Professor Wong is the Founding Steering Committee Chair of the IEEE International Conference on Software Security and Reliability (SERE) and the IEEE International Workshop on Program Debugging. In 2015, the SERE conference and the QSIC conference (International Conference on Quality Software) merged into one large conference, QRS, with Q representing Quality, R for Reliability, and S for Security. Professor Wong continues to be the Steering Committee Chair of this new conference (<http://paris.utdallas.edu/qrs>).

# 大会特邀报告

## Networks of ‘Things’

Jeff Voas

IEEE Reliability Society, USA

### Abstract

System primitives allow formalisms, reasoning, simulations, and reliability and security risktradeoffs to be formulated and argued. In this talk, five core primitives belonging to most distributed systems are presented. These primitives apply well to systems with large amounts of data, scalability concerns, heterogeneity concerns, temporal concerns, and elements of unknown pedigree with possible nefarious intent. These primitives are the basic building blocks for a Network of ‘Things’ (NoT), including the Internet of Things (IoT). This talk offers an underlying and foundational understanding of IoT based on the realization that IoT involves sensing, computing, communication, and actuation. The material presented here is generic to all distributed systems that employ IoT technologies (i.e., ‘things’ and networks). The expected audience is computer scientists, IT managers, networking specialists, and networking and cloud computing software engineers.

### Bio



Jeffrey Voas is an author and innovator. Voas was an entrepreneur and co-founded Cigital that is now a part of Synopsys (Nasdaq: SNPS). He has served as the IEEE Reliability Society President (2003-2005, 2009-2010, 2017-2018), and served as an IEEE Director (2011-2012). Voas co-authored two John Wiley books (Software Assessment: Reliability, Safety, and Testability [1995] and Software Fault Injection: Inoculating Software Against Errors [1998]), is on the editorial board of IEEE Computer Magazine, and was on the Editorial Advisory Board of IEEE Spectrum Magazine.

Voas received his undergraduate degree in computer engineering from Tulane University (1985), and received his M.S. and Ph.D. in computer science from the College of William and Mary (1986, 1990 respectively). Voas is a Fellow of the IEEE, member of Eta-Kappa Nu, Fellow of the Institution of Engineering and Technology (IET), Fellow of the American Association for the Advancement of Science (AAAS), and member of the Washington Academy of Sciences. Voas’s current research interests include Internet of Things (IoT) and BlockChain.

## **Reliability Modeling for Large-Scale Computing System**

Yuanshun Dai

University of Electronic Science and Technology of China, China

### **Abstract**

It has become an important research area on how to make a large-scale computing system with higher reliability and intelligent self-improvement functions. This speech is mainly on large-scale computing system (LSCS) reliability modeling and optimization, and intelligent self-improvement in LSCS. Prof. Dai provides new ideas in merging Artificial Intelligence (AI) into Reliability area for Large-Scale computing system to have self-diagnosis and self-healing capability. Thus, the large-scale computing system (such as Cloud or Big-data system) can self-improve its reliability instead of traditional decrease with running time.

### **Bio**



Prof. Dai's research mainly focuses on Reliability Modeling and Optimization, and is the Pioneer in studying the Reliability for Large-Scale Networking Systems, such as Complex software/hardware/network system reliability, Grid service reliability, Cloud system reliability, IoT system reliability as well as AI system reliability. In these fields, Dr. Dai has published more than 160 articles, where there are 4 books, 120 journal papers including 56 IEEE/ACM Transactions papers, and 38 conference papers including 2 Best Paper Awards. According to Google Scholar, Dr. Dai's papers are cited by others 3961 times and his h-index is 35 and i10-index is 81. Dr. Dai is continuously elected as

“Chinese Most Cited Researchers” by Elsevier since 2015 every year till now, and is recently (2017) ranked No. 2 in China in the field of “Safety, Risk, Reliability and Quality”, according to SCI others' citation number(>800 times). He also serves as the Director of “National-Local Joint Laboratory in Next Generation Network and Big-Data Technology”, Associate Editor of IEEE Transactions on Reliability, Vice Dean of School of Computer Science & Engineering and Dean of School of Cyberspace Security in University of Electronic Science and Technology of China, etc.



# **Track1--Architecture and design-based reliability and performance**

## **1.1 A Secure and Reliable Smart Home**

Guoping Wang

### Abstract

The Internet of things (IoT) is the inter-networking of physical devices, vehicles (also referred to as connected devices and smart devices), buildings, and other items embedded with electronics, software, sensors, actuators, and network connectivity that enable these objects to collect and exchange data. IoT allows objects to be controlled and gather information remotely across the already established network. In this paper, an IoT Smart House Prototype is implemented that can monitor specific criteria, as well as control specific devices. Data to be monitored are: temperature, humidity, movement, water, and power. An outlet, camera, and microphone can be controlled by the user from any mobile device. The user will be notified in any change in the monitored data, if it changes beyond their given range. The device also works while power is out in the house; which means a battery back-up and Internet hot spot must be included as well. The security features of this Smart Home is also described, which uses the technique of firewall, user authentication with user name and password, TLS certification and encryption. Possible payload encryption is also described.

## **1.2 Sequenced Switch Migration for Balancing Controller Loads in Large-scale Software-Defined Networking**

Lan Yao, Tao Hu\*, Julong L

### Abstract

The proposal of multi-controller has improved the scalability and reliability of software-defined networking (SDN), and the entire network is divided into several subdomains with the self-governed controller. Due to the dynamic change of network traffic in different subdomains, it brings a new challenge for balancing loads on the distributed controllers. Switch migration, as a promising method, is designed to solve unbalanced distribution of controller loads. However, existing schemes implement switch migration without considering migration sequence and will produce long migration time and poor controller processing efficiency. In order to solve the above problems, this paper proposes Sequenced Switch Migration (SSM) approach, which considers migration parameters (e.g., delay, traffic, residual capacity and failure probability) for multi-objective optimization and achieves efficient switch migration using a sequenced way. By executing parallel and heuristic algorithm, SSM could reduce the execution time of migration while ensuring the performance requirements of controllers. The simulation results show that compared with the existing schemes, SSM reduces the total migration time by about 32.7% and decreases controller

load variance by 28.5% at least when controllers are under high load condition.

### **1.3 The meter management system based on the Internet of things**

Zhongxing Huo, Yongjie Yang, Yuelan Ji

Abstract

In order to realize the convenient and intelligent monitoring and management of the cable manufacturer's production line, this paper designs a set of meter management system based on the Internet of things, which can replace artificial monitoring cable production. The whole system takes the STM32 processor of the ARM kernel as the core, and it combines the embedded technology, wireless communication technology, the Internet of things technology, the 485 bus technology and the upper computer software technology. The system includes the front-end signal processing equipment, the Internet of things server and the client software, which can respectively realize the information collection and automatic control of the cable production line, real-time transmission of production data under the MQTT protocol, and storage and graphical display of production data. The system was tested in the factory and proved the timeliness of the control of the production line, the real-time nature of the data transmission and the practicality of the client software, which plays a great role in the modernization of the traditional factory.

### **1.4 Data acquisition and processing system under hydrogen sensor**

Shimin Wang, Yongjie Yang, Junjiao Zhang

Abstract

In order to facilitate data acquisition and analysis of hydrogen sensors in early stage, a set of data acquisition and processing system for hydrogen sensor is developed[4]. The system applies the embedded technology and combines the acquisition terminal with the upper computer to realize data acquisition and processing of hydrogen sensor. At present, it has been applied to a constant voltage type hydrogen sensor to collect and process the data. The conversion from resistance to current to voltage is realized. The resistance value at both ends of the measured material is within 200 K $\Omega$ . The measurement accuracy is 1  $\Omega$ . The upper computer assisted with the temperature compensation mechanism to achieve the effective data acquisition and processing of the measured materials. The practical application shows that the system is of great significance to the data acquisition and processing of the early hydrogen sensor[13].

### **1.5 Wearable Wireless Calling System in Hospital Based on ZigBee**

Sheng Li, Yongjie Yang and Junjiao Zhang

Abstract

With the continuous optimization of the reform of the medical system, many of the equipment of the hospital are developing towards the direction of intelligence. At present, the hospital bed call system is mainly called by the traditional cable. Wired call system wiring is tedious, high cost, sometimes also encounter short circuit, circuit breakage and other problems, which will affect the patient's timely treatment. Based on ZigBee CC2530 software and hardware technology, this paper designs a wearable wireless calling system in hospital based on ZigBee. ZigBee technology is a short distance wireless communication technology, which is characterized by low power consumption and low cost. This article sets up the style of the watch based on the ZigBee wireless communication hardware. This article sets up the style of the watch based on the ZigBee wireless communication hardware. The nurse can detect the patient's location at all times through the wireless call system device worn by the patient. When a patient leaves the sick bed alone and meets a sudden condition, the patient can call the nursing station nurse according to the wireless communication system worn on his wrist. The nurse can arrive at the first time and carry out the treatment, which can greatly reduce the occurrence of the patient's emergency. The application of wireless call system has greatly improved the level of hospital care, and further promoted the development of hospital equipment in the direction of intelligence.

### **1.6 A Unified Framework for Bug Report Assignment**

Yuan Zhao, Tieke He and Zhenyu Chen

Abstract

It is typically a manual, time-consuming, and tedious task of assigning bug reports to individual developers. Although some machine learning techniques are adopted to alleviate this dilemma, they are mainly focused on the open source projects, which uses traditional repositories such as Bugzilla to manage their bug reports. With the boom of mobile internet, some new requirements and methods of software testing are emerging, especially the crowdsourced testing. Unlike the traditional channels, whose bug reports are often heavyweight, which means their bug reports are standardized with detailed attribute localization, however, bug reports tend to be lightweight in the context of crowdsourced testing. To exploit the bug reports assignment differences in the new settings, a unified bug reports assignment framework is proposed in this paper. The framework is capable of handling both the traditional heavyweight bug reports and the lightweight ones by (i) first preprocessing the bug reports and feature selection (ii) then tuning the parameters that indicate the ratios of choosing different methods to vectorize bug reports (iii) and finally applying classification algorithms for assigning bug reports. Extensive experiments are conducted on three datasets to evaluate the proposed framework, the results indicate the applicability of the proposed framework, it also reveals the differences of bug report assignment between traditional repositories and crowdsourced ones.

### **1.7 Automation Control System of Nuclear Track Membrane Research and Design**

Abstract

The nuclear track membrane of the Institute of Modern Physics of the Chinese Academy of Sciences through the heavy ions generated by the HIRFL to form microspores and then undergoes special chemical etching. It is widely used in electronics, medicine, filtration, and analysis. The control system of the nuclear pore membrane has an important role in the entire production system. Due to the special beam radiation, the automation requirements of the control system is also very high. This article mainly studies the beam homogeneity correction control system and the production automation control system. The principle of beam uniformity correction, the implementation process, and the specific implementation of the automatic control system are studied in detail. Specific hardware deployment architecture and software design process.

## **Track2--Formalization verification & Fault tolerance and diagnosis**

### **2.1 Program Disturb Research and Error Avoidance Algorithm Design of 3D-TLC NAND Flash Memory**

Xiaoshan Yang, Ligu Zhu, Qicong Zhang, Meng Zhang, Fei Wu, Wei Zhang

Abstract:

To find and settle or reduce the program disturb error of 3D-TLC NAND flash memory, some experiments have been done in this paper. Through the experimental analysis on the FPGA test platform, it is found that the program disturb error has some characteristics: program disturb error let the state transfer rate of storage cell lose his balance; MSB, CSB, and LSB pages have unbalanced bit error ratio and bit error rate distribution; page program disturb bit error is not balanced with the change of the number of erase cycles. Based on the experimental results of the error rate imbalance, a error avoidance algorithm is designed, data transfer state of the algorithm can be vulnerable to interfere the data program state is not vulnerable to interfere program, the test results show that this algorithm can reduce 20% to 90% of the program disturb error rate. Therefore, the phenomenon this paper found and the program disturb error avoidance algorithm which help to improve the reliability of 3D-TLC NAND flash memory.

### **2.2 Formal Process Virtual Machine for Smart Contract Verification**

Zheng Yanga, Hang Leia

Abstract:

This paper reports on the development and verification of a novel formal symbolic process virtual machine (FSPVM) for verifying the reliability and security of Ethereum smart contracts, denoted as FSPVM-E, in Coq proof assistant. It adopts execution-verification isomorphism (EVI), an extension of Curry-Howard isomorphism (CHI), as its fundamental theoretical framework. The current version of FSPVM-E is constructed on a general, extensible, and reusable formal memory (GERM) framework, an extensible and universal formal intermediate programming language Lolisa, which is a large subset of the Solidity programming language using generalized algebraic datatypes, and the corresponding formally verified interpreter of Lolisa, denoted as FEther. It supports the ERC20 standard and can automatically simultaneously symbolically execute the smart contract programs of Ethereum and verify their reliability and security properties using Hoare logic in Coq. In addition, this work, contributes to solving the problems of automation, inconsistency and reusability in higher-order logic theorem proving.

### **2.3 Formal Analysis and Verification of Timing and Resource Adaptability for Internetware**

Wang Zhongquna, Li Juna, Xia Qia

Abstract:

To address the trustworthiness of Internetware under open and dynamic environments, this paper proposes an approach to verify whether Internetware is satisfied with timing and resource constraints. Firstly, interface automata are extended with time and resource semantics. Then timing and resource interface automata is used to model the behaviors of a software component. An algorithm is also provided to check whether all behaviors of an Internetware system are satisfied with resource constraints within specified time. Finally, an online bookstore system is employed to illustrate our work, and model checker Spin is used to verify the correctness of our approach.

### **2.4 Formal Verification of Helicopter Automatic Landing Control Algorithm in Theorem Prover Coq**

Xi Chen, Gang Chen

Abstract:

Helicopter flight control system plays an important role in the flight of helicopter and is known as the "brain" of helicopter. Only if the system is verified correct can the helicopter fly safely and steadily. This paper describes and validates the major part of an algorithm of automatic landing control in the high-order theorem prover Coq. Z transform is currently one of the most important flight control system analysis tools. This paper formally describes the definition of Z transform, validates some properties (that is homogeneous, uniformity, linear and complex shift properties) of Z transform to extend the system analysis capabilities of theorem proving, lay the foundation for further formalizing helicopter flight control system.

## **2.5 A Study of Applying Fault-Based Genetic-Like Programming Approaches to Automatic Software Fault Corrections**

Chia-Hao Lee, Chin-Yu Huang, Tzu-Yang Lin

Abstract:

Automatically correcting software bugs is not an easy job because the process of repairing bugs contains many uncertainties. As the size and complexity of software increases, manually correcting software bugs becomes very difficult. Hence, automatic software repair is becoming more and more essential. Genetic programming (GP) is a great method for addressing this problem and a great deal of research has used GP to find ways the repair faulty programs in recent years. Nevertheless, most of variants generated by GP are not precise to detect solution repair. In this paper, we propose a fault-based genetic-like programming approach that heuristically searches all possible variants as they increasing with the number of modifications. Our method is able to find the best repairs for programs with few faults faster than genetic programming. However, the penalty is that heuristically searching for suitable repairs takes too much time. Hence, we also optimized our approach to speed up the performance. In this study, our approach was used to repair faulty C programs and the results were compared with those generated by genetic programming. The results show that our approach was able to better detect faulty programs in up to 18000 lines of code when the number of program faults was less than two.

## **2.6 Survey of Software Trustworthiness Measurement Validation**

Hongwei Tao, Yixiang Chen

Abstract:

The software trustworthiness measurement is an essential research subject in trustworthy software. software trustworthiness measurement validation can show whether the measurement is adequate for measuring the software trustworthiness. There are a lot of research results in software trustworthiness measurement validation. In this paper, we survey on software trustworthiness measurement theoretical validation and empirical validation. The research state of the software trustworthiness measurement theoretical validation are summarized from the view of validation based on measurement theory and validation based on axiomatic approaches, and the state-of-art of the empirical validation are studied in the aspects of case study, survey and experiment. Lastly, we analyze the challenges facing in the software trustworthiness measurement validation.

## **2.7 Using Cross-Entropy Value of Code for Better Defect Prediction**

Xian Zhang, Kerong Ben, Jie Zeng

Abstract:

Defect prediction is meaningful since it can assist software inspection by predicting defective code locations and improve software reliability. Many software features are designed for defect prediction models to identify potential bugs, but no one feature set can perform well in most cases yet. To make better defect prediction, this paper proposes a new code feature, the cross-entropy value of the sequence of code's abstract syntax tree nodes (CE-AST), and develops a neural language model for feature measurement. To evaluate the effectiveness of CE-AST, we first investigate its discrimination for defect-proneness. Experiments on 12 Java projects show that CE-AST is more discriminative than 45% of twenty widely used traditional features. Furthermore, we investigate CE-AST's contribution to defect prediction. Combined with different traditional feature suites to feed prediction models, CE-AST can bring performance improvements of 4.7% in Precision, 2.5% in Recall and 3.5% in F1 by average.

## **2.8 From Predicate Testing to Identify Fault Location for Safety-Critical Software**

Yong Wang, Guifu Lu, Zhiqiu Huang, Bingwu Fang, Yong Li, Weiwei Li,

Abstract:

Statistical fault localization is one of the essential tasks in program debugging aids, which has shown that the evaluation history of predicates may disclose important clues about root cause of failures. However, there exists, especially for safety-critical software, evaluation bias using same granularity to measure simple predicates and complex compound predicates. Intuitively, we should use fine-grain predicate to evaluate suspiciousness of complex compound predicate to reduce the evaluation bias. In this paper, we propose a novel predicate fault localization technique from predicate testing to identify fault location. Based on predicate fault model, we first generate constraint sets for each predicate, then calculate the suspiciousness of predicates through evaluating their constraint sets, finally, we sort those suspicious predicate descend by their suspiciousness. Our preliminary experimental results show that our approach can significantly improve fault absolute ranking.

## **Track3--Reliability analysis and optimization**

### **3.1 Bayesian Reliability Analysis of Exponential Distribution Model Under a New Loss Function**

Haiping Ren, Shigang Chao

Abstract:

Loss function is an important content in Bayes statistical inference. The aim of this paper is to study the reliability analysis of exponential model based on a new proposed symmetric loss function. The new proposed loss function is established on the basis of LINEX asymmetric loss function. Firstly, the Bayes estimation of the parameter is derived under the prior distribution of the parameter based on non-information Quasi prior distribution, then the admissibility of the estimators are also discussed. Furthermore, this paper put forward a new testing procedure of the lifetime performance

index for exponential products based on the new derived Bayes estimator. Finally, Monte Carlo statistical simulation and an applicable example are used to illustrate that the new proposed Bayes estimators and testing procedure are effective and feasible. Keywords

### **3.2 Data complexity analysis for software defect detection**

Ying Ma, Yichang Li, Junwen Lu, Peng Sun, Xiatian Zhu

Abstract:

Most researchers conduct defect detection under the assumption that the training and future test data must be in the same feature space and the same distribution. But in the practical applications, data sets come from different domains and different distributions. Even sometimes local data in the target projects are limited and data are usually affected by noise. In these cases, the performance of software defect detection model is uncertain. Firstly, we introduce the data complexity concept into the software engineering from data mining filed. Secondly, we investigate the data complexity measurement on public software data sets to find out which complexity metric is appropriate to apply in defect detection. Finally, we analyze the relationship between complexity metrics and model performance to gain valuable insight into the effect of data complexity on defect detection. We are optimistic that our method can provide decision-making support for detection model management and design.

### **3.3 Fuzzy AHP based comprehensive evaluation for smart grid in energy internet system**

Ying Ma, Yichang Li, Shunzhi Zhu, Nan Qin, Guang zhao, Chao Huang

Abstract:

Reliability validation is an important research field in smart grid, which involves comprehensive consideration for the various evaluation factors. On this basis, the fuzzy comprehensive evaluation method is introduced to evaluate each index, which is difficult to accurately define the indicators of qualitative analysis, and obtains reasonable, comprehensive and effective evaluation results. A novel model evaluation method called fuzzy analytic hierarchy process (FAHP) has proposed for smart grid in area energy internet, considering the interaction among the indices. The solution estimates the index weight with analytic hierarchy process, and builds the evaluation model with fuzzy comprehensive evaluation method based on hierarchy process to assess the performance of the evaluation model with fuzziness. And then, the rationality of effectiveness of method for the smart grid is verified by the numerical examples. The fuzzy method proposed will provide an alternative technique for assessing different aspects of interaction in smart grid.

### **3.4 STAMP-based Hazard Analysis for Computer-controlled Systems Using Petri Nets**

Danjiang Zhu, Shuzhen Yao, Chonghao Xu

Abstract:

Systems-Theoretic Accident Modeling and Process (STAMP) is a novel accident causality model and has been used in various areas. However, most of the STAMP based hazard analysis methods are ad-hoc without rigorous procedures, and the process model used in STAMP is too simple to identify the hazardous control actions as the causes. Petri Nets, which are effective tools for complex computercontrolled system modeling and analysis, can make the hazard analysis with STAMP effectively. Aimed to identify the hazardous control action in the STAMP-based hazard analysis,



this paper extends the Petri Nets to model and analyze the control processes of system control structure. And the runtime control action failures are considered in the reachability graph for the hazard analysis. Furthermore, the types of hazardous control action are studied and analyzed in the extended reachability graph. Finally, a case study is given to illustrate the feasibility and availability of proposed method.

### **3.5 Prioritizing-based Message Scheduling for Reliable Unmanned Aerial Vehicles Ad hoc Network**

Jun Li, Ming Chen, Fei Dai, Huibing Wang

Abstract:

The Unmanned Aerial Vehicles Ad hoc Network (UAANET) consisted of multi UAVs through multi-hop wireless communication links, can execute missions more efficiently compared with single UAV. Due to dynamic topology, fast moving velocity, and unstable radio channel quality, message delivery in UAANET suffers from increased delay and packet loss. Especially, the command messages and the coordination messages are lost or significantly delayed, which results in uncontrolled UAV, failure of the task execution or even the crash of UAANET. For reliability and performance of UAANET, the message scheduling scheme should be taken into account. In this paper, we propose Prioritizing-based Message Scheduling algorithm (PMS) to provide reliable transmission of the command messages and coordination messages. The proposed algorithm assigns different priorities to the messages based on the content of messages and dynamic context factors, then schedules the messages respectively. Simulation results verify that PMS could substantially increase the reliability of UAANET

### **3.6 Innate-adaptive response and memory based artificial immune system for dynamic optimization**

Weiwei Zhang, Menghu Zhang, Weizheng Zhang, Yinghui Meng

Abstract:

Artificial immune system has been widely used to cope with optimization problems in static situation. There are particular challenges when handling the dynamic optimization problems (DOPs), so that the designed algorithms must conquer the challenges in order to perform an efficient optimization. In the paper, a new artificial immune system denoted as IMAIS is proposed to solve the DOPs, in which, several mechanisms were employed to face the challenges. In this algorithm, innate and adaptive responses in immune system are elaborated. The innate response is introduced to maintain the diversity of the population and implement global search, while adaptive immune response is developed to locally locate the optima. Moreover, memory mechanism is presented to reserve the found optima and further track the optima when environmental change happens. The experiments were conducted on Moving Peak Benchmark which is the most well-known benchmark in this domain and results have been compared with advance algorithms. Experimental results demonstrate that IMAIS is competitive for dynamic optimization problems.

### **3.7 Hierarchical Bayesian Reliability Analysis of Binomial Distribution Based on Zero-failure Data**

Shixiao Xiao, Haiping Ren

Abstract:

The aim of this paper is to develop a new hierarchical Bayesian estimation method under symmetric entropy loss function for reliability of binomial distribution. With the rapid development of manufacturing techniques, some electric products are highly reliable, and thus the zero-failure data often occurs when putting them in censored lifetime test. Based on zero-failure data, the reliability analysis is very important for the manufacture, hierarchical Bayesian estimator is regarded as a robust estimating method, but many existing robust Bayes estimators are complex, which is not easy to be utilized in practice. Then the contribution of this article is to put forward an easy hierarchical Bayesian estimator for reliability of binomial distribution when the prior distribution of reliability is negative log-gamma distribution. Finally, a practical example is given to show the feasibility and robustness of the proposed hierarchical Bayesian estimator.

### **3.8 A Solution to Make Trusted Execution Environment More Trustworthy**

Xiao Kun,Luo Lei

Abstract:

Trusted Execution Environment is an execution environment that resides in connected devices and ensures that sensitive data are stored, processed and protected isolated from the general-purpose OS such as Android. TrustZone TEE solution can achieve a medium protection level with comparatively low cost, so it is widely used. But related researches show that TrustZone TEE solution has security defects such as hardware isolation provide by TrustZone is not enough. In this paper, we propose a security enhancement scheme based on TEE. According to the existing problems in TrustZone TEE scheme, establish a corresponding protection mechanism to fully enhance the reliability of connected devices. In our scheme, TEE is used alongside other security technology such as secure elements, microkernel and kernel real-time protection to provide multi-layered defense mechanisms. In our scheme we introduce of security element as the root of trust (ROT) of connected devices. The secure element is used to store sensitive data such as the first-stage bootloader, various secret keys, and the certificate of the second-stage bootloader. The secure element is also used to execute sensitive operations such as encryption and decryption.

## **Track4—Reliability, measurement, estimation, and predication & Reliability modeling and validation & Reliability technological models & Reliability requirement and growth models & Testing and simulation**

### **4.1 Visual Simulation Model of Highline Cable during Alongside Replenishment for Solid Cargo**

Abstract:

Since there were few researches on visual simulation of highline cable so far, a kind of simulation model that reflected how shape of highline cable changed at various stages of alongside replenishment for solid cargo visually was proposed. With analysis of forces exerted on highline cable, expressions of several mechanical properties and parametric equations which described shape of highline cable were deduced using theory of catenary and structural mechanics, which comprised algorithmic sub models of different stages. Then, based on such algorithmic sub models, a series of physical sub models were established in Unity platform. Both algorithmic sub models and physical sub models constituted the simulation model. What this kind of model differed from pure mathematical model and theoretical simulation model was that it was able to not only display how shape of highline cable changed qualitatively but also manifest values of these relevant physical properties in real time quantificationally. Results of executions show that this model can mirror changes of highline cable at various stages of replenishment faithfully.

#### **4.2 A reliability-based preventive maintenance methodology for Projection Spot Welding Machine**

Ulugbek Fayzimatov, Buyun Sheng, Zheng Xiao, Ismael Toure

Abstract:

Maintaining an effective operation of a projection spot welding (PSW) machine is closely related to the effectiveness of the maintenance. Timely maintenance can prevent failures and improve reliability and maintainability of the machine. Therefore, establishing the maintenance frequency for the welding machine is one of the most important tasks for plant engineers. In this regard, reliability analysis of the welding machine can be used to establish preventive maintenance intervals (PMI) and to identify the critical parts of the system. In this research reliability and maintainability, analysis of the PSW machine was carried out. The failure and repair data for analysis were obtained from automobile manufacturing company located in Uzbekistan. The machine was divided into three main sub-systems: electrical, pneumatic and hydraulic. Different distributions functions for all sub-systems was tested and their parameters tabulated. Based on estimated parameters of the analyzed distributions, PMI for the PSW sub-systems at different reliability levels was calculated. Finally, preventive measures for enhancing the reliability of PSW sub-systems are suggested.

#### **4.3 Low Complexity Texture Video Coding for Multi-view videos System Reliability**

Shuru Liu, Shuaichao Wei, Qiuwen Zhang

Abstract:

3D extension of the high efficiency video coding (3D-HEVC) is a new emerging video compression international standard for multi-view videos system applications. Similar to HEVC, a computationally expensive mode decision is required to be checked all the possible prediction modes and depth levels to find the least rate distortion cost for each coding unit (CU) in 3D-HEVC. Furthermore, additional coding tools and inter-component prediction techniques have been added to 3D-HEVC for improving the coding efficiency of the multi-view texture videos. Those techniques achieve the highest texture video coding efficiency, but also require extremely high computational complexity which limits the use of 3D-HEVC encoders in reliability applications. In this paper, a fast texture video coding is proposed to reduce 3D-HEVC computational complexity. The basic idea of the algorithm is to adjust various steps of ME and DE based on motion homogeneity of texture motion field. The proposed overall algorithm incorporates early SKIP/Merge mode decision, and adaptive motion search range adjustment. Experimental results show that the proposed fast texture video coding algorithm can reduce the 56.6% computational complexity on average with negligible loss of video quality.

#### **4.4 A modeling approach combining with performance and reliability for Mobile Cloud System**

Han Xu, Xun Guo, Xiwei Qiu, Sa Meng, Haiqing Wang

Abstract:

In recent years, cloud computing have been wildly used to improve the quality of mobile services in wireless networks. The ability of cloud computing give the new born system, Mobile cloud system (MCS), power to provide high-performance services. However, services may be interrupted by random resource failures (such as, network failure, virtual machine (VM) failure) which extremely affects the service performance in realistic scenario. In this paper, we present a theoretical modeling approach to evaluate the service performance of the MCS, which takes into consideration the impact of the reliability on the service performance. The queue theory and the Markov chain are first used to model the performance and the reliability. In reliability modeling, network failure and VM failure are considered. Then, a Bayesian method is applied to connect the performance and the reliability, and a correlation metric is proposed. Finally, numerical examples are illustrated.

#### **4.5 Software Trustworthiness Metric Model Based on Component Weight**

Dujuan Huang, Yanfang Ma, Mengyue Wang, Haiyu Pan

Abstract:

In recent years, the component-based development pattern is becoming more and more popular with the developers. Generally, a software system is made up of multiple components. The trustworthiness of software system depends on the trustworthiness of every component. The paper will try to study the trustworthiness of system from the component view. Firstly, all components in the system are divided into the critical and non-critical ones according to their importance, and a

weight value is assigned to each component. For every basic construction between components, the trustworthiness metric model of subsystem is proposed by composing the trustworthiness of components. Secondly, we prove that these metric models satisfy the metric criteria, such as monotonicity, non-negativity, acceleration, sensitivity and substitution. Furthermore, the trustworthiness metric model of whole system is showed based the trustworthiness metric model of subsystem. Finally, an algorithm is designed to compute the trustworthiness metric of whole system. And, an example is showed to verify the reasonability of the metric model.

#### **4.6 Reliability Simulation in Cloud Computing System**

Sa Meng, Xiwei Qiu, Liang Luo, Han Xu, Meilian Lei

Abstract:

With the expansion of scale and the increase of users, the reliability of the cloud system has become a challenging issue in the industry and academia. Many researchers have studied the reliability mechanism of cloud computing systems and proposed reliability awareness methods to achieve resource integration to improve system reliability. However, various hardware and software failures occur inevitably and cannot be accurately found and repaired in a timely manner. Moreover, since most of the studies cannot know the background operation mechanism of the cloud system, this brings great problems to the research of cloud computing reliability. To solve this problem, we first extract the key features that can be used to increase system reliability in cloud computing architectures. Secondly, we present an architecture framework for reliability simulation, and analyze four types of common system failures which form hardware failures to virtual machine failures and data inconsistency failure. Finally, experiments and verification based on a set of realistic configurations and operation runtimes are implemented as an extension of well-known cloud simulation tool, CloudSim, to illustrate how these failures affect the reliability of cloud computing systems, and different resource scheduling algorithms handle these failures.

#### **4.7 A Markov Error Propagation Model for Component-Based Software Systems**

Zijing Tian, Yichen Wang, Pengyang Zong

Abstract:

In this paper, we propose a Markov Chain based error propagation model to analyze the reliability of the component-based software systems and take measures to make the critical components safer. Because it is difficult to test the whole component-based system, we apply an error propagation model to evaluate the reliability of the system with parameters which obtained by preliminary data from existing components and integration testing from two connected components. The main parameters required in our Markov model is: error probability for each component, error tolerance probability and error propagation probability for every two connected components. Therefore, our model is applied to compute the reliability of the system, find the most suspicious component during

debugging and protect the critical components. Finally, we simulate the process of these three applications to three different systems on MATLAB.

#### **4.8 Research and Development of Blockchain Security**

Zengyu Cai, Du Chunfeng, Yong Gan, Jianwei Zhang, Xuhui Wang

Abstract:

Blockchain is a distributed data structure which integrates security, reliability, and centralization. It is also the central support technology of the emerging digital encryption currency. With the emergence of Bitcoin, the blockchain as its underlying support has begun to attract attention from all walks of life, and has been initially applied in the fields of finance, stocks, and securities. This article briefly describes the classification, architecture, and key technologies of blockchain. At the same time, it briefly analyzes the key management, access control mechanism, DDOS attack defense mechanism, and fragment information leakage prevention mechanism in the blockchain security mechanism. Finally, the prediction of the future development trend of the blockchain aims to help further research on the blockchain and its security

## **Track5--Machine learning related to reliability & Trustworthy evaluation & Data-Driven reliability model design**

### **5.1 Feature Extraction of Gearbox based on Order Analysis of Instantaneous Angular Speed**

Lin Liang , Zhe Lei , Maolin Li ,Xiangwei Kong

Abstract:

As key components in a mechanical transmission chain, gearboxes work in non-stationary conditions in many cases and the effect of conventional vibration analysis is limited by low signal-noise ratio. Considering the advantage of Instantaneous Angular Speed (IAS), this paper proposes a gearbox feature extraction method based on the order analysis of IAS signals. Firstly, IAS signals of the input and output shafts are sampled synchronously by photoelectric encoders. Then the instantaneous angular speed difference (IASD) between the input shaft and output shaft is calculated to eliminate the interference of the transmission channel. Finally, the order spectrum of the gearbox can be obtained by the Fourier transform of IASD signal. Thus, gearbox's working status can be judged according to the characteristic distribution of rotational components in the order spectrum. The effectiveness of this method has been validated experimentally on a two-stage gearbox test rig.

## **5.2 An Image Encryption Method Based on Hill Matrix and Dynamic DNA Encoding**

Xuncaizhang, Yishan Liu, Guangzhao Cui, Zheng Zhou

Abstract:

An image encryption algorithm based on Hill matrix and dynamic DNA encoding is proposed. The algorithm firstly combines the elliptic curve with the hyper-chaotic sequence to construct the Hill encryption matrix, and the plaintext image is permuted and encrypted. Secondly, the dynamic DNA encoding technique is used to diffuse the pixel value of the image. Finally, chaotic sequences are used to complete the confusion and diffusion of the images. Experimental results show that the proposed algorithm can not only resist statistical attack and differential attack, but also effectively resist chosen plaintext attack, and has the advantages of large key space, good encryption effect and easy implementation.

## **5.3 Grain Ration Consumption Forecasting based on Multivariate Regression Model Combined with Gliding Data Barycenter**

ChunhuaZhu JiaojiaoWang

Abstract:

For the existing few original data and lower prediction robustness, this paper was considered from the thought of robust, a new multivariate regression forecasting model combined with gliding data barycenter was proposed. In this new forecasting method, the original data was interpolated and the corresponding data barycenter was optimized, then the important impact factors of ration consumption were analyzed and chose for multivariate regression model. In simulation experiments, the training data of 35 years (1981-2015) is used, and the results have shown that the proposed method can greatly improve the prediction accuracy and robustness.

## **5.4 Video Indexing and Retrieval Based on Key frame Extraction**

Wenshi Wang, Zhangqin Huang, Weidong Wang, Shuo Zhang, Rui Tian

Abstract:

With the ever growing amounts of digital video data becoming available, people are increasingly challenged to offer solutions that support the indexing and retrieval of videos. In this paper, we propose a keyframe based retrieval method which exploits the shot segmentation and “bag-of-visual-words (BoW)” based on the local keypoints for key frame extraction and semantic concept detection. The performance of BoW features is optimized by choosing appropriate representation choices. Once video frames are represented by BoW features, we can adopt a spectral clustering algorithm for generation of key frames in each shot, and then we can classify these keyframes by support vector machines (SVM) for semantic concept detection. Finally, this paper performs a query by concept search for the video retrieval. The experiment results demonstrate that the proposed method is capable of efficiently retrieving video shots. Compared with the related method, the proposed method yields better results for key frame extraction and yields a mean average precision

(MAP) of 0.68 for video retrieval model.

### **5.5 RatecontrolAlgorithm forMultiviewVideoCodingbasedonhumanvisual characteristics**

TaoYan, WenHui,XuHang, Qiuwenzhang,JinhuoHuang

Abstract:

Rate control has not been well studied for multi-view video coding (MVC). This paper proposes a rate control algorithm for MVC based on human visual characteristics. Firstly, the proposed algorithm improve the quadratic rate-distortion (R-D) model. Then, the proposed method reasonably allocates bit-rate among views based on human visual characteristics, which can put the three-dimensional video point of view between the bit allocationthe problem boils down to the cost equation for the rate-distortion optimization problem. Extensive experiments show that the proposed algorithm can efficiently implement bit allocation and rate control according to coding parameters.

### **5.6 Measuring Surface Area of Leaf based on Multi-angle Images**

Weizheng Zhang, Weiwei Zhang, Yan Liu, Guoqing Li, Qiqiang Chen

Abstract:

The measurement of plant leaf area (LA) has important guiding significance for the diagnosis of plant growth status and prediction model of growth. The existing methods for measuring the LA are all contact measurement, and the leaves need to be flatten, which not only causes some damage to the leaves, but also fails to realize three-dimensional (3D) modeling and measurement of the leaves. This paper proposes a method to directly create the 3D model of the leaf and calculate the surface area of the leaf in the natural state. Firstly, the digital camera is calibrated to obtain the camera parameters; then the leaves in the natural state are photographed from multi-angle, and the images are processed by the Photomodeler software, in order to obtain the three-dimensional point cloud; then use MATLAB programming to achieve 3D modeling of the leaf and calculate the surface area; finally using a scanner combination Photoshop software methods compared with the previous. The experimental results shows that the method proposed has a good effect on the measurement of the leaf under natural conditions with an accuracy of 99%, which is more superior than the existing methods.

### **5.7 Learning to Predict Price Based on E-commerce Online Auction Machine**

Xiaohui Li, Hongbin Dong, Xiaowei Wang, Shuang Han

Abstract:

In this paper, we present a novel optimization framework, named as E-commerce Online Auction Machine. Considering all the characteristics that affect online auction prices, this paper calculates the best fitting line to predict online auction prices by the ordinary least square. After that, regression weights are optimized by the method of local weighted. Finally, using the shrinkage method, each characteristic optimal weight is obtained using EOAM-RR algorithm. Then we have found the key



characteristics that affect the auction price and some characteristics are not important.

### **5.8 An Improved Text Sentiment Analysis Algorithm Based on TF-Gini**

Songtao Shang, Yong Gan, Huaiguang Wu

Abstract:

With the development of social media, more people prefer to express their opinions to the Internet. Therefore, how to exactly mine people's emotional attitudes has become an important problem. Text sentiment analysis is a better method for us mining people's emotional attitudes through texts. It is an effective tool to grasp the Internet users' emotional tendency. Naïve Bayes is an excellent text classification algorithm, which has been approved by many researchers. Feature weighting is the most important problem for Naïve Bayes. Hence, this paper proposes an improved feature weighting algorithm, named as TF-Gini. The improved feature weighting algorithm sharply increases the performance of Naïve Bayes, especially for text sentiment classification. The experimental results in paper have approved the effectiveness of the improved algorithm.

### **5.9 An Improved Tensor Decomposition Model for Recommendation System**

Wenqian Shang, Kaixiang Wang, Junjie Huang

Abstract:

With the arrival of the large data age, the algorithm of traditional recommendation system cannot fully excavate the context information of the user's decision-making and cannot provide a satisfactory recommendation for users. With the development of the label system, it becomes a hot topic to use multidimensional context-aware data to provide an accurate recommendation for users. At present, the more advanced scheme is to use the recommendation algorithm based on tensor decomposition to excavate the three element relationship group of user-item-label. This paper proposes KMeans and Time-Context Based Tensor Decomposition Model(KTTD). The initial clustering of datasets is carried out through K-Means to improve the data aggregation and algorithm efficiency. The time context of the situation recommendation is excavated, and the implicit feedback in the temporal context perception is used as a dimension of tensor to establish the tensor decomposition model, so as to improve the efficiency and quality of the recommendation. At the end of the paper, we verified the model by experiments, and the results show that the improved algorithm is better than the traditional recommendation algorithm in the accuracy of the recommended system.

## **Track6—Applications of System and Software Reliability**

### **6.1 GOIL-Apo: Enhancing Subcellular Localization Prediction of Apoptosis Proteins by ensembling SVMs with random undersampling**

Xiao Wang\*, Xiaohe Li, Hui Li, Hongwei Tao and Rong Wang\*

Abstract:

Apoptosis proteins play a key role in maintaining the stability of organism. The functions of apoptosis proteins are related to their subcellular locations. To better understand the functions of apoptosis proteins, it is an important step to predict their subcellular locations. In recent years, a lot of computational methods have been developed specifically for apoptosis protein subcellular localization prediction. However, most of the existing predictors have the following problems: (1) they utilize sequence-based methods rather than knowledge-based methods (especially gene ontology (GO) based methods) for feature representation; (2) they ignore the negative impact of the imbalanced training dataset. To address these problems, this paper proposes a balanced predictor, namely GOIL-Apo, which can yield balanced solutions for subcellular localization prediction of apoptosis proteins. Firstly, by using gene ontology (GO) based methods, apoptosis proteins are represented as GO feature vectors. Subsequently, an ensemble classifier by fusing multiple SVMs with random under-sampling is proposed to deal with the data imbalance problem. Rigorous crossvalidations show that GOIL-Apo performs significantly better than the state-of-the-art predictors.

## **6.2 User-group-based Method for Cold-start Recommendation**

**Jing He, Shuo Yuan, Yi Xiang, Wei Zhou\***

Abstract:

Recommendation algorithms seek to predict user ratings or preferences. Due to limited information, it is difficult to make these predictions for new users. Therefore, a dynamic cold-start recommendation algorithm would be highly helpful in such quick-changing social networks. In this paper, a novel user-group-based collaborative method, called UCFRA (User-group-based Collaboration for Recommendation Algorithm) is proposed. UCFRA integrates a graphical model and statistical population characteristics into a user-group model and then combines this extended user-group model with cold-start information to generate a new recommendation algorithm. Moreover, a content popularity model based on user groups and a user rating matrix is designed. In order to improve recommend precision, a user group Top-N recommendation model based on k-nearest neighbors is provided. A series of experiments involving collection of a huge data set were developed to evaluate the effectiveness of UCFRA. The experimental results showed that UCFRA is a valid algorithm.

## **6.3 Research on active braking of electronic brake booster facing intelligent automobile**

**Jian Wua\*, and Pengcheng Chenb, Jian Zhao, Rui He**

Abstract:

In this paper, a novel electronic brake booster and an accurate pressure control method for

engineering are put forward considering the shortcomings of the existing braking system in active braking for intelligent driving. Together with the hydraulic control unit, it has two working modes: active braking for automatic drive and passive braking for driver intervention. For wheel cylinder pressure control, we translate the control problem of pressure to position tracking. The strong nonlinearity and the load-dependent friction make the position tracking control of the electro-mechanical brake booster become more challenging. Consequently, a modified PI control architecture is presented with techniques of cascaded three closed loop PI controller, friction compensation based on friction model, and gain scheduling. Finally, based on dSPACE, we carried out the rapid prototyping tests of active braking and hardware in the loop tests covering full speed ACC conditions. The results show that pressure control, acceleration control and speed control are well performed.

#### **6.4 A novel multi-label predictor for identifying multi-functional types of human membrane proteins**

Xiao Wang\*, Guoqing Li, Weiwei Zhang and Hongwei Tao

Abstract:

Identifying multi-functional types of human membrane proteins is very helpful for understanding their functions. However, most of existing predictors perform poorly and more importantly, they are limited to identifying single-label functional types of human membrane proteins but ignore those membrane proteins belonging to two or more types. To solve these problems, this paper proposes a new multi-label predictor, namely mMem-Hum, which can predict not only membrane proteins with single functional types but also those with multi-functional types. Specifically, pseudo-amino acid composition and position-specific scoring matrix with auto covariance transformation are used to extract features for membrane proteins, and then are classified by a new multi-label classifier by utilizing label correlations. Experimental results show that mMem-Hum significantly outperforms other existing state-of-the-art predictors. It indicates that mMem-Hum may become a promising high-throughput tool for identifying functional types of human membrane proteins.

#### **6.5 Understanding the similarity of log revision behaviors in open source software**

Xu Niu, Shanshan Li\*, Zhouyang Jia, Shulin Zhou, Wang Li, Xiangke Liao

Abstract:

As logging code evolves with bug fixes or feature updates, developers may miss some log revisions due to lack of general specifications and attention from developers. This makes it more troublesome to reach good logging practices. In this paper, we try to study log revision behaviors from evolution history. Motivated by similar edits on clone code, we assume there also exist similar log revisions which implicated log revision behaviors. Based on this assumption, we study the similarity of log revision behaviors and answer six research questions. Specifically, we find that 54.14% of log revisions belong to groups of similar log revisions and 64.4% of groups contain log revisions which are missed by developers. And we stress the importance of branch statements

on learning from similar log revisions since 53.51% of sampled similar log revisions are related to the semantics of branch statements.

## **6.6 Calibration and Imaging of CT System Parameters**

Yuping Li, Jinnuo Zhang and Zhe Lyu

Abstract:

The progress of human society cannot be separated from medicine development. CT is an important auxiliary instrument of modern medicine, and its imaging precision and stability are essential conditions. To provide more accurate reference for medicine, data fitting, parameter estimation, interpolation, neural network, continuous discretization and image processing algorithm are applied in this paper to establish the corresponding model between absorption strength and images through radon transform and I radon transform so as to demonstrate CT imaging process and CT parameter calibration process. Meanwhile, the CT imaging rules are gained. Further, CT parameter calibration precision and stability improve, and diagnosis precision also improves. First of all, Excel form is compressed according to the data in Annex 1, and characteristics of data in Annex 2 are observed. Horizontal illumination and vertical illumination of light are taken to figure out the detector unit space. When horizontal light illuminates the medium, the chord passing through the center of circle is longest. The energy magnitude, physical relation between energy and thickness, length of corresponding chord can be found in Annex 2 to establish matrix equation set and solve the center of rotation of CT system. The data in Annex 2 corresponds to 180 directions, and the equation set is established to gain every direction.

## **6.7 Solution Generation through an Approach of Hybrid Intelligence and Creativity Basing on an Investment Portfolio Case**

Qinyun Liu, Hongji Yang, William Cheng Chung Chu

Abstract:

Artificial Intelligence (AI) has developed to be robust on computing. Connecting with heterogeneous data, AI algorithms, such as Artificial Neural Network, can achieve learning. These kinds of heuristic algorithms can make the machine learn knowledge and discover the rules in the data. However, machine has not achieved creativity like human brain by using AI algorithms individually. This research is to explore an approach to achieve creative solution generation by simulating the process of generating creativity by human. Under the relationships of intelligence is the subset of the creativity, AI algorithms are used to fulfil the computing and the theories of achieving creativity is the guidance of this approach.

## **6.8 Performability Modeling for Cloud Service With Check-pointing Mechanism Considering Hardware and Software Failures**

Xiwei Qiu, Liang Luo, Sa Meng, Xiaochuan Tang

Abstract:

Cloud services have recently attracted much attention, where performance becomes an important

metric need to be considered. Most of existing researches study various methods and approaches for evaluating the performance metric, which however is inadequate because dynamic change of the performance caused by reliability factors is not taken into account. In fact, both software failures of a virtual machine (VM) and hardware failures of a server inevitably interrupt execution of a cloud service, and eventually result in spending more time on completing the cloud service. Meanwhile, the check-pointing mechanism is an important fault tolerant technique that is widely adopted to handle software failures. In this paper, we present a joint modeling approach encompassing Semi-Markov and the Laplace-Stieltjes transform to analyze the reliability-performance correlation for cloud services adopting the check-pointing fault recovery mechanism. Finally, we present a recursive method to evaluate the expected service time. Illustrative examples are provided.

### **6.9 Remote Sensing Image De-noising Algorithm Based on Elite Atomic Union Dictionary Learning**

Xiaodong Yu, Hongbin Dong, Tian Xia, Xiaohui Li

Abstract:

For the problem of remote sensing image de-noising, this paper proposes a remote sensing image de-noising algorithm based on elite atom cascade dictionary learning. The algorithm first trains the relevant redundant dictionary by using remote sensing image samples of various types of objects. Then according to the elite atomic selection strategy, the joint selection of various types of elites. Finally, it constructs an iterative format to solve the model to obtain the redundant dictionary of the remote sensing image and the common sparse representation coefficient matrix. And restore the image to achieve the purpose of de-noising.

## **Track7--Process improvement and maintenance & Quality and safety & Redundancy technology**

### **7.1 Application of An Improved Grab Cut Method in Tongue Image Segmentation**

Liu Bin, Hu Guangqing, Zhang Xinfeng

Abstract:

Grab Cut is a image segmentation method based on graph theory, and it is an improved algorithm of Graph Cut. Grab Cut can segment color images. Grab Cut has good interactivity and high segmentation accuracy, which has been a hot spot of image segmentation algorithm. However, Grab Cut has the disadvantage of long segmentation time consuming. The application of SLIC(simple linear iterative clustering) super pixel method can reduce the time consumption. According to the particularity of the higher R value in the pixel of the tongue image, the formula of SLIC color space distance is improved, so that the super pixel produced by SLIC is more suitable for tongue image segmentation. Experiments on 300 tongue segmentation experiments show that the segmentation accuracy of the improved SLIC Grab Cut algorithm is over 0.95, and the segmentation time is

reduced by half compared with the original Grab Cut algorithm. Algorithm can reduce the time of the segmentation of the tongue and improve the efficiency of the segmentation of the tongue, while maintaining the accuracy of the segmentation of the tongue body.

## **7.2 Fast depth level range determination algorithm for 3D-HEVC system application**

Hanqing Ding, Wei An, Tao Yan and Qiuwen Zhang

Abstract:

In this paper, a fast depth level range determination based on motion homogeneity is proposed to reduce 3D-HEVC computational complexity. Since the multi-view videos represent the same scene at the same time instantly (they have the same motion characteristics), it is not efficient to use all the depth levels and prediction modes in 3D-HEVC (considering that the optimal CU depth level and prediction modes are highly multi-view content-dependent). The motion homogeneity model of a CU is first analyzed according to the motion vectors and prediction modes from the corresponding CUs in the reference views. Based on this model, we propose fast depth level range determination for 3D-HEVC system. Experimental results show that the proposed algorithm can achieve the average computational complexity reduction up to 30.9%, while maintaining almost the same rate-distortion (RD) performance as the original 3D-HEVC system.

## **7.3 Coding Method for HEVC System Based on Homogeneity Region Classification Analysis**

Qiuwen zhang, Kunqiang Huang

Abstract:

High Efficiency Video Coding (HEVC) employs flexible coding unit (CU) partitioning pattern and advanced modes prediction method which contributes to video coding efficiency. It adopts Rate Distortion Optimization (RDO) method to achieve coding parameters selection. However, the advanced coding technologies improve HEVC encoders performance, which also introduce computation complexity increasement in the same time. Both in coding unit partitioning and prediction mode decision process, HEVC needs to utilize RDO method to calculate all the rate-distortion (RD) cost of all candidates. The optimal candidate selection process always accompanied by large computation complexity in original HEVC. Therefore, a decision early termination method is important to omit complex RD calculation. In this paper, a region classification method based on motion diversity is proposed to early stop CU partitioning and mode decision process. In the proposed method, if a CU is classified into smooth region, it will stop further depth levels partitioning and limit intra modes in candidates list. Therefore, the fast coding algorithm can omit large coding time and reduce computation complexity. Extensive experiment shows that the proposed method can save about average 32% coding time with negligible 0.049dB PSNR drop compare with original HEVC encoders.

#### **7.4 Research on parallel volume rendering algorithm of volume mineralization model based on GPU**

Ma Bin , Liu YaoHe and Hyder Abbas

Abstract:

Volume rendering is an important technique in data visualization, but it has some problems such as low sampling efficiency and slow drawing speed, especially for the model of body visualization calculation, too large scene rendering speed and high throughput rate. To improve the drawing speed of the volume rendering algorithm, a method of parallel GPU computing is proposed to optimize the algorithm. A parallel volume rendering algorithm based on GPU is implemented to improve the rendering speed, and the experimental results show that the algorithm can improve the speed of the algorithm without affecting the image quality.

#### **7.5 Autonomic Cloud Resource Allocation Method Based on LS-SVM and Virtual Allocation**

ChenYang Zhao, JunLing Wang

Abstract:

Current cloud resource allocation is unable to perform autonomously. When a cloud server overloads, the task queue keeps growing, which leads to delay or failure of task execution. In order to solve the problem, an autonomic cloud resource allocation method is proposed in this paper. For each type of task, Least Squares Support Vector Machine (LS-SVM) is used to predict the number of upcoming tasks in the next period by analyzing a time series of historical task numbers. Meanwhile, the queue lengths of various types of tasks are also periodically monitored during each period. And then, according to the predicted task numbers and the real-time queue lengths, Virtual Allocation (VA) is used to autonomously adjust resource allocation for various types of tasks during the task execution. The experiment shows that LS-SVM prediction is more accurate and VA is more effective, which can improve loads of cloud servers and reduce completion time of tasks.

#### **7.6 Fast 3D-HEVC Coding Based on Support Vector Machine**

Hanqing Ding, Shuaichao Wei, Yan Zhang, and Qiuwen Zhang

Abstract:

3D high efficiency video coding (3D-HEVC) is the state-of-the-art video compression standard for multi-view video system applications. In this paper, a fast coding algorithm is proposed based on machine learning to reduce the complexity of 3D-HEVC system while maintaining the RD performance. The basic idea of the proposed algorithm is to utilize the support vector machine (SVM) analyze the motion properties of texture video where variable mode prediction are needed, and early skip unnecessary modes for a given coding unit (CU). Experimental results show that the proposed fast coding algorithm can significantly reduce the computational complexity of 3D-HEVC system, while only a little BD-rate loss for texture view and synthesized view.

### **7.7 A Hierarchical Caching Decision Algorithm for Content-Centric Network**

Zengyu Cai, Xuhui Wang, Jianwei Zhang, Chunfeng Du

Abstract:

Content-Centric Network (CCN), one of the current research hotspots, is known as the network architecture with the best development prospects. As an important part of CCN, the performance of cache decision strategy directly affects the whole performance of CCN. A hierarchical caching decision algorithm (HCDA) is proposed to solve the problem of existing cache decision strategies in CCN. The strategy grades contents and nodes in network topology, so that the content can be hierarchically cached, solving the redundancy caused by LCE (Leave Cache Everywhere). Simulation results show that compared with LCE and ProbC (Probabilistic Caching), HCD effectively raising the cache hit ratio, reduces the cache content redundancy, thus reducing the user requests hop.

### **7.8 Research on the Cache Replacement Algorithm of Universal Network Based on Cooling Mechanism**

Yuan Feng, LuWang, Jianchun Li, Chunfeng Du, Jianwei Zhang

Abstract:

Universal network is a kind of typical separation network about identity or position, and it is one of the important trends of the new generation of network. In this paper, identity mapping query process of universal network was analyzed, and a beforehand push scheme of universal network was put forward in view of the main problems about time delay occurring in the identity mapping query process. On this basis, the access route cache partition scheme was given, and the access router cache replacement algorithm based on cooling mechanism was proposed. In the end, a detailed simulation experiment scheme was presented to validate that the method of replacement between pre - fetching and cache partition cooling was effective. The experimental results showed that the pre - fetching scheme of universal network identity mapping could effectively shorten the communication time delay of the mobile terminals, which improved the mobile supportive ability of universal network; the access router cache replacement algorithm based on cooling mechanism could improve routing cache hit ratio, which could shorten the routing time delay.

### **7.9 A Method Encoding coordinates on Paper for Digitizing Hand-writing**

Qingcheng Li, guangming Zheng, Ye Lu, Heng Cao

Abstract:

We have been using paper for more than a thousand years and we are so accustomed to using it. However, digital information is easy to share and manage. It is necessary to digitize the



handwriting. This article proposes a method Encoding coordinates on two-dimensional page for digitizing hand-writing combining Aoto encoding and nCode encoding. The coding scheme is calibrated based on coordinate relation, and the feasibility of the scheme is verified through experiments.