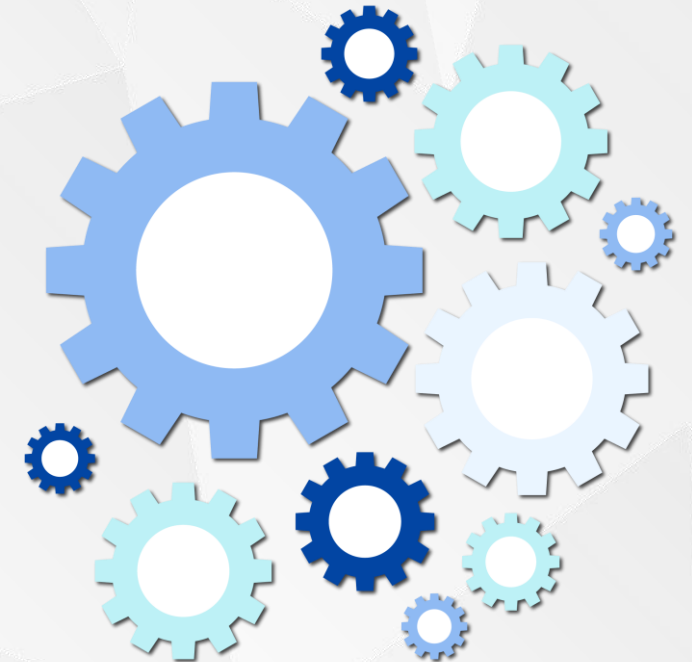


# The 3rd International Conference on Industrial Applications of Big Data and Artificial Intelligence

## BDAI 2021 Conference Programme

September 24, 2021 | Virtual Conference



Organized & sponsored by



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# 01 / WELCOME MESSAGE



Dear Participants,

Currently, the entire world is struggling against the virulent pandemic COVID-19. Unfortunately, each of us is affected, either overtly or covertly. Our conference, The 3rd International Conference on Industrial Applications of Big Data and Artificial Intelligence (BDAI 2021), is not an exception.

To provide a safe conference environment and reduce people gathering, BDAI 2021 which should be held in Wuhan, China from Sept. 24, 2021 as planned, is now changed as on-line conference. Changing the format however shall not affect the desire of the conference. We wish to continue our communication to share our new research ideas, discuss challenges and form collaborations to solve various issues on big data and artificial intelligence .

We would like to thank our outstanding Speakers: Prof. Dan Zhang from York University, Canada; Prof. Lefei Zhang from Wuhan University, China; Prof. Deze Zeng from China University of Geosciences (Wuhan), China; Assoc. Prof. Simon James Fong from University of Macau, Macau S.A.R., China for sharing their deep insights on future challenges and trends.

We would like to thank all the committees for their great support on organizing the conference. We also would like to thank all the reviewers for their great effort on reviewing the papers submitted to BDAI 2021. Special thanks to all the researchers and students who with their work and participate in the conference.

While we may not see each other face-to-face in Wuhan, we hope the conference can still establish a solid linkage among all the participant as desired. We look forward to your contribution to making BDAI 2021 a success.

BDAI 2021 Organizing Committee



**Prof. Dan Zhang**  
(Keynote Speaker)

Fellow of CAE, EIC, ASME, CSME  
York University, Canada  
Time: 9:10-9:50, Sept. 24, 2021

**Biography:** Professor Ramesh K. Agarwal is the William Palm Professor of Engineering in the department of Mechanical Engineering and Materials Science at Washington University in St. Louis. From 1994 to 2001, he was the Sam Bloomfield Distinguished Professor and Executive Director of the National Institute for Aviation Research at Wichita State University in Kansas. From 1978 to 1994, he was the Program Director and McDonnell Douglas Fellow at McDonnell Douglas Research Laboratories in St. Louis. Dr. Agarwal received Ph.D in Aeronautical Sciences from Stanford University in 1975, M.S. in Aeronautical Engineering from the University of Minnesota in 1969 and B.S. in Mechanical Engineering from Indian Institute of Technology, Kharagpur, India in 1968. Over a period of 45 years, Professor Agarwal has worked in Computational Fluid Dynamics (CFD) and its application to fluid flow problems in mechanical and aerospace engineering, and in energy and environment. He is the author and coauthor of over 600 publications. He has given many plenary, keynote and invited lectures at various national and international conferences worldwide in over sixty countries. He is a Fellow of 24 professional societies including AIAA, ASME, IEEE, SAE, AAAS, APS, and U.K. Institute of Physics among others. He has received many prestigious honors and national/international awards from various professional societies and organizations for his research contributions including the AIAA Reeds Aeronautics Award, SAE Medal of Honor, ASME Honorary Membership and Honorary Fellowship from Royal Aeronautical Society.

# 02 / CONFERENCE SPEAKERS



**Prof. Dan Zhang**  
(Keynote Speaker)

Fellow of CAE, EIC, ASME, CSME  
York University, Canada  
Time: 9:10-9:50, Sept. 24, 2021

## **Keynote Lecture:** Kinetostatic Modelling of Robotic Manipulator Systems

**Abstract:** In this talk, several new types of spatial parallel kinematic mechanisms with prismatic/revolute actuators whose degree of freedom is dependent on a constraining passive leg connecting the base and the platform are introduced. A generic kinetostatic model is established with the consideration of the characteristics of joints and links flexibilities. The model is used to demonstrate that flexible links have significant effects on the stiffness and accuracy of parallel kinematic machines. Stiffness mappings are shown and design guidelines for parallel kinematic machines are concluded.

The optimization of system parameters in achieving a better system stiffness is performed. This includes the development of a more explicit representation of an objective function in the optimization model. The genetic algorithm is employed to solve this optimization problem. As a result, a significant improvement of the system stiffness is achieved.

Finally, the remote manipulation with Java 3D is implemented and a sample is demonstrated.

# 02 / CONFERENCE SPEAKERS



**Prof. Lefei Zhang**  
(Keynote Speaker)

Wuhan University, China  
Time: 9:50-10:30, Sept. 24, 2021

**Biography:** Lefei Zhang received the B.S. and Ph.D. degrees from Wuhan University, Wuhan, China, respectively. He was a Big Data Institute Visitor with the Department of Statistical Science, University College London, U.K., and a Hong Kong Scholar with the Department of Computing, The Hong Kong Polytechnic University, Hong Kong. He is a professor with the School of Computer Science, Wuhan University. His research interests include pattern recognition, image processing, and remote sensing.

Dr. Zhang serves as an associate editor for Pattern Recognition and IEEE Geoscience and Remote Sensing Letters.



# 02 / CONFERENCE SPEAKERS



**Prof. Lefei Zhang**  
(Keynote Speaker)

Wuhan University, China  
Time: 9:50-10:30, Sept. 24, 2021

## **Keynote Lecture:** AI Innovation for Big Vision Data

**Abstract:** Artificial intelligence (AI) plays a growing role in all traditional areas. In this talk, we will introduce our recently developed AI techniques for computer vision data processing tasks, including image super-resolution, inpainting, semantic segmentation, and object detection. From these successful examples, we observe that the carefully designed AI algorithms and networks are usually inspired by human experiences of solving problems in practice. Furthermore, benefit from the strong support of the computational resources and big data, AI algorithms could reach even exciting performance. However, there are also critical concerns exist. In the future work, we will study how to run the AI models with extremely limited human expert labeled data, to serve for more challenging tasks such as autonomous driving and medical data analysis.

# 02 / CONFERENCE SPEAKERS



**Prof. Deze Zeng**  
(Keynote Speaker)

China University of Geosciences (Wuhan), China  
Time: 10:30-11:10, Sept. 24, 2021

**Biography:** Deze Zeng is a full professor in School of Computer Science, China University of Geosciences, Wuhan, China. He received his Ph.D. and M.S. degrees in computer science from University of Aizu, Aizu- Wakamatsu, Japan, in 2013 and 2009, respectively. He received his B.S. degree from School of Computer Science and Technology, Huazhong University of Science and Technology, China in 2007. His current research interests include: network function virtualization, software-defined networking, cloud computing and edge computing. He has authored 2 books and over 100 papers in refereed journals and conferences in these areas. He also received 5 best paper awards from IEEE/ACM conferences and the IEEE Systems Journal Annual Best Paper Award of 2017. He serves in editorial boards of IEEE Transactions on Sustainable Computing, Journal of Network and Computer Applications, Frontiers of Computer Science, and guest editors of many prestigious journals. He has been the in organization or program committees of many international conferences including ICPADS, ICA3PP, CollaberateCom, MobiQuitous, ICC, Globecom. He is a member of IEEE and senior member of CCF.



# 02 / CONFERENCE SPEAKERS



**Prof. Deze Zeng**  
(Keynote Speaker)

China University of Geosciences (Wuhan), China

Time: 10:30-11:10, Sept. 24, 2021

## **Keynote Lecture:** When Computer Networks meet Artificial Intelligence: Opportunities and Challenges

**Abstract:** The growing diverse needs in network applications and services ask for a more flexible network management approach. However, traditional rule or policy based “hard” network management fails to catch up with such ever-growing needs. Fortunately, recent developments in various “softwarization” technologies like software-defined networking (SDN), network function virtualization (NFV) and cloud-radio access networks (CRAN) impose a new developing trend in computer networks. These technologies together “soften” the network such that network administrators can flexibly manage the networks to cater for various application needs. Meanwhile, recent advances in artificial intelligence (AI) also have inspired the trend of applying AI technologies in the management of many fields, with no exception to computer network. The openness resulted from the softwarization provisions the opportunities for future networks to embrace the AI technologies. In this talk, we would like to share our opinions on why AI is important to future networks and how to pursue intelligent network management. While, at the early stage of such marriage, there are still many challenges, which will also be discussed in this talk.

# 02 / CONFERENCE SPEAKERS



**Assoc. Prof. Simon James Fong**  
(Keynote Speaker)

University of Macau, Macau S.A.R., China  
Time: 11:10-11:50, Sept. 24, 2021

**Biography:** Fong graduated from La Trobe University, Australia, with a 1st Class Honours BEng. Computer Systems degree and a PhD. Computer Science degree in 1993 and 1998 respectively. Simon is now working as an Associate Professor at the Computer and Information Science Department of the University of Macau. He is a co-founder of the Data Analytics and Collaborative Computing Research Group in the Faculty of Science and Technology. Prior to his academic career, Simon took up various managerial and technical posts, such as systems engineer, IT consultant and e-commerce director in Australia and Asia. Dr. Fong has published over 500 international conference and peer-reviewed journal papers, mostly in the areas of data mining, data stream mining, big data analytics, meta-heuristics optimization algorithms, and their applications. He serves on the editorial boards of the IEEE IT Professional Magazine, and various special issues of IEEE journals. Simon is also an active researcher with leading positions such as Vice-chair of IEEE Computational Intelligence Society (CIS) Task Force on Business Intelligence & Knowledge Management, and Vice-director of International Consortium for Optimization and Modelling in Science and Industry (iCOMSI).

# 02 / CONFERENCE SPEAKERS



**Assoc. Prof. Simon James Fong**  
(Keynote Speaker)

University of Macau, Macau S.A.R., China  
Time: 11:10-11:50, Sept. 24, 2021

## **Keynote Lecture:** Critical Industrial Applications by Optimized Machine Learning

**Abstract:** With the rapid development of industrial technology and intelligent information technology, the processing of big data by artificial intelligence (AI) enables industrial production to reach a higher level of automation. This is because AI has the ability of learning and identifying manufacturing defects using machine learning. It can control, monitor, and predict the state of the manufacturing equipment through the production data it has obtained, and it can achieve self-learning by establishing a neural network. On this basis, industrial production can rely on AI to achieve advanced intelligent requirements. As a branch of computer science and technology, the buzzword AI is actually rebranded from traditional machine learning techniques. But in industrial applications, especially for critical applications, the demand for precision and performance of AI is extremely high. Any mistake made by the AI means life and death. Machine Learning (ML) has been around for decades, empowering many AI applications from computer vision to bioinformatics. Recently Deep Learning gained a remarkable popularity as a branch of ML, by its power to progressively extract higher-level features from the raw input through multiple "deep" layers. Convolutional Neural Network (CNN) is such a flagship model of DL that has unprecedented influential innovations in the field of computer vision and object recognition.

## 02 / CONFERENCE SPEAKERS

While CNN has shown its power in many real-life case studies and successful deployment, recently much attentions of computer scientists are focused on how to build a best CNN for a given task with the best performance [1]. In this talk, I will describe holistic methodology called Optimized Learning (OL) which is designed to uplift the performance of DL, from augmenting the input data, to the CNN optimization and corrective output learning. The context of optimization in OL here is different from traditional optimization algorithms. ML usually acts indirectly in terms of enhancing the prediction performance. It is supposed that optimization in OL needs to be done at several levels and at different places of a ML model. This endeavor aims at leveraging a better ML/DL model for better outcomes, especially in critical applications where the best possible accuracy matters. Some prior works have already been done and applied in industries [2]. Some demos in real commercial AI projects will be shown, with a highlight of the importance of researching for enhanced ML/DL algorithms to better solve industrial problems.



## Oral Presentation

1. File format: MS-PowerPoint (\*.ppt) or Adobe PDF (\*.pdf)
2. Time: About 15mins, including Q/A time. Each presentation should have at least **10 minutes**.
3. Language: English
4. Fonts: Arial or Times New Roman
5. Dress code: Formal clothes
6. Facility: Presenters need to use own laptop, please notify conference secretary via e-mail in advance and test the connection before session start.

## Poster Presentation

1. Poster Size: 1m\*0.8m (height\*width); jpg.
2. Language: English.
3. The poster should include: Paper ID, Conference Name's Acronym(BDAI 2021), Significance of the research, the methods used, the main results obtained, and conclusions drawn.
4. Posters are required to be condensed and attractive.

## Note:

1. We'll record the whole conference. If you do mind, please inform us in advance. We'll stop to record when it's your turn to do the presentation.
2. The recording will be used for conference program and paper publication requirements. It cannot be distributed to or shared with anyone else, and it shall not be used for commercial nor illegal purpose.





## Online Conference Software---VooV Meeting(腾讯会议)

### Download link:

A) Chinese version

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B) International Version

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### Conference Information:

Conference Time: 9:00-12:30, BJT, GMT+8, Sept. 24, 2021

Conference Room ID: 224 807 683

Conference Link: <https://meeting.tencent.com/dm/AeF4ni9TSXDf?rs=25>

### Note:

1. Please rename your name to your paper ID-Name (e.g. D001-Suzy) when you join the online room;
2. Suggest to change your virtual background to conference background. The background can be found on p.25.
3. Please wear headphones during the conference.
4. Session Chair will call the roll 10 minutes before the session, please join the conference in advance for at least 10-15 minutes.
6. If you have any questions, please hands up or unmute your microphone directly or send you questions to the Chat box.
7. We will take a group photo and announce the best presenter after all the presentations this session.



# 04/ PROGRAMME OVERVIEW



Sept. 24, 2021 Friday | Beijing time, GMT+8

Online Room ID: 224 807 683| Conference Link: <https://meeting.tencent.com/dm/AeF4ni9TSXDf?rs=25>

09:00-09:10	Opening Remark	
09:10-09:50	KN1	<b>Kinetostatic Modelling of Robotic Manipulator Systems</b> <i>Prof. Dan Zhang, York University, Canada</i>
09:50-10:30	KN2	<b>AI Innovation for Big Vision Data</b> <i>Prof. Lefei Zhang, Wuhan University, China</i>
10:30-11:10	KN3	<b>When Computer Networks meet Artificial Intelligence: Opportunities and Challenges</b> <i>Prof. Deze Zeng, China University of Geosciences (Wuhan), China</i>
11:10-11:50	KN4	<b>Critical Industrial Applications by Optimized Machine Learning</b> <i>Assoc. Prof. Simon James Fong, University of Macau, Macau S.A.R., China</i>
11:50-12:30	Technical Session Poster Session	D004, D006 D002, D003, D005, D1001, D1003, D1004, D1005, D1007, T302, T001, T002, T006, T008, T014, T1003, T1007



## Technical Session

**11:00-12:15, May 14, Friday | Room ID: 224 807 683 | Link: <https://meeting.tencent.com/dm/AeF4ni9TSXDf?rs=25>**

**D004**

**11:50-12:05**

### **Landform Features for Infrared Pedestrian Detection**

*Lei Wang*, Beihang University, China

Abstract: Pedestrian detection has long been a research hot spot for its wide range of potential applications, e.g. public transportation, video surveillance. In this paper, we tackle the problem of infrared pedestrian detection as infrared images do not rely on sufficient illumination and have better environmental adaptability. To be specific, we propose a novel landform-based infrared feature extraction scheme, which richly exploits the heat source and temperature distribution information and therefore provides stronger infrared features. Following this feature extraction scheme, we build a LandForm Feature Network (LFF-Net) for infrared pedestrian detection. We show that the LFF-Net achieves a state-of-the-art performance of 70.75% on the widely-used FLIR dataset (improving 3.46% over its baseline), demonstrating the effectiveness of the proposed landform features for infrared images.

**D006**

**12:05-12:20**

### **Latent Topic Analysis of the Post Property for Sales to Predict a Selling Price of Second-Hand Condominiums**

*Pornpimol Chaiwuttisak*, King Mongkut's Institute of Technology Ladkrabang, Thailand

Abstract: This research objective is to study the latent topics analysis in selling post of real estate of second-hand condominium by using Latent Dirichlet Allocation (LDA) and build a price prediction model of second-hand condominium using multiple linear regression and artificial neural networks by measuring and comparing the performance of the second hand condominium price prediction model with root mean square error (RMSE). This experiment included four variables are room size, number of bathroom, number of bedroom and latent topics from LDA. The result of LDA indicated that selling post of real estate can be separated into 4 topics, in which finding the factors that affect the price use the regression analysis method to get five variables are room size, number of bathroom, floors, topic 2 and topic 4. The RMSE based on the multiple linear regression analysis was 1.349, while the RMSE based on artificial neural network was 1.156. Thus, it can be concluded that the predictive model using the artificial neural networks is superior to multiple linear regression.



D002

**Chinese Math Word Problems Generation Network***Presenter: Junjian Huang, Shenzhen University, China*

**Abstract:** Aiming at the feature vector bottleneck problem and the high time cost of the training process in the automatic generation of Chinese math word problems under the end-to-end architecture, we proposed an automatic generation method of Chinese math word problems based on the pre-training model combined with the integration of encoder and decoder. We used a deep neural network to model the mathematical equation sequence and Chinese keyword information, and used the stepped attention matrix to generate word problems. For training and testing on the Ape210K data set, compared with the end-to-end method, the Rouge-1 and Rouge-L evaluation indicators in our method was increased by 14.1% and 12.5%, as well as the training time cost was reduced by nearly 50%.

D003

**Intelligent Question Answering System Based on Machine Reading Comprehension***Presenter: Qian Shang, Shenzhen University, China*

**Abstract:** Question answering(Q&A) system is important for accelerating the landing of artificial intelligence. This paper makes an improvement on the Q&A system which uses the method of retrieval-machine reading comprehension (MRC). In the retrieval phase, we use BM25 to recall some documents and split these documents into paragraphs, then we reorder the paragraphs according to the correlation with the question, so as to reduce the number of recalled paragraphs and improve the speed of MRC. In the MRC stage, we design a multi-task MRC structure, which can judge whether the paragraph contains answer and locate answer accurately. Besides, we modify the loss function to fit the sparse labels during the training. The experiments are carried out on multiple data sets to verify the effectiveness of the improved system.



D005

**Latency Aware Distributed ADMM over Networks***Presenter: Shuai Zeng, Chongqing University of Posts and Telecommunications, China*

**Abstract:** Methods based on the alternating direction method of multipliers (ADMM) has attracted academic attention because of its excellent convergence performance and potential application scenarios in many machine learning or optimization fields. However, classical distributed ADMM algorithm assumed ideal network communication, which do not consider the impact of network delay on computing performance. In this paper, based on the strategy of selecting bridges with lowest network latency and appropriate iterative process, we propose a latency aware distributed ADMM algorithm to alleviate the impact of network delay. The classical algorithm and proposed algorithm are tested and compared in real network scenarios. Experiments show that the proposed algorithm reduces the running time and improves the computing performance. Especially in networks with large delay, the effect is more obvious.

D1001

**Self-Amplificated Network: Learning fine-grained learner with few samples***Presenter: Xili Dai, University of Electronic Science and Technology of China, China*

**Abstract:** Training deep neural networks from only a few examples has been an interesting topic that motivated few shot learning. In this paper, we study the fine-grained image classification problem in a challenging few-shot learning setting, and propose the Self-Amplificated Network (SAN), a method based on meta-learning to tackle this problem. The SAN model consists of three parts, which are the Encoder, Amplification and Similarity Modules. The Encoder Module encodes a fine-grained image input into a feature vector. The Amplification Module is used to amplify subtle differences between fine-grained images based on the self attention mechanism which is composed of multi-head attention. The Similarity Module measures how similar the query image and the support set are in order to determine the classification result. In-depth experiments on three benchmark datasets have showcased that our network achieves superior performance over the competing baselines.



## **Recognition method of pipeline damage degree based on one-dimensional convolutional neural network**

*Presenter: Jianjun Pan, Wuhan University of Technology, China*

**D1003**

**Abstract:** The pipeline is a key component for the transportation of oil, gas, water and other media, and an indispensable part of industrial fluid transportation equipment. In the service process, the pipeline is easily damaged due to fluid erosion, fatigue and other factors. Optical fiber sensing technology has the advantages of high sensitivity, anti-electromagnetic interference, and good corrosion resistance; while deep learning technology has the advantage of automatically extracting data features and classification. This article combines distributed optical fiber sensing technology and deep learning technology to diagnose the degree of damage to the pipeline. This article divides the pipeline damage degree into four types, namely the complete pipeline, 1mm damage, 2mm damage, and 3mm damage. Based on the wavelength division multiplexing demodulation system, the strain time domain signal of the pipeline was collected, and then we independently built a one-dimensional convolutional neural network model, and obtained a recognition accuracy of 95%. Finally, we divided the data into four equal parts and did a four-fold cross-validation, and finally got an average accuracy rate of 85.6%, indicating that the model we designed can better identify the degree of pipeline damage.

## **An investigation into the influence of big data technology on the profitability of China's city commercial banks**

*Presenter: Guo Wu, Sanda University, China*

**D1004**

**Abstract:** Modern technologies, such as big data technology and artificial intelligence, have been continuously reshaping the traditional banking industry and posing challenges for China's city commercial banks (CCBs) which are relatively slow in embracing innovations. This study aims at evaluating the current applications of big data technology in the banking sector and how these applications could help upgrade services provided by CCBs. Meanwhile, the influence of big data technology on the bank profitability is statistically examined using the data from the 2013-2019 period. The results show that big data technology currently has a negative influence on the level of bank profitability. The regression results from using different estimators and standard errors are also compared to assess the robustness of the regression results.

T302

## **An AUV path planner for large-scale search and rescue based on A\* algorithm**

*Presenter: Chang Cai*, Northwestern Polytechnical University, China

**Abstract:** For large-scale search and rescue (SAR) tasks that require complete coverage of the workspace, it is important to increase the efficiency and obtained sensor data quality. A novel path planner named SAR-A\* to this problem is introduced, which takes into account the sensor performance and practical prior information. Firstly, the workspace is decomposed into plenty of hexagonal cells which are treated as waypoints for A\* algorithm. Target present probability is then modeled to Gaussian distribution and the performance of the side-scan sonar (SSS) is evaluated. The proposed path planner is validated in a complex terrain scenario which proves that the SAR-A\* path planner can increase confidence in locating the target quickly, and is suitable for the large-scale SAR.

T001

## **RainfallNet: A Dual-Source of Spatial-Channel Attention Fusion Network for Precipitation Nowcasting**

*Presenter: Junhao Huang*, Southeast University, China

**Abstract:** Accurate rainfall prediction is conducive to human life and disaster prevention. Meanwhile, deep learning methods are confirmed to be helpful to improve the accuracy of weather prediction. A novel data-driven neural network is proposed in this work referred as RainfallNet which introduces fusion module based on both radar echo observations and numerical weather prediction (NWP) data. The architecture of the network includes three elements: (1) dual encoders to extract the spatio-temporal feature of the radar echo images and NWP data respectively, (2) parallel attention mechanism combining channel attention and spatial attention to reveal the contribution of each data source and (3) combined loss function joining structural similarity loss, mean square error and mean absolute error with different weight for each rainfall level to further increase the meteorologically assessment metrics. The experiments on South China dataset demonstrate the effectiveness of our model, achieving superior performance on meteorologically assessment metrics over most existing algorithms.



T002

## **An Intra-Pulse Modulation Type Recognition Algorithm for Radar Signals Based on the Improved Residual Network**

*Presenter: Jun Tang, Anhui University, China*

**Abstract:** For purpose of solve the problem of poor discrimination and robustness of intra-pulse signal features extracted by the traditional methods, this paper proposes a radar signal intra-pulse modulation type recognition algorithm based on the improved residual network. Firstly, one-dimensional time-domain radar signal is converted into two-dimensional time-frequency image by Smoothing Pseudo Wigner-Ville Distribution; Then the time-frequency image is preprocessed; ResNet-50 network is chosen as the framework. In order to retain the feature map information as much as possible, the convolution kernel is increased in the residual module. The cross entropy loss function and the center loss function are used as the loss function to speed up the convergence of the network. The improved residual network is used to realize the intra-pulse modulation type recognition of radar signal. The simulation experiments show that when the SNR is -14dB, the overall average recognition accuracy of the improved algorithm for eight kinds of radar signals (CM, LFM, NLFM, BLFM, BPSK, QPSK, OPSK, LFM+BPSK) can reach 97.29%, which shows the effectiveness.

T006

## **Design of Intelligent Security Management and Control System for a Large Nuclear Facility**

*Presenter: Fei Wu, Naval University of Engineering, China*

**Abstract:** There are many kinds of safety control sub-systems of a large nuclear facility, and their information is isolated from each other, so the overall safety control efficiency is low. To solve this problem, based on the original security control sub-system, an intelligent security management and control system is designed by using the technology of system integration and multi-sensor cooperative scheduling. Firstly, the web service interfaces of each security control sub-system are developed, and the interconnection and information sharing of each security control sub-system are realized through these interfaces. Then, based on the multi-sensor system cooperative optimization scheduling technology and the improved ant colony algorithm, the information synthesis and security cooperative optimization scheduling of heterogeneous multi-sensor messages are realized. The highly integrated intelligent security management and control system reduces the alarm omission rate and false alarm rate of the safety control and improves the efficiency of the security control.

T008

## Design of Fault Diagnosis Algorithm fo Electromechanical System Based on Artificial Intelligence

*Presenter: Fuyou Zhao*, Harbin Institute of Technology, China

**Abstract:** A relatively perfect system for the fault diagnosis of mechanical and electrical products has been formed through decades of development. Nevertheless, the traditional fault diagnosis methods fail to cope with the gradual huge mechanical and electrical system. As a result, the advantages of fault diagnosis mode driven by data are increasingly prominent. Meanwhile, the effect of fault diagnosis has exceeded the traditional fault diagnosis methods in many fields. Through the use of the deep learning technology based on artificial intelligence, it carries out mapping and fitting. By fully taking advantages of neural network, it can effectively obtain the accurate classification of fault data. A fault diagnosis method based on the fault data of mechanical and electrical system is designed in this thesis. When it comes to the basic process, it is to take data sets for different mechanical and electrical products. Through the use of feature engineering method, it extracts the fault features of data. Through the use of deep learning technology, it carries out the intelligent diagnosis. According to the experimental results, it indicates that the fault diagnosis method based on deep learning technology can distinguish a variety of fault modes in mechanical and electrical system in an effective way. What's more, good classification results in fault recognition have been achieved by a variety of deep convolutional neural network structures, so the feasibility of the method is further verified.

T014

## The Reform Scheme of Fundamentals of Computer Culture based on Multi-level Blended Teaching

*Presenter: Jiemin Yang*, Shanghai University of Medicine&Health Sciences, China

**Abstract:** As a general course for college students, Fundamentals of Computer Culture plays an important role in the training of professional talents. However, there is a large gap in the ability and quality of college students. In order to promote the creative teaching reform of this course and improve the theoretical and skill levels of college students, our college proposed a reform scheme of multi-layer blended teaching to realize an all-round reform of curriculum system, teaching content, teaching arrangement, teaching method and means, teaching assessment, etc. It also gives a detailed introduction to the reform plan and its implementation in the paper, and provides a creative solution for the teaching reform of the Fundamentals of Computer Culture in other universities, which has great practical value.

T1003

## Research on scheduling problem of manufacturing/remanufacturing hybrid systems

*Presenter: Si Huang*, Hefei University of Technology, China

**Abstract:** Remanufacturing plays a significant effect on saving social resources, developing green economy and reducing enterprise cost. Aiming at a production scheduling problem in manufacturing/remanufacturing hybrid systems we investigated, a multi-objective optimal scheduling model is built. The goals of optimization are to minimize total equipment idle time, total delivery delay and total setup time which are consistent with actual needs of the enterprise. An improved NSGA-II is adopted to increase the population diversity and improve the search performance. The similarity degree  $S$  is employed to evaluate the diversity of population in this paper. Crossover and mutation operations are adjusted adaptively based on  $S$ . This algorithm is applied to an engine manufacturing enterprise compared with the original genetic algorithm. The analysis of experimental results shows that the way in this paper has certain superiority.

T1007

## Control of Stochastic Nonlinear Switched Systems using Fuzzy Law

*Presenter: Hong Yang*, Shenyang University, China

**Abstract:** The problem about controller design for stochastic nonlinear switched systems with delay is considered. Stochastic switched nonlinear system is a kind of nonlinear system which integrates switching and nonlinear fuzzy characteristics and can fully reflect stochastic factors. First, the mathematical model of stochastic nonlinear switched systems with time delay and disturbance is given. Second, the corresponding controller is designed for the proposed model. Then, we use the multi-Lyapunov method to establish the closed-loop system on the basis of our designed controller, and give the necessary and sufficient conditions for the stability of the system. The switching law is designed to ensure the stability of subsystems activated by switching time. Finally, through the simulation software, we can see that the stability condition we obtained can make the studied system stable.



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