

# Conference Abstract

**2022 the 8th International Conference on  
Communication and Information Processing**

**ICCIP 2022**

**Beijing University of Posts and Telecommunications, China**

**October 27-29, 2022 (Beijing Time)**

Sponsored by



**北京邮电大学**

BEIJING UNIVERSITY OF POSTS AND TELECOMMUNICATIONS

# TABLE OF CONTENTS

- Welcome Message .....3
- Useful Information .....4
- Daily Schedule.....7
- Keynote Speakers ..... 10
- Invited Speakers ..... 15
- Onsite Session ..... 17
- Online Session 1 ..... 20
- Online Session 2 ..... 25
- Online Session 3 ..... 29
- Note ..... 32

# WELCOME MESSAGE



2022 the 8th International Conference on Communication and Information Processing (ICCIP 2022) , hosted by Beijing University of Posts and Telecommunications, China on October 27-29, 2022, will significantly contribute to address the unprecedented research advances in the areas of communication & information processing.

ICCIP 2022 is dedicated to explore the cutting-edge applications of communication & information processing technologies to enhance the future of applications. ICCIP 2022's key theme is on “communication and information processing”. This conference will make up of world-class plenary speakers, major technical symposiums, industry and academic panels, workshops, tutorials and invited tracks. The technical program chairs invite the submission of original papers for conference proceedings. This international conference serves a forum for researchers to address. The conference covers almost all the areas of this field.

Submitted papers will be peer reviewed by conference committees. The accepted paper will be included into ICCIP 2022 Conference Proceedings, which will be archived in the ACM Digital Library, and indexed by Ei Compendex and Scopus.

We are very pleased to announce that this year's Keynote speeches given by

- Prof. Thierry Blu, IEEE Fellow, The Chinese University of Hong Kong, Hong Kong, China
- Prof. Mohamed-Slim Alouini, Fellow of IEEE, OSA, AAS, EASA, AE, TWAS, King Abdullah University of Science and Technology, Saudi Arabia
- Prof. Yonghui Li, ARC Future Fellow, IEEE Fellow, The University of Sydney, Australia
- Prof. Boxin Shi, Peking University, Beijing, China

Due to the coronavirus (COVID-19) outbreak and travel restrictions, online presentation is acceptable this year. 4 sessions are organized by domain experts within the technical scopes of the conference (including one onsite session and three online sessions).

Once again, on behalf of the conference committee, we welcome you all to Beijing! We wish you all the best in Beijing and hope ICCIP 2022 will be a good memory for you.

Conference Chairs

Teng Joon Lim, The University of Sydney, Australia (IEEE Fellow)

Li Guo, Beijing University of Posts and Telecommunications, China

# USEFUL INFORMATION

## Conference Venue

**Conference Venue:** BUPT JINJIANG HOTEL (北邮锦江饭店)

**Address:** NO.10 Xitucheng Road, Haidian District, Beijing (北京海淀区西土城路 10 号)

## Temperature

**Average Temperature in October in Beijing**

**9°C - 19°C**

## Bank and Foreign Exchange

The Currency is RMB here. You can exchange foreign currency (24hours) at the airport, or exchange at the bank, Money exchanger.

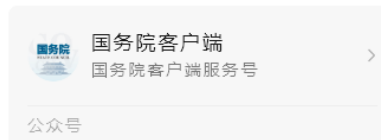
## Attention Please

♣ Due to COVID-19 Pandemic, attendees must check the registrations in Beijing, and wear face mask to attend conference. We'll measure attendees' temperature. And cleaning hand gel and masks is provided onsite.

♣ For health consideration, please wash hands before meals and please use disposable tableware.



北京健康宝 政府  
北京市防疫相关健康状态查询  
北京市经济和信息化局(...)



♣ Please take care of your belongings in public area. For your personal and property safety, delegates are suggested to wear representative card during conference and not to lend it to those unconcerned to enter event rooms. Conference does not assume any responsibility for loss of personal belongings of participants.

♣ Don't stay too late in the city, don't be alone in the remote area. Be aware of the strangers who offer you service, signature of charity, etc., at scenic spots. You can search more Tourist Information and Security tips online.

## Emergency

Ambulance: 120      Police: 110

# USEFUL INFORMATION

## Follow us on We-chat



We-chat Account  
(remark "ICCIP 2022")

## Online Conference Information (GMT+8, Beijing Time) 【腾讯会议室】

**Note:** Conference rooms will be open 30 mins before scheduled time.  
Pls join the zoom 10-15 mins before your session start and be prepared.

**Tencent Meeting Download:  
(Chinese version)**  
URL: <https://meeting.tencent.com/>

**VooV Meeting Download:  
(Oversea authors)**  
URL: <https://voovmeeting.com/>

### Tips:

- Please unmute audio and start video while your presentation.
- It's suggested to use headset with microphone or earphone with microphone.
- Duration of each Presentation: about 12 Minutes of Presentation and 3 Minutes of Q&A.
- E-certificate will be sent to presenters after conference by email.
- An excellent presentation will be selected from each session and announced on the website after conference. An excellent presentation certificate will be sent after conference by email.

Rename your screen name before entering the room	Example
Authors: Paper ID-Name	IP0001-San Zhang
Listener: Listener Number-Name	Listener- San Zhang
Keynote Speaker: Keynote-Name	Keynote- San Zhang
Committee Member: Position-Name	Committee- San Zhang

## **Devices Provided by the Conference Organizer**

- ✧ Laptops (with MS-Office & Adobe Reader)
- ✧ Projectors & Screen

## **Materials Prepared by the Presenters**

- ✧ Oral Presentation:  
Onsite Presentation: PowerPoint or PDF files. Please copy your slides to the desktop 10mins before your session.  
Online Presentation: PowerPoint or PDF files. Please install TECENT APP in advance and join our online session on time.

## **Duration of Each Presentation**

- ✧ Keynote Speech: 40 Minutes of Presentation including Q&A.
- ✧ Regular Oral Presentation: 15 Minutes of Presentation including Q&A.  
(Duration of each Presentation: about 12 Minutes of Presentation and 3 Minutes of Q&A.)

## **Dress Code**

- ✧ All participants are required to dress formally. Casual wear is unacceptable.
- ✧ National formal dress is acceptable.

## **Note**

- ✧ The regular oral presentation time arrangement is for reference only. In case any absence or some presentations are less than 15 minutes, please join your session before it starts.
- ✧ An excellent presentation will be selected from each session which will be announced and awarded an excellent presentation certificate.

# DAILY SCHEDULE

Day 1, October 27, 2022 (GMT+8, Beijing Time)

## Online Test Timetable and Online Sign-in

\*Please enter the room 5-10 minutes before the test session start

Meeting ID: 359-1277-5307 password: 102729

<b>10:00-15:00</b>	<b>Keynote Speakers</b>
<b>11:00-12:00</b>	<b>Session Chairs and Technical Committee Members</b>
<b>14:00-14:30</b>	<b>Online session 1&amp;2&amp;3</b> Online Session 1: IP2441, IP1219, IP1212, IP1324, IP1213, IP1331, IP2435, IP2442 Online Session 2: IP1103, IP1215, IP1217, IP1218, IP1102, IP1320, IP1325, IP2434 Online Session 3: IP1322, IP1107, IP1209, IP1214, IP1330, IP1502, IP2443

## Onsite sign-in on Oct. 28<sup>th</sup>

<b>08:00-08:30</b>	Sign in and Collect Conference Materials outside the conference room. <b>BUPT JINJIANG HOTEL   北邮锦江饭店</b> <b>Address: NO.10 Xitucheng Road, Haidian District, Beijing</b> <b>(北京海淀区西土城路10号)</b> Details of conference venue: <a href="http://iccip.org/venue.html">http://iccip.org/venue.html</a>
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# DAILY SCHEDULE

Day 2, October 28, 2022 (GMT+8, Beijing Time)

**Morning Program-Location: Multi-Function Room/ 二层多功能厅 (2<sup>nd</sup> Floor/2楼)**  
**[Meeting ID: 359-1277-5307 Password: 102729]**

Morning Host: Prof. Shibiao XU, Beijing University of Posts and Telecommunications, China

## Welcome Message

**09:00-09:05** Prof. Hongxiang Sun, Vice President of Beijing University of Posts and Telecommunications

## Opening Remarks

**09:05-09:10** Prof. Teng Joon Lim, The University of Sydney, Australia

## Keynote Speaker 1

**09:10-09:50** Prof. Thierry Blu, The Chinese University of Hong Kong, Hong Kong, China  
Speech Title: The Finite Rate of Innovation Approach to Sparsity

## Keynote Speaker 2

**09:50-10:30** Prof. Yonghui Li, The University of Sydney, Australia  
Speech Title: Beyond 5G towards a Super-connected World

**10:30-11:00**

*Coffee Break*

## Keynote Speaker 3

**11:00-11:40** Prof. Mohamed-Slim Alouini, King Abdullah University of Science and Technology, Saudi Arabia  
Speech Title: A light in digital darkness: Free space optics to connect the unconnected

## Keynote Speaker 4

**11:40-12:20** Prof. Boxin Shi, Peking University, Beijing, China  
Speech Title: NeuImg: Hybrid Imaging Fusing Neuromorphic and Conventional Cameras

**12:20-14:00**

*Lunch Time and Break Time*

**ONSITE SESSION** ..... [Multi-Function Room/ 二层多功能厅 (2<sup>nd</sup> Floor/2楼)]

## Session Topic: Image and Signal Analysis

**14:00-15:45** Session Chair: Assoc. Prof. Dongyu Wang, Beijing University of Posts and Telecommunications, China  
IP1108, IP1216, IP2433, IP2440, IP1327, IP1323, IP2439

**From 18:00**

*Dinner*



# DAILY SCHEDULE

## Digital Asset Development Forum (onsite)

Time		Location
October 28 <sup>th</sup>	16:00-18:00	Multi-Function Room (2 <sup>nd</sup> Floor)
October 29 <sup>th</sup>	09:30-12:00	Multi-Function Room (4 <sup>th</sup> Floor)

## ICCIP Blockchain Innovation Competition (onsite)

Time	Meeting Information	Location
14:00-18:00 October 29 <sup>th</sup>	Meeting ID: 441-856-840 Password: 102729	Teaching Building III 326

# DAILY SCHEDULE

**Day 3, October 29, 2022** (GMT+8, Beijing Time)

★Meeting ID: 359-1277-5307 Password: 102729★

## ONLINE SESSION 1

**Session Topic: Image Analysis and Intelligent Calculation**

**09:30-12:00** **Session Chair: Assoc. Prof. Xiangtao Zheng, Key Laboratory of Spectral Imaging Technology, Xi'an Institute of Optics and Precision Mechanics, Chinese Academy of Sciences, China**

Invited Speech 1: Assoc. Prof Lantian Li, Beijing University of Posts and Telecommunications, China

IP2441, IP1219, IP1212, IP1324, IP1213, IP1331, IP2435, IP2442

*12:00-14:00*

*Break time*

## ONLINE SESSION 2

**Session Topic: Data Management and Information Security**

**14:00-16:00** **Session Chair: Prof. Glenn Paul P. Gara, University of the Immaculate Conception, Philippines**

IP1103, IP1215, IP1217, IP1218, IP1102, IP1320, IP1325, IP2434

*16:00-16:30*

*Break time*

## ONLINE SESSION 3

**Session Topic: Data Communication and Information Network**

**16:30-18:45** **Session Chair: Prof. Li Fenglian, Taiyuan University of Technology, China**

Invited Speech 2: Dr. Xidong Mu, Queen Mary University of London, UK

IP1322, IP1107, IP1209, IP1214, IP1330, IP1502, IP2443

**20:00-20:30**

**Closing Ceremony**

# KEYNOTE SPEAKER



## **Prof. Thierry Blu**

**IEEE Fellow, The Chinese University of Hong Kong, Hong Kong, China**

**Meeting ID: 359-1277-5307 Password: 102729**

Thierry Blu received the "Diplôme d'ingénieur" from École Polytechnique, France, in 1986 and from Télécom Paris (ENST), France, in 1988. In 1996, he obtained a Ph.D in electrical engineering from ENST for a study on iterated rational filterbanks, applied to wideband audio coding.

Between 1998 and 2007, he was with the Biomedical Imaging Group at the Swiss Federal Institute of Technology (EPFL) in Lausanne, Switzerland. He is now a Professor in the Department of Electronic Engineering, The Chinese University of Hong Kong.

Dr. Blu was the recipient of two best paper awards from the IEEE Signal Processing Society (2003 and 2006). He is also a coauthor of a paper that received a Young Author best paper award (2009) from the same society.

He has been an Associate Editor for the IEEE Transactions on Image Processing (2002-2006), the IEEE Transactions on Signal Processing (2006-2010), Elsevier Signal Processing (2008-2011). He was a member of the IEEE Signal Processing Theory and Methods Technical Committee (2008-2013), and is now in the Bio Imaging and Signal Processing Technical Committee (2017-). He is also on the board of Eurasip J. on Image and Video Processing (2010-) and SIAM J. on Imaging Sciences (2019-).

His main research interests are signal and image approximations (harmonic analysis, wavelets, sparsity, statistics), with applications to super-resolution, noisy image restoration, image registration, and practical interest in biomedical imaging (e.g., Fluorescence Microscopy, Magnetic Resonance Imaging, Computed Tomography). He was elected Fellow of the IEEE in 2012 for "fundamental contributions to approximation theory in signal and image processing".

### **Speech Title:**

#### **The Finite Rate of Innovation Approach to Sparsity**

**Abstract:** Sparsity is nowadays considered an essential hypothesis for addressing ill-posed problems. In its simplest setting, the Finite Rate of Innovation (FRI) framework formalises sparse signals explicitly, as streams of Dirac pulses. Each Dirac pulse is then completely characterised by a location and an amplitude--innovations. Practical settings can usually be transformed into this formalisation.

Despite having infinite bandwidth, such signals can be sampled exactly at their "rate of innovation" (proportional to the pulse density). A key observation is that retrieving such sparse signals from their samples is equivalent to recovering sinusoids (frequencies+amplitudes) from their discrete Fourier transform. We show a highly robust algorithm that allow to reconstruct FRI signals from their samples, and that also achieves high-resolution frequency estimation.

We illustrate the FRI concept in real super-resolution applications taken from optical coherence toography and radioastronomy. We also show the power of our algorithms in a surprising application to recover 2D geometry from 1D samples.

# KEYNOTE SPEAKER



## **Prof. Yonghui Li**

**ARC Future Fellow, IEEE Fellow, The University of Sydney, Australia**

**Meeting ID: 359-1277-5307 Password: 102729**

Yonghui Li is a Professor and Director of Wireless Engineering Laboratory, in School of Electrical and Information Engineering, the University of Sydney. He is the recipient of the prestigious Australian Research Council (ARC) Queen Elizabeth II Fellowship in 2008 and ARC Future Fellowship in 2012. His current research interests are wireless communications, Internet of Things, Wireless networks, 5G and wireless AI. He participated in \$500million Australian national Smart Grid Smart City project, the world first large-scale demonstration project. He has published more than 300 papers in IEEE journals and conferences. Several of his journal papers have been included in ESI highly cited papers. According to google scholar, his research works have been cited more than 10000 times. He is now an editor for IEEE Transactions on Communications, and IEEE Transactions on Vehicular Technology. He also served as a guest editor for several special issues of IEEE journals, such as IEEE JSAC special issue on Millimeter Wave Communications, IEEE Communications Magazine on Wireless AI, IEEE IoT Journal, IEEE Transactions on Industrial Informatics, IEEE Access. He received several best paper awards from IEEE International Conference on Communications (ICC) 2014, IEEE PIMRC 2017 and IEEE Wireless Days Conferences (WD) 2014.

### **Speech Title:**

### **Beyond 5G towards a Super-connected World**

**Abstract:** Connected smart objects, platforms and environments have been identified as the next big technology development, enabling significant society changes and economic growth. The entire physical world will be connected to the Internet, referred to as Internet of Things (IoT). The intelligent IoT network for automatic interaction and processing between objects and environments will become an inherent part of areas such as electricity, transportation, industrial control, utilities management, healthcare, water resources management and mining. Wireless networks are one of the key enabling technologies of the IoT. They are likely to be universally used for last mile connectivity due to their flexibility, scalability and cost effectiveness. The attributes and traffic models of IoT networks are essentially different from those of conventional communication systems, which are designed to transmit voice, data and multimedia. IoT access networks face many unique challenges that cannot be addressed by existing network protocols; these include support for a truly massive number of devices, the transmission of huge volumes of data burst in large-scale networks over limited bandwidth, and the ability to accommodate diverse traffic patterns and quality of service (QoS) requirements. Some IoT applications have much stringent latency and reliability requirements which cannot be accommodated by existing wireless networks. Addressing these challenges requires the development of new wireless access technologies, underlying network protocols, signal processing techniques and security protocols. In this talk, I will present the IoT network development, architecture, key challenges, requirements, potential solutions and recent research progress in this area, particularly in 5G and beyond 5G.



## **Prof. Mohamed-Slim Alouini**

**Fellow of IEEE, OSA, AAS, EASA, AE, TWAS  
King Abdullah University of Science and Technology, Saudi  
Arabia**

**Meeting ID: 359-1277-5307 Password: 102729**

Mohamed-Slim Alouini was born in Tunis, Tunisia. He received the Ph.D. degree in Electrical Engineering from the California Institute of Technology (Caltech) in 1998. He served as a faculty member at the University of Minnesota then in the Texas A&M University at Qatar before joining in 2009 the King Abdullah University of Science and Technology (KAUST) where he is now a Distinguished Professor of Electrical and Computer Engineering. Prof. Alouini is a Fellow of the IEEE and OPTICA (Formerly the Optical Society of America (OSA)). He is currently particularly interested in addressing the technical challenges associated with the uneven distribution, access to, and use of information and communication technologies in rural, low-income, disaster, and/or hard-to-reach areas.

### **Speech Title:**

**A light in digital darkness: Free space optics to connect the unconnected**

**Abstract:** Despite the ubiquitous digital connectivity that we experience all around us, it is a fact that almost third of the population of the world is still “offline” due to the lack of a robust Internet and communications infrastructure in many places on the globe. The reason why such digitally dark spots still exist in the world is mainly two-folds. For one, economically backward or thinly scattered populations are not viable for relatively larger investments in communications infrastructure. Secondly, a hostile geography/terrain raises the cost of installing optical fibers and other equipment. Thus, its no wonder that many big Internet giants such as Amazon, Facebook, and SpaceX, have attempted to reach the hitherto “digitally inaccessible” regions by providing connectivity through satellites or high altitude platforms (HAPs). A constellation of satellites/HAPs provides a more cost-effective and reliable alternative to the deployment of optical fiber and related equipment in such locations of the world. Because of the large chunks of relatively unlicensed bandwidth available in the optical spectrum, there is a great opportunity to use lasers for ground gateway station-satellite/HAPs, and inter-satellite or inter-HAP communications, a communications model known as the free-space optics (FSO). Towards that end, this talk examines the FSO communications from the perspective of satellite and HAP communications. In this regard, some new pointing, acquisition and tracking aspects are presented. Furthermore, this talk goes also through the adaptive optics and relaying schemes that are needed to deal with atmospheric turbulence which affects such kind of networks.

# KEYNOTE SPEAKER



**Prof. Boxin Shi**

**Peking University, Beijing, China**

**Meeting ID: 359-1277-5307 Password: 102729**

Boxin Shi received the BE degree from the Beijing University of Posts and Telecommunications, the ME degree from Peking University, and the PhD degree from the University of Tokyo, in 2007, 2010, and 2013. He is currently a Boya Young Fellow Assistant Professor and Research Professor at Peking University, where he leads the Camera Intelligence lab. He also serves as the Assistant Director at the Institute of Artificial Intelligence, Peking University, a Young Scientist at Beijing Academy of Artificial Intelligence, and an Adjunct Professor with Beijing University of Posts and Telecommunications. Before joining PKU, he did postdoctoral research with MIT Media Lab, Singapore University of Technology and Design, Nanyang Technological University from 2013 to 2016, and worked as a researcher in the National Institute of Advanced Industrial Science and Technology from 2016 to 2017. His papers were awarded as Best Paper Runner-Up at International Conference on Computational Photography 2015 and selected as Best Papers from ICCV 2015 for IJCV Special Issue. He has served as an editorial board member of IJCV and an area chair of CVPR/ICCV. He is a Senior Member of the IEEE and CCF. Please access Camera Intelligence website for more information: <http://camera.idm.pku.edu.cn>

## **Speech Title:**

**NeurImg: Hybrid Imaging Fusing Neuromorphic and Conventional Cameras**

**Abstract:** In recent years, some specially designed neuromorphic cameras, such as event cameras and spike cameras, have drawn increasing attention of researchers. Neuromorphic cameras have unique features different from conventional frame-based cameras, and they are particularly good at sensing very fast motion and high dynamic range scenes. In this talk, I will introduce our hybrid imaging framework fusing neuromorphic and conventional cameras. Such a system complements speed and dynamic range advantages of neuromorphic cameras with advantages in resolution, robustness, and color from RGB cameras, to achieve joint filtering of intensity images and neuromorphic events/spikes for high-resolution noise-robust imaging and high-resolution high dynamic range imaging with natural color appearance.



## **Assoc. Prof. Lantian Li**

**Beijing University of Posts and Telecommunications, China**

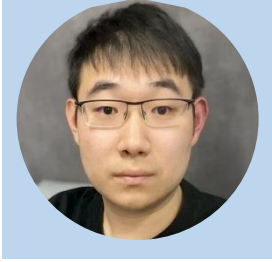
**Meeting ID: 359-1277-5307 Password: 102729**

Lantian Li received the Ph.D. degree from the Department of Computer Science, Tsinghua University in 2018. He joint with the Center for Speech and Language Technology (CSLT), Tsinghua University as a postdoctoral fellow from 2018 to 2022. He is now an associate professor with Beijing University of Posts and Telecommunications, Beijing, China. His research and development interests are speech signal processing tasks with machine learning methods. His research findings achieved the first prize of the 2021 science and technology award (technical invention) of Chinese Institute of Electronics.

### **Speech Title: Pay Attention to Hard Trials**

**Abstract:** Evaluation trials are used to probe performance of speaker verification systems. In spite of the clear importance and impact, evaluation trials have not been seriously treated in research and engineering practice. This talk presents our study on evaluation trials: the importance, the representation, and the design. We firstly present the concept CP map, which represents performance of a verification system on various trial configs in a 2-dimensional map. The C-P map offers a powerful tool for system analysis, tuning and comparison. Furthermore, we advocate focusing on hard trials as they represent the most risk for present speaker verification systems. We present two approaches to retrieving commonly-agreed hard trials, one based on ensemble and the other based on SVM. We test the performance of SOTA systems on the hard trials, and study the properties of the hard trials from perspectives of both machines and humans. Experimental results demonstrated that the hard trials we retrieved are very challenging even for today's most powerful models, indicating that substantial research effort is required.

# INVITED SPEAKER



**Dr. Xidong Mu**

**Queen Mary University of London, London, UK**

**Meeting ID: 359-1277-5307 Password: 102729**

Xidong Mu received the Ph.D. degree in Information and Communication Engineering from the Beijing University of Posts and Telecommunications (BUPT), Beijing, China, in 2022. He is currently a Postdoctoral Researcher with the School of Electronic Engineering and Computer Science, Queen Mary University of London, U.K. His research interests include non-orthogonal multiple access, IRSs/RISs aided communications, integrated sensing and communications, and optimization theory. He serves the Conference Symposium and Workshop Officer for IEEE ComSoc Next Generation Multiple Access Emerging Technology Initiative (NGMA-ETI). He received the Exemplary Reviewer Certificate of the IEEE Transactions on Communications in 2020, the VTC-2022 Fall Best Student Paper Award, and the ISWCS 2022 Best Paper Award.

## **Speech Title:**

**Beamforming Design for STAR-RISs: From Independent to Coupled Phase Shifts**

**Abstract:** Simultaneously transmitting and reflecting (STAR) reconfigurable intelligent surfaces (RISs) have emerged as promising techniques for the sixth-generation (6G) wireless networks. The wireless signal incident upon STAR-RISs is divided into transmitted and reflected signals passing into both sides of the space surrounding the surface, thus facilitating a 360° coverage. In this talk, the basic signal model of STAR-RISs will be first introduced. Then, the beamforming design of STAR-RISs will be discussed from independent to coupled phase-shift model. Finally, research opportunities of STAR-RISs will be discussed.



# Onsite Session

**Topic: Image and Signal Analysis**

**Time: 14:00-15:45, October 28, 2022, Beijing Time**

**Place: Multi-Function Room/ 二层多功能厅 | 2nd Floor/2 楼**

**Session Chair: Associate Professor Dongyu Wang, Beijing University of Posts and Telecommunications, China**

**IP1108** Multi-modal Variational Auto-Encoder Model for Micro-video Popularity Prediction  
**14:00-14:15** Zhuoran Zhang, Shibiao Xu, Li Guo and Wenke Lian  
Presenter: Zhuoran Zhang, Beijing University of Posts and Telecommunications, China

**Abstract:** Popularity prediction of micro videos on multimedia is a hotly studied topic due to the widespread use of video upload sharing services. It's also a challenging task because popular pattern is affected by multiple factors and is hard to be modeled. The goal of this paper is to use feature extraction techniques and variation auto-encoder (VAE) framework to predict the popularity of online micro-videos. First, we identify four declarable modalities that are important for adaptability and expansibility. Then, we design a multi-modal based VAE regression model (MASSL) to exploit the domestic and foreign information extracted from heterogeneous features. The model can be applied to large-scale multimedia platforms, even the modality absence scenarios. With extensive experiments conducted on the dataset, which was originally generated from the most popular video-sharing website in China, the result demonstrates the effectiveness of our proposed model by comparing with baseline approaches.

**IP1216** MFFNet: Multi-Receptive Field Fusion Net for Microscope Steel Grain Grading  
**14:15-14:30** Jiayi Sun, Jiguang Zhang, Shibiao Xu, Weiliang Meng,  
Presenter: Jiayi Sun, Institute of Automation, Chinese Academy of Sciences, University of Chinese Academy of Sciences, China

**Abstract:** The grain size is an important steel grading parameter. For metallographic images with various grain sizes and complex textures, it is not possible for a human expert to determine the grain size efficiently. Meanwhile, conventional computer vision models are designed based on general images and they are not capable of achieving high performance in metallographic grain size classification. To solve these problems, a method based on multiple receptive field fusion is proposed. A multi-scale convolutional kernel set is used to extract various scale information of microstructures in consideration of line pixels as input elements, and it greatly improves the classification accuracy and efficiency. In addition, to augment the extracted features, a selfattention module is used to improve the robust feature representation of complex microstructure textures. At last, via a multiple receiver extraction module, the data capacity is extended by projecting objects into multiple hidden spaces. A comprehensive experiment was conducted on the dataset [7] and a classification accuracy of 84% was achieved, while our model was only 0.06 GFLOPs.

**IP2433** Detecting and Punishing Mute Nodes in Shard-Based Permissionless Blockchains  
**14:30-14:45** Mufei Qiu, Tianyu Kang, Li Guo, Wenwei Huang  
Presenter: Mufei Qiu, Beijing University of Posts and Telecommunications, China

**Abstract:** As a key technology to solve the problem of trust in application systems, blockchain has attracted more and more attention in recent years. Many researches

focus on applying voting-based consensus in permissionless blockchain to improve the throughput. However, in these methods, mute nodes may get the reward without participating in consensus, which may impact the availability of the system. We propose an observation exchanging protocol based on double-chain architecture to detect mute nodes. Nodes will vote on whether other nodes have sent protocol messages, and agree on an observation matrix which is generated by merging the observation of all nodes through consensus. We also propose an incentive mechanism and adopt a reputation system based on the matrix to punish mute nodes. Block reward is divided into three parts and is distributed according to the observation matrix. Security analysis shows that the observation exchanging protocol ensures mute nodes can be detected, and the incentive mechanism ensures mute nodes and the nodes adopt selfish strategies can be punished. Finally, we implement a prototype to evaluate our observation exchanging protocol and incentive mechanism. Experiment shows that the observation exchanging protocol merely has small influence on consensus delay.

**IP2440**  
**14:45-15:00**

AN RDN-based image super-resolution method using Meta-learning  
JUE WANG, HAO XU, DAN QIAO, YUMO TIAN  
Presenter: JUE WANG, College of Computer Science and Technology, Chongqing University of Technology, Chongqing, China

Abstract: In this paper, we propose a residual dense networks (RDN)-based image super-resolution method using Meta-learning. Specifically, deep extraction of global features is performed on the external dataset through an RDN, meta-learning to obtain an initial parameter definitely for internal learning, so we can utilize both external and internal data. Our method achieves good results with only one gradient update. And it can be appropriate for image super-resolution under the action of different blur kernels, with a wider application range and high flexibility.

**IP1327**  
**15:00-15:15**

Fully Fused Cover Song Identification Model via Feature Fusing and Clustering  
Qiang Yuan, ShiBiao Xu, Li Guo  
Presenter: Qiang Yuan, Beijing University of Posts and Telecommunications, China

Abstract: In recent years, Cover Song Identification (CSI) based on Siamese Network and music representation learning has achieved good performance, however, there are still many problems such as limited feature fusion, missing decision threshold and single data label. In this paper, we propose a novel fully fused cover song identification model via feature fusing and clustering. In our proposed model, there are a fusion feature extraction structure, a channel separation decision structure, and a music feature clustering structure. First, we combine the pre-processing features of the dual input along the channel dimension to achieve full feature fusion and increase the fusion degree of the two songs in the feature extraction process. Secondly, we introduce channel separation to calculate multi-channel cross-features to improve the ability of the model to learn the difference between feature channels, and combined with the binary decision network to avoid the shortcomings of lack of decision thresholds in music representation learning. Finally, feature clustering generates invisible feature labels to enriches the types of cover data labels and reduces the difficulty of training. The model is trained in stages to optimize the clustering loss and the classification loss for cover and non-cover pairs, respectively. The model is validated on three public datasets, and experiments show that our model could achieve competitive results.

**IP1323**  
**15:15-15:30**

Multi-view 3D Human Physique Dataset Construction For Robust Digital Human Modeling of Natural Scenes

Weitao Lin, Jiguang Zhang, Zhaohui Zhang, Shibiao Xu, Hao Xu, Xiaopeng Zhang  
Presenter: Weitao Lin, University of Chinese Academy of Sciences, China

Abstract: A large number of diverse data sets are necessary for networks to predict human body parameters and reconstruct 3D body models from images. Due to the high cost of motion capture and body scanning, high precision pose and body shape parameters are difficult to obtain. Meanwhile, existing datasets cannot meet the requirements in terms of diversity, size, and data accuracy for practical applications. Inspired by the construction schemes of various datasets, we design and construct a large multi-view 3D human body reconstruction dataset (3DMVHumanBP) with more types of supervised data. By recording the different poses of 25 women and 25 men in a green screen laboratory from six perspectives, we constructed a complete large multi-view 3D body posture dataset containing 340,000 images. It is worth noting that, we innovatively propose a body dimension prior to the constrained human parametric model construction strategy to provide high-precision ground truth parameters of the human body SMPL models. In addition, we also designed a dense UV data generation method based on human body boundary and mask mapping to provide high-quality dense UV data, which more closely fits the features of the human images. It makes up for the defect that few existing data sets can only provide sparse UV data. In the experiment, the effectiveness and advantages of the data set constructed by us in network training are verified. Compared with the training of existing datasets, the mainstream network models trained on our datasets can significantly improve their prediction accuracy and robustness, thanks to the monitoring data of multiple kinds of high-precision human model parameters provided by 3DMVHumanBP. We hope that the human body dataset construction scheme we designed can provide ideas for building large-scale high precision human body datasets in the future.

**IP2439**  
**15:30-15:45**

Song popularity prediction model based on multi-modal feature fusion and LightGBM

Huafeng Zeng, Qiang Yuan, Li Guo, Shibiao Xu  
Presenter: Huafeng Zeng, Beijing University of Posts and Telecommunications, China

Abstract: Since the task of hit song prediction was proposed, many experts and technicians have done a lot of research and achieved good results, but there are still some problems such as limited song feature types, lack of feature importance, and insufficient prediction accuracy. This paper proposes a song popularity prediction model based on multi-modal feature fusion and LightGBM. In our proposed model, there is a multi-modal feature extraction structure, a LightGBM structure and a logistic regression structure. First, in order to solve the problem of limited song feature types, we fuse metadata, audio features and other relevant important features into multi-modal features. Then, in order to improve the accuracy of prediction, we introduce LightGBM algorithm to preprocess the dataset and train the model, so as to obtain the predicted value of song popularity. At the same time, we introduce a logistic regression model to research the influence of each feature on whether a song is popular from the perspective of binary classification, so that we can further study the importance of song features, and obtain the response coefficient of each feature, namely, the coefficient of response mean. Finally, we compare the prediction results of our model with the existing models, and the experiments show that the prediction results of our model have higher accuracy.

# Online Session 1

**Topic: Image and Signal Analysis**

**Time: 09:30-12:00, October 29, 2022, Beijing Time**

**Meeting ID: 359-1277-5307 Password: 102729**

**Session Chair: Assoc. Prof. Xiangtao Zheng, Key Laboratory of Spectral Imaging Technology, Xi'an Institute of Optics and Precision Mechanics, Chinese Academy of Sciences, China**

**Invited Speech 1** [Assoc. Prof. Lantian Li, Beijing University of Posts and Telecommunications, China](#)

**09:30-10:00** Speech Title: Pay Attention to Hard Trials

**IP2441** A 1D-CNN prediction model for stroke classification based on EEG signal  
**10:00-10:15** Teng Wang, Fenglian Li\*, Xueying Zhang, Lixia Huang, Wenhui Jia  
Presenter: Teng Wang, Taiyuan University of Technology, China

**Abstract:** Stroke is an acute cerebrovascular disease with high mortality and disability. Computer-aided interventional diagnosis is a necessary measure to improve the efficiency of stroke diagnosis by using modern advanced medical instruments and machine learning methods. Electroencephalogram (EEG) as a diagnostic means, is a test that measures the electrical activity of the brain through electrodes attached to the scalp to find changes in brain activity. EEG detection has the advantages of low cost, simple and easy to implement, and no physical harm and psychological stress to patients. Studies have shown that EEG signal might be useful in diagnosing stroke. By using machine learning methods, EEG signals can be used to classify stroke patients and normal subjects, or subtypes. Stroke is generally divided into two types: ischemic stroke and hemorrhagic stroke. How to classify ischemic and hemorrhagic strokes based on stroke patients' EEG data by constructing prediction model is the main purpose on this paper. In recent years, researchers have developed many technologies in the field of stroke classification prediction based on EEG signals, using a variety of machine learning methods to ensure the improvement of prediction accuracy. The typical methods usually extract the time domain, frequency domain or spatial domain features of EEG signals before establishing a stroke classification model. However, the quality of the extracted features cannot be guaranteed in stroke patient or subtype classification. In addition, EEG feature extraction is usually computationally expensive. The main goal of this paper is to propose a novel classification prediction model using an end-to-end deep neural network that avoids the process of manual feature extraction. This paper proposes a one-dimensional convolutional neural network (1D-CNN) classification model based on stroke EEG signal. The model includes four convolutional blocks, a global average pooling layer, a dropout layer, and a SoftMax layer. Each convolution block consists of two convolution layers and a pool layer for extracting features and reducing the number of parameters. A one-dimensional convolution kernel is used in order to match the characteristics of EEG one-dimensional time domain signal. The model can automatically extract the features of stroke EEG signal for classifying stroke by using convolutional layers. The EEG data of clinical stroke patients collected from the neurology department of a hospital are used in the experiments. Long Short-Term Memory (LSTM) model is also used as a benchmark to achieve end-to-end prediction for verifying the proposed model performance. The experimental results show that the proposed 1D-CNN

# Online Session 1

prediction model has good prediction performance, with an accuracy of 90.53%, a precision of 87.90%, a sensitivity of 91.60%, and a specificity of 89.65%. It is much higher than the prediction result of LSTM model.

**IP1219**  
**10:15-10:30**

Designing Web Based Proctoring System for Online Examination (SPIRIT 1.0) in Telkom University  
Muhammad Bambang Hidayanto, Sedy Prayogo, Muharman Lubis  
Presenter: Muhammad Bambang Hidayanto, Telkom University, Indonesia

**Abstract:** The digital era, which is a jargon in welcoming the technological developments has given birth to a new form of learning that eliminates the requirement of physical presence of teachers and students within the same place and time, or it can be known as Online Learning. The possibility for the institution of education in supporting their business into a new level of services in supporting their ecosystem have met the challenges of the readiness in doing the transformation from the traditional learning within the context of human resources, technology, and learning concept into a syllabus with the purpose of achieving the same level or output. When the Corona Virus Diseases 19 (COVID 19) made drastic changes in every aspect that afterwards became a global pandemic, the implementation of online learning would ensure the survivability of the educational institution in keeping their business. Telkom University, as one of private university in Indonesia, with the student body almost reaches 30.000, uses Learning Management System (LMS) in enabling the learning activities as the primary solution but has a problem in ensuring no cheating activities during the examination. As the common approach in ensuring the integrity of online examination through LMS with the creation of question bank and randomize the question is seen as not efficient, the institution also tries to monitor and control with the implementation of video conference-based application like ZOOM and Safe Exam Browser (SEB), but raises another problem in cost, compatibility issues, and motivation issues. Proctoring has become another approach that is recently has continue evolving with the involvement from Artificial Intelligence (AI) in doing the facial recognition. This research will develop the proctoring tools that can be integrated with the LMS used in Telkom University as the strategy in preventing misconduct behavior that led to academic cheating in online examination.

**IP1212**  
**10:30-10:45**

Improved Motion Planning Algorithms Based on Rapidly-exploring Random Tree: A Review  
Improved Motion Planning Algorithms Based on Rapidly-exploring Random Tree: A Review  
Presenter: Yixin Wang, Northwestern Polytechnical University, China

**Abstract:** This paper mainly summarizes and introduces the improvements proposed by scholars at home and abroad in recent years for the application of Rapidly-exploring Random Tree in robot arms. This paper first briefly introduces the existing path planning algorithms and expounds their advantages and disadvantages. Then the principle and process of Rapidly-exploring Random Tree are described and the RRT algorithm in three-dimensional space is simulated and analyzed. Next, the improved RRT algorithm proposed by domestic and foreign researchers is classified, analyzed and explained. Finally, the whole article is summarized and the direction of future development and research of manipulator motion planning algorithms is prospected.

**IP1324**  
**10:45-11:00**

Using Text Mining to Evaluation for Online Shopping Rural Fruits and Vegetables  
WANG CHIEN-HUA, YEH CHIA-HSUAN, PANG CHIN-TZONG  
Presenter: WANG CHIEN-HUA, Lingnan Normal University

Abstract: Online purchasing has become a new front in the conflict between agricultural products with the Internet's rapid expansion. Besides the cost saving because of no physical store, the adoption of Internet marketing is an inevitable trend. The development of several marketing strategies and physical channels has also changed traditional customers' purchasing habits. As user-generated information with analytical value grows rapidly, so does the percentage of unstructured data in the enormous data set. By mining unknown and hidden data of customer opinions, enterprises can gain valuable feedback and keep track of the benefits or drawbacks of products. Unstructured text mining technology is used for analysis in order to understand the factors that affect the evaluation of online shopping for rural fruits and vegetables. In order to achieve the sustainable development of agricultural products, this study examines the hidden issues buried beneath the heat of the rural revitalization plan using the unique fruit of the Maoming region, Shatangju, as the research object.

**IP1213**  
**11:00-11:15**

Distributed Learning based on Asynchronized Discriminator GAN for remote sensing image segmentation  
MingKang Yuan, Ye Li, JiaXi Sun, BaoKun Shi, JinZhong Xu, LeLe Xu, YiSu Wang  
Presenter: Mingkang Yuan, Key Laboratory of Space Utilization, Technology and Engineering Center for Space Utilization, Chinese Academy of Sciences, Beijing, China.

Abstract: Remote sensing images are usually distributed in different departments and contain private information, so they normally cannot be available publicly. However, it is a trend to jointly use remote sensing images from different departments, because it normally enables the model to capture more information and remote sensing image analysis based on deep learning generally requires lots of training data. To address the above problem, in this paper, we apply a distributed asynchronized discriminator GAN framework (DGAN) to jointly learn remote sensing images from different client nodes. The DGAN is composed of multiple distributed discriminators and a central generator, and only the synthetic remote sensing images generated by the DGAN are used to train a semantic segmentation model. Based on DGAN, we establish an experimental platform composed of multiple different hosts, which adopts socket and multi-process technology to realize asynchronous communication between hosts, and visualize the training and testing process. During DGAN training, instead of original remote sensing images or convolutional network model information, only synthetic images, losses and labeled images are exchanged between nodes. Therefore, the DGAN well protects the privacy and security of the original remote sensing images. We verify the performance of the DGAN on three remote sensing image datasets (City-OSM, WHU and Kaggle Ship). In the experiments, we take different distributions of remote sensing images in client nodes into consideration. The experiments show that the DGAN has a great capacity for distributed remote sensing image learning without sharing the original remote sensing images or the convolutional network model. Moreover, compared with a centralized GAN trained on all remote sensing images collected from all client nodes, the DGAN can achieve almost the same performance in semantic segmentation tasks for remote sensing images.

**IP1331**

Analysis of MOOC's Continuous Learning Intention and Its Influencing Factors of Higher Vocational Students

**11:15-11:30** Fengmei Zhao, Yong Hu  
Presenter: Fengmei Zhao, Guangdong Open University, China

**Abstract:** While MOOC brings a great impact to higher education, there is also the problem of low course completion rate, and it is important to analyze the factors influencing learners' continuous learning and participation in Massive Open Online Course (MOOC) for improving the teaching quality of MOOC. This paper constructs a model to predict and explain learners' MOOC continuous learning intention based on expectation confirmation model, technology acceptance model, planned behavior theory and flow theory, and carries out a questionnaire survey on students of our university who participate in the general elective courses on the platform of Chinese University MOOC. The results based on structural equation modeling show that expected confirmation and perceived ease of use significantly influence learners' perceived usefulness of MOOC; perceived usefulness and perceived ease of use significantly influence learners' attitudes towards MOOC; expected confirmation and perceived usefulness significantly influence learning satisfaction; perceived ease of use, satisfaction, attitude, focus, Perceived behavior control and subjective norms significantly influence learners' MOOC continuous learning intention. Based on the data analysis, the researcher discusses the theoretical and practical significance of this study and proposes the follow-up research plan.

**IP2435** A Survey of Hand Gesture Recognition Based on FMCW Radar  
**11:30-11:45** Zhengjie Wang, Fei Liu, Xue Li, Mingjing Ma, Xiaoxue Feng, Yinjing Guo  
Presenter: Fei Liu, Shandong University of Science and Technology, China

**Abstract:** In recent years, with the development of unmanned vehicle fields, the millimeter wave radar has also developed rapidly and has been applied to many systems. Frequency modulated continuous wave (FMCW) radar has become a hot research topic in millimeter radar areas due to its physical characteristics, including strong sensing capability and high resolution. This paper investigates gesture recognition applications based on FMCW radar and summarizes the latest research using FMCW radar system. Firstly, this paper reviews existing gesture recognition applications using wireless signals. Secondly, it focuses on the FMCW radar gesture recognition system and gives the general framework of gesture recognition, including gesture data acquisition, signal preprocessing, gesture recognition algorithm and classification results. Next, it analyzes the typical gesture recognition application systems from coarse-grained and fine-grained granularity and elaborates experimental scenes, experimental equipment, gesture types, signal preprocessing and classification methods. Finally, it presents the challenges and issues involved in gesture recognition based on FMCW radar and proposes future research directions.

**IP2442** Hybrid Deep Learning CNN-Bidirectional LSTM and Manhattan Distance for Japanese Automated Short Answer Grading  
**11:45-12:00** Anak Agung Putri Ratna, Prima Dewi Purnamasari, Nadhifa Khalisha Anandra, Dyah Lalita Luhurkinanti  
Presenter: Anak Agung Putri Ratna, Universitas Indonesia, Indonesia

**Abstract:** This paper discusses the development of an Automatic Essay Grading System (SIMPLE-O) designed using hybrid CNN and Bidirectional LSTM and Manhattan Distance for Japanese language course essay grading. The most stable and best model is trained using hyperparameters with kernel sizes of 5, filters or CNN outputs of 64, a pool size of

# Online Session 1

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4, Bidirectional LSTM units of 50, and a batch size of 64. The deep learning model is trained using the Adam optimizer with a learning rate of 0.001, an epoch of 25, and using an L1 regularization of 0.01. The average error obtained is 29%.

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# Online Session 2

**Topic: Data Management and Information Security**

**Time: 14:00-16:00, October 29, 2022, Beijing Time**

**Meeting ID: 359-1277-5307 Password: 102729**

**Session Chair: Prof. Glenn Paul P. Gara, University of the Immaculate Conception, Philippines**

**IP1103** An encrypted traffic classification method based on contrastive learning  
**14:00-14:15** SIYUAN TIAN、YATING GAO、GUOQUAN YUAN、RU ZHANG、JINMENG ZHAO、  
SONG ZHANG  
Presenter: SIYUAN TIAN Beijing University of Posts and Telecommunications China

**Abstract:** Network traffic classification has become an important part of network management, which is conducive to realizing intelligent network operation and maintenance, improving network quality of service (QoS), and ensuring network security. With the rapid development of various applications and protocols, more and more encrypted traffic appears in the network. Due to the loss of semantic information after traffic encryption, poor content intelligibility, and difficulty in feature extraction, traditional detection methods are no longer applicable. Existing solutions mainly rely on the powerful feature self-learning ability of end-to-end deep neural networks to identify encrypted traffic. However, such methods are overly dependent on data size, and it has been experimentally proven that it is often difficult to achieve satisfactory results when validating across datasets. In order to solve this problem, this paper proposes an encrypted traffic identification method based on contrastive learning. First, the clustering method is used to expand the labeled data set. When the encrypted traffic features are difficult to extract, it is only necessary to learn the feature space to achieve discrimination more suitable for encrypted traffic identification. When validating across datasets, only fine-tuning is required on a small amount of labeled data to achieve good recognition results. Compared with the end-to-end learning method, there is an improvement of about 5%.

**IP1215** Privacy Protection Technology in Supply Chain-oriented Blockchain  
**14:15-14:30** ZHEN SUN, BO LIU, BOYANG ZHANG, FAGUO WU, BO ZHOU, HAO WU  
Presenter: Boyang Zhang, Beihang university, China

**Abstract:** The supply chain refers to the process that starts from the production of parts, goes through transportation, storage and other processes, and finally forms products and sells them. The supply chain generally consists of suppliers, manufacturers, sales companies, consumers and other elements. With the increase in the scale of the supply chain and the increase in transactions, it becomes difficult to track the transportation process of goods, and the transaction reliability is low, which leads to problems such as low logistics and transportation efficiency, difficulty in market supervision, and difficulty in confirming the ownership of goods. Therefore, we need a means to informatize the supply chain. Blockchain consists of blocks containing information connected in chronological order. Compared with traditional networks, blockchain has two core characteristics: one is the immutability of data, and the other is decentralization. Its structure naturally fits the characteristics and development trend of the supply chain, so we can consider using blockchain technology to solve the problems in the supply chain, so as to realize the innovative development of the supply chain. Our article first gives the concrete scheme of applying blockchain technology to supply

chains. From the four aspects of data collection, uploading, storage and use, we discussed how those various blockchain privacy protection technologies protect and enhance data privacy in the supply chain, including public key cryptography, digital signature, secret sharing technology, threshold cryptography, access control, and secure multi-party computation. We also predict the possible development direction of blockchain technology which is applied to supply chain.

**IP1217**  
**14:30-14:45** Optimization Tracking Algorithm Based on Extended Target Gaussian Mixture PHD Filter  
Liping Guo, Xinglin Shen, Shanzhu Xiao, Huanzhang Lu  
Presenter: Liping Guo, National University of Defense Technology, China

Abstract: Under low signal-to-noise ratio (SNR) target tracking, poor target information and high clutter limit the tracking effect. Extended targets potentially generate more than one measurement per time step. Multiple extended targets tracking is therefore can be used to improve tracking performance with low SNR, due to the expanded data than point targets tracking. Based on the classical probability hypothesis density (PHD) filter, the extended target PHD (ET- PHD) filter is proposed to track multiple extended targets. The main contribution of this paper is the improvement of the classical extended target Gaussian-mixture probability hypothesis density (ET-GM-PHD) filter. A method based on the ET-GM-PHD filter is proposed for decreasing false alarms and improving measurement set partition performance under low SNR cases. The optimized method is shown a better tracking performance in estimation accuracy of the targets number and targets state in comparison with a point PHD filter.

**IP1218**  
**14:45-15:00** Non-Intrusive Load Identification Based on Complex Spectrum and Support Vector Machine  
Lingling Tu, Gaoyan Cai, Bingji Liang, Weining Mao  
Presenter: Lingling Tu, School of Information Science and Engineering, Southeast University, China

Abstract: Aiming at the problem that the load identification accuracy of non-intrusive load monitoring (NILM) is greatly affected by the power of loads and the number of background loads, a non-intrusive load identification method based on the current complex spectrum and support vector machine (SVM) is proposed. Through the high-frequency sampling of the load's voltage and current, the complex spectrum of the current is extracted by the fast Fourier transform (FFT), and the multi-class SVM load identification model is established and optimized to realize the non-intrusive load identification. The algorithm is verified using the PLAID datasets, and the load identification accuracy of the algorithm is compared with SVM classifiers based on total harmonic distortion rate (THD), harmonic component ratio and harmonic amplitude. The results of the experiments show that the proposed method not only improves the identification accuracy of low-power loads, but also has higher identification accuracy and better identification robustness of switching load in multi-load scenarios.

**IP1102**  
**15:00-15:15** Malicious Code Classification Method of Advanced Persistent Threat Based on Asm2Vec  
Liu Kaijie, Hu Wei, Liu Jianyi , Cheng Jie, Gao Yating, Pang Jin  
Presenter: Kaijie Liu, Beijing University of Posts and Telecommunications

Abstract: In recent years, network security has become the main factor that threatens

the development of the Internet. Among the network security threats, advanced persistent threat (APT) is one of the most representative attacks and has brought unprecedented security challenges. APT attacks mainly depend on malicious code. At present, the homology analysis of malicious code for APT mainly converts the malicious code into a gray image or semantic fragment, which is realized by pre-training models such as neural network. The effect of the method based on pre-training depends heavily on the training process of the model and the form of the data set, which may lead to misjudgment of the organization of the malicious code in an APT real-time attack. In this paper, we propose a homology analysis of malicious code for APT groups based on Asm2Vec. The basic function blocks are obtained by disassembling and removing unimportant functions from the malicious code. The semantic representation model Asm2Vec is used to analyze and find out the possible APT group for targeted malware. The experimental results show that the Energetic Bear group classification accuracy of this paper is 91.30% and the F1-Score is 95.46%.

**IP1320**  
15:15-15:30

Construction of Nonlinear Optimal Diffusion Functions over Finite Fields  
BING SHEN, YU ZHOU  
Presenter: BING SHEN, Science and Technology on Communication Security Laboratory, Chengdu, China

Abstract: The diffusion function with large branch number is a fundamental building block in the construction of many block ciphers to achieve provable bounds against differential and linear cryptanalysis. Conventional diffusion functions, which are constructed based on linear error-correction code, has the undesirable side effect that a linear diffusion function by itself is “transparent” (i.e., has transition probability of 1) to differential and linear cryptanalysis. Nonlinear diffusion functions are less studied in cryptographic literature, up to now. In this paper, we propose a practical criterion for nonlinear optimal diffusion functions. Using this criterion we construct generally a class of nonlinear optimal diffusion functions over finite field. Unlike the previous constructions, our functions are non-linear, and thus they can provide enhanced protection against differential and linear cryptanalysis.

**IP1325**  
15:30-15:45

Post quantum identity authentication mechanism in blockchain  
Peng Duan, Bo Zhou  
Presenter: Bo Zhou, Zhongguancun Laboratory, China

Abstract: The blockchain technology has developed rapidly in recent years and has been widely used in all walks of life. However, most of the authentication systems adopted by the current blockchain technology are public key infrastructure based on large integer decomposition or discrete logarithm difficulties, and these cryptosystems are not secure in the quantum environment. Therefore, this paper considers an identity based post quantum authentication system applicable to the blockchain, which provides anti quantum protection and eliminates the dependence on public key certificates. Under the control of the supervision node, the authentication system has the key revocation function.

**IP2434**  
15:45-16:00

An Identity-based Group Signature Approach on Decentralized System and Chinese Cryptographic SM2  
Jiayi Liu, Tianyu Kang, Li Guo  
Presenter: Jiayi Liu, Beijing University of Posts and Telecommunications, China

Abstract: While reducing costs and improving data security, the new generation of informatics technologies such as blockchain also face problems of operation efficiency and privacy leakage, which have attracted extensive attention from researchers. Digital signature is one of the key technologies to solve the above problems. The group signature algorithm has the dual characteristics of protecting the privacy of signer identity and tracing effectively when disputes occur. The scheme we proposed can simultaneously solve the low efficiency of signature verification caused by the high time-consuming bilinear pairwise operation in existing group signature algorithms and the privacy leakage of signers caused by the vulnerability of single group administrators to malicious attacks. Compared with the SM2 digital signature algorithm of Chinese cryptographic standard, the proposed scheme increases the signature anonymization while maintaining the same signature and verification efficiency as the SM2 signature algorithm. Compared with Yang et al. 's scheme, the main computation overhead and communication bandwidth of the proposed protocol are significantly reduced. Therefore, the design scheme in this paper has stronger practicability and is more suitable for scenarios that require both efficiency and strong privacy protection, such as blockchain, anonymous certificate, electronic cash and electronic voting.

# Online Session 3

**Topic: Data Communication and Information Network**

**Time: 16:30-18:45, October 29, 2022, Beijing Time**

**Meeting ID: 359-1277-5307 Password: 102729**

**Session Chair: Prof. Li Fenglian, Taiyuan University of Technology, China**

**Invited** Dr. Xidong Mu, Queen Mary University of London, UK

**Speech 2** Speech Title: Beamforming Design For STAR-RISs: From Independent to  
**16:30-17:00** Coupled Phase Shifts

**IP1322** Recognition of Non-cooperative Radio Communication Relationships based on  
**17:00-17:15** Transformer  
Dejun He, Xinrong Wu, Lu Yu, Tianchi Wang  
Presenter: Dejun He, Army Engineering University of PLA, China

Abstract: The recognition of communication relationships under Non-cooperative conditions is significant for understanding the network composition of unknown targets, inferring network topology, and identifying key nodes, which is a prerequisite and basis for conducting efficient electronic countermeasures. However, under Non-cooperative conditions, for prior knowledge related to the target network is difficult to obtain, the communication relationships recognition faces enormous challenges. To address this issue, we construct a system model, analyze the mechanism of wireless communication interaction, extract feature series of signals from spectrum monitoring data, and propose a Transformer-based algorithm for recognizing target network communication relationships. This paper conducts simulation experiments in different scenarios to compare the Transformer-based communication relation recognition algorithm with the other four methods, such as SVM, CNN-based recognition algorithm, ResNet-based recognition algorithm, and LSTM-based recognition algorithm, respectively. And results demonstrate that the proposed algorithm shows high recognition accuracy, good anti-interference performance, and robustness.

**IP1107** Spatial spectrum estimation algorithm of polarization sensitive array based on  
**17:15-17:30** compensating spatial domain manifold matrix  
Chi Jiang, Xiaoli Zhang, Yongwu Zhao, Shujie Lei, Zhiwei Huang  
Presenter: Xiaoli Zhang, Shanghai Radio Equipment Research Institute, China

Abstract: Aiming at the uniform circular array model of conformal antenna array, we proposed a spatial spectrum estimation algorithm of polarization sensitive array based on compensating spatial domain manifold matrix. Because the conformal antenna is highly sensitive to the polarization information of the incident signal, traditional spatial spectrum direction-finding algorithm is not suitable. Meanwhile, when the classical polarization sensitive array spatial spectrum estimation algorithm is adopted, the interference generated by the anti-radiation detection system in the case of multipath, signal refraction and diffraction will be directly introduced into the model of the polarization sensitive array spatial spectrum finding theory, and then, resulting in a large estimation error of direction of arrival (DOA) and polarization parameters. The algorithm compensates the spatial domain components of the spatial domain array manifold matrix, which combine with the multiple signal classification (MUSIC) DOA estimation algorithm to construct a four-dimensional polarization sensitive array spatial spectrum function. And then, applying the reducing dimension spectral peak search to

achieve the two-dimensional DOA and polarization parameters estimation of the target signal. Compared with the classical polarization sensitive array MUSIC direction-finding algorithm, the algorithm we explored can suppress the front-end error of the system, avoid the mismatch between the spatial domain components and the theoretical model of the algorithm, and realize the high precision direction-finding and tracking of the target signal.

**IP1209**  
17:30-17:45

Evaluation of Waveform RF Stealth Performance Based on Relative Entropy  
Min Zhao\*, Siyu Xu\*, Bing Sun  
Presenter: Min Zhao, Beihang University, China

Abstract: RF stealth waveform design is an essential technology in RF stealth radar. LPI performance evaluation of waveforms becomes more and more critical. Several radars transmit waveforms are designed through compound modulation, and the relative entropy between the signal and Gaussian White Noise is used as an index to evaluate the LPI performance of the waveform. At the same time, two methods of ambiguity function and interception factor are used to compare and verify them. The final simulation realizes the quantitative evaluation of waveform RF stealth performance based on relative entropy.

**IP1214**  
17:45-18:00

Design of an intelligent substation auxiliary control edge gateway system supporting 5G  
Chun Zhu;Bingjie Liu;Xiaoyu Zhao  
Presenter: Xiaoyu Zhao, Fudan university, China

Abstract: In order to solve the problems of low intelligence and complex deployment of substation auxiliary control system, a new edge gateway system supporting 5g is designed. The gateway system designs a horizontal and vertical data flow mechanism; AI algorithm is applied to automatically classify different scenes of different video streams; Support 5g, WiFi and short-range communication access. The system is highly intelligent and scalable. The actual verification shows that the system is stable, flexible and easy to use.

**IP1330**  
18:00-18:15

The Enhanced Usage Control for data sharing in Industrial Internet  
Zhongli Na, Kai Li, Wei Liu, Zhifeng Gao  
Presenter: Zhongli Na, Research Institute of China Telecom, Beijing, China

Abstract: Usage control (UCON) model realizes the usage control of resources by integrating authorization, obligations and conditions and providing characteristics of decision continuity and attribute mutability. In order to better adapt to the data interaction demand in the industrial Internet environment, the enhanced UCON(EN-UCON) model is proposed to extend the UCON model to maintain the persistent control of obligations in the lifecycle of resources usage. Firstly, the continuous monitoring of obligations is implemented through the post obligation model. And then, the performance of the obligation is recorded through the trust level, which will be incorporated into the subsequent authorization strategy as an important factor. Finally, the application of EN-UCON model in the industrial Internet interaction scenario is described through a specific case.

**IP1502**  
18:15-18:30

Dynamic resource allocation on Vehicular edge computing and communication  
SENYU YU, YAN GUO\* , NING LI, DUAN XUE, and CUNTAO LIU  
Presenter: Senyu Yu, PLA Army Engineering University, China

**Abstract:** The improvement of modern communication technology has made the Internet of Vehicles (IoV) advance by leaps and bounds, and promotes the progress of many technologies, such as mobile sensing, vehicular edge computing, sensor networks, satellite positioning, data analysis, etc. Vehicular edge computing (VEC) is an innovative computing paradigm which can provide flexible and reliable computation services for intelligent and connected vehicles. Due to limited resources on a single vehicle, partial delay-sensitive or compute-intensive tasks cannot be finished locally and it could be a good solution to offload those tasks to nearby vehicles or Roadside Unit (RSU) so as to satisfy task requirements with different characteristics. However, how to rationally allocate resources on nearby vehicles and RSU is still a sticking point and lack of adequate research, and an efficient resource allocation mechanism is thus urgently required. In view of this, this paper comprehensively modeled the intelligent vehicle movement and computational offloading, in which nearby intelligent vehicles and RSU can perform tasks for intelligent vehicles synchronously. An optimized problem is formulated to minimize the total task offloading time delay by making a tradeoff between vehicle mobility and task nature. To tackle the optimization problem, we proposed the Delay-sensitive half-Determined atomic Search algorithm, called DeshDaS, in which we regard each intelligent vehicle as an atom and strategy as electron and consider electron transition process. Experimental results validate the effectiveness and superior of our algorithm compared with several existed offloading strategy, and the larger average amount of data waiting to be processed, the more significant our advantage is.

**IP2443**  
**18:30-18:45**

**Traffic Steering in Large-scale Public Cloud**  
ZHANGFENG HU, SIQING SUN, PING YIN, YANJUN LI, QIUZHENG REN, BAOZHU LI, XIONG LI  
Presenter: ZHANGFENG HU, Inspur Cloud, China

**Abstract:** More and more complex services composed of a series of sequentially arranged middleboxes which are mainly used to meet the requirements of advanced services such as security services, auditing services, monitoring services, personalized enterprise services, and so forth, are increasingly deployed in cloud data centers of public cloud. SFC (Service Function Chaining) is a technique that facilitates the enforcement of complex services and differentiated traffic forwarding policies, dynamically steering the traffic through an ordered list of service functions. Flow table-based traffic steering scheme is commonly adopted in SDN-enabled scenarios, which consumes too many flow entries and is unsuitable for large-scale public clouds in steering traffic between VNFs (Virtual Network Function) inside of VPC (Virtual Private Cloud). Legacy PBR (Policy-based Routing) based schemes which are widely used in traditional physical networks cannot fulfill the requirements of fully distributed routing architectures of large-scale public clouds. In this paper, we present a PBR and unsymmetrical NAT (Network Address Translation) converged scheme to structure SFC in a fully distributed routing architecture. The scheme uses distributed PBR rules to steer traffic between an ordered list of VNFs located on different nodes while performing NAT on different nodes for ingress/egress traffic of a specific flow to avoid asymmetry of packet headers which may lead to failures of communication. The proposed scheme brings no overhead in data transmission, eliminates extra configurations on each middle box of the chain, and is scalable to support the scenarios of large-scale public cloud.

