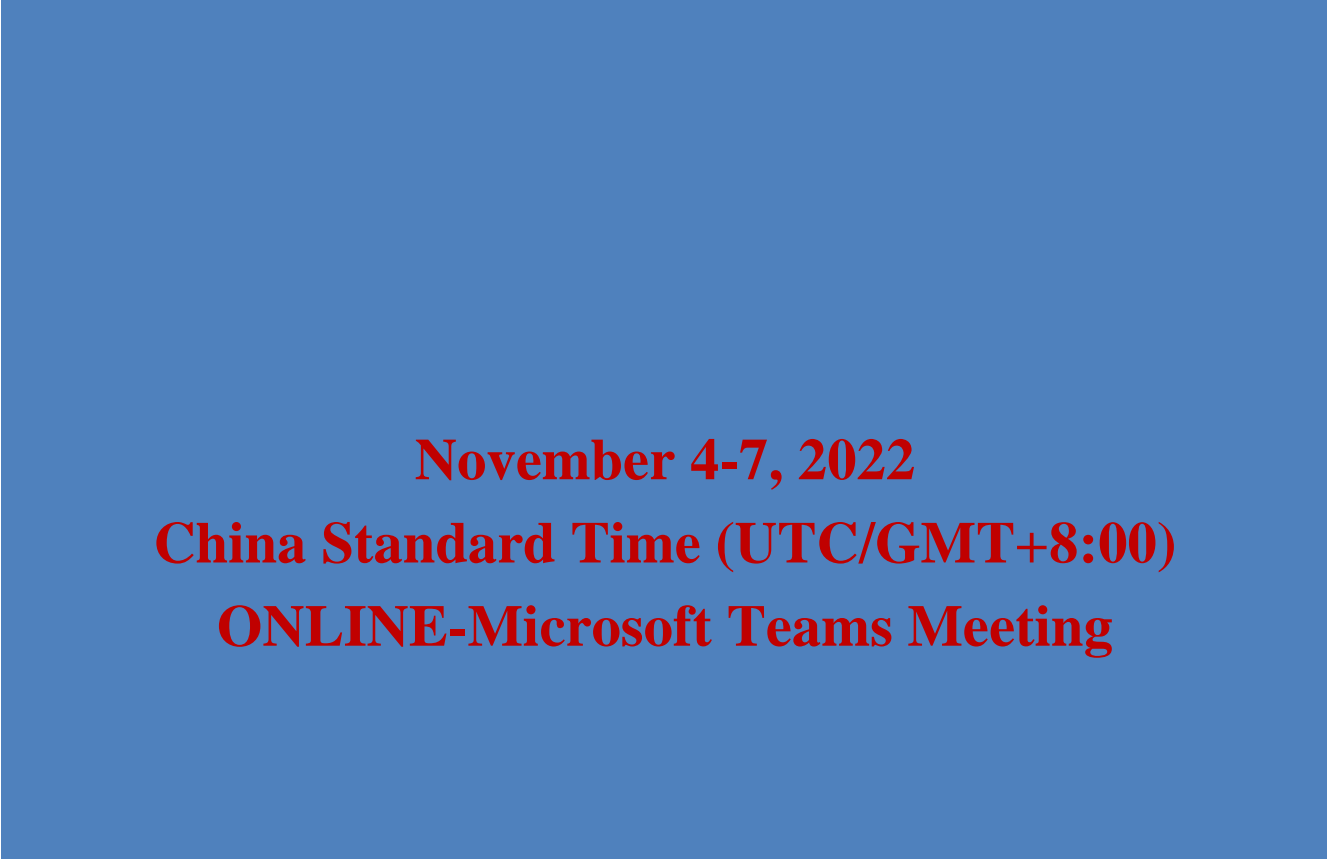




# CECNET2022 CONFERENCE PROGRAM

**November 4-7, 2022**  
**China Standard Time (UTC/GMT+8:00)**  
**ONLINE-Microsoft Teams Meeting**



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# Part I Conference Schedule

## Friday, November 4, 2022

*MS Teams:* <http://www.academicconf.com/teamslink?confname=cecnet2022>

09:00-11:00  
15:00-17:00 MS Teams Online Conference Testing and Ice Breaking

## Saturday Morning, November 5, 2022

*MS Teams:* <http://www.academicconf.com/teamslink?confname=cecnet2022>

*Host: Dr. Hanyu Quan, Vice Director of Network and Information Security Department, Huaqiao University, China*

### WELCOME SPEECH

09:00-09:10 *Prof. Hui Tian, Deputy Dean, College of Computer Science and Technology, Huaqiao University, China; Dean, College of Network and Information Security Industry, Huaqiao University, China;*

### Keynote Speech 1: Towards Trustworthy Machine Learning Methods

09:10-09:50 *Prof. Lyudmila Mihaylova, Department of Automatic Control and Systems Engineering, University of Sheffield, United Kingdom*

### Keynote Speech 2: Mobile Crowdsourcing: Towards Smart Cities

09:50-10:30 *Prof. Xiangjie Kong, College of Computer Science & Technology, Zhejiang University of Technology, China*

10:30-10:50 BREAK

### Keynote Speech 3: The Innovative Internet of Medical Things and Machine Learning (ML) Algorithms for Diabetes, Cancer and Healthcare Analysis

10:50-11:30 *Prof. Victor Chang, Aston Business School, Aston University, United Kingdom*

11:30-12:00 **Poster Session**

## Saturday Afternoon, November 5, 2022

*MS Teams:* <http://www.academicconf.com/teamslink?confname=cecnet2022>

14:00-18:40 **Oral Session 1: Electronics Technology and VLSI**

## Sunday, November 6, 2022

*MS Teams:* <http://www.academicconf.com/teamslink?confname=cecnet2022>

08:30-12:45 **Oral Session 2: Systems Science and Information Communication**

14:00-18:25 **Oral Session 3: Communication Networks and Network Security**

## Monday, November 7, 2022

*MS Teams:* <http://www.academicconf.com/teamslink?confname=cecnet2022>

08:30-12:10 **Oral Session 4: Information Functional Materials and Devices**

## Part II Keynote Speeches

### Keynote Speech 1: Towards Trustworthy Machine Learning Methods

*Speaker: Prof. Lyudmila Mihaylova*

*Department of Automatic Control and Systems Engineering, University of Sheffield, United Kingdom*

**Bio:** Lyudmila Mihaylova is Professor of Signal Processing and Control in the Department of Automatic Control and Systems Engineering at the University of Sheffield, Sheffield, United Kingdom. Her research interests are in the areas of trustworthy autonomous systems with applications to smart cities, sensor networks, digital health and others. She has expertise in the areas of machine learning, intelligent sensing and sensor data fusion. She won the Tammy Blair best award from the International Conference of Information Fusion 2017, best paper awards from the IEEE DESSERT'2019, 17th IEEE SPA'2013 Conference and IEEE Sensor Data Fusion Workshop, 2013. Prof. Mihaylova is on the Board of Directors of the International Society of Information Fusion (ISIF) and was the ISIF President in the period 2016–2018. She has given a number of talks and tutorials, including NATO SET- 262 AI 2018 (Hungary), Fusion 2017 (Xi'an, China), plenary talks for the IEEE Sensor Data Fusion 2015 (Germany), invited talks at IPAMI Traffic Workshop 2016 (USA) and others.



She is a member of the organising committee of the International Conference of Information Fusion 2022, 2021, IEEE MFI' 2021, UKCI' 2021 and vice-chair of the UKCI 2022. She was the general vice-chair for the International Conference on Information Fusion 2018 (Cambridge, UK), of the IET Data Fusion & Target Tracking 2014 and 2012 Conferences, publications chair for ICASSP 2019 (Brighton, UK) and others.

**Abstract of the speech:** There is a fast development of different machine learning methods – for object classification, tracking, action recognition and other tasks with multiple types of data – from images and videos to time series data. Autonomous image and video analytics face a number of challenges due to the huge volumes of data that sensors provide, the changeable environmental conditions and other factors. However, it is important to know when the methods work well and when they are not reliable, e.g., how much could we trust the obtained results? How could we characterise trust is a related question. How could we quantify the impact of uncertainties on the developed solutions? This talk will discuss current trends in the area of machine learning and show results for image and video analytics for autonomous systems.

Automated detection and behaviour analysis is another important area which necessitates unsupervised learning algorithms. Recent results for automated video analytics will be presented with Dirichlet process models, deep learning and other methods. Their pros and cons will be discussed.

## Keynote Speech 2: Mobile Crowdsourcing: Towards Smart Cities

*Speaker: Prof. Xiangjie Kong*

*College of Computer Science & Technology, Zhejiang University of Technology, China*

**Bio:** Dr. Xiangjie Kong is currently a Full Professor in the College of Computer Science & Technology, Zhejiang University of Technology (ZJUT), China. Previously, he was an Associate Professor in School of Software, Dalian University of Technology (DUT), China, where he was the Head of the Department of Cyber Engineering. He is the Founding Director of City Science of Social Computing Lab (The CSSC Lab) (<http://cssclab.cn/>). He is/was on the Editorial Boards of 6 International journals. He has served as the General Co-Chair, Workshop Chair, Publicity Chair or Program Committee Member of over 30 conferences. Dr. Kong has authored/co-authored over 140 scientific papers in international journals and conferences including IEEE TKDE, ACM TKDD, IEEE TNSE, IEEE TII, IEEE TITS, IEEE NETW, IEEE COMMUN MAG, IEEE TVT, IEEE IOJ, IEEE TSMC, IEEE TETC, IEEE TASE, IEEE TCSS, WWWJ, etc. 5 of his papers is selected as ESI-Hot Paper (Top 1%), and 16 papers are ESI-Highly Cited Papers (Top 1%). His research has been reported by Nature Index and other medias. He has been invited as Reviewers for numerous prestigious journals including IEEE TKDE, IEEE TMC, IEEE TNNLS, IEEE TNSE, IEEE TII, IEEE IOTJ, IEEE COMMUN MAG, IEEE NETW, IEEE TITS, TCJ, JASIST, etc. Dr. Kong has authored/co-authored three books (in Chinese). He has contributed to the development of 14 copyrighted software systems and 20 filed patents. He has an h-index of 36 and i10-index of 87, and a total of more than 4200 citations to his work according to Google Scholar. He is named in the 2019 and 2020 world's top 2% of Scientists List published by Stanford University. Dr. Kong received IEEE Vehicular Technology Society 2020 Best Land Transportation Paper Award, and The Natural Science Fund of Zhejiang Province for Distinguished Young Scholars. He has been invited as Keynote Speaker at 2 international conferences, and delivered a number of Invited Talks at international conferences and many universities worldwide. His research interests include big data, network science, and computational social science. He is a Distinguished Member of CCF, a Senior Member of IEEE, a Full Member of Sigma Xi, and a Member of ACM.



**Abstract of the speech:** Leveraging new communication technologies and Internet of Things (IoT) applications, local administrations and governments aim at managing the city infrastructures and optimize the public services in an efficient and sustainable manner. Furthermore, they adopt intelligent and cost-effective mobile applications to deal with natural disasters, such as pollution and traffic congestion. Mobile crowdsourcing (MCS) is an emerging paradigm for enabling smart cities, which integrates the wisdom of dynamic crowds with ubiquitous mobile devices to provide decentralized applications and services. Using MCS solutions, residents play the role of an active worker to generate a wealth of crowdsourced data which can significantly promote the development of smart cities. This talk highlights research challenges in computing and analyzing mobile crowdsourced data generated by large amount of participants/devices, and fusing multi-sourced and heterogeneous urban big data to facilitate applications towards smart cities.

# Keynote Speech 3: The Innovative Internet of Medical Things and Machine Learning (ML) Algorithms for Diabetes, Cancer and Healthcare Analysis

*Speaker: Prof. Victor Chang*

*Aston Business School, Aston University, United Kingdom*

**Bio:** Prof. Victor Chang is a Professor of Business Analytics at Operations and Information Management, Aston Business School, Aston University, UK, since mid-May 2022. He was previously a Professor of Data Science and Information Systems at the School of Computing, Engineering and Digital Technologies, Teesside University, UK, between September 2019 and mid-May 2022. He has deep knowledge and extensive experience in AI-oriented Data Science and has significant contributions in multiple disciplines. Within 4 years, Prof Chang completed Ph.D. (CS, Southampton) and PGCert (Higher Education, Fellow, Greenwich) while working for several projects simultaneously. Before becoming an academic, he has achieved 97% on average in 27 IT certifications. He won 2001 full Scholarship, a European Award on Cloud Migration in 2011, IEEE Outstanding Service Award in 2015, best papers in 2012, 2015 and 2018, the 2016 European award: Best Project in Research, 2016-2018 SEID Excellent Scholar, Suzhou, China, Outstanding Young Scientist award in 2017, 2017 special award on Data Science, 2017-2022 INSTICC Service Awards, Talent Award Suzhou 2019, Top 2% Scientist 2017/2018, 2019/2020 & 2020/2021, the most productive AI-based Data Analytics Scientist between 2010 and 2019, Highly Cited Researcher 2021 and numerous awards mainly since 2011. He is ranked number 2 in distributed computing and number 42 in AI globally based on top 2% Scientists 2020 from Stanford University. Prof Chang was involved in different projects worth more than £14 million in Europe and Asia. He has published 3 books as sole authors and the editor of 2 books on Cloud Computing and related technologies. He published 1 book on web development, 1 book on mobile app and 1 book on Neo4j. He gave 32 keynotes at international conferences. He is widely regarded as one of the most active and influential young scientist and expert in IoT/Data Science/Cloud/security/AI/IS, as he has the experience to develop 10 different services for multiple disciplines. He is the founding conference chair for IoTBDS, COMPLEXIS and FEMIB to build up and foster active research communities globally with positive impacts.



**Abstract of the speech:** This keynote proposes an e-diagnosis system based on machine learning (ML) algorithms to be implemented on the Internet of Medical Things (IoMT) environment, particularly for diagnosing diabetes mellitus (type 2 diabetes) and breast cancer analysis. It can also be further adapted for heart disease detection analysis. The ML applications tend to be mistrusted because of their inability to show the internal decision-making process, resulting in slow uptake by end-users within certain healthcare sectors. This research delineates the use of three interpretable supervised ML models: Naïve Bayes classifier, random forest classifier, and J48 decision tree models to be trained and tested using the Pima Indians diabetes dataset. The performance of each algorithm is analyzed to determine the one with the best accuracy, precision, sensitivity, and specificity. An assessment of the decision process is also made to improve the model. It can be concluded that a Naïve Bayes model works well with a more fine-tuned selection of features for binary classification, while random forest works better with more features. IoMT is then used to help analyzing breast cancer and other medical analysis. Other methods such as support vector machine (SVM) and its vari-

ant models using the radial basis function kernel outperformed all other models we tested and those previously developed by others, achieving an accuracy of 99%. Additional scientific research for heart disease detection. We explain our analysis, research contributions and impacts. In summary, this keynote will present the latest research outputs for using applied IoMT and machine learning algorithms for healthcare domains.

## Part III Oral Presentations

### Oral Presentation Guidelines

- ✚ Online Oral Presentations will be held on [Microsoft Teams Meeting](#).
- ✚ All presenters are requested to reach the Online Session Room prior to the schedule time and complete their presentation on time.
- ✚ All presentations are scheduled in **China Standard Time (UTC/GMT+8)**.
- ✚ If a presenter is not able to show up via Teams, the session chair / conference secretary will download and play the pre-recorded video presentation during his/her scheduled presentation time, if listeners have questions about the presentation, please contact the conference secretary to forward the questions.
- ✚ Signed and stamped electronic presentation certificate would be issued via e-mail after conference.

### Best Oral Presentations Selection

#### Selection Criteria:

The session chair will select one best oral presentation from his/her session based on the following criteria:

- ✓ Research Quality
- ✓ Presentation Performance
- ✓ Presentation Language
- ✓ PowerPoint Design

### Best Oral Presentations Award

The Best Presenters will receive an official certificate and a free registration to the CECNet 2023.



## Session 1: Electronics Technology and VLSI

Online room link: <http://www.academicconf.com/teamslink?confname=cecnet2022>

Session Chair:

*Dr. Shilong Sun, College of Electronic Science and Technology, National University of Defense Technology, China*

*Assoc. Prof. Cong Sun, Beijing University of Posts and Telecommunications, China*

**Time:** 14:00-18:40, Saturday, November 5, 2022

14:00-14:25	CNT3014 (Invited)	<b>Design of a Compact Ultra Wideband Planar Helical Antenna</b> <i>Prof. Hongxin Zhang, Beijing University of Posts and Telecommunications, China</i>
14:25-14:50	CNT3128 (Invited)	<b>Stable and Fresh Massive Access for Passive IoT</b> <i>Prof. Jihong Yu, School of Information and Electronics, Beijing Institute of Technology, China</i>
14:50-15:15	CNT3140 (Invited)	<b>Organic Thin-film Transistor-based Chemical Sensors Toward Real-sample Analysis</b> <i>Prof. Tsuyoshi Minami, The University of Tokyo, Japan</i>
15:15-15:40	CNT3141 (Invited)	<b>Engineering Progress and Innovations of Large Optics Assembly in China's High Laser Facility</b> <i>Dr. Zhao Xiong, Research Center of Laser Fusion, China Academy of Engineering Physics, China</i>
15:40-16:05	CNT3083 (Invited)	<b>An Experience with a Design and Fabrication of an Inset-Fed Rectangular Microstrip Antenna Built on an Ultra Thin Substrate in the S-Band</b> <i>Prof. Miroslav Joler, Faculty of Engineering, University of Rijeka, Croatia</i>
16:05-16:20	CNT3088	<b>Study Analysis of Printed Monopole Antenna for C and X Band Application</b> <i>Dr. Samom Jayananda Singh, Department of Electronics and Communication Engineering, NERIST, India</i>
16:20-16:35	<b>Coffee Break</b>	
16:35-16:50	CNT3096 (Invited)	<b>Quantitative Inversion Radar Imaging: A Physical Remote Sensing Modality of High Resolution</b> <i>Dr. Shilong Sun, College of Electronic Science and Technology, National University of Defense Technology, China</i>
16:50-17:05	CNT3149	<b>A Method of Anti-nonsynchronous Short Pulse Jamming Based on Waveform Entropy</b> <i>Dr. Zijun Hu, Key Laboratory of Electronic and Information Technology in Satellite Navigation Beijing Institute of Technology, China</i>
17:05-17:20	CNT3117	<b>A Design of Hierarchical Bloom Filter</b> <i>Dr. Tao Ma, Information Engineering College, Yangzhou University, China</i>
17:20-17:45	CNT3030 (Invited)	<b>Sum Rate Maximization for Discrete Phase Shifted RIS Aided Downlink Network</b> <i>Assoc. Prof. Cong Sun, Beijing University of Posts and Telecommunications, China</i>

17:45-18:00	CNT3153	<b>Smart Automated Energy Efficient Railway Tunnel</b> <i>Dr. Sagar Shinde, Arvind Gavali College of Engineering, India</i>
18:00-18:25	CNT3173 (Invited)	<b>Modelling Dynamics of Energy Consumption in Batteries of Autonomous (IoT nodes, UAVs) Devices</b> <i>Prof. Tadeusz Czachorski, Institute of Theoretical and Applied Informatics, Polish Academy of Sciences, Poland</i>
18:25-18:40	CNT3101	<b>Induction Motor Fault Tolerant Control with Wavelet Fault Indicator</b> <i>Prof Dr Khalaf S Gaeid, Electrical Engineering Department, Tikrit University, Iraq</i>

## Abstracts of Session 1

### CNT3014

#### Design of a Compact Ultra Wideband Planar Helical Antenna

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

**Abstract.** In order to meet the wide-band full-space radio monitoring task, the design of a low-profile planar composite helical antenna and Barron structure is presented in this paper. The antenna operation covers the L-band and S-band frequencies ranging from 200MHz to 6GHz. The inner ring of the antenna adopts equiangular helix and the outer ring adopts Archimedes square helix, which not only extends the effective electrical length of the metal arm of the antenna, but also has non-frequency variable characteristics and improves the low frequency characteristics and axis ratio of the antenna. The antenna volume is reduced to 280mm\*280mm\*280mm. The simulated and measured results show that the antenna has a very good impedance matching. The specific results are shown below. In the range of 200MHz-6GHz band, the standing wave ratio of the antenna feed system is less than 2, the test axis ratio is less than 3.5dB. In the whole band, the antenna has high gain, good directivity of the direction diagram and no splitting phenomenon. Finally, the designed antenna is applied to the environmental monitoring system, which can cover the broadcast signal of about 100MHz and the UHF band above 6GHz, indicating that the optimization effect is great in the low-band.

### CNT3128

#### Stable and Fresh Massive Access for Passive IoT

*Jihong Yu*  
*School of Information and Electronics, Beijing Institute of Technology, China*

**Abstract.** Battery-free sensors that can be energized wirelessly are promising for continuously sensing the physical world and providing time-sensitive data for intelligent decisions and applications. The deployment

of such ambient power-enabled IoT usually involves massive access of the passive sensors. This talk would introduce how to control access of the massive sensors so that the systems are stable and the collected data is fresh from MAC layer perspective. Specifically, this talk focuses on random access named Frame Slotted Aloha (FSA) with its stability and age of information (AOI) presented in sequence. These theoretical results could provide guidelines for stable and fresh FSA-based access protocol design.

### **CNT3140**

#### **Organic Thin-film Transistor-based Chemical Sensors Toward Real-sample Analysis**

*Tsuyoshi Minami*

*The University of Tokyo, Japan*

**Abstract.** Given the fact that the increase in attention to SDGs, rapid and accurate chemical sensing for food analysis, diagnosis, and environmental assessment is in high demand. Chemical species in real samples have been conventionally analyzed by large analytical apparatuses, while such methods have considerable issues such as the requirement of trained personnel and time-consuming measurements. Hence, the development of portable and easy-to-use chemical sensors is desirable. To this end, the presenter has focused on organic field-effect transistors (OFETs) as sensor platforms for accurate real-sample analysis, which possess beneficial properties including switching properties, mechanical flexibilities, and applicability to printing methods for high-throughput manufacturing. By employing appropriate molecular recognition materials, such OFETs enable quantitative chemical sensing in aqueous media. The details of approaches for the establishment of the OFET-based chemical sensors will be discussed in the presentation.

**Keywords:** Organic Transistor, Chemical Sensor, Real-Sample Analysis, Molecular Recognition

### **CNT3141**

#### **Engineering Progress and Innovations of Large Optics Assembly in China's High Laser Facility**

*Zhao Xiong*

*Research Center of Laser Fusion, China Academy of Engineering Physics, China*

**Abstract.** Thousands of optical units are used in China's large high-power laser facility. Hundreds of optical line-replaceable units (LRUs) are used in each 3.75 kilojoules laser beam. LRUs is design to assembly by standardized joints in laser building to form laser beams, so if one optic of the hundreds optical units suffer damage, the optic will be removed and replaced quickly, safely, and cost-effectively. ICF laser is designed so precisely that all laser beams can hit the target ( $\sim 250 \mu\text{m}$  focal spot) with the accuracy better than  $50 \mu\text{m}$  (Root Mean Square, RMS) from numerous directions at the almost same time. To realize these extreme specifications, thousands LRUs must be manufactured and assembled with the most stringent requirements. So, the Optics Assembly Building (OAB), a 1000 m<sup>2</sup> sized Class-100 (ISO Class 5) cleanroom in China's large high-power laser facility, is built and all LRUs are assembled in that building with a condition of strict cleanliness and precise alignment. However, due to the fact that stringent technical specifications for large

ICF optics, there are huge challenges to realize those requirements of large ICF optics assembly and mounting. In this paper, on the basis of ten years' experience, we will propose a detailed introduction on the engineering progress and our essential methodologies. In total, we attribute our success in the following key factors: v Multi-physical modeling and simulation is the fundamental design tool v Anticipation is paramount to optimize time / budget / ... v Coordination / arbitration between numerous factors v Automation / robotization for high assembly/operation consistence v Integration reflects future maintenance.

**Keywords:** Large optics, Assembly, Innovations

### **CNT3083**

#### **An Experience with a Design and Fabrication of an Inset-Fed Rectangular Microstrip Antenna Built on an Ultra Thin Substrate in the S-Band**

*Miroslav Joler and Leo Mihalić*

*Faculty of Engineering, University of Rijeka, Croatia*

**Abstract.** In this paper, we report on the experience of the design and fabrication of an insetfed rectangular microstrip antenna (IRMA) on an ultra thin substrate, in the S frequency band in the vicinity of 2.45 GHz. The designed models showed a fairly small feasible range of the inset gap dimension with respect to the feed line width, to enable good output parameters. Ultimately, an IRMA was successfully designed and fabricated, with the impedance bandwidth of 2%, the directivity of 5.9 dB, the beamwidths of 135° and 90° in the YZ and XZ cut-plane, respectively, and the efficiency of 4.2%, which is attributed to being fabricated on an ultra thin and a very low-loss substrate that was utilized in this work. This paper will discuss the key aspects of this design experience.

**Keywords:** Ultra Thin Substrate, Rectangular Microstrip Antenna, Inset Feed, Pyralux, Quarter-Wave Transformer

**Acknowledgements:** We thank the DuPont company for the samples of the Pyralux AP laminate.

**CNT3088 To avoid repeatability issue, this abstract will be available after the full paper is published in the conference proceedings.**

**CNT3096 To avoid repeatability issue, this abstract will be available after the full paper is published in the conference proceedings.**

**CNT3149 To avoid repeatability issue, this abstract will be available after the full paper is published in the conference proceedings.**

**CNT3117 To avoid repeatability issue, this abstract will be available after the full paper is published in the conference proceedings.**

### CNT3030

#### Sum Rate Maximization for Discrete Phase Shifted RIS Aided Downlink Network

Cong Sun

Beijing University of Posts and Telecommunications, China

**Abstract.** Reconfigurable intelligent surface (RIS) with discrete phase shifts aided two-user downlink network is considered. The precoding beamforming and RIS parameters are jointly designed for sum rate maximization. The nonconvex problem is approximated through maximum ratio transmission, optimal power allocation and Courant penalty function techniques. Two algorithms are proposed for the approximated problem based on alternating direction of multipliers method and proximal gradient method, respectively. Simulations show that the two proposed algorithms achieve higher sum rate with significantly lower computational cost than the state of the art.

### CNT3153

#### Smart Automated Energy Efficient Railway Tunnel

Sagar Shinde<sup>1</sup>, Lalit Kumar Wadhwa<sup>2</sup>

<sup>1</sup>Arvind Gavali College of Engineering, India

<sup>2</sup>Dr. D. Y. Patil Institute of Technology, India

**Abstract.** It is observed that most of the electricity is consumed by Railway Sector so chosen the problem concerned with Railway Sector. In railway tunnels, bulbs or lights are ON for 24 hours which causes wastage of electricity. Actually, we need to ON bulbs or Lights only during the railway passes through tunnels and during maintenance. By studying the traffic through Nine Tunnels which having length more than 1 Km, it is observed that after electronic control and switching circuitry which includes load cell, detector, micro-controller and relay with buzzer driver circuit can save electricity up to 13751 MW/yr. Energy saving cost is nearly equal to 5,50,04000/- rupees.

**Keywords:** Load cell, Detector, Switching, Smart Tunnel, Electricity Saving

### CNT3173

#### Modelling Dynamics of Energy Consumption in Batteries of Autonomous (IoT nodes, UAVs) Devices

Tadeusz Czachorski

Institute of Theoretical and Applied Informatics, Polish Academy of Sciences, Poland

**Abstract.** The complexity of battery-powered autonomous devices such as Internet of Things nodes or Unmanned Aerial Vehicles, and the necessity to ensure an acceptable quality of service, reliability, and security, have significantly increased their energy demand. Batteries become an important part of any autonomous device and therefore their performance should be carefully modeled. In this presentation, we discuss a model where a battery energy content is represented by a diffusion process. The model takes into account energy harvesting; the energy is represented by unitary energy packets that come to the system, are queued, and then consumed. Both the arrivals and consumption are probabilistic and the battery is represented by G/G/1/B queueing system; the number of energy packets in the queue represents the energy in the battery.

The transient solution of such a model gives us the distribution of energy, as well as the probability that the battery is empty or full as a function of time. The introduction of the first passage time inside a diffusion process enables us to determine time-dependent probability density functions of

- time remaining until the battery becomes empty,
- time required to charge the battery to its total capacity,
- time the battery is operational between two moments of complete depletion.

The use of the diffusion process makes the model more precise than frequently used Poisson or fluid-flow models. In special cases, when interarrival times and the time needed to consume one energy packet are exponentially distributed, we compare the results of diffusion approximation with corresponding models based on continuous-time Markov chains and find that the errors introduced by the diffusion approximation are really small.

## **CNT3101**

### **Induction Motor Fault Tolerant Control with Wavelet Fault Indicator**

*Khalaf S Gaeid*

*Electrical Engineering Department, Tikrit University, Iraq*

**Abstract.** Induction Motors are an important part of the industry as they provide convenience through their simple construction and a minimum maintenance. In addition, they are highly rigid and reliable. They are mostly used in compressors, fans and pumps, but their usage has progressed to a much advanced level such as, aircrafts, space shuttles and military applications. These operations are crucial and cannot tolerate compromise in reliability and safety. This work aims at exploring the fault tolerant control of the IMs. This involves sensor based closed loop vector control for a healthy IM, Variable frequency with constant flux(V/F) closed loop for both stator open winding and stator short winding faults, V/F open loop to control the drive in case of minimum voltage fault and using the sensorless vector control in case of encoder faults. The model that has been suggested for the fault tolerant control has been verified through a 0.5 hp IM with the inclusion of condition monitoring and protection against the above faults. A platform of more than 13 trips has been included in this work. The faults will be classified according to the location, severity and the time. The speed for the sensorless vector control and closed loop V/F controllers is evaluated through the model reference adaptive control estimator. There are two steps in the fault tolerant control process; in the first step the fault is identified with the feature extraction module, a fault decision module and a feature cluster module. After that the controller is redesigned accordingly. In this work however, the fault protection is an additional feature of the control system, where the wavelet based fault tolerant system has been tested.

## **Session 2: Systems Science and Information Communication**

**Online room link:** <http://www.academicconf.com/teamslink?confname=cecnet2022>

**Session Chair:** *Prof. Hongying Zhang, Department of Automation, Civil Aviation University of China, China*

**Time:** 08:30-12:45, Sunday, November 6, 2022

08:30-08:45	CNT3121	Algorithm Based on Deep Learning to Improve the Logistics Management of a Company That Distributes Reading Material <i>Mr. Angel Cordova Baquijano, Private University of the North, Peru</i>
08:45-09:00	CNT3158 (Invited)	Deformation Measurement in the Presence of Discontinuities by Using Intelligent Algorithms <i>Dr. Ghulam Mubashar Hassan, Department of Computer Science and Software Engineering, University of Western Australia, Australia</i>
09:00-09:25	CNT3021 (Invited)	Practical Interference Exploitation Precoding without Symbol-by-Symbol Optimization for MU-MISO Downlink: A Block-Level Approach <i>Prof. Ang Li, Faculty of Electronic and Information Engineering, Xi'an Jiaotong University, China</i>
09:25-09:50	CNT3026 (Invited)	Application of Multiple Targets Tracking in Computer Vision <i>Prof. Hongying Zhang, Department of Automation, Civil Aviation University of China, China</i>
09:50-10:05	CNT3125	Efficient Security Detection Strategy Based on K-Means Algorithm in LPWAN <i>Dr. Minhao Jin, State Grid Zhejiang Electric Power Company, China</i>
10:05-10:30	CNT3035 (Invited)	Quantized Federated Learning under Transmission Delay and Outage Constraints <i>Assoc. Prof. Tsung-Hui Chang, The Chinese University of Hong Kong (Shenzhen) and Shenzhen Research Institute of Big Data, China</i>
10:30-10:45	<b>Coffee Break</b>	
10:45-11:10	CNT3075 (Invited)	Convergence of Perturbed Delayed Switched Nonlinear Systems with Applications <i>Prof. Xingwen Liu, Southwest Minzu University, China</i>
11:10-11:35	CNT3113 (Invited)	Stability and Event-triggered Control of Stochastic Nonlinear Delay Systems <i>Prof. Quanxin Zhu, Hunan Normal University, China</i>
11:35-11:50	CNT3127	All-optical Control of Light Transmission in a Topological Waveguide Array <i>Dr. Shirong Lin, School of Physical Sciences, Great Bay University, China</i>
11:50-12:05	CNT3170	Blind Source Separation: A Deep Learning Approach <i>Dr. Monorama Swain, Silicon Institute of Technology, India</i>
12:05-12:30	CNT3090 (Invited)	A Method for Power Amplifier Distortions Compensation at the RX Side for the 5G NR Communication Systems <i>Prof. Alexander Maltsev, Nizhny Novgorod State University, Nizhny Novgorod, Russia</i>
12:30-12:45	CNT3167	3D Point Cloud and BIM Component Retrieval for Subway Stations via Deep Learning <i>Mr. Wei Ye, Fujian Key Laboratory of Sensing and Computing for Smart Cities, School of Informatics, Xiamen University, China</i>

## Abstracts of Session 2

**CNT3121** To avoid repeatability issue, this abstract will be available after the full paper is published in the conference proceedings.

### **CNT3158**

#### **Deformation Measurement in the Presence of Discontinuities by Using Intelligent Algorithms**

*Ghulam Mubashar Hassan*

*Department of Computer Science and Software Engineering, University of Western Australia, Australia*

**Abstract.** Deformation measurement is a challenging real-world problem in many fields and requires high accuracy. It involves measuring displacements and strains of each point on the surface of the specimen. Digital Image Correlation (DIC) is a computational technique which can remotely measure deformation with high accuracy using images. However, DIC has some limitations including failure in the presence of discontinuities such as cracks or crevices. This makes the problem of remote deformation measurement more challenging.

In this invited talk, I will explain the core concept of DIC and explain the challenges posed by the problem of deformation measurement. I will also discuss the solutions I developed and their outcomes in terms of commercial value and research contributions. I will also discuss its application in the upcoming problems.

### **CNT3021**

#### **Practical Interference Exploitation Precoding without Symbol-by-Symbol Optimization for MU-MISO Downlink: A Block-Level Approach**

*Ang Li*

*School of Information and Communications Engineering, Faculty of Electronic and Information Engineering, Xi'an Jiaotong University, China*

**Abstract.** In this talk, we share a new constructive interference (CI)-based block-level precoding (CI-BLP) approach for the downlink of a multi-user multiple-input single-output (MU-MISO) communication system. Contrary to existing CI precoding approaches which have to be designed on a symbol-by-symbol level, here a constant precoding matrix is applied to a block of symbol slots within a channel coherence interval, thus significantly reducing the computational costs over traditional CI-based symbol-level precoding (CI-SLP) as the CI-BLP optimization problem only needs to be solved once per block. For both PSK and QAM modulation, we formulate an optimization problem to maximize the minimum CI effect over the block subject to a block- rather than symbol-level power budget. We mathematically derive the optimal precoding matrix for CI-BLP as a function of the Lagrange multipliers in closed form. By formulating the dual problem, the original CI-BLP optimization problem is further shown to be equivalent to a quadratic programming (QP) optimization. Finally, numerical results validate our derivations, and show that the proposed CI-BLP scheme achieves improved performance over the traditional CI-SLP method, thanks to the relaxed power constraint



over the considered block of symbol slots.

### **CNT3026**

#### **Application of Multiple Targets Tracking in Computer Vision**

*Hongying Zhang*

*Department of Automation, Civil Aviation University of China, China*

**Abstract.** With the wide application of intelligent video surveillance in various public areas such as transportation hubs and business districts and excellent performance in security and passenger flow monitoring, computer vision technology on which it relies has become a research hotspot. Multiple target tracking is under a research direction in the field of computer vision, through analyzing the video data obtained by passengers or the location of the pedestrians and trajectory. It has high initiative, real-time and practicality relative to other positioning method which could be well applied to the safety protection, public health, traffic analysis, etc. This speech mainly focuses on the current mainstream of visual technology and multiple target tracking technology. I will introduce related definition and principle in the field of computer vision and multi-target tracking and analyze the application prospects of civil aviation by economic value, and face difficulties and challenges, which leads to the current cases and methods. Finally, the future development trend and innovation direction of tracking algorithm and engineering project will be discussed.

**CNT3125 To avoid repeatability issue, this abstract will be available after the full paper is published in the conference proceedings.**

### **CNT3035**

#### **Quantized Federated Learning under Transmission Delay and Outage Constraints**

*Tsung-Hui Chang*

*School of Science and Engineering, The Chinese University of Hong Kong (Shenzhen) and Shenzhen Research Institute of Big Data, China*

**Abstract.** Federated learning (FL) has been recognized as a viable distributed learning paradigm which trains a machine learning model collaboratively with massive mobile devices in the wireless edge while protecting user privacy. Although various communication schemes have been proposed to expedite the FL process, most of them have assumed ideal wireless channels which provide reliable and lossless communication links between the server and mobile clients. Unfortunately, in practical systems with limited radio resources such as constraint on the training latency and constraints on the transmission power and bandwidth, transmission of a large number of model parameters inevitably suffers from quantization errors (QE) and transmission outage (TO). In this talk, we consider such non-ideal wireless channels, and carry out the first analysis showing that the FL convergence can be severely jeopardized by TO and QE, but intriguingly can be alleviated if the clients have uniform outage probabilities. These insightful results motivate us to propose a robust FL scheme, named FedTOE, which performs joint allocation of wireless resources and quantization

bits across the clients to minimize the QE while making the clients have the same TO probability. Extensive experimental results are presented to show the superior performance of FedTOE for deep learning-based classification tasks with transmission latency constraints.

### **CNT3075**

#### **Convergence of Perturbed Delayed Switched Nonlinear Systems with Applications**

*Xingwen Liu*

*Southwest Minzu University, China*

**Abstract.** Switched delayed nonlinear systems are a typical class of complex systems and have wide applications. This talk will reveal the following properties of switched delayed nonlinear systems subject to perturbations: (i) Suppose that the nominal system is exponentially stable. Then the trajectories of perturbed system decay exponentially if so is the perturbation, and decay asymptotically if so is the perturbation. The conclusions hold for both local and global cases. (ii) Suppose that the nominal system is asymptotically stable. Then the trajectories of perturbed system decay asymptotically to zero if the perturbation decays to zero exponentially, and may diverge if the perturbation asymptotically decays to zero. Utilizing these properties, some important stability conditions can be established: Suppose that a cascade switched nonlinear delayed system consists of two separate systems and that the coupling term satisfies a linear growth rate condition. Then the cascade system is exponentially stable, locally or globally, if and only if so are two separate systems and is locally asymptotically stable if one of separate systems is locally asymptotically stable and the other one is locally exponentially stable.

### **CNT3113**

#### **Stability and Event-triggered Control of Stochastic Nonlinear Delay Systems**

*Quanxin Zhu*

*Hunan Normal University, China*

**Abstract.** In this report, we study the stabilization problem of stochastic nonlinear delay systems with exogenous disturbances and the event-triggered feedback control. By introducing the notation of input-to-state practical stability and an event-triggered strategy, we establish the input-to-state practically exponential mean-square stability of the suggested system. Moreover, we investigate the stabilization result by designing the feedback gain matrix and the event-triggered feedback controller, which is expressed in terms of linear matrix inequalities. Also, the lower bounds of inter-execution times by the proposed event-triggered control method are obtained. Finally, an example is given to show the effectiveness of the proposed method. Compared with large number of results for discrete-time stochastic systems, only a few results have appeared on the event-triggered control for continuous-time stochastic systems. In particular, there has been no published papers on the event-triggered control for continuous-time stochastic delay systems. Our work is a first try to fill the gap on the topic.

**CNT3127**

**All-optical Control of Light Transmission in a Topological Waveguide Array**

*Shirong Lin<sup>1,2,\*</sup>, Luojia Wang<sup>1</sup>, Luqi Yuan<sup>1,\*</sup> and Xianfeng Chen<sup>1,3,4,5</sup>*

<sup>1</sup> *School of Physical Sciences, Great Bay University, China*

<sup>2</sup> *State Key Laboratory of Advanced Optical Communication Systems and Networks, School of Physics and Astronomy, Shanghai Jiao Tong University, China*

<sup>3</sup> *Shanghai Research Center for Quantum Sciences, China*

<sup>4</sup> *Jinan Institute of Quantum Technology, China*

<sup>5</sup> *Collaborative Innovation Center of Light Manipulation and Applications, Shandong Normal University, China*

**Abstract.** The quantum Hall system possesses topologically protected edge states, which have enormous theoretical and practical implications in both fermionic and bosonic systems. Harnessing the quantum Hall effect in optical platforms with lower dimensionality is highly desirable with synthetic dimensions and has attracted broad interests in the photonics society. Here, we introduce an alternative way to realize the artificial magnetic field in a frequency dimension, which is achieved in a pump-probe nonlinear optical configuration with cross-phase modulations in a one-dimensional four-waveguide array. The dynamics of the topological chiral edge state has been studied and the influence from the crosstalk of the pump fields has been explored. Our work shows an all-optical way to simulate the quantum Hall system in a photonic system, which can be of great significance in nonlinear frequency generation and signal multiplexing, thus holding potential applications in ultra-fast data transmission and processing for communication.

**Keywords:** Light Transmission, Nonlinear Optics, Topological Optics, Waveguide

**CNT3170**

**Blind Source Separation: A Deep Learning Approach**

*Monorama Swain*

*Silicon Institute of Technology, Bhubaneswar, India*

**Abstract.** An attempt has been made in this type of study to use two distinct algorithms to inspect blind source separation (BSS). We have used multiuser Kurtosis (MUK) algorithm for BSS and an information maximization algorithm for the separation and deconvolution of voice signals. Information theory principles and Kurtosis are considered a measure of statistical independence among the various criteria available for evaluating the objective function of BSS. The MUK algorithm combines Gram–Schmidt orthogonalization and a stochastic gradient update to achieve non-Gaussian behavior. A correlation coefficient is used as an evaluation criterion to analyze the performance of both algorithms. Meanwhile, it can be efficient, and if we focus on today's era, deep learning is one of the best solutions for Blind source separation. My speech focuses on the new deep learning methods applied for Blind source separation.

**Keywords:** Bss, Muk, Ica, Infomax, Deep Learning

**CNT3090** To avoid repeatability issue, this abstract will be available after the full paper is published in the conference proceedings.

**CNT3167** To avoid repeatability issue, this abstract will be available after the full paper is published in the conference proceedings.

### Session 3: Communication Networks and Network Security

**Online room link:** <http://www.academicconf.com/teamslink?confname=cecnet2022>

**Session Chair:** Dr. Chuan Feng, Northeastern University, China

**Time:** 14:00-18:25, Sunday, November 6, 2022

14:00-14:15	CNT3114	<a href="#">Approch for Cryptography Digital Ecosystem Deployment</a> <i>Dr. Inara Opmane, Institute of Mathematics and Computer Science of University of Latvia, Latvia</i>
14:15-14:40	CNT3044 (Invited)	<a href="#">Cyber Smart Cities – Challenges Ahead</a> <i>Dr. Mohiuddin Ahmed, School of Science, Edith Cowan University, Australia</i>
14:40-15:05	CNT3126 (Invited)	<a href="#">An Integration of IoT, IoC, and IoE towards Building a Green Society</a> <i>Prof. Sudan Jha, Department of Computer Science &amp; Engineering, Kathmandu University, Nepal</i>
15:05-15:30	CNT3156 (Invited)	<a href="#">Content Connectivity Based Polyhedron Protection against Multiple Link Failures in Optical Data Center Networks</a> <i>Assoc. Prof. Xin Li, School of Electronic Engineering, Beijing University of Posts and Telecommunications, China</i>
15:30-15:55	CNT3146 (Invited)	<a href="#">How to Offload Multi-Function Services in Collaborative Edge-Cloud Networks</a> <i>Dr. Chuan Feng, Northeastern University, China</i>
15:55-16:20	CNT3155 (Invited)	<a href="#">A Photonic Neural Network Accelerator Featuring Hybrid Mode-Wavelength Division Multiplexing and Photonic Nonvolatile Memory</a> <i>Dr. Pengxing Guo, Chongqing University of Posts and Telecommunications, China</i>
16:20-16:35	<b>Coffee Break</b>	
16:35-17:00	CNT3160 (Invited)	<a href="#">Future Indoor Wireless Network: Wi-Fi 7 and Its Evolution</a> <i>Prof. Gang Xie, Beijing University of Posts and Telecommunications, China</i>
17:00-17:25	CNT3010 (Invited)	<a href="#">Weighted Ensemble of Deep Convolution Neural Networks for Single-Trial Character Detection in Devanagari-script-based P300 Speller</a> <i>Assoc. Prof. Narendra Londhe, Department of Electrical Engineering, Na-</i>

17:25-17:40	CNT3123	<a href="#">Performance Analysis of 256-QAM Demodulation for 5G NR Sidelink</a> <i>Prof. Alexander Maltsev, Nizhny Novgorod State University, Nizhny Novgorod, Russia</i>
17:40-17:55	CNT3046	<a href="#">Multi-applicable Text Classification based on Deep Neural Network</a> <i>Dr. Feng Deng, Beijing Information Science &amp; Technology University, China</i>
17:55-18:10	CNT3151	<a href="#">Measuring the State of ECN Readiness in Mail Servers on the Internet</a> <i>Prof. Chunxiang Chen, Prefectural University of Hiroshima, Japan</i>
18:10-18:25	CNT3163	<a href="#">Deterministic Satellite Networks: Requirement, Development, and Enabling Technology</a> <i>Dr. Ran Zhang, Beijing University of Posts and Telecommunications, China</i>

### Abstracts of Session 3

**CNT3114 To avoid repeatability issue, this abstract will be available after the full paper is published in the conference proceedings.**

#### **CNT3044**

#### **Cyber Smart Cities – Challenges Ahead**

*Mohiuddin Ahmed*

*School of Science, Edith Cowan University, Australia*

**Abstract.** Governments across the world are focussing more on a sustainable future. Simultaneously, wireless communication technology is rapidly growing (5G-100 times faster than 4G and 6G – 10 times faster than 5G!) and the Internet of Everything (IoE). Hence, the need to rethink how the cities operate and cater to connected Internet citizens. In recent years, the term smart city has been coined to address these issues. Smart cities exploit the advantages of wireless communication and Internet connectivity to improve lifestyle, sustainability, and economic growth. The implementation of the smart city is still in the pilot stage, but there are some successful ones, such as Singapore, Dubai, London, and New York. Smart cities are primarily targeted to enhance citizen wellbeing, sustainable governance practice and infrastructure effectiveness. Ensuring cybersecurity for smart cities should not be an afterthought and a considerable challenge. Recently, the complex diversity of cyber-attacks has skyrocketed, and zero-day attacks are happening more frequently than before, such as ransomware 2.0. New hacking strategies would easily bypass existing security and governance platforms using advanced persistent threats. This talk will address the cybersecurity challenges associated with the smart city, which will provide a bigger picture of the concepts, intelligent techniques, practices, and open research directions in this area.

## CNT3126

### **An Integration of IoT, IoC and IoE towards Building a Green Society**

*Sudan Jha*

*Department of Computer Science & Engineering, Kathmandu University, Nepal*

**Abstract.** Energy waste altogether adds to expanded expenses in the car fabricating industry, which is liable to energy use limitations and tax assessment from national and global strategy creators and confinements and charges from national energy suppliers. This checking is essential for energy sparing since it empowers organizations to roll out operational improvements to diminish energy utilization and expenses. The primary test to energy observation is the need to incorporate assembling and energy checking and control gadgets that help diverse correspondence conventions and are generally dispersed over a wide region. One of the most significant challenges in the advancement of the Internet of Things (IoT) has been the powering of billions of connected devices. Evaluation of digital services considering an energy impression of the Internet normally requires models of the energy intensity of the Internet. A typical way to deal with the display of the energy intensity is to consolidate assessments of market studies of introduced gadgets on a national or worldwide scale and their related power utilization with the aggregate information volume transported at a similar scale. Energy sources are a fundamental part of society development, and a steady power supply is essential for today progress. End-use energy is transferred to various consumers via power transmission and circulation networks after being transformed to optional energy as electricity by various power facilities. The power grid serves as the physical stage for both wide-area electric power sharing and display exchanges, and it is at the heart of auxiliary energy sources. In this manner, it attempts to connect the part of a center point between essential energy and end-use energy. With the bidirectional power stream given by the Energy Internet, different techniques are elevated to enhance and increase the energy usage between Energy Internet and Main-Grid. Energy proficiency and, in addition, quick information transmission are fundamental to green correspondences-based applications for IoT. Here, we are trying to provide a state-of-the-art survey over various Internet of Energy techniques along with IoT.

**Keywords:** IoT, IoC, IoE, Green Energy, Society 5.0, Industrial IoT

## CNT3156

### **Content Connectivity Based Polyhedron Protection against Multiple Link Failures in Optical Data Center Networks**

*Xin Li*

*School of Electronic Engineering, Beijing University of Posts and Telecommunications, China*

**Abstract.** Survivability has always been an important research focus for optical networks. We have proven that the  $k$ -regular and  $k$ -edge connected structure is the optimal protection structure against multi-link failures. Based on the  $k$ -regular and  $k$ -edge connected structure, the  $p$ -polyhedron protection scheme which has low resource redundancy is proposed. In optical data center networks (ODCNs), the required data or services can be replicated and maintained in multiple geographically distributed data centers. Based on this, the content connectivity which represents the reachability of the required content from each user is defined for ODCNs. Moreover, the degree of content connectivity can be improved by increasing the number of copies

of content. In ODCNs, the content connectivity can be integrated with the p-polyhedron protection scheme. With the help of content connectivity, the resource efficiency of the p-polyhedron protection scheme can be further improved. We propose the content connectivity based polyhedron protection (CCPP) scheme to minimize the network redundancy of ODCNs. An ILP model and a heuristic algorithm are developed to realize the CCPP scheme under static and dynamic circumstances respectively. Numerical results show that the proposed CCPP scheme has a lower network redundancy. Moreover, the network redundancy of the CCPP scheme is positively correlated with the degree of content connectivity.

**CNT3146**

### **How to Offload Multi-Function Services in Collaborative Edge-Cloud Networks**

*Xu Zhang*

*Chongqing University of Posts and Telecommunications, China*

**Abstract.** Cloud Computing (CC) is powerful for the computation offloading of services, promoting the implementation of various modern applications. Mobile Edge Computing (MEC) can provide low-latency services utilizing edge servers locating in proximity to users. The combination of MEC and CC can give play to the dual advantages of both. However, it is a challenging problem to offload service requests to the collaborative edge-cloud networks aiming at minimizing costs due to the resource limitation of edge servers and the online feature of services. In this talk, to address this issue, we mathematically model the service requests with multiple inter-connected functions. Then, the problem of computation offloading of multi-function service requests in collaborative edge-cloud networks is formulated to be an Integer Linear Programming (ILP) and is proved to be NP-hard. Furthermore, a Cost-minimized Computation Offloading with Reconfiguration (CCOR) algorithm is proposed to minimize the total cost of online services. Finally, simulation results show that the proposed CCOR algorithm can effectively reduce the cost of computation offloading with higher resource utilization of edge cloud compared with baseline algorithms.

**CNT3155**

### **A Photonic Neural Network Accelerator Featuring Hybrid Mode-Wavelength Division Multiplexing and Photonic Nonvolatile Memory**

*Pengxing Guo*

*Chongqing University of Posts and Telecommunications, China*

**Abstract.** Artificial neural networks (ANNs) have gained significant success in various applications. However, limited by the power and speed of electronic devices, the electronic accelerators are challenging to meet the requirements of computing power and energy consumption for large-scale matrix multiplication operations in ANN. In this presentation, we share a new low energy-consumption photonic ANN (PANN) accelerator, which features photonic in-memory computing and hybrid mode-wavelength division multiplexing technologies. Specifically, the proposed accelerator uses nanophotonic non-volatile memory and passive microring resonators to form a photonic dot-product engine, achieving optical in-memory multiplication

operation during the inference phase. Furthermore, we design an on-chip wavelength and mode hybrid multiplexing module and scheme to increase the computational parallelism. Therefore, the proposed PANN accelerator promises to address the incoming challenges of data-intensive artificial intelligence applications.

### **CNT3160**

#### **Future Indoor Wireless Network: Wi-Fi 7 and Its Evolution**

*Gang Xie*

*Beijing University of Posts and Telecommunications, China*

**Abstract.** Wi-Fi, a family of IEEE 802.11 standards, becomes the most popular wireless technology used for data transmission in home as well as in enterprise. The Wi-Fi community is currently developing IEEE 802.11be (Extremely High Throughput, EHT) and planning the next generation Wi-Fi (UHR), which will bring high-throughput, low-latency, and high-reliability requirements. In this talk, we analyze the key features proposed for the new technology, such as multi-link operation, channel sounding and multi-AP cooperation. And the increasing Wi-Fi complexity coupled with uncoordinated deployment, we apply machine learning (ML) to solving the optimization problems in Wi-Fi. Finally, the future evolution trend of Wi-Fi will be discussed.

### **CNT3010**

#### **Weighted Ensemble of Deep Convolution Neural Networks for Single-Trial Character Detection in Devanagari-script-based P300 Speller**

*Narendra Londhe*

*Department of Electrical Engineering, National Institute of Technology Raipur, India*

**Abstract.** The existing Devanagari-script-input-based P300 speller (DS-P3S) performs better mostly with 3-15 trials. This leads to poor information transfer rate (ITR) and a major concern in its real-time adaptation. In DS-P3S, the display paradigm is a matrix of  $8 \times 8$  size which has 28 more characters than the  $6 \times 6$  English paradigm. The increased number of characters leads to user-related issues such as a crowding effect, double flashing, adjacency distraction, task difficulty, and fatigue which increases the false detection rate. To tackle this, we propose an efficient single-trial character detection approach for DS-P3S using weighted ensemble of deep convolution neural networks (WE-DCNNs). The weighted strategy is constructed based on measured ensemble diversity to counter the instability by the individual classifier. Additionally, to reduce the false detection rate arising from a single trial, a new channel dropout-based character detection approach is introduced first time in this article. The ITR of 55.45 b/min and an average P300 classification accuracy of 92.64% achieved are comparatively higher than existing methods of DS-P3S. The significant reduction in tradeoff between bias and variance for the different subjects affirms the ease of applicability of the proposed model with just a single trial.



**CNT3123 To avoid repeatability issue, this abstract will be available after the full paper is published in the conference proceedings.**

**CNT3046 To avoid repeatability issue, this abstract will be available after the full paper is published in the conference proceedings.**

**CNT3151 To avoid repeatability issue, this abstract will be available after the full paper is published in the conference proceedings.**

### **CNT3163**

#### **Deterministic Satellite Networks: Requirement, Development, and Enabling Technology**

*Ran Zhang<sup>1,2</sup>, Xinyuan Zhang<sup>1</sup>, Jiang Liu<sup>1,2</sup>, Zekun Sun<sup>1</sup>, Shiran Sun<sup>1</sup>, Tao Huang<sup>1,2</sup>*

*<sup>1</sup> Beijing University of Posts and Telecommunications, China*

*<sup>2</sup> Purple Mountain Laboratories, China*

**Abstract.** Satellite networks have huge advantage in providing global coverage. Generally there are three kinds of satellites according to their orbit height, namely, Geosynchronous Earth Orbit (GEO) Satellites, Medium Earth Orbit (MEO) Satellites, and Low Earth Orbit (LEO) Satellites. Among them, LEO satellites has the advantage of low latency, and LEO constellation has become a research hot spot in the recent years, such as Starlink, OneWeb, Hongyan, and so on. These novel plans promise to an economic solution to provide global broadband access, internet of things service, and mobile communication service. The ability above can be applied in the context of sparse populated area such as ocean and dessert, and it can also be used in disaster areas where communication infrastructure is destroyed. However, the dynamics of satellite networks in terms of topology and propagation latency make it challenging to provide deterministic service. In this talk, I will present the requirements of deterministic satellite networks, the key challenge, the development, and the key enabling technology.

## **Session 4: Information Functional Materials and Devices**

**Online room link:** <http://www.academicconf.com/teamslink?confname=cecnet2022>

**Session Chair:** *Dr. Xiaoyang Chen, China Academy of Space Technology, China*

**Time:** 08:30-12:10, Monday, November 7, 2022

08:30-08:55	CNT3022 (Invited)	<b>Optical Frequency Comb Source Employing a Short Bismuth-based Nonlinear Erbium-doped Fiber</b> <i>Assoc. Prof. Yutaka Fukuchi, Tokyo University of Science, Japan</i>
08:55-09:20	CNT3048 (Invited)	<b>Evolutionary Computation and Genetic Algorithm</b> <i>Prof. Mamta Madan, Vivekananda Institute of Professional Studies, (Affiliated to Guru Gobind Singh Indraprastha University), India</i>

09:20-09:35	CNT3119	Constellation Configuration Analysis Based on Angle Condition Number for Tri-satellite TDOA Geolocation System <i>Dr. Xiaoyang Chen, China Academy of Space Technology, China</i>
09:35-09:50	CNT3135	The Continuous Time Dynamical Analysis of Heart Rate Asymmetry <i>Dr. Jiahua Yu, Xiamen University Tan Kah Kee College, China</i>
09:50-10:05	CNT3131	Study of Phase Transition of Potts Model with DANN <i>Dr. Xiangna Chen, Key Laboratory of Quark and Lepton Physics (MOE) and Institute of Particle Physics, Central China Normal University, China</i>
10:05-10:20	Coffee Break	
10:20-10:35	CNT3145	Highly Sensitive High-temperature Superconducting Quantum Interference Devices <i>Prof. Jianxin Lin, Qingdao Innovation and Development Center of Harbin Engineering University, China</i>
10:35-10:50	CNT3147	Mathematical Representation of the Meter through the Ski-hill Graph and the Stereo Metronome <i>Mrs. Andrea M. Calilhanna, Cherrybrook Music Studio, Australia</i>
10:50-11:05	CNT3172	Cost-Efficient Service Function Chaining with CoMP ZEROFORCING Beamforming in Mobile Edge Networks <i>Dr. Yuan Gao, Xi'an University of Technology, China</i>
11:05-11:20	CNT3168	Emulation of the Updated CANARIE Backbone Network Topology Under IPv6 Up to 2022 <i>Dr. Jose-Ignacio Castillo-Velazquez, Autonomous University of Mexico City, Mexico</i>
11:20-11:45	CNT3023 (Invited)	Application of Metamaterial Photonic Crystal Array for Confinement of Light Pulses <i>Prof. Kusalaya Chakrabarti, Department of Electronics and Communication Engineering, Haldia Institute of Technology, India</i>
11:45-12:10	CNT3024 (Invited)	Electronic and Magnetic Properties of Diluted Magnetic Semiconductor Thin Films: A Synchrotron based X-Ray Spectroscopic Techniques <i>Assoc. Prof. Vijay Raj Singh, Department of Physics, Central University of South Bihar, India</i>

## Abstracts of Session 4

### CNT3022

#### Optical Frequency Comb Source Employing a Short Bismuth-based Nonlinear Erbium-doped Fiber

*Yutaka Fukuchi*

*Tokyo University of Science, Japan*

**Abstract.** Optical frequency comb sources with multi-gigahertz spacing are very important for many practical applications such as optical frequency reference, multi-wavelength lasers, optical signal processing, short pulse generation, and coherent optical waveform syntheses. Good spectral flatness, wide operation bandwidth, high coherence, high stability, low noise, and low cost are commonly required for those optical fre-

quency comb applications. Several methods to produce the optical frequency comb have been proposed and demonstrated in the past. Especially, actively and harmonically mode-locked fiber ring lasers have become an attractive candidate for the optical frequency comb sources. The actively and harmonically mode-locked fiber ring lasers generally feature wide wavelength range, short pulse width, small timing jitter, and high repetition frequency. However, it is difficult to produce an optical frequency comb with good spectral flatness. One of the difficult challenges in the actively and harmonically mode-locked fiber ring lasers is how to produce a spectrally flat optical frequency comb. Furthermore, the actively and harmonically mode-locked fiber ring lasers usually employ silica-based erbium-doped fibers as the intracavity gain media. Consequently, the tunable wavelength range of the actively and harmonically mode-locked fiber ring lasers is limited to the alternative of the conventional wavelength band region or the longer wavelength band region. The tunable wavelength range is also another important issue for the optical frequency comb sources. In this presentation, we review stable, wavelength-tunable, and flat optical frequency comb generation from a 10-GHz actively and harmonically mode-locked short-cavity fiber ring laser using a bismuth-based nonlinear erbium-doped fiber with a fiber length of 1.5 m and a bandwidth-variable tunable filter with a rectangular filter profile.

#### **CNT3048**

##### **Evolutionary Computation and Genetic Algorithm**

*Mamta Madan*

*Institute of Professional Studies, (Affiliated to Guru Gobind Singh Indraprastha University), India*

**Abstract.** Evolutionary computation is field of artificial intelligence (AI) and is used in complex optimization problems. Evolutionary computation is used to solve problems that have too many variables for traditional algorithms. one of the important algorithm of Evolutionary computation is Genetic Algorithm. This talk would detail on the various aspects of evolutionary computation and working of Genetic Algorithm. Implementation of complete genetic algorithm along with all of its operators. It will also include applying genetic algorithm in few areas of optimisation and try and achieve global optimum solutions to few problems.

**CNT3119 To avoid repeatability issue, this abstract will be available after the full paper is published in the conference proceedings.**

**CNT3135 To avoid repeatability issue, this abstract will be available after the full paper is published in the conference proceedings.**

#### **CNT3131**

##### **Study of Phase Transition of Potts Model with DANN**

*Xiangna Chen<sup>1</sup>, Feiyi Liu<sup>1,2,\*</sup>, Shiyang Chen<sup>1</sup>, Jianmin Shen<sup>4</sup>, Weibing Deng<sup>1</sup>, Gabor Papp<sup>2</sup>, Wei Li<sup>1,3</sup> and*

Chunbin Yang<sup>1</sup>

<sup>1</sup>Key Laboratory of Quark and Lepton Physics (MOE) and Institute of Particle Physics, Central China Normal University, China

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<sup>3</sup>Max-Planck-Institute for Mathematics in the Sciences, Germany

<sup>4</sup>School of Engineering and Technology, Baoshan University, China

**Abstract.** A transfer learning method, domain adversarial neural network (DANN), is introduced to study the phase transition of two-dimensional q-state Potts model. With the DANN, we only need to choose a few labeled configurations automatically as input data, then the critical points can be obtained after training the algorithm. By an additional iterative process, the critical points can be captured to comparable accuracy to Monte Carlo simulations as we demonstrate it for  $q=3, 5, 7$  and  $10$ . The type of phase transition (first or second-order) is also determined at the same time. Meanwhile, for the second-order phase transition at  $q=3$ , we can calculate the critical exponent  $\nu$  by data collapse. Furthermore, compared with the traditional supervised learning, the DANN is of higher accuracy with lower cost.

**Keywords:** ML, Transfer learning, DANN, Potts model, Phase transition

**CNT3145 To avoid repeatability issue, this abstract will be available after the full paper is published in the conference proceedings.**

**CNT3147**

**Mathematical Representation of the Meter through the Ski-hill Graph and the Stereo Metronome**

Andrea M. Calilhanna

Cherrybrook Music Studio, Australia

**Abstract.** *Stereo Metronome* is a new Android application for the pedagogy of the meter fundamentals currently in beta form developed and tested by Siqi Fan and Andrea Calilhanna. Inspired by the contemporary meter theories of Yale professor Richard Cohn (2020), *Stereo Metronome* is a digital version of Cohn's Ski-hill graph to provide students studying the fundamentals of the meter with mathematical representations to scaffold their learning. *Stereo Metronome* forms an integral part of Ski-hill Graph Pedagogy the author developed and has taught for several years based on Cohn's music theories (2001, 2016, 2017, 2018, 2020). The application can be used as a multi-pulse metronome and is the world's first inclusive metronome with visualisations of the meter for children in this modern format introducing geometry to develop aural skills. The meter is taught as notation, time signatures, and beats grouped in measures. However, students report experiencing many more pulses and meters beyond the capacity of time signatures to represent. The paper provides a summary of the benefits of integrating the Ski-hill graph the *Stereo Metronome* wherever the meter is taught.

**Keywords:** Ski-hill Graph, Meter, Stereo Metronome, Mathematical Music Theory, Music Education Technology

**CNT3172 To avoid repeatability issue, this abstract will be available after the full paper is published in the conference proceedings.**

**CNT3168 To avoid repeatability issue, this abstract will be available after the full paper is published in the conference proceedings.**

**CNT3023**

**Application of Metamaterial Photonic Crystal Array for Confinement of Light Pulses**

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**Abstract.** We have designed for the first time, a Position chirped Photonic crystal fiber (which is made up of metamaterials) having a negative refractive index and being able to confine the light pulse inside it completely. As a consequence, it can be used as a storage device for light pulses. In reality, we cannot completely stop any light pulse and store it, to date. The effectiveness of this structure is by storing the light pulse we can construct an optical computer, where all the computations will be done in the light domain. It will be much faster than existing electrical computers because of the speed of the light and it is electromagnetic interference-free, noiseless structure. Here the presence of stored light pulse will be considered as "1" and the absence of light pulse is considered as "0".

**CNT3024**

**Electronic and Magnetic Properties of Diluted Magnetic Semiconductor Thin Films: A Synchrotron based X-Ray Spectroscopic Techniques**

*Vijay Raj Singh*

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**Abstract.** The study of spintronics materials such as diluted magnetic semiconductor (DMSs), multiferroic and half-metallic alloys is one of the most attractive fields in science from the viewpoints of both academic research and applications. In order to clarify the origin of ferromagnetism of these spintronics, it is necessary to investigate the electronic structure. Here, we have investigated the electronic structure of spintronics materials i.e. multiferroic materials (e.g. BiFeO<sub>3</sub>) using x-ray absorption spectroscopy (XAS) and x-ray magnetic circular dichroism (XMCD).

The first discovery of room-temperature ferromagnetism in Co-doped TiO<sub>2</sub> by Matsumoto et al. has arisen great interest in the search for such materials and a number of studies have been carried-out to investigate whether the ferromagnetism is carrier-mediated or not, but the issue still remains controversial. XMCD at the Co 2<sup>?</sup> → 3<sup>?</sup> absorption (Co 2<sub>2,3</sub>) edge is an ideal technique to clarify this issue because it is an element-specific magnetic probe. Our previous XMCD study has revealed that the ferromagnetism is not due to seg-

regated Co metal clusters but is due to  $\text{Co}^{2+}$  ions in the  $\text{TiO}_2$  matrix. However, the XMCD signal intensities were an order of magnitude lower than that expected from the bulk magnetization. We performed XAS and XMCD studies on rutile Co-doped  $\text{TiO}_2$  by the surface-sensitive total electron yield (TEY) mode and the bulk-sensitive total fluorescence yield (TFY) mode and found that Co ions in the bulk indeed have a large moment of 0.8-2.2  $\mu_B/\text{Co}$ . Then we extended the same approach to anatase Co-doped  $\text{TiO}_2$  and studied the correlation between magnetism and transport properties.

## Part IV Poster Presentations

### Online Poster Guidelines

- All E-Posters will be demonstrated on the official conference website during the conference time.
- Participants could view and share their comments on the website. If any questions on E-posters, kindly contact conference secretary for assistance.
- Signed and stamped electronic presentation certificate would be issued via e-mail after the presentation is delivered.

### List of Posters

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CNT3069	<a href="#">A Low Power Test Data Compression Scheme for Scan Test</a> <i>Ye Bo, Shanghai Educational Technology Centre, Shanghai, China</i>
CNT3084	<a href="#">Anti-jamming Method of Cognitive Radio Based on Q-Learning</a> <i>Yichen Xiao, Science &amp; Technology on Integrated Information System Laboratory, Institute of Software Chinese Academy of Sciences Science, China</i>
CNT3115	<a href="#">Effect of Light Window on All-Silicon MOS-like gate-control LED Electro-optical Modulator</a> <i>Zepeng Li, State Key Laboratory of Electronic Thin Films and Integrated Devices, University of Electronic Science and Technology of China, China</i>
CNT3137	<a href="#">A One-to-Two Filter Power Divider Based on LTCC</a> <i>Yuanyuan Li, Key Laboratory of Intelligent Computing and Signal Processing, Ministry of Education, Anhui University, China</i>
CNT3154	<a href="#">Coherent Accumulation Algorithm for Maneuvering Weak Target Based on Angular-Stepped-GRFT</a> <i>Yuxian Sun, Key Laboratory of Electronic and Information Technology in Satellite Navigation Beijing Institute of Technology, China</i>
CNT3164	<a href="#">RL-based Load Balancing for Software-defined WiFi Networks</a> <i>Jun Li, School of Computer and Information, Anhui Polytechnic University, China</i>
CNT3157	<a href="#">Analysis of Artificial Intelligence Applied in Virtual Learning Environments in Higher Education for Ecuador</a> <i>Mgs. Eriannys Zharayth Gómez Díaz, Research Department, Instituto Tecnológico Superior Rumiñahui, Av. Atahualpa 1701 y 8 de febrero, Ecuador</i>

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## Part V Acknowledgements

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