ICGHIT

International Conference on
Green and Human Information Technology 2025

ICGHIT 2025

Jan.15 – 17, 2025
Nha Trang, Vietnam

GHIT IEIE The Institute of Electronics and Information Engineers SsangYong Information & Communications Corp. TDT DAI HOC TON DUC THANG TON DUC THANG UNIVERSITY

http://icghit.org/

Contents

The ICGHIT 2025 Committee

General Co-Chairs:

- Hyunsik Ahn (Tongmyong Univ., Korea)
- Kyutae Lee (Kongju National Univ., Korea)
- Dong Si Thien Chau (Ton Duc Thang Univ., Vietnam)

Organizing Co-Chairs:

- Byung Seo Kim (Hongik Univ., Korea)
- Phuong T. Tran (Ton Duc Thang Univ., Vietnam)

International Advisory Co-Chairs:

- Sang-ug Kang (Sangmyung Univ., Korea)
- Huynh Van Van (Ton Duc Thang Univ., Vietnam)
- Nguyen Hong Tin, (Ton Duc Thang Univ.-Khanh Hoa., Vietnam)

Local Management Co-Chairs:

- Seungcheon Kim (Hansung Univ., Korea)
- Tan N. Nguyen (Ton Duc Thang Univ., Vietnam)
- Nguyen Hong Tin, (Ton Duc Thang Univ.-Khanh Hoa., Vietnam)

International Journal Co-Chairs:

- Eun Sung Jung (Hongik Univ., Korea)
- Muhammad Arif Rehman (Manchester Metropolitan Univ., UK)
- Wai-Kong Lee (Universiti Tunku Abdul Rahman, Malaysia)

International Cooperation Co-Chairs:

- Rehmat Ullah (Cardiff Metropolitan Univ., UK)
- Dihn -Hieu Tran(Nokia Bell Labs, France)
- Lam-Thanh Tu (Ton Duc Thang Univ., Vietnam)

Publication Co-Chairs:

- Ki Young Lee (Incheon National Univ., Korea)
- Soyoung Rho (Wolsong Books Co., Korea)

Finance and Administration Chair:

• Alexis Jinhong Kim (Paichai Univ., Korea)

Promotion Co-Chairs:

• DoHyun Kim (JeJu Nat'l Univ., Korea)
• Yong-Gyu Jung (Eulji Univ., Korea)

Industrial Cooperation Co-Chairs:

• SangChul Yu (SsangYong Info. & Comm. Co., Korea)
• Anh-Vu Le (Ton Duc Thang Univ., Vietnam)

Workshop Co-Chairs:

• Soohyun Park (Kookmin Univ., Korea)
• Sungwook Park (GangneungWonju Nat. Univ., Korea)

Technical Program Committee Co-Chairs:

• Young-Hoon Park (Sookmyung Women's Univ., Korea)
• Kyusung Shim (Hankyong Nat. Univ., Korea)
• Nguyen Trung Thang (Ton Duc Thang Univ., Vietnam)
• Salah Ud Din Muhammad (Hongik Univ., Korea)

Steering Committee Members:

• Beongku An (Hongik Univ., Korea)
• Moonsik Kang (GangneungWonju Nat. Univ., Korea)
• Seong Oun Hwang (Gacheon Univ., Korea)
• Yongsoo Choi (Shinhan Univ., Pres. Of IEIE CIS, Korea)

Technical Program Committee Members:

• Afizan Azman (Multimedia Univ., Malaysia)
• Anil Dubey (Poornima Institute of Eng. & Technology, India)
• Ali Reza Masoum (Urmia Univ. of Technology, Iran)
• Balázs Sonkoly (Budapest University of Technology and Economics, Hungary)
• Bilal Ahmed Lodhi (Teesside University, UK)
• Byeungwoo Jeon (SungKyunKwan Univ., Korea)

- Bok-Min Goi (Universiti Tunku Abdul Rahman, Malaysia)
- Bui Huu Phu (HCMUTE, Vietnam)
- Bongsang Suh (All4land, Korea)
- Claudia Linnhoff-Popien (Institut für Informatikm, Germany)
- Chin Ji Jian (Multimedia Univ., Malaysia)
- Chibong Song (Wavers Co., Korea)
- Chom Kimpan (Panyapiwat Institute of Management, Thailand)
- Cheol-Min Park (NIMS, Korea)
- Chiung Ching Ho (Multimedia Univ., Malaysia)
- Duckki Lee (Yonam Institute of Technology, Korea)
- Derya Yiltas (Istanbul Univ., Turkey)
- Dao Thanh Toan (University of Transport and Communications)
- Dayu Kao (Central Police Univ., Taiwan)
- Derya Yiltas-Kaplan (Istanbul Univ., Turkey)
- Dongseop Lee (EzInno Lab Co. Ltd., Korea)
- Eun Sung Jung (Hongik Univ., Korea)
- Franklin Bien (UNIST, Korea)
- Gilbert M. Tumibay (AUF, Philippines)
- Gnana Vathanam (VIT Univ. Chennai Campus, India)
- Goh Hock Guan (Universiti Tunku Abdul Rahman, Malaysia)
- Geong Sen Poh (MIMOS Berhad, Malaysia)
- Goh Kah Ong Michael (Multimedia Univ., Malaysia)
- Gnana Swathika (Vellore Institute of Technology, India)
- Gokhan Secinti (Istanbul Technology University, Türkiye)
- Hoo-Jin Lee (Hansung Univ., Korea)
- Hyung-Woo Lee (Hanshin Univ., Korea)
- Hyeonsang Eom (Seoul National Univ., Korea)
- Hoang Van Xiem (Vietnam National Univ., Vietnam)
- Hong Min (Hoseo Univ., Korea)
- Ivan Ku (Multimedia Univ., Malaysia)
- Imran Khan (Cardiff Metropolitan University, UK)
- Jang-Geun Ki (Kongju National Univ., Korea)
- Ji-Jian Chin (Multimedia Univ., Malaysia)
- Jiyoung Kang (Dankook Univ., korea)
- Jungwoo Ryoo (Penn State Univ., USA)
- Jianping He (Penn State Univ., USA)
- Junbeom Hur (Korea Univ., Korea)
- Jayabalan Sudharsan (MRIET, India.)
- Junseok Lee (ETRI, Korea)
- Justinian Anatory (Univ. of Dodoma, Tanzania)
- Jiwa Abdullah (Univ. Tun Hussein Onn Malaysia, Malaysia)
- Jaeseok Kim (Yonsei Univ., Korea)

- Jun Yan (Nanjing Univ. of Posts and Tele., China)
- Jong-Yun Kim (Kyungdong Univ., Korea)
- Jawad Ahmed (Edinburgh Napier University, UK)
- Kyusung Shim (Hankyong National Univ., Korea)
- Kyung-Rak Sohn (Korea Maritime and Ocean Univ., Korea)
- Le Minh Thuy (HaNoi University of Science and Technology)
- Le Sun (Nanjing Univ. of Info. Science & Technology, China)
- Lim Kian Ming (Multimedia Univ., Malaysia)
- Lee Chin Poo (Multimedia Univ., Malaysia)
- Laszlo Toka (Budapest University of Technology and Economics, Hungary)
- Moon S. Lee (Univ. of Luxembourg, Luxembourg)
- Michele Fiorini (The IET Council Chairman, Italy)
- Md Shohel Sayeed (Multimedia Univ., Malaysia)
- Muazzam Khattak (NUST, Pakistan)
- Myung-Sup Kim (Korea Univ., Korea)
- Muhammad Usman Akram (NUST, Pakistan)
- Mohammad Haseeb Zafar (Cardiff Metropolitan University, UK)
- Nguyen Minh Dat (Institut National de recherche Scientifique, Canada)
- Navneet Agrawal (MPUAT, India)
- Nguyen Van Trung (Le Quy Don Tech. Univ., Vietnam)
- Nguyen Quoc Dinh (Le Quy Don Tech. Univ., Vietnam)
- Nguyen Minh Giang (Le Quy Don Tech. Univ., Vietnam)
- Nguyen Tuan Hung (Le Quy Don Tech. Univ., Vietnam)
- Nguyen Van Huynh (Edinburgh Napier University, UK)
- Noel Tay Nuo Wi (Tokyo Metropolitan Univ., Japan)
- Nalini Iyer (KLE Technological Univ., India)
- Ong Thian Song (Multimedia Univ., Malaysia)
- Pang Ying Han (Multimedia Univ., Malaysia)
- Pham Viet Hung (Vietnam Maritime Univ., Vietnam)
- Piotrowski Zbigniew (Military Univ. of Technology, Poland)
- Parinya Sanguansat (Panyapiwat Institute of Management, Thailand)
- Quoc Huy Nguyen (Saigon Univ., Vietnam)
- Omar Dakkak (Karabük University, Türkiye)
- Rashid Ali (Universitat Pompeu Fabra, Spain)
- Rana Asif Rehman (National University of Computer and Emerging Sciences, Pakistan)
- Rajkumar Kettimuthu (Argonne National Lab., USA)
- Renny Badra (Universidad Simón Bolívar, Caracas, Venezuela)
- Roy Chang (Multimedia Univ., Malaysia)
- Renny Badra (Universidad Simon Bolivar, Venezuela)
- Rashid Mehmood (King Abdul Aziz Univ., Saudi Arabia)
- Ronnel Atole (Partido State Univ., Philippines)
- Seung-Hun Jin (ETRI, Korea)

- Sarhan Musa (Prairie View A&M Univ., USA)
- Shivani Sud (Intel, USA)
- Shing Chiang Tan (Multimedia Univ., Malaysia)
- Sweety Chauhan (Microsoft, USA)
- Sansanee Auephanwiriyakul (Chiang Mai Univ., Thailand)
- Seon Wook Kim (Korea Univ., Korea)
- Stenio Fernandes (Federal Univ. of Pernambuco, Brazil)
- Sejong Kim (SJ Telecom, Korea)
- Shahid Butt (NUST, Pakistan)
- Shing-Chiang Tan (Multimedia Univ., Malaysia)
- SangYep Nam (Kookje Univ., Korea)
- Sana Ullah Jan (Edinburgh Napier University, UK)
- Taehwa Han (Yonsei Univ. Health System, Korea)
- Tekin Bicer (Argonne National Lab., USA)
- Tom Oh (Rochester Institute of Technology, USA)
- Truong Xuan Tung (Le Quy Don Tech. Univ., Vietnam)
- Tran Thi Thu Huong (Le Quy Don Tech. Univ., Vietnam)
- Tri Nhu Do (Polytechnique Montreal, Canada)
- Taekyoung Kwon (Yonsei Univ., Korea)
- Tan Tran Duc (Vietnam National Univ., Vietnam)
- Tan Syh Yuan (Multimedia Univ., Malaysia)
- Tingjun Xie (Univ. of Virginia, USA)
- Tudor Palade (Technical Univ. of Cluj-Napoca, Romania)
- Tee Connie (Multimedia Univ., Malaysia)
- Thumrongrat Amornraksa (KMUTT, Thailand)
- Thai Son Nguyen (Tra Vinh Univ., Vietnam)
- Tammam Tillo (Libera Univ. of Bozen-Bolzano, Italy)
- Tho Quan (HCMUT, Vietnam)
- Tariq Rahim (Kingston University London, UK)
- Vo Nguyen Quoc Bao (Posts and Telecommunications Institute of Technology)
- Vineet Kumar (CG Power and Industrial Solutions, India)
- Woontack Woo (KAIST., Korea)
- Wonsoo Kim (Texas Instruments, USA)
- Woomin Hwang (NSRI, Korea)
- Wathiq Mansoor (Univ. of Dubai, UAE)
- Wai-Kong Lee (Universiti Tunku Abdul Rahman, Malaysia)
- Wali Ullah Khan (University of Luxembourg, Luxembourg)
- Young B. Choi (Regent Univ., USA)
- Yap Wun She (Universiti Tunku Abdul Rahman, Malaysia)
- Yong-Gyu Jung (Eulji Univ., Korea)
- Yan-Ming Cheng (Beihua Univ., China)

Message from General Co-Chairs of ICGHIT 2025

Dr. Dong Si Thien Chau
General Co-Chairs
Ton Duc Thang University,
Vietnam

Prof. Kyutae Lee
General Co-Chairs
Kongju National University,
Korea

Prof. Hyunsik Ahn
General Co-Chairs
Tongmyong University,
Korea

Welcome to the International Conference on Green and Human Information Technology 2025 (ICGHIT 2025)!

We are very pleased to hold ICGHIT 2025 from January 15 to 17, 2025 at the Khanh Hoa Branch of Ton Duc Thang University, Nha Trang, Vietnam.

ICGHIT was first started in 2013, to provide good chances for technical exchanges and advancements, cooperation among the participants, and local development of the country hosting the conference.

At that time, we first met in Hanoi, Vietnam, and we received wonderful hospitality and felt the dynamic energy of this country. We still have great memory of the first ICGHIT at this country. Actually, we had a pilot conference in 2012, before ICGHIT, that was the Green Technology workshop/Conference/Exhibition (IGTWCE 2012). TDTU had host the IGTWCE 2012 at main campus in Ho CHi Mihn City. We met again.

The goal of ICGHIT is to make a platform to seek the advancement of human-related IT in various viewpoints of research. The philosophy of the conference is the achievement of the dream of IT that can improve human welfare and happiness. Along with the recent issues about the fourth industry revolution,

global interest in AI, deep learning, virtual reality, IoT and other advanced areas is increasing. This conference seeks to interact internationally with these changing technical advances.

This year's conference theme is "Towards Generative Artificial Intelligence" The latest technologies of Generative Artificial Intelligence are already pervading our personal lives every single day regardless of our recognition. They give us big challenges and great opportunities at the same time.

The conference attendees will have an opportunity to discuss new results theoretical and practical results on the latest AI technologies. We also want you to meet researchers and companies interested in the same areas and have a good chance for future cooperation.

In ICGHIT 2025, more than 80 scientists from 16 different countries (Korea, Vietnam, Indonesia, USA, Japan, Philippines, UK, China, India, Malaysia, Pakistan, Czech Republic, Germany, Iraq, Australia and Canada) will present their excellent research results in multiple sessions.

The committee prepared four plenary talks, multiple technical sessions consisting of oral and poster presentations, and a special workshop to complement the technical sessions.

We have received 102 paper submissions, which were peer-reviewed by experts in the area of the paper's subject. The selected papers, 81 high-quality research papers, consist of 38 oral presentation papers (Korea: 18, other countries: 20) and 16 poster presentation papers and 27 workshop papers.

During this conference, the presented papers will be evaluated by session chairs and the program committee. Then, some papers will be selected for publication in excellent international journals.

For preparing ICGHIT 2025, the support and help of many people and multiple institutions were required.

First, we would like to thank the sponsors: The Institute of Electronics and Information Engineers (IEIE), the Green Human IT Association(GHIT), and Ton Duc Thang University(TDTU), especially, Dr. Dong Si Thien Chau, Vice President of Ton Duc Thang University.

We also appreciate the devotion of Prof. Byung-Seo Kim and Dr. Phuong T. Tran, Acting Dean of faculty for preparing all things for the conference. We give heartfelt thanks to Dr. Huynh Van Van, Dr. Anh-Vu Le, Dr. Tan N. Nguyen, and Dr. Nguyen Hong Tin, and the faculty members of Ton Duc Thang University for successful local management.

In particular, we would like to thank the companies who provided financial support for this conference. We also appreciate the committee members who have been responsible and fulfilled successfully in their fields, and reviewers who carried out the careful evaluation of the submitted papers.

Above all, we would like to express our deep appreciation to all authors, participants, and speakers for making ICGHIT 2025 prosper. We wish you to have a great time during your stay in this beautiful city, Nha Trang. Thank you!

Welcome Message from the Vice-President of TDTU

Dr. Dong Si Thien Chau
Vice-President of Ton Duc Thang University, Vietnam

Dear Distinguished Guests, Respected Professors, Colleagues and Participants, Ladies and gentlemen!

It is my great honor and privileged to welcome you to the 13th International Conference on Green and Human Information Technology (ICGHIT 2025). We are thrilled to host you in the picturesque and vibrant city of Nha Trang, a famous beach destination in Vietnam, and at the Khanh Hoa Branch of Ton Duc Thang University.

This conference marks a significant milestone, as it is the first time an international scientific conference of this magnitude has been organized at our Khanh Hoa Branch, since it was upgraded to an official branch in 2021. We are proud to be able to provide this platform in such a unique and inspiring setting, encouraging innovation and collaboration.

We are pleased to announce that this year's conference has attracted 80 papers written by 303 authors from 16 diverse countries. This impressive turnout underscores the global interest in advancing green and human-centered information technology. I am so happy to see such a distinguished gathering of academics, industry leaders, and researchers from around the world.

Ton Duc Thang University is a young, public, and research-oriented university, which has been growing fast in the last decade to become a visionary, pioneering, and top research university in Vietnam. We are an institution committed to

excellence in Education, Research, and Creativity for the Comprehensive Development of Humans and Society.

Reflecting on the journey of this prestigious conference, TDTU has had the privilege to host this conference back in 2012 at our main campus in Ho Chi Minh City. Now, after 13 years, we are delighted to bring this conference to Nha Trang, offering new perspectives and fostering research collaborations that transcend borders.

I would like to express my sincere gratitude to the organizing committee, the sponsors, and all participants who have made this conference possible. Your dedication and hard work are crucial to its success.

We hope that over the next few days, ICGHIT 2025 will serve as a fertile ground for insightful discussions, inspiring presentations, groundbreaking research, and promising partnerships.

Once again, welcome to ICGHIT 2025. May this conference be a rewarding and enriching experience for all of us.

Sincerely yours,

Dr. Dong Si Thien Chau
Vice President of Ton Duc Thang University

Welcome to ICGHIT 2025

Prof. YongSoo Choi
International Advisory Chair and President of IEIE Computer
Information Society
ShinHan University, Korea

Welcome to ICGHIT 2025 and Ton Duc Thang University, Nha Trang, Vietnam! On behalf of IEIE CIS (The Institute of Electronics and Information Engineering Computer Information Society), I have a great pleasure to welcome you all to ICGHIT (International Conference on Green and Human Information Technology) 2025, in Nha Trang, Vietnam. I am very happy to host this conference again in Vietnam, one of the most fantastic and friendly countries in the world, for its mild weather and historical relics.

First of all, I express my appreciation to all speakers, participants, professors, researchers, and students coming from multiple countries. And I thank the general chairs of this conference, Prof. Hyunsik Ahn, Prof. Kyutae Lee, and Prof. Dong Si Thien Chau, the organizing Co-chairs, Prof. ByungSeo Kim and Prof. Phuong T. Tran, the local sponsor, Ton Duc Thang University, Korea Software Assessment and Valuation Society, the industrial sponsors, SsangYong Info. & Comm. Corp., and all the committee members who have eagerly devoted to the preparation of ICGHIT 2025.

ICGHIT first began as a little workshop to encourage friendship and partnership between Korean IEIE CIS members and researcher and professors of other countries (Especially Vietnam). The first was weak, but it became prosperous! Now it has evolved to one of vitalizing international conferences as a platform of the

advancement of green technology and human related Green IT in various engineering industry.

IEIE is the outstanding and largest institute of electronics and information engineering in Korea for professors, researchers and students in IT related area. Moreover, it has developed its vision for encouraging international relationship. As a founder and sponsor, we are going to support ICGHIT continually for pursuing the philosophy of this conference, which is to pursue the dream of green and human information technology improving human welfare and happiness together with friends of other countries.

Please join us with this idea! What I remember about Vietnam was that people are very friendly and kind. And once you make a friend with Vietnam people, they are not going to betray you in any circumstances. I also trust that Vietnam people are strong in their will so that they have never surrendered to the outer force. We always have an open mind to make a friendship with such a strong willed Vietnam people in IT area.

Once again, I would like to express my heartfelt welcoming to all the participants and speakers. I wish you to have a great experience during your stay in this oriental and fantastic city, Nha Trang, Vietnam.

Thank you.

Information on the Conference Venue

Ton Duc Thang University, Khanh Hoa Branch, Nha Trang, Vietnam

Address   Số 22 Nguyễn Đình Chiểu, P. Vĩnh Phước, TP. Nha Trang
Homepage https://khanhhoa.tdtu.edu.vn/

Introduction

Ton Duc Thang University (TDTU) - Khanh Hoa Branch

With modern facilities, which are increasingly being improved and upgraded, Ton Duc Thang University - Khanh Hoa Branch commits to the quality of training for students who register to study at the school. The school has the function of training and applied research to meet the requirements of training local resources, providing research results for the socio-economic development needs of Khanh Hoa province in particular and the South Central and Central Highlands provinces in general.

History in brief

Ton Duc Thang University Branch in Khanh Hoa Province (Khanh Hoa Branch, Branch) is a unit under Ton Duc Thang University, established on July 15, 2008 with the name Nha Trang Campus according to Decision No. 1077/QD-TLĐ of the President of the Vietnam General Confederation of Labor.

* On May 13, 2011, Nha Trang Campus was upgraded to Nha Trang Vocational College under Decision No. 603/QD-TLĐ.

* On February 20, 2017, the Ministry of Education and Training issued Decision No. 500/QD-BGDDT, officially establishing Ton Duc Thang University Branch in Khanh Hoa province.

* On May 31, 2022, the Ministry of Education and Training issued Decision No. 1421/QD-BGDDT, allowing the Branch to organize training activities, marking an important step forward in the School's mission of education and human resource development.
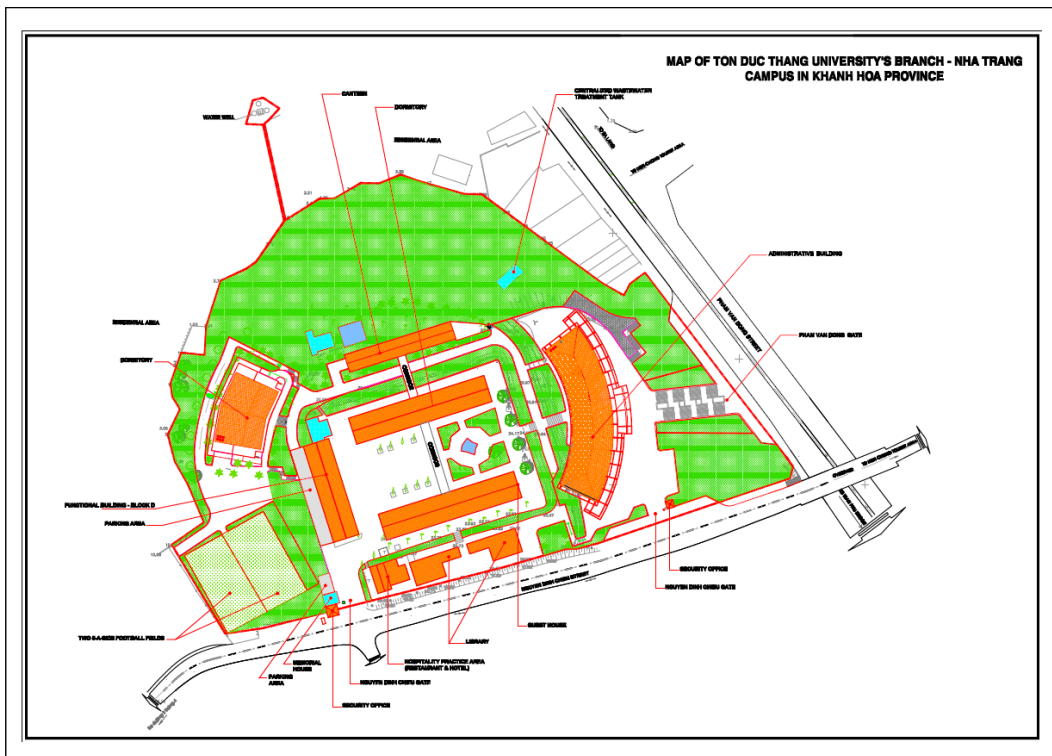
Khanh Hoa Branch is located at 22 Nguyen Dinh Chieu, Vinh Phuoc Ward, Nha Trang City, Khanh Hoa Province. The Branch is responsible for organizing and managing training, scientific research and applied research activities, in accordance with the general plan of Ton Duc Thang University and the approved specific plan. The Branch's goal is to train high-quality human resources and local talents, and at the same time provide research results to meet the socio-economic development needs of the South Central and Central Highlands provinces in general, and Khanh Hoa Province in particular. In particular, the Branch also implements Resolution No. 20 of the 10th Party Central Committee, 6th session, to "continue to build the Vietnamese working class in the period of accelerating industrialization and modernization of the country".
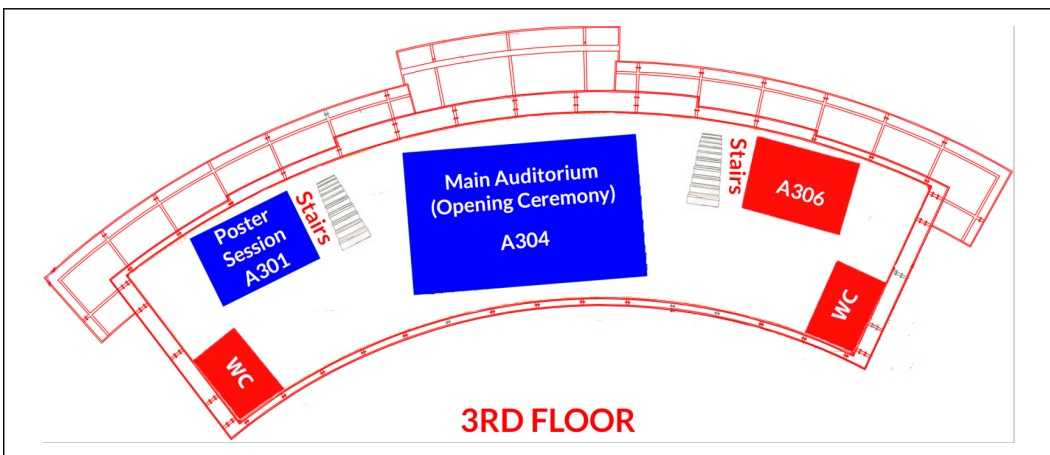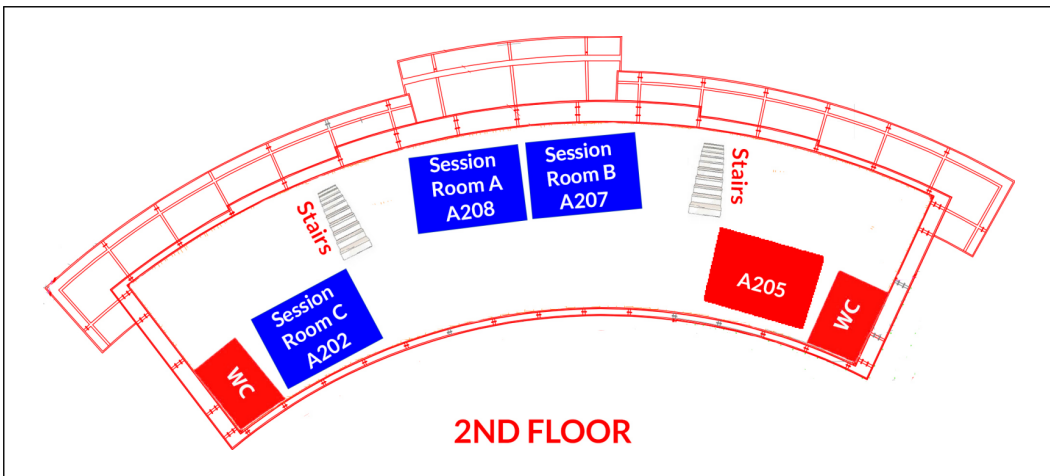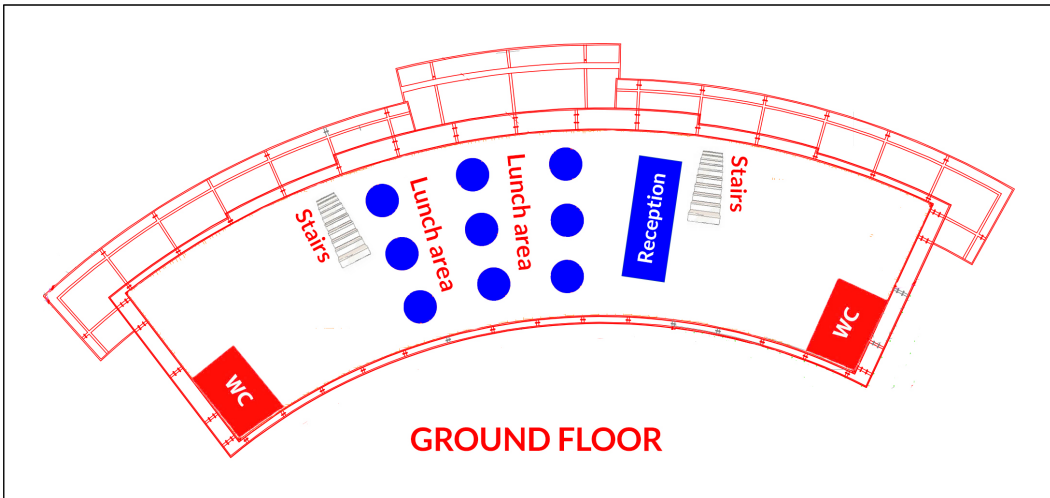
Conference Rooms:

- ▣ Opening Ceremony & Plenary Talks
    - ‣ **Main Auditorium** (**A304** on 3rd floor of Administrative Bldg)
- ▣ Oral Sessions
    - ‣ Session Room A (**A208** on 2nd floor of Administrative Bldg)
    - ‣ Session Room B (**A207** on 2nd floor of Administrative Bldg)
    - ‣ Session Room C (**A202** on 2nd floor of Administrative Bldg)
- ▣ Poster Sessions (**A301** on 3rd floor of Administrative Bldg)
- ▣ Reception and Lunch - Ground floor of Administrative Bldg
- ▣ Banquet – Havana Nha Trang Hotel

Map of TDTU-Khanh Hoa Branch

MAP OF TON DUC THANG UNIVERSITY'S BRANCH - NHA TRANG CAMPUS IN KHANH HOA PROVINCE

Conference Rooms (Floor Plan)

Stairs

Lunch area Lunch area

Reception

Stairs

WC

WC

GROUND FLOOR

Stairs

Session Room A A208

Session Room B A207

Stairs

A205

WC

Session Room C A202

WC

2ND FLOOR

Stairs

Poster Session A301

Main Auditorium (Opening Ceremony) A304

Stairs

A306

WC

WC

3RD FLOOR

Program Schedule

Time (Saigon)	Room A	Room B	Room C
Wednesday, January 15			
10:30 am-11:10 am	Welcome Ceremony		
11:10 am-11:20 am	Break Time		
11:20 am-12:00 pm	Plenary Talk 1		
12:00 pm-01:20 pm	Lunch		
01:20 pm-02:00 pm	Plenary Talk 2		
02:00 pm-02:20 pm	Coffee Break		
02:20 pm-03:50 pm	CI1: Communication and IoT 1	W1: SACS'25 Workshop Paper	
03:50 pm-04:10 pm	Coffee Break		
04:10 pm-05:40 pm	CI2: Communication and IoT 2	W1: SACS'25 Workshop Paper	GT: Green Information Technology
Thursday, January 16			
09:30 am-11:00 am	CNS: Computer and Network Security	W2: SACT 2025 Workshop Paper	DAD: SW/HW Design, Architecture & Development
11:00 am-11:20 am	Coffee Break		
11:20 am-12:00 pm	Plenary Talk 3		
12:00 pm-01:20 pm	Lunch		
01:20 pm-02:00 pm	Plenary Talk 4		
02:00 pm-03:30 pm	MSP: Multimedia and Signal Processing	W3: AICT2025 Workshop Paper	W4: IPWC 2025 Workshop Paper
03:30 pm-03:50 pm	Coffee Break		
03:50 pm-05:20 pm	AI: AI & Big Neural Network 1	W3: AICT2025 Workshop Paper	P: Poster Session
06:00 pm-08:00 pm	Banquet		
Friday, January 17			
09:30 am-12:00 pm	Birds of a Feather		
01:00 pm-04:00 pm	ICGHIT Industry-Academic Meeting		
Saturday, January 18			
10:00 am-12:00 pm	ICGHIT Committee Meeting		

Plenary Speeches

Plenary Talk I

Title : "Advanced Wireless Communication"

Speaker : Prof. Xuan Nam Tran
(Le Quy Don Technical University, Ha Noi City, Vietnam)

Biography

Dr. Xuan Nam Tran (Member, IEEE) received the Master of Engineering (M.E.) degree in telecommunications engineering from the University of Technology Sydney, Sydney, NSW, Australia, in 1998, and the Doctor of Engineering degree in electronic engineering from The University of Electro-Communications, Japan in 2003. He is currently a Full Professor and the Head of a Strong Research Group on advanced wireless communications, Le Quy Don Technical University, Hanoi, Vietnam. From November 2003 to March 2006, he was a Research Associate with the Information and Communication Systems Group, Department of Information and Communication Engineering, The University of Electro-Communications, Tokyo, Japan. His research interests include space-time signal processing for communications such as adaptive antennas, space-time coding, MIMO, spatial modulation, and cooperative communications. Prof. Tran was the recipient of the 2003 IEEE AP-S Japan Chapter Young Engineer Award, and a co-recipient of two best papers from The 2012 International Conference on Advanced Technologies for Communications and The 2014 National Conference on Electronics, Communications and Information Technology. He is the founding Chair and is currently the chapter Chair of the Vietnam Chapter of IEEE Communications Society. He is a Member of IEICE and the Radio-Electronics Association of Vietnam (REV).

Plenary Talk II

Title : "How Generative AI and the Internet of Things Can Complement
Each Other"

Speaker : Dr. Axel Sikora
(Associate Professor, Offenburg University, Germany)

Abstract

It is increasingly accepted that to an important degree, "innovation" is a process of combining pre-existing ideas and technologies in novel ways. Generative AI and the Internet of Things can be seen as one successful example of such "Innovation by Combination" combining two megatrends. The Internet of Things connects anything, anywhere, anytime. Thus, it provides a platform for a truly pervasive and intelligent environment. Artificial Intelligence and most notably Edge AI use this platform and make devices intelligent. However, training AI models for IoT applications can be a challenge, as in many cases, devices come with very limited ressources, are spatially distributed, and sample only smaller amounts of data. Thus, we are often suffering from a "small data challenge". Generative AI may help to overcome this challenge. The keynote disccusses the manifold IoT applications, which potentially could benefit from Generative AI, shows basic architectures and approaches for such solutions on the different IoT layers, and presents several examples from the community and from the author's own research.

Biography

Dr. Axel Sikora is an associate professor at Offenburg University, Germany, where he serves as Scientific Director of the Institute of Reliable Embedded Systems and Communication Electronics, a leading R&D institute for IIoT connectivity solutions. He is also deputy director of Hahn-Schickard Association of Applied Research, where he manages the division "Software Solutions", including several research groups around AI. Dr. Sikora is also engaging in several standardization activities around secure and efficient IIoT connectivity. Since many years, he is serving as chairman of the embedded world Conference, the world's largest event on the topic. In parallel, he is engaged in some deep-tech spinoff companies.

Plenary Talk III

Title : "6G NTN for Ubiquitous Connectivity from Network Perspective"

Speaker : Dr. Namseok Ko
(Director in Electronics and Telecommunication Research Institute (ETRI), Korea)

Abstract

The advent of 6G networks heralds a new era of ubiquitous connectivity, with Non-Terrestrial Networks (NTN) playing a pivotal role in bridging the global digital divide. This talk focuses on the integration of NTNs into the 6G ecosystem, emphasizing the architectural, operational, and standardization challenges from a network perspective. We will explore how NTNs enable seamless connectivity across diverse environments—urban, rural, maritime, and aerial—by complementing terrestrial networks. The presentation delves into key topics in NTN-enabled 6G architectures. Through technical insights and case studies, this session aims to illustrate the transformative potential of 6G NTNs in ensuring global connectivity, shaping a truly inclusive, hyper-connected future.

Biography

Dr. Namseok Ko earned his M.S. and Ph.D. from KAIST in 2000 and 2015, respectively. Currently, he directs the Mobile Core Network Research Section at the Electronics and Telecommunication Research Institute (ETRI) and is an associate professor at the University of Science and Technology (UST). He holds positions as Vice-Chair of SG11 at ITU-T, and serves as Vice-Chair of the Technology Committee and Chair of the Network Technology Work Group at Korea's 6G Forum. Since joining ETRI in 2000, he has contributed to several R&D projects, notably in 5G mobile core technologies, and currently leads projects focused on 6G network architecture. His research interests encompass 5G/6G mobile core network architecture and enabling technologies, including network programmability, networking and computing convergence, and non-terrestrial networks.

Plenary Talk IV

Title : "AI for Science and Systems for AI"

Speaker : Prof. Rajkumar Kettimuthu
(Argonne National Laboratory, The University of Chicago,
United States of America)

Abstract

Deep learning techniques use multi-layer ("deep") neural networks (DNNs) to learn representations of data with multiple levels of abstraction. These techniques can discover intricate structure in a dataset by using a back-propagation algorithm to set the internal parameters that are used to transform data as they flow between network layers. We have applied deep learning methods to accelerate various science applications including ones from light sources and climate science. In this talk, I will provide an overview of this work. We have also developed systems such as FairDMS (Findable, Accessible, Interoperable and Reusable Data and Model Service) and FreeTrain (A Framework to Utilize Unused Supercomputer Nodes for Training Neural Networks) to accelerate deep learning training. I will discuss these systems as well in my talk.

Biography

Dr. Rajkumar Kettimuthu is a Computer Scientist and Group Leader at Argonne National Laboratory, a Senior Scientist at The University of Chicago and a Senior Fellow at Northwestern University. His research interests include AI for science, advanced wired and wireless communications for science, and Quantum networks. Data transfer protocol and tools developed by him and his colleagues at Argonne have become the de facto standard for file transfers in many science environments. With 60K+ installations in six continents, these tools perform 50M+ file transfers & move 5 Petabytes+ of data every day. AI for science tools developed by his team at Argonne are being used in many science environments. These tools have been highlighted by top scientific journals and have won multiple awards at prestigious

venues. He has co-authored 150+ peer-reviewed articles most of which appeared in premier journals and top IEEE/ACM conferences, and several of which won best paper award. His work has featured in 20+ news articles. He is a recipient of the prestigious R&D 100 award. He is a distinguished member of ACM and a senior member of IEEE.

Information for Presenters

Guideline for Oral Session:

• The allotted time per each presenter is 15 minutes including Q&A.

• Beam projectors and computers running the MS PowerPoint with USB ports are available.

• Presenters shall prepare both their PowerPoint presentation files and biographic details.

• Presenters shall arrive at the presentation room 15 minutes before the session starts.

• Presenters shall introduce themselves to the session chair so that he/she can introduce you before your presentation.

Guideline for Poster Session:

• A poster wall of 65cm (width) by 125cm (height) accommodating 12 slides of A4 size is available with hanging equipment.

• Presenters shall prepare printed posters or A4 slides and prepare their Powerpoint presentation file as much as 5~7 minutes about their poster.

• Presenters shall arrive at the poster area 15 minutes before the session starts.

• Presenters shall stand by their posters during their poster sessions.

Program Details

Welcome Ceremony

Main Auditorium (A304)

Chair: Byung-Seo Kim (Hongik University, Korea (South)

Plenary Talk I

Advanced Wireless Communication

Prof. Xuan Nam Tran (Le Quy Don Technical University, Ha Noi City, Vietnam)

Main Auditorium (A304)

Chair: Byung-Seo Kim (Hongik University, Korea (South)

Lunch

Rooms: Ground Floor of Administrative Building

Plenary Talk II

How Generative AI and the Internet of Things Can Complement Each Other

Dr. Axel Sikora (Associate Professor, Offenburg University, Germany)

Main Auditorium (A304)

Chair: Byung-Seo Kim (Hongik University, Korea (South)

Coffee Break

CI1: Communication & IoT1

Session Room A

Chair: Tran Trung Duy (Posts and Telecommunications Institute of Technology, Vietnam)

A Deep Learning Approach to Ultra Reliable Low Latency Communications in 6G

Srikanth Kamath (Manipal University & MIT MANIPAL, India); Somilya Anand (Manipal Institute of Technology, India)

Mission-critical applications' and new technologies' demands have fuelled a considerable evolution in ultra-reliable low-latency communication (URLLC) over time. URLLC, which was first introduced in 5G, has continued to develop in 6G to meet even stricter criteria for ultra-reliable and low-latency communication. Deep learning techniques' inclusion has significantly changed URLLC. Large volumes of data created by URLLC systems can be mined using deep learning to uncover significant insights and trends, resulting in increased performance, dependability, and efficiency. Deep learning models have the ability to correctly categorise and forecast URLLC traffic patterns, enabling effective resource management and optimised transmission parameters. Deep learning additionally supports fault prediction and real-time anomaly detection, ensuring proactive network management and continuous service for vital applications. Deep learning has a dramatic effect on URLLC in 6G, enabling a variety of industries, such as autonomous vehicles, remote surgery, industrial automation, and smart cities, to make use of extremely dependable, low-latency communication systems that satisfy their exacting standards.

Short Packet Communication in IoT Networks: Performance Analysis

Dinh Vo (Institute of Engineering HUTECH University Ho Chi Minh City, Vietnam); Thu Ha Thi Pham and Minh Tran (Ton Duc Thang University, Vietnam); Byung-Seo Kim (Hongik University, Korea (South)); Rupak Kharel (University of Huddersfield, United Kingdom (Great Britain)); Miroslav Voznak (VSB – Technical University of Ostrava, Czech Republic)

In this paper, we investigated the block error rate (BLER) performance of a wireless powered communication network (WPCN) employing short packet communication (SPC). In this system, a source node harvests energy from a dedicated power beacon and utilizes the harvested energy to transmit short packets to a destination equipped with multiple antennas. We adopt a time-switching (TS) protocol for energy harvesting and information transmission. To enhance the reliability of the communication link, selection combining (SC) is employed at the receiver. We derive a closed-form expression for the average BLER, taking into account the impact of key system parameters such as the time-switching ratio, energy harvesting (EH) efficiency, and the number of receive antennas. Our analytical results, validated through Monte Carlo simulations, reveal the interplay between these parameters and their influence on the BLER performance. The findings of this study provide valuable insights into the design and optimization of WPCNs for reliable short packet transmission in various emerging applications, particularly those with stringent energy and latency constraints.

Joint Optimization of IRS Phase and Relay Selection in Combined IRS-Relay-Assisted Communication Networks

Thien Nguyen Phuc (Ton Duc Thang University, Vietnam)

Intelligent Reflecting Surfaces (IRSs) are increasingly recognized as pivotal for advancing spectral and energy efficiency in next-generation communication systems. This study addresses the joint optimization of phase shifts and relay selection within an IRS-assisted communication framework. By leveraging nonlinear constrained optimization techniques, we achieve effective simultaneous refinement of both parameters. Experimental results demonstrate that the proposed strategy substantially enhances achievable rate performance and scalability with an increasing number of relays, outperforming baseline methods.

Analysis of Full-Duplex Two-Way UAV-Aided System

Bao Quoc Bo (Hanoi University of Industry, Vietnam); Pham Thanh Hiep and Nguyen Thu Phuong (Le Quy Don Technical University, Vietnam)

Full-duplex (FD) communication technology combined with unmanned aerial vehicles (UAVs) is an attractive approach for improving performance of wireless communication systems. This research focuses on analyzing a two-way (TW) communication system via two full-duplex devices connect with the assistance of a FD UAV. The impact of residual self-interference (RSI) on this FD-TW-UAV system is thoroughly evaluated. We derive mathematical expressions for the outage probability (OP) and the system throughput, based on practical channels compliant with 5G and beyond (B5G) standards. The results indicate that the FD-TW-UAV communication system demonstrates high performance, although it is still affected by RSI, particularly at high transmission power levels. Additionally, the study evaluates the effect of metrics including carrier frequency, UAV height on OP and throughput.

Improving the System Throughput and Energy Efficiency of IoT Networks by Using Intelligent Reflecting Surfaces

Dinh Tan Tran (Telecommunication University, Vietnam); Ba Cao Nguyen and Jaydeep Bodwadkar (Telecommunications University, Vietnam); Xuan Nam Tran (Le Quy Don Technical University, Vietnam)

The article proposes integrating two intelligent reflecting surfaces (IRSs) with a relay station to improve the system throughput (ST) and energy efficiency (EE) of an Internet of Things (IoT) system applied in low-power wide-area networks (LPWAN). Specifically, this proposal integrates two IRSs to enhance the link between the IoT sensor, relay station, and IoT gateway. The theoretical expressions for ST and EE are derived for LPWAN using IRSs and relay over Nakagami-m channels. Subsequently, the performance of the proposed systems is compared with the previous systems (without IRSs) to highlight the significant performance improvements achieved by using IRSs. Specifically, with a given target ST and EE, the proposed system reduces power consumption by 10 dBm compared to the previous system. The results show that LPWAN with IRSs and relay can operate effectively at high frequencies (5 GHz) with a wide range (200 m). Additionally, we also investigate and survey in detail the influence of factors such as data transmission rate, IRS position, number of reflecting elements, frequency, and bandwidth on ST and EE. From this, several suggestions to enhance ST and EE are proposed.

How Generative AI and the Industrial Internet of Things Complement Each Other

Axel Sikora (University of Applied Sciences Offenburg, Germany)

Generative modeling is an artificial intelligence (AI) technique to generate synthetic artifacts from analyzing training examples and from learning their patterns and distribution. Generative AI (GenAI) uses generative modeling and advances in Deep Learning to produce diverse content at scale by utilizing exist-ing data. Whereas GenAI is mostly using media contents, such as text, graphics, audio, and video, it can additionally be used also for data from the (Industrial) Internet of Things.

This article gives an overview on the manifold different practical opportunities and challenges GenAI brings for the IIoT. It also presents selected examples from the author's research with his teams. In doing so, it covers the relevance of GenAI for the complete lifecycle of IoT, from design and development, over testing to deployment.

This paper summarizes a keynote presentation from the 13th International Conference on Green and Human Information Technology (ICGHIT) in January 2025 held in Nha Trang, Vietnam.

W1: Workshop – SACS'25 (1)

Session Room B

Chair: Byung-Seo Kim (Hongik University, Korea (South))

Semantic Communication for Named Data Network

Ghulam Musa Raza (Hongik University, SEJONG CAMPUS, Korea (South)); Ihsan Ullah (Hongik Unviersity, Korea (South)); Byung-Seo Kim (Hongik University, Korea (South))

Named Data Networking (NDN) is an emerging future internet architecture that routes packets based on named data. To implement this paradigm, semantic communication must be employed in NDN naming and forwarding, utilizing the content names. Unfortunately, existing literature proposes schemes based on URL-based or hierarchical naming structures, which lack of balance among memory consumption, lookup speed, and semantic retrieval. To address this, an NLP-based naming scheme is proposed in NDN. Preliminary evaluations indicate that this scheme can reduce memory consumption of content names by 40 % compared to traditional URL or hierarchical approaches while maintaining fewer numbers of alphabetical characters in content name strings.

AI-Enhanced Information-Centric Networking for Aerial Communications: A Survey

Ghulam Bahoo (Hongik University, South Korea, Korea (South)); Muhammad Imran and Ihsan Ullah (Hongik Unviersity, Korea (South)); Byung-Seo Kim (Hongik University, Korea (South)

The current Internet's distinctive packet-switched and end-to-end communication architecture are raising expectations for what constitutes a modern "communication service." This paradigm is no longer relevant due to the advancements in technology. ICN has established itself as a comparatively expanding field in this context, particularly in context with the recent explosion in telecommunications research, particularly in the areas of video communication and networking. While conventional networks offer a foundation for network scalability, they also face issues. The purpose of the survey is to improve the performance and operational tasks of aerial networks through the use of AI and ICN applications. We perform a thorough examination of the ICN-based applications used in the present world.

FactorNet: a Faster CNN Architecture for Real-Time Object Detection

Jaemo Sung (DesignedAI, Korea (South)); Eun-Sung Jung (Hongik University, Korea (South))

GoogleNet has gained recognition as one of the lighter CNN models for visual feature extraction in object detection. However, GoogleNet still faces challenges, such as deep feature contamination when concatenating diverse features and performance overheads that limit its applicability in resource-constrained environments. To address these issues and enhance efficiency, we propose a faster and more streamlined CNN structure, FactorNet. FactorNet consists of multiple independent sub-CNNs, each dedicated to encoding specific aspects of deep visual features, which not only reduces weight parameters and floating-point operations but also delivers superior speed. Integrated into the Faster-RCNN framework, FactorNet achieves higher accuracy and notable speed improvements over GoogleNet, as evidenced in real-time object detection on the KITTI benchmark dataset.

Deep Learning Design for Spectral Efficiency in RIS-Enabled Massive MIMO-RSMA Networks

Ridho Hendra Yoga Perdana (Hongik University, Korea (South)); Toan-Van Nguyen (San Diego State University, USA); Yushintia Pramitarini (Hongik University, Korea (South)); Duy H. N. Nguyen (San Diego State University, USA); Beongku An (Hongik University, Korea (South))

In this paper, we study a spectral efficiency maximization problem in downlink reconfigurable intelligent surface (RIS)-enabled massive multiple-input multiple-output (mMIMO)-rate-splitting multiple access (RSMA) networks. This problem belongs to the non-convex mixed-integer class due to the maximum power budget constraint at the base station (BS) and the discrete phase shift at the RIS, which is difficult to solve optimally. To address this, we divide this problem into phase shift sub-optimization and beamforming sub-optimization problems. A bisection search is used to solve the phase shift sub-optimization problem and the inner approximation

is employed to solve the beamforming sub-optimization problem by transforming this non-convex to tractable forms. We then develop a deep learning (DL) framework to learn the optimal solution achieved from the conventional optimization approach to predict the optimal precoding matrix and RIS phase shift based on each channel gain and the positions of users and the RIS. Simulation results show that the DL-based method predicts the optimal solutions with high accuracy and low execution time through a fast mapping process. We also evaluate the impact of the number of RIS elements and the total power budget on the SE of the considered system.

Deep Learning Blockchain-Based Clustering Protocol to Improve Security and Scalability in FANETs

Yushintia Pramitarini and Ridho Hendra Yoga Perdana (Hongik University, Korea (South)); Kyusung Shim (Hankyong National University, Korea (South)); Beongku An (Hongik University, Korea (South))

This paper proposes a deep learning and blockchain-based clustering (DBC) protocol to enhance security and stability in flying ad hoc networks (FANETs). By integrating a deep neural network (DNN) for real-time prediction and blockchain for secure validation, the proposed DBC protocol identifies illegitimate nodes without adding control overhead. Specifically, the DNN predicts optimal cluster heads (CHs) based on physical layer information (such as mobility, position, channel capacity, and remaining energy) and network layer information (such as connectivity) to form clusters. To ensure stability, CHs are further selected based on the highest remaining energy and lower mobility. Blockchain technology validates node trustworthiness and enables secure cluster formation.

Simulations demonstrate the DBC protocol's capability to establish secure and stable clusters under various scenarios. The numerical results show that the proposed DBC protocol achieves high security, low control overhead, real-time prediction, and high connectivity, making it highly suitable for future mobile wireless networks.

Federated Learning-Based Clustering Protocol Utilizing Cross-Layer Design in IoT-Enabled MANETs with CF-mMIMO

Amalia Amalia, Yushintia Pramitarini and Ridho Hendra Yoga Perdana (Hongik University, Korea (South)); Kyusung Shim (Hankyong National University, Korea (South)); Beongku An (Hongik University, Korea (South))

In this paper, we propose a novel federated learning (FL)-based clustering (FedCL) protocol utilizing cross-layer design in internet of things (IoT)-enabled mobile ad-hoc networks (MANETs). The main contributions of this paper can be summarized as follows. First, we consider the highest remaining energy of the node to select the cluster head (CH). Second, we consider the cost-value maximization problem using a cross-layer design that combines physical layer information (i.e., mobility, position, remaining energy, spectral efficiency) with network layer information (i.e., connectivity) to improve network stability and connectivity while reducing control overhead. Simulation results show that the proposed FedCL protocol exhibits high stability and lower control overhead.

Wednesday, January 15 3:50 – 4:10 p.m.

Coffee Break

Wednesday, January 15 4:10 – 5:40 p.m.

CI2: Communication & IoT2

Session Room A

Chair: Seungcheon Kim (Hansung University, Korea (South))

Enhancing QoS in Opportunistic Networks Through Direct Communication for Dynamic Routing Challenges

Ambreen Memom (Canterbury Institute of Management, Australia); Aqsa Iftikhar (Universiti Tunku Abdul Rahm, Malaysia); Muhammad Nadeem Ali and Byung-Seo Kim (Hongik University, Korea (South))

Opportunistic networks (OppNets) lack the ability to maintain a consistent end-to-end path between the source and destination as Mobile Ad hoc Networks(MANETs) do. This lack of a stable route presents significant challenges for routing in OppNets. Due to the mobility of nodes, routing paths in OppNets are inherently dynamic, necessitating the selection of a neighboring node as the next hop to forward data toward the destination. However, the frequent movement of nodes can lead to substantial delays for the sender in identifying an appropriate next hop, which, in turn, negatively impacts the quality of service (QoS) in OppNets. To address this issue, this paper proposes an alternative approach for situations where the sender is unable to find a suitable next hop. In such cases, we suggest that the sender should resort to direct communication with the destination, ensuring that QoS constraints are upheld. The proposed scheme is simulated using the ONE simulator and evaluated against key parameters, including the number of dead nodes, overhead ratio, and average energy consumption.

Sigma-Based RSSI Annular Section and Two-Way Ranging Scheme for Enhanced Performance of Trilateration Technique

Chao Sun, Kyongseok Jang, Junhao Zhou, Yongbin Seo and Youngok Kim (Kwangwoon University, Korea (South))

This paper proposes an enhanced probabilistic model, named σ-Trilateration, based on the conventional trilateration localization technique used in wireless sensor network. The received signal strength indication (RSSI) values collected from wireless nodes are assumed to follow a normal distribution. By incorporating the two-way ranging method, which calculates the statistical RSSI standard deviation on two wireless links, we select the link with the smaller deviation due to its higher sensitivity and reliability. The path loss model provides an approximate mapping between the distance and RSS values. We use RSSI covered by the 1σ, 2σ, and 3σ standard deviation in distribution mapped distance values derived from the path loss model to form annular regions around each wireless node, which expand the area compared to the region based only on the RSSI mean value. By analyzing the overlapping regions between wireless nodes using probabilistic methods, a more accurate location estimate for the wireless nodes can be calculated by using optimization method. Simulations reveal the results of the proposed model, demonstrating its good performance,

Empowering Metaverse Through Mobile Edge Computing: a Survey on Integrated Computation Offloading and Data Caching Strategies

Tanmay Baidya and Sangman Moh (Chosun University, Korea (South))

The metaverse, an expansive digital universe where virtual and real worlds merge to enable lifelike social, work, and entertainment experiences, has become a major research focus, requiring ultra-low latency and rapid data processing to bring its immersive possibilities to life. Mobile edge computing (MEC) has emerged as a key solution to meet these demands, enabling data processing and storage closer to end-users. To optimize metaverse applications, joint strategies that integrate computation offloading with edge data caching have proven effective in both enhancing resource utilization and minimizing latency. This survey provides a detailed examination of integrated offloading and caching techniques in MEC environments, compares the techniques, and highlights open challenges and future research directions. This survey serves as a guide for researchers and developers aiming to optimize MEC for a more responsive and efficient metaverse experience.

Information-Centric Intelligent and Adaptive Content Rate Control in Metaverse

Muhammad Atif Ur Rehman (Manchester Metropolitan University, United Kingdom (Great Britain)); Byung-Seo Kim (Hongik University, Korea (South)); Mohammed Al-Khalidi (Manchester Metropolitan University, United Kingdom (Great Britain)); Rabab Al-Zaidi (University of Salford, United Kingdom (Great Britain))

The rapid proliferation of content-centric immersive 3D applications, such as the Metaverse, augmented reality (AR), and virtual reality (VR), has put significant strain on traditional address-centric networking protocols such as the Internet Protocol (IP) and Transmission Control Protocol (TCP). These protocols struggle to meet the stringent requirements of immersive applications, particularly in delivering large-scale 3D content with sub-millisecond latency while maintaining user immersion. Information-centric networking (ICN), a content-oriented alternative to TCP/IP, offers a promising solution to these challenges, particularly when synergised with artificial intelligence (AI). This ongoing work explores an information-centric, intelligent, and adaptive rate control mechanism for the Metaverse, aiming to optimise performance in immersive environments.

W1: Workshop – SACS'25 (2)

Session Room B

Chair: Byung-Seo Kim (Hongik University, Korea (South))

Secrecy Comparison of Active and Passive RIS

Yosefine Triwidyastuti (Hongik University, Korea (South)); Tri Nhu Do (Polytechnique Montréal, Canada); Kyusung Shim (Hankyong National University, Korea (South)); Beongku An (Hongik University, Korea (South))

The presence of double path loss at the end-to-end link in the reconfigurable intelligent surface (RIS) network introduces the implementation of active RIS. In this paper, we analyze the secrecy performance of passive RIS and active RIS in the effort of increasing the main channel and degrading the eavesdropping link when an illegitimate user attempts to overhear the legitimate transmission. We establish a phase-shift optimization to gain the maximum secrecy capacity with the constraint of discrete-valued phase-shifts at both RISs that is more available and practical in the implementation. Simulation results demonstrate that active RIS has higher secrecy performance to safeguard the main channel transmission. Higher source transmit power and shorter node distance were assured that they can also increase the average secrecy rate at all passive or active RIS-assisted networks.

Topic Classification Training Model with Automatic Textual Data Transformation

Jinmo Yang (Hongik University, Korea (South)); Chaeyun Seo (SE Laboratory, Hongik University, Korea (South)); Kidu Kim (Telecommunications Technology Association, Korea (South)); Janghwan Kim (Hongik University, Korea (South) & Software Engineering Laboratory, Korea (South)); Robert Youngchul Kim (Hongik University, Korea (South))

Nowadays, large language models (LLMs) are used in all domains and various tasks for fast and competent solutions as well as minor and supplementary tasks. These models have been trained on many kinds of data in large quantities, and further fine-tuned for better understanding in specific domains and tasks. There is much research on inventing and enhancing fine-tuning methods and datasets; however, there is little research on the generating datasets in various syntax for better language comprehension. Therefore, we propose an automatic textual data transformation for enhancing f1-score on classification. This mechanism augments topic classification (TC) data of 45,678 Korean news headlines from Korean Language Understanding Evaluation (KLUE) benchmark dataset. Our future work includes fine-tuning a few LLMs with the augmented sentences and conducting ablation study.

AI Driven Code Generation Mechanism

Yejin Jin (Hongik University, Korea (South)); Chaeyun Seo (SE Laboratory, Hongik University, Korea (South)); Kidu Kim (Telecommunications Technology Association, Korea (South)); Robert Youngchul Kim (Hongik University, Korea (South))

In traditional software engineering, we focused on formal/informal requirements for developing a project. From this moment, most requirements engineers should deal with natural language requirements for it. Our approach applies AI techniques at each step of the software development process. To solve this, we propose an automatic code generation mechanism from natural language requirements. In order to systematically analyze natural language requirements, we use Chomsky's linguistics for structural analysis and Fillmore's linguistics for semantic analysis.

Value Estimation Model with Learning Book Condition 's Image Data

Ryu Donghoon (Hongik University, Korea (South)); So-yoon Park, Seong-eun Kim and Du-hyeon Hwang (Hongik, Korea (South)); Sanho Lee (RasTech, Korea (South)); JiHoon Kong (Hongik, Korea (South)); Kidu Kim (Telecommunications Technology Association, Korea (South)); Chaeyun Seo (SE Laboratory, Hongik University, Korea (South)); Robert Youngchul Kim (Hongik University, Korea (South))

Currently, the number of readers is rapidly decreasing, and with so many books published, it is difficult for readers to find the books they want. To solve this problem, generative AI book recommendation proposes a customized book recommendation AI suitable for busy modern people. The service aims to solve various inconveniences that readers experience in the process of finding and reading books. First, in cases where readers only remember a brief synopsis and cannot recall the title of the book, a service is provided to help them easily find the book they want. Second, to simplify the complicated process of purchasing or borrowing books, a service is provided to provide the status of books in bookstores or libraries. Through this AI book recommendation service, we expect to improve the accessibility and literacy of modern people to read, and to improve the quality of human life and a life that can be observed.

GT: Green Information Technology

Session Room C

Chair: Lam Thanh Tu (Ton Duc Thang University, Vietnam)

Design of Parallel Control System for Faster DC Current Network Control

Yuuki Minagawa (Kanagawa Institute of Technology, Japan); Haruhisa Ichikawa and Shinji Yokogawa (The University of Electro-Communications, Japan); Yoshito Tobe (Aoyama Gakuin University, Japan); Yuusuke Kawakita (Kanagawa Institute of Technology, Japan)

We are developing a Virtual Grid Hub (VG-Hub), which can virtually construct a single large-capacity storage battery by networking multiple battery-powered devices. By interconnecting multiple VG-Hubs, a DC current network (VG-Hub network) can be constructed in which multiple power and load devices are connected. The objective of this study is to reduce the time required to control a VG-Hub network. In previous implementations, VG-Hubs were not controlled in parallel. Therefore, the need for faster VG-Hub network control has become apparent. Other researchers have sought solutions for control parallelization to reduce the control turnaround time, but they have not been able to implement them in their equipment. Therefore, it is desirable to modify the system design to support parallelization. In this paper, we address the issue of reducing the control time by modifying the control system of the VG-Hub network to support parallelization. We also describe the design of a system that can control a VG-Hub network in parallel.

Electromagnetic Wave-Based Respiratory Sensor System for Real-Time Monitoring and Sleep Apnea Diagnosis in Home Environments for Elderly Care

Hyungki Min (SB Solutions, Inc., Korea (South)); Seungcheon Kim (Hansung University, Korea (South)); Franklin Bien (Ulsan National Institute of Science and Technology, Korea (South))

This paper introduces a novel, non-intrusive respiratory sensor system using electromagnetic waves, aimed at diagnosing sleep apnea and enabling real-time respiratory monitoring for elderly individuals in home environments. The system, designed with the comfort of elderly users in mind, is especially beneficial for those living alone, offering a solution for detecting overnight respiratory irregularities, including potential apnea events. By leveraging electromagnetic wave technology, the system facilitates real-time monitoring without the discomfort of physical contact, making it an attractive alternative to conventional, hospital-based respiratory diagnostics. Experimental results show promising accuracy in detecting apnea events, with a sensitivity suitable for home health applications and the potential to reduce risks associated with unattended respiratory failure.

Moving Target TSP Based Path Planning with Deep Learning-Based Perception Sensor for Recure Robot

Ngoc Nghia Nguyen (ARAR JSC, Vietnam); Anh Vu Le (Communication and Signal Processing Research Group, Vietnam); Nhat Tan Le (Ton Duc Thang University, Vietnam); Anh Dung Nguyen (ARAR JSC, Vietnam); Dao Nguyen (Ton Duc Thang University, Vietnam); Minh Do (ARAR JSC, Vietnam)

Evacuating high-rise buildings during fires is critical and life-threatening, requiring optimized fire drill procedures. Robots with advanced perception and intelligent modules offer promising solutions for navigating complex, confined environments, driving interest in advanced path planning algorithms. This seminar will explore path planning for reconfigurable robots, addressing the challenges of shortest path and complete coverage. After the staircase and human are detected by a deep learning-based perception sensor, a novel routing method based on Multi-objective NSGA-II optimization for moving object TSP shortest path planning is proposed. Case studies demonstrate the energy efficiency and adaptability of these approaches, showcasing their potential for path planning in constrained spaces.

SmartWater plus – a Big Data and IoT Enabled Water Purification Systems

Phuong T. Tran, Lam Thanh Tu and Pham Van Huy (Ton Duc Thang University, Vietnam); Gi-Chul Yi (Korea Wetland Conservation Alliance, Korea (South)); Hae Kyung Lee (Korean Environmental Health and Welfare Association (KEHWA), Korea (South)); Nguyen Van Thai (Ho Chi Minh City University of Technology and Education, Vietnam); Do Kyong Kim (Korea Wetland Conservation Alliance, Korea (South)); Hyung Nam Kim (LFO, Korea (South)); Nam Chun Han (Yeha Global, Korea (South))

The increasing demand for efficient and sustainable water management has driven the development of SmartWater Plus, an Internet of Things (IoT)-enabled water purification system. Leveraging long-range (LoRa) communication for low-power, long-distance data transmission, SmartWater Plus facilitates real-time monitoring and control of water quality across diverse regions. IoT sensors gather data that is analyzed using big data techniques and artificial intelligence (AI) algorithms to optimize filtration processes, predict maintenance needs, and enhance overall efficiency. A pilot implementation in the Mekong Delta region has demonstrated significant improvements in water quality monitoring and operational performance. This system provides a scalable, cost-effective solution to tackle global water challenges while promoting sustainability.

Driving the Future: Examining the Switching Intention to Sustainable Transport: Insights from Electric Vehicle Adoption in Indonesia

Sharon Priscillia Wijaya, Natashya Chu and Indra Adiputra (Bina Nusantara University, Indonesia)

The study explores factors influencing the adoption of electric vehicles (EVs) in Indonesia, focusing on environmental motivations, incentives, and barriers. With the urban transport sector significantly contributing to air pollution and climate change, EVs present a promising alternative to reduce greenhouse gas emissions. Employing the Push-Pull-Mooring (PPM) framework, this research investigates three main factors: "push" factors like perceived environmental threats and environmental attitudes, "pull" factors such as government incentives and green transport policies and campaigns, and "mooring" factors including charging infrastructure and high initial costs. A survey of 186 Indonesian respondents reveals that government incentives and green transport policies and campaigns are the strongest motivators for adopting EVs, while limited infrastructure and high initial costs hinder the transition. The findings highlight the importance of effective policies, infrastructure expansion, and public education to overcome barriers and foster EV adoption. These insights aim to guide policymakers and stakeholders in promoting sustainable transportation solutions in Indonesia.

A Study on Peer-to-Peer Energy Trading for Secure Dynamic Power Pricing Strategies in Blockchain Networks

Faiza Qayyum and Syed Shehryar Ali Naqvi (Jeju National University, Korea (South)); Kyutae Lee (Kongju National University, Korea (South)); DoHyeun Kim (Jeju National University, Korea (South))

Peer-to-peer (P2P) energy trading transforms modern power systems by enabling decentralized energy exchanges. This paper provides a comprehensive survey of secure dynamic power pricing and optimization strategies within blockchain-enabled P2P energy networks. We explore advanced techniques to minimize trading costs and enhance energy distribution. Key methods, such as particle swarm optimization (PSO), time-aware power-sharing strategies, and renewable energy integration, are analyzed to optimize pricing and energy sharing. This survey is a resource for researchers aiming to develop intelligent and secure P2P energy trading solutions

CNS: Computer & Network Security

Session Room A

Chair: Younghoon Park (Sookmyung Women's University, Korea (South))

Reliable Deep Learning Training Data Management Scheme Using Hedera Hashgraph

Yeonsong Suh, Yoonseo Jung and Younghoon Park (Sookmyung Women's University, Korea (South))

This paper investigates the performance of Hedera, a fourth-generation blockchain, by comparing it to Ethereum Geth in the context of autonomous driving data management. Using road and traffic signal data collected from the CARLA simulator, the proposed system encrypts training data with a hash function and stores it on the Hedera network. The integrity of the data is verified before it is used for deep learning model training, ensuring reliable and untampered data is employed in the learning process. Experimental results demonstrate that Hedera significantly outperforms Ethereum Geth in execution time for both data upload and validation tasks, particularly as the number of data entries increases. Hedera's faster processing and scalability make it a more suitable choice for real-time, high-volume data management, such as autonomous driving environments. By overcoming the limitations of traditional blockchain systems, this study highlights Hedera's potential to enhance the reliability and efficiency of large-scale data-driven AI systems.

Digital Forensic Analysis of Navigation Apps on an Android Phone Connected to a Car via Android Auto

Ahn Gyun-Seung, Jiheon Jung and Seong-je Cho (Dankook University, Korea (South)); Youngsup Hwang (Sunmoon University, Korea (South)); Xuefeng Piao (Harbin Institute of Technology, China)

This paper presents a digital forensic analysis of navigation apps on an Android smartphone connected to a car via Android Auto. By designing and executing a controlled driving scenario, we examine data generated and stored by two popular navigation applications, Kakao Navi and Naver Map. The study focuses on extracting and analyzing app-related data to evaluate its alignment with the predefined driving scenario and assess its forensic utility. The findings highlight the potential of navigation app forensics in understanding driver behavior and offer insights into their applicability for investigative purposes.

A Faster Quantum Search Algorithm for Cryptanalysis of Proof-of-Work Blockchain

Younghoon Park (Sookmyung Women's University, Korea (South))

Blockchains are widely regarded as highly secure data structures due to their reliance on strong cryptographic algorithms. However, the emergence of quantum computers and various quantum algorithms poses a significant threat to blockchain security. For instance, Grover's algorithm, when implemented on quantum computers, can potentially break the hash functions used in blockchains more efficiently. Nevertheless, the operational cost of Grover's algorithm includes an exponential term of n, where n represents the number of bits. In this paper, we propose a novel, fast algorithm for breaking hash functions in blockchains. Unlike the conventional Grover's algorithm, our approach eliminates the need for iteration, which we anticipate will dramatically reduce the operational time.

Average Secrecy Capacity of RIS-Assisted Relaying Networks with Artificial Jamming

Ty Ta Vo (HCMC University of Technology and Education, Vietnam); Hop Quoc Pham (Posts and Telecommunications Institute of Technology, Campus in Ho Chi Minh City, Vietnam); Do Van Viet Em (Post and Telecommunications Institute of Technology, Ho Chi Minh City Campus, Vietnam & Ho Chi Minh City, Vietnam); Ngoc Son Pham (Ho Chi Minh City University of Technology and Education, Vietnam)

In this paper, we propose a method to enhance the physical layer security (PLS) of communication systems by combining reconfigurable intelligent surfaces (RIS) with artificial jamming (AJ). Specifically, RIS is utilized to ensure confidential communication between a source transmitter and a legitimate user in the presence of an eavesdropper. Additionally, we employ the artificial jamming technique to confuse the eavesdropper, further improving the secrecy performance of the wireless system. Moreover, the imperfect collaboration between the jamming device and the legitimate user is taken into account to adopt a more practical approach. To evaluate the secrecy performance, we derive closed-form expressions for the average secrecy capacity (ASC) of the investigated system. The ASC of the proposed system is then compared with that of a non-jamming system.

Design and Implementation of a User-Friendly Smart Router

Taeung Ryu, Hojin Kim and Duckki Lee (Yonam Institute of Technology, Korea (South))

In the modern digital ecosystem, routers are essential for providing internet access in various environments, yet they often harbor vulnerabilities to cyber threats like CSRF, brute-force, and MITM attacks. This research introduces an innovative router management system utilizing Raspberry Pi and integrated physical displays to enhance security and simplify user interaction. By eliminating traditional password-based authentication and confining configuration access to physical interfaces, the system significantly enhances security while

improving user-friendliness. The system features real-time network monitoring, intuitive configuration adjustments, and AI-driven diagnostics, enabling even novice users to manage their networks effectively.

Securing Medical Image with Cycle-GAN

Mays Yousif Mhawi, Hikmat N. Abdullah (AL-Nahrain University, Baghdad, Iraq); Axel Sikora (University of Applied Sciences Offenburg, Germany)

To secure sensitive patient data, encryption is essential to maintain confidentiality, integrity, and privacy. This work presents a deep learning-based encryption method for medical images using Cycle Generative Adversarial Network. Cycle-GAN performs image translation without paired training data, enhancing quality and preserving features. Unlike traditional image-to-image translation methods, Cycle-GAN doesn't require a dataset with corresponding input-output pairs. Cycle-GAN consists of two major components: a generator used to generate fake images, and a discriminator utilized to distinguish between real and generated images. Further, the least squares loss function is employed to train the network to quantify the difference between probability distributions, assisting model training by penalizing inaccurate predictions. The parameters of the generation network are the privacy key for encryption, whilst the parameters of the decryption network are the privacy key for the decryption. Peak Signal-to-Noise Ratio (PSNR), Structural Similarity Index Measure (SSIM), and correlation coefficient values are used to evaluate the translation process for skin lesion images.

W2: Workshop – SACT'25

Session Room B

Chair: Kyutae Lee (Kongju National University, Korea (South))

Hardware Digital Forensics for the IT Devices Estimation

Hyun Mook Cho, Jang-Geun Ki and Kyutae Lee (Kongju National University, Korea (South)); Alexis Jinhong Kim and Seokhong Min (Paichai University, Korea (South)); Nam Sang-Yep (KookJe, Korea (South))

Digital data consists of the binary data stored in files, and it can be created, copied, modified, deleted, and transmitted with simple operations. Digital forensics refers to a digital investigation process which analyzes the digital data to get the digital evidence, so it can be used as legal evidence. In order for intentionally modified data to have legal evidentiary effect, a method of tracing back the production process is required. Information device hardware has the characteristic of being manufactured and operated based on specific processors and source code programs. This is because the designer's unique habits tend to be included in the configuration, arrangement, and file structure of the hardware components used. This paper discusses methods for analyzing and utilizing forensic information resulting from intentional illegal copy of interface parts through hardware interface analysis.

Layered Structure Contract: a Study on the Design for Enhancing Reliability and Operability in Electronic Contracts

Dong-Wan Kim and Changjun Choi (LSware Inc., Korea (South)); YongJoon Joe (LSware Inc. & PPUZZL Group Inc., Korea (South)); Dong-Myung Shin (LSWare. Inc., Korea (South))

The Layered Structure Contract (LScontract) is a digital contract framework designed to address the limitations of Ricardian contracts and smart contracts. This paper analyzes key issues in the digital contract environment, including insufficient legal reliability, lack of technical robustness, challenges in handling complex contract terms, and the absence of standardization. To resolve these challenges, the LScontract framework is proposed, providing a mapping mechanism between natural language contracts, Ricardian documents, and smart contracts. By incorporating multi-signature functionality, LScontract enhances the reliability and stability of contracts. Furthermore, it contributes to improving the legal reliability and operability of digital contracts by clarifying contractual terms and systematizing dispute resolution procedures.

Applying Requirements Quality Quantification to Software Completeness Assessment

Yukyong Kim (Sookmyung Women's University, Korea (South))

Software requirements quantify a software development project's work, cost, and duration and act as an agreed-upon contract. It is essential to software development because it is derived by understanding the specifications and expectations of the product that both parties, the developer and the customer, want to develop. Most software completeness disputes arise mainly from functional differences between the developer and the customer about the final delivered product. Accordingly, the current software completeness appraisal verifies that the customers' requirements included in the contract are implemented and operated properly. As it is necessary to identify the source of responsibility that causes the dispute, it is very important to review whether the customer's role as a project participant has been sufficiently fulfilled and complete requirements have been provided. In this paper, we examine methods for assessing the completeness of requirements specifications and discuss their potential for use in software completeness assessment through the problems of requirements specification revealed in the case of job portal site completeness appraisal.

A Study on PDS-Based Contract Management for Secure Information Exchange in Web 3.0 Ecosystem

Sung-Il Jang (LSWare. Inc., Korea (South)); YongJoon Joe (LSware Inc. & PPUZZL Group Inc., Korea (South)); Dong-Myung Shin (LSWare. Inc., Korea (South))

As concerns about data privacy grow, the importance of secure and user-controlled data management systems has become apparent. Personal Data Store (PDS) systems allow individuals to store, manage, and share their personal data securely while maintaining ownership and control. We examine how PDS can be applied to contract management to enable secure and transparent information exchange in the context of Web 3.0. The proposed workflow ensures secure contract creation, updates, and approvals utilizing PDS features such as selective data sharing, decentralized storage, and user consent. This study highlights the benefits of PDS in ensuring privacy and providing a scalable approach to digital contract management in the Web 3.0 ecosystem.

Simulation Model for Tri-State Logic Device in Virtual Experiments

Jang-Geun Ki, Kyutae Lee and Hyun Mook Cho (Kongju National University, Korea (South))

Many changes have been made in overall social life, such as the rapid increase in digital nomads due to the influence of COVID-19, which was prevalent over three years from 2020. In the field of education, attempts to utilize the advantages of online non-face-to-face education in traditional face-to-face classes are increasing. In order for such a hybrid learning to achieve its intended goal in experiment-oriented engineering education, the development of online virtual experiment software that can provide a similar environment to offline experiment must be preceded. This paper describes the digital 3-state simulation method required for research on the development of digital virtual experiment software that can be used in the field of digital circuit design. In the proposed digital 3-state logic simulation, when the input and output terminals of the devices constituting the circuit are connected by a wire, each input terminal creates and manages a list of registered output terminals while registering as an observer with the output terminals connected by the wire. When there is a change in their output value, the output terminals notify the registered observers, and the notified input terminal calculates the final result value by considering the 3-state values of the output terminals in the output terminal list and sets it as an input value. The digital 3-state simulation method proposed in this paper enables simulation such as a wired-OR connection method, which is expected to increase the usefulness of virtual digital experiment software.

DAD: SW/HW Design, Architecture & Development

Session Room C

Chair: YongSoo Choi (Shinhan University, Korea (South))

Experimental Verification for Dual Functions of Power Divider and Balun

Hyungzun Mun, Jeongho Park, Jongsik Lim and Seong-Ho Son (Soonchunhyang University, Korea (South)); Sang-Min Han (Soonchunhyang, Korea (South)); Dal Ahn (Soonchunhyang University, Korea (South))

This paper presents the experimental verification of a dual-functional microwave power divider which is capable of also serving as a balun. One power divider and two RF SPDT switches are combined to achieve the dual function. Connecting these switches to the power divider's two output ports produces four output paths. By incorporating an 180o phase conversion structure into one of the paths, the switching operation allows for selective role either as a power divider or a balun. Experimental verification of the proposed concept confirms well its dual functions, demonstrating both in-phase power division and out-of-phase balun operation depending on the switching status.

A New Smart Video Surveillance System Using Edge Devices and Edge AI

Chang Mo Yang (Korea Electronics Technology Institute, Korea (South)); Dongchil Kim (Korea Electronics Techonlogy Institute (KETI), Korea (South)); Kyeongeun Seo (Korea Electronics Technology Institute, Korea (South)); Kyungwon Kim (Korea Electronics Technology Institute, Korea (South) & Konkuk University, Korea (South))

In this paper, we propose a new smart video surveillance system which uses edge devices and edge AI. The proposed system is intended to solve the performance degradation problem of edge AI in existing edge video surveillance systems. The proposed system uses edge devices that can be replaced or updated for edge AI. In addition, the proposed system uses edge AI monitoring technology to monitor edge AI performance degradation, edge AI relearning technology to create a new edge AI when edge AI performance degradation occurs, and edge AI deployment and control technology to load and operate the newly created edge AI on the edge devices. The implementation results show that the proposed system is suitable for video surveillance services using edge devices and edge AI.

Investigation of High-Order Exceptional Points in anti-PT Symmetric System for High-Performance Sensor Applications

Ngoc Hung Phi, Bilal Ahmad, Sasani Chethana and Jong-Wook Lee (Kyung Hee University, Korea (South))

Anti-parity-time (APT) symmetric systems, where the Hamiltonian anti-commutes with parity (P) and time-reversal (T) operations, have gained high interest for their unique non-Hermitian properties. In an APT symmetric system, their eigenvalues can coalesce to create an exceptional point (EP) where a small perturbation results in a significant change in system response. This paper explores an APT symmetric system realized using coupled RLC resonators that can exhibit third-order exceptional points (EP3) for high-performance sensor

applications. We investigate the coalescence of three eigenfrequencies by tuning the circuit's frequencies and dissipative couplings. Our results demonstrate a strong alignment between practical simulation and theoretical analysis, highlighting the system's high sensitivity. The result will be promising for future precision sensing and signal processing applications.

Design of a Deployable Wrapped Rib Mesh Reflector Antenna

En-yeal Yim (Hongik Universitiy, Korea (South)); Changhyeon Im (University of Hongik, Korea (South)); Hosung Choo (Hongik University, Korea (South))

In this paper, we propose a design method for a wrapped rib mesh reflector antenna. Herein, conducting mesh is employed on the surface of the large reflector to reduce the weight of the antenna. To minimize the diameter of the mesh reflector, multiple curved ribs and a center hub are applied to the frame of the mesh reflector. The curved ribs are made of a carbon fiber reinforced plastic (CFRP), which can have both the high elasticity and flexibility. When the number of ribs is 30 and 50, the aperture efficiencies of the proposed antenna are 25% and 48%, respectively.

Unlearning Dataset-Specific Biases for Domain Adaptation in Retinal Fundus Image Analysis

Minnkyung Kim (Korea University, Korea (South)); William Lotter (Harvard Medical School, USA)

Retinal fundus image analysis aids in early detection and monitoring of ocular diseases, yet the performance of deep learning models is often hindered by domain shifts between different datasets, imaging devices, and patient populations. Domain adaptation, which aims to improve the generalization of models across diverse domains, is crucial for ensuring robustness of models. However, achieving effective domain adaptation remains a significant challenge due to variations in image quality, resolution, lighting conditions, and acquisition protocols. A range of techniques including adversarial training and cross-domain consistency regularization to bridge the gap between source and target domains have been suggested. This paper explores whether an unlearning approach is feasible to enhance the generalization ability of neural networks. We investigate the effect of confusion loss on unlearning dataset-specific biases while training to maintain the essential domain-invariant attributes for robust performance across different datasets.

Blue Carbon by Microalgae System on Global Smart Future (GSF) – a Big Data Platform

Gi-Chul Yi (Korea Wetland Conservation Alliance, Korea (South)); Pham Van Huy and Phuong T. Tran (Ton Duc Thang University, Vietnam); Dam Duc Tien (Institute of Marine Environment and Resources, Vietnam); Nguyen Van Thuong (Independent Researcher, Vietnam); Do Kyong Kim (Korea Wetland Conservation Alliance, Korea (South))

The Global Smart Future (GSF) platform focuses on developing models that blend advanced information technologies with fields like agriculture, wetland and environmental management. Specifically, the Blue Carbon by Microalgae (BCM) project is designed to create a business model centered on microalgae's ability to sequester carbon. This initiative utilizes remote sensing technology, such as satellite and drone imagery, combined with analytical systems to accurately measure and analyze microalgae's carbon absorption, showcasing a pioneering approach in leveraging technology for environmental sustainability.

Thursday, January 16 11:00 – 11:20 a.m.

Coffee Break

Thursday, January 16 11:20 a.m.– 12:00 p.m.

Plenary Talk III

6G NTN for Ubiquitous Connectivity from Network Perspective

Dr. Namseok Ko (Director in Electronics and Telecommunication Research Institute (ETRI), Korea)

Main Auditorium (A304)

Chair: Byung-Seo Kim (Hongik University, Korea (South))

Lunch

Rooms: Ground Floor of Administrative Building

Plenary Talk IV

AI for Science and Systems for AI

Prof. Rajkumar Kettimuthu (Argonne National Laboratory, The University of Chicago, United States of America)

Main Auditorium (A304)

Chair: Eun-Sung Jung (Hongik University, Korea (South))

MSP: Multimedia and Signal Processing

Session Room A

Chair: Sang-ug Kang (Sangmyung University, Korea (South))

Three-Stage Shockable vs. Non-Shockable Rhythm Classification with ECG Peak Detection

Heonzoo Lee, Sejin Kim and Rayoung Park (Chonnam National University, Korea (South)); Tan Loc Nguyen (AITOMATIC, USA); Yonggwan Won (Chonnam National University, Korea (South))

Electrocardiography (ECG) is a standard tool to detect cardiac diseases and heart conditions, which are characterized by parameters determined from peaks. The detection and classification of irregular ECG rhythms are essential for diagnosing patients with cardiac abnormalities. This paper introduces a novel method for detecting peaks in ECG signals and a three-stage classification system to identify the ECG rhythms. The peak detection method used a moving average filter for DC component and noise reduction. R-peaks were then detected by identifying peaks with amplitudes higher than 70% of the local maximum within a three-second window. Other peaks were then detected by finding local minima and maxima in the left and the right sides of R-peak. The best result was 99.87% for R-peak detection and over 98% for P and T peaks which are relatively harder than other peaks. Classification study used three popular ECG datasets available at PhysioNet database. The accuracies were 91.46% for shockable vs. non-shockable, 97.1% for normal vs. abnormal, and 97.74% for 13 abnormal diseases. Despite the study focuses on method development rather than higher accuracy, its performance is comparable to existing methods. Further improvement can be achieved by conducting a thorough investigation of classifiers and parameter optimization.

Uplink Achievable Rate and Energy Efficiency Analysis for Massive MIMO Systems with One-Bit ADCs

Hung Dang (Posts and Telecommunications Institute of Technology, Vietnam)

This paper analyzes the performance of massive multiple-input multiple-output (MIMO) systems using One-bit analog-to-digital converters (ADCs) for uplink achievable rates and energy efficiency. Through simulations with varying user configurations (10, 20, 40, 100, and 200 users), we observe that while the uplink sum rate improves significantly with smaller users but levels off for larger groups due to multi-user interference. Additionally, Energy efficiency, initially high for small user numbers, drops rapidly as the number of base station antennas increases. These findings provide valuable insights into optimizing system design for One-bit ADCs in massive MIMO deployments, suggesting that balancing user count and antenna numbers is key to maximizing energy efficiency while still achieving moderate uplink sum-rate improvements.

Enhanced VASM Performance Through Efficient FNN-Based Transmit Antenna Selection in Rician Fading Channels

Tran Viet Vinh, Pham Thanh Hiep and Thu Phuong Nguyen (Le Quy Don Technical University, Vietnam)

Variable Active Antenna Spatial Modulation (VASM) is a spatial modulation variant designed to improve spectral efficiency and offer greater flexibility in system configuration. In this paper, we propose a feedforward neural network (FNN) framework to address the transmit antenna selection (TAS) problem, aiming to enhance performance in VASM systems operating over Rician fading channels. Computational results demonstrate that the proposed FNN-TAS approach significantly reduces computational complexity compared to

the optimal Euclidean distance-based TAS technique. Additionally, simulation results indicate that the bit error rate (BER) of the VASM system increases with the Rician factor. However, the proposed FNN-TAS method effectively improves BER performance for VASM systems, particularly at high Rician factors, and outperforms conventional TAS methods based on channel gain.

An Improved 3D Graph Convolution Algorithm and Its Applications

Songwen Jin and Yanming Zhao (Hebei Minzu Normal University, China)

To address the neighbor space selection problem in 3D graph convolution algorithms, an "Improved 3D Graph Convolution Algorithm and Its Applications" is proposed. First, a graph convolution algorithm based on 3D visual computing theory is introduced to determine the neighbor space range for the 3D graph convolution algorithm. Secondly, inspired by the single-ink processing mode of primate visual information, a single-link depth-daptive graph convolution algorithm based on 3D visual selectivity theory is constructed to learn the different depth visual features in the same sub-space of a 3D point cloud. By comparing with traditional methods on the ShapeNetPart dataset, the proposed algorithm is shown to have good segmentation performance, with an effective segmentation accuracy of 82.78%.

A Speech Enhancement Model with an Asymmetric Autoencoder Structure

Seorim Hwang (Yonsei University, Korea (South)); Sung Wook Park (Gangneung-Wonju National University, Korea (South)); Young-cheol Park (Yonsei University, Korea (South))

This paper proposes a speech enhancement model of two-encoder-three-decoder. With preliminary studies, we found that speech enhancement models employ not only one-encoder-one-decoder structure, but also one-encoder-two-decoder structure. Further the decoders estimate either a complex mask or the speech spectrum directly. However, no detailed idea behind the selection of the structure and the selection of the target of estimation is well justified. We performed ablation tests to understand the benefits of each structure and target, which led to an asymmetric autoencoder structure that demonstrates superior performance across various evaluation metrics compared to other recent SE models.

W3: Workshop – AICT'25
Session Room B

Chair: Hye Young Kim (Hongik University, Korea (South))

Enhancing Digital Rights Management with a Modeling Using BML Against Generative AI

Jongho Seol (Middle Georgia State University, USA); Hye Young Kim (Hongik University, Korea (South)); Abhilash Kancharla (University of Tampa, USA); Jongyeop Kim (Georgia Southern University, USA)

This paper presents a Markov chain model for Digital Rights Management (DRM) and copyright management, which incorporates Blockchain technology and Machine Learning (BML) to prevent unauthorized use, particularly in the context of Generative AI (GAI). Traditional DRM systems often fail to adequately protect Intellectual Property (IP) due to their centralized nature and lack of transparency. By integrating a Markov chain approach, this model simulates the sequence of events in content usage, allowing for predictive analytics on unauthorized access. Blockchain technology enhances this framework by providing a secure, immutable ledger for tracking rights ownership and transactions, while smart contracts automate licensing agreements and royalty distributions. Machine learning algorithms further improve the system by identifying patterns of usage and detecting anomalies indicative of unauthorized use. This integrated approach aims to create a more efficient, transparent, and inclusive DRM system that empowers creators and rights holders in the evolving digital landscape.

Ergodic Capacity of NOMA-Based Multi-Hop Relaying Schemes in Clustered Networks with Energy Harvesting and Node Selection

JNgo Hoang An (Ho Chi Minh City University of Industry and Trade, Vietnam & Industrial University of Ho Chi Minh City, Vietnam); Lam Thanh Tu (Ton Duc Thang University, Vietnam); Tran Trung Duy and Nguyen Binh (Posts and Telecommunications Institute of Technology, Vietnam); Lubos Rejfek (University of Pardubice, Czech Republic); Yeonho Chung (Pukyong National University, Korea (South))

This paper evaluates ergodic capacity (EC) of non-orthogonal multiple access (NOMA)-based multi-hop relaying schemes in clustered networks. In the proposed model, a single-antenna source node transmits different data to two multi-antenna users with the aid of intermediate relays grouped into clusters. At each hop, one node within the cluster is selected to forward the received data to the next hop. Two node selection strategies-random node selection (RAN) and best node selection (BNS)-are considered in this study. In addition, selection combining (SC) technique is applied at both users. For data transmission, the source and selected relays at each cluster have to harvest the wirelessly energy from a power beacon. We derive the end-to-end (e2e) instantaneous signal-to-interference-plus-noise ratio (SINRs) and their cumulative distribution functions (CDFs) over Rayleigh fading channels. Then, we derive the ergodic capacity achieved by each user. The results indicate that the BNS scheme outperforms RAN, although with higher complexity.

W4: Workshop – IPWC'25

Session Room C

Chair: Phuong T. Tran (Ton Duc Thang University, Vietnam)

Physical Layer Security in RIS-Assisted Hybrid Satellite-Terrestrial Networks Under Asymmetric Fading

Thien Nguyen Phuc and Lam Thanh Tu (Ton Duc Thang University, Vietnam)

In this paper, we analyze the physical layer security performance of reconfigurable intelligent surface (RIS)-assisted satellite-terrestrial networks operating over a mixed Rayleigh/shadowed-Rician fading channel. The study addresses a challenging scenario where a direct line-of-sight (LOS) path is absent between the RIS and the destination node, while a LOS path exists between the RIS and the eavesdropper. To enhance the desired transmission, we propose an optimization framework aimed at maximizing the channel gain from the source to the destination node. A closed-form expression for the optimal phase shift of each RIS element is derived. Finally, Monte Carlo simulations are conducted to validate the superiority of the proposed approach over random phase design. The impact of key system parameters on the performance is also thoroughly evaluated.

Intelschoolbus – the System for Counting Controlling Students on School Buses

Tan Le (Ton Duc Thang University, Vietnam); Anh Dung Nguyen (ARAR JSC, Vietnam); Ngoc Nghia Nguyen (Ton Duc Thang University, Vietnam); Anh Vu Le (Communication and Signal Processing Research Group, Vietnam); Minh Do (ARAR JSC, Vietnam)

Real-time passenger counting on buses is a critical task to enhance the efficiency of public transportation systems and plays a vital role in the development of smart cities. This paper presents an AI-powered with integrates GPS system for real-time student/passenger monitoring and counting on buses, addressing safety and operational concerns within public transportation and smart city development. While existing researches utilizes various methods like DeepSORT, Kalman Filters, and YOLO variants with hardware such as Raspberry Pi, Arduino and focuses on tracking, this work advances the field by employing optimized models for embedded systems. Specifically, this system leveraging YOLOv8 outperforms YOLOv5 and YOLOv11 for head detection and tracking by ByteTrack in both the RISC-V architecture with an integrated NPU (MaixCAM) and ARM v8 (Raspberry Pi).

Design and Implementation of a Saline Water Filtration System

Vien Vu Tri and Phuc Quang Tran (Ton Duc Thang University, Vietnam); Tien Van Truong (Truong Van Tien, Vietnam); Tuan Quang Tran and Nam Nguyen Hoang Le (Ton Duc Thang University, Vietnam)

Water is essential for all living organisms and one of the most valuable resources on Earth. Without it, life would not exist. Brackish water treatment systems play a crucial role in converting salty or brackish water into fresh, potable water. This process utilizes high-pressure pumps to force water through reverse osmosis (RO) membranes, effectively removing salts, organic compounds, heavy metals, microorganisms, and other impurities. The system operates on the principle of pressure differential, where pump-generated pressure drives water through the RO membrane. Featuring a scientifically optimized design, the system functions fully automatically within a closed, monitored process. It ensures the reliable production of fresh water for drinking and daily living needs, offering an efficient and sustainable solution for water scarcity

Generating Artistic Images Using Neural Style Transfer with Pre-Trained Convolutional Neural Networks

Tri Duc Nguyen and Phuong T. Tran (Ton Duc Thang University, Vietnam)

In fine arts, especially painting, people have mastered the skill of creating unique visual experience through creating a complex interweaving of content and style way of an image. In important areas of visual perception, for example object and face recognition, near-human performance has recently been demonstrated by a class of biologically inspired vision models called Deep Neural Networks. Here, we apply an artificial system based on Deep Neural Network, which helps create artistic images of high perceptual quality. The system uses neural models to decompose and recombine the content and style of arbitrary images, provides a neural algorithm to generate artistic images.

Thursday, January 16 03:30 – 03:50 p.m.

Coffee Break

AI: AI & Big Neural Network

Session Room A

Chair: Anh Vu Le (Communication and Signal Processing Research Group, Vietnam)

Meta Learning for Fast Adaptation of Personalized Federated Learning in Industrial IoT Networks

Thu Thi-Anh Nguyen and Quang Vinh Do (Ton Duc Thang University, Vietnam); Duong Minh Nguyen (Pusan National University & VinGroup, Vietnam); Phuong T. Tran (Ton Duc Thang University, Vietnam)

The rise of the Industrial Internet of Things (IIoT) has led to the proliferation of interconnected devices within industrial environments, generating vast amounts of data that can be utilized to enhance efficiency and decision-making processes. However, the stochastic and heterogeneous nature of IIoT networks presents challenges for implementing effective machine learning algorithms, particularly in scenarios where personalization and privacy are paramount. In this paper, we propose a novel Meta Learning with Model Interpolation (MLMI) approach for the rapid adaptation of personalized federated learning (pFL) in heterogeneous IIoT networks. The MLMI framework leverages meta-learning techniques to train local models, enabling personalized updates while preserving data privacy. Additionally, model interpolation is employed to facilitate knowledge transfer and collaboration among devices, promoting faster convergence and improved performance. We evaluate the proposed MLMI approach on various datasets and compare it with state-of-the-art federated learning methods. Experimental results demonstrate the efficiency of our method, showing significant improvements in both adaptation speed and accuracy.

Procedural Information Extraction from News: Leveraging Hierarchical Context and Paraphrasing-Based Oversampling

Muhammad Iskandar Java and Shintami Chusnul Hidayati (Institut Teknologi Sepuluh Nopember, Indonesia); Sri Devi Ravana (Universiti Malaya, Malaysia); Ratih Nur Esti Anggraini (Institut Teknologi Sepuluh Nopember, Indonesia & University of Bristol, United Kingdom (Great Britain))

Procedural information is highly valuable across various domains, including education, journalism, and research, as it describes processes, steps, or methods. Extracting such information from news articles presents significant challenges due to the absence of explicit keywords and the diverse structure of news content. Identifying procedural sentences often requires a deep understanding of both the context and the surrounding text. This study aims to improve the identification of procedural sentences within unstructured news articles. We analyze approaches that leverage transformer-based models to capture both sentence-level and hierarchical-level semantics for this task. Additionally, we address the issue of class imbalance by incorporating an oversampling technique using T5-based paraphrasing. Our results demonstrate that that the hierarchical-level approach using Robustly Optimized BERT Pretraining Approach (RoBERTa) model, combined with the oversampling technique, achieves best performance, with an F1-score of 0.7360 and accuracy of 0.9300 on an annotated procedural news dataset.

Stress Detection Using Multiple Physiological Signals: A Federated End-To-End Deep Learning Approach

Uzma Shakoor (COMSATS University Islamabad Wah Campus, Pakistan); Muhammad Khalil Afzal (Comsats Institute of Information Technology, Wah Cantt, Pakistan); Byung-Seo Kim (Hongik University, Korea (South))

Stress is an adaptation of an organism in which an individual is intended to behave extremely well under difficult environmental situations. The increased prevalence of crime, noise, and slums, as well as demanding employment challenges, are major stressors in modern city living. The significant rise in the stress of modern humans needs to be addressed. It not only has an impact on decision-making abilities, but it has also been connected to obesity, suicides, accidents, aggression, and aggravating symptoms of various diseases, among other things. Emotion recognition has several purposes, including human-robot communication, assisting emergency personnel in making decisions, monitoring drivers, treating different diseases, and monitoring sick individuals. Stress detection is more reliable based on physiological data than facial expression or voice monitoring because they are generated by the Autonomous Nervous System (ANS) since it is highly unlikely to be manipulated via conscious control. Previous studies on stress detection using physiological signals did not consider privacy concerns along with the end-to-end feature selection methodology. Federated Learning enables the learning model to be fine-tuned with bigger datasets while simultaneously addressing data privacy concerns. This work proposes a stress detection technique based on federated deep learning that uses several physiological data to study prediction accuracy using end-to-end deep learning methods.

Enhancing Chatbots for Spiritual and Mental Health Counseling: a Systematic Literature Review on Tokenization, Contextual Embeddings, Sentiment Analysis, and Denominational Awareness

Jimmy Agustian Loekito (Institut Teknologi Sepuluh Nopember, Indonesia & Universitas Kristen Maranatha, Indonesia); Aris Tjahyanto (Sepuluh Nopember Institute of Technology, Indonesia); Rarasmaya Indraswari (Institut Teknologi Sepuluh Nopember, Indonesia)

This study explores the integration of specialized tokenization, contextual embeddings, sentiment analysis, and denominational awareness into chatbots for spiritual and mental health counseling. A Systematic Literature Review (SLR) was conducted, analyzing 53 studies from 2019 to 2024 to identify gaps and advancements in these areas. The results revealed limited research on domain-specific tokenization and theological embeddings in NLP models, particularly in religious counseling contexts. Additionally, sentiment analysis and denominational awareness were underexplored, though they have the potential to significantly enhance chatbot responses by providing personalized, empathetic, and theologically accurate guidance. This study addresses these gaps by proposing enhancements to chatbot frameworks, focusing on improving intent prediction, emotional understanding, and personalized responses for diverse religious contexts. Future research should focus on empirical validation and cross-cultural adaptations. The findings aim to advance chatbot technology for both spiritual and mental health counseling.

Deep Learning-Based Object Classification Model for Risk Situation Detection and Prediction

Dongchil Kim (Korea Electronics Techonlogy Institute (KETI), Korea (South)); Kyeongeun Seo and Chang Mo Yang (Korea Electronics Technology Institute, Korea (South))

The accurate detection and prediction of risk situations in real-time environments are critical for ensuring safety and reducing the potential for accidents. In this paper, we propose a novel deep learning-based object classification model designed to enhance the detection and prediction of dangerous situations. By fine-tuning a Vision Transfer(ViT) model, we improve its ability to classify objects that are commonly associated with dangerous situations. Our model uses a transfer learning approach to adapt pre-trained models to specific risk-related object categories, enabling the model to recognize and prioritize potentially dangerous objects in various contexts. We evaluate the performance of the proposed scheme across multiple real-world datasets. The implementation results show that the proposed model significantly improves classification accuracy and inference speed, making it a viable solution for applications in intelligent video surveillance and safety-critical industries.

Hybrid Iris Recognition for Authentication Systems in AI Edge Device (NPU) Environments

HuiJae Bae, Eunsu Yun, SeonKyun Park and Jongweon Kim (Sangmyung University, Korea (South)); Dae Sik Jung (University of SangMyung, Korea (South))

In this study, we developed a deep learning-based hybrid iris recognition that operates on AI edge devices (NPU) and analyzed its performance in various hardware environments. The goal is to extract the unique patterns of the iris for fast and accurate recognition. We applied the YOLOv8 model for the segmentation of the iris, pupil, and eyelid regions. Furthermore, eyelash removal and iris code extraction were conducted to enhance the matching process. Performance evaluation results showed that the average IoU (Intersection over Union) value across all classes was above 0.94, and the inference speed in the NPU environment was 42.7 ms. This research presents an iris recognition system that demonstrates high performance even in edge device environments. Future research aims to improve generalization performance by utilizing diverse datasets and to implement a real-time system.

W3: Workshop – AICT'25

Session Room B

Chair: Hye Young Kim (Hongik University, Korea (South))

An Integrated Security Framework for NFT Marketplace Enhancement and Intellectual Property Protection

Su-hong Shin, Siyoung Nam, Hyeong-Gyun Yun and Hye Young Kim (Hongik University, Korea (South))

This study proposes a multi-tiered blockchain security framework to mitigate security vulnerabilities in the non-fungible token (NFT) market. Statista predicts that the global NFT market will grow to 683.9 million dollars by 2024; however, fraud and forgery are becoming more common in major NFT marketplaces, including OpenSea. Consequently, this study proposes a thorough analysis of smart contracts, metadata, and digital assets used in NFTs, as well as a security framework encompassing data validity verification, URL information verification, source code transparency verification, ERC-721 standard compliance verification, and malware detection. The proposed framework includes a hash chain mechanism that validates the integrity of IPFS/HTTP-based metadata as well as an on-chain verification protocol for the copyright protection of digital assets. By applying weighted evaluation techniques to existing research, we established an enhanced verification system. While previous approaches only determined correctness based on test conditions, our approach now enables evaluation that considers the importance and risk levels of individual test items. The proposed framework is designed to safeguard users from threats such as unauthorized duplication, intellectual property rights violations, and malware infections that may occur during the acquisition of NFT assets, thereby improving the security of the NFT ecosystem.

A Survey of the Trends in Convergence of Blockchain and Watermarking for Copyright Protection

Jungmin Park, Siyoung Nam and Hye Young Kim (Hongik University, Korea (South)); Hoa N. Nguyen (VNU University of Engineering and Technology, Vietnam)

In the digital age, the exponential growth of multimedia and intellectual property on the internet has led to increasing concerns about data authenticity, copyright protection, and security. Blockchain has emerged as an innovative technology capable of addressing these issues, characterized by its decentralized and immutable ledger. Combined with digital watermarking, which allows information to be directly embedded in multimedia content, blockchain offers new opportunities for copyright management, security, and authentication. This survey provides a comprehensive review of the latest technological trends in the integration of blockchain and watermarking, covering their applications, benefits, and challenges. This study aims to explore recent advancements, highlight potential synergies, and assess the feasibility of combining these technologies in real-world scenarios.

A Study on Perceptions of AI and Copyright in the Game Software and Webtoon/Comics Industries of Vietnam and Korea

Yun Hyeong Gyun, Woo Jae Yeong and Hye Young Kim (Hongik University, Korea (South))

This study examines the impact of AI technology on the creative processes within the game software and webtoon/comics industries in South Korea and Vietnam, as well as perceptions regarding copyright protection for AI-generated content. Survey results indicate that South Korean respondents exhibit higher frequencies of AI technology utilization and stronger awareness of copyright protection compared to their Vietnamese counterparts, who express a more pronounced demand for policy improvements. The study proposes tailored policies and legal regulatory directions that consider the unique characteristics of each country.

P: Poster Session

Poster Room (A301)

Chair: Sung Wook Park (Gangneung-Wonju National University, Korea (South))

Design and Implementation of an AI-Driven Indoor Temperature Control System Using Modbus TCP

HongKyun Kim (Kongju National University, Korea (South) & Faculty, Korea (South)); Kyutae Lee, Jang-Geun Ki and Hyun Mook Cho (Kongju National University, Korea (South))

This paper proposes a centralized AI indoor temperature control system using the Modbus protocol for distributed HVAC systems in indoor environments. The system consists of individual air conditioning control units installed in each room and a central AI controller. Each unit regulates temperature and manages environmental conditions for its respective space, while exchanging data in real time with the central AI controller via the Modbus protocol. The central AI controller analyzes data from all spaces to develop an optimal temperature control algorithm, centrally managing the entire HVAC system. This approach aims to maximize energy efficiency in residential and small buildings, while providing a comfortable, customized environment for each space. The experimental setup involved analyzing 10,000 temperature and humidity sensor values along with one year of temperature data from Cheonan, Korea. This analysis was performed using the NVIDIA Jetson Orin Nano 8G platform. The control framework utilized the Long Short-Term Memory (LSTM) network and the Deep Q Network (DQN). To ensure stability, a hysteresis control mechanism was integrated at the final AI control stage. Real-time sensor data, such as power usage, temperature, and humidity, are stored in the InfluxDB database. AI algorithms predict environmental conditions and dynamically adjust HVAC settings based on user preferences.

A Non-Visible-Light Based Document Identity Verification System Using Siamese Networks

Yelda Asgari (Sungkyunkwan University & Logichain, Korea (South)); Ngan Linh Nguyen (Soongsil University & Logichain, Korea (South)); GiHyeok Hong (Hallym University & Logichain, Korea (South)); Nliyufar Shodmonova (Sejong University & Logichain, Korea (South)); Gaeun Lee (Hankuk University of Foreign Studies & Logichain, Korea (South)); Ken Oak (Logichain, Korea (South)); JIn Hoon (Kyonggi University, Korea (South)

The proliferation of forged and altered identification documents has become a social global concern. Existing verification technologies and services are limited in their ability and often lack accurate authentication of forged documents, especially with recent advancements in AI (Artificial intelligence) technology and sophisticated editing tools. This paper presents an innovative solution that combines multispectral imaging techniques with on-device AI to achieve reliable and faster document verification. The proposed system combines Optical Character Recognition (OCR), YOLO for object detection, Histogram of Oriented

Gradients (HOG) for image representation, Segment Anything Model (SAM) with LaMa model for training data management and preprocessing, and Siamese Network for UV hologram verification. Implemented as a smartphone application, the system can verify passport images and facial identities within two seconds while ensuring data security through a blockchain system. Experimental results reveal robust performance in diverse conditions, effectively identifying and validating documents with high accuracy using AI-based models. The proposed system addresses the limitations of current systems, offering a reliable and efficient approach to personal identification and document verification.

Comparative Analysis of Research Venues in Medical Artificial Intelligence

Linta Iqbal and Seong Oun Hwang (Gachon University, Korea (South))

This study offers a comparative analysis of research methodologies and findings from different venues focused on medical AI applications, particularly in cancer and brain tumor diagnosis. By analyzing recent papers across some major publication venues (ICML, NIPS, AAAI, ICLR, IEEE Access, and journals like Nature Communications and Scientific Reports) and some less prestigious conferences like ICMLSC and CSAI, distinct trends in AI's application are highlighted for non-invasive diagnostics, data augmentation, and survival prediction models. The emphasis is placed on identifying problems that need to be addressed, dataset accessibility, and clinical application.

Exploiting Secrecy Performance on Cooperative NOMA Networks with Active Eavesdropper

Kyusung Shim (Hankyong National University, Korea (South)); Shrutika Sinha (Kookmin University, Korea (south)), Soo-Hyun Park (Kookmin University, Korea(South))

In this paper, we investigate the impact of active eavesdropping attacks on cooperative non-orthogonal multiple access (NOMA) networks. Additionally, we examine the effect of a random antenna selection scheme on secrecy performance. We derive closed-form expressions for the secrecy outage probability (SOP) of cell-center and cell-edge users, respectively. The numerical results indicate that the random antenna selection scheme does not significantly affect the secrecy performance.

Laplace Feature Perturbation for Domain Generalization

Chihoon AN (Sangmyung University, Korea (South)); Minsu An (University of Sangmyung, Korea (South)); Changhee Kang and Sang-ug Kang (Sangmyung University, Korea (South))

Recent deep learning models are trained based on the assump-tion of independent and identically distributed (i.i.d.) data. However, in real-world scenarios, domain shifts frequently occur, leading to significant performance degradation. To ad-dress this issue, research has focused on maximizing domain diversity. Nevertheless, existing methods have limitations, such as the quality issues of generated data, restricted feature diver-sity, and semantic distortion. The purpose of this paper is to propose a novel feature perturbation module for domain gen-eralization (DG). By applying a Laplace distribution to the existing learnable feature perturbation module, we aim to en-hance domain generalization capabilities through new feature variations. The model employing the proposed method demon-strates overall improved results on the PACS benchmark da-taset, which is widely used in DG research, compared to exist-ing models.

Panel Data Analysis of Rice Price, Production, and Yield Dynamics: ASEAN Countries Case Study

Ulima Inas Shabrina and Riyanarto Sarno (Institut Teknologi Sepuluh Nopember, Indonesia); Ratih Nur Esti Anggraini (Institut Teknologi Sepuluh Nopember, Indonesia & University of Bristol, United Kingdom (Great Britain)); Agus Tri Haryono (Institut Teknologi Sepuluh Nopember, Indonesia & Universitas Mulawarman, Indonesia)

This study investigates the interplay between rice price, production, and yield in ASEAN countries using panel data approach. By analyzing cross-sectional and temporal variations, the study identifies critical drivers of price dynamics and agricultural productivity. Stationarity and cointegration tests ensure methodological rigor, revealing that most variables are suitable for short-term analysis, with yield exhibiting a significant negative effect on price. The Fixed Effects Model (FEM), selected through the Hausman test, addresses unobserved heterogeneity across countries, enhancing model robustness. Diagnostic tests highlight challenges on multicollinearity, heteroscedasticity, and autocorrelation. The findings emphasize the pivotal role of yield in shaping market prices, while production demonstrates a weaker positive relationship. These insights provide policymakers with actionable strategies to stabilize prices, improve productivity, and ensure food security across the region.

Rice Quality Identification Based on Gas Sensors and Neural Networks

Moh Hanif Mubarok (INSTITUT TEKNOLOGI SEPULUH NOPEMBER, Indonesia); Muhammad Rivai (Institut Teknologi Sepuluh Nopember, Indonesia); Totok Mujiono (Institute Technology Sepuluh Nopember, Indonesia)

Rice is one of the primary food commodities. The quality measurement of rice is mostly still conducted manually, which is prone to errors due to human visual limitations and examiner subjectivity. Post-harvest rice continues to undergo respiration processes driven by microbial activity, leading to deterioration during storage. This study developed an electronic nose system capable of identifying rice quality. The system utilizes MQ2, MQ135, and TGS2602 gas sensors. The quality of rice can be assessed by analyzing the CO_2, O_2, and VOC gas patterns during storage. A learning process was conducted to recognize these patterns using the Backpropagation Neural Network (BPNN). Experimental results and sensor testing indicated that this method can accurately identify both good and poor quality of rice with an accuracy of 97%. The sensor device was also tested on rice samples packaged with Modified Atmosphere Packaging (MAP), including the addition of CO_2, N_2, vacuum, and humidity.

Bus Arrival Time Prediction Through Single-Layer LSTM and DTG Data Preprocessing

Gaon Cheon (Sun Moon University, Korea (South)); Seong-je Cho (Dankook University, Korea (South)); Youngsup Hwang (Sunmoon University, Korea (South))

Accurate bus arrival time prediction is essential for optimizing passenger travel plans and improving the efficiency of public transportation systems. This study utilizes a single-layer Long Short-Term Memory (LSTM) model to analyze the route data of Bus No. 13 in Cheonan, South Korea. The model maintains a simple structure while providing efficient and reliable predictions suitable for practical applications. The study also introduces a preprocessing pipeline that effectively leverages digital tachograph (DTG) data, which are challenging to process, to construct a high-quality dataset. This preprocessing approach enables precise arrival time predictions at all stops. Experimental results demonstrate that the single-layer LSTM model achieves comparable accuracy to more complex models, such as multi-layer LSTM or Transformer-based architectures, while significantly reducing the number of parameters and computational costs. This study highlights that a simple LSTM can achieve competitive performance, offering a practical contribution to developing scalable and robust public transportation systems.

A Pyramidal Model of Channel-Coordinates Attention for Medical Image Recognition

Zhao Tian Shuai (Dongmyung University, Korea (South)); Hyunsik Ahn (Tongmyoung University, Korea (South))

As the depth of convolutional neural networks (CNNs) increases, it can lead to the loss of features for small objects, and CNNs are unable to capture the long-term dependencies of features. Based on this, a pyramidal model of channel-coordinates attention is proposed. This model incorporates a channel-coordinate parallel fusion attention mechanism, which is embedded into the skip connection path of ResNet, forming a residual module based on the channel-coordinate parallel fusion attention mechanism. This enables the network to learn long-range feature dependencies and addresses the gradient vanishing problem in deep neural networks. The residual module with the channel-coordinate parallel fusion attention mechanism is then embedded into the deep CNN, replacing traditional convolutional modules, and using the pyramid model to fuse multi-depth features, thereby solving the problem of small object feature loss. Experimental results on the RUNA16 dataset demonstrate that the proposed attention model is feasible and has significant advantages.

Personalized AI-Driven Smart Home Solutions Integrating User Behavior Recognition and Energy Efficiency

Myeong-Im Jeon (GangneungWonju National University, Korea (South)); Moon-Sik Kang (GangneungWonju Nat'l University, Korea (South))

This paper introduces the design of an AI-based smart home system that integrates advanced user behavior recognition technology to deliver personalized and optimized services. Personalized services are recognized as a vital element in maximizing the functionality and value of smart home systems, particularly for individuals requiring special assistance, such as the elderly or people with disabilities. The proposed system utilizes advanced data analysis techniques, including behavior prediction and preference modeling, to provide tailored solutions that adapt dynamically to user needs. Performance evaluations highlight the system's effectiveness in enhancing user convenience, optimizing energy management with a 15% improvement in efficiency, and delivering adaptive, user-centered functionalities, demonstrating its potential to redefine smart home technologies.

AI-Based Data Transmission Scheduling Algorithm Incorporating Extreme Cold Environmental Factors

Ari Hwang, Soo-Hyun Park and Sun-Ho Yum (Kookmin University, Korea (South)); Dongjin Yoon (Office of Technology Development and Service of Korea Polar Research Institute, Korea (South)) and Soo-Hyun Park (Kookmin University, Korea (South))

The extreme cold environment poses significant challenges to data transmission due to low temperatures and high humidity. This study analyzes the effects of environmental factors (temperature, humidity) on data transmission performance and proposes an AI-based data transmission scheduling algorithm. The proposed algorithm integrates RSSI with environmental variables to improve transmission success rates and reduce transmission time while prioritizing critical data for enhanced reliability. Simulation results demonstrate the model's capability to shorten transmission time and increase success rates, proving its adaptability to environmental changes. Future work will involve enhancing model performance using real-world extreme cold environment data and validating the proposed model through field experiments.

Delay Tolerant Network for Multi-Modal Underwater Communication

Sun-Ho Yum (Kookmin University, Korea (South)); Dongjin Yoon (Office of Technology Development and Service of Korea Polar Research Institute, Korea (South)); Ari Hwang and Soo-Hyun Park (Kookmin University, Korea (South))

This paper presents the design and implementation of delay/disturbance tolerant network (DTN) technology to operate in a short-range underwater communication environment. It describes the need to apply DTN technology as a means to ensure the reliability of underwater information delivery in unstructured communication environments where it is difficult to improve the accuracy of channel models. To combine this with an underwater hybrid software-defined modem (UHSDM) applying multimodal underwater communication (MM-UWC) technology, the DTN7, open source project that implements the best international technical standards for DTN technology, was analyzed, and a DTN for UHSDM was designed and implemented for software matching. The researchers conducted experiments to verify the store-and-forward function, which is the core function of DTN, and confirmed that reliable application message transmission is possible even underwater.

A Study on Traceability Management DApp Development on Hedera Blockchain Platform

Kwangman Ko (Sangji University, Korea (South)); Hanyong Choi (Shinhan University, Korea (South)); Byung-Suk Seo (Sangji University, Korea (South)); Sung-Jun Park (Sungkyul University, Korea (South)); Dong-Sik Kim and Jung-Hwan Ko (Inha Technical College, Korea (South))

In recent years, the demand for traceability in supply chains, product provenance, and asset tracking has surged, particularly in industries such as pharmaceuticals, food, logistics, and luxury goods. Blockchain technology, with its immutability and transparency features, has emerged as a powerful tool for solving these challenges. Among the various blockchain platforms available, Hedera Hashgraph stands out due to its unique consensus algorithm, high throughput, and low latency. This paper explores the development of a decentralized application (DApp) focused on traceability, utilizing the Hedera platform. We investigate the platform's architecture, performance metrics, and the benefits of leveraging Hedera's capabilities in creating an efficient, scalable, and secure traceability solution. The paper also provides a detailed guide on how to build a traceability DApp on Hedera, discussing key design considerations, smart contract implementation, and integration with external systems.

Electronic Document Forgery Detection Based on Signal Energy Change

YongSoo Choi (Shinhan University, Korea (South))

In this paper, we aim to present the possibility of detecting forgery and alteration through basic experiments on the development of forensic technology for detecting forgery and alteration of electronic documents, among digital documents.

Low-Power Wireless Communication Module for Wireless Power Transfer and RF Energy Harvesting

Gyeongdeok Ju (Hanbat National University, Korea (South)); Jung Ick Moon (Electronics and Telecommunications Research Institute, Korea (South)); Hosun Chung (Tec-ahead Inc., Korea (South)); Young-Bae Jung (Hanbat National University, Korea (South))d Salah Ud Din (Hongik University, Sejong, Replulic of Korea, Korea (South)); Byung-Seo Kim (Hongik University, Korea (South))

This paper proposed a battery-free wireless communication module using ambient radio waves which are signals such as Wi-Fi, terrestrial DTV or RF signals for wireless communication services present in the environment, which are backscattered to enable ultra-low-power communication. The proposed structure mainly composed of an energy harvesting circuit using ambient RF signal and an on/off keying communication function that can transmit simple information data using the input signal. The research involved creating a hardware prototype and validating its performance in real-world settings, demonstrating the potential for implementing low-power IoT sensors and their practical applications.

Deep Learning-Based Real-Time Flood Detection Using a Dynamic Virtual Baseline

Tara Kit, Kimsay Pov and Youngsun Han (Pukyong National University, Korea (South))

A flood is a natural disaster that can cause significant damage to nearby affected areas. This natural phenomenon not only results in destruction but also incurs financial losses, damages goods and properties, and, most critically, endangers human lives. It is a global issue that requires proactive solutions to minimize losses and better prepare for such events. This paper proposes a real-time flood detection system using a custom-trained Yolov8 segmentation model with a dynamic virtual baseline to determine flood thresholds. Enhanced preprocessing and data augmentation enable precise identification of water surfaces crossing the baseline. A dynamic algorithm is applied to detect areas of interest, enabling the system to accurately identify flooding. The model achieved an AP of 0.919 for bounding box detection and 0.910 for mask segmentation with 89% water surface classification accuracy, highlighting its effectiveness.

Thursday, January 16 6:00 – 8:00 p.m.

Banquet

Havana Nha Trang Hotel

Friday, January 17 9:30 a.m.– 12:00 p.m.

Birds of a Feather

Session Room A, B, C

Friday, January 17 01:00 – 04:00 p.m.

ICGHIT Industry-Academic Meeting

Session Room A, B, C

Saturday, January 18 10:00 a.m.– 12:00 p.m.

ICGHIT Committee Meeting

Session Room A

http://www.bonc.co.kr

AI로 만들어가는
더 나은 세상

(주)비온시이노베이터가 한걸음 앞서 나아가겠습니다.

빅데이터
– 빅데이터 플랫폼 구축
– 데이터 자원 확보
– 데이터 품질 관리
– 정형/비정형 데이터
– 시각화

클라우드
– NHN 등 Cloud 파트너사
– G-Cloud Service
– Public Cloud Service
– Private Cloud Service
– Cloud Consulting

AI플랫폼
– 알고리즘을 통한 AI구현
– 머신러닝
– 데이터 라벨링
– AI서비스 개발

시스템통합
– 전문영역 SI (공공 부분)
– 시스템분석, 설계 및 개발
– 패키지소프트웨어 기반 시스템 개발
– 시스템관리, 운영 및 유지보수
– H/W, S/W 통합구축 및 관리

네트워크통합
– 네트워크 통합구축 및 유지관리
– 보안 환경 구축 및 유지관리
– 네트워크/보안 상태 점검 서비스
– 인프라 고도화 컨설팅

IT아웃소싱
– IT아웃소싱 컨설팅
– Network인프라운영서비스
– Application서비스
– 재해복구 · 보안관리서비스
– On-Site서비스

b BonC Innovators
(주)비온시이노베이터

대표전화 062)371-9339 **팩스** 062)371-9449
광주본부 광주광역시 북구 추암로 69(대촌동 959-51)
본 사 전라남도 나주시 그린로 229, 5층 501, 502호(빛가람동, 그린타워)