History-Aware Adaptive Route Update Scheme for Low-Power and Lossy Networks

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***Abstract*—Sudden link failure degrades the network performance in the Internet of Things, which comprises energy-constrained sensors. At the network layer, the trickle timer algorithm is responsible to propagate the route updates across the network. The trickle timer manages the transmission of control messages by increasing the control message transmission frequency after detecting inconsistency in the network, and if the network is consistent, it reduces the transmission rate. The transmission rate is regulated by maintaining a redundancy coefficient parameter. Optimizing the control traffic transmission is an active research area that aims to reduce the network traffic overhead and power consumption, which directly affects the network lifetime. The control traffic can be optimized more efficiently by optimal selection of redundancy coefficient value. This article proposes a History-Aware Adaptive Trickle (HAAT) algorithm. HAAT algorithm selects the optimal redundancy coefficient value based on the history of DODAG information object transmissions and suppression corresponding to every redundancy coefficient value. The simulation results indicate that the proposed HAAT algorithm improves the network performance compared to other state-of-the-art mechanisms.**

***Index Terms*—Trickle algorithm, Internet of Things (IoT), RPL, Low-power and lossy networks (LLNs)**

I. Introduction

Internet of Things (IoT) is a communication paradigm which integrates physical and the cyber-world. The use of IoT devices for various applications has increased significantly. Billions of IoT devices provide smart health tracking, automated industries, smart cities, and autonomous mobility. The connected devices are equipped with limited computational and energy resources to provide sensing and communication capabilities. The communication of these devices is supported by light-weight protocols. For example, Internet Engineering Task Force (IETF) designed the Routing Protocol for Low-Power and Lossy Network (RPL) to support network layer operation of these tiny devices. [1] [2].

RPL is a proactive distance vector routing algorithm [3]. It constructs a Destination Oriented Directed Acyclic Graph (DODAG) of the network using different types of routing metrics and objective functions. DODAGs are built using three distinct control message types, i.e. DODAG Destination Advertisement Object (DAO), DODAG Information Object (DIO), and DODAG Information Solicitation (DIS) [4]. The major overhead is due to DIO messages, since it is always a broadcast message. The overhead of DIS and DAO is negligible because DAO message is forwarded up to the sink only, and DIS messages are sent only at the beginning to find the neighbor nodes in order to solicit a DIO message. RPL targets to reduce the energy and power consumption of the nodes as well as to reduce the convergence time of the network. Energy consumption is greatly influenced by the DIO transmission rate of the node. Thus, decreasing the number of DIO control messages is an important factor to reduce energy consumption. However, at the same time, DIO messages are important for faster network convergence and rapid resolution of network inconsistencies.

The trickle-timer is designed to minimize the control message overhead while building the DODAG hierarchy. Due to its scalability and reliability, the trickle-timer is the focus of many recent research works in the area of IoT. The trickle timer algorithm increases the DIO transmission rate when the network is inconsistent. Otherwise, it decreases the DIO transmission rate by exponentially increasing the sending window size [5].

A short-listen period is among the major challenges of trickle-timer algorithm. In the short-listen period problem, some of the nodes may start sending control messages soon after the beginning of the interval, while some of the nodes are not synchronized yet. To achieve synchronization among the nodes, a listen-only period is introduced. Once all the nodes are synchronized, then broadcast of DIO messages starts. Load balancing of control messages among nodes in the network is another challenge that degrades the network lifetime. The load-balancing problem can be potentially solved by implementing a fair broadcast suppression mechanism.

A recent proposal introduces a trickle-timer variant known as Drizzle algorithm [6]. Drizzle algorithm achieves load balancing of DIO transmissions among nodes via a variable, *'s'*. The variable *s* records the total DIO transmissions performed by a node. A node with less DIO transmissions in the past is assigned with a higher probability to transmit a DIO in future intervals and vice-versa. Moreover, it also eliminates the listen-only duration from the start of each interval. This results in the fast propagation of DIO messages to the neighbor nodes. Therefore, achieving a quick network convergence time. However, on discovering an inconsistency, the redundancy

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coefficient $'k'$ value is not changed while moving to minimum interval I_{min}. This may lead to DIO suppression and resulting in additional delay in inconsistency resolution. Moreover, Drizzle continuously alters its redundancy coefficient k and never converges to an optimal k [7]. Therefore, this article proposes a History-Aware Adaptive Trickle (HAAT) algorithm to solve these issues. HAAT selects an optimal redundancy coefficient k value based on the history of DIO transmissions and DIO suppression corresponding to every redundancy coefficient value k.

The remainder of the paper is structured as follows. Section II briefly discuses the related research work, while section III describes the proposed HAAT algorithm. Section IV outlines the performance evaluation of proposed HAAT algorithm, followed by Section V that summarizes the paper.

II. Related research work

Trickle timer algorithm in the RPL protocol is designed to broadcast routing information to the neighboring nodes. The network is created using three type of control messages namely DIS, DAO, and DIO. Trickle timer [5] maintains the transmission frequency of DIO messages. It divides the time into intervals, and on detecting any inconsistency in the network, it increases its DIO message transmission rate by reducing the interval length, otherwise decreases DIO transmission rate by exponentially increasing the interval length. However, in this algorithm, the authors do not cater for the load balancing of control message transmission between the nodes. Besides, the energy consumption is also higher because of non-adaptive redundancy constant selection.

Trickle-F: A fair broadcast suppression is proposed in [7] which takes the load balancing issue into consideration. It aims to optimize the load balancing by maintaining a variable s. The variable s counts the total number of DIO suppressions performed in an interval. In the upcoming interval, the random time t_{Timer} is selected between $[I/2^{(s+1)}, I/2^s]$. Node with larger s value is assigned with a higher probability to transmit their DIO message resulting in fair broadcast suppression.

Optimized trickle is proposed in [8] which tries to quickly resolve the inconsistencies by eliminating the listen only period. On detection of an inconsistent DIO message, the interval duration, *I* is reset to I_{min} and a random time t_{Timer} is chosen between $[0, I_{min}]$ instead of $[I/2, I]$ for normal intervals. Thus, resolving the inconsistencies rapidly.

The adaptive trickle presented in [9] mainly aims to adaptively select the redundancy constant k. Each node selects its own redundancy constant k adaptively as per local network density. Ideally, the dense network should have higher values of k, while on the other hand sparse networks should have a lower value of k. Redundancy constant k is calculated using a redundancy counter c function i.e. $k = f(c)$.

Enhanced-Trickle (E-Trickle) [10] on the other hand, removes the listen-only period in order to decrease the convergence time of the network. E-Trickle also resets its redundancy counter c when t_{Timer} expires. It chooses t_{Timer} in between $[0, I]$ instead of $[I/2, I]$. Consequently, this improves the efficiency of RPL in terms of quicker convergence time, but the energy consumption remains unchanged.

Energy-Aware Adaptive Trickle Timer (EAAT) algorithm [11] increases/decreases the rate of DIO transmission per the residual energy (RE) and future energy (FE). EAAT aims to prolong the network life time by reducing the rate of DIO transmission for nodes having less remaining energy.

Trickle-plus algorithm is proposed in [12]. A network can either have a lesser energy consumption or have higher convergence time and vice-versa. Trickle-plus aims to find optimal values of energy consumption and network convergence time. Trickle-plus assigns the new interval size via $2 * I * SF$, while SF (Shift Factor) specifies the count of interval doublings that can be skipped and still have a quicker network convergence time while keeping energy consumption to a minimum.

The redundancy constant k selection significantly affects the control overhead ratio and energy consumption. A mathematical analysis presented in [13] which concludes that the selection of a single redundancy constant k by all the nodes in the default trickle timer results in increased DIO transmissions for nodes having fewer neighbors. [9] highlights the vagueness regarding the redundancy constant k configuration. For example, Trickle RFC [5] recommends a value between 1 and 5 for k. Another RPL RFC [2] specifies that the default value for k should be 10. A recent IETF draft [14] recommends the value for k in between 3 and 5. RFC for the multicast protocol of LLNs recommended value for k as 1 in [15]. These contrasting recommendations shows that the optimal configuration of redundancy constant k is greatly dependent upon the application.

III. Proposed Algorithm

In this paper, we propose a HAAT algorithm. HAAT aims to optimize the performance of Drizzle algorithm by dividing its operation into two phases, namely, exploration and exploitation. In exploration phase, HAAT saves the number of DIO transmissions and suppressions corresponding to every redundancy coefficient value k. Whereas, in exploitation phase, HAAT utilizes its historical information for the selection of redundancy coefficient k value that results in maximum DIO suppressions or transmissions in the past. For example, when HAAT discovers an inconsistency in the network, it resets its current interval to minimum length by assigning I_{min} to I. Additionally, HAAT also utilizes history-based information and selects redundancy constant k that results in highest number of DIO transmissions in the past. Which eventually leads to quick resolution of network inconsistencies and consequently leads to a higher packet delivery ratio. On the other hand, when there is no inconsistency in the network the HAAT selects the redundancy coefficient k value that results in maximum DIO suppressions in the past which leads to reduce control overhead and less total network power consumption.

Table-I describes the variables used in the proposed algorithm, while the pseudo-code of HAAT is outlined in Algorithm 1. The detailed description of the HAAT algorithm is explained in the following steps.

TABLE I: Key Notations

Variables	Description
s	Counts the total DIO transmissions performed till next reset to I_{min}
n	Counts the number of intervals passed till the last reset to I_{min}.
c_k	Records the current value of redundancy coefficient.
I	Records current interval length. It is always between I_{min} and I_{max}.
t_{Timer}	A random time to transmit DIO in the current interval.
c	Counts the total consistent DIO received inside the current interval.
$History\,[k][0]$	Records the number of DIO transmissions performed for every value of redundancy coefficient k.
$History\,[k][1]$	Records the number of DIO suppressions performed for every value of redundancy coefficient k
$exploration$	The percentage of time algorithm explores the different values of redundancy coefficient c_k .
$exploitation$	The percentage of time algorithm exploits the saved history record of DIO transmissions and suppressions against each values of redundancy coefficient c_k.
I_{min}	The smallest interval size.
I_{max}	The largest interval size.
k	Holds the number of consistent messages that a node must receive to suppress DIO transmission.
t_{rand}	Random number to determine that algorithm explores or exploits in the current interval.

A. Initialization

HAAT initiates its operation by initializing its current interval I to I_{min}, s and c to zero. It also sets n to 1 as this is the first interval. Moreover, during DODAG initialization it sets $rFlag$ to 1. Finally, it initializes the current redundancy coefficient value c_k with default redundancy constant value k.

B. Begin Interval

HAAT selects a random time t_{Timer} for DIO transmission as follows,

$$t_{Timer} = [s \times I/n, (s+1) \times I/n] \quad (1)$$

C. Consistent DIO Transmission Received

On receiving a consistent DIO message, the node increments its redundancy constant c by 1.

D. Inconsistent DIO Transmission Received

When an inconsistency is detected, the node resets I to I_{min} in order to increase its DIO transmission rate. HAAT also resets the total number of DIO messages transmitted s and redundancy constant c to zero. The $rFlag$ is set to 1 if any of the following condition resulted in inconsistency. Otherwise it sets the $rFlag$ to zero.

- *initDODAG:* Root started the construction of DODAG
- *JoinDODAAG:* Node joins a DODAG
- *GRepair:* Root initializes the global repair

Algorithm 1 History-Aware Adaptive Trickle (HAAT) Algorithm

```
1:  procedure INITIALIZATION
2:      c_k ← k, I ← I_min, s ← 0, n ← 1, c ← 0, rFlag ← 1, History ← 0
3:  procedure NEW INTERVAL
4:      calculate t_Timer via Eq. (1)
5:  procedure CONSISTENT TRANSMISSION RECEIVED
6:      c = c + 1
7:  procedure INCONSISTENT TRANSMISSION RECEIVED
8:      s ← 0, I ← I_min, n ← 1, c ← 0
9:      if joinDODAG, InitDODAG, Grepair then
10:         rFlag = 1
11:     else rFlag = 0
12: procedure t_Timer EXPIRED
13:     select a random number in the range [0,1] (t_rand)
14:     to explore or exploit
15:     if t_rand <= explore then
16:         if c < c_k then
17:             Transmit DIO, s+=1, History[c_k][0]+=1,c_k-=1
18:             never allow c_k to go beyond 0
19:         else
20:             Suppress DIO,History[c_k][1]+=1, c_k+=1,
21:             never allow c_k to exceed the value of k
22:     else
23:         if I = I_min then
24:             Select c_k value from history which resulted
25:             in highest DIO transmissions in the past
26:         else
27:             Select c_k value which resulted in highest DIO
28:             suppressions in the past.
29: procedure INTERVAL END
30:     if rFlag = 1 then
31:         I ← I × 2
32:         if I > I_max then
33:             I ← I_max
34:     else
35:         I ← I_max
36:     n+ = 1
```

E. t_{Timer} Expires

When t_{Timer} expires, the HAAT generates a random number t_{rand} between 0 to 99 and if t_{rand} is less than or equal to exploration then algorithm explores the different values of c_k. i.e. if consistency counter c is less than redundancy coefficient c_k then broadcast the DIO message and accumulate this DIO transmission against current value of c_k in history table and decrements c_k by one. On the other hand if consistency counter c is not less than redundancy coefficient c_k, then suppress the DIO transmission and accumulate this suppression against current value of c_k in history table and increment c_k by one.

Similarly, when t_{rand} is greater than exploration then HAAT exploits the previously saved history data in history table and

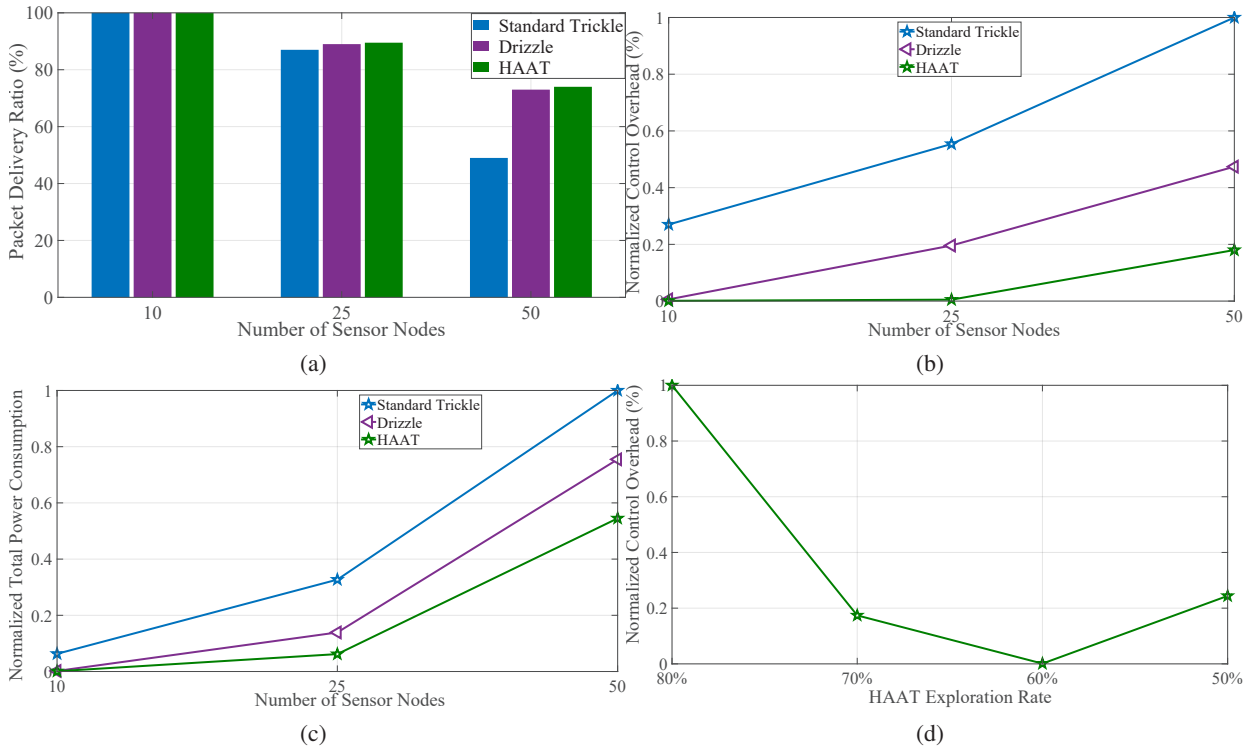

Fig. 1: (a) PDR; (b) Control overhead (%); (c) power consumption (Normalized); (d) Exploration rates and their effect on HAAT performance

finds the c_k value that results in maximum DIO transmissions/suppressions in the past and assign this value to c_k. for example when I is equal I_{min} then HAAT selects c_k value which has highest number of DIO transmissions in the past.This enables HAAT to resolve inconsistencies quickly. While HAAT selects the c_k value which has highest DIO suppressions in the past if I is greater than I_{min} this enables HAAT to avoid unnecessary transmissions of DIO messages which leads to lower control overhead lesser total network power consumption.

F. Interval End

HAAT doubles its interval length if the $rFlag$ is set to one. Otherwise, it sets it directly to maximum interval length I_{max}. Similarly, HAAT increases the interval counter n by one and re-executes from step B.

The computational complexity of HAAT depends on the value of redundancy coefficient k. Larger k values will have larger history table and more computational time will be consumed to process that history table. Thus, the computational complexity of HAAT is $O(k)$. Regarding space complexity, HAAT consumes 900 bytes of extra ROM as compared to Drizzle. Moreover, when redundancy coefficient k value is set to five HAAT requires 26 bytes of extra RAM for efficient operation compared to Drizzle.

IV. Performance Evaluation

The proposed algorithm is implemented in Cooja emulator which is specially designed for low-power and lossy devices. [16]. The detailed analysis of performance assessment results are presented in this section. The simualtion results of HAAT algorithm are compared with Drizzle algorithm and the default trickle timer. The details related to the simulation parameters are given in Table-II. Simulations are carried out for variable network sizes including 10, 25 and 50 nodes. A loss ratio of 0%,10% and 20% is applied 10, 25 and 50 nodes respectively to study the behaviour of proposed algorithm under different loss ratio and variable network sizes.

Figure.1a represents the PDR comparison of proposed algorithm. The result shows that HAAT is able to achieve highest PDR, due to history based data. On reception of any inconsistency, HAAT selects k value that resulted in highest DIO transmission in the past. Which consequently leads to immediate resolution of inconsistencies in the network and achieves a higher packet delivery ratio.

Figure.1b shows the control overhead of the proposed algorithm in comparison to two other variants of trickle timer. Results indicate that as the network size increases, control overhead also increases. The default trickle algorithm has highest control overheads due to its non-adaptiveness in the selection of optimal redundancy constant. Drizzle performs better in reducing control overhead because of its nature to adapt k value according to the local environment of a node. However, HAAT is able to achieve the lowest control overheads because of selection of the redundancy constant that has resulted in more number of DIO suppressions in the past.

Figure.1c shows the comparison of total power consumption

TABLE II: Simulation Parameters

Name	Values
Network size	10, 25, 50
I_{min} - I_{max}	2^{10} - 2^{20}
Redundancy constant k	5
Simulation time	one hour
Loss ratio	0, 10, 20
Data transmission rate	01 packet per 40s

of proposed algorithm compared to default trickle and Drizzle algorithms. The total power consumption increases as the network size increases. HAAT consumes less power because it reduces the unnecessary transmission of DIO messages by selecting the redundancy coefficient value that resulted in highest DIO suppressions in the past.

Performance of HAAT algorithm largely depends on exploration rate i.e. higher exploration rate allows HAAT to explore more and results in better understanding of environment. As the exploration rate increases, the exploitation time also decreases. Therefore, after a certain point, increase in the exploration rate results in performance degradation.

Figure.1d shows the performance of HAAT under different exploration rates. Results show that as the exploration rate increases beyond 70% the control over head increases drastically. The performance improves with increase in exploration time, as exploitation utilizes the history table in selection of optimal redundancy coefficient k. Moreover, as the exploration rate decreases beyond 60%, performance starts to degrade as well due to inadequate exploration. Exploration rate in the range from 60% to 70% provides a good balance between exploration and exploitation rates. The networks with less mobility can set the smaller exploration rate of 60% and can still achieve good performance. The networks with high mobility can set their exploration rate to 70%, because they need more time to understand the environment.

V. Conclusion

In this paper, a history-aware adaptive trickle algorithm is proposed for LLNs. HAAT builds the history of past DIO transmissions and DIO suppressions corresponding to every redundancy coefficient value of k. Based on the historical information, HAAT can select the optimal redundancy coefficient value. We have validated the performance of HAAT by performing simulations in Cooja under different network sizes. The results indicates that HAAT outperforms the default trickle and Drizzle algorithms in terms of lower control overheads and consumes less total power along with achieving a higher PDR. In the future, we plan to apply federated reinforcement learning techniques to manage DIO transmission more intelligently.

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Message from the Chairs

With great pleasure, we would like to welcome you to the 12th International Conference on Information and Communication Technology Convergence (ICTC 2021) being held in Jeju Island, Korea.

ICTC 2021 is one of the major international conferences in the area of ICT convergence organized by the Korean Institute of Communications and Information Sciences (KICS) with technical co-sponsorship of IEEE Communication Society and IEICE Communications Society, and patronized by leading ICT companies, organizations, and government including Ministry of Science and ICT, ETRI, KOFST, Samsung Electronics, LG Electronics, SK Telecom, KT, LG Uplus, Huawei, Qualcomm, Ericsson-LG, FRTek, YOUNGWOO DIGITAL, Netvision Telecom, INNOX Advanced Materials, Jeju CVB, Korea Tourism Organization, and ICT Convergence Korea Forum.

ICTC 2021 features an extremely rich program with the main theme of "Beyond the Pandemic Era with ICT Convergence Innovation". The attendees will have the opportunity to associate with the world's most distinguished industry leaders, researchers, government officials, and academia professionals in the areas of next mobile networks, B5G/6G issues and challenges, AI-based technologies for networking and communications, new waves and spectrum, future ICT services and their enablers, computing-networking convergence, quantum and neural technology, and new ICT paradigms and concepts.

During ICTC 2021, distinguished keynote speeches will be delivered by highly prominent experts from University of Waterloo (President Elect of IEEE ComSoc), Instituto de Telecomunicações, Samsung Electronics, LG Electronics, Qualcomm, and ETRI. The industrial experts of Huawei, KTsat, CEA-LETI, LG Uplus, DTCP, KT, and Samsung Electronics will deliver their talks. Moreover, special experts of POSTECH, George Mason University, Hanyang University, Kookmin University, UNSW Sydney, ETRI, KAIST, University of California San Diego, Samsung Research, SUNY Korea, UNIST, Pennsylvania State University, Keio University, Yonsei University College of Medicine, University of Oregon, and DGIST will give talks in different sessions. The technical program will also include presentations of invited and regular papers from diverse groups all around the world on the topics of AI/ML, B5G/6G, WLAN, IoT, maritime & military communications, information & communication theory, network virtualization and future internet, applications for ICT convergence, smart media & broadcasting, energy internet, smart grid, big data & smart computing, signal & image processing, and vehicular information & communications

We cordially invite you to join us in Jeju Island from October 20 to 22 for this great ICT event and enjoy Jeju, known as the "Island of the Gods". We especially recommend you to visit and enjoy the natural World Heritage Site Jeju Volcanic Island and Lava Tubes.

We look forward to seeing you in Jeju Island and your participation in the ICTC 2021!

Younghan KIM
KICS President

Seung Chan Bang
Organizing Committee Chair

Jae-Hyun Kim
Technical Program Committee Chair

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Symposia Program Committee Chair

Program at a Glance

October 20th (Wednesday), 2021									
Time	**Mara Room**	**Biyang Room**	**Udo Room**	**Chuja Room**	**Ramada Ballroom 2**	**Ramada Ballroom 3**	**Ramada Ballroom 4**	**Ramada Ballroom 1**	**Lobby**
08:30~10:10 (100min)	**Session 1A :** Artificial Intelligence and Machine Learning I	**Session 2A :** 5G, 4G, WLAN I	**Session 3A :** Wireless & Mobile Communication Systems I	**Session 4A :** Internet of Things	**Session 5A :** Big Data and Smart Computing	**Session 6A :** Mobile Cloud Computing & Communication Systems and Applications	**Session 7A :** Encryption and Security for ICT Convergence	**SPC Special Session I :** Towards 6G: Enabling Technologies	**Poster 8A :** Artificial Intelligence and Machine Learning I
10:10~10:30	Coffee Break								
10:30~11:20 (50min)	**Plenary Session I : Keynote Speeches and Opening Ceremony** (Ramada Ballroom1) • Opening Address 1 : Prof. Young-Han Kim, President of KICS • Congratulatory Address 1 : Prof. Hisaya HADAMA, President of IEICE-CS • Congratulatory Address 2 : Prof. Xuemin (Sherman) Shen, President Elect(Professor), IEEE ComSoc(University of Waterloo), Canada • Keynote Speech 1 : Dr. Xuemin (Sherman) Shen, President Elect(Professor), IEEE ComSoc(University of Waterloo), Canada, "6G: Holistic Network Virtualization and Intelligence"								
11:20~12:40	Lunch (1F Tammora, Blackstone)								
12:40~14:10 (90min)	**Industrial Session I : Beyond 5G for the Post-Pandemic Era** (Ramada Ballroom1) • Invited Talk 1 : Dr. Zukang Shen, Director of Wireless Standards, Huawei, China, "Evolution of 5G Standards Toward 2025: 5G_Advanced" • Invited Talk 2 : Dr. Kevin K. Choi, CTO, KTsat, Korea, "Connectivity and SDG, the Role of Space Segment" • Invited Talk 3 : Dr. Calvanese Strinati Emilio, CEA-LETI, "6G Networks: Beyond Shannon Towards Semantic and Goal-Oriented Communications"								
14:10~14:30	Coffee Break								
14:30~16:10 (100min)	**Session 1B :** Artificial Intelligence and Machine Learning II	**Session 2B :** 5G, 4G, WLAN II	**Session 3B :** Wireless & Mobile Communication Systems II	**Workshop I :** Quantum Internet Technology	**Workshop II :** Intelligent and Immersive Content Technology	**Workshop III :** The Workshop on Satellite Information Convergence Application Service	**Workshop IV :** The Workshop on Intelligent 6G communication system	**SPC Special Session II :** Computer-Networking Convergence	**Poster 8B :** Applications for ICT Convergence
16:10~16:30	Coffee Break								
16:30~17:50 (80min)	**Plenary Session II : Keynote Speeches** (Ramada Ballroom1) • Keynote Speech 2 : Prof. Rui Luis Aguiar, Head of Networks and Services, Instituto de Telecomunicações, "Challenges and Views for 6G Research : an European View" • Keynote Speech 3 : Dr. Juho Lee, Fellow, Samsung Research, Samsung Electronics, "Evolution from 5G to 6G"								
17:50~18:20	Coffee Break								
18:20~20:20 (120min)	**Banquet** (Ramada Ballroom1) • Opening Address 1 : Seung Chan Bang, Organizing Committee Chair • TPC Report : Jae-Hyun Kim, TPC Chair • SPC Report : Moon-Sik Lee, SPC Chair • Awards Ceremony • Banquet Course								

Program at a Glance

October 21st (Thursday), 2021

Time	Mara Room	Biyang Room	Udo Room	Chuja Room	Ramada Ballroom 2	Ramada Ballroom 3	Ramada Ballroom 4	Ramada Ballroom 1	Lobby
08:30~10:10 (100min)	**Session 1C :** Artificial Intelligence and Machine Learning III	**Session 2C :** 5G, 4G, WLAN III	**Session 3C :** Wireless & Mobile Communication Systems III	**Workshop V :** The 2nd Workshop on Korea University AI Engineering Research (KU-AIER)	**Session 5C :** Internet of Things II	**Workshop VII-A :** The 3rd Joint International Workshop on Military Informatics (Emerging Technology)	**Workshop VIII-A :** The 4th Workshop on Advances in Convergence of ICT and Brain Science	**SPC Special Session III :** From Mobility to Localization: Recent Innovations	**Poster 8C :** 5G, 4G, WLAN
10:10~10:30	Coffee Break								
10:30~12:10 (100 min)	**Session 1D :** Signal and Image Processing	**Session 2D :** ICT Communication	**Workshop VI :** The workshop on Information and Communication Strategic Technology for Industry Convergence	**Workshop IX :** Sub-THz/THz Communication for 6G	**Workshop X :** 5G+ and 6G R&D in ETRI	**Workshop VII-B :** The 3rd Joint International Workshop on Military Informatics (IoT for Military and Logistics)	**Workshop VIII-B :** The 4th Workshop on Advances in Convergence of ICT and Brain Science	**SPC Special Session IV :** New Paradigms and Concepts	**Poster 8D :** Wireless & Mobile Communication Systems
12:10~13:20	Lunch (1F Tammora, Blackstone)								
13:20~15:00 (100min)	**Industrial Session II : A Broader View of ICT Convergence for New Normal** (Ramada Ballroom1) • Invited Talk 4 : Mr. Kahng Jong-Oh, Vice President, LG U plus, "5G will be a Key Driving Force in the Upcoming C-ITS Era" • Invited Talk 5 : Mr. Dillon Seo, Country Manager, DTCP Korea, "Rising of Metaverse" • Invited Talk 6 : Dr. Soonmin Bae, Senior Vice President, KT, "Collaborative R&D Ecosystem for AI Platform" • Invited Talk 7 : Dr. Seungjoo Maeng, Master, Samsung Electronics, "How AI/ML Technology can be used in Mobile Communication Systems"								
15:00~15:30	Coffee Break								
15:30~17:30 (120 min)	**Plenary Session III : Keynote Speeches** (Ramada Ballroom1) • Keynote Speech 4 : Dr. Jilei Hou, Vice President, Qualcomm Technologies, Inc., "Pushing the Boundaries of AI Research" • Keynote Speech 5 : Dr. Byoung-Hoon Kim, Senior VP/Head of Future Technology Center, LG Electronics, "The Road to New Wireless Frontier 2030" • Keynote Speech 6 : Dr. Woo Jin Byun, Assistant VP, ETRI, "Integration of Terrestrial and Non-Terrestrial Networks Towards 6G"								

October 22nd (Friday), 2021

Time	Mara Room	Biyang Room	Udo Room	Chuja Room	Ramada Ballroom 2	Ramada Ballroom 3	Ramada Ballroom 4	Ramada Ballroom 1	Lobby
08:30~10:10 (100min)	**Session 1E :** Vehicular Information and Communication Technologies I	**Session 2E :** Communication Networks and Future Internet Technologies I	**Session 3E :** Internet of Things III	**Session 4E :** Applications for ICT Convergence I	**Workshop XI :** International Workshop on Internet of Energy	**Workshop VII-C :** The 3rd Joint International Workshop on Military Informatics (Military Civil IT Convergence)	**Workshop XII :** 6G Mobile Communication	**SPC Special Session V :** ICT for Social Good	**Poster 8E :** Artificial Intelligence and Machine Learning II
10:10~10:30	Coffee Break								
10:30~12:10 (100min)	**Session 1F :** Energy Internet, Smart Grid Infrastructure and Applications	**Session 2F :** Communication Networks and Future Internet Technologies II	**Session 3F :** SDN and Network Virtualization	**Session 4F :** Applications for ICT Convergence II	**Session 5F :** ICT Services	**Workshop VII-D :** The 3rd Joint International Workshop on Military Informatics (Military communication and Network)	**Session 7F :** Indoor Positioning and Navigation Systems	**SPC Special Session VI :** Expanding the Horizon	**Poster 8F :** Internet of Things

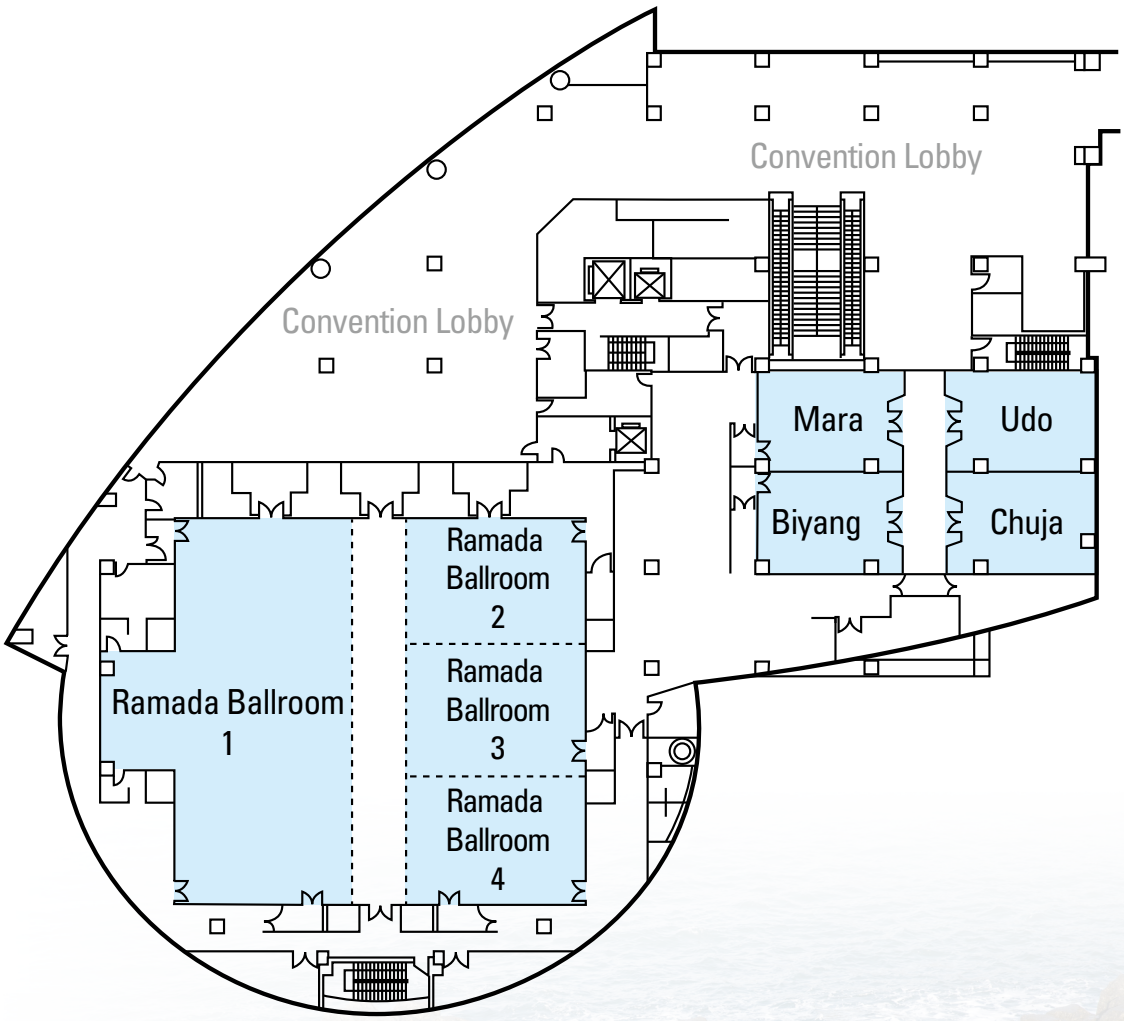
Registration Hours

Oct. 20th (Wednesday) 07:50 - 17:00 | Oct. 21st (Thursday) 07:50 - 17:00 | Oct. 22nd (Friday) 07:50 – 12:00

Session Room Locations

Ramada Plaza Hotel

2nd Floor



Plenary Sessions

October 20th (Wednesday), 2021

Plenary Session I : Keynote Speeches and Opening Ceremony

10:30-11:20 | Ramada Ballroom 1

Chair : Kyunghan Lee (Seoul National Univ., Korea)

Time	Title	Invited Speakers
10:30-11:20	Opening Address	Prof. Young-Han Kim President of KICS
	Congratulatory Address 1	Prof. Hisaya HADAMA President of IEICE-CS
	Congratulatory Address 2	Prof. Xuemin (Sherman) Shen President Elect(Professor), IEEE ComSoc(University of Waterloo), Canada
	Keynote Speech 1 : 6G: Holistic Network Virtualization and Intelligence	Prof. Xuemin (Sherman) Shen President Elect(Professor), IEEE ComSoc(University of Waterloo), Canada

Keynote Speech 1 : 6G: Holistic Network Virtualization and Intelligence

Prof. Xuemin (Sherman) Shen, President Elect(Professor), IEEE ComSoc(University of Waterloo), Canada

Abstract:
Next-generation wireless networks should have scalable network architecture, provide automated network management, and perform intelligent and flexible resource allocation in order to support diversified applications with various quality of service requirements. Through network virtualization and intelligence, this presentation will provide potential solutions to achieve the goal.

Biography:
Xuemin (Sherman) Shen (M'97–SM'02–F'09) is a University Professor with the Department of Electrical and Computer Engineering, University of Waterloo, Canada. His research focuses on network resource management, wireless network security, Internet of Things, 5G and beyond, and vehicular ad hoc and sensor networks. Dr. Shen is a registered Professional Engineer of Ontario, Canada, an Engineering Institute of Canada Fellow, a Canadian Academy of Engineering Fellow, a Royal Society of Canada Fellow, a Chinese Academy of Engineering Foreign Member, and a Distinguished Lecturer of the IEEE Vehicular Technology Society and Communications Society.
Dr. Shen received the Canadian Award for Telecommunications Research from the Canadian Society of Information Theory (CSIT) in 2021, the R.A. Fessenden Award in 2019 from IEEE, Canada, Award of Merit from the Federation of Chinese Canadian Professionals (Ontario) in 2019, James Evans Avant Garde Award in 2018 from the IEEE Vehicular Technology Society, Joseph LoCicero Award in 2015 and Education Award in 2017 from the IEEE Communications Society (ComSoc), and Technical Recognition Award from Wireless Communications Technical Committee (2019) and AHSN Technical Committee (2013). He served as the Technical Program Committee Chair/Co-Chair for IEEE Globecom'16, IEEE Infocom'14, IEEE VTC'10 Fall, IEEE Globecom'07, and the Chair for the IEEE ComSoc Technical Committee on Wireless Communications. Dr. Shen is the President Elect of the IEEE ComSoc. He was the Vice President for Technical & Educational Activities, and Vice President for Publications. Dr. Shen served as the Editor-in-Chief of the IEEE IoT JOURNAL, IEEE Network, and IET Communications.

Plenary Sessions

October 20th (Wednesday), 2021

Plenary Session II : Keynote Speeches

16:30-17:50 | Ramada Ballroom 1

Chair : Jae-Hyun Kim (Ajou Univ., Korea)

Time	Title	Invited Speakers
16:30-17:50	Keynote Speech 2 : Challenges and Views for 6G Research : an European View	Prof. Rui Luis Aguiar Head of Networks and Services, Instituto de Telecomunicações
	Keynote Speech 3 : Evolution from 5G to 6G	Dr. Juho Lee Fellow, Samsung Research, Samsung Electronics

Keynote Speech 2 : Challenges and Views for 6G Research : an European View

Prof. Rui Luis Aguiar, Head of Networks and Services, Instituto de Telecomunicações

Abstract:

The presentation will discuss current challenges for the development of 6G. The presentation will highlight the societal pressures driving innovation inside Europe, and highlight some of the technical challenges that will need to be addressed for reaching the KPIs that we expect to see in the upcoming systems.

Biography:

Rui L. Aguiar (born 1967) received his Ph.D. degree in electrical engineering in 2001 from the University of Aveiro, where he is currently a Full Professor. He has supervised more than than 20 PhD and 100 Master students. He was the founder of the ATNOG research group, an advanced telecommunication research group at the Universidade de Aveiro and is currently co-coordinating a research line in Instituto de Telecomunicações, on the area of Networks. He has been an advisory for the portuguese Secretaria de Estado das Comunicações. He is a Chartered Engineer, a Senior Member of IEEE, and a member of ACM. He is serving as the Portugal Chapter Chair of IEEE Communications Society and has been serving as Steering Board Chair of Networld Europe, the European ETP representing the telecommunications community. As further community engagement, he has served as Technical and General (co)Chair of several conferences (ICNS, ICT, ISCC, Mobiarch, Monami, NTMS, etc). He has more than 500 papers published.

Plenary Sessions

Keynote Speech 3 : Evolution from 5G to 6G

Dr. Juho Lee, Fellow, Samsung Research, Samsung Electronics

Abstract:

Since the start of commercial deployments of 5G communication systems, the mobile industry has been focusing on realization of 5G vision characterized by three representative use cases, i.e., enhanced mobile broadband (eMBB), ultra-reliable and low latency communications (URLLC), and massive machine type communications (mMTC). Following the successful start of 5G deployments, there has been discussion on evolution of 5G. 3rd Generation Partnership Project (3GPP) recently held a workshop to prepare technologies for the evolution to 5G-Advanced.

In parallel to the effort for 5G evolution, we can see that initial consideration about the next generation of mobile communications, i.e., 6G, is already happening. Considering the general trend of introducing new services with higher requirements over different generations of communication systems, it would be natural to expect that 6G technologies need to be developed to envision more advanced services than 5G.

This presentation will introduce the expected plan and candidate technologies for 5G evolution. Further, initial views about vision, requirements, and technologies for 6G will be discussed.

Biography:

Juho Lee is currently a Fellow with Samsung Electronics, where he is leading research and standardization for mobile communications. He joined Samsung Electronics in 2000 and has worked on 3G, 4G, and 5G technologies. He is now leading research for future technologies such as 5G evolution and 6G. He was a vice chairman of 3GPP RAN WG1 from February 2003 to August 2009 and chaired LTE/LTE-Advanced MIMO sessions. He received his Ph.D. degree in electrical engineering from Korea Advanced Institute of Science and Technology (KAIST), Korea, in 2000. Dr. Lee is a Fellow of IEEE.

Plenary Sessions

October 21st (Thursday), 2021

Plenary Session III : Keynote Speeches

15:30~17:30 | Ramada Ballroom 1

Chair : Young-chai Ko (Korea Univ., Korea)

Time	Title	Invited Speakers
15:30~17:30	Keynote Speech 4 : Pushing the Boundaries of AI Research	Dr. Jilei Hou Vice President, Qualcomm Technologies, Inc.
	Keynote Speech 5 : The Road to New Wireless Frontier 2030	Dr. Byoung-Hoon Kim Senior VP/Head of Future Technology Center, LG Electronics
	Keynote Speech 6 : Integration of Terrestrial and Non-Terrestrial Networks Towards 6G	Dr. Woo Jin Byun Assistant VP, ETRI

Keynote Speech 4 : Pushing the Boundaries of AI Research

Dr. Jilei Hou, Vice President, Qualcomm Technologies, Inc.

Abstract:

Qualcomm has a rich history of foundational research across technologies that have led to breakthrough innovations. In this talk, we will talk about how Qualcomm AI Research is pushing the boundaries of AI research in a few exciting areas. An area that we put substantial effort into is AI model efficiency research which brings state-of-the-art power efficiency and performance to the mobile platforms. This is what is going to allow mobile AI to truly scale and become ubiquitous. Next, we will introduce personalized AI which allows machine learning model adaptation and continuous learning subject to user behavior and preference. This is an area where Qualcomm will play significant leadership to drive the technology adoption and eco-system advancement including on-device training. Last, learning representation is on the frontier of AI innovations to improve model expressive power, allow model explanability, or train with less or no data annotation. We will demonstrate a few advanced techniques that Qualcomm provides the thought leadership in the research community ranging from unsupervised learning, geometric deep learning, to quantum machine learning.

Biography:

Dr. Jilei Hou is a Vice President at Qualcomm Technologies, Inc. (QTI) and currently leads Qualcomm AI Research group at Corporate R&D. Jilei obtained his Ph.D. from University of California, San Diego and joined Qualcomm in 2003. He made substantial contributions in technology innovation, standardization, and product commercialization across wireless 3G/4G/5G standards. In 2011, he moved to Beijing and became the Head of Qualcomm Research China. In this role, he developed the China R&D team into a local research powerhouse, where he initiated 5G research and intelligent robotics programs that benefit Qualcomm business interests in the Greater China region. In 2017, he moved back to San Diego and currently leads the AI Research effort. He is responsible for building the machine learning research infrastructure, driving technical innovations for next-gen hardware and software platforms, and leading forward looking research to benefit technology verticals. He is board members for a few university collaboration joint AI labs. He is an IEEE Senior Member and participated in several Frontiers of Engineering (FOE) Symposia organized by US National Academies of Engineering.

Keynote Speech 5 : The Road to New Wireless Frontier 2030

Dr. Byoung-Hoon Kim, Senior VP/Head of Future Technology Center, LG Electronics

Abstract:

While 5G networks are widely deployed and 3GPP standardization community is discussing the skeleton of 5G-Advanced evolutionary standards, a number of leading R&D organizations have already started to explore and develop next-generation wireless technologies for 6G. Wireless communication industry is expected to initiate the 6G standardization around 2025, aiming the first commercialization

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in 2029-2030.
In this presentation, we first introduce 6G visions and promising use cases to be anticipated in our society and industry around 2030, which require substantially improved communication capabilities and performances in comparison with those of the current 5G wireless networks.
As key 6G enabling technology candidates, Terahertz communication and Full Duplex Radio (FDR) are extensively investigated for potential cellular network applications. Terahertz communication is the radio transmission and reception technology over 100GHz frequency spectrum, which has a potential to provide ultra-high data rate due to a broad bandwidth but suffers from a significant radio propagation loss and RF/antenna fronted implementation challenges. FDR is a transceiver technology which enables simultaneous transmission and reception in a given carrier frequency band. The potential benefits and standardization prospect of FDR are discussed and in-device self-interference, cross-link interference and their mitigation technologies are thoroughly investigated. System design aspects and performance analyses for Terahertz communication and FDR are demonstrated on the basis of LG Electronics' prototype implementation and measurement results.

Biography:
Byoung-Hoon Kim received the B.S. and M.E. degrees in electronics engineering, and the Ph.D. degree in electrical engineering and computer science, from Seoul National University, Seoul, Korea, in 1994, 1996, and 2000, respectively. From 2000 to 2003, he was with GCT Semiconductor, developing W-CDMA and WLAN chip sets. From 2003 to 2008, he was with QUALCOMM, where he was responsible for MIMO technology development and 3GPP LTE standard and design works. Since March 2008, he has been with LG Electronics currently as SVP and Head of Future Technology Center, developing advanced communications, AI, robotics, connected car, media, and IoT technologies. He has made extensive contributions to 3GPP, IEEE802.11, and 5GAA standards and assumed the role of a member of board of directors of Wi-Fi Alliance. He is a Fellow of IEEE, an Associate Member of National Academy of Engineering of Korea, and was elected as the 1st IEEE Communications Society Asia-Pacific Best Young Researcher in 2001. Dr. Kim is co-author of Scrambling Techniques for CDMA Communications (Springer, 2001).

Keynote Speech 6 : Integration of Terrestrial and Non-Terrestrial Networks Towards 6G

Dr. Woo Jin Byun, Assistant VP, ETRI

Abstract:
Until now, mobile communication infrastructure has been mainly built-in urban areas. Mobile communication services could not be used smoothly in the air, sea, and remote areas. However, as the cost of launching and producing satellites has decreased, efforts are being made to build and service non-terrestrial networks such as low-orbit satellite networks in areas with weak mobile communication infrastructure. Currently, the non-terrestrial network and the mobile communication network are separated. However, in the 6G era, mobile communication networks and non-terrestrial networks are expected to be integrated. Integration of non-terrestrial networks and mobile networks will be discussed in this talk.

Biography:
He received Ph.D. degrees in electrical engineering from the Korea Advanced Institute of Science and Technology, (KAIST) Daejeon, Korea, in 2000. In 1999, he joined Samsung Electro-Mechanics Company, Suwon, Korea, where he developed mobile communication devices such as power amplifiers and radio modules from 1999 to 2004. Since 2004, he has been a member of researchers in ETRI. He has received best paper award at ETRI Journal, best researcher from KIEES and certificate of the Minister of Science and ICT (Korea Government). He serves as a member of Editorial Committee at ETRI Journal. He was with the ATHENA group at Georgia Institute of Technology as a visiting scholar from 2015 to 2016. He is currently serving as Assistant Vice President for Radio Satellite Research Division at ETRI.

Industrial Sessions

October 20th (Wednesday), 2021

Industrial Session I : Beyond 5G for the Post-Pandemic Era

12:40-14:10 | Ramada Ballroom 1

Chair : Joongheon Kim (Korea Univ., Korea)

Time	Title	Invited Speakers
12:40-14:10	Evolution of 5G Standards Toward 2025: 5G_Advanced	Dr. Zukang Shen Director of Wireless Standards, Huawei, China
	Connectivity and SDG, the Role of Space Segment	Dr. Kevin K. Choi CTO, KTsat, Korea
	6G Networks: Beyond Shannon Towards Semantic and Goal-Oriented Communications	Dr. Emilio CALVANESE STRINATI CEA-LETI, MINATEC, Grenoble, France

Invited Talk 1 : Evolution of 5G Standards Toward 2025: 5G_Advanced

Dr. Zukang Shen, Director of Wireless Standards and Patents Department, Huawei Technologies Co., Ltd.

Abstract:
This presentation will comprise the following parts:
1) Overview of 3GPP progresses on 5G standards from Rel-15 to Rel-17;
2) Overview on 3GPP 5G evolution toward 2025, i.e. 5G-Advanced;
Overview of Huawei's vision on 5G_Advanced

Biography:
Dr. Zukang Shen currently serves as the Director of Huawei Wireless Standards and Patents Department, responsible for the development of wireless related standards in 3GPP, CCSA, ITU-R, and spectrum related activities.
Dr. Shen has been actively contributing to 3GPP standards work over the past 15 years, in the areas of 4G LTE and 5G NR. Dr. Shen currently serves as the Editor of "3GPP Technical Specification 38.212: Multiplexing and Channel Coding"

Invited Talk 2 : Connectivity and SDG, the Role of Space Segment

Dr. Kevin K. Choi, CTO, KTsat, Korea

Abstract:
From the prehistoric era through various stages of their recorded historic period, our civilization evolves now into another stage, the era of the cloud and connectivity.
Almost all new human knowledge and discoveries are now recorded and stored electronically in the cloud and made available to all who has the connectivity. Great technology democracy for some but unrecoverable gap for others without connectivity due to this ever-increasing digital divide. A community without connectivity can no longer be considered as member of the modern connected world.
Many philanthropic attempts to connect everyone on the planet failed so far. As it's not the role of private companies to serve the under-served, it relies heavily on the local government or the international bodies such as UN to support the Universal Service Obligation (USO) projects in the needed countries and regions.
For such USO projects, the satellite plays a vital role, with its broadcast capability over large coverage areas with relatively easy-to-build network capabilities compared to its terrestrial counterpart. However, it has its own drawbacks and inconveniences.
In this talk, I'd like to address the current status of the GEO and LEO constellation projects and eventual alternative solutions that

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we may want to consider, in view of providing the USO connectivity to the needed communities, inviting them into the modern connected civilization.

Biography:

Kevin Choi is one of the pioneer engineers in the Korean space exploration, having participated in Korea's 1st satellite (Wooribyeul 1 & 2) project in SaTReC, KAIST with close collaboration with UoSAT lab, Univ. of Surrey, UK. He obtained his PhD in satellite communication systems in Telecom Paristech / CNES, France (1999). Since then, he developed his career exclusively in the space domain for more than 20 years in Europe (Eumetsat, Germany and Eutelsat, France) with various engineering and management responsibilities, including also a secondment to ISRO, Bengaluru, India for a joint satellite manufacturing project between France and India. Lately, he was responsible for system engineering in the Eutelsat 9B satellite with the EDRS-A (European Data Relay Satellite) hosting (launched in Jan. 2016) and served as NonGEO infrastructure manager for Eutelsat's LEO ambition.
Kevin is appointed as CTO of KTsat in Aug. 2020, and responsible for all technical and operational matters of Korea's unique satellite operator. His main interests include Flexible HTS satellite, hybrid cooperation of Space-Terrestrial telecom infrastructure, incorporating cutting edge technologies such as laser communication for the era of multi-planet connected humanity.

Invited Talk 3 : 6G Networks: Beyond Shannon Towards Semantic and Goal-Oriented Communications

Dr. Emilio CALVANESE STRINATI, Smart Device, and Telecommunications Innovation and Scientific Director - International Research Programs New-6G Director, CEA-LETI, MINATEC, Grenoble, France

Abstract:
This talk promotes the idea that including semantic and goal-oriented aspects in future 6G networks can produce a significant leap forward in terms of system effectiveness and sustainability. Semantic communication goes beyond the common Shannon paradigm of guaranteeing the correct reception of each single transmitted packet, irrespective of the meaning conveyed by the packet. The idea is that, whenever communication occurs to convey meaning or to accomplish a goal, what really matters is the impact that the correct reception/interpretation of a packet is going to have on the goal accomplishment. Focusing on semantic and goal-oriented aspects, and possibly combining them, helps to identify the relevant information, i.e. the information strictly necessary to recover the meaning intended by the transmitter or to accomplish a goal. Combining knowledge representation and reasoning tools with machine learning algorithms paves the way to build semantic learning strategies enabling current machine learning algorithms to achieve better interpretation capabilities and contrast adversarial attacks. 6G semantic networks can bring semantic learning mechanisms at the edge of the network and, at the same time, semantic learning can help 6G networks to improve their efficiency and sustainability.

Biography:

Dr. Emilio Calvanese Strinati obtained his Engineering Master degree in 2001 from the University of Rome 'La Sapienza' and his Ph.D in Engineering Science in 2005. He then started working at Motorola Labs in Paris in 2002. Then in 2006 he joint CEA/LETI as a research engineer. From 2007, he becomes a PhD supervisor. From 2010 to 2012, Dr. Calvanese Strinati has been the co-chair of the wireless working group in GreenTouch Initiative which deals with design of future energy efficient communication networks. From 2011 to 2016 he was the Smart Devices & Telecommunications European collaborative strategic programs Director. Between December 2016 and January 2020 is was the Smart Devices & Telecommunications Scientific and Innovation Director. Since February 2020 he is the Nanotechnologies and Wireless for 6G (New-6G) Program Director focusing on future 6G technologies. In December 2013 he has been elected as one of the five representative of academia and research center in the Net!Works 5G PPP ETP. From 2017 to 2018 he was one of the three moderators of the 5G future network expert group. Between 2016 and 2018 he was the coordinator of the H2020 joint Europe and South Korea 5GCHAMPION project that showcased at the 2018 winter Olympic Games, 5G technologies in realistic operational environments. Since July 2018 he is the coordinator of the H2020 joint Europe and South Korea 5G-AllStar project. Since 2018 he holds the French Research Director Habilitation (HDR). In 2021 he started the coordination of the H2020 European project RISE-6G, focusing on the design and operation of Reconfigurable Intelligent Surfaces in future high frequency 6G networks. Since February 2021 he is also the director of the New-6G (Nano Electronic & Wireless for 6G) initiative , dedicated to the required convergence between microelectronic & telecom, hardware & software, network & equipment for upcoming 6G technologies

Industrial Sessions

October 21st (Thursday), 2021

Industrial Session II : A Broader View of ICT Convergence for New Normal

13:20-15:00 | Ramada Ballroom 1

Chair : Haejoon Jung (Kyung Hee Univ., Korea)

Time	Title	Invited Speakers
13:20-15:00	5G will be a Key Driving Force in the Upcoming C-ITS Era	Mr. Kahng, Jong-Oh Vice president, LG Uplus
	Rising of Metaverse	Mr. Dillon Seo Country Manager, DTCP Korea
	Collaborative R&D Ecosystem for AI Platform	Dr. Soonmin Bae Senior Vice President, KT
	How AI/ML Technology can be used in Mobile Communication Systems	Dr. Seungjoo Maeng Master, Samsung Electronics

Invited Talk 4 : 5G will be a Key Driving Force in the Upcoming C-ITS Era

Mr. Kahng, Jong-Oh, Vice president, LG Uplus

Abstract:

This presentation introduces the progress of C-ITS and autonomous driving pilot projects in Korea. In addition, it will cover LG U+ 5G technology and platform, which are indispensable for successful implementation of C-ITS and autonomous driving.

Biography:

2020 ~ LG Uplus Vice President
2014 ~ LG Uplus R&D Managing Director
2009 ~ LG Telecom R&D Team Leader
2000 ~ LG Telecom Research Engineer

Invited Talk 5 : Rising of Metaverse

Mr. Dillon Seo, Country Manager, DTCP

Abstract:

The presentation will examine why Metaverse is an inevitable trend and explain what major traits and trends within Metaverse we should be keeping our eyes on by examining some of the industry use cases and movements.

Biography:

Dillon is a serial entrepreneur and investor who is known to be one of the co-founding members of Oculus, the VR HMD manufacturing company acquired by Facebook in 2014. After Oculus, Dillon found a VR game company called VoleR Creative and invested in number of early-stage startups including Shakr. Currently, Dillon is a country manager and managing director at Deutsche Telekom Capital Partners Korea and closely working with Deutsche Telekom to advise on various ICT trends including VR, AR and Gaming.

Industrial Sessions

Invited Talk 6 : Collaborative R&D Ecosystem for AI Platform

Dr. Soonmin Bae, Senior Vice President, KT

Abstract:

South Korea is well known for its ICT readiness, use, and capability. It has been ranked first or second in the ICT Development Index (IDI) for many years. Korea Telecom (KT) launched the world's first nationwide commercial fifth-generation (5G) wireless network in April 2019 after showcasing the world's first 5G services at the 2018 Winter Olympics in PyeongChang. Moreover, South Korea Government has declared its vision to become an AI powerhouse beyond an IT powerhouse in 2019. Since then, many efforts have been made to develop infrastructure and ecosystems by planning national strategies and establishing AI graduate schools. Leading companies such as NAVER and KT are building collaborative R&D ecosystems connecting industries and universities. In particular, KT has launched AI One Team. AI One Team consists of companies from different sectors including financial services firms, heavy industries, consumer electronics companies, food manufacturer, telecommunication companies and world leading universities and research institutes. They share on-going project issues and data, solve problems collectively, and develop AI employee training programs together. In this talk, I will talk about how these collaborative effects are solving real-world problems.

Biography:

Dr. Soonmin Bae aims to transform AI technology into meaningful services. To this end, she directed teams on Video Intelligence and Avatar at NAVER Clova and led Vision AI team for Robotics and security cameras at Samsung Techwin.

She recently joined KT to help its plan to transform itself from a telecommunication company to a digital platform company. KT is to further focus on artificial intelligence, big data, and cloud computing businesses.

Prior to industrial experiences, she worked on computational photography and received her Ph.D. and M.S. in EECS/CSAIL at MIT and earned her B.S. at KAIST

Invited Talk 7 : How AI/ML Technology can be used in Mobile Communication Systems

Dr. Seungjoo Maeng, Master, Samsung Electronics

Abstract:

Recently, as AI / ML technology evolves rapidly, technology sectors to apply AI/ML are also increasing. The mobile communication sector is one of them.

Although it is still an early stage, there are various attempts to adopt AI / ML technology to improve the performance of mobile communication systems.

This talk provides a way to use AI / ML technology to improve the performance of mobile communication systems based on actual implementation. Also, it presents a candidate use cases in the communication system where AI / ML can be used.

Biography:

Seungjoo Maeng is a Master of Samsung Electronics. He joined Samsung Electronics in 1998 and developed his career in the telecommunication domain for more than 20 years. He led the scheduler design of 2G, 3G, and 4G systems, and also led the development of massive MIMO system, which is the main RF system of 5G technology. His major interests include scheduler design, modem algorithm design and performance analysis using AI / ML. He received a Ph.D. degree in electronics engineering at Seoul National University in 1998.

SPC Special Sessions

October 20th (Wednesday), 2021

SPC Special Session I : Towards 6G: Enabling Technologies

08:30-10:10 | Ramada Ballroom 1

Chair : Hyun Jong Yang (POSTECH, Korea)

Time	Title	Invited Speakers
08:30-10:10	THz MIMO Communications	Prof. Namyoon Lee POSTECH
	Resilient Cross-layer mmWave Network Design through Coordination	Prof. Parth Pathak George Mason University
	Next Generation Multiple Access: Reboot of S-ALOHA with Online Control	Prof. Hu Jin Hanyang University, Korea

Invited Talk 1 : THz MIMO Communications

Prof. Namyoon Lee, POSTECH, Korea

Abstract:

A relentless trend in wireless communications is the hunger for bandwidth, and fresh bandwidth is only to be found at ever higher frequencies. While 5G systems are seizing the mmWave band, the attention of researchers is shifting already to the terahertz range. In that distant land of tiny wavelengths, antenna arrays can serve for more than power-enhancing beamforming. Defying lower-frequency wisdom, spatial multiplexing becomes feasible even in line-of-sight conditions. In this talk, I will review the underpinnings of this phenomenon, and present recent results on the ensuing information-theoretic capacity. Reconfigurable array architectures are put forth that can closely approach such capacity, practical challenges are discussed, and supporting experimental evidence is presented.

Biography:

NAMYOON LEE [S'11, M'14, SM'20] (nylee@postech.ac.kr) received a Ph.D. degree from the University of Texas at Austin in 2014. He was with Communications and Network Research Group, Samsung Advanced Institute of Technology, Korea, in 2008–2011 and also with Wireless Communications Research, Intel Labs, Santa Clara, California, in 2015–2016. He is currently an associate professor at POSTECH. He was a recipient of the 2016 IEEE ComSoc Asia–Pacific Outstanding Young Researcher Award, the 2020 IEEE Best YP Award (Outstanding Nominee), and the 2021 IEIE-IEEE Joint Award for Young Scientist and Engineer. He is currently an associate editor for IEEE Transactions on Wireless Communications, IEEE Transactions on Communications, and IEEE Transactions on Vehicular Technology.

Invited Talk 2 : Resilient Cross-layer mmWave Network Design through Coordination

Prof. Parth Pathak, George Mason University, USA

Abstract:

Millimeter-wave (mmWave) wireless is poised to revolutionize the next generation of wireless networking and sensing systems with its large available bandwidth and multi-gigabit link rates. Even as mmWave wireless is being commercialized, coordinated and cross-layer solutions are needed to address the fundamental challenges of blockage and mobility in densely deployed next generation networks. In this talk, I will present our recent progress on addressing these issues. First, I will introduce mmChoir, a multi-point transmission framework that utilizes joint transmissions from multiple APs to provide proactive blockage resilience to clients. I will then discuss a coordinate beamforming architecture that aims at reduces beamforming overhead through network-level coordination in densely deployed mmWave networks. Lastly, I will present our cross-layer mmWave immersive content streaming solution that exploits content similarity along with multi-beam adaptation and coordination to realize a reliable video quality delivery over mmWave.

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We will conclude with a discussion on our ongoing work on low-power commodity mmWave wireless backscattering systems and their applications.

Biography:
Parth Pathak is an assistant professor In the Computer Science Department at George Mason University. His research interests include design and development of wireless and mobile computing systems including next-gen 5G and beyond networks, IoT systems, wireless sensing and ubiquitous computing. He received his Ph.D. degree in computer science from North Carolina State University in 2012. He was a post-doctoral scholar at University of California, Davis until 2016 before joining George Mason University. He has published 30+ papers in top-tier networking conferences and journals including two best paper awards in IFIP Networking 2014 and IEEE DSAA 2019.

Invited Talk 3 : Next Generation Multiple Access: Reboot of S-ALOHA with OnlineControl

Prof. Hu Jin, Hanyang University, Korea

Abstract:
For slotted random access systems, the slotted ALOHA protocol provides the maximum throughput of 0.368 (packets/slot) while in the category of splitting (or tree) algorithms, the maximum achievable throughput can reach up to 0.487 with the first-come first-serve (FCFS) algorithm. However, those maximum throughputs are hard to be achieved in practical systems especially when the network population changes over time. In this talk, we discuss the role of real-time/online control of random access in achieving those maximum throughputs. In addition, as the 5G mobile communication system and beyond still adopt random access procedure for establishing initial connections to the base station which is more important for the machine type communications and Internet of Things (IoT) applications, we further discuss the application of the proposed online control algorithms in cellular systems.

Biography:
Hu Jin received the B.E. degree from the University of Science and Technology of China, China, in 2004, and the M.S. and Ph.D. degrees from the Korea Advanced Institute of Science and Technology, South Korea, in 2006 and 2011, respectively. From 2011 to 2013, he was a Postdoctoral Fellow with The University of British Columbia, Canada. Since 2014, he has been with the Division of Electrical Engineering, Hanyang University, Ansan, South Korea, where he is currently is an Associate Professor. His research interests include medium-access control and radio resource management for random access networks and scheduling systems considering advanced signal processing and queuing performance. Recently, his research is more focused on the real-time/online control of the random access in order to maximize the throughput and minimize the delay.

SPC Special Sessions

October 20th (Wednesday), 2021

SPC Special Session II : Computer-Networking Convergence

14:30-16:10 | Ramada Ballroom 1

Chair : JeongGil Ko (Yonsei Univ., Korea)

Time	Title	Invited Speakers
14:30-16:10	Serverless Computing and Beyond for Computing-enabled 6G	Prof. Kyungyong Lee Kookmin University, Korea
	Towards a Secure Cloud Radio LoRaWANs	Prof. Wen Hu UNSW Sydney, Australia
	Low-latency and High-precision Packet Networking Technologies	Dr. Taesik Cheung ETRI, Korea

Invited Talk 4 : Serverless Computing and Beyond for Computing-enabled 6G

Dr. Kyungyong Lee, Kookmin University, Korea

Abstract:
The advancement of cloud computing changes the way we develop software applications and maintain computing resources. The initial cloud computing service focused on helping developers to build highly available system from the perspective of fault-tolerance and scalability relying on virtualization, which is termed as IaaS. Since the launch of the first-generation cloud service, the cloud computing is evolving in the direction of hiding complex operations and management overhead. In such context, FaaS and various fully-managed cloud services open up opportunities for the serverless computing which frees developers from complex cloud resource management overhead. In this talk, the present discusses opportunities and challenges when developing cloud application using the serverless computing architecture. The presenter also covers the direction and opportunities of further advancement of the serverless computing in the edge-computing environment where limited computing resources are connected using very fast mobile network.

Biography:
Kyungyong Lee is an Associate Professor in the Department of Computer Science at Kookmin University. His current research topic covers cloud computing, big data platforms, and large-scale distributed computing environment. He received the Ph.D. Degree in the Department of Electrical and Computer Engineering at the University of Florida. Before joining Kookmin University, he worked as a software development engineer at Amazon Web Services and HP Labs.

Invited Talk 5 : Towards a Secure Cloud Radio LoRaWANs

Prof. Wen Hu, UNSW Sydney, Australia

Abstract:
LoRaWAN is an emerging technology of low-power wide-area networks to provide connectivity for Internet of Thing (IoT) devices. As the number of devices increases, the network suffers from scalability issues. Therefore, we design a cloud radio access network (C-RAN or Cloud-RAN) with multiple LoRaWAN gateways to address this problem. Specifically, we propose a compressive sensing-based algorithm to reduce the uplink bit rate between the gateways and the cloud server. Our evaluation shows that with four gateways up to 87.5% PHY radio samples can be compressed and 1.7x battery life for end devices can be achieved. To provide location information to the LoRaWAN end devices, we propose a novel algorithm to improve the resolution of the radio signals. The proposed algorithm synchronizes multiple non-overlapped communication channels by exploiting the unique features of the LoRaWAN radio to increase the overall bandwidth, and both the original and the conjugate of the physical

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layer to increase the number of multiple paths that it can resolve. Our evaluation shows that it can achieve median errors of 4.4 m and 2.4 m outdoors and indoors respectively. Finally, we introduce a novel algorithm to secure end devices by exploiting the LoRa radio channel models.

Biography:

Wen Hu is an associate professor at School of Computer Science and Engineering, the University of New South Wales (UNSW). Much of his research career has focused on the novel applications, low-power communications, security and compressive sensing in sensor network systems and Internet of Things (IoT). Hu published regularly in the top-rated sensor network and mobile computing venues such as ACM/IEEE IPSN, ACM SenSys, ACM MobiCOM, ACM UbiCOMP, IEEE Infocom, ACM transactions on Sensor Networks (TOSN), IEEE Transactions on Mobile Computing (TMC), and Proceedings of the IEEE.

Hu is a senior member of ACM and IEEE and is an associate editor of ACM TOSN and the general chair of CPS-IoT Week 2020, as well as serves on the organizing and program committees of networking conferences including ACM/IEEE IPSN, ACM SenSys, ACM MobiCOM and ACM MobiSys.

Hu worked as the Chief Scientist (part time) in WBS Tech to commercialize his research results in smart buildings and IoT. He was a principal research scientist and research project leader at CSIRO Digital Productivity Flagship, and received his Ph.D from the UNSW.

Invited Talk 6 : Low-latency and High-precision Packet Networking Technologies

Dr. Taesik Cheung, ETRI, Korea

Abstract:

It is expected that real-time, hyper-immersive interactive services such as AR/VR/XR and hologram communications, and high-precision vertical services such as remote control of robots, machines and drones will become prevail in the near future. To support time-sensitive services, network infrastructure needs to guarantee the bounded end-to-end latency in the delivery of packets and the minimized, or even no loss of packets. Providing high-precision control of latency is another important characteristic that the network should have, in order to support mission-critical and high-precision vertical services stably. Time-deterministic networking technologies such as TSN, DetNet, and MTN are considered as a possible solution to meet those requirements and being developed in the global standard bodies. This presentation briefly introduces those emerging technologies, compares their characteristics including pros and cons, and discusses their limitations and R&D issues that should be resolved.

Biography:

Taesik Cheung received the B.S., M.S., and Ph.D. degrees in electronics engineering from Yonsei University, Seoul, South Korea. Since 2000, he has been with ETRI, where he was involved in the development of network systems such as Carrier Ethernet switches, flow QoS routers, and packet/optical integrated transport network systems. Since 2005, he has been participating in ITU-T and IETF, and contributed to the standardization of protection mechanisms for transport networks. He is the co-editor of ITU-T Rec. G.873.2, and G.808.2, and the co-author of IETF RFC 7271 and RFC 8234. He is currently serving as a director of Ultra-low Latency Network Research Section of ETRI. His current work focuses on deterministic packet networking technologies such as IEEE TSN and IETF DetNet.

SPC Special Sessions

October 21st (Thursday), 2021

SPC Special Session III : From Mobility to Localization: Recent Innovations

08:30-10:10 | Ramada Ballroom 1

Chair : Hyoil Kim (UNIST, Korea)

Time	Title	Invited Speakers
08:30-10:10	LEO Satellite Internet for High-Speed Aerial Vehicles	Prof. Jihwan Choi KAIST, Korea
	Autonomous Sensing with Millimeter-Wave Radar	Dr. Kun Qian University of California San Diego, USA
	High-precision and Scalable Positioning with UWB	Dr. Haeyoung Jun Head of Service Standards Lab, Samsung Research, Korea

Invited Talk 7 : LEO Satellite Internet for High-Speed Aerial Vehicles

Prof. Jihwan Choi, KAIST, Korea

Abstract:

The 3rd Generation Partnership Project (3GPP) has included non-terrestrial networks (NTN) in the 5G New Radio (NR) standards and the mega-constellation low-Earth orbit (LEO) satellites are being deployed for the global broadband service. This talk will present an overview of the state-of-the-art LEO networks, key technologies for the LEO satellite Internet, and their applications for supporting high-speed aerial vehicles, such as urban air mobility (UAM).

Biography:

Jihwan Choi received the Ph.D. degree in electrical engineering and computer science from the Massachusetts Institute of Technology (MIT), Cambridge, MA, USA. He is currently an Associate Professor at the Dept. of Aerospace Engineering, Korea Advanced Institute of Science and Technology (KAIST), Daejeon, Korea. He was with Marvell Semiconductor Inc., Santa Clara, CA, USA and with the Daegu Gyeongbuk Institute of Science and Technology (DGIST), Daegu, Korea. His research interests are in aerospace and wireless communications, and the applications of machine learning and deep learning. Dr. Choi is an Associate Editor for the IEEE TRANSACTIONS ON AEROSPACE AND ELECTRONIC SYSTEMS and an Editorial Board Member for Remote Sensing.

Invited Talk 8 : Autonomous Sensing with Millimeter-Wave Radar

Dr. Kun Qian, University of California San Diego, USA

Abstract:

Emerging autonomous driving systems require the reliable perception of 3D surroundings. Unfortunately, current mainstream perception modalities, i.e., camera and Lidar, are vulnerable under challenging weather conditions where opaque particles distort lights and significantly reduce visibility. On the other hand, despite their all-weather operations, today's vehicle Radars only have coarse resolution and are limited to location and speed detection. I will present two solutions that better exploit the Radar sensing capability in autonomous sensing tasks, especially under adverse weather conditions. The first solution generates higher-quality point clouds by enabling synthetic aperture radar (SAR) imaging on low-cost commodity vehicle Radars. The second solution is a deep fusion detector that takes advantage of complementary Lidar and Radar data for vehicle detection.

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Biography:

Kun Qian is a post-doctoral researcher in the Department of Electrical and Computer Engineering, University of California San Diego. He received his Ph.D. in 2019 in the School of Software, Tsinghua University. He received his B.E. in 2014 in Software Engineering from the School of Software, Tsinghua University. His research interests include mobile computing and wireless sensing. He has published over 20 papers in competitive conferences and journals.

Invited Talk 9 : High-precision and Scalable Positioning with UWB

Dr. Haeyoung Jun, Head of Service Standards Lab, Samsung Research, Korea

Abstract:

The presentation focuses on the UWB technology, and introduces various aspects of the technology including algorithm and protocol, Global standards, industry trends and implementations.
Firstly, it introduces various indoor positioning technologies using radio-communication signals, and compare pros and cons. Especially, it explains why UWB has been attracting huge interest from various Global industry stakeholders. Secondly, it explains details about the UWB ranging and indoor positioning solutions using UWB. The UWB based indoor positioning technologies include multiple approaches using Two-way Ranging, Uplink TDoA (Time Difference of Arrival), and Downlink TDoA. Finally, the presentation also shares current status of industry standardization efforts for the UWB interoperability among different manufacturers as well as various service applications using UWB including indoor positioning applications.

Biography:

Dr. Haeyoung Jun is a Principal Engineer & Director at Samsung Research. He is currently leading Service Standards Lab, which is responsible for advanced technology development and standardization of connectivity technologies such as Wi-Fi, Bluetooth and UWB.
He represented Samsung as a member of Board of Directors in multiple standards organizations such as WiGig Alliance, Car Connectivity Consortium, Wi-Fi Alliance and OCF. He also led foundation of several standards bodies, which Samsung has established, such as Alliance for Wireless Power, UHD Alliance and FiRa Consortium. He also worked as an initial Board member of those consortia.
He received Ph.D., M.S. and B.S. degrees from Seoul National University where he worked in the areas of GPS signal processing algorithms, software-based receiver technologies, and indoor positioning systems.

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October 21st (Thursday), 2021

SPC Special Session IV : New Paradigms and Concepts

10:30-12:10 | Ramada Ballroom 1

Chair : Jeongho Kwak (DGIST, Korea)

Time	Title	Invited Speakers
10:30-12:10	Addressing Wireless Blindspots using Transparent Antennas and Surfaces: Opportunities and Challenges	Prof. Wonbin Hong POSTECH, Korea
	Enable 4K Quality 3D Video Streaming	Prof. Jihoon Ryoo SUNY Korea (Stony Brook University), Korea
	Memory Disaggregation and its Performance Enhancement Using SmartNICs	Prof. Youngbin Im UNIST, Korea

Invited Talk 10 : Addressing Wireless Blindspots using Transparent Antennas and Surfaces: Opportunities and Challenges

Prof. Wonbin Hong, POSTECH, Korea

Abstract:
Frequency spectrums are increasingly becoming diversified and are resorting to higher bands amid the explosive growth of wireless applications and services. The propagation path loss and material penetration loss tend to worsen as a function of the operating frequency spectrum. Naturally, despites its benefits and potential, future wireless networks are becoming more prone to wireless blindspots, which becomes critical for OPEX and CAPEX. In this talk, an approach based on transparent antennas and electromagnetic surfaces (e.g., RIS) will be discussed and exemplified followed with key challenges and potential strategies.

Biography:
Prof. Wonbin Hong is currently a Mueunjae Chaired Professor at POSTECH (Pohang University of Science and Technology) since 2016. He was previously a Principal Engineer at Samsung Electronics from 2009-2016. Prof. Hong was the first to develop the world's first mmWave 5G mobile antenna and Antenna-on-Display (AoD) technology, in which he twice received official commendations from the Ministry of Science and ICT, Korea. He holds a Ph.D. and Masters from University of Michigan and a B.S. from Purdue University.

Invited Talk 11 : Enable 4K Quality 3D Video Streaming

Prof. Jihoon Ryoo, SUNY Korea (Stony Brook University), Korea

Abstract:
Along with the recent enhancement of display technology, users demand a higher quality of streaming service, which escalates the bandwidth requirement. Considering the recent advent of high FPS (frame per second) 4K and 8K resolution 360° videos, such bandwidth concern further intensifies in 360° Virtual Reality (VR) content streaming even at a larger scale. However, the currently available bandwidth in most of the developed countries can hardly support the bandwidth required to stream such a scale of content. To address the mismatch between the demand on higher quality of streaming service and the saturated network improvement, we propose encoding algorithm that practically solves the mismatch by utilizing the characteristics of the human vision system (HVS). By pre-rendering a set of regions - where viewers are expected to fixate - on 360° VR content in higher quality than the other regions, new encoding algorithm improves viewers' quality of perception (QoP) while reducing content size with geometry-based 360° content encoding. In our user experiment, we compare the performance of new algorithm to the

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existing 360° content-encoding techniques based on viewers' head movement and eye gaze traces. To evaluate viewers' QoP, we propose FoL (field of look) that captures viewers' quality perception area in the visual focal field (8°) rather than a wide (around 90°) field of view (FoV). Results of our experimental 360° VR video streaming show that new algorithm achieves noticible PSNR improvement in FoL and FoV.

Biography:
Jihoon Ryoo is an assistant professor at the Computer Science Department of SUNY Korea (State University of New York) - where he has been on the faculty since 2017. An applied computer scientist, Dr. Jihoon Ryoo's research interests concern how the advanced technologies of mobile, embedded computing enhance our daily life. He and his collaborators are active inventors of new sensing and perception technologies in the field of wireless networks and computer vision. He did his research intern at Microsoft Research, Microsoft Research Asia, Bell Labs, and Motorola Solutions through his graduate years. He is also the co-founder of start-up IDCITI - an underground GPS service company.

Invited Talk 12 : Memory Disaggregation and its Performance Enhancement Using SmartNICs

Prof. Youngbin Im, UNIST, Korea

Abstract:
Recently, disaggregated memory systems are gaining attention to meet the increasing memory requirements in data centers. Disaggregated memory system enables applications to use the memory of remote servers connected through the network. In addition, smartNICs are becoming popular in data centers to offload host CPUs' load and use the saved CPU cycles for user applications.
In this talk, I will introduce several recent works on memory disaggregation, smartNICs and propose utilizing SmartNICs for improving the performance of the disaggregated memory system.

Biography:
2019.09 ~ present: Assistant Professor, Department of Computer Science and Engineering, UNIST
2015.03 ~ 2019.07: Postdoctoral Researcher, Computer Science, University of Colorado Boulder

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October 22nd (Friday), 2021

SPC Special Session V : ICT for Social Good

08:30-10:10 | Ramada Ballroom 1

Chair : Song Min Kim (KAIST, Korea)

Time	Title	Invited Speakers
08:30-10:10	AI for Cybersecurity: Current Status and Future Directions	Prof. Peng Liu Pennsylvania State University, USA
	Cyber/Physical Well-being Technology That Supports Human's Bounded Rationality	Prof. Tadashi Okoshi Faculty of Environment and Information Studies, Keio University, Japan
	ICT Adopted in Healthcare	Prof. Dukyong Yoon Yonsei University College of Medicine, Korea

Invited Talk 13 : AI for Cybersecurity: Current Status and Future Directions

Prof. Peng Liu, Pennsylvania State University, USA

Abstract:

In this talk, I will provide an overview of AI for Cybersecurity, an emerging area of research in the field of cybersecurity. The overview will consist of the following parts: first, I will introduce the concept of AI for Cybersecurity. Second, I will review the current status of this emerging sub-field. Finally, I will point out several future directions.

Biography:

Peng Liu received his BS and MS degrees from the University of Science and Technology of China, and his PhD from George Mason University in 1999. Dr. Liu is the Raymond G. Tronzo, MD Professor of Cybersecurity, founding Director of the Center for Cyber-Security, Information Privacy, and Trust, and founding Director of the Cyber Security Lab at Penn State University. His research interests are in all areas of computer security. He has published over 350 technical papers, including numerous papers on top conferences and journals. His research has been sponsored by NSF, ARO, AFOSR, DARPA, DHS, DOE, AFRL, NSA, TTC, CISCO, and HP.

Invited Talk 14 : Cyber/Physical Well-being Technology That Supports Human's Bounded Rationality

Prof. Tadashi Okoshi, Faculty of Environment and Information Studies, Keio University, Japan

Abstract:

As our daily lives have been drastically evolving not only in the real (physical) space but also in the cyber space, the concept of "well-being" has also been growing into several different areas our physical, mental, and social activities, in both spaces.

Recent information systems for supporting users' physical and mental wellness/well-being have been developed based on a traditional architecture of the cyber-physical systems, which involves in sensing and recognition of human's behavior and states, big data analysis mainly in the cloud side, and the information feedback and/or actuation back to the human user. However, in reality, our behavior will not be easily changed just by information presentation itself, typically through push-type notifications. We are witnessing many examples of it about people's behavior during the COVID-19 pandemic.

We human is not always rational and rather emotional. According to behavior economics, the concept of "bounded rationality" has been studies to better handle such human nature. In this talk, I will introduce this bounded rationality concept along with our latest research on the information system that supports human user's bounded rationality in several different aspects.

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Biography:

Tadashi Okoshi is Associate Professor in Faculty of Environment and Information Studies, Keio University. He is a computer scientist especially focusing on information and computing systems for supporting our life-long cyber-physical well-being. His broader research areas include mobile and ubiquitous computing systems, application and services, human computer interaction, behavior change and persuasive computing. His recent research works are on human attention management, mobile affective computing, and computing for well-being (WellComp).

He has served as organizing and program committee member of mobile and ubiquitous systems, and networking conferences and workshops. He sits on the editorial boards of ACM Proceedings on Interactive, Mobile, Wearable and Ubiquitous Technologies (IMWUT). He has been servicing as social media director of ACM SIGMOBILE since 2016. In 2019, he was awarded IPSJ Microsoft Faculty Award, an annual award for young researchers who have made outstanding international contributions to research and development in major areas of informatics.

He holds B.A. in Environmental Information (1998), Master of Media and Governance (2000) from Keio University, M.S. in Computer Science (2006) from Carnegie Mellon University, and Ph.D. in Media and Governance (2015) from Keio University, respectively. He also has over 7-year experiences of entrepreneurship, software architecting, product management, and project management in IT industries (Web2.0, blogging, social networking, and social media).

Invited Talk 15 : ICT Adopted in Healthcare

Prof. Dukyong Yoon, Yonsei University College of Medicine, Korea

Abstract:

Machine learning-based artificial intelligence (AI) models that find patterns in data such as deep learning are the most widely studied and used in all fields. There is a variety of data to which AI can be applied in hospitals. In addition to structured data such as diagnosis, drug and treatment prescription, and laboratory test results, there is a large amount of unique natural language data such as admission and discharge records or pathology reports. In addition, various types of image data, and biosignal data such as an electrocardiogram are also one of important data in hospital. Since these data do not exist independently, but interact with each other, there are various hidden information that can be revealed through artificial intelligence. Although the basic principles of AI are similar, its application area can be diversified depending on what kind of data is applied to. In this presentation, I will focus on cases where AI was applied to data existing in hospitals, and examine the characteristics and possibilities of AI application in the medical field.

Biography:

My research covers data science in the field of medicine—processing and analysis of structured and unstructured medical data. Because medical data comprise diverse data types (numeric, natural language, signal, and image), a multidisciplinary approach is needed. I am interested in discovering novel valuable information (novel features in biosignals or prescription patterns) in medical data. For that purpose, I use both traditional statistical methods and up-to-date artificial intelligence methods. Using such information, our laboratory develops computational models to detect or predict clinical outcomes (clinical conditions or new drug effects) and evaluates the implications of these models in clinical practice. The basic features extracted from the medical data, the computational models, and experience in applying the models in clinical practice will promote digital healthcare, software as a medical device, and digital therapeutics.

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October 22nd (Friday), 2021

SPC Special Session VI : Expanding the Horizon

10:30-12:10 | Ramada Ballroom 1

Chair : Jaeho Lee (Duksung Univ., Korea)

Time	Title	Invited Speakers
10:30-12:10	Learning for Learning: Predictive Online Control of Federated Learning with Edge Provisioning	Dr. Lei Jiao University of Oregon, USA
	Artificial Tactile Sensing System Mimicking Human Tactile Cognition	Prof. Ji-Woong Choi DGIST, Korea
	The Participatory AR Platform and Applications	Dr. Sung-Uk Jung Principal Researcher, ETRI, Korea

Invited Talk 16 : Learning for Learning: Predictive Online Control of Federated Learning with Edge Provisioning

Dr. Lei Jiao, University of Oregon, USA

Abstract:
Operating federated learning optimally over distributed cloud-edge networks is a non-trivial task, which requires to manage data transference from user devices to edges, resource provisioning at edges, and federated learning between edges and the cloud. We formulate a non-linear mixed-integer program, minimizing the long-term cumulative cost of such a federated learning system while guaranteeing the desired convergence of the machine learning models being trained. We then design a set of novel polynomial-time online algorithms to make adaptive decisions by solving continuous solutions and converting them to integers to control the system on the fly, based only on the predicted inputs about the dynamic and uncertain cloud-edge environments via online learning. We rigorously prove the competitive ratio, capturing the multiplicative gap between our approach using predicted inputs and the offline optimum using actual inputs. Extensive evaluations with real-world training datasets and system parameters confirm the empirical superiority of our approach over multiple state-of-the-art algorithms.

Biography:
Lei Jiao received the Ph.D. degree in computer science from the University of Göttingen, Germany. He is currently an assistant professor at the Department of Computer and Information Science, University of Oregon, USA. Previously he worked as a member of technical staff at Alcatel-Lucent/Nokia Bell Labs in Dublin, Ireland and as a researcher at IBM Research in Beijing, China. He is interested in the mathematics of optimization, control, learning, and economics, applied to computer and telecommunication systems, networks, and services. He publishes papers in journals such as IEEE/ACM ToN, IEEE TPDS, and IEEE JSAC, and in conferences such as INFOCOM, MOBIHOC, ICNP, and ICDCS. He is a recipient of the NSF CAREER Award. He also received the Best Paper Awards of IEEE LANMAN 2013 and IEEE CNS 2019, and the 2016 Alcatel-Lucent Bell Labs UK and Ireland Recognition Award. He served as a guest editor for IEEE JSAC and was on the program committees of many conferences including INFOCOM, MOBIHOC, ICDCS, and IWQoS.

Invited Talk 17 : Artificial Tactile Sensing System Mimicking Human Tactile Cognition

Prof. Ji-Woong Choi, DGIST, Korea

Abstract:
With an upcoming era of the metaverse, the importance of computer understanding human sensibilities becomes one of the most promising topics nowadays. Digital experiences, which offer vicarious sensory experiences without actual contact, can be widely applied in various fields such as entertainment and on-line marketing. For a more immersive digital experience, textile sense is

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an inevitable component along with visual and auditory sensations. In this talk, I will introduce an artificial tactile perception and cognition system, named "Tactile Avatar", producing smooth/soft and rough tactile sensations. A piezoelectric tactile sensor is developed to record dynamically various physical information such as pressure, temperature, hardness, sliding velocity, and surface topography. For artificial tactile cognition, the tactile feeling of humans to various tactile materials ranging from smooth/soft to rough are assessed and found variation among participants. Because tactile responses vary among humans, a deep learning structure is designed to allow personalization through training based on individualized histograms of human tactile cognition and recording physical tactile information. This approach can be applied to electronic devices with tactile emotional exchange capabilities as well as advanced digital experiences.

Biography:

Ji-Woong Choi received the B.S., M.S., and Ph.D. degrees from Seoul National University (SNU), Seoul, South, Korea, in 1998, 2000, and 2004, respectively, all in Electrical Engineering. From 2005 to 2007, he was a Postdoctoral Visiting Scholar with the Department of Electrical Engineering, Stanford University, Stanford, CA, USA. From 2007 to 2010, he was with Marvell Semiconductor, Santa Clara, CA, USA, as a Staff Systems Engineer for next-generation wireless communication systems, including WiMAX and LTE. Since 2010, he has been with the Information and Communication Engineering Department, Daegu Gyeongbuk Institute of Science and Technology (DGIST), Daegu, South Korea, as a Full Professor, and also working as Director of Brain Engineering Convergence Research Center, DGIST. His research interests include communication theory and signal processing, and related applications such as vehicular communications, biomedical signal processing/machine learning applications, brain–machine/computer interface (BMI/BCI), and near-field wireless power transfer. He is Editor of Journal of Communications and Networks (JCN) and IEEE Transactions on Molecular, Biological, and Multi-Scale Communications (TMBMC).

Invited Talk 18 : The Participatory AR Platform and Applications

Dr. Sung-Uk Jung, Principal Researcher, ETRI, Korea

Abstract:

My research strives to develop the practical AR core technologies which can be suitable for mobile devices and utilized in real situation by developing the AR cloud framework for multi-users, mobile SLAM for estimating the device's position and mobile skeleton extraction for real-virtual object interaction. In this talk, I will outline a participatory AR platform which is the government funded research project in Korea. I will also show the AR platform applications which have commercially applied for public spaces such as AR musical, miniature AR, outdoor AR service and so on.

Biography:

Sung-Uk Jung received the B.Sc. degree in electrical engineering from Korea University in 2003, the M.Sc. degree in electrical engineering and computer science from Korea Advanced Institute of Science and Technology (KAIST), Korea, in 2005, and the Ph.D. degree in electronics and computer science from the University of Southampton, U.K., in 2012. Since August 2005, he has been with Electronics and Telecommunications Research Institute (ETRI), Korea, and is currently with the Content Research Division of ETRI. His current research interests include computer vision, human motion analysis, augmented reality, and human computer interaction.

Technical Paper Sessions

October 20th (Wednesday), 2021

[Session 1A] Artificial Intelligence and Machine Learning I

Oct. 20, 08:30~10:10

Chair : Yagya Raj Pandeya (Jeonbuk National University)

Session 1A-1 A Case Study: Characterization of Performance Inconsistency for Reinforcement Learning on Flappy Bird Game
Aidar Shakerimov, Dmitriy Li and Jurn-Gyu Park (Nazarbayev University, Kazakhstan)

Session 1A-2 Transformer based prediction method for solar power generation data
Nacwoo Kim, HyunYong Lee, Jungi Lee and Byung Tak Lee (ETRI, Korea (South))

Session 1A-3 Benchmark Analysis of Deep Learning-based 3D Object Detectors on NVIDIA Jetson Platforms
Minjae Choe (University of Illinois at Urbana-Champaign (UIUC), USA); Sukjun Lee (Korea Electronics Technology Institute (KETI), Korea (South)); Nak-Myoung Sung (Korea Electronics Technology Institute, Korea (South)); Sungwook Jung and Chungjae Choe (Korea Electronics Technology Institute (KETI), Korea (South))

Session 1A-4 Performance evaluation method of cyber attack behaviour forecasting based on mitigation
Changhee Choi (Agency For Defense Development, Korea (South)); SungUk Shin (Agency for Defense Development, Korea (South)); Chanho Shin (Agency For Defense Development, Korea (South))

Session 1A-5 Machine Learning for Diabetes Prediction
Usman Ahmed and Chunxiao Li (Yangzhou University, China)

Session 1A-6 A Comprehensive Data Imbalance Analysis in Covid-19 Classification dataset
Zineb Tissir (Gachon University & Institute of Information & Communications Technology Planning & Evaluation (IITP), Korea (South))

[Session 2A] 5G, 4G, WLAN I

Oct. 20, 08:30~10:10

Chair : Sangheon Pack (Korea University)

Session 2A-1 Fifth Generation Cellular Networks for Underground Block Cave Mining: A Position Paper
Philip Branch (Swinburne University of Technology, Australia)

Session 2A-2 Performance Analysis of AMC for LTE-LAA under Rayleigh Fading Channel
Jaehong Yi (Samsung Electronics & Samsung Research, Korea (South)); Junseok Kim (Samsung Electronics, Korea (South)); Kitaek Lee and Saewoong Bahk (Seoul National University, Korea (South))

Session 2A-3 Performance Evaluation of IEEE 802.11ax Midamble and Impact of Interference
Kanghyun Lee and Saewoong Bahk (Seoul National University, Korea (South))

Session 2A-4 Performance Evaluation of OFDM Hybrid Number and Index Modulation for 6G Mobile System
Mohammad Tanvir Mahmud and Heung-Gyoon Ryu (Chungbuk National University, Korea (South))

Session 2A-5 A Joint Denoising and Channel Smoothing Algorithm in Time-domain
Juho Park (ETRI, Korea (South)); Moon-Sik Lee (Electronics and Telecommunications Research Institute & Stanford University, Korea (South))

Technical Paper Sessions

Session 2A-6 Deep Learning-based Automatic Modulation Classification for Wireless OFDM Communications
Thien Huynh-The (Kumoh National Institute of Technology, Korea (South)); Quoc-Viet Pham (Pusan National University, Korea (South)); Toan-Van Nguyen (Utah State University, USA); Qui Pham and Dong Seong Kim (Kumoh National Institute of Technology, Korea (South))

[Session 3A] Wireless & Mobile Communication Systems I

Oct. 20, 08:30~10:10
Chair : Williams-Paul Nwadiugwu (ICT Convergence Research Center, Kumoh National Institute of Technology)

Session 3A-1 Deep Learning-based Secure Transmission for SWIPT System with Power-Splitting Scheme
Huynh Thien (University of Ulsan, Korea (South)); Pham Viet-Tuan (Hue University, Vietnam); Insoo Koo (University of Ulsan, Korea (South))

Session 3A-2 Sensing weight selection using the genetic algorithm to enhance cooperative decision
Noor Gul (University of Peshawar & Korea Polytechnic University, Korea (South)); Saeed Ahmed (Mirpur University of Science and Technology, Pakistan); Najeeb Ullah (Northern University, Nowshera, Pakistan); Su Min Kim and Junsu Kim (Korea Polytechnic University, Korea (South))

Session 3A-3 Fingerprint-based Cooperative Beam Selection for UAV communication
Huaping Liu (Oregon State University, USA); Hyeonsung Kim and Intae Hwang (Chonnam National University, Korea (South)); Sangmi Moon (Korea Nazarene University, Korea (South))

Session 3A-4 Contactless Interconnect Circuit Design for Automotive CAN Communication
Seunghun Ryu (Korea Advanced Institute Science and Technology (KAIST), Korea (South)); Haerim Kim (Korea Advanced Institute of Science and Technology, Korea (South)); Jangyong Ahn (Korea Advanced Institute of Science and Technology (KAIST), Korea (South)); Seungyoung Ahn (Korea Advanced Institute of Science and Technology, Korea (South)); Jiseong Kim (Suwon Science College, Korea (South))

Session 3A-5 Bi-directional Power and Trajectory Control for UAV-assisted Cellular System
Gil-Mo Kang, Hyeon Min Kim and Oh-Soon Shin (Soongsil University, Korea (South))

[Session 4A] Internet of Things I

Oct. 20, 08:30~10:10
Chair : Yeunwoong Kyung (Hanshin University)

Session 4A-1 Sound-based anomaly detection using a locally constrained capsule network
Nacwoo Kim, HyunYong Lee, Jungi Lee and Byung Tak Lee (ETRI, Korea (South))

Session 4A-2 A Deep Learning Model for LoRa Signals Classification Using Cyclostationay Features
Abdullateef Almohamad and Mazen Omar Hasna (Qatar University, Qatar); Saud Althunibat (Al-Hussein Bin Talal University, Jordan); Kürşat Tekbıyık (Istanbul Technical University, Turkey); Khalid A. Qaraqe (Texas A&M University at Qatar, USA)

Session 4A-3 Towards Context-Aware Smart Contracts for Blockchain IoT Systems
Lovemore Ngwira and Mpyana Mwamba Merlec (Korea University, Korea (South)); Youn Kyu Lee (Hongik University, Korea (South)); Hoh Peter In (Korea University, Korea (South))

Session 4A-4 Deterministic Scheduling Methods with Conflict Degree and Proportional Deadline in Industrial Wireless Sensor Networks
Heng Wang, Jingqi Yang and Jianglin Hu (Chongqing University of Posts and Telecommunications, China)

Technical Paper Sessions

Session 4A-5 Selective Beam Switching System for Wireless Sensor Network Communication
Toufiq Aziz and Heung-Gyoon Ryu (Chungbuk National University, Korea (South))

Session 4A-6 IoT Statistic and Analytics of Networking Traffic Data using AWS IoT Cloud Core
Quoc Trung Khuong (Rochester Institude of Technology, USA); Tae (Tom) H Oh (Rochester Institute of Technology, USA)

[Session 5A] Big Data and Smart Computing

Oct. 20, 08:30~10:10

Chair : Heecheol Yang (Chungnam National University)

Session 5A-1 An Approach for Utilizing Correlation among Sensors for Unsupervised Anomaly Detection of Wind Turbine System
HyunYong Lee, Nacwoo Kim, Jungi Lee and Byung Tak Lee (ETRI, Korea (South))

Session 5A-2 Smart-mDAG: An Intelligent Scheduling Method for Multi-DAG Jobs
Yifan Zhu and Bo HU (Beijing University of Posts and Telecommunications, China)

Session 5A-3 Optimizing the location of products in a warehouse using genetic algorithms
Won Yong Ha, Ki-yang Cho, Chung Sik Han and Jun Lyeu Cho (Ministry of National Defense, Korea (South)); Ho Jun Lee (University of Twente, Korea (South))

Session 5A-4 BPTE: Bitcoin Price Prediction and Trend Examination using Twitter Sentiment Analysis
Muhammad K. Shahzad, Laiba Bukhari and Tayyeba Muhammad Khan (National University of Sciences & Technology (NUST), Pakistan); S. M. Riazul Islam (Sejong University, Korea (South)); Mahmud Hossain (University of Alabama at Birmingham, USA); Kyung Sup Kwak (Inha University, Korea (South))

Session 5A-5 ETRI Extended Memory Pool System Architecture using Gen-Z Protocol
Wonok Kwon (ETRI, Korea (South))

[Session 6A] Mobile Cloud Computing & Communication Systems and Applications

Oct. 20, 08:30~10:10

Chair : Sungtek Kahng (Incheon National University)

Session 6A-1 Greedy-Based Edge Collaboration Scheme for Improving Quality of Experience
JInho Park and Kwangsue Chung (Kwangwoon University, Korea (South))

Session 6A-2 A QoE-based Optimization Approach to Computation Offloading in Vehicle-assisted Multi-access Edge Computing
Qui Pham, Thien Huynh-The and Dong Seong Kim (Kumoh National Institute of Technology, Korea (South))

Session 6A-3 Neural Architecture Search for Computation Offloading of DNNs from Mobile Devices to the Edge Server
Kyungchae Lee (Korea Advanced Institute of Science and Technology, Korea (South)); Linh Vu Le (Korea Advanced Institution of Science and Technology, Korea (South)); Heejae Kim (KAIST, Korea (South)); Chan-Hyun Youn (Korea Advanced Institute of Science and Technology, Korea (South))

Session 6A-4 A method to integrate heterogeneous time-series data with a specific description frequency
Jaewon Moon and Seungtaek Oh (Korea Electronics Technology Institute, Korea (South)); Seung Woo Kum (Korea Elecronics Technology Institute, Korea (South))

Technical Paper Sessions

Session 6A-5 Kubernetes-based DL Offloading Framework for Optimizing GPU Utilization in Edge Computing
Chorwon Kim, Ryangsoo Kim, Geun-Yong Kim and Sungchang Kim (ETRI, Korea (South))

Session 6A-6 TRUMP: Trace Revisitation for User Mobility Prediction
Seungyeol Lee (ETRI, Korea (South))

[Session 7A] Encryption and Security for ICT Convergence

Oct. 20, 08:30~10:10

Chair : Hyung Tae Lee (Chung-Ang University)

Session 7A-1 Blockchain-based Personal Data Trading System using Decentralized Identifiers and Verifiable Credentials
Daegeun Yoon and Sung-Jin Moon (ETRI, Korea (South)); KiSung Park (Electronics and Telecommunications Research Institute, Korea (South)); SungKee Noh (ETRI, Korea (South))

Session 7A-2 Enhanced security computational double random phase encryption by using additional random function
Kazuaki Honda, Jaehoon Lee and Hyun-Woo Kim (Kyushu Institute of Technology, Japan); Myungjin Cho (Hankyong National University, Korea (South)); Min-Chul Lee (Kyushu Institute of Technology, Japan)

Session 7A-3 Wi-SUN Device Authentication using Physical Layer Fingerprint
Mi-kyung Oh (ETRI, Korea (South)); Sangjae Lee (ETRI, KOREA, Korea (South)); Yousung Kang (ETRI, Korea (South))

Session 7A-4 A Secret Sharing Scheme to Reduce the Total Data Size
Kuniaki Tsuji, Shiden Kishimoto, Yuya Tarutani, Yukinobu Fukushima and Tokumi Yokohira (Okayama University, Japan)

[Poster 8A] Artificial Intelligence and Machine Learning I

Oct. 20, 08:30~10:10

Chair : Hyosu Kim (Chung-Ang University)

Poster 8A-1 Performance-related Internal Clustering Validation Index for Clustering-based Anomaly Detection
HyunYong Lee, Nacwoo Kim, Jungi Lee and Byung Tak Lee (ETRI, Korea (South))

Poster 8A-2 Multi-modal, Multi-task and Multi-label for Music Genre Classification and Emotion Regression
Yagya Raj Pandeya (Jeonbuk National University, Jeonju, South Korea & Guru Technologies, Korea (South)); Jie You (Jeonbuk National University); Bhuwan Bhattarai (Jeonbuk National University, Korea (South)); Joon Whoan Lee (Jeonbuk National University)

Poster 8A-3 Personalized Federated Learning with Clustering: Non-IID Heart Rate Variability Data Application
Joo Hun Yoo, Ha Min Son and Hyejun Jeong (Sungkyunkwan University, Korea (South)); Eun-Hye Jang, Ah Young Kim and Han Young Yu (Electronics and Telecommunications Research Institute, Korea (South)); Hong Jin Jeon (Samsung Medical Center, Korea (South)); TaiMyoung Chung (SungkyunKwang University, Korea (South))

Technical Paper Sessions

Poster 8A-4 The Precision SOC Estimation Method of LiB for EV Applications Using ANN

Ga-Eun Jung (KERI, Korea (South)); JiKook Baek (IES Co. LTD., Korea (South)); Jianyong Liu (IES Co., Ltd., Korea (South)); Van Quan Dao, Minh-Chau Dinh and Chang Soon Kim (Changwon National University, Korea (South)); Myung-Kwan Lee (Battery Solution Co., Ltd., Korea (South)); JungHyo Bae (Korea Electrotechnology Research Institute, Korea (South))

Poster 8A-5 A Framework for Adaptive Deep Reinforcement Semantic Parsing of Unstructured Data

Shubham Jain (Athlone Institute Of Technology & Ericsson, Ireland); Enda Fallon (Athlone Institute of Technology, Ireland); Amy Amy de Buitléir (Ericsson, Ireland)

Poster 8A-6 Image-based Sleep Stage Classification Model for Multi-Institutional Dataset

Yunhee Woo (HALLYM University, Korea (South)); DongYoung Kim (Hallym Univ, Korea (South)); Jaemin Jeong, Dong-Kyu Kim and Jeong-Gun Lee (Hallym University, Korea (South))

Poster 8A-7 Enhancing the Data Regularization Effect with Randomly Combined Features for Object Detection

Jiyeon Kim (University of Science and Technology, Korea (South)); Yong-Ju Lee (ETRI, Korea (South)); Yong-Hyuk Moon (Electronics and Telecommunications Research Institute (ETRI) & University of Science and Technology (UST), Korea (South))

Poster 8A-8 Machine Learning-Based Channel Prediction Exploiting Frequency Correlation in Massive MIMO Wideband Systems

Beomsoo Ko (Korea Advanced Institute of Science and Technology (KAIST), Korea (South)); Hwanjin Kim and Junil Choi (KAIST, Korea (South))

Poster 8A-9 Feature Vector Extraction Technique for Facial Emotion Recognition Using Facial Landmarks

Alwin Poulose (Kyungpook National University, Korea (South)); Jung Hwan Kim (KyungPook National University, Korea (South)); Dong Seog Han (Kyungpook National University, Korea (South))

Poster 8A-10 Does Identity Mapping Really Help in ResNet?

Yoo-Kyung Lee and Dong-Hwan Lee (University of Science and Technology, Korea (South)); Jae-Hun Choi, Jang-Hee Yoo and Seung-Ik Lee (Electronics and Telecommunications Research Institute, Korea (South))

Poster 8A-11 Lightweight Monocular Depth Estimation Based On Perceptual Loss and Network Slimming

Seungjae Lee and Yongsik Lee (ETRI, Korea (South)); Suwoong Lee (Electronics and Telecommunications Research Institute, Korea (South)); Jong Gook Ko (ETRI, Korea (South))

Poster 8A-12 Domain-Robust Pedestrian-View Intersection Classification

Marcella Astrid and Muhammad Zaigham Zaheer (University of Science and Technology, Korea (South)); Jae-Yeong Lee and Seung-Ik Lee (Electronics and Telecommunications Research Institute, Korea (South))

Poster 8A-13 Fast Anomaly Detection Model based on Long Sequences for Energy Storage System

Hong-Soon Nam (ETRI, Korea (South)); Jongwon Park (Chungnam National University, Korea (South))

Poster 8A-14 Dynamic graph neural network for super-pixel image classification

Linh Vu Le (Korea Advanced Institution of Science and Technology, Korea (South)); Chan-Hyun Youn (Korea Advanced Institute of Science and Technology, Korea (South))

Poster 8A-15 Arrhythmia Detection Using Convolutional Neural Networks with Temporal Attention Mechanism

Muhammad Zubair (Korea University of Science and Technology & Electronics and Telecommunication Research Institute, Korea (South)); Sungpil Woo and Sunhwan Lim (ETRI, Korea (South)); Chan-Won Park (Electronics and Telecommunications Research Institute, Korea (South))

Technical Paper Sessions

Poster 8A-16 A Study on Online ARIMA Algorithms applying various gradient descent optimization algorithms for Time Series Prediction
Jungi Lee, HyunYong Lee, Nacwoo Kim and Byung Tak Lee (ETRI, Korea (South))

Poster 8A-17 Facial Micro-Expression Recognition in Video using Squeezed Landmark Feature Maps
Nayeon Kim (University of Science and Technology, Korea (South)); Sukhee Cho (ETRI, Korea (South)); Chung Hyun Ahn (Electronics and Telecommunicaitons Research Institute, Korea (South)); Byungjun Bae (Electronics and Telecommunications Research Institute, Korea (South))

Poster 8A-18 A Weight-Sharing Autoencoder with Dynamic Quantization for Efficient Feature Compression
Ji Sub Choi, Jungrae Kim and Jong Hwan Ko (Sungkyunkwan University, Korea (South))

Poster 8A-19 A Study on American Football Player Tracking based on Video through deep learning and GPS convergence
Jung Soo Lee and SungWon Moon (ETRI, Korea (South)); Jiwon Lee (Electronics and Telecommunications Research Institute, Korea (South)); Ah Reum Oh (ETRI, South Korea, Korea (South)); Do-Won Nam and Wonyoung Yoo (ETRI, Korea (South))

Poster 8A-20 Pixel-based Continuous State Prediction with Perceptual Loss
Donghun Lee (Electronics and Telecommunications Research Institute, Korea (South)); Jun Hee Park (ETRI, Korea (South))

Poster 8A-21 Reusing Agent's Representations for Adaptation to Tuned-environment in Fighting Game
Dae-Wook Kim (Electronics and Telecommunications Research Institute, Korea (South)); Sung-Yun Park (University of Science & Technology & Electronics and Telecommunications Research Institute, Korea (South)); Seong-Il Yang (Electronics and Telecommunications Research Institute, Korea (South))

Poster 8A-22 Per-frame Sign Language Gloss Recognition
Chang Jo Kim and Han-Mu Park (Korea Electronics Technology Institute, Korea (South))

Poster 8A-23 GaN/Si 60nm 1W High Power 80GHz Power Amplifier
Ji-Hye Hwang (Korea Electronics Technology Institute & KETI, Korea (South))

Poster 8A-24 GaN/SiC 150nm 3W High Linearity 28GHz Power Amplifier
Ji-Hye Hwang (Korea Electronics Technology Institute & KETI, Korea (South))

Poster 8A-25 A study on fire prediction method using air quality measurement sensors of smart indoor parking lot
Eunjoo Kim, Woongshik You and Cheol Sig Pyo (ETRI, Korea (South))

Poster 8A-26 OSTGazeNet: One-stage Trainable 2D Gaze Estimation Network
Heeyoung Joo, Min-Soo Ko and Hyok Song (Korea Electronics Technology Institute, Korea (South))

Poster 8A-27 A Fast 4K Video Frame Interpolation based on StepWise Optical Flow Computation and Video Spatial Interpolation
Jinwoo Jeong (Korea Electronics Technology Institute, Korea (South)); Minsoo Hong (KETI, Korea (South)); JeWoo Kim (Korea Electronic Technology Institute (KETI), Korea (South)); Sungjei Kim (Korea Electronics Technology Institute, Korea (South))

Poster 8A-28 Error Distribution-based Anomaly Score for Forecasting-based Anomaly Detection of PV Systems
HyunYong Lee, Nacwoo Kim, Jungi Lee and Byung Tak Lee (ETRI, Korea (South))

Poster 8A-29 An Incremental Learning for Plant Disease classification
Bhuwan Bhattarai (Jeonbuk National University, Korea (South))

Poster 8A-30 A Review on Collision Avoidance Systems for Unmanned Aerial Vehicles
Kelvin Dushime, JaeSeung Song and Lewis Nkenyereye (Sejong University, Korea (South)); Seong Ki Yoo (Coventry University, United Kingdom (Great Britain))

Technical Paper Sessions

Poster 8A-31 A Comparative Analysis of Methods Based on Semantic Segmentation for Cloud Detection in Remote Sensing Imagery
Ji Hyeon Yim (Korea Aerospace Research Institute, Korea (South)); Min-a Kim, Ku-hyeok Kim, Jaeyeol Lee, MyungShin Lee and DaeWon Chung (KARI, Korea (South)); Kyeongmi Jeon (SIIS, Korea (South)); Jamyoung Koo (SIA, Korea (South))

Poster 8A-32 Content Caching in HAP-assisted Multi-UAV Networks Using Hierarchical Federated Learning
Arooj Masood (Chung-Ang University, Korea (South)); The-Vi Nguyen (Chung-Ang University, Seoul, Republic of Korea, Korea (South)); Thanh Phung Truong and Sungrae Cho (Chung-Ang University, Korea (South))

Poster 8A-33 Sequential Deep Learning Architectures for Anomaly Detection in Virtual Network Function Chains
Chungjun Lee (Handong Global University, Korea (South)); Jibum Hong (Pohang University of Science and Technology, Korea (South)); Dongnyeong Heo and Heeyoul Choi (Handong Global University, Korea (South))

Poster 8A-34 Dual-Encoding Style Transfer for Korean Font Generation
Daigeun Lee (Sejong University, Korea (South)); Jin Tae Kwak (Korea University, Korea (South))

Poster 8A-35 Few-shot modulation recognition using Recurrence Plot Algorithm
Woojin Yun, Jiyeon Park, Hyeongyun Kim and Haewoon Nam (Hanyang University, Korea (South))

Poster 8A-36 UAV Detection Using Split-Parallel CNN For Surveillance Systems
Ali Aouto, Jae Min Lee and Dong Seong Kim (Kumoh National Institute of Technology, Korea (South))

Poster 8A-37 Acceleration of DNN-Based Video Object Detection Using Temporal Dependency of the Object Size
JeongYeop Yoo (SungKyunKwan University, Korea (South)); Jong Hwan Ko (Sungkyunkwan University, Korea (South))

Poster 8A-38 Triad of Split Learning: Privacy, Accuracy, and Performance
Dongho Lee, Jaeseo Lee, Jun Hyunsung, Kim HongDeok and Seehwan Yoo (Dankook University, Korea (South))

[Session 1B] Artificial Intelligence and Machine Learning II

Oct. 20, 14:30~16:10

Chair : Payam Hosseinzadeh Kasani (Kangwon National University)

Session 1B-1 Reward Shaping to Learn Natural Object Manipulation With an Anthropomorphic Robotic Hand and Hand Pose Priors via On-Policy Reinforcement Learning
Patricio Rivera (Kyung Hee University, Korea (South)); Jiheon Oh (Kyung Hee University, USA); Edwin Valarezo, Gahyeon Ryu, Hwanseok Jung and Jin Hyunk Lee (Kyung Hee University, Korea (South)); Jin Gyun Jeong (Kyung Hee University, USA); Tae-Seong Kim (Kyung Hee University, Korea (South))

Session 1B-2 A Floyd-Warshall-based Reoptimization of Q Matrix on the Single DVRPPD with On-demand Cancellations
Jasper Kyle Catapang (University of Birmingham, United Kingdom (Great Britain)); Geoffrey A. Solano (University of the Philippines Manila, Philippines)

Session 1B-3 Signal Recovery Technique Using Recurrent Neural Network in Interference Environment
Haesik Kim (VTT Technical Research Centre of Finland, Finland)

Session 1B-4 A Nonlinear Autoregressive Neural Network for Interference Prediction and Resource Allocation in URLLC Scenarios
Christian Padilla, Ramin Hashemi, Nurul Huda Mahmood and Matti Latva-aho (University of Oulu, Finland)

Technical Paper Sessions

Session 1B-5 Graph Neural Network based Scene Change Detection Using Scene Graph Embedding with Hybrid Classification Loss
Soyeon Kim and Kyungno Joo (KAIST, Korea (South)); Chan-Hyun Youn (Korea Advanced Institute of Science and Technology, Korea (South))

Session 1B-6 HEp-2 Cell Classification Using an Ensemble of Convolutional Neural Networks
Payam Hosseinzadeh Kasani (Kangwon National University & Kangwon National University Hospital, Korea (South)); Sara Hosseinzadeh Kasani (University of British Columbia, Canada); Han Wool Kim (Seoul National University, Korea (South)); Kee Hyun Cho and Jae-Won Jang (Kangwon National University Hospital, Korea (South)); Cheol-Heui Yun (Seoul National University, Korea (South))

[Session 2B] 5G, 4G, WLAN II

Oct. 20, 14:30~16:10

Chair : Yeon Ho Chung (Pukyong National University)

Session 2B-1 Reinforcement Learning-Based Resource Allocation for Streaming in a Multi-Modal Deep Space Network
Taeyun Ha, Junsuk Oh, Donghyun Lee, Jeonghwa Lee, Yongin Jeon and Sungrae Cho (Chung-Ang University, Korea (South))

Session 2B-2 Joint Optimization of Time and Power allocation in Energy-Constrained Wireless Powered Communication Network
Iqra Hameed and Insoo Koo (University of Ulsan, Korea (South))

Session 2B-3 NOMA-based Uplink OFDMA Collision Reduction in 802.11ax Networks
Won-Jae Lee (Ajou, Korea (South)); Wonjae Shin (Ajou University, Korea (South)); Joan A Ruiz-de-Azua (i2CAT Foundation, Spain); Lara Fernandez Capon and Hyuk Park (UPC-BarcelonaTech, Spain); Jae-Hyun Kim (Ajou University, South Korea, Korea (South))

Session 2B-4 A Design of Hybrid CSMA using Sequential-based Scheduling Algorithm
Tae Yoon Kim (University of Ajou, Korea (South)); Lara Fernandez Capon and Hyuk Park (UPC-BarcelonaTech, Spain); Jae-Hyun Kim (Ajou University, South Korea, Korea (South))

Session 2B-5 Weighted Sum-Rate Maximization for Rate-splitting Multiple Access with Imperfect Channel Knowledge
Byungju Lee (Kumoh National Institute of Technology, Korea (South)); Wonjae Shin (Ajou University, Korea (South)); H. Vincent Poor (Princeton University, USA)

Session 2B-6 Profiling Vehicles for Improved Small Cell Beam-Vehicle Pairing Using Multi-Armed Bandit
Abdulkadir Kose, Chuan Heng Foh, Haeyoung Lee and Klaus Moessner (University of Surrey, United Kingdom (Great Britain))

[Session 3B] Wireless & Mobile Communication Systems II

Oct. 20, 14:30~16:10

Chair : Intae Hwang (Chonnam National University)

Session 3B-1 A Study on Machine Learning-based Approaches for Reconfigurable Intelligent Surface
K M Faisal and Wooyeol Choi (Chosun University, Korea (South))

Session 3B-2 Compact Multiple Wideband Slotted Circular Patch Antenna for Satellite and Millimeter-Wave Communications
Md. Moklesur Rahman and Heung-Gyoon Ryu (Chungbuk National University, Korea (South))

Technical Paper Sessions

Session 3B-3 On the Performance of Source Location Privacy Protocols under Varied Sensor Node Residual Energy
Lilian Mutalemwa and Seokjoo Shin (Chosun University, Korea (South))

Session 3B-4 Path Loss Analysis for VANET in Tunnel Environment
Honghui Jin, Wen Wu and Chunxiao Li (Yangzhou University, China)

Session 3B-5 Performance Analysis of Uplink NOMA based Full-Duplex UAV for Indoor Disaster Environment
Jung-Hwa Kang (University of Ajou, Korea (South)); Hisato Kashihara and Josaphat Tetuko Sri Sumantyo (Chiba University, Japan); Jae-Hyun Kim (Ajou University, South Korea, Korea (South))

Session 3B-6 Max-Min Fair Power Control and Coverage Probability for UAV-Assisted Cooperative and Cognitive NOMA
Sultangali Arzykulov (King Abdullah University of Science and Technology, Saudi Arabia); Abdulkadir Celik (King Abdullah University of Science & Technology, Saudi Arabia); Galymzhan Nauryzbayev (Nazarbayev University, Kazakhstan); Ahmed M. Eltawil (King Abdullah University of Science and Technology, Saudi Arabia)

[Workshop I] Quantum Internet Technology

Oct. 20, 14:30~16:10

Chair : Jun Heo (Korea University)

Workshop I-1 Position-Error Compensation Method for FSO using Two-Step Search
Jong-Min Kim, Ju-Hyung Lee and Young-Chai Ko (Korea University, Korea (South))

Workshop I-2 Side Channel Vulnerability in Parity Computation of Generic Key Reconciliation Process on QKD
GyuSang Kim (Korea University, Korea (South)); Dongjun Park (Koera University, Korea (South)); HeeSeok Kim and Seokhie Hong (Korea University, Korea (South))

Workshop I-3 Visible Wavelength Polarization Entangled Photon-Pairs Using SFWM in Nondegenerate Spatial Modes
Kyungtaek Lee, Junha Jung and Ju Han Lee (University of Seoul, Korea (South))

Workshop I-4 Finite-key-size Effect in Asymmetric Twin-Field Quantum Key Distribution
Jooyoun Park and Jun Heo (Korea University, Korea (South))

Workshop I-5 A Small Phase Shift Attack on Blind Quantum Computing
Kunhoo Kim and Jun Heo (Korea University, Korea (South))

Workshop I-6 A hybrid architecture for resolving cryptographic issues in Internet of things (IoT), Employing quantum computing supremacy
Shuhab Shamshad (University Azad Jammu and Kashmir Muzaffarabad, Pakistan); Rabia Riaz (AJK University, Pakistan); Farina Riaz (University of Southern Queensland Australia, Australia); Sanam Shahla Rizvi (Ajou University, Korea (South))

[Workshop II] Intelligent and Immersive Content Technology

Oct. 20, 14:30~16:10

Chair : Jin-Seo Kim (ETRI)

Workshop II-1 Free Form Plenoptic Video Acquisition and Visualization System
Seongjin Park and Yugu Jung (Electronics and Telecommunications Research Institute, Korea (South)); Ho Wook Jang (ETRI, Korea (South)); DoHyung Kim (Electronics and Telecommunications Research Institute, Korea (South))

Technical Paper Sessions

Workshop II-2 A study on the application of knowledge distillation in ship type classification model development
Jiwon Lee (Electronics and Telecommunications Research Institute, Korea (South)); SungWon Moon, Do-Won Nam and Jung Soo Lee (ETRI, Korea (South)); Ah Reum Oh (ETRI, South Korea, Korea (South)); Wonyoung Yoo (ETRI, Korea (South))

Workshop II-3 An Efficient Policy Improvement in Human Interactive Learning Using Entropy
Sung-Yun Park (University of Science & Technology & Electronics and Telecommunications Research Institute, Korea (South)); Dae-Wook Kim, Sang-Kwang Lee and Seong-Il Yang (Electronics and Telecommunications Research Institute, Korea (South))

Workshop II-4 3D hand motion and position estimation using ultrasonic receiver array and inertial sensors
Sang-Woo Seo (Electronics and Telecommunications Research Institute (ETRI), Korea (South)); SeungJoon Kwon (ETRI, Korea (South))

Workshop II-5 Convolutional Neural Network for Implementing a 2D Median Filter
Soonchul Jung (ETRI, Korea (South)); Jae Woo Kim (Electronics and Telecommunications Research Institute, Korea (South)); Yoon-Seok Choi (ETRI, Korea (South)); Hyeongju Jeon and Jin-Seo Kim (Electronics and Telecommunications Research Institute, Korea (South))

Workshop II-6 Simplification method of photogrammetry building models based on vectorization techniques
Kyung-Kyu Kang and Chang-joon Park (ETRI, Korea (South))

[Workshop III] The Workshop on Satellite Information Convergence Application Service

Oct. 20, 14:30~16:10

Chair : Choong-Ho Ki (Ajou University)

Workshop III-1 Monitoring of Vertical Land Motion at Tide Gauges Using Time-series Sequential SBAS Technique
Suresh Krishnan Palanisamy Vadivel and Duk-jin Kim (Seoul National University, Korea (South))

Workshop III-2 Electromagnetic Wave Propagation Considering Planar Array Antenna in Atmospheric Environments
Changseong Kim, Soyeong Lee, Junmo Yang and Yong Bae Park (Ajou University, Korea (South))

Workshop III-3 Performance Maximization of Satellite SAR image Processing using Reinforcement Learning
Kyeongrok Kim (Ajou, Korea (South)); Howard Yang (ZJU-UIUC Institute & University of Illinois at Urbana Champaign (UIUC), China); Tony Q. S. Quek (Singapore University of Technology and Design, Singapore); Jae-Hyun Kim (Ajou University, South Korea, Korea (South))

Workshop III-4 Disparity probability volume guided defocus deblurring using dual pixel data
Soo Hyun Jung and Yong Seok Heo (Ajou University, Korea (South))

Workshop III-5 Automating the Classification of Roof Waterproofing Buildings Using Satellite Images
Sehyeong Kim, Sangho Ahn, Jungwoo Chae, Jaehyeong Park and Kang Juyoung (Ajou University, Korea (South))

Workshop III-6 Image Data Augmentation for SAR Automatic Target Recognition Using TripleGAN
Jieon Hwang and Yoan Shin (Soongsil University, Korea (South))

Technical Paper Sessions

[Workshop IV] The Workshop on Intelligent 6G communication system

Oct. 20, 14:30~16:10

Chair : Hoon Lee (Pukyong National University)

Workshop IV-1 Robust Wireless Fronthauling Methods for Decentralized Deep Learning in Fog-RAN
Hoon Lee (Pukyong National University, Korea (South)); Junbeom Kim and Seok-Hwan Park (Jeonbuk National University, Korea (South))

Workshop IV-2 Enhanced Vehicular Localization under Non-Line-of-Sight Multipath Propagation
Sung Il Choi (Uiversity of Korea, Korea (South)); Hong Ki Kim and Sang Hyun Lee (Korea University, Korea (South))

Workshop IV-3 Performance Analysis of IRS-Assisted LEO Satellite Communication Systems
Juhwan Lee (Seoul National University, Korea (South)); Wonjae Shin (Ajou University, Korea (South)); Jungwoo Lee (Seoul National University, Korea (South))

Workshop IV-4 Throughput Analysis of MISO Communication Systems with Limited Feedback
Wentao Zhou, Jeonghyeon Jang and Inkyu Lee (Korea University, Korea (South))

Workshop IV-5 Autonomous Aerial Mobility Learning for Drone-Taxi Flight Control
Won Joon Yun, Yoo Jeong Ha, Soyi Jung and Joongheon Kim (Korea University, Korea (South))

Workshop IV-6 Sign Gradient Aggregation for Wireless Federated Learning Using Bussgang LMMSE Estimation
Seunghoon Lee (Pohang University of Science and Technology, Korea (South)); Chanho Park and Namyoon Lee (POSTECH, Korea (South))

[Poster 8B] Applications for ICT Convergence

Oct. 20, 14:30~16:10

Chair : Nhu-Ngoc Dao (Sejong University)

Poster 8B-1 Design of Task Allocation Algorithm for Simulating Warehouse Logistics Scenarios
YouHee Choi (ETRI, Korea (South)); Wonpil Yu (Korea (South))

Poster 8B-2 Optical wireless power path configuration based on DS-OCDMA technique
Gunzung Kim, Jeongsook Eom and YongWan Park (Yeungnam University, Korea (South))

Poster 8B-3 Multiple PUF-based lightweight authentication method in the IoT
Seungyong Yoon (ETRI, Korea (South)); Byoungkoo Kim (Electronics and Telecommunications Research Institute (ETRI), Korea (South)); Yousung Kang (ETRI, Korea (South))

Poster 8B-4 Analysis of Coexistence between Unmanned Aerial Vehicles and Wireless Devices below 1GHz
Suna Choi (ETRI, Korea (South))

Poster 8B-5 WebRTC-based real-time non-face-to-face visual assistance system design and research for the visually impaired using glasses-type assistive devices
Incheol Jeong, Kapyol Kim, Jongwon Lee and Mukhriddin Nuriddin ugli Mukhiddinov (Gachon University, Korea (South)); Abdinabi Nuralievich Mukhamadiyev (Gachon University, Uzbekistan); Jinsoo Cho (Gachon University, Korea (South))

Poster 8B-6 Feature Correlation-based Data Fusion using Dempster-Shafer Evidence Theory for WSN
Ihsan Ullah, Hyun-Kyo Lim and Youn-Hee Han (Korea University of Technology and Education, Korea (South))

Technical Paper Sessions

Poster 8B-7 A HashChain-based Partial Matching Embedded Manifest for NDN
Sae Hyong Park (Electronics and Telecommunications Research Institute, Korea (South)); YongYoon Shin and Namseok Ko (ETRI, Korea (South))

Poster 8B-8 Generation method of a drone map using VWorld
HeyonJoong Wi (University of Science and Technology, Korea (South)); Insung Jang and Ahyun Lee (Electronics and Telecommunications Research Institute, Korea (South))

Poster 8B-9 Study on Laser-Powered Aerial Vehicle: Prolong Flying Time Using 976nm Laser Source
Youngchan Lim, Youngwon Choi and Jihoon Ryoo (SUNY Korea, Korea (South))

Poster 8B-10 Concurrent firing LIDAR for self-driving car
Jeongsook Eom, Gunzung Kim and YongWan Park (Yeungnam University, Korea (South))

Poster 8B-11 A Study on the Improvement of Fine-grained Ship Classification through Data Augmentation Using Generative Adversarial Networks
SungWon Moon (ETRI, Korea (South)); Jiwon Lee (Electronics and Telecommunications Research Institute, Korea (South)); Jung Soo Lee (ETRI, Korea (South)); Ah Reum Oh (ETRI, South Korea, Korea (South)); Do-Won Nam and Wonyoung Yoo (ETRI, Korea (South))

Poster 8B-12 The development and verification of a similar crimes search system in Korean
Wonjoo Park (ETRI, Korea (South)); Kwangho Jang (Police Science Institute, Korea (South)); Myung-Sun Baek (ETRI, Korea (South)); Yong-Tae Lee (Electronics and Telecommunications Research Institute, Korea (South))

Poster 8B-13 Design and Evaluation of Exercise Management Application for Patients with Parkinsonism
Su Ji Chae and Kyudong Park (Kwangwoon University, Korea (South))

Poster 8B-14 Heuristic Evaluation for Augmentative and Alternative Communication Application: A Case Study
BeomYoung Jeong (KwangWoon University, Korea (South)); Seungman Choi (Sovoro Inc., Korea (South)); Kyudong Park (Kwangwoon University, Korea (South))

Poster 8B-15 Network Anomaly Detection based on GAN with Scaling Properties
Hyun Jin Kim (Electronics and Telecommunications Research Institute, Korea (South)); Jonghoon Lee (ETRI, Korea (South)); Cheolhee Park and Jong-Geun Park (Electronics and Telecommunications Research Institute, Korea (South))

Poster 8B-16 New communication methods using information tone channels in synchronous wireless distributed communication systems
Hyungu Hwang (Electronics and Telecommunications Research Institute (ETRI), Korea (South)); Jaemin Ahn (Chungnam National University, Korea (South))

Poster 8B-17 Implementation of CSMA-CA state diagram for swarm drone network
Gwonhan Mun (Electrionics and Telecommunications Research Institute, Korea (South)); Daeho Kim (Korea (South)); Hee Wook Kim (Electrionics and Telecommunications Research Institute, Korea (South))

Poster 8B-18 Fleet-sizing of Autonomous Vehicles based on Queueing Modeling for Transportation Service in Tourist Spot
Lae Yeop Lee and Won Seok Choi (Chungbuk National University, Korea (South)); Seong Gon Choi (Chungbuk University, Korea (South))

Poster 8B-19 The analysis of UAV detection performance using rotating cameras
Young-il Kim and Kunmin Yeo (Electronics and Telecommunications Research Institute, Korea (South)); Seong Hee Park (ETRI, Korea (South)); Wun-cheol Jeong (ETRI & University of Science & Technology, Korea (South)); Soonyong Song and Tae-Wook Heo (ETRI, Korea (South))

Technical Paper Sessions

Poster 8B-20 Energy Consumption Location-Based QoS Routing Protocol for Vehicular Ad-Hoc Networks
Yushintia Pramitarini, Thong Nhat Tran and Beongku An (Hongik University, Korea (South))

Poster 8B-21 Log-domain Decoding of Nonbinary Polar Codes
Giyoon Park, Ok-Sun Park and Gweondo Jo (ETRI, Korea (South))

Poster 8B-22 Automatic Network QoS Control Framework for a Small Network
Jeehyeong Kim, Sohyun Kim, Won Gi Choi, Min-Hwan Song and Sang-Shin Lee (Korea Electronics Technology Institute, Korea (South))

Poster 8B-23 In-memory storage based real-time data pipeline for Transportation Equipment in Port
Won Gi Choi, Seolyeong Park, Jeehyeong Kim, Min-Hwan Song and Sang-Shin Lee (Korea Electronics Technology Institute, Korea (South))

Poster 8B-24 A Study on Augmented Reality-based Virtual Pets for the Elderly Living Alone
Myeon-gyun Cho (Semyung University, Korea (South))

Poster 8B-25 Seamless CAN: CAN Bus plus High-availability Seamless Redundancy
Jong Rhee, Ibraheem Abdulsalam, Duc N. M. Hoang, Dong Hwan Kim, Jin Seok Yang and Sang Yoon Park (Myongji University, Korea (South))

Poster 8B-26 Design and Evaluation of Container-based Networking for Low-latency Edge Services
Jae-Geun Cha (ETRI, Korea (South))

Poster 8B-27 A PoC Service of Intelligent Device in the Smart City: Human Detection
Hyunhak Kim (ETRI, Korea (South)); Dong-Hwan Park (Electronics and Telecommunications Research Institute, Korea (South)); Young-Ho Suh and TaeJoon Park (ETRI, Korea (South))

Poster 8B-28 Crack Minimization Between Adjacent 3D Terrain Model Tiles for Planetary-Scale Geospatial Platforms
Ahyun Lee and Insung Jang (Electronics and Telecommunications Research Institute, Korea (South))

Poster 8B-29 Mental stress assessment using SVM with physiological sensor data
Jungsook Kim, Minjung Kim and Kyonghyun Park (ETRI, Korea (South)); Hyunsuk Kim (Electronics and Telecommunications Research Institute & Emotion Recognition IoT Research Section, Korea (South))

Poster 8B-30 Device Independent YANG Auto-generation Mechanism
PyungKoo Park (ETRI, Korea (South)); Taeheum Na (Electronics and Telecommunications Research Institute, Korea (South)); Tae-Yeon Kim (ETRI, Korea (South))

Poster 8B-31 Pretrained network-based sound event recognition for audio surveillance applications
Su-Wan Park (ETRI, Korea (South))

Poster 8B-32 Adaptive Power Quality Monitoring Data Aggregation Method in the Shipyard Environment
Woo-Sung Jung and Tae Hyun Yoon (ETRI, Korea (South)); Daeseung Yoo (Electronics and Telecommunications Research Institute, Korea (South))

Poster 8B-33 Artificial Intelligence-Enabled Data Value Curation on AI-Data Commons
Boyun Eom, Sunhwan Lim, Young-Ho Suh and Sungpil Woo (ETRI, Korea (South)); Dong-Hwan Park and Chan-Won Park (Electronics and Telecommunications Research Institute, Korea (South))

Poster 8B-34 Enabler Development Infrastructure Design for Hyper-connected Common Networking Services
Byeongok Kwak (ETRI, Korea (South))

Technical Paper Sessions

Poster 8B-35 CNN-Based Modulation Classification for OFDM Signal
Geonho Song, Mingyu Jang and Dongweon Yoon (Hanyang University, Korea (South))

Poster 8B-36 A Study on Visualization of Spatial Information using Drone Images
Sangsu Kim, Min-Hyeok Kim and Jung-Hoon Kim (ICTWAY, Korea (South))

Poster 8B-37 Adaptive Beamforming Design for Angular Dynamics in High-Speed Mobility
Ha-Lim Song and Young-Chai Ko (Korea University, Korea (South))

Poster 8B-38 A Design of MANO System for Cloud Native Infrastructure
Jangwon Lee and younghan Kim (Soongsil University, Korea (South))

Poster 8B-39 A Sequential Update Algorithm with Parallel Processing for Deep Learning-Based Beamforming in Real Environments
Sung-Wook Yoon and Oh-Wook Kwon (Chungbuk National University, Korea (South))

Poster 8B-40 Transform-based Lossy Compression for HPC Big Datasets
Aekyung Moon (ETRI, Korea (South))

Poster 8B-41 Vehicle Anti-collision Warning System Based on V2V Communication Technology
Shu-Zhi Liu and Seung-Hoon Hwang (Dongguk University, Korea (South))

Poster 8B-42 On the Performance of SC-Flip and SC-Perturbation Decoders for Parallel Decoding of Polar Codes
Jisang Park and Hyosang Ju (Sungkyunkwan University, Korea (South)); Chanho Yoon (ETRI, Korea (South)); Woncheol Cho (Electronics and Telecommunications Research Institute, Korea (South)); Sang-Hyo Kim (Sungkyunkwan University, Korea (South))

Poster 8B-43 Circuit depth reduction algorithm for QUBO and Ising models in gate-model quantum computers
Kyungtaek Jun (IQCT Inc., Korea (South)); Hyunju Lee (IQCT, Korea (South)); Sun Woo Park (National Institute for Mathematical Sciences, Korea (South)); Byung Chun Kim (IQCT, Korea (South)); Youngho Woo (National Institute for Mathematical Sciences, Korea (South))

Poster 8B-44 On the application of matrix congruence to QUBO formulations for systems of linear equations
Sun Woo Park (National Institute for Mathematical Sciences, Korea (South)); Hyunju Lee and Byung Chun Kim (IQCT, Korea (South)); Youngho Woo (National Institute for Mathematical Sciences, Korea (South)); Kyungtaek Jun (IQCT Inc., Korea (South))

Poster 8B-45 Distance based MCS method for LTE-V2X Mode4
Ji-cheng Yin and Seung-Hoon Hwang (Dongguk University, Korea (South))

Poster 8B-46 Data encryption method using CP-ABE with symmetric key algorithm in blockchain network
Tae Rim Lee, Ho-se Moon and Juwook Jang (Sogang University, Korea (South))

Technical Paper Sessions

October 21st (Thursday), 2021

[Session 1C] Artificial Intelligence and Machine Learning II

Oct. 21, 08:30~10:10

Chair : Kyungjae Lee (Chung-Ang University)

Session 1C-1 Crack Localization of Pipelines Using Machine Learning and Fuzzy Digital Twin
Jongmyon Kim and Farzin Piltan (University of Ulsan, Korea (South))

Session 1C-2 A Preliminary Study on Wav2Vec 2.0 Embeddings for Text-to-Speech
Yohan Lim (University of Science and Technology, Korea (South)); Kim Namhyeong (University of Science and Technology(UST), Korea (South)); Seung Yun, Sanghun Kim and Seung-Ik Lee (Electronics and Telecommunications Research Institute, Korea (South))

Session 1C-3 DARS: Data Augmentation using Refined Segmentation on Computer Vision Tasks
Young Hoon Cho (University of Science and Technology & Electronics and Telecommunications Research Institute, Korea (South)); Jinwuk Seok (Electronics and Telecommunication Research Institute, Korea (South)); Jeong-Si Kim (Electronics and Telecommunications Research Institute, Korea (South))

Session 1C-4 Communication cost reduction using sparse ternary compression and encoding for FedAvg
Khanh Thi Quynh Dinh (Hanoi University of Science and Technology & International Research Institute MICA, Vietnam); Thanh-Hai Tran (Hanoi University of Science and Technology, Vietnam); Thi-Lan Le (School of Electronics and Telecommunications, Vietnam)

Session 1C-5 Quantized Distributed Online Kernel Learning
Jonghwan Park (University of Hanyang, Korea (South)); Songnam Hong (Hanyang University, Korea (South))

Session 1C-6 An Evaluation of Machine Learning Classifiers for Prediction of Alzheimer's Disease, Mild Cognitive Impairment, and Normal Cognition
Payam Hosseinzadeh Kasani (Kangwon National University & Kangwon National University Hospital, Korea (South)); Sara Hosseinzadeh Kasani (University of British Columbia, Canada); Yeshin Kim (Kangwon National University Hospital, Korea (South)); Cheol-Heui Yun (Seoul National University, Korea (South)); Seong Hye Choi (Inha University, Korea (South)); Jae-Won Jang (Kangwon National University Hospital, Korea (South))

[Session 2C] 5G, 4G, WLAN III

Oct. 21, 08:30~10:10

Chair : Ramneek (Korea University)

Session 2C-1 Carrier Frequency Offset Estimation for OFDM System with Large Oscillator Phase Noise
Jun woo Kim (ETRI, Korea (South)); Yong Su Lee (Electronics and Telecommunications Research Institute, Korea (South)); Young-jin Moon (ETRI, Korea (South)); Seungjae Bahng (Electronics and Telecommun. Research Institute, Korea (South)); Jang-won Moon and Heesoo Lee (ETRI, Korea (South))

Session 2C-2 Performance Evaluation of Efficient Collection Method of Sensor Information in Wireless Sensor Networks for Event Detection
Taiki Suehiro, Tsuyoshi Kobayashi, Osamu Takyu and Yasushi Fuwa (Shinshu University, Japan)

Session 2C-3 Actual Machine Experiment of Efficient Collection Method of Sensor Information in Wireless Sensors Network for Event Detection
Taiki Suehiro, Tsuyoshi Kobayashi, Osamu Takyu and Yasushi Fuwa (Shinshu University, Japan)

Technical Paper Sessions

Session 2C-4 High Linearity Ka-band GaN Hemt Low Noise Amplifier
Ji-Seung Seo (KETI(Korea Electronics Technology Institute), Korea (South))

Session 2C-5 Performance Enhancement of UFMC Systems using Kaiser Window Filter
Esmot Ara Tuli (Kumoh National Institute of Technology & Networked Systems Lab, Korea (South)); Dong Seong Kim and Jae Min Lee (Kumoh National Institute of Technology, Korea (South))

Session 2C-6 DNN inference offloading for object detection in 5G multi-access edge computing
Geun-Yong Kim, Ryangsoo Kim, Sungchang Kim and Ki-Dong Nam (ETRI, Korea (South)); Sung-Uk Rha (NIA, Korea (South)); Jung-Hyun Yoon (Korea Telecom, Korea (South))

[Session 3C] Wireless & Mobile Communication Systems III

Oct. 21, 08:30~10:10

Chair : Kyoung-Jae Lee (Hanbat National University)

Session 3C-1 Secure Voting Scheme for Cooperative Sensing
Noor Gul (University of Peshawar & Korea Polytechnic University, Korea (South)); Saeed Ahmed (Mirpur University of Science and Technology, Pakistan); Najeeb Ullah (Northern University, Nowshera, Pakistan); Su Min Kim and Junsu Kim (Korea Polytechnic University, Korea (South))

Session 3C-2 A Low Power Gap-Filler Using ATSC 3.0 Transmission Chip for Mobile TV Broadcasting
Jae-Hwui Bae (Electronics and Telecommunications Research Institute, Korea (South))

Session 3C-3 A Generalized Clutter Loss Model for Slant Path
Jong Ho Kim (ETRI, Korea (South)); Young-Keun Yoon (Electronics and Telecommunications Research Institute, Korea (South)); Jangsuk Choi and Kwangho Choi (RRA, Korea (South))

Session 3C-4 A study on the effect of the adjacent channel interference between C-ITS systems
Ho Kyung Son and Young Jun Chong (ETRI, Korea (South))

Session 3C-5 Design and Implementation of Kubernetes enabled Federated Learning Platform
Kim Jingyeom, DoYeon Kim and Lee JooHyung (Gachon University, Korea (South))

Session 3C-6 Separation Distance Performances between Ingenu and Wi-Fi Systems with Concatenated FEC
Kentaro Yamamoto and Takatoshi Sugiyama (Kogakuin University, Japan)

[Workshop V] The 2nd Workshop on Korea University AI Engineering Research (KU-AIER)

Oct. 21, 08:30~10:10

Chair : Joongheon Kim (Korea University)

Workshop V-1 Introduction to Quantum Reinforcement Learning: Theory and PennyLane-based Implementation
Yunseok Kwak, Won Joon Yun, Soyi Jung, Jong-Kook Kim and Joongheon Kim (Korea University, Korea (South))

Workshop V-2 Trends in Neural Architecture Search: Towards the Acceleration of Search
Youngkee Kim (Korea Univiersity, Korea (South)); Won Joon Yun (Korea University, Korea (South)); Youn Kyu Lee (Hongik University, Korea (South)); Soyi Jung and Joongheon Kim (Korea University, Korea (South))

Technical Paper Sessions

Workshop V-3 A Study on Effective Use of BPM Information in Deepfake Detection
Soo-Hyun Lee, Gyung-eun Yun, Min Young Lim and Youn Kyu Lee (Seoul Women's University, Korea (South))

Workshop V-4 A Measurement Study on Gray Channel-based Deepfake Detection
Seok Bin Son, Seong Hee Park and Youn Kyu Lee (Seoul Women's University, Korea (South))

[Session 5C] Internet of Things II

Oct. 21, 08:30~10:10

Chair : Jaehoon Paul Jeong (Sungkyunkwan University)

Session 5C-1 Experiment on Threshold in Ambient Backscatter Communication with Amplitude Modulation
Jae-Han Lim (University of California, Los Angeles, USA & Kwangwoon University, Korea (South)); Kim Dong Gyun (University of Kwangwoon, Korea (South))

Session 5C-2 A Feasibility Study of An Intelligent Environmental Monitoring System Based On The Ethereum Blockchains
Yiyang Cheng and Kazu Takashio (Keio University, Japan)

Session 5C-3 Real-Time Monitoring of COVID-19 Vaccination Compliance: A Ubiquitous IT Convergence Approach
Simeon Ajakwe (Kumoh National Institute of Technology, Gumi, Korea (South)); Rubina Akter (Kumoh National Institute of Technology & Networked Systems Laboratory, Korea (South)); Love Allen Ahakonye, Dong Seong Kim and Jae Min Lee (Kumoh National Institute of Technology, Korea (South))

Session 5C-4 Unlicensed-band Single-hop LPWA Repeater for Smart-city IoT Applications
Eun-Hee Kim (Electronics and Telecommunications Research Institute, Korea (South)); Kyeseon Lee and TaeJoon Park (ETRI, Korea (South)); Hae-Won Son (Chonbuk National University, Korea (South))

Session 5C-5 Endorsement Policy for Industrial Internet of Thing with Private Blockchain
Yunseong Lee, Donghyun Lee and Junsuk Oh (Chung-Ang University, Korea (South)); Laihyuk Park (Seoul National University of Science and Technology, Korea (South)); Woongsoo Na (Kongju National University, Korea (South)); Sungrae Cho (Chung-Ang University, Korea (South))

Session 5C-6 MERLIN: Smart Framework for Agriculture in India
Arunima Sharma (Malaviya National Institute of Technology Jaipur, India)

[Workshop VII-A] The 3rd Joint International Workshop on Military Informatics (Emerging Technology)

Oct. 21, 08:30~10:10

Chair : Soo Young Shin (Kumoh National Institute of Technology(kit))

Workshop VII-A-1 Enhanced Vulnerability Detection in SCADA Systems using Hyper-Parameter-Tuned Ensemble Learning
Love Allen Ahakonye, Gabriel Amaizu, Cosmas Ifeanyi Nwakanma, Jae Min Lee and Dong Seong Kim (Kumoh National Institute of Technology, Korea (South))

Technical Paper Sessions

Workshop VII-A-2 Selecting Gaussian Process Regression Kernels for IoT Intrusion Detection and Classification
Cosmas Ifeanyi Nwakanma, Love Allen Ahakonye, Jae Min Lee and Dong Seong Kim (Kumoh National Institute of Technology, Korea (South))

Workshop VII-A-3 Energy Efficient Drone Deployment with Optimized Path-planning in Post-Disaster Environment
Mohtasin Golam (Kumoh National Institute of Technology (KIT) & IT Convergence, Korea (South)); Rubina Akter (Kumoh National Institute of Technology & Networked Systems Laboratory, Korea (South)); Jae-Min Lee and Dong Seong Kim (Kumoh National Institute of Technology, Korea (South))

Workshop VII-A-4 CNN-based Burst Signal Detection with Covariance Matrix
Dongho Seo and Jiyeon Park (Hanyang University, Korea (South)); Sreeraj Rajendran and Sofie Pollin (KU Leuven, Belgium); Haewoon Nam (Hanyang University, Korea (South))

Workshop VII-A-5 Doppler Radar-based Real-Time Drone Surveillance System Using Convolution Neural Network
Rubina Akter (Kumoh National Institute of Technology & Networked Systems Laboratory, Korea (South)); Mohtasin Golam (Kumoh National Institute of Technology (KIT) & IT Convergence, Korea (South)); Dong Seong Kim and Jae Min Lee (Kumoh National Institute of Technology, Korea (South))

[Workshop VIII-A] The 4th Workshop on Advances in Convergence of ICT and Brain Science

Oct. 21, 08:30~10:10

Chair : Seokhee Oh (Gachon University)

Workshop VIII-A-1 On the Formulation of Boundary Layer Functions
Assiya Zhumanazarova and Young Im Cho (Gachon University, Korea (South))

Workshop VIII-A-2 Nasolabial wrinkle segmentation based on Nested Convolutional Neural Network
Sabina Umirzakova (Sonnam, Korea (South)); Taeg Keun Whangbo (Gachon University, Korea (South))

Workshop VIII-A-3 VR content for Non contact job training and experience
Dayeon Lee, Incheol Jeong, Jongwon Lee, JungYoon Kim and Jinsoo Cho (Gachon University, Korea (South))

Workshop VIII-A-4 The deep learning method for predict beck's depression inventory score using EEG
Min Kang, SeoHyun Oh, KyoungSu Oh, Seokhwan Kang and Youngho Lee (Gachon University, Korea (South))

Workshop VIII-A-5 Emotion Detection and Analysis from Facial Image using Distance between Coordinates Feature
Jin Hee Bae, Minwoo Kim and JoonS Lim (Gachon University, Korea (South))

Workshop VIII-A-6 Deep learning-based automatic brain metastatic detection and treatment assesment system using 3D MRI
Ye Rang Park, Young Jae Kim and Kwang Gi Kim (Gachon University, Korea (South))

Workshop VIII-A-7 Selecting a Suitable Feature Subset for Classification using Multi-Agent Reinforcement Learning
Minwoo Kim, Jin Hee Bae and JoonS Lim (Gachon University, Korea (South))

Workshop VIII-A-8 Development of Online Service for Brain Disease Prediction Using Machine Learning
Batzaya Tuvshinjargal and Heejoung Hwang (Gachon University, Korea (South))

Technical Paper Sessions

[Poster 8C] 5G, 4G, WLAN

Oct. 21, 08:30~10:10

Chair : Howon Lee (Hankyong National University)

Poster 8C-1 The Empirical Evaluation of Machine Learning Models Predicting Round-Trip Time in Cellular Network

Seunghan Choi (Electronics and Telecommunications Research Institute, Korea (South)); Changki Kim (ETRI, Korea (South))

Poster 8C-2 ESS Capacity Decision Tool for Plus-Energy Housing Complex

Sewan Heo (Electronics and Telecommunications Research Institute, Korea (South)); Tai Yeon Ku and Wan-Ki Park (ETRI, Korea (South))

Poster 8C-3 An Empirical Study on Channel Pruning through Residual Connections

Jong-Ryul Lee (ETRI, Korea (South)); Yong-Hyuk Moon (Electronics and Telecommunications Research Institute (ETRI) & University of Science and Technology (UST), Korea (South))

Poster 8C-4 Methodology for network capacity assessment of 5G NSA EN-DC network

Kyung-yul Cheon (ETRI(Electronics and Telecommunications Research Institute), Korea (South)); Jaehyouk Jahng (ETRI, Korea (South)); Seung Keun Park (Electronics and Telecommunications Research Institute, Korea (South)); Jun Kyun Choi (KAIST, Korea (South))

Poster 8C-5 Design of Low-latency Synthesizable PUCCH Demodulation Unit Using Simulink HDL Coder

Young-Hoon Kim (Electronics and Telecommunications Research Institute, Korea (South)); Hyungsik Ju and Ikjae Chun (ETRI, Korea (South)); Chan-Bok Jeong (Electronics and Telecommunications Research Institute (ETRI) & Chungbuk National University, Korea (South)); Moon-Sik Lee (Electronics and Telecommunications Research Institute & Stanford University, Korea (South))

Poster 8C-6 Temperature Sensor Circuit with Dynamic Element Matching in CMOS 65 nm for a mmWave Beamformer

Seunghyun Jang (ETRI, Korea (South)); Sunwoo Kong (Electronics and Telecommunications Research Institute, Korea (South)); Hui Dong Lee (Electonics and Telecommunications Research Institute, Korea (South)); Bonghyuk Park and Soek-Bong Hyun (ETRI, Korea (South))

Poster 8C-7 Norm-Correlation based filter pruning to accelerating networks

Minsoo Hong (KETI, Korea (South)); Sungjei Kim and Jinwoo Jeong (Korea Electronics Technology Institute, Korea (South))

Poster 8C-8 Fast Beam Search for IRS-Assisted Cellular Systems

Qasim Sultan and Yong Soo Cho (Chung-Ang University, Korea (South)); Yeong Jun Kim (LG Electronics, Korea (South)); Mohammed Saquib Khan (Chung-Ang University, Korea (South))

Poster 8C-9 Demonstration of service continuity based on multi-connectivity with cellular and satellite access networks

Hee Sang Chung and Junhyeong Kim (ETRI, Korea (South)); Gosan Noh (Electronics and Telecommunications Research Institute, Korea (South)); Seok Ho Won (ETRI, Korea (South)); Taesang Choi (Electronic and Telecommunications Research Institute, Korea (South)); Ilgyu Kim (ETRI of KOREA, Korea (South))

Poster 8C-10 Vision-Aided Beam Allocation for Indoor mmWave Communications

Abdul Latif Sarker, Igbafe Orikumhi and Jeongwan Kang (Hanyang University, Korea (South)); Hyekyung Jwa and Jeehyeon Na (ETRI, Korea (South)); Sunwoo Kim (Hanyang University, Korea (South))

Poster 8C-11 Analysis of Averaging Effects of Probing Signal on Moving Target Detection Radar

Sung Jun Lee (Electronics and Telecommunications Research Institute (ETRI), Korea (South))

Technical Paper Sessions

Poster 8C-12 Countering Interest flooding DDoS attacks in NDN Network
DongMyung Sul, Sung Hyuk Byun and JongSeck Lee (Electronics and Telecommunications Research Institute, Korea (South)); Namseok Ko (ETRI, Korea (South))

Poster 8C-13 Relay Node Load Balancing Method In Mobile Communication Environment
MinSuk Choi and Hee Sang Chung (ETRI, Korea (South))

Poster 8C-14 Design and Implementation of Smart Energy Platform for Industrial Complex
Dong Seong Kim, Jae Woo Kim, Jae Min Lee and Won Jae Ryu (Kumoh National Institute of Technology, Korea (South)); Geoil Yang (LG U plus, Korea (South))

Poster 8C-15 Indoor Navigation Algorithm Based on a Smartphone Inertial Measurement Unit and Map Matching
Taewon Kang and Younghoon Shin (Yonsei University, Korea (South))

Poster 8C-16 An Analysis of Incident Report Data for Emergence Dispatch
Sungwon Byon (Electronics and Telecommunication Research Insititute, Korea (South)); Eunjung Kwon and Eui-Suk Jung (ETRI, Korea (South)); Yong-Tae Lee (Electronics and Telecommunications Research Institute, Korea (South))

Poster 8C-17 Phase Noise Compensation Method in Sub-THz SC-FDE systems
HyeongSook Park (ETRI, Korea (South))

Poster 8C-18 A construction of 2-sequential-recovery locally repairable codes
Zhi Jing and Hong-Yeop Song (Yonsei University, Korea (South))

Poster 8C-19 Buffer-Aided Cooperative Phase Steering Technique for Delay Tolerant Networks
Sangku Lee (Republic of Korea Air Force Academy, Korea (South)); Janghyuk Youn (Chungnam National Universiy, Korea (South)); Yongjae Kim (KIOST, Korea (South)); Bang Chul Jung (Chungnam National University, Korea (South))

Poster 8C-20 A Proposal of Parameter Extension for Multilanguage in 5G CBS
Hyunjoo Kang, Seung-Hee Oh, Sang-Lim Ju, Woo-Sug Jung and Yong-Tae Lee (ETRI, Korea (South))

Poster 8C-21 Analysis of the Effect of Covid-19 on the Floating Population of Seoul Using the PageRank Algorithm
JinWoo Kim and HyoungSun Na (Kwangwoon University, Korea (South)); Hee-Gook Jun (Openup, Korea (South)); Jinhyun Ahn (Jeju National University, Korea (South)); Daesung Jun (Junju University, Korea (South)); Dong-Hyuk Im (Kwangwoon University, Korea (South))

Poster 8C-22 A Study on hybrid content delivery based on popularity in 5G satellite communications
Jeongyun Kim and Changki Kim (ETRI, Korea (South))

Poster 8C-23 Unified Baseband Signal Generation for Multiple Component Carriers Using Phase Compensation
Youngil Jeon (Electronics and Telecommunications Research Institute, Korea (South)); Chan-Bok Jeong (Electronics and Telecommunications Research Institute (ETRI) & Chungbuk National University, Korea (South)); Ikjae Chun (ETRI, Korea (South)); Moon-Sik Lee (Electronics and Telecommunications Research Institute & Stanford University, Korea (South))

Poster 8C-24 Mechanism of a big-data platform for residential heat energy consumption
Tai Yeon and Wan-Ki Park (ETRI, Korea (South)), Hoon Choi(CNU, Korea(South))

Poster 8C-25 A Practical Dense-to-Sparse Learning for a Manageable Object Detector on the Ground
Yong-Hyuk Moon (Electronics and Telecommunications Research Institute (ETRI) & University of Science and Technology (UST), Korea (South)); Yong-Ju Lee (ETRI, Korea (South))

Poster 8C-26 mobileYOLACT: Toward Lightweight Instance Segmentation for Mobile Devices
Juwon Lee, Seungjae Lee and Jong Gook Ko (ETRI, Korea (South))

Technical Paper Sessions

Poster 8C-27 Hybrid peer-to-peer network based layered blockchain architecture for enhancement of synchronization performance
Wook Hyun (ETRI, Korea (South))

Poster 8C-28 Service Mesh Based Distributed Tracing System
Donghun Cha and younghan Kim (Soongsil University, Korea (South))

Poster 8C-29 A Design of Service Function Chaining with VNF and CNF on Cloud Native Environment
Hokeun Lim (Soongsil, Korea (South)); younghan Kim (Soongsil University, Korea (South))

Poster 8C-30 Developing a Real-time OPC UA based Aggregated Monitoring System for Small-scale Distributed Energy Resources among Microgrids
Yoon-Sik Yoo (KAIST & ETRI, Korea (South)); S H Shah Newaz (Universiti Teknologi Brunei (UTB), Brunei Darussalam); Il-Woo Lee (ETRI, Korea (South))

Poster 8C-31 Overview of 5G NR technology for Non-Terrestrial Networks
Mi Young Yun (Electronis and Telecommunications Research Institute, Korea (South)); Jihyung Kim and Dukhyun You (ETRI, Korea (South)); Moon-Sik Lee (Electronics and Telecommunications Research Institute & Stanford University, Korea (South))

Poster 8C-32 A Practical Approach to Dealing with Missing Sensor Data for Data Users
Seungtaek Oh and Jaewon Moon (Korea Electronics Technology Institute, Korea (South)); Seung Woo Kum (Korea Elecronics Technology Institute, Korea (South))

Poster 8C-33 Link-Level Performance Evaluation of mmWave 5G NR Sidelink Communications
Junhyeong Kim (ETRI, Korea (South)); Gosan Noh (Electronics and Telecommunications Research Institute, Korea (South)); Taehyoung Kim (Soonchunhyang University, Korea (South)); Hee Sang Chung (ETRI, Korea (South)); Ilgyu Kim (ETRI of KOREA, Korea (South))

Poster 8C-34 Performance Comparison of NLOS Detection Methods in UWB
Jae Hyeok Yoon, Hyeongyun Kim, Dongho Seo and Haewoon Nam (Hanyang University, Korea (South))

[Session 1D] Signal and Image Processing

Oct. 21, 10:30~12:10

Chair : Sangmi Lee (IITP)

Session 1D-1 Hand Segmentation based on Geometry
Wen Wu, Chunxiao Li and Honghui Jin (Yangzhou University, China)

Session 1D-2 Digital holographic microscopy (DHM) using a Gaussian weighted sideband to reduce noise from DC spectrum
Hyun-Woo Kim (Kyushu Institute of Technology, Japan); Myungjin Cho (Hankyong National University, Korea (South)); Naoki Konishi and Min-Chul Lee (Kyushu Institute of Technology, Japan)

Session 1D-3 Scatter denoising technique using Fourier domain filtering and integral imaging
Ryo Shinohara, Hyun-Woo Kim and Jaehoon Lee (Kyushu Institute of Technology, Japan); Myungjin Cho (Hankyong National University, Korea (South)); Min-Chul Lee (Kyushu Institute of Technology, Japan)

Session 1D-4 One-take video boundary point extraction system based on frame characteristics
Jaewon Lee (Korea Electronics Technology Institute, Korea (South)); Dalwon Jang and Jongseol J. Lee (KETI, Korea (South))

Session 1D-5 PAPR Improvement by Clipping in Spectrum Suppressed Transmission
Teppei Kanke and Takatoshi Sugiyama (Kogakuin University, Japan)

Technical Paper Sessions

Session 1D-6 Decompression of Bluetooth-transmitted Audio using Super Resolution for Low-Latency Applications

Allysa Joy Atienza, Andrei Calabano, Marie Lourdes Manalo and Sophia Beatrice Salandanan (University of the Philippines Diliman, Philippines); Charleston Dale M. Ambatali and Franz De Leon (University of the Philippines, Philippines); Crisron Rudolf Lucas (University of the Philippines Diliman, Philippines); Carl Timothy S. Tolentino (University of the Philippines, Diliman, Philippines)

[Session 2D] ICT Communication

Oct. 21, 10:30~12:10

Chair : Eunkyung Kim (Hanbat National University)

Session 2D-1 Personality Enhancement for Speaker-dependent Voice Activity Detection

JoonGyu Maeng (University of Science and Technology, Korea (South)); MinKyu Lee, Seung Yun and Sanghun Kim (Electronics and Telecommunications Research Institute, Korea (South))

Session 2D-2 Decision-Tree Based Transceiver Selection for Medium Access Control in Wireless Sensor Networks

Arnold Chau (HME ClearCom, United Kingdom (Great Britain)); Paul D Mitchell and John F Dawson (University of York, United Kingdom (Great Britain))

Session 2D-3 Simplifying Dynamic Public Key Certificate Graph for Certification Path Building in Distributed Public Key Infrastructure

Shohei Kakei (Nagoya Institute of Technology, Japan); Yoshiaki Shiraishi (Kobe University, Japan); Shoichi Saito (Nagoya Institute of Technology, Japan)

Session 2D-4 Delay Performance Optimization in Passive Optical Network

Fahmida Rawshan, Monir Hossen and Md. Rafiqul Islam (Khulna University of Engineering & Technology, Bangladesh)

Session 2D-5 Ergodic Capacity of Cognitive Satellite-Terrestrial Relay Networks with Practical Limitations

Yerassyl. Akhmetkaziyev and Galymzhan Nauryzbayev (Nazarbayev University, Kazakhstan); Sultangali Arzykulov (King Abdullah University of Science and Technology, Saudi Arabia); Khaled M. Rabie (Manchester Metropolitan University, United Kingdom (Great Britain)); Ahmed M. Eltawil (King Abdullah University of Science and Technology, Saudi Arabia)

Session 2D-6 Analytical Framework for NOMA-assisted mmWave D2D Networks with System Impairments

Leila Tlebaldiyeva and Galymzhan Nauryzbayev (Nazarbayev University, Kazakhstan); Sultangali Arzykulov (King Abdullah University of Science and Technology, Saudi Arabia); Yerassyl. Akhmetkaziyev and Mohammad Hashmi (Nazarbayev University, Kazakhstan)

[Workshop VI] The workshop on Information and Communication Strategic Technology for Industry Convergence

Oct. 21, 10:30~12:10

Chair : Woo Yong Lee (ETRI)

Workshop VI-1 Impact of Hovering on Laguerre-Gaussian Beam Propagation for UAV-to-Ground Optical Communications

Yeong Hae Kim and Sudhanshu Arya (Pukyong National University, Korea (South)); Prakriti Saxena (Pukyong National University, Busan); Yeonho Chung (Pukyong National University, Korea (South))

Workshop VI-2 Skin lesion segmentation in dermoscopic images using CNN architecture

Chaitra D and Bumshik Lee (Chosun University, Korea (South))

Technical Paper Sessions

Workshop VI-3 Predicted Seamless Human Positioning Algorithm based on M-RCNN in Obstacle Environment for Indoor Localization
Tae Wan Kim and Dong Myung Lee (Tongmyong University, Korea (South))

Workshop VI-4 A Real-time Clustering Scheme using Coordinate Density for 3D Localization
Ho Chul Lee and Dong Myung Lee (Tongmyong University, Korea (South))

Workshop VI-5 Introduction to Building and Service of the Fire Safety Big Data Platform in Korea
Yeonjin Kim (University of Seowon, Korea (South)); Bongseop Park and Gapyong Choi (National Fire Agency, Korea (South)); Gyoung-Bae Kim (Seowon University, Korea (South))

Workshop VI-6 Unsupervised Learning for 2D Image Texture Enhancement
Boney Labinghisa (EasyGeo Co., Korea (South)); Dong Myung Lee and Jeongsu Kim (Tongmyong University, Korea (South))

Workshop VI-7 A Study on Spatial Multiplexing Gain in LOS-2x2 MIMO Intelligent Reconfiguration Channel Environment
Woo Yong Lee (ETRI, Korea (South))

Workshop VI-8 Investigation of Deep Learning Method for Fire Detection from Videos
Soonghwan Ro (Kongju University, Korea (South))

[Workshop IX] Sub-THz/THz Communication for 6G

Oct. 21, 10:30~12:10

Chair : Sang-Woon Jeon (Hanyang University)

Workshop IX-1 A Study on 5G Communication-Based Smart Logistics Cart System
Sung-hun Lee (Kwangwoon University, Korea (South)); Yong-An Jung, Dong-Cheul Han, Soo-Hyun Cho and Hyun-Kyu Cho (Gumi Electronics & Information Technology Research Institute, Korea (South)); Byung-Yong Kim (BYMETECH Corp., Korea (South))

Workshop IX-2 Frequency and Symbol Timing offset Estimation Method for CP-OFDM based System
Yong-An Jung, Sang-Bong Byun, Han-Jae Shin, Dong-Cheul Han and Soo-Hyun Cho (Gumi Electronics & Information Technology Research Institute, Korea (South)); Sung-hun Lee (Kwangwoon University, Korea (South))

Workshop IX-3 Performance Evaluation for NR Coexistence Study: Indoor Office Scenarios at 60 GHz
Kwanghyun Park, HoonGeun Song, Jaehyung Cho, Jieun Han and Sung-hwan Song (Korea Testing Laboratory, Korea (South)); Sang-Woon Jeon (Hanyang University, Korea (South))

Workshop IX-4 5G NR Performance Evaluation Under Phase Noise Distortion for 52.6 GHz to 71 GHz
HoonGeun Song, Kwanghyun Park, Ji-young Park, Tae-Hoon Kwon and Jun-seok Seo (Korea Testing Laboratory, Korea (South)); Sang-Woon Jeon (Hanyang University, Korea (South))

Workshop IX-5 Performance Evaluation of Wireless Absolute Time Synchronization for Mission-Critical Industry
Kapseok Chang (ETRI, Korea (South)); Woncheol Cho (Electronics and Telecommunications Research Institute, Korea (South)); Yongsun Kim (ETRI, Korea (South)); Young-Jo Ko (Electronics and Telecommunications Research Institute, Korea (South))

Workshop IX-6 3D Hybrid Beamforming with 2D Planar Antenna Arrays for Downlink Massive MIMO Systems
Najam Us Saqib (Hanyang University, Korea (South)); Kwanghyun Park and HoonGeun Song (Korea Testing Laboratory, Korea (South)); Sang-Woon Jeon (Hanyang University, Korea (South))

Technical Paper Sessions

[Workshop X] 5G+ and 6G R&D in ETRI

Oct. 21, 10:30~12:10

Chair : ILGYUI KIM (ETRI)

Workshop X-1 Enhanced Resource Allocation Method for 5G V2X Communications
Taehyoung Kim (Soonchunhyang University, Korea (South)); Gosan Noh (Electronics and Telecommunications Research Institute, Korea (South)); Junhyeong Kim and Hee Sang Chung (ETRI, Korea (South)); Ilgyu Kim (ETRI of KOREA, Korea (South))

Workshop X-2 Beam Management for IAB Network in 5G-Advanced Wireless Communication Systems
Hoondong Noh (Electronics and Telecommunications Research Institute, Korea (South)); Moon-Sik Lee (Electronics and Telecommunications Research Institute & Stanford University, Korea (South))

Workshop X-3 Coded multicarrier systems for high mobility environments in 30 GHz band
Wooram Shin (Electronics and Telecommunications Research Institute & Korea Advanced Institute of Science and Technology, Korea (South)); Kyeongpyo Kim (Electronics and Telecommunications Research Institute, Korea (South)); Kapseok Chang (ETRI, Korea (South)); Young-Jo Ko (Electronics and Telecommunications Research Institute, Korea (South))

Workshop X-4 Structure of UAV-based Emergency Mobile Communication Infrastructure
JungSook Bae (ETRI, Korea (South))

Workshop X-5 Performance Evaluation on Optically Disaggregated Memory Architecture
Jongtae Song and Jiwook Youn (ETRI, Korea (South)); Dae-ub Kim (Electronics and Telecommunications Research Institute (ETRI) & Chungnam National University, Korea (South)); Kyeong-Eun Han (ETRI, Korea (South)); Joon Ki Lee (Electronics and Telecommunications Research Institute, Korea (South))

Workshop X-6 Nonbinary Polar Codes Constructions Based on k-means Clustering
Giyoon Park, Ok-Sun Park and Gweondo Jo (ETRI, Korea (South)); Hossein Rezaei, Vismika Ranasinghe and Nandana Rajatheva (University of Oulu, Finland)

Workshop X-7 Performance analysis of Access Point Switch ON/OFF schemes for Cell-free mmWave massive MIMO UDN systems
Soojung Jung and Seung-Eun Hong (ETRI, Korea (South))

[Workshop VII-B] The 3rd Joint International Workshop on Military Informatics (IoT for Military and Logistics)

Oct. 21, 10:30~12:10

Chair : Dong Seong Kim (Kumoh National Institute of Technology(kit))

Workshop VII-B-1 FedRC: A Federated Learning-Based Roadside Computing Paradigm Through the Facilitation of Internet of Drones
Anik Islam and Soo Young Shin (Kumoh National Institute of Technology, Korea (South))

Workshop VII-B-2 Dynamic VRP Optimization Using Discrete PSO in Edge Computing Environment
Philip T. Daely (Kumoh National Institute of Technology, Korea (South) & Institut Teknologi Telkom Surabaya, Indonesia); Yohanna Jayanti Aruan, Jae Min Lee and Dong Seong Kim (Kumoh National Institute of Technology, Korea (South))

Workshop VII-B-3 Countering Attacks in IN-Vehicle Network: An Evaluation of Machine Learning Algorithms
Goodness Oluchi Anyanwu, Cosmas Ifeanyi Nwakanma, Jae Min Lee and Dong Seong Kim (Kumoh National Institute of Technology, Korea (South))

Technical Paper Sessions

Workshop VII-B-4 Impact of Task Splitting on the Delay Performance of Task Offloading in the IoT-enabled Fog Systems
Tran Hoa and Dong Seong Kim (Kumoh National Institute of Technology, Korea (South))

Workshop VII-B-5 A Survey on Low Latency Blockchain Architectures for Industrial Networks
Ikechi Igboanusi, Jae Min Lee and Dong Seong Kim (Kumoh National Institute of Technology, Korea (South))

[Workshop VIII-B] The 4th Workshop on Advances in Convergence of ICT and Brain Science

Oct. 21, 10:30~12:10

Chair : Seokhee Oh (Gachon University)

Workshop VIII-B-1 Senior healthcare testbed design and construction : focusing on the temperature control system
Wonjun Jeong and Seok Hee Oh (Gachon University, Korea (South))

Workshop VIII-B-2 Investigation and Research on the Negotiation Space of Mental and Mental Illness Based on Metaverse
Yiqian Han (Gachon University, Korea (South)); Seok Hee Oh (Gachon University, Korea (South))

Workshop VIII-B-3 The Prediction Model for Classification of COVID-19 Infected Patients Using Vital Sign
Se-Min Hyun, Tae-ho Hwang and KangYoon Lee (Gachon University, Korea (South))

Workshop VIII-B-4 Deep vein thrombosis detection based on deep learning for CT images
Jae Won Seo (Gachon Advanced Institute for Health Sciences and Technology (GAIHST), Gachon University, Korea (South)); Young Jae Kim and Kwang Gi Kim (Gachon University, Korea (South))

Workshop VIII-B-5 Development and verification of Immersive contents to alleviate mental illness: Focusing on mild depressive disorder
Gi Sung Oh and Seok Hee Oh (Gachon University, Korea (South))

Workshop VIII-B-6 3D Volume Reconstruction from MRI Slices based on VTK
Jakhongir Asadulla ugli Nodirov, Akmalbek Abdusalomov and Taeg-Keun Whangbo (Gachon University, Korea (South))

Workshop VIII-B-7 A Study on the Content of Mental and Physical Stability Game in Virtual Reality through EEG Detection
Jongwon Lee, Dayeon Lee, Incheol Jeong and Jinsoo Cho (Gachon University, Korea (South))

[Poster 8D] Wireless & Mobile Communication Systems

Oct. 21, 10:30~12:10

Chair : Byungju Lee (Kumoh National Institute of Technology(kit))

Poster 8D-1 Dynamic Spatial Area Design for Transportation Management at Smart Road Lighting Platform System in Korea
Tae Wan Kim (Ajou University & Ajou Transportation Research Institute, Korea (South)); Ryu Ingon (Ajou University, Korea (South)); Hyun Mi Lee (TOD-based Engineering Research Center, Korea (South)); Jeong Ah Jang (Ajou University & Transportation Oriened Development, Korea (South))

Technical Paper Sessions

Poster 8D-2 Intelligent real-time control system through deep learning-based object detection and socket communication in the embedded board environment
Jehong An, Kwang Hyun Jung, Sang Yoo Kim and Ji Su Jenny Mun (Korea Photonics Technology Institute(KOPTI), Korea (South))

Poster 8D-3 Cross-eye Jamming System with Effective Cross-Eye Gain by the Phase and Gain Control
Jung Hoon Lee (Agency for Defense Development, Korea (South)); Jeil Jo (Agency for Defense Development & Chungnam National University, Korea (South)); Chi ho Lee and Chang hoon Lee (Korea (South))

Poster 8D-4 Indoor Positioning System with Grouping Strategy of BLE Advertising Packets
Jeong-Sun Yoon, Dae-Ho Kim and Hui-Seon Gang (Chosun University, Korea (South)); Jae-Young Pyun (Chosun University & Dept. of Information and Communication Engineering, Korea (South))

Poster 8D-5 Enforcing Spatially Coherent Structures for Accurate 3D Shape Recovery
Usman Ali and Muhammad Tariq Mahmood (Korea University of Technology and Education, Korea (South))

Poster 8D-6 A Unified Framework Issue for 5G MEC Deployment
Heeyoung Jung and Jonghwa Yi (Electronics and Telecommunications Research Institute, Korea (South))

Poster 8D-7 A Simple Method to Detection the Lung Cancer Tumor using CT images on Deep Learning
Young-Jin Park and Hui-Sup Cho (DGIST, Korea (South))

Poster 8D-8 CM DATA - KIITC Pandemic Simulator (CMKPS): A tool to simulate quarantine policy in pandemic
Kyungdon Choi (CM DATA, Korea (South)); ChaeSeok Lee and Byunghun Han (KAIST Institute for IT Convergence, Korea (South)); Yongho Kim and Nam Hyoung Ho (CNFrontier, Korea (South)); Hojong Chang (Korea Advanced Institute of Science and Technology, Korea (South))

Poster 8D-9 Acoustic feedback detection for online video conferencing
Dalwon Jang (KETI, Korea (South)); Jaewon Lee (Korea Electronics Technology Institute, Korea (South)); Jongseol J. Lee (KETI, Korea (South))

Poster 8D-10 Impacts of Cluster Architecture on Security and Performance of UAV-assisted Wireless Sensor Networks
Gicheol Wang (Electronics and Telecommunications Research Institute, Korea (South)); Jaein Kim and Sungchang Kim (ETRI, Korea (South))

Poster 8D-11 Efficient Implementation of the SAGE Algorithm for Channel Impulse Response Estimation
Kyung-Won Kim, Myung-Don Kim, Juyul Lee, Jae-Joon Park and Heon Kook Kwon (ETRI, Korea (South))

Poster 8D-12 Propagation Characteristics of an Industrial Environment Channel at 4.1 GHz
Junseok Kim, Chung Sup Kim, Ju Yeon Hong, Jong Soo Lim and Young Jun Chong (ETRI, Korea (South))

Poster 8D-13 Supervised Service Classification using Downlink Control Indicator in LTE Physical Downlink Control CHannel
Jeong-Woo Son (ETRI, Korea (South)); Sunghee Lee (Electronics and Telecommunications Research Institute, Korea (South)); Minho Han (ETRI, Korea (South))

Poster 8D-14 Machine Learning-Based Error Recovery System for NAND Flash Memory with Process Variation
Seonmin Lee, Jeongju Jee and Hyuncheol Park (KAIST, Korea (South))

Poster 8D-15 Emergency Dispatch Support System for Police Officers in Incident Scenes
Hyunho Park (ETRI, Korea (South)); Sungwon Byon (Electronics and Telecommunication Research Insititute, Korea (South)); Eunjung Kwon, Dong Man Jang and Eui-Suk Jung (ETRI, Korea (South))

Technical Paper Sessions

Poster 8D-16 Emergency Call Fusion Analysis System for Disaster Response
Hyunho Park and Eunjung Kwon (ETRI, Korea (South)); Sungwon Byon (Electronics and Telecommunication Research Insititute, Korea (South))

Poster 8D-17 Downlink Performance of Testbed for MN system Using 22-GHz mmWave
Seon-Ae Kim (Electrics and Telecommunications Research Institute, Korea (South)); Seung Nam Choi and Hee Sang Chung (ETRI, Korea (South))

Poster 8D-18 Considerations on Ultra broadband, High reliable and Low latency services in 6G system
Sun Mi Jun (ETRI, Korea (South))

Poster 8D-19 SPER: Stay-Point Extraction considering Revisits in a Single Trajectory
Jiyoun Lim and Seunghee Yoo (ETRI, Korea (South)); Seungeun Chung (Electronics and Telecommunications Research Institute, Korea (South)); Ga Gue Kim and Kyoung-Ju Noh (ETRI, Korea (South)); Jeong Mook Lim (Electronics and Telecommunications Research Institute, Korea (South)); Hyun-Tae Jeong (ETRI, Korea (South))

Poster 8D-20 3D Mesh Transformation System using Multi-Object Tracking for Augmented Reality Services
Young-Suk Yoon (ETRI, Korea (South))

Poster 8D-21 Link Association for Small Cell Networks with Wireless Backhaul
Byungju Lim and Young-Chai Ko (Korea University, Korea (South))

Poster 8D-22 Global-Local Three-Stream Network for Acoustic Scene Classification
Su-Hwa Jo (Pukyong National University & Electronics and Telecommunications Research Institute, Korea (South)); Chi Yoon Jeong (Electronics and Telecommunications Research Institute & University of Science and Technology, Korea (South)); Kyeong-Deok Moon (Electronics and Telecommunications Research Institute, Korea (South)); Chae-Kyu Kim (Pukyong National University, Korea (South))

Poster 8D-23 Patient Identification based on Physical Rehabilitation Movements using Skeleton Data
JeongKyun Kim (University of Science and Technology, Korea (South)); Kang Bok Lee (Electronics and Telecommunications Research Institute, Korea (South)); Jae-Chul Kim (LBS Research Team, Telematics Research Division, ETRI, Korea (South)); Sang Gi Hong (Electronics and Telecommunication Research Institute, Korea (South))

Poster 8D-24 Carrier Aggregation enhancement
Junsik Kim (ETRI, Korea (South))

Poster 8D-25 Partial CSI based Regularized Zero-Forcing Precoder for Multibeam Satellite Communications toward 6G Networks
Jinho Kang and Gyeongrae Im (ETRI, Korea (South)); Sooyeob Jung (Electronics and Telecommunication Research Institute (ETRI), Korea (South)); JoonGyu Ryu (ETRI, Korea (South)); Woo Jin Byun (Electronics and Telecommunications Research Institute, Korea (South))

Poster 8D-26 Intelligent Offloading and Resource Allocation in HAP-Assisted MEC Networks
Demeke Shumeye and Anh-Tien Tran (Chung-Ang University, Korea (South)); Nhu-Ngoc Dao (Sejong University, Korea (South)); Sungrae Cho (Chung-Ang University, Korea (South))

Poster 8D-27 Multi-Stage Precoder Design for Cooperative Massive MIMO Networks with Limited Feedback
Jinho Kang (ETRI, Korea (South)); Wan Choi (Seoul National University, Korea (South))

Poster 8D-28 Quantum-Assisted Decoding for Non-Binary Low-Density Parity-Check Codes
Hyunwoo Jung (Korea Advanced Institute of Science and Technology (KAIST), Korea (South)); Jeonghwan Kang (Samsung Electronics, Korea (South)); Jeongseok Ha (KAIST, Korea (South))

Technical Paper Sessions

Poster 8D-29 Sum Spectral Efficiency Maximization in Cell-Free Millimeter-Wave Massive MIMO Systems
Minhyun Kim, Seung-Eun Hong and Jeehyeon Na (ETRI, Korea (South))

Poster 8D-30 Cumulant Matrix-based Channel Estimation for Near-Field Massive MIMO Systems
Kyoungchan Seo (Korea Advanced Institute of Science and Technology (KAIST), Korea (South)); Gye-Tae Gil (KAIST, Korea (South)); Girim Kwon (Massachusetts Institute of Technology, USA); Songcheol Hong (IEEE, USA); Hyuncheol Park (KAIST, Korea (South))

Poster 8D-31 Energy-Efficient Timing Estimation and SRS Allocation Scheme for Wireless Industry Service
Yongsun Kim and Kapseok Chang (ETRI, Korea (South)); Woncheol Cho and Young-Jo Ko (Electronics and Telecommunications Research Institute, Korea (South))

Poster 8D-32 eHealth Information Exchange Using a Networked Android Application
Nazib Abdun Nasir and Seong-Ho Jeong (Hankuk University of Foreign Studies, Korea (South))

Poster 8D-33 Fast eHealth Information Delivery in the ICN-based Mobile Networks
Kamrul Hasan and Seong-Ho Jeong (Hankuk University of Foreign Studies, Korea (South))

Poster 8D-34 A Delete-based Beam Selection Algorithm for Cell-free Networks
Seungkwon Cho (Electronics and Telecommunication Research Institute, Korea (South)); In-Kyeong Choi (ETRI, Korea (South)); Donghyuk Gwak (Electronics and Telecommunications Research Institute, Korea (South)); Seung-Eun Hong (ETRI, Korea (South))

Poster 8D-35 SSF: Smart city Semantics Framework for reusability of semantic data
JiEun Lee (Sejong University, Korea (South)); SeungMyeong Jeong (Korea Electronics Technology Institute, Korea (South)); Seong Ki Yoo (Coventry University, United Kingdom (Great Britain)); JaeSeung Song (Sejong University, Korea (South))

Poster 8D-36 A Novel Unified Trilateration Method for RSSI based Indoor Localization
Yang-Bae Park and Ye Hoon Lee (Seoul National University of Science and Technology, Korea (South))

Poster 8D-37 Reference Model of Integrated Public Alert System in Korea
Yoonkwan Byun (University of Seoul, Korea (South))

Poster 8D-38 System Requirements for the Reference Model of Integrated Public Alert System in Korea
Yoonkwan Byun (University of Seoul, Korea (South))

Poster 8D-39 Performance Analysis of IEEE 802.11 based Long-range Drone Networks in Disaster Environment
Jun-Woo Cho and Jung-Hoon Lee (Ajou University, Korea (South)); Jong Soo Baik (University of Ajou, Korea (South)); Jae-Hyun Kim (Ajou University, South Korea, Korea (South))

October 22nd (Friday), 2021

[Session 1E] Vehicular Information and Communication Technologies I

Oct. 22, 08:30~10:10

Chair : Haneul Ko (Korea University)

Session 1E-1 Data Design for Driving Monitoring of Hydrogen Electric Bus
Yongju Yi (Ajou University, Korea (South)); Jeong Ah Jang (Ajou University & Transportation Oriened Development, Korea (South)); Insik Lee (Ajou University, Korea (South))

Technical Paper Sessions

Session 1E-2 Vehicle Augmented Reality Head-up Display information visualization enhancement algorithm and system
Jaehoon Lee (Kyushu Institute of Technology, Japan); Jungsik Koo and Jiyong Park (Gumi Electronics and Information Technology Research Institute(GERI), Korea (South)); Min-Chul Lee (Kyushu Institute of Technology, Japan)

Session 1E-3 Facilitating the Development of Self-driving Cars with Open-source Projects
Hongki Cha (ETRI, Korea (South)); Kangchan Lee (Electronics and Telecommunications Research Institute, Korea (South))

Session 1E-4 Improving Loop Counting Algorithms for Public Transportation System Service Level Monitoring Through the Incorporation of a Tolerance Mechanism
Katrina Mae Kopio, John Matthew L. Villaluz and Wilson Tan (University of the Philippines, Philippines); Cedric Angelo Festin (Networks and Distributed Systems Lab, Philippines)

Session 1E-5 Coexistence study on 5G V2X in mmWave
Jin Woong Park, Jin-Yup Hwang, Suhwan Lim, Yoonoh Yang and Sang-Wook Lee (LG Electronics, Korea (South))

Session 1E-6 Jointly Coordinated GUE-to-BS MP-Terminals in Dense Multi-UAV Based C-NOMA Network Environment
Williams-Paul Nwadiugwu (Kumoh National Institute of Technology & ICT Convergence Research Center, School of Electronic Engineering, Korea (South)); Dong Seong Kim (Kumoh National Institute of Technology, Korea (South))

[Session 2E] Communication Networks and Future Internet Technologies I

Oct. 22, 08:30~10:10

Chair : Junaid ur Rehman (Kyung Hee University)

Session 2E-1 Design and Implementation of Quantum Key Distribution Network Control and Management
Taesang Choi (Electronic and Telecommunications Research Institute, Korea (South)); Sangsik Yoon and Tae-Yeon Kim (ETRI, Korea (South)); HyungSoo Kim (Korea Telecom, Korea (South))

Session 2E-2 Towards Detection and Mitigation of Traffic Anomalies in SDN
Zohaib Latif (Hanyang University & Seoul, Korea (South)); Nabeela Kausar and Umer Iqbal (Riphah International University, Faisalabad, Pakistan); Choonhwa Lee (Hanyang University, Korea (South))

Session 2E-3 QoS Evaluation of Home Network with IEEE 802.1TSN
Taleb Ennouhe (Nagoya Institute Of Technology, Japan); Yoshihiro Ito (Nagoya Institute of Technology, Japan)

Session 2E-4 Root Cause Analysis of Data Integrity Errors in Networked Systems with Incomplete Information
Yufeng Xin (University of North Carolina, USA); Shih-Wen Fu (University of North Carolina at Chapel Hill, USA); Anirban Mandal (Renaissance Computing Institute (RENCI), USA); Ilya Baldin (RENCI/UNC Chapel Hill, USA); Ryan Tanaka and Mats Rynge (University of Southern California, USA); Karan Vahi (USC Information Sciences Institute, USA); Ewa Deelman (ISI, USC, USA); Ishan Abhinit and Von Welch (Indiana University, USA)

Session 2E-5 An Empirical Study on Root Cause Analysis and Prediction of Network Failure using Deep Learning
Minhwan Choi, Taeyoung Kim, Jong pil Lee and Seunghyun Koh (Korea Telecom, Korea (South))

Session 2E-6 High-speed PAM-4 Signal Transmissions with Directly Modulated Lasers for the Next-Generation Passive Optical Networks
Ahmed Galib Reza and Marcos Troncoso Costas (Dublin City University, Ireland); Colm Browning (DCU, Ireland); Liam Barry (Dublin City University, Ireland)

Technical Paper Sessions

[Session 3E] Internet of Things III

Oct. 22, 08:30~10:10

Chair : Yongseok Son (Chung-Ang University)

Session 3E-1 Behavior-based Authentication using User Biological Data to IoT Device having Touchscreen
Lee Jiwoo and SoHyeon Park (Incheon National University, Korea (South)); Eun-Kyu Lee (Incheon National University & UCLA, USA)

Session 3E-2 Air Quality Measurement Device Using Programmable Quadcopter Drone Towards Internet of Drone Things
Nyoman Karna and Deriel Lubna (Telkom University, Indonesia); Soo Young Shin (Kumoh National Institute of Technology, Korea (South))

Session 3E-3 System for Multi Parameter Water Quality Monitoring Based on NB-IoT
Chang-Won Lee (ETRI, Korea (South)); Hoon Jeong (218 Gajeong-ro, Yuseong-gu, Korea (South) & ETRI Electrconics and Telecommunications Research Institute, Korea (South)); Jae-Hong Ryu (ETRI, Korea (South)); Juderk Park (Electronics and Telecommunication Research Institute (ETRI), Korea (South)); Byeong-cheol Choi (Electronics and Telecommunications Research Institute, Korea (South))

Session 3E-4 Vibration Sensor-Based Fall Detection in Smart Factory Shop Floor
Mareska Pratiwi Maharani, Adinda Riztia Putri, Jae Min Lee and Dong Seong Kim (Kumoh National Institute of Technology, Korea (South))

Session 3E-5 Comparison of Wristband Type Devices to Measure Heart Rate Variability for Mental Stress Assessment
Minjung Kim, Jungsook Kim and Kyonghyun Park (ETRI, Korea (South)); Hyunsuk Kim (Electronics and Telecommunications Research Institute & Emotion Recognition IoT Research Section, Korea (South)); Daesub Yoon (Electronics and Telecommunications Research Institute, Korea (South))

[Session 4E] Applications for ICT Convergence I

Oct. 22, 08:30~10:10

Chair : Pyung Soo Kim (Korea Polytechnic University)

Session 4E-1 Abnormal Situation Detection using Global Surveillance Map
Ho Chul Shin (Electronics and Telecommunication Research Institude, Korea (South)); Kiin Na (ETRI, Korea (South))

Session 4E-2 Polar Codes for Fast Converging Belief-Propagation Decoding
Seokju Han (Korea Advanced Institute of Science and Technology (KAIST), Korea (South)); Jeongseok Ha (KAIST, Korea (South))

Session 4E-3 CAC: Content-Aware Captioning for Professional Online Lectures in Korean Language
Yoonha Bahng, Yunjung Lee and Jeongyeup Paek (Chung-Ang University, Korea (South))

Session 4E-4 A Generalized Approach For Practical Task Allocation Using A MAPE-K Control Loop
Reinout Eyckerman (University of Antwerp, Belgium); Philippe Reiter (University of Antwerp & IMEC-IDLab Antwerpen, Belgium); Siegfried Mercelis and Steven Latré (University of Antwerp - imec, Belgium); Johann M. Marquez-Barja (University of Antwerpen & imec, Belgium); Peter Hellinckx (University of Antwerp - imec, Belgium)

Session 4E-5 An Analysis of the Digital Transformation Trends in ASEAN-5 after Covid-19 Pandemic
Eun Hye Yi and Ilsue Roh (Electronics and Telecommunications Research Institute, Korea (South))

Session 4E-6 Scheme for Mitigating the Interference by Violation of Indoor-only Operation in the 6 GHz Band
Jungsun Um, Igor Kim and Bongsu Kim (ETRI, Korea (South)); Seung Keun Park (Electronics and Telecommunications Research Institute, Korea (South))

Technical Paper Sessions

[Workshop XI] International Workshop on Internet of Energy

Oct. 22, 08:30~10:10

Chair : Yeong Min Jang (Kookmin University)

Workshop XI-1 Comparison of Different Methods to Estimate Blood Oxygen Saturation using PPG
Chowdhury Azimul Haque, M Shifat Hossain, Tae-Ho Kwon and Ki-Doo Kim (Kookmin University, Korea (South))

Workshop XI-2 Anomaly Detection in Semiconductor Cleanroom Using Isolation Forest
Israt Jahan, Md Alam, Faisal Ahmed and Yeong Min Jang (Kookmin University, Korea (South))

Workshop XI-3 Design and Implementation of Rolling Shutter MIMO-OFDM scheme for Optical Camera Communication system
Huy Nguyen and Yeong Min Jang (Kookmin University, Korea (South))

Workshop XI-4 Current Challenges in Optical Vehicular Modulation Techniques
Md. Osman Ali, Faisal Ahmed, Md. Shahjalal, Md Rahman and Yeong Min Jang (Kookmin University, Korea (South))

[Workshop VII-C] The 3rd Joint International Workshop on Military Informatics (Military Civil IT Convergence)

Oct. 22, 08:30~10:10

Chair : Sungtek Kahng (Incheon National University)

Workshop VII-C-1 Stabilizing On-chip Secure Key Generation Using RO-PUF
Toan Van Tran, Quang Kien Trinh and Van-Phuc Hoang (Le Quy Don Technical University, Vietnam)

Workshop VII-C-2 Design and Implementation of Low-Cost Fog Computing Architecture for IoT-Based Applications
Ahmad Zainudin, Cosmas Ifeanyi Nwakanma, Jae Min Lee and Dong Seong Kim (Kumoh National Institute of Technology, Korea (South))

Workshop VII-C-3 DB-BiLSTM: Euclidean Distance-Based Sensor Data Prediction for IoT Applications
Made Adi Paramartha Putra (Kumoh National Institute of Technology & IT Convergence Engineering, Korea (South)); Dong Seong Kim and Jae Min Lee (Kumoh National Institute of Technology, Korea (South))

Workshop VII-C-4 Optimizing Multibit Spread Spectrum Audio Watermarking for Internet of Things
Revin Naufal Alief, Jae Min Lee and Dong Seong Kim (Kumoh National Institute of Technology, Korea (South))

Workshop VII-C-5 Overview of ICT Convergence Specialized Research Center in South Korea
Arslan Musaddiq (Kumoh National Institute of Technology, Korea (South)); Tariq Rahim (Kumoh National Insitute of Technology, Korea (South)); Dong Seong Kim (Kumoh National Institute of Technology, Korea (South))

Workshop VII-C-6 Internet of Things for Smart Manufacturing: A Review of Benefits and Challenges
Vivian Ukamaka Ihekoronye, Cosmas Ifeanyi Nwakanma, Goodness Oluchi Anyanwu, Dong Seong Kim and Jae Min Lee (Kumoh National Institute of Technology, Korea (South))

Technical Paper Sessions

[Workshop XII] 6G Mobile Communication

Oct. 22, 08:30~10:10

Chair : Een-Kee Hong (KyungHee University)

Workshop XII-1 Low-Complexity Passive Beamforming for IRS-Aided Uplink NOMA
Jihyun Choi, Luiggi Cantos and Yun Hee Kim (Kyung Hee University, Korea (South))

Workshop XII-2 Wireless Infrastructure Drone based on NR-U: A Perspective
Rojeena Bajracharya (Kyung Hee University, S. Korea); Rakesh Shrestha (Yonsei University, Korea (South)); Haejoon Jung (Kyung Hee University, Korea (South))

Workshop XII-3 Multi-Device Charging RIS-Aided Wireless Power Transfer Systems
Nguyen Minh Tran, Amri Muhammad Miftahul and Je Hyeon Park (Sungkyunkwan University, Korea (South)); Dong In Kim (Sungkyunkwan University (SKKU), Korea (South)); Kae Won Choi (Sungkyunkwan University, Korea (South))

Workshop XII-4 Classical Capacity Regions for Generalized Pauli Channels
Junaid ur Rehman, Kyesan Lee and Hyundong Shin (Kyung Hee University, Korea (South))

Workshop XII-5 Quantum Pulse Coding for Rabi And Ramsey Evolution on IBM Armonk
Muhammad Asad Ullah and Ahmad Farooq (Kyung Hee University, Korea (South)); Youngmin Jeong (Samsung Electronics, Korea (South)); Hyundong Shin (Kyung Hee University, Korea (South))

Workshop XII-6 Bistatic Backscatter NOMA with Transmit and Receive Beamforming
Gerardo Sacarelo, Muhammad Awais and Yun Hee Kim (Kyung Hee University, Korea (South))

Workshop XII-7 Identification of Mobile Traffic Characteristics in University Area with Decision Tree Learning Model
Young-Jun Kim and Een-Kee Hong (Kyunghee University, Korea (South))

Workshop XII-8 Multivariate Deep Learning Model For Workload Prediction In Cloud Computing
Minh Dang and Myungsik Yoo (Soongsil University, Korea (South))

[Poster 8E] Artificial Intelligence and Machine Learning II

Oct. 22, 08:30~10:10

Chair : Changhee Lee (Chung-Ang University)

Poster 8E-1 Generating Face Images Using VQGAN and Sparse Transformer
Dong-Hyuck Im and Yongseok Seo (ETRI, Korea (South))

Poster 8E-2 Tumor-Stroma Classification in Colorectal Cancer Patients with Transfer Learning based Binary Classifier
Lakpa Dorje Tamang, Min Tae Kim, Seong Joon Kim and Byung Wook Kim (Changwon National University, Korea (South))

Poster 8E-3 Stroke medical ontology QA system for processing medical queries in natural language form
SoonHyun Kwon (Electronics and Telecommunications Research Institute Daejeon Korea, Korea (South)); Jaehak Yu (Electronics and Telecommunications Research Institute, Korea (South)); Se Jin Park (Principle Reseacher, Korea (South)); Jong-arm Jun and Cheol Sig Pyo (ETRI, Korea (South))

Poster 8E-4 Human Motion Assessment on Mobile Devices
HoBeom Jeon (University of Science and Technology & Electronics and Telecommunications Research Institute, Korea (South)); DoHyung Kim (Electronics and Telecommunications Research Institute, Korea (South)); Jaehong Kim (Electronics & Telecommunication Research Institute (ETRI), Korea (South))

Technical Paper Sessions

Poster 8E-5 CoFirNet: Conditional Feature Vector-based Fashion Image Retrieval Network
Min-Soo Ko and Young Han Lee (Korea Electronics Technology Institute, Korea (South)); Choong Sang Cho (Korea Electronic Technology Institute (KETI), Korea (South)); Hyok Song (Korea Electronics Technology Institute, Korea (South))

Poster 8E-6 Development of AI-based ESS control algorithm to reduce peak load of building
Cheol-Ho Shin and Taehyung Kim (ETRI, Korea (South))

Poster 8E-7 Impact of Optical ISL on Satellite Routing Path Discovery in LEO Satellite Mega-Constellation
Yonghwa Lee (Daegu Gyeongbuk Institute of Science and Technology, Korea (South)); Jeongho Kwak (DGIST, Korea (South)); Jihwan P. Choi (Korea Advanced Institute of Science and Technology, Korea (South))

Poster 8E-8 Coord-FCN for same-class objects segmentation
Guohua Zhu and Suk Chan Kim (Pusan National University, Korea (South))

Poster 8E-9 V2X Based Lateral Acceleration Prediction for Connected and Automated Vehicle
Wonwoo Jo (Hanyang University, Korea (South)); Hyun-kyoo Park (University of Hanyang, Korea (South)); Sang-Sun Lee (Hanyang University, Korea (South))

Poster 8E-10 Hybrid ResNet: A Shallow Deep Learning Architecture for Moderate Datasets
Ghulam Murtaza, Obaid-ur Rehman and Muhammad K. Shahzad (National University of Sciences & Technology (NUST), Pakistan); S. M. Riazul Islam (Sejong University, Korea (South)); Mahmud Hossain (University of Alabama at Birmingham, USA); Kyung Sup Kwak (Inha University, Korea (South))

Poster 8E-11 Machine Learning Aided KREONET for Advanced Scientific Research Support
Chankyun Lee (KISTI, Korea (South)); Minseok Jang (Korea Institute of Science and Technology Information, Korea (South)); Min-ki Noh (KISTI, Korea (South)); Buseung Cho (Korea Institute of Science and Technology Information & University of Science and Technology, Korea (South))

Poster 8E-12 High-level Image Classification by Synergizing Image Captioning with BERT
Xiaohong Yu, Yoseop Ahn and Jaehoon Jeong (Sungkyunkwan University, Korea (South))

Poster 8E-13 Are You a Good Client? Client Classification in Federated Learning
Hyejun Jeong, JaeJu An and Jaehoon Jeong (Sungkyunkwan University, Korea (South))

Poster 8E-14 Learning Cooperative Intrinsic Motivation in Multi-Agent Reinforcement Learning
Seung-Jin Hong (University of Science and Technology(UST), Korea (South)); Sang-Kwang Lee (Electronics and Telecommunications Research Institute, Korea (South))

Poster 8E-15 On Constructing Vessel Dataset Structure Using GAN-based Data Augmentation
Ah Reum Oh (ETRI, South Korea, Korea (South)); Jiwon Lee (Electronics and Telecommunications Research Institute, Korea (South)); SungWon Moon, Jung Soo Lee, Do-Won Nam and Wonyoung Yoo (ETRI, Korea (South))

Poster 8E-16 Automatic Stylized Plaid Check Pattern Try-on
Ji Soo Kim, Jisoo Park and Junseok Kwon (Chung-Ang University, Korea (South))

Poster 8E-17 LSTM-based Office Occupancy Detection Using Smart plug Data
Seunghyeon Park, Kiwoong Kwon, Eunggi Lee, Sanghun Kim and Yongho Kim (Korea Electronics Technology Institute, Korea (South))

Poster 8E-18 Design of NNEF-PyTorch Neural Network Model Converter
KyungHee Lee (ETRI, Korea (South))

Poster 8E-19 A Compact Neural Architecture Search for Accelerating Image Classification Models
Tuan Manh Tao (Korea Advanced Institute of Science and Technology, Korea (South)); Heejae Kim (KAIST, Korea (South)); Chan-Hyun Youn (Korea Advanced Institute of Science and Technology, Korea (South))

Technical Paper Sessions

Poster 8E-20 Quantized ADAM with Monotonically Increasing Resolution of Quantization
Jinwuk Seok (Electronics and Telecommunication Research Institute, Korea (South)); Jeong-Si Kim (Electronics and Telecommunications Research Institute, Korea (South))

Poster 8E-21 An Analysis of Elderly Drivers' Traffic Accidents Influential Factors using Multiple Linear Regression
Ahhyeon Hong and Donghee Noh (Korea Electronics Technology Institute, Korea (South))

Poster 8E-22 Deep Learning for Coexistence Radar-Communication Waveform Recognition
Thien Huynh-The (Kumoh National Institute of Technology, Korea (South)); Quoc-Viet Pham (Pusan National University, Korea (South)); Toan-Van Nguyen (Utah State University, USA); Dong Seong Kim (Kumoh National Institute of Technology, Korea (South))

Poster 8E-23 Multi-feature based Object Classification using Flexible Gloves inspired by Human Grasping
Yu-Lim Min (University of Science and Technology, Korea (South) & ETRI, Korea (South)); Yun-Jeong Kim (Electronics and Telecommunications Research Institute (ETRI), Korea (South)); Jeong-Nam Kim (University of Science and Technology, Korea (South)); Hye-Jin Kim (Electronics and Telecommunications Research Institute (ETRI), Korea (South))

Poster 8E-24 Deep Learning-Based Beamforming for Intelligent Reflecting Surface-Assisted mmWave Systems
Yongjun Ahn and Byonghyo Shim (Seoul National University, Korea (South))

Poster 8E-25 Experimental Design for Multi-task Deep Learning toward Intelligence Augmented Visual AI
ByungRae Cha (GIST, Korea (South))

Poster 8E-26 Korean Traditional Document Translation Using Transformers In Bidirectional-CRF
JunGi Lee and Jongwon Jang (Kyungpook National University, Korea (South)); Jangwon Lee (SK Holdings C&C, Co. Ltd., Korea (South)); Gil-Jin Jang and Minho Lee (Kyungpook National University, Korea (South))

Poster 8E-27 Conducted Electromagnetic Interference Energy Harvesting for Green Communication of IoT Sensors
Changhee Hyoung (Electronics and Telecommunications Research Institute, Korea (South))

Poster 8E-28 AMM based p2p energy trading system using hyperledger fabric blockchain
Juwon Kim, Song Jae Geun, HyeonWoo Shin and Juwook Jang (Sogang University, Korea (South))

Poster 8E-29 UWB Sensor Assisted Self-Quarantined Person Health Status Monitoring using LSTM
Fabliha Bushra Islam, Cosmas Ifeanyi Nwakanma, Jae Min Lee and Dong Seong Kim (Kumoh National Institute of Technology, Korea (South))

Poster 8E-30 Compressed Neural Network for Thermal Array-Based Fall Detection System on Embedded AI
Adinda Riztia Putri, Goodness Oluchi Anyanwu, Mareska Pratiwi Maharani, Jae Min Lee and Dong Seong Kim (Kumoh National Institute of Technology, Korea (South))

Poster 8E-31 Optimization for LEO Satellites-Ground-Integrated Networks via Deep Reinforcement Learning
Ju-Hyung Lee and Young-Chai Ko (Korea University, Korea (South))

Poster 8E-32 End-to-End Learning-based Self-Driving Control Imitating Human Driving
Donghyun Kim (Hanyang University, Korea (South)); Jaerock Kwon (University of Michigan - Dearborn, USA); Haewoon Nam (Hanyang University, Korea (South))

Poster 8E-33 Improvements on Integrated Health and Safety Management System based on Wi-pose to increase Productivity
Punitharuban Thirugnanasammandamoorthi and Jae-ho Choi (Dong-A University, Korea (South))

Poster 8E-34 User Association with Multi-Agent Reinforcement Learning for Energy-Efficient UDN
Jihoon Moon and Byonghyo Shim (Seoul National University, Korea (South))

Technical Paper Sessions

[Session 1F] Vehicular Information and Communication Technologies II

Oct. 22, 10:30~12:10

Chair : Haneul Ko (Korea University)

Session 1F-1 A Study on the Performance of Multi-Channel Communication Protocol for Intelligent Connected Autonomous Driving System
Yoo-seung Song (ETRI, Korea (South))

Session 1F-2 QoS Evaluation of In-Vehicle Network with SPQ of IEEE 802.1TSN
Moe Nitta and Yoshihiro Ito (Nagoya Institute of Technology, Japan)

Session 1F-3 C-band Air-to-Ground Communications for Small Drone
Hee Wook Kim (Electrionics and Telecommunications Research Institute, Korea (South)); Daeho Kim (Korea (South)); Byounggi Kim and Jongsoo Lee (COMESTAR, Korea (South))

Session 1F-4 Propagation characteristics of Urban and Highway Vehicle-to-Everything(V2X) Channels at 5.9 GHz
Chung Sup Kim and Junseok Kim (ETRI, Korea (South)); Jong Soo Lim (Electronics and Telecommunications Research Institute, Algeria); Ju Yeon Hong and Young Jun Chong (ETRI, Korea (South))

Session 1F-5 VANET-Enabled Safety and Comfort-Oriented Car-Following System
Hung-Chin Jang and Bing-Yan Li (National Chengchi University, Taiwan)

[Session 2F] Communication Networks and Future Internet Technologies II

Oct. 22, 10:30~12:10

Chair : Waqas Khalid (Korea University (Sejong))

Session 2F-1 Automatic Data Model Mapper for Security Policy Translation in Interface to Network Security Function Framework
Patrick Lingga (Sungkyunkwan University, Korea (South)); Jeonghyeon Kim (SungKyunKwan University, Korea (South)); Jorge David Iranzo Bartolome and Jaehoon Jeong (Sungkyunkwan University, Korea (South))

Session 2F-2 A Comparative Study on Centralized MAC Protocols for 60 GHz mmWave Communications
Pulok Tarafder, Moonsoo Kang and Wooyeol Choi (Chosun University, Korea (South))

Session 2F-3 Efficient multi-UAV Relay Nodes Placement Scheme in Wireless Networks
Hassen Redwan Hussen, Sungchan Choi, Jong-Hong Park and Il-Yeop Ahn (Korea Electronics Technology Institute, Korea (South))

Session 2F-4 On the Impact of Transceiver Impairments and Reflecting Elements for RIS-Aided Communications
Waqas Khalid (Korea University & Sejong, South Korea, Korea (South)); Heejung Yu (Korea University, Korea (South))

Session 2F-5 Deep Learning for Intelligent Reflecting Surfaces Aided MIMO Systems
WenBin Li (University of Soongsil, China); Yoan Shin (Soongsil University, Korea (South))

Session 2F-6 The Impact of Imperfect Orthogonality of LoRa Communication in Multiple Drone Identification
Jinhyung Oh (Electronics and Telecommunications Research Institute, Korea (South)); Dong-Woo Lim (Electronics and Telecommunications Research Institute (ETRI), Korea (South)); Kyu-Min Kang (ETRI, Korea (South))

Technical Paper Sessions

[Session 3F] SDN and Network Virtualization

Oct. 22, 10:30~12:10

Chair : Youn-Hee Han (Korea University of Technology and Education)

Session 3F-1 AI-based Resource Prediction in Network Function Virtualization Architectures
Vincenzo Eramo (University of Rome "La Sapienza", Italy); Francesco Valente (Sapienza University of Rome, Italy); Francesco Giacinto Lavacca (Fondazione Ugo Bordoni, Italy); Tiziana Catena (University of Roma Sapienza, Italy)

Session 3F-2 A SDN-Based Heterogeneous Networking Scheme for Profinet and Modbus Networks
Heng Wang, Anhua Deng and Chenghao Hu (Chongqing University of Posts and Telecommunications, China)

Session 3F-3 A Game Theoretic Bandwidth Allocation Scheme towards Improving the Fairness of XG-PON Systems
Damanjeet Kaur (Indira Gandhi Delhi Technical University for Women, India); Garima Gupta (Indira Gandhi Delhi Technical University For Women, India); Vivekanand Jha (Indira Gandhi Delhi Technical University for Women, India)

Session 3F-4 An rate adjustment algorithm for scalable URLLC in beyond 5G networks
Chanho Yoon and Seokki Kim (ETRI, Korea (South)); Nurul Huda Mahmood and Irfan Muhammad (University of Oulu, Finland); Gweondo Jo (ETRI, Korea (South)); Young-Jo Ko (Electronics and Telecommunications Research Institute, Korea (South))

Session 3F-5 Early Termination Scheme for 5G NR LDPC Code
Nam-il Kim and Jin-Up Kim (ETRI, Korea (South))

Session 3F-6 Predicting the Bandwidth Requests in XG-PON System using Ensemble Learning
Garima Gupta (Indira Gandhi Delhi Technical University For Women, India); Anamika Rai and Vivekanand Jha (Indira Gandhi Delhi Technical University for Women, India)

[Session 4F] Applications for ICT Convergence II

Oct. 22, 10:30~12:10

Chair : Mucheol Kim (Chung-Ang University)

Session 4F-1 Phase-based predicting the battery remaining time for Android mobile devices
Seung-Ryeol Ohk, Seok Min Hong and Young-Jin Kim (Ajou University, Korea (South))

Session 4F-2 Evaluation of Azalea on many-core test bed system
Yeonjeong Jeong (Electronics and Telecommunications Research Institute, Korea (South)); Jinmee Kim and Seung Hyub Jeon (ETRI, Korea (South)); Seung-Jun Cha and Sung-In Jung (Electronics and Telecommunications Research Institute, Korea (South))

Session 4F-3 A Study on the Necessity of Multi-Factor Design for Predicting Safety of Shipyard Workers
Yoonsook Hwang (Intelligent Robotics Research Division, ETRI, Korea (South)); Woo-Sung Jung (ETRI, Korea (South)); Daeseung Yoo (Electronics and Telecommunications Research Institute, Korea (South))

Session 4F-4 Simulation-based Study of LPI Interference on Fixed Microwave links in 6GHz Band
Igor Kim and Jungsun Um (ETRI, Korea (South)); Seung Keun Park (Electronics and Telecommunications Research Institute, Korea (South))

Session 4F-5 A Statistical Approach for Assessing Time-to-First-Fix Performance of Global Navigation Satellite Systems
Jung-Bin Kim (ETRI - Electronics & Telecommunications Research Institute, Korea (South)); Hyoungsoo Lim (Electronics and Telecommunications Research Institute (ETRI), Korea (South)); Sanguk Lee and JoonGyu Ryu (ETRI, Korea (South))

Technical Paper Sessions

[Session 5F] ICT Services

Oct. 22, 10:30~12:10

Chair : Soyi Jung (Hallym University)

Session 5F-1 A Service Management Method for Distributed Deep Learning
Seung Woo Kum (Korea Elecronics Technology Institute, Korea (South)); Seungtaek Oh and Jaewon Moon (Korea Electronics Technology Institute, Korea (South))

Session 5F-2 Waypoint: Online Semi-automatic Vehicle Occupancy Data Collection System
John Philip Ortiz Chanchico (University of the Philippines, Philippines); Patric Charles M. Garcia (University of the Philippines - Diliman, Philippines); Wilson Tan (University of the Philippines, Philippines)

Session 5F-3 Effect of Mechanical (Dry and Wet) Pollination of Date Palms on Cultivar Naghal in the Sultanate of Oman
Rehna V J (University of Technology and Applied Sciences - Ibri & Lincoln University College, Oman); Mukil Alagirisamy (University Malaya & Lincoln University College, Malaysia)

Session 5F-4 Design Proposal for a Novel Automated Smart System to Curb Mishaps due to Unfocussed Driving
Abid Siddique and Mohammed Gousuddin (Lincoln University College, Malaysia); Rehna V J (University of Technology and Applied Sciences - Ibri & Lincoln University College, Oman)

Session 5F-5 An IoT based parking recommendation system considering distance and parking lot flow
Tzu-Chieh Tsai and Yuan Chen (National Chengchi University, Taiwan)

Session 5F-6 On Performance of multi-hop assisted mMTC for DECT-2020 New Radio System
Sandhya Soni (LNMIIT, India); Rahul Makkar (The LNM Institute of Information Technology & Rupa Ki Nangal, Post-Sumel, Via-Jamdoli, India); Tanmay Singhwi (The LNMIIT, India); Divyang Rawal (LNMIIT, India); Nikhil Sharma (The LNM Institute of Information Technology, Jaipur, India); Laxmikant Minz (KAIST, Korea (South))

[Workshop VII-D] The 3rd Joint International Workshop on Military Informatics (Military communication and Network)

Oct. 22, 10:30~12:10

Chair : Jae Min Lee (Kumoh National Institute of Technology(kit))

Workshop VII-D-1 On the Reliability Evaluation in Downlink VLC NOMA Systems
Won Jae Ryu, Jae Woo Kim and Dong Seong Kim (Kumoh National Institute of Technology, Korea (South))

Workshop VII-D-2 A Small and Angle-Diversity Antenna Mountable for the Small Drone
Sungtek Kahng (University of Incheon, Korea (South)); Yejune Seo (Inchoen National University, Korea (South)); Ye jin Lee, Munsu Jeon, Junghyun Cho and Ji Yeon Jang (Incheon National University, Korea (South)); Changhyeong Lee (Korea Institute of Machinery & Materials, Korea (South))

Workshop VII-D-3 NOMA-Based CRDSA with Access Control for Next Generation IoT Networks
I Nyoman Apraz Ramatryana and Soo Young Shin (Kumoh National Institute of Technology, Korea (South))

Workshop VII-D-4 The Design of The Emerging 5G Using Hybrid GPON and XGS-PON Technology
Yohanna Jayanti Aruan (Kumoh National Institute of Technology, Korea (South)); Philip T. Daely (Kumoh National Institute of Technology, Korea (South) & Institut Teknologi Telkom Surabaya, Indonesia); Gabriel Avelino R Sampedro (Kumoh National Institute of Technology, Korea (South) & National University, Philippines); Jae Min Lee and Dong Seong Kim (Kumoh National Institute of Technology, Korea (South))

Technical Paper Sessions

Workshop VII-D-5 Introducing 5G+ (28GHz) mmWave Campus Test-bed
Tariq Rahim, Arslan Musaddiq, Jae Min Lee and Dong Seong Kim (Kumoh National Institute of Technology, Korea (South))

Workshop VII-D-6 Encrypted Traffic Classification: An Overview
Syifa Maliah Rachmawati, Dong Seong Kim and Jae-Min Lee (Kumoh National Institute of Technology, Korea (South))

[Session 7F] Indoor Positioning and Navigation Systems

Oct. 22, 10:30~12:10

Chair : Jeongyeup Paek (Chung-Ang University)

Session 7F-1 GPS Pseudo Range Correction by the Number of Reflections and Incident Angle Estimations
Koichi Saito (University of Kogakuin, Japan); Takatoshi Sugiyama (Kogakuin University, Japan)

Session 7F-2 Low-complexity Neighborhood-based Weighted Centroid Localization for Secondary Users in Cognitive Radio Network
Narayan Nath (Chongqing University of Posts and Telecommunications, Bangladesh); Xiaowei Liang (Chongqing University of Posts and Telecommunications, China); Bin Shen (Chongqing University of Posts and Telecommunications (CQUPT), China)

Session 7F-3 Cost Reduction in Fingerprint-Based Indoor Localization using Generative Adversarial Network
Changsung Lim and Jeongyeup Paek (Chung-Ang University, Korea (South))

Session 7F-4 Calculated Distance Error Performances According to Actual GPS Measurements in Relay Type GPS
Kouhei Yoshida and Takatoshi Sugiyama (Kogakuin University, Japan)

Session 7F-5 Learning based Wi-Fi RTT Range Estimation
Boo-Geum Jung (ETRI, Korea (South)); Byung Chang Chung (Gyeongsang National University, Korea (South)); Jinhyuk Yim (ETRI, Korea (South)); Yoon-Sik Yoo (Electronics and Telecommunications Research Institute, Korea (South)); HeaSook Park (ETRI, Korea (South))

Session 7F-6 A Deep Learning Approach for Robust Target Tracking in a Cluttered Environment
Jaeuk Baek (ETRI, Korea (South)); SungHo Lee (Seoul National University of Science&Technology, Korea (South)); Chang Eun Lee and Sangjoon Park (ETRI, Korea (South))

[Poster 8F] Internet of Things

Oct. 23, 10:30~12:10

Chair : Jinsung Kim (Chung-Ang University)

Poster 8F-1 Perspectives using Reinforcement Learning approach and Ray-tracing SW for 5G+ Indoor Coverage Optimization
Ju Yeon Hong, Chung-Sup Kim, Jun Seok Kim, Jong-Su Lim and Young Jun Chong (ETRI, Korea (South))

Poster 8F-2 Collective AHU Anomaly Detection for Building Energy Optimization
Marie Kim (ETRI, Korea (South))

Poster 8F-3 Sensor Fault Diagnosis Using an Indirect Fuzzy Feedback Linearization and Decision Trees
Shahnaz Tayebihaghighi and Insoo Koo (University of Ulsan, Korea (South))

Poster 8F-4 Evaluating the Performance of Deep Learning Inference Service on Edge Platform
Hyun Hwa Choi (Electronics and Telecommunications Research Institute, Korea (South))

Technical Paper Sessions

Poster 8F-5 Research and Implementation of Network Clock Synchronization Based on IEEE1588v2 Protocol
Jaesun Cha (Electronics and Telecommunications Research Institute (ETRI), Korea (South)); TaeJoon Park (ETRI, Korea (South))

Poster 8F-6 Sleep Stage Classification for Inter-institutional Transfer Learning
DongYoung Kim (Hallym Univ, Korea (South)); Jaemin Jeong (Hallym University, Korea (South)); Yunhee Woo (HALLYM University, Korea (South)); Jeong-Gun Lee and Dong-Kyu Kim (Hallym University, Korea (South))

Poster 8F-7 Route Prediction in Software Defined Networks Using Ensemble Extreme Learning Machines
Sowmya Sanagavarapu and Sashank Sridhar (Anna University, India)

Poster 8F-8 Learning-driven Spatio-temporal Feature Extraction for Violence Detection in IoT Environments
Dipon Kumar Ghosh and Amitabha Chakrabarty (BRAC University, Bangladesh); Nafees Mansoor (University of Liberal Arts Bangladesh, Bangladesh); Doug Young Suh (Kyunghee University, Korea (South)); M. Jalil Piran (Sejong University, Korea (South))

Poster 8F-9 Improved Early Exiting Activation to Accelerate Edge Inference
Junyong Park and Jong-Ryul Lee (ETRI, Korea (South)); Yong-Hyuk Moon (Electronics and Telecommunications Research Institute (ETRI) & University of Science and Technology (UST), Korea (South))

Poster 8F-10 LSFD: Lightweight Single Stage Masked Face Detector with a CPU Real-time Speed
Youngsam Kim, Jong-Hyuk Roh and Soohyung Kim (ETRI, Korea (South))

Poster 8F-11 A Cloud QoS-driven Scheduler based on Deep Reinforcement Learning
Minh-Ngoc Tran and younghan Kim (Soongsil University, Korea (South))

Poster 8F-12 Deep Learning-based fault prediction in cloud system
Dai Dinh Vu, younghan Kim and Tuong Vu (Soongsil University, Korea (South))

Poster 8F-13 History-Aware Adaptive Route Update Scheme for Low-Power and Lossy Networks
Nain Zulqar (Yeungnam University, Korea (South)); Arslan Musaddiq (Kumoh National Institute of Technology, Korea (South)); Yazdan Ahmad Qadri and Sung Won Kim (Yeungnam University, Korea (South))

Poster 8F-14 Metadata Modeling and Operation Flow of Problem Solving Ecosystem for ECG Data Engineering and Arrhythmia Diagnosis
Sungpil Woo and Young-Ho Suh (ETRI, Korea (South)); Muhammad Zubair (Korea University of Science and Technology & Electronics and Telecommunication Research Institute, Korea (South)); Boyun Eom (ETRI, Korea (South)); Dong-Hwan Park (Electronics and Telecommunications Research Institute, Korea (South)); Sunhwan Lim (ETRI, Korea (South)); Chan-Won Park (Electronics and Telecommunications Research Institute, Korea (South))

Poster 8F-15 PCI Workplace: A decentralized collaboration framework for AI based problem-solving
Young-Ho Suh, Sungpil Woo and Boyun Eom (ETRI, Korea (South)); Dong-Hwan Park (Electronics and Telecommunications Research Institute, Korea (South)); Sunhwan Lim (ETRI, Korea (South)); Chan-Won Park (Electronics and Telecommunications Research Institute, Korea (South))

Poster 8F-16 Robust Inspection of Micro-LED Chip Defects Using Unsupervised Anomaly Detection
Sooill Park and Jong Hwan Ko (Sungkyunkwan University, Korea (South))

Poster 8F-17 A Hadamard Matrix Beamforming System for Direction Estimation of IoT Sensors
Soo-Chang Chae, Ki-Jin Kim and Kwang-Ho Ahn (Korea Electronics Technology Institute, Korea (South))

Poster 8F-18 Towards Measuring Body Temperature Using COTS Mobile Devices
Sanghoon Jun (Sungkyunkwan University & College of Computing and Informatics, Korea (South)); Jinkyu Lee (Sungkyunkwan University, Korea (South))

Technical Paper Sessions

Poster 8F-19 Fine Frequency Offset Synchronization Scheme for Internet of Things Devices in 5G non-terrestrial network
Gyeongrae Im and JoonGyu Ryu (ETRI, Korea (South)); Woo Jin Byun (Electronics and Telecommunications Research Institute, Korea (South))

Poster 8F-20 Non-intrusive Occupancy Estimation using a Smartphone GPS
Sanghun Kim, Eunggi Lee, Seunghyeon Park and Kiwoong Kwon (Korea Electronics Technology Institute, Korea (South))

Poster 8F-21 Development of CCTV Stream Annotation Tool for Preparing Office Occupancy Learning Dataset
Eunggi Lee, Kiwoong Kwon, Sanghun Kim and Seunghyeon Park (Korea Electronics Technology Institute, Korea (South))

Poster 8F-22 Acoustic IoT Framework to Detect Missing Person in Mountainous Areas
Jeehyeong Kim, Heeseok Oh, Won Gi Choi, Min-Hwan Song and Sang-Shin Lee (Korea Electronics Technology Institute, Korea (South))

Poster 8F-23 An Analysis of Emergency Calls Data Record for Patient Severity Prediction
Eunjung Kwon and Hyunho Park (ETRI, Korea (South)); Sungwon Byon (Electronics and Telecommunication Research Insititute, Korea (South)); Kyu-Chul Lee (Changnam National University, Korea (South)); Kyo-Hoon Son (Electronics and Telecommunications Research Institute, Korea (South))

Poster 8F-24 Real-time Submodule Communication Link Monitoring for MMC-HVDC systems
Hark Yoo, Byung Hee Son, Giha Yoon, Ryangsoo Kim and Sungchang Kim (ETRI, Korea (South))

Poster 8F-25 Path planning of ROS autonomous robot based on 2D lidar-based SLAM
Shengmin Zhao (DonggukUniversity, Korea (South)); Seung-Hoon Hwang (Dongguk University, Korea (South))

Poster 8F-26 PUF-based IoT Device Authentication Scheme on IoT Open Platform
Byoungkoo Kim (Electronics and Telecommunications Research Institute (ETRI), Korea (South))

Poster 8F-27 PubMob: Publisher Mobility Support in NDN-based Pub/Sub System
Hak Suh Kim (Electronics and Telecommunications Research Institute, Korea (South)); Namseok Ko (ETRI, Korea (South))

Poster 8F-28 Implementation and Evaluation of NDN-based Video Streaming System
HyunKyung Yoo (Electronics and Telecommunications Research Institute, Korea (South)); Namseok Ko (ETRI, Korea (South))

Poster 8F-29 mIoTwins: Design and Evaluation of mIoT Framework for Private Edge Networks
Junhee Lee (Electronics and Telecommunications Research Institute, Korea (South)); Sungjoo Kang (Electronics and Telecommunications Research Institute (ETRI), Korea (South)); Ingeol Chun (SungKyunKwan University & School of Information & Communication Engineering, Korea (South))

Poster 8F-30 A Design of Policy-Based Scheduling for Federated Multi-Clusters
Youngsun Kim and younghan Kim (Soongsil University, Korea (South))

Poster 8F-31 A Design of Serverless Computing Service for Edge Clouds
Jaeeun Cho (Soongsil University & DCN lab, Korea (South)); younghan Kim (Soongsil University, Korea (South))

Poster 8F-32 Understanding IoT climate Data based Predictive Model for Outdoor Smart Farm
Aekyung Moon and Juyoung Park (ETRI, Korea (South))

Poster 8F-33 Soft Checksum Method for Error-tolerant Multi-hop Transmission in Wireless Sensor Networks
Myung-Sup Lee and Saewoong Bahk (Seoul National University, Korea (South))

Poster 8F-34 On the performance of SEC and SEC-DED-DAEC codes over burst error channels
Donggeun Lee (SungKyunKwan University, Korea (South)); Cho Eunyoung and Sang-Hyo Kim (Sungkyunkwan University, Korea (South))

Registration

- Author Registration Deadline : October 4, 2021
- Early Registration Deadline: October 4, 2021
- Non-author Registration Deadline: October 22, 2021

Registration Policy

1.To be published in the ICTC 2021 Conference Proceedings, a minimum of one author from each accepted paper MUST register at the Regular registration fee (member or non-member) and the paper must be presented at the conference.

2. "Member" rates apply to members of IEEE (Institute of Electrical and Electronics Engineers), IEICE (The Institute of Electronics, Information and Communication Engineers), KICS (Korea Institute of Communications and Information Science), and CIC (China Institute of Communications).

3. A valid student ID is required at the registration desk to check the eligibility for student-rate registration.

4. Non-refundable author registration fees must be paid prior to the early registration due (October 4, 2021).

5. For non-author registrations, absolutely no cancellations/refunds will be accepted after October 4, 2021.

Registration Fee

		Member / Non-member	
		US $ (International)	KRW (Domestic) *
Regular	Early Birds	$600 / $660	₩600,000 / ₩660,000
	On-Site	$660 / $770	₩660,000 / ₩770,000
Student*	Early Birds	$400 / $450	₩400,000 / ₩450,000
	On-Site	$450 / $500	₩450,000 / ₩500,000
International Virtual Authors**	Early Birds	$200 / $220	₩200,000 / ₩220,000

* Student : Students who do not present a paper

** International Virtual Author : Authors from institutions outside Korea may present their paper using online video due to the COVID-19. In this case, the registration fee will be discounted to USD 200 from USD 600.

Contact Information

If you have any questions, please contact Registration Secretariat of ICTC 2021 at ictc@kics.or.kr

- Tel: +82-2-3453-5555
- Fax: +82-2-539-5588

Venue

Ramada Plaze Jeju

Web Site: http://www.ramadajeju.co.kr/ENG/

Ramada Plaza Jeju has been founded and financed by the Korean Teachers Credit Union under a franchise agreement with Ramada International as the highest grade hotel "Ramada Plaza". Designed after the Northern European cruise ship SILJA LINE, this resort-type business hotel opened on July 1 2003 with 400 rooms and suites in a building with 9 floors above ground and 1 underground floor.
The hotel with unique, prestige interior designs has various types of rooms and suites, and banquet halls in different sizes including Grand Ballroom capable of accommodating up to 1,500 guests for seminars, meetings, and wedding ceremonies. With other convenient and versatile facilities, Ramada Plaza Jeju provides guests with some of the best hotel services and experience.

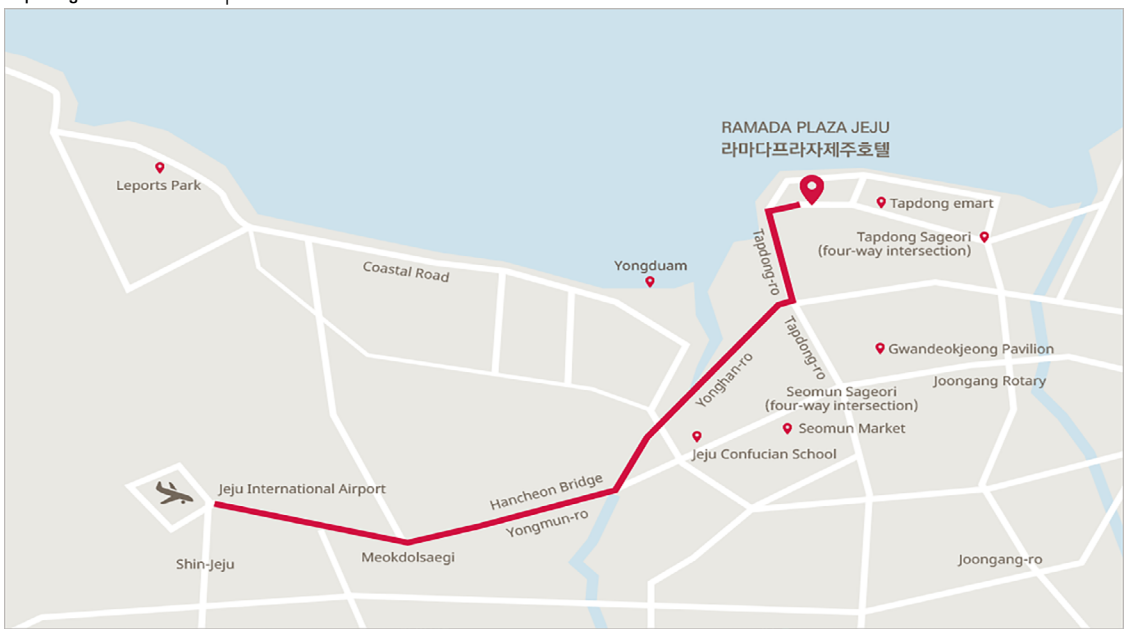
Ramada Plaze Jeju

Address: 66 Tapdong-ro, Jeju-si, Jeju Island
TEL. +82-64-729-8100 | E-mail : ramadajeju@ramadajeju.co.kr

Transportation to and from Hotel

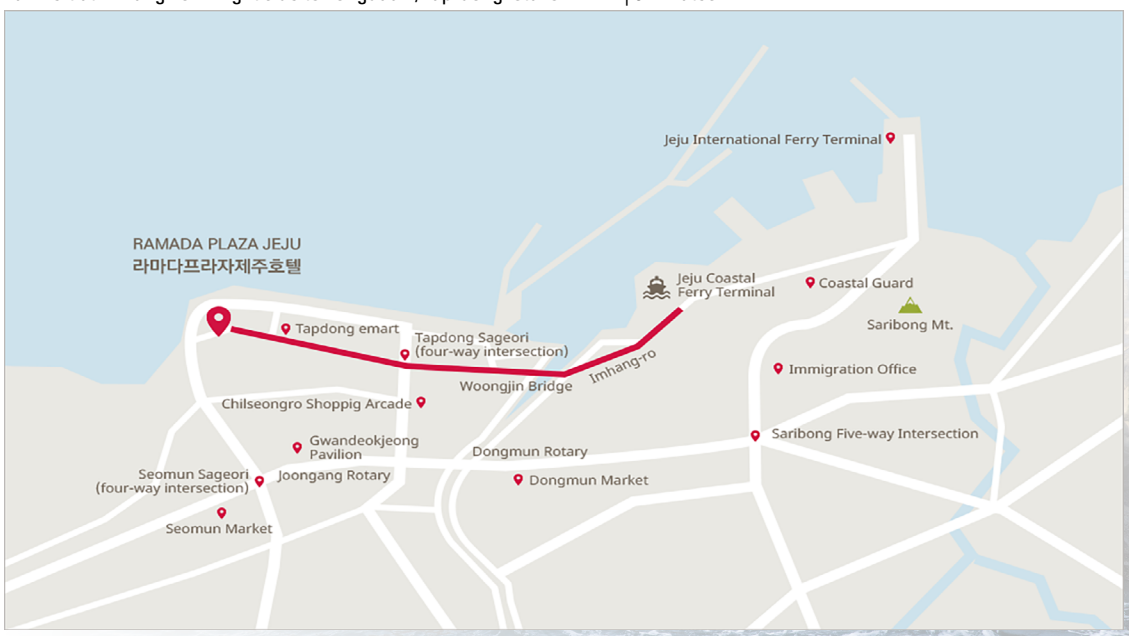
From Jeju International Airport to Ramada Plaza Jeju

To Yongmun rotary →Hancheon Bridge →Seomun Market →Turn left at Seomun Sageori (four-way intersection) →Go straight to Tapdong-roTotal of 3.8km | 10 minutes



From Jeju Port to Ramada Plaza Jeju

Turn left at Imhang-ro → right side to Yongduam/Tap-dongTotal of 2.2km | 6 minutes



Travel Information

Hallasan National Park

Hallasan stands out at the center of South Korea's southernmost island, boasting exquisite landscapes due to its varied volcanic topography and vegetation distribution ranging vertically through the subtropical, temperate, frigid and alpine zones. The special nature of this area led to its being designated and managed as a national park in 1970, a UNESCO Biosphere Reserve in 2002, a World Natural Heritage Site in 2007. Muljangori Oreum registered as a Ramsar Wetland in 2008.

Jeju Olle

"Olle" [Ole] is the Jeju word for a narrow pathway that is connected from the street to the front gate of a house. Hence, "Olle" is a path that comes out from a secret room to an open space and a gateway to the world. If the road is connected, it is linked to the whole island and the rest of the world as well. It has the same sound as "Would you come?" in Korean, so Jeju's "Olle" sounds the same as 'Would you come to Jeju?'. The first trail route was opened to the public in September, 2007. Since then, the Jeju Olle exploration team has created a combined total of 200km of walking trails in Jeju island. Currently eleven trail routes have been opened to walkers and the trail exploration team is still working on new routes.

Udo (Cow Islet)

The island was named "Udo" or "Cow Island" as its contours look like a cow lying down on the ground. There are 8 scenic wonders of Udo: day and night(Judan-myeongwol and Yahang-eobeom), sky and earth (Cheonjin-gwansan and Jidu-cheongsa), front and back (Jeonpo-mangdo and Huhae-seokbyeok), and east and west (Dongan-gyeonggul and Seobin-baeksa). The movie "In October" and "The mermaid" were shot at Cow Island, capitalizing on its picturesque scene of a fishing village and a lush, peaceful grassy field. The white sand beach facing the indigo and turquoise sea of Jeju is very impressive.

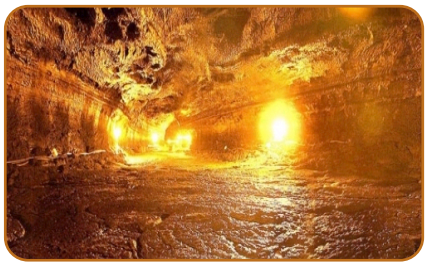
Seongsan Ilchulbong (Sunrise Peak)

99 rocky peaks surround the crater like a fortress and the gentle southern slope connected to water is a lush grassland. On the grassland at the entrance of Sunrise Peak, you can enjoy horseback riding. Breathtaking scenic views while taking a rest in the middle of climbing up the peak such as Mount Halla, the deep blues of the ocean, the multi-colored coast line, and the picturesque neighboring villages will become unforgettable memories.

Seopjikoji

Jutting out at the eastern seashore of Jeju Island, Seopji-Koji is one of the most scenic views with the bright yellow canola and Seongsan Sunrise Peak as a backdrop. The pristine beauty of Jeju can be seen in Seopji-koji. Sinyang Beach, a meadow filled with canola flowers, peacefully grazing Jeju ponies, a rocky sea cliff, and a towering legendary large rock (Sunbawe) all combine to make nature s masterpiece. Unlike the other coastal areas of Jeju, it has red volcanic rock (songi) and strangely-shaped rocks that at low tide transform this area into a breath-taking stone exhibition gallery.

Travel Information



Manjang Cave

Manjang Cave, situated at Donggimnyeong-ri, Gujwa-eup, North Jeju, 30 kilometers east of Jeju City, was designated as Natural Monument No. 98 on March 28, 1970. The 7,416-meter long cave has been officially recognized as the longest lava tube in the world. The annual temperature inside the cave ranges from 11℃ to 21℃, thus facilitating a favorable environment throughout the year. The cave is also academically significant as rare species live in the cave. Created by spewing lava, "the lava turtle", "lava pillar", and "Wing-shaped Wall" look like the work of the gods. It is considered to be a world class tourist attraction.

Gimnyeong Maze Park

This park was opened to the public in 1997 after its development was begun in 1987. In the area of about 3300 square meters, there are 1232 Leylandii trees and two Gold Leylandii trees from England. The overall extended length of labyrinth is 932 m and the shortest course between entrance and exit is 190 m long. Manjang Cave Culture Center, located between Manjang Cave and Gimnyeoungsa Cave, is a part of Manjang Cave tourist complex which is currently being expanded. Three bridges totaling 46 m and an observatory give visitors ample opportunities for picture taking.

Mysterious Road (Dokkaebi Road)

On Mysterious Road (or Bugaboo Road), a parked car on a slight hill road rolls uphill instead of going downhill. This is a result of an optical illusion in which the lower part looks higher because of its surrounding environment.

Cheonjiyeon Waterfall

The waterfall falls from a precipice with thundering sounds, creating white water pillars. It has the name Cheonjiyon, meaning 'the heaven and the earth meet and create a pond'. At 22 m in height and 12 min width, the waterfall tumbles down to the pond to produce awe-inspiring scenery. The valley near the waterfall is home to Elaeocarpus sylvestrisvar, ellipticus, which is Natural Monument No. 163, Psilotum nudum, Castanopsis cuspidatavar.sieboldii, Xylosma congestum, Camellia and other subtropical trees. This place is also famous as home to the eel of Anguilla mauritiana, which is Natural Monument No. 27 and is active primarily at night.

Jeju International Convention Center (ICC)

The International Conventional Center Jeju serves as a world class venue for hosting a variety of different large-scale international events. With the vast Pacific Ocean at its front and majestic Mt. Halla towering behind it as a backdrop, ICC Jeju, standing 5 stories above ground and two levels underground, sprawls over 54,700 square meters of land. As ICC Jeju is nestled right in the middle of the Jungmun Tourism Resort Complex, major tourist sites such as Yeomiji Botanical Garden, Teddy Bear Museum, Jungmun Beach, Fishing Village Museum, Cheonjeyeon Waterfall, Jusangseolli, Gangjeong Resort, Yakcheonsa Temple and Beophwasa Temple are located conveniently nearby.

Memo

Memo

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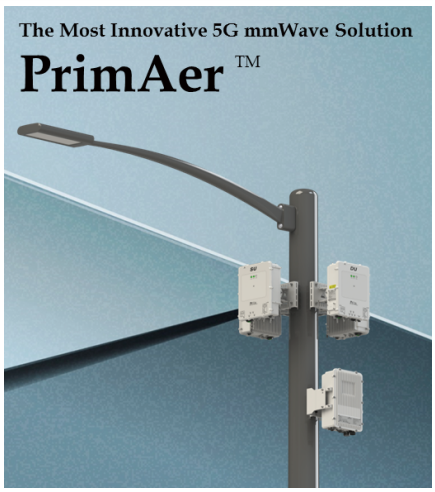
5G 이동통신중계기 선도기업

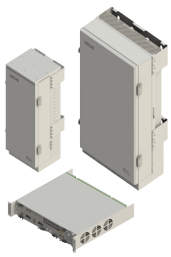
- 20년 업력의 탄탄한 강소기업 (2000.10.13 창립)
- 코스닥 상장법인 (2007.05)
- 총 9회 KT 우수협력사 선정
- 중계기 최초 장영실상 수상 (2002.07)
- 소부장 강소기업 100 선정 (2020.11)
- 혁신기업 국가대표 1000 선정 (2021.05)

5G Line-up



PrimAer™ (5G mmWave RF Repeater)

- 주파수 범위: 28GHz(26.5GHz ~ 29.5GHz), 39GHz(37GHz ~ 40GHz)
- 출력: 39dBm/ path
- 2X2 MIMO 지원
- 특장점:
  - Beamforming, Beamscanning 기능 지원
    : 최적의 기지국 신호를 수신하여 각 서비스 위치별 최적화된 서비스 제공을 통한 효율적 커버리지 확대 가능
  - 옥내외 서비스 지원 가능(IP66)
  - Multi-hop 지원을 통해 SU #1~ #4까지 확장 가능

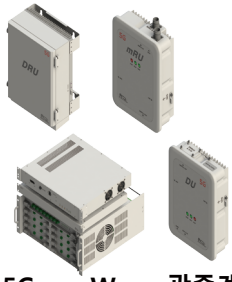


5G sub-6 광중계기

- 출력: 40W/ path
- 5G, FD-LTE, WCDMA 지원

5G sub-6 소출력 광중계기

- 출력: 24dBm/ path
- 4X4 MIMO 지원



5G mmWave 광중계기

- 출력: 22dBm/ path
- 2X2 MIMO 지원

㈜에프알텍/ 대표전화 031 – 470 -1515/ 홈페이지 www.frtek.com
본사: 경기도 안양시 동안구 시민대로 327번길11-25, 에프알텍타워
공장: 경기도 안양시 동안구 흥안대로 415, 두산벤처다임 서관 9, 10F

SERVICES

컨설팅 & 구축

- 고객 환경 및 요구 사항 분석
- 기존 시스템 진단 및 개선 방향 제시
- 아키텍처 설계
- PoC 테스트
- 자동화 및 비용 최적화
- 마이그레이션

매니지드

- 365 *24 운영 서비스
- AWS Certified 전문인력 대응으로 인한 신속한 장애 대처와 업무지원
- 자원모니터링을 통해 비효율자원을 추적하여 유휴자원삭제로 인한 비용 절감

빌링

- 월별 클라우드 비용 분석
- 실시간 빌링 현황 분석
- 할인 정보 제공
- 대납 형태의 요금 청구 서비스

교육

- 국내 유일 고용노동부 환급 과정
- AWS 공인 교육 파트너
- 교육장내 AWS 공인시험센터 보유
- AWS 공인 강사가 진행하는 전문적인 커리큘럼

SPECIAL OFFERING

Billing 연동 시 (기본 계약)

- 최초 1회 컨설팅, 구축 서비스 무상 제공 (신규 워크로드에 한함)
- Billing-On(빌링 솔루션) 무상 제공
- Cloud Front 서비스 단가 할인 (무약정)

AWS Support Plan 구독 시 (Business Support)

- 영우 클라우드 전문 SA 배정
- 구축 단계 이후 기술 자문 서비스 제공
- 기본 계약의 혜택 사항 모두 제공 (컨설팅, 구축/Billing-On/Cloud Front 할인)

Managed Service 이용 시

- 24시간 관제 서비스 제공
- 별도 모니터링 서비스 제공
- Business Time 내 기술 지원, 24시간*365일 장애 대응 서비스 제공 (기본형)
- 월간 Report 제공, 24시간*365일 기술 지원 및 장애 대응 서비스 제공 (고급형)

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Tel 02-6004-7031
E-mail sales@ywdcloud.com
Homepage www.youngwoocloud.com
Address 서울시 중구 세종대로 7길 43(순화타워) 6~17층

영우 클라우드 유튜브 바로가기

영우 클라우드 카카오 채널 바로가기

Enterprise 5G 기반 서비스

커넥티드카
자동차의 AVN(Audio, Video, Navigation)을 통해 인포테인먼트 서비스를 AI 음성 인식으로 제어

스마트드론
'클라우드 관제 시스템'을 활용, 거리 · 공간 제약 없이 경로 자동 비행 및 영상 촬영, 실시간 전송 · 저장

원격제어
관제센터에서 영상전송솔루션을 연결하여 수백km 떨어진 현장을 실시간 모니터링 하며 중장비를 원격제어

스마트시티
도시 교통, 환경, 안전, 주거 등의 분야에 첨단 IT를 적용하는 사업

C-ITS/자율주행
실시간 교통 현황과 도로 상황 정보를 활용하여 사고를 예방하고 교통 흐름을 개선

스마트팩토리
제조공정 전반에 IoT와 AI 기술을 적용하여 지능화된 설비진단 및 품질검사, 효율적인 안전/환경/에너지 관리 서비스 제공

LG U+ | U+5G

한번 보면 놓치지 않을 거예요

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DIGICO KT의 프로파일러
저는 **기가아이즈**입니다.

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실시간으로 클라우드에 저장하고
AI 영상분석을 통해 도난사고, 화재
등의 감지가 가능하죠.

모두가 더 안전한 세상을 위해
잠시도 한눈 팔지 않겠습니다.

GiGA eyes

클라우드와 AI 기술 활용
영상분석을 통해
도난, 사고, 화재 등 긴급사항을
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- **안전한 원격저장** 화재, 도난 등에 의한 영상 걱정 끝
- **AI 영상분석** 침입 감지는 물론, 피플카운팅 등 마케팅분석까지
- **기타 특장점** 깔끔한 매장 인테리어, KT 통신상품 결합 할인

기가아이즈 가입문의 100번

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지켜봐 주세요
SK telecom과 SK square,
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더 큰 내일을 시작합니다

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나를 새로 활짝

Galaxy Z Flip3

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