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# The ICGHIT 2022 Committee

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- Hong Min (Hoseo Univ., Korea)
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## Message from General Co-Chairs of ICGHIT 2022



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



**Prof. Hyunsik Ahn**  
**General Co-Chair**  
**Tongmyong University, Korea**

Welcome to the International Conference on Green and Human Information Technology 2022 (ICGHIT 2022)!

We are very pleased to hold ICGHIT 2022 from January 19 to 21, 2022 at the Ramada City Hotel, Jeju island, Korea. We are very glad to hold the conference successfully despite concerns for the spread of Covid-19. I would like to thank all the participants who take part in the conference locally and remotely at abroad. ICGHIT was started to provide good chances for technical exchanges and advancements, mutual cooperation among the participants, and local development of the country hosting the conference. The goal of ICGHIT is to form a platform to seek the advancement of human related IT in various view points of research. The philosophy of the conference is the achievement of the dream of IT that can improve human welfare and happiness. Along with the recent issues about the fourth industry revolution, global interest in deep learning, virtual reality, IoT and other advanced areas is increasing. This conference seeks to interact internationally with these changing technical advances. This year's conference theme is "Emerging AI+X technology." The latest technologies of AI+X are already pervading our daily life regardless of our recognition including deep learning, VR-AR, IoT, digital

twin, etc. The conference attendees will have an opportunity to discuss new results theoretical and practical results on the topics.

In ICGHIT 2022, more than 140 scientists from 11 different countries (Korea, China, India, Japan, Morocco, Indonesia, Pakistan, Philippine, Spain, United Kingdom, Vietnam, etc.) will present their excellent research results in multiple sessions. The committee prepared two plenary talks, multiple technical sessions consisting of oral and poster presentations. We have received 83 paper submissions, which were peer-reviewed by experts in the area of the paper's subject. The selected papers, 59 high quality research papers, consist of 45 oral presentation papers (Korea: 23, other countries: 22) and 14 poster presentation papers. During this conference, the presented papers will be evaluated by session chairs and program committee. Then, some papers will be selected for publication in excellent international journals. Also, due to the social changes caused by Covid-19, we are taking a new way which it has never experienced yet. Especially, in order to overcome the obstacles caused by the pandemic, the conference is being held on a mixed way to consist of both live and recorded online presentations.

For preparing ICGHIT 2022, the supports and helps of many people and multiple institutions were required. First, we would like to thank sponsors: The Institute of Electronics and Information Engineers (IEIE) and Green Human IT Association (GHIT).

We specially appreciate the devotion of Prof. Duckki Lee, the organizing chair. We also appreciate all the committee members who have been responsible and fulfilled successfully on their fields, and reviewers who carried out the careful evaluation of the submitted papers. Above all, we would like to express our deep appreciation to all authors, participants and speakers despite the matter of the virus.

We hope to hold the next ICGHIT face-to-face with you next year in wonderful place without the virus. We wish you to have a great time during your stay in this beautiful island.

Thank you!



## Welcome to ICGHIT 2022



**Prof. Seong Oun Hwang**  
**International Advisory Committee**  
**President of IEIE Computer Information Society**  
**Gachon University, Korea**

On behalf of all members of the IEIE CIS (Computer Information Society), I welcome you to the ICGHIT 2022 conference in Jeju, Korea.

First of all, I would like to thank all speakers, participants, professors, researchers and students from around the world. I would also like to thank Prof. Kyu-tae Lee, Prof. Hyun-sik Ahn, General co-chairs, Prof. Duckki Lee, Organizing Chair and all the other ICGHIT 2022 committee members. The ICGHIT was first launched as a workshop to encourage friendship and partnership between Korean IEIE CIS members and researchers and professors from other countries. It was very small when launched, but has evolved into one of the major international conferences for the development of green technology and human-related information technology.

The IEIE is the largest institute of electronics and information engineering in Korea. We have hosted various workshops and seminars for professors, researchers and students in IT-related fields. We have also developed a vision to encourage international relations. As a sponsor, we will continue to support the ICGHIT which pursues the philosophy of green and human information technology to enhance human well-being and happiness.

Once again, I would like to express my sincere gratitude to all participants and speakers. We hope you have a great experience during the conference in sharing new and exciting results.

Thank you!

## Information on The Conference Venue

### **Ramada by Wyndham Jeju City Hall, Korea**

Make yourself at home in the heart of Jeju when you stay at our Ramada Jeju City Hall hotel, ideally located near national icons such as Jeju National Museum, Dragon Head Rock, and Samyang Arboretum. Enjoy comfort and convenience less than 5 miles from Jeju International Passenger Terminal (Bus Station) and Jeju International Airport (CJU). After touring Jeju's best attractions during the day, you're assured comfortable nights in guest rooms with a flat-screen HDTV, free WiFi, and plush comforts such as bathrobes, slippers, and spa-style toiletries. Whether you forgot to pack an essential or need directions to nearby attractions, we have a 24-hour front desk and variety of shops onsite. Work out at our fitness center, and enjoy delicious meals at our restaurant throughout your stay.



## Program Schedule

<i>Time</i>	<i>Session Room A</i>	<i>Session Room B</i>
<b>Wednesday, January 19</b>		
10:30 am - 05:30 pm	Registration	
01:00 pm - 02:00 pm	Opening Ceremony & Plenary Talk I	
02:00 pm - 02:30 pm	Coffee Break	
02:30 pm - 04:00 pm	CI1: Communication & IoT 1	P1: Poster 1
04:00 pm - 04:30 pm	Coffee Break	
04:30 pm - 05:30 pm	CI2: Communication & IoT 2	CNS: Computer & Network Security
<b>Thursday, January 20</b>		
10:30 am - 12:00 pm	Workshop 1	CIS: Control and Intelligent System
12:00 pm - 01:00 pm	Lunch (Bring your own lunch)	
01:00 pm - 02:30 pm	Workshop 2	GR: Green Technology
02:30 pm - 03:00 pm	Coffee Break	
03:00 pm - 04:00 pm	Plenary Talk II	
04:00 pm - 04:30 pm	Coffee Break	
04:30 pm - 05:30 pm	MSP: Multimedia and Signal Processing	SW & HW Design
<b>Friday, January 21</b>		
10:30 am - 12:00 am	BoF: Birds-of-a-feather Session	

## Plenary Speeches



### Plenary Talk I

**Title : “Smart Healthcare IoT based on Edge Computing: Architecture, Applications and Challenges”**

**Speaker : Le Anh Ngoc (Ph.D. Info & Comm. Eng.)  
(Swinburne University of Technology, Vietnam)**

### Abstract

The history of human development has proven that medical and healthcare applications for humanity always are the main driving force behind the development of science and technology. The advent of Cloud technology for the first time allows providing systems infrastructure as a service, platform as a service and software as a service. Cloud technology has dominated healthcare information systems for decades now. However, one limitation of cloud-based applications is the high service response time. In some emergency scenarios, the control and monitoring of patient status, decision-making with related resources are limited such as hospital, ambulance, doctor, medical conditions in seconds and has a direct impact on the life of patients. To solve these challenges, optimal computing technologies have been proposed such as cloud computing, edge computing, and fog computing technologies. This talk will present a comparison between computing technologies, and a common architectural framework based on fog and edge computing for Internet of Health Things (Fog-IoHT) applications. Besides, our talk will also indicate possible applications and challenges in integrating fog and edge computing into IoT Healthcare applications. The analysis results indicated that there is huge potential for IoHT applications based on fog and edge computing.

### Short Biography

Prof. Le Anh Ngoc is a Director of Swinburne Innovation Space, Swinburne University of Technology (Vietnam). He received his B.S in Mathematics and Informatics from

Vinh University and VNU University of Science, respectively. He received a Master's degree in Information Technology from Hanoi University of Technology, Vietnam. He obtained a Ph.D. degree in Communication and Information Engineering from the School of Electrical Engineering and Computer Science, Kyungpook National University, South Korea, in 2009. His general research interests are Embedded and Intelligent Systems, Communication Networks, the Internet of Things, Image/Video Processing, AI & Big Data Analysis. On these topics, he published more than 60 papers in international journals and Conference proceedings. He served as a Keynote Speaker, TPC member, Session chair, Book Editor, and Reviewer of the international conferences and journals (Email: nle@swin.edu.au)



## Plenary Talk II

**Title : “Prediction, Optimization, and Control Technology: Techniques, Applications and Challenges”**

**Speaker : Dr. Israr Ullah (Ph.D. Computer Eng.)  
(Research Associate in IoT, Ulster University, UK)**

### Abstract

IoT based applications are getting popular in everyday life. These applications make use of many underlying enabling technologies such as communication, electronic, information processing and artificial intelligence (AI) algorithms, etc. Remarkable development in IoT related technologies in recent past along with advancement in smart solutions has paved the way for transforming conventional cities into smart cities. In most of the IoT-based solutions, AI algorithms are mainly used for prediction, classification, optimization, control applications. Growing demands for smart solutions are putting increasing pressure on experts and system designers to seek efficient and economical way of resources utilization. Development of advanced optimization algorithms has attracted many researchers to seek solutions for complex real-world problems. However, most of the studies are focused on individual key component (i.e., prediction, optimization, control) or in combination of two. Usually, many systems are based on a selected AI algorithm which is once trained and then used (locked). This talk will present an integrated solution based on three distinct algorithms i.e. (prediction, optimization, and control). Further, the performance of these modules can be enhanced using learning module to support autonomous environment monitoring and control. Some use-case applications scenarios will be presented to highlight the effectiveness of this novel integrated solution.

### Short Biography

Israr Ullah is currently working as research associate in IoT at School of Computing, Ulster University, UK. He is the research lead of the “Information SLA for IoT Echo Systems” project team and conducting research on novel machine learning solutions

for IoT systems that are relevant to service level agreement and end-to-end communication in collaboration with other Ulster University and British Telecom (BT) members of the team. Earlier, he has completed Ph.D. in Computer Engineering from Jeju National University, South Korea in February 2019. He has published more than 50 peer-reviewed research articles in reputed journals. His research is mainly focused on development of AI based IoT solutions for smart cities. His research interests also include designing and analysis of optimization algorithms using AI techniques.

## Program Details

Wednesday, January 19 1:00 – 2:00 pm

### Opening Ceremony & Plenary Talk I

Rooms: Room A, Room B

Chair: Duckki Lee (Yonam Institute of Technology, Korea)

### Plenary Talk I

[Smart Healthcare IoT based on Edge Computing: Architecture, Applications and Challenges](#)

Dr. Le Anh Ngoc (Swinburne University of Technology, Vietnam)

Wednesday, January 19 2:00 – 2:30 pm

### Coffee Break

Rooms: Room A, Room B

Wednesday, January 19 2:30 – 4:00 pm

### CI: Communication & IoT 1

Room: Room A

Chair: Young-Hoon Park (Sookmyung Women's University, Korea)

### [Map-Matching-Based Trace Estimation for Ecological Surveys of Wild Animals](#)

Michiki Hara, Kaito Eda, Akihito Taya, Daisuke Shimotoku, Yoshito Tobe and Hiroki Kobayashi (Aoyama Gakuin University, Japan)

In order to investigate ecological systems, it is essential to track the movement routes of wild animals to understand their behaviors and the range of their activities. Although Global Positioning System (GPS) is commonly used to track behavior, GPS with its high power consumption is not suitable for wildlife tracking. As a solution to the problem, it is possible to activate the GPS intermittently and supplement the path between the points where the GPS measurement is successful using the accelerometer. In this paper we propose a method to utilize 3D maps and Kalman filter to compensate the error incurred by accelerometer signals.

### [Implementing Network Access Control \(NAC\) Using Computer Network](#)

Qamar Abbas (Quaid e Awam University of Engineering Science and Technology, Pakistan)

With the increased demand in Network Security there is a need for devices and software's which can provide reliable security in the Network. Firewall is a network security system that grants or rejects network access to traffic flow between an untrusted zone and a trusted zone. In this project we have created software base firewall that Local Area Network (LAN) will use in which we have implemented our own rules that can control the traffic. We will provide the administration side and can control the access of clients so that clients can only access those parts where we grant them the access. Our system will be used in different environments such as for employees, students, parents, teachers etc. The system is not expensive and highly secure. We can update the system anytime we want.

### [Skew Estimation for V2X Networks](#)

Usman Hashmi (Iqra University, Pakistan), Muntazir Hussain (Air University, Pakistan), Fahad Bin Muslim, Kashif Inayat (Iqra University, Pakistan) and Seong Oun Hwang (Gachon University, Korea)

Today's technology made vehicles capable of exchanging information. This vehicular communication can be from vehicle to any vehicle, infrastructure, network, pedestrian, device or grid which forms vehicle to everything (V2X) wireless systems. One of the major challenge is time synchronization among all nodes. Having same notion of time support many network functions like scheduling, resource sharing and sequencing of events. Many synchronization protocols are used in V2X systems, however a skew based approach for synchronization is proposed in this paper. Simulation results shows that efficiency can be improved by using proposed clock skew estimation method.

### [Secure Massive Multiple in Multiple Out \(MIMO\) Network](#)



Sadaf Abbasi, Usman Hashmi, Muntazir Hussain, Dawood Khan, Fahad Bin Muslim and Kashif Inayat (Iqra University, Pakistan)

Massive MIMO is the cutting edge technology used in 5G wireless networks, one of the promising technology to get better throughput and spectral efficiency using numerous transmit and receive antennas. On contrary to this Massive MIMO has a pitfall that limits its performance is "Pilot Contamination". A proposed approach is used to diminish pilot contamination in massive MIMO system deployed in time division duplexing 5G. Secure and reliable transmission strategies is also being targeted for Massive MIMO system with active eavesdropper. We deal with a TDD system in which uplink training is needed and active eavesdropper be able to harm the training phase that cause PCat the transmit side. In proposed approach, pilot sequences are encrypted using symmetric cipher. This scheme provides security from eavesdropper as well as this technique will mitigate the problem of pilot contamination i.e. intercell interference and intracell interference.

#### [IoT Based Fire Alarm Navigation System Using GPS and GSM Modules](#)

Asia Mumtaz, Ibtisam Ehsan and Syed Ihtisham Mehdi (University of Sialkot, Pakistan)

This study aims to develop an IoT-based fire alarm navigation system using GPS and GSM. This system provides several benefits, including detecting fires early by considering the nature of the fire and detecting temperature rises due to fires. This system will also detect the smoke produced by the fire. To achieve this, temperature and smoke sensors are used. An Arduino Uno micro controller controls this system. The system will activate the smoke sensor if the temperature exceeds 45 degrees Celsius and the humidity exceeds 75 percent; an alarm is sounded like a warning, the System will activate Buzzer. Through the GSM Module, GPS will provide the longitude and latitude of the point of fire, sending an SMS alert to the fire head station and other emergency centers. This paper presents a concept for an Internet of Things (IoT)-based fire alarm navigation system which can provide competent directional guidance according to the circumstances of a disaster and uses wireless sensor networks to address existing fire emergency response problems in times of fire.

**P: Poster**

**Room: Room B**

Chair: Kyutae Lee (Kongju National University, Korea)

#### [Performance and Real-Time Analysis of Deep Neural Networks Based Automatic Smart Traffic Management System](#)

Muhammad Asfand Hafeez, Seong Oun Hwang and Wai Kong Lee (Gachon University, Korea)

Traffic jams are growing more prevalent in the nation and throughout the globe as the number of cars on the road increases. To overcome this issue, smart traffic management system using real time analysis is designed for a density based smart traffic management system in which time and signal light of traffic signal changes after observing the density of traffic present on the road. The construction of this intelligent traffic control system enables us to overcome traffic congestion in populated areas. Deep transfer learning is utilized in this paper, and we used three convolutional neural network-based designs (AlexNet, Inception V4, and ResNeXt-50). We created a collection of traffic pictures that have been labeled with the appropriate density of traffic at each junction duration of each signal is changed automatically according to density of vehicles present on the roads and this approach help to automate the traffic flow at each junction. We used our own dataset to train deep convolutional neural networks to identify the density of traffic on the road. According to the experimental findings, the pretrained model ResNeXt-50 obtains the best classification accuracy of 97.53% for our dataset out of all pre-trained models. Real time analysis of all pre-trained models is also observed by its hardware implementation. Results and implementation of this automatic controlled traffic management system shows that is far better than the timer based conventional traffic system. The application of this project is to overcome the traffic congestion on the roads by allocating more time to the busy roads and safe time.

#### [Digital Energy Prosumer Platform Promotion Status and Revenue Model](#)

Se-Hwan Park(ENF Incorporation, Korea), Wan-ki Park/Tai-Yeon Ku(Electronics and Telecommunications Research Institute, Korea), Taek-Joong Jung/Young-Seong Ji(Korea Energy Convergence Association, Korea), and In-Seuk Lee(HERIT Corporation, Korea)

The study describes the proliferation of digital energy prosumer platforms that enable energy data collection/analysis along with convergence of ICT-energy technologies, changes in energy policy, changes in the prosumer market, and the development of I/C/B/M technology, as well as five characteristics by type. It also presents the development of digital energy prosumers in Korea and peer-to-peer power trading platforms in the UK and The Netherlands. Based on this, it presents a digital energy prosumer revenue model centered on smart phone platforms using block chain.

#### [Enhancement of 3D Instance Segmentation Using Point Based Rendering](#)

Siddiqui Muhammad Yasir and Hyunsik Ahn (Tongmyong University, Korea)

A large increase in RGB-D data will allow new highly effective approaches to be developed. Key concept of research is to split the entire cycle into two levels of separation and recognition. 2D-RGB information was then propagated to the depth image to acquire 3D pixel points even in cluttered environment. We present a deep learning-based technique for effective 3D instance segmentation using RGB-D data. The Detectron deep learning model with point based rendering module has been developed to recognize and segment 3D instances of objects using depth information. Segmented 2D pixels (u, v) of detected object regions in the RGB picture are combined with aligned (x, y, z) points in the (u, v) of the depth image to obtain 3D point cloud coordinates. In addition, we carried out an experiment and analysis to compare our proposed method from various angles and distances. Experiments show that the suggested 3D object recognition and instance segmentation are useful for supporting object handling in robotic and intelligent systems.

#### *PNet: Deep Learning Approach for Pashto Handwritten Characters Classification*

Muhammad Sadiq Amin(University of Central Punjab, Pakistan) and Hyunsik Ahn(Tongmyong University, Korea)

Despite improved object recognition technologies, Pashto's hand-written character recognition (PHCR) remains largely unsolved due to the presence of many enigmatic hand-written characters, enormously cursive Pashto characters, and lack of research attention. We propose a CNN model for recognition of multi-font Pashto hand-written characters for the first time in an unrestricted environment. Besides that, a novel Pashto handwritten character data set POHA for 44 characters is suggested that is generated by native and non-native people, it is then preprocessed by applying deep fusion image processing techniques for texture optimization and induced noise reduction, as no such public data set is available before. Moreover, a set of benchmark deep convolutional neural networks are discussed and their performance on POHA is systemically evaluated and compared with the proposed model.

#### *Direction Finding of ESPAR Antenna Based on Beam Scanning Method for IoT Sensor Network*

Md. Moklesur Rahman and Heung-Gyoon Ryu (Chungbuk National University, Korea)

It is very complicated and challenged to fix the exact location of the tag at a particular direction in the IoT sensor network that uses beamforming to extend the communication range to the sensors or tags. To tackle this problem in the ESPAR (electronic steering parasitic array radiator) antenna based IoT sensor network, a very useful direction finding method is suggested: beam scanning method (BSM). Different from the traditional simple peak searching, the beam scanning method (BSM) provides potential advantages to find out the direction, location of tags or sensors by analysis of the received signal strengths. This BSM can be used for the selective beam switching system by designing ESPAR (electronically steerable parasitic array radiation) antenna to suppress the interference regarding multiple RFID readers and RFID tags. Beam scanning method (BSM) is the prerequisite process of the selective beam switching (SBS). ESPAR antenna exhibits higher gain (8.44 dBi), and proper radiation pattern at a particular direction. This works can be applied into the vast/massive IoT sensor network system by providing better advantages such as higher accuracy, longer range, and more battery life span.

#### *Performance Analysis and Comparison of Distributed Training Strategies for Deep Learning*

Eun-Sung Jung and Hassam Tahir (Hongik University, Korea)

In recent years, much complex neural networks had been introduced with much accurate results. But, at crucial points fast training with accurate results are required, whereas, in traditional practice Deep Neural Network demands rigorous and time taking process. In worst case scenarios, training can even extend to days and weeks. To cater this issue, different distributed and parallel training strategies have been introduced, to reduce the training time in a parallel fashion. Parallel training can be either of model parallelism or dataset parallelism across multiple GPU'S or TPU'S. TensorFlow & PyTorch introduced different strategies in the form of convenient API'S. In this study, we made in depth comparison of different API'S of TensorFlow & PyTorch. Four different strategies inculcating Mirror Strategy, Multimirror Strategy, TPU Strategy, & Parameter Server Strategy are compared. Similarly, three strategies of PyTorch incriminating Distributed Data Parallel Training, RPC-Based Distributed Training, & Collective Communication are also compared. Above mentioned Api's are implemented on 3- different scenarios that is Classification, Prediction & Object Detection, for this purpose 3 different datasets are used. MNIST dataset of 70,000 fashion item images is used for prediction purposes. Coco-2017 is used for detection purposes. Dataset of types of flowers are used for classification purposes. Training was carried out on Google Colab which contains GPU (Tesla, K-80) with 2 cores.

#### *A Smart Educational Direction of the AI and Neuroscience Subject in Biology and Chemistry*

Seung Chang Park (KITELA Institute & IT-ethics and POSEN, Korea)

This paper has studied a smart educational direction of the AI and neuroscience subject. At first, this paper analyzes the current tasks of Korean university education to be adapted to the AI and Neuroscience industries. Secondly, this paper forecasts the industrial demands for the AI and Neuroscience subject in biology and chemistry. Finally, this paper concludes a smart educational direction of the AI and neuroscience subject to implement some innovative university educations with O2O HAIL platform, digital contents and DX services.

#### *Customer(Driver)-Specific Height Recognition System for User Convenience of Drive-Thru Store Touch Panel*

YongSoo Choi (Shinhan University, Korea)

Recently, drive-Thru sales systems are widely applied and increased in many stores for the purpose of increasing labor costs, reducing costs, and improving service quality. Also, under the influence of covid-19, many stores are adopting touch panel as a non face-to-face ordering system. However, the advantages of IT devices are not well utilized in the current use of Dive-Thru system. In the digital imaging device (Monitor), the degree of freedom interns of vision is very higher than what we are thinking now. When we use a certain drive-thru store. the customer presses the call button and the order is transferred through the voice. In this study, the algorithm is to be developed to reduce the labor cost for the user and to transfer the user's request more successively and directly when it use the proposed ordering system developed for Drive-Thru. That is, the vehicle's entrance is detected automatically through the camera device and the height(order position) of the driver is also estimated by camera device. By displaying the menu sheet of touch screen according to the estimated height and it can make payment. By proposing this touch screen ordering system, the existing order system can be improved very efficiently.

#### [An Efficient ECG Data Analysis and Management Scheme Using CNN and Residual Block Structure](#)

Moon-Sik Kang and Kyeong-Nam Ko(GangneungWonju Nat'l University, Korea) and Seungcheon Kim (Hansung University, Korea)

In this paper, we propose an efficient ECG (electrocardiogram) data analysis and management scheme using Enhanced Residual Network (ERN) model. This scheme learns ECG data and classifies cardiovascular diseases based on a convolutional neural network (CNN). The CNN model is optimized for image analysis and is appropriate to analyze time series data. The proposed ERN model uses the PyTorch framework and considers 1-dimensional convolution as well as 2-dimensional convolution. In order to evaluate the performance of the proposed system, we use ECG sample data classified as arrhythmia stored in the MIT-BIH database. As a result of the performance evaluation, the average of the classification accuracy is 98.17%, which shows the effectiveness of the proposed scheme.

#### [Deep Learning Based Dynamic Taint Analysis Framework of Binary Program](#)

Kwangman Ko(Sangji University, Korea), Young-Hoon Park(Sookmyung Women's University, Korea) and Jee-Hyun Koo(Sangji University, Korea)

Program analysis is conducted at the source code or executable code level for the purpose of blocking the possibility of attacks such as forgery or falsification by analyzing SW vulnerabilities. Recently, intelligent new or variant hacking of binary programs is continuously increasing, and technologies for detecting and defending malicious codes in source programs through secure coding are exposed to limitations. A Taint analysis method is used for SW vulnerability analysis by assigning a tainted value to a specific variable, identifying the part that uses the value and judging the part affected by the tainted value as vulnerable. In the dynamic taint analysis method, taint analysis is performed by loading a binary program into memory and then tracing the path of the use of values in the memory through execution. In this paper, we set up a deep learning based learning model that collected the learning data required for binary program analysis, and designed and implemented a framework to evaluate the accuracy and time of the learning model through dynamic taint analysis for binary programs. The our deep learning-based binary program analysis framework will be used to build accurate and reliable training data sets through active learning on raw data and incremental learning through binary analysis models. In addition, it is valuable to verify the operation of the analysis framework through dynamic contamination analysis and to utilize it in a binary analysis system that can perform precise analysis in the future.

#### [Privacy-Preserving Genome Data Management Scheme Using Local Differential Privacy](#)

Young-Hoon Park(Sookmyung Women's University, Korea) and Kwangman Ko(Sangji University, Korea)

Privacy of genome sequence have received considerable attentions from researchers and healthcare institutes. Demands for sharing the genome data grow, however, with the traditional encryption schemes and access control, privacy can be no longer expected after the genome data is shared to a third party. In this paper, we propose a privacy preserving scheme for genome data management using a local differential privacy (LDP). With the LDP, the gene data is modified irreversibly, so the privacy of the gene owner would be still guaranteed even though the gene data is exposed illegally. Moreover, in our proposed scheme, only the privacy-sensitive sections are modified, which occupy only less than 1% of the genome data, so both efficiency and usability can be achieved.

#### [Comparison of Deep Learning Models for Judging Business Card Image Rotation](#)

Yoon HyeWon, Kim Eunkyeoung, Seongbae Eun, Shin Cha(Hannam University, Korea) and Jung ByungWan(Wepnp Inc, Korea)

With the development of information and communication technology, the existing printing industry has become available to order and receive online. And it is developing into a smart factory by incorporating artificial intelligence into printing factories. Especially, deep learning has been applied to judge rotational error that greatly affect print quality. This paper tests the deep learning model that can determine the rotation of the business card image. By experimenting with 2 depths of 3 models, VGG, ResNet, and DenseNet, we confirm whether there is a difference in accuracy by depth. And we explain which model is most accurate when used under the same conditions is presented.

#### [Cloud-Based Smart Building Management System for Cost Efficiency](#)

JinGyu Park and Duckki Lee (Yonam Institute of Technology, Korea)

As global urbanization progresses, buildings are becoming bigger and more complex. The Building Management System (BMS) manages energy efficiency and monitors and controls the status of buildings. Although interest in BMSs has increased since the concept of IoT emerged, its introduction has been slow due to high costs and a lack of experts. To solve these problems, this paper uses a cloud-based smart BMS.

### *An Optimal Sizing Strategy of User-Side Battery Energy Storage System Considering Uncertainty On-Demand and Generation in the Energy Community*

Hyuna Kang, Jinwoo Choi, Seunghoon Jung, Hakpyeong Kim and Taehoon Hong (Yonsei University, Korea)

Battery energy storage system (BESS), which provides instantaneous power to the grid and backs up the photovoltaic (PV) system in buildings, plays a crucial role in achieving renewable energy transition at the national level. To stably supply power generated from the PV system with low-cost and technological advances, the adoption of BESS with the PV system is essential for expanding the renewable energy platforms in terms of environmental aspects. This paper, therefore, aims to develop a framework to propose the optimal sizing of the BESS in the building where the PV system is installed considering the uncertain load demand and generation. The optimal sizing of the BESS is determined for each building type and region, which affects the energy consumption of the building and the PV potential. The results show that the optimal sizing of the BESS had to reflect the building type and regional conditions, which affect the energy consumption of the building and the hourly PV generation. The study can suggest a feasible plan to introduce the BESS for the PV adopters to maximize their environmental benefits from the residential level to the national level.

Wednesday, January 19 4:00 - 4:30 pm

#### **Coffee Break**

Rooms: Room A, Room B

Wednesday, January 19 4:30 - 5:30 pm

#### **CI2: Communication & IoT 2**

Room: Room A

Chair: YongSoo Choi (Shinhan University, Korea)

### *Technology and Interactivity in EFL Learning Model During Pandemic COVID-19*

Kiky Soraya(Bina Nusantara University, Indonesia)

This study was conducted to gather the latest data of EFL students' perspectives on the interactive multichannel learning model implemented during the pandemic Covid-19. Reacting to the virtual EFL classroom challenges due to pandemic Covid-19, it is important to gain the students' feedback and views to find the suitable active learning model to be implemented in this difficult era. This research was gathering 440 EFL students' perceptions from a private university in Indonesia. Online questionnaires are used in this research and sent to the students located all around Indonesia. The research found that the interactive multichannel learning helps the students to actively engage inside of the virtual meetings. The students' stated that through the assistance of interactive multichannel learning, the learning can be livelier although most of the students still prefer to have the real meeting in the classes. At the end, some suggestions for the next EFL virtual classes were also discussed in this paper. Keywords- Technology, Interactivity, Virtual Classes, EFL Learning.

### *IoT Integrated Fire Prevention and Alert Systems for Garments Industries in Bangladesh*

Mohammad Rezaul Karim (University of Bradford & Invacare, United Kingdom)

Garments industry plays a vital role in the economic growth of Bangladesh. However, the sector has a terrible record for fire safety. In addition to causing harm to human beings, every year fire related incidents cause significant economic loss to the country. Considering the fact that there is insufficient fire risk assessment in the garments industry, this paper proposes an Internet of Things (IoT) integrated fire prevention and alert systems for garments industries in Bangladesh. The proposed system for IoT devices and their integrated use in fire safety systems can save lives and prevent damage to property and environment

### *An Intelligent, Energy and Mobility-Aware Routing Protocol for Internet of Things*

Muhammad Farhan Saleem (Comsats University Islamabad Wah Campus, Pakistan) and Muhammad Khalil Afzal (COMSATS Institute of Information Technology, Pakistan)

Lots of new technology are invented and joining the Internet, making the Internet of Things idea more common. Most of the new technologies coming have low power and lossy network. In some Internet of Things applications, like the Internet of battle things in the smart military, a dynamic and lossy environment is a key problem due to mobility. Routing protocol for low power and lossy network identified that it's unable to adapt its link metric effectively in a dynamic and lossy environment, where changes in the link metric expected transmission count cause network disruption and significant influence on performance measures. In this paper, we suggested the Q-learning objective function to tackle this problem to incorporate artificial intellect characteristics in a routing protocol for low power and lossy network. Q-Learning learns the environment over a set amount of time and updates the probability vector of expected transmission. The learning process then comes to a halt, only to be restarted if the network becomes unstable in the future, which is very likely owing to mobility in an environment where speed cannot be maintained at all times. The suggested objective function is compared using standardized objective functions and its performance shows noteworthy enhancements in terms of throughput and energy consumption.

#### *Energy-Aware and Congestion-Aware Routing Metric for Low Power and Lossy Networks*

Rehmat Ullah(Queen's University Belfast, United Kingdom), Muhammad Atif Ur Rehman(Hongik University, Korea), Dong-Hak Kim(KISTI, Korea) and Byung-Seo Kim(Hongik University, Korea)

Devices in Low-power and Lossy Networks(LLNs) are very limited in terms of battery, processing power and memory. Parent selection can affect the behavior of the wireless network. An efficient routing metric for parent selection is needed to deal with resource constrained devices. In this paper, we propose an adaptive parent selection mechanism that taking into account the residual energy and queue utilization of the neighbouring nodes. We propose a composite metric that incorporate residual energy, queue utilization, link quality and minimum hopcount. Minimizing energy consumption will surely enhance the network lifetime. The proposed scheme is evaluated using Cooja Simulator 3.0 (latest). Simulation results show that our scheme prolongs the network lifetime and also achieve possible network performance in terms of average power consumption and packet delivery ratio.

#### *Enhanced Channel Access Mechanism for Future Wi-Fi Network*

Rashid Ali(Universitat Pompeu Fabra, Spain), Abdul Rehman and Faisal Bashir Hussain (Bahria University, Pakistan)

Future wireless communication scenarios, like dense sports stadium, airport lounge, train stations, exhibition hall, private/govt offices, dense apartment building and super dense urban streets are considered as major applications of future Wi-Fi networks. The IEEE 802.11 standard defines Distributed Coordination Function (DCF) based on Carrier Sense Multiple Access Collision Avoidance (CSMA/CA) as basic channel access mechanism that adopts Binary Exponential back-off algorithm to reduce the transmission collisions within the dense deployments. However, the Wi-Fi network (Wi-Fi 7) is expected to experience a huge challenge for channel accessing in highly dense users due to basic DCF mechanism. In this paper, we propose an Enhanced Channel Access Mechanism for dense Wi-Fi (ECAM-DWF) networks. The proposed ECAM-DWF, scales the Contention Window size efficiently by following channel collision probabilities. The simulation results show that the proposed ECAM-DWF mechanism achieves improved throughput for dense Wi-Fi networks.

#### **CNS: Computer & Network Security**

Room: Room B

Chair: Dung The Le (Dong Nai Technology University, Vietnam)

#### *Malicious OLE Image Object Hidden Abnormal MS-Office Digital File Detection Mechanism*

Hyung-Woo Lee (Hanshin University, Korea)

Digital crimes such as infecting a specific system by forging a normal digital file have been rapidly increasing in recent years. In order to determine whether a digital file has been forged or not, a method of comparing hash values generated from the original and modified versions using a cryptographic hash function such as SHA-2[1] can be used in general. However, if there is no original or modified file to be compared, there is a problem in that it is not easy to determine whether the file is forged or tampered with. Therefore, in order to solve this problem, it is necessary to specify the detailed range to determine whether or not forged or not by using the internal structure and format information of individual files stored in the computer system, and then to analyze in detail whether malicious code is hidden in the file [2,3,4]. In order to analyze whether a file is forgery or not based on the concealment of malicious code, it is necessary to first analyze whether the file is frequently used for forgery or not [5,6]. In particular, the frequency of use of word processing documents such as MS-Word [7] and image files such as JPG/PNG/BMP is rapidly increasing. Therefore, it is necessary to first perform an analysis process targeting such a file. In addition, damage caused by ransomware maliciously distributed using the macro function included in the MS-Word processor continues to occur. In the case of GandCrab ransomware [8], it exploits security vulnerabilities and macro functions. It is a malicious code with a high ripple effect in that it automatically downloads a malicious file and executes it immediately after interworking with an external C&C server without the user's knowledge to infect the computer system. can do. If the user activates the macro function while using MS-Word, communication with the external C&C server is made by the malicious script included in the forged MS-Word file, and the PNG/JPG image is downloaded again from the specific web server and displayed on the screen. And if the user clicks the OK button, the malicious script is downloaded again and the file stored in the computer system is encrypted, making it difficult to access the file. Therefore, as previously suggested, a mechanism for verifying and determining whether forgery or not through analysis of the internal structure of MS-Word files should be presented in advance. In addition to the

analysis of the image file, a method for verifying and determining whether the image file is forged or falsified should be proposed. Therefore, in this study, a mechanism that can efficiently determine whether a file is forged or falsified by analyzing the abnormality of MS-Word and image file structure was presented in detail.

#### *Predictive Optimal Control Model for Smart Home Appliance Scheduling*

Wafa Shafqat, Sehrish Malik, Kyutae Lee(Kongju National University, Korea), Nam Sang-Yep(KookJe, Korea) and DoHyeun Kim (Jeju National University, Korea)

In this paper, we aim to propose an effective an optimized scheduling solution for smart home energy management. The proposed approach focuses on the optimized scheduling of smart home appliances to minimize the energy consumption and its cost. User and appliance categorization is performed before applying the scheduling technique.

#### *Secure Connectivity and Hop Count of Security-Aware Multi-Hop Ad-Hoc Wireless Networks*

Dung The Le (Dong Nai Technology University, Vietnam)

In this paper, we use stochastic geometry graphs to model the ad-hoc wireless networks (AHWNs) with eavesdroppers' presence, then propose a simulation-based analysis method to investigate the characteristics of connectivity, average hop count, and their relations in various scenarios. Simulation results show that even when more legitimate users appear, the quality of the multi-hop path in the non-colluding case does not greatly improve compared with that in colluding case. This observation provides helpful guidelines for network designers on designing security-aware AHWNs.

#### *Cyber Security and Data Protection - Information Obfuscation in Mobile Devices*

Hassan Azwar (NUST, Pakistan)

With the advancement in technology, systems are getting secure and vulnerable at the same time. Hiding the information in plain sight from the attacker is thousands of years old technique but until this day it still appears as a backbone of security along with encryption. These days our smartphones have every data about us, from our photos, documents to our conversation with others. These smart devices, though appear useful can be extremely dangerous. In order to protect data from the wrong hands, researches derived the ways to hide the data within the smartphone. And in serious cases, the system destroys its data itself to protect it. Hiding data has gathered more attention in the recent years because of advancements in communication and the internet. Not every data moving around in the world is what it appears, sometimes the simple sentences hold the key to the world matters. There are further techniques, ways and levels of information hiding which are applicable according to the requirement and situation. Steganography is covert communication of very secret message which must be kept hidden from unauthorized users. Some properties of information hiding which must be consider before applying the method, include hiding capacity, self recovery, percentage of detection chances, security, transparency of data as it should not be visible to human eyes and robustness of data. This paper presents a survey of information hiding techniques used in mobile devices.

#### *Blockchain: Decentralization and CyberSecurity Risks*

Hassan Azwar (NUST, Pakistan)

This paper covers the detailed overview of blockchain types along with the unique features of blockchain. Blockchain services are helping in making the transfer of the information regarding transactions safer. There are many possible attacks on the blockchain, some of them are discussed in this paper. Its security is as much important as its benefits for the world. This technology has a solution to the world's problem of making secure transactions. This decentralized system of approving and validating every transaction has changed the course of the world and it is still changing bringing innovation to its model. As more and more organizations are using this technology now, it is very much important to keep upgrading blockchain with countermeasures of the possible attacks. This technology has evolved over time with better security. In the near future, blockchain can take the whole world under its umbrella if it keeps growing at the same pace.

### Workshop 1

Room: Room A

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

#### [A Speed and Cosine Similarity-Based Clustering for QoS Routing Protocol in Distributed Vehicular Ad-Hoc Networks](#)

Yushintia Pramitarini, Thong Nhat Tran, Kyusung Shim(Hongik University, Korea), Ahmad Wilda Yulianto(State Polytechnic of Malang, Korea) and Beongku An(Hongik University, Korea)

In this paper, we propose a speed and cosine similarity-based (SCS) clustering for quality-of-service (QoS) routing, which utilizes vehicle's speed and cosine similarity between vehicles to select the cluster head and forming cluster, respectively. Vehicular ad-hoc networks (VANETs) has become an effective technology and essential means to guarantee vehicle safety provides intelligent traffic management for high-speed data communication and vehicle entertainment. However, in the high-way scenario, the node mobility and dynamic topology raise difficulties and challenges on data transmission in VANETs. We solve this problems by proposing a SCS clustering protocol that considers the node speed and direction to elect the cluster head and cosine similarity to help self-organized VANETs form clusters. Simulation results show that the proposed SCS clustering protocol obtains high stability and low control overhead to form the cluster and elect the cluster head.

#### [Lightweight Deep Learning Model for Road Pothole Detection](#)

Hassam Tahir, Jinwook Choi and Eun-Sung Jung (Hongik University, Korea)

In this era, the evolution of smart cars leads to 2-dimensional researches around the world. Firstly, assessment of national and local road conditions becomes a necessity to observe and manipulate smartly for self-driving and autonomous vehicles. Secondly, the development and deployment of lightweight Convolutional Neural Networks had increased especially for smart vehicles, to reduce memory issues and increase efficiency. In this paper, pothole detection is carried out by a lightweight neural network known as FactorNet. The incorporation of FactorNet into Faster R-CNN had been carried out. A dataset of 500 images of the different potholes is annotated for models. The training is carried out on Google Colab (NVIDIA K80/T4). An in-depth comparison has been made with a state-of-the-art lightweight Neural Network, Detectron2. FactorNet outperformed Detectron2 in terms of accuracy and speed. Results demonstrated that the overall detection accuracy of Faster R-CNN is >84%, whereas the detection accuracy of Detectron2 is >79%.

#### [Consumer Mobility Management in Named Data Wireless Mobile AdHoc Networks](#)

Sana Fayyaz, Muhammad Atif Ur Rehman(Hongik University, Korea), Dong-Hak Kim(KISTI, Korea) and Byung-Seo Kim(Hongik University, Korea)

Named data networking(NDN)-which is one of the projects under the umbrella of Information-centric networking is shifting the underlying communication architectural design from address-based stateless communication protocol to the named centric stateful one. NDN features several beneficial characteristics as compared to the IP-based architecture, nonetheless, mobility management in NDN is still a challenging task. Although consumer mobility support is innately provided in the original architectural design of NDN proposed for the wired networks, it confronts several challenges when it comes to wireless mobile adhoc network including excessive energy and bandwidth consumption due to the in-efficient request retransmission mechanism. In this paper, therefore, we proposed a PIT-only construction mechanism to provide seamless consumer mobility management in wireless MANET and to resolve aforementioned issues.

#### [Applied Practice on the Guide Code Generation Based on Model Driven Development for Developing Huge Systems on Distribute Environments](#)

Sejun Jung, So Young Moon and Robert Youngchul Kim (Hongik University, Korea)

Defining complex and multifunctional software requires a lot of requirements and design. In particular, the more complicated functions have, the more use case scenarios are created. Implementation and verification based on these requirements and design documents require a high understanding of design and requirements. Therefore, costs are incurred even before development begins. This research proposes a metamodel that integrates design documents. The structure of the metamodel makes it possible to trace related design elements. It also uses the metamodel to generate guide code automatically. The guide code helps developers understand the design and makes development more straightforward. This is expected to reduce the cost of development.

#### [A Deep Learning Design for Spectral Efficiency Maximization in Multi-IRS-Aided Massive MIMO Systems](#)

Ridho Hendra Yoga Perdana(Hongik University, Korea), Toan-Van Nguyen(Utah State University, USA) and Beongku An(Hongik University, Korea)

In this paper, we design a deep learning neural network framework for spectral efficiency maximization problems in multi-intelligent reflecting surface (IRS)-aided massive multiple-input multiple-output (MIMO) networks. In particular, a base station with multiple antennas is deployed to serve multiple users via multiple IRSs. In this system, we formulate the spectral efficiency maximization with a joint power allocation and phase shift of the IRS, where the power allocation and phase shift processes take long processing time to be converged. To overcome this problem, we design a deep neural network (DNN) framework, where the IRS and user equipment locations are used to train the deep learning model, and then it is used to predict the optimal power allocation and phase shift according to the user equipment and IRS locations. Compared to the conventional optimization method, the DNN design helps to obtain the optimal solution of the power allocation and phase shift problems within short time via a quick-inference process. Simulation results show that the DNN approach achieves excellent results in predict power allocation and phase shift with accuracy 96%.

### **CS: Control and Intelligent System**

Room: Room B

Chair: Mook-Sik Kang (GangneungWonju National University, Korea)

### **Education-Based Big Data and Artificial Intelligent**

Gilbert M. Tumibay (Angeles University Foundation, Philippines) and Jinhong (Alexis) Kim (Paichai University, Korea)

Our research is about use of big data and artificial intelligent for education. Recently, a various of use case about big data and artificial intelligent for education was significant headways. It is purposed novel trend in leading-edge education research and improved education technologies with related in big data analysis and artificial intelligent technology on reality. Accordingly, we discuss about its substantial adoption in many areas of education. Thus their key research trends in the domains of big data and artificial intelligent are associated with assessment, individualized learning, and precision education. Especially, Model-driven data analytics approaches will grow quickly to guide the development, interpretation, and validation of the algorithms.

### **Application of Machine Learning and Deep Learning Algorithms for Breast Cancer Prediction**

Samiya Qanoun and Hassan Ammor (Mohammed V University, Morocco)

Breast cancer has been identified as the most diffused cancer among women worldwide, with a high rate of mortality and diagnosis of breast cancer is time consuming. Due to the least availability of systems, it is necessary to develop a system that can diagnose breast cancer in its early stages. Numerous Machine Learning and Deep Learning algorithms have been used for the classification of benign and malignant tumors. In this research, we applied different classification algorithms of machine learning such as Logistic Regression (LR), The K-nearest neighbor (KNN), the Support Vector Machine (SVM). We then, compared it to Deep Learning algorithms including artificial neural network (ANN) and convolutional neural network (CNN). The experiments have proven SVM to be the best Machine Learning method that can predict Breast Cancer with an accuracy as high as 95.32%. On the other hand, Deep Learning has reached an even higher accuracy of 98.25% and 98.59% using ANN and CNN models respectively.

### **Underwater Autonomous Diver Gesture Detection System for Communication Between AUV and Human Diver**

Shrutika Sinha (Kookmin University, Korea)

Recently, various underwater diver communication means, such as sonar and underwater optical communication, have been introduced and used. In a situation where underwater communication is difficult, the Gesture Detection method, which can be recognized by an AUV as a camera for communication with various underwater vehicles such as AUV, is a useful method. In this paper, we present a gesture detection method using artificial intelligence.

### **Development of a Credit Default Model Using R and Neural Network**

Prashant Ubarhande and Arti Chandani (Deemed University, India)

Lenders decide for the approval or rejection of debt proposals by following a credit rating procedure. The complex nature of existing rating process leads to unpleasant decisions by lenders and borrowers. Therefore, lenders are struggling to find flexible and simple rating methods which are widely acceptable, comprehensive, objective and modifiable as per the lender's requirements. Credit rating reflects the creditworthiness of borrowers. A model based on financial data can provide more objectivity and flexibility to determine such creditworthiness. We have developed a model based on financial data of 100 companies from India. This model is developed in R and Neural network. This model can be used to predict whether the company will default in the future or not. By training the model on 70% of the data we obtained an accuracy of 70.58%. Testing the model using remaining 30% of the data generates an accuracy of 68.75. Use of advanced techniques such as R and Neural networks coupled with financial data, makes this model comprehensive. Furthermore, this model saves time and resources while ensuring the accuracy of prediction. The proposed model could help to build, a reasonable system to predict creditworthiness. This study provides a feasible future research scope.

### **A Study of Control Mechanism Based on OCF Connectivity in Smart Home**



Anam Nawaz Khan, Rashid Ahmad, Atif Rizwan, Naeem Iqbal (Jeju National University, Korea), HeeDong Park, KyungNam Park (Korea Nazarene University, Korea) and DoHyeun Kim (Jeju National University, Korea)

This paper proposes an optimal control mechanism for Active Chilled Beam systems (ACB) based on OCF standard connectivity for efficient energy resource management considering the occupant comfort levels. We developed a predictive optimization model that firstly predicts the environmental parameters and energy consumption as function of operating points of the ACB system. The results of the model are utilized by the optimization model to locate the global optimal actuator set points considering user comfort and potential energy savings. The results of the optimization model are implemented via actuator control commands. Optimal control helps achieve optimal resource utilization with potential energy saving scope.

#### [A Self-Diagnosis System for Measurement of Facial Skin Condition Using Smartphone](#)

Xia Jiun Lau and Jae Kang Won(nCyC Corporation, Korea), Jeung Sun Lee and Yong Gyu Jung(Eulji University, Korea), Hoon Jin (nCyC Corporation, Korea)

The global pandemic has caused a boom in the personalized skin care service industry. In order to recommend customers a product that suits them, skin analysis through user survey or skin analyzer device has to be done. In consideration of the fact that people nowadays spend most of their time on smartphone and more familiar to online shopping, a self-diagnosis system to measure the facial skin condition of users using smartphone is proposed. This model uses a combination of questionnaire and image analysis techniques to find the skin condition of customers. Also, the accumulated big data collected from customers can improve the accuracy of our model. Customers are able to get a recommendation of product that suits their skin according to the results from our skin diagnosis system.

Thursday, January 20 12:00 – 1:00 pm

#### **Lunch (Bring your own lunch)**

Rooms: Room A, Room B

Thursday, January 20 1:00 – 2:30 am

#### **Workshop 2**

Room: Room A

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

#### [Compression of ViT Models Using Heterogeneous Device](#)

Jinwook Choi, Soo-Hyuck Choe and Eun-Sung Jung (Hongik University)

In recent years, image classification and object detection problems have achieved more state-of-the-art (SOTA) in ViT-based models than conventional CNN-based models. However, these high-performance models do not have a big problem with computer resources running in sufficient server environments, but there are many problems running in environments such as Edge Device, where computer resources are limited. To efficiently execute a model in Edge Device, it is required to make a model whose size is reduced while its performance is not degraded significantly using the model compression method, such as the knowledge distillation method. Using the gRPC-based Parameter Server-based distributed learning method provided by TensorFlow and PyTorch, the distribution process of additional models can be reduced and the performance of compressed models in Edge Devices can be measured by using time-efficient methods.

#### [PVAAS: A Cost-Efficient Computation Offloading Strategy for Information-Centric Vehicular Networks](#)

Muhammad Salah Ud Din, Muhammad Atif Ur Rehman, Muhammad Imran, Sana Fayyaz and Byung-Seo Kim (Hongik University, Korea)

The emerging autonomous vehicular applications require substantial computational resources to perform realtime latency-sensitive operations. A single vehicle's onboard unit (OBU) may not solely perform the computations due to resource limitations and eventually forward the compute-intensive tasks request towards the lightweight edge servers co-located with the Road Side Units (RSU-Edge). However, the increasing number of vehicles in the urban areas and frequent diverse natured compute-intensive real-time application requests especially in the peak hours may overload the RSU-Edge. This situation enforces the RSU-Edge to offload entire or partial workload towards the central cloud to avoid computation losses at the expense of higher communication and computation delays. To address these constraints, this article proposes RSU-Edge assisted parked vehicles as a service (PVAAS) aiming to facilitate the proximate computation within the application latency requirements by exploiting the available resources of parked vehicles in the vicinity of RSU-Edge. The proposed work utilizes named Data networking as an underlying communication mechanism and employs microservices-based computation offloading to judiciously utilize the vehicular resources and minimize the processing delays.

### [Integrated Construction with Plug&Play Mechanism Based on Metamodel for Development Process](#)

Woo Sung Jang, So Young Moon and Robert Youngchul Kim (Hongik University, Korea)

The software development environment of SMEs may not mature in the development process. This can lead to failure in software quality management and asset management. To solve this problem, we study software visualization. Software visualization visualizes the software development process and visualizes the overall workflow within the company. However, in an existing software visualization environment, once a tool is selected, it is difficult to change the tool. Software visualization proposes an easy plug&play environment for process visualization to solve this problem. This method supports easy changes in issue tracking systems, continuous integration tools, and toolchain tools in a visualization environment.

### [QoS-Aware Secrecy Rate Improvement in RIS-Aided Wireless Network](#)

Thong Nhat Tran, Kyusung Shim (Hongik University, Korea), Pham Minh Quang (Posts and Telecommunications Institute of Technology, Vietnam), Nam Sang-Yep (Kookje University, Korea) and Beongku An (Hongik University, Korea)

This paper studies on the secure transmission problem in reconfigurable intelligent surfaces (RIS)-aided wireless networks, in which a source transmits data to a destination via a RIS, in the presence of a passive eavesdropper. We propose a secure RIS-Aided transmission (SRT) scheme to maximize the secrecy rate by adjusting the phase shift of the RIS subject to the communication quality constraint at the destination. Particularly, we propose an optimization SRT problem which is a non-convex problem. To solve the SRT problem, we convert the problem to a semi-definite programming problem which can be solved by the CVX software. Simulation results show that the secrecy rate performance of the SRT scheme outperforms the fixed phase shift scheme.

### [Best Practices on Improving Gas Consumption Through Simplifying Quality Complexity of Solidity Code for Smart Contracts in Distributed Network Environments](#)

Janghwan Kim, Chan Sol Park, So Young Moon and Robert Youngchul Kim (Hongik University, Korea)

Recently, power consumption is exponentially increasing due to the huge execution of smart contracts on distributed networks. Every time a smart contract with complex code is executed, performance is degraded, and cost is high. To solve this problem, we propose making the Code complexity simplification for spending low power consumption. Through this, we expect to improve the quality of the code running in the distributed network environment.

## **GR: Green Technology**

Room: Room B

Chair: Seungcheon Kim (Hansung University, Korea)

### [Systematic Benchmarking/Profiling Approaches to Improve I/O Performance of GloSea](#)

Hassan Asghar, Soo-Hyuck Choe, Jinwook Choi and Eun-Sung Jung (Hongik University, Korea)

Scientific applications are journeying towards the exascale, producing a sheer amount of data that needs analysis along with a demand of significant I/O workload facing severe I/O performance bottlenecks. Many researchers have done lots of work on the computation aspect of scientific applications. On the other hand, in the case of I/O performance, this is not true. This paper aims to provide the benchmarking approaches for I/O performance improvement of climate prediction software GloSea encompassing transfer buffer size to read parallelism, dataset chunking and data compression. To conclude, we have also proposed optimization opportunities specific to GloSea using PnetCDF. Adopting these approaches not only empowers GloSea in terms of I/O performance improvement, but the strategies presented in this paper also bring more robustness and a stable communication acceleration.

### [User Activity Recognition and Modeling for Energy Saving in Smart Homes](#)

Wafa Shafqat, Sehrish Malik, KyuTae Lee (Kongju National University, Korea) and DoHyeun Kim (Jeju National University, Korea)

With rising economic and environmental causes and services, energy demand for smart home appliances is becoming an unadorned challenge. There is a dire need for more effective and automated approaches that also focus on user modeling in a smart home, such as prediction of their activity patterns throughout the day. We aim to monitor and predict user motion patterns by using sensory data to reduce energy consumption by ensuring that peak demands do not exceed a given threshold. The proposed model is based on deep learning approaches that take user data and environment data to predict motion patterns and then generate control commands for appliances for effective consumption of energy.

### [Improving Weather Prediction Through Multimodal Deep Learning Optimization](#)

Kyungkyu Ko and Eun-Sung Jung (Hongik University, Korea)

Many forms of air pollution are increasing due to the Fourth Industrial Revolution, and in particular fine dust adversely affects the human body, such as causing or worsening heart and lung-related diseases. In this study, fine dust levels in Seoul after 8 hours are predicted to prevent damage in advance. We constructed the data by combining two modalities (numerical data and image data) for accurate prediction, and we are working on a multimodal deep learning model that combines models from the LSTM-series that show good performance in time series data prediction and models from the CNN-series that are useful for image processing.

#### [IoT Based Cost-Effective Water Quality Monitoring System for Domestic Use](#)

Moazzam Shah Bukhari Syed (Xi'an Jiaotong University, China), Shahzad Memon, and Sher Muhammad Bhurgr (University of Sindh, Pakistan)

Water is the main ingredient for every living specie that is needed for survival. If the water condition is ill, the life of living beings is at risk. There are steps taken on a larger scale to purify and clean the water, but the areas which are still underdeveloped, this problem remains unanswered there. Sustainable Development Goal (SDG) 06 also identifies the mentioned problem and aims at provision of clean water by 2030 across the globe. In this paper, not only the problem of evaluating the quality of water at a low cost is proposed but also a system has been developed which timely conveys the present levels of multiple parameters in water bodies to the concerned management as well as the end users. The designed system is an IoT prototype with various sensors to measure essential parameters/properties like pH, temperature, humidity, turbidity to measure the quality of drinking water. Moreover, the resultant prototype results in achieving SDG 06 - Clean Water and Sanitation by providing water quality monitoring equipment to the management of underdeveloped regions and low-income neighborhoods as well as communities especially of Sindh province of Pakistan which were kept in consideration during this study because of their limited water resources.

#### [Versatile Robot for Plantation and Water Distribution](#)

Ayesha Waris, Muntazir Hussain, Usman Hashmi and Kashif Inayat

Innovation and research in the farming sector is essential if agriculturalists are asked to provide more with less. In this research paper, we have implemented a versatile robot for plantation and water distribution. The implemented robot is multipurpose, which is not only capable to perform the picking and placing operation, but also perform the other tasks like smoke detecting in an industry during a fire, the measurement of soil moisture during the plant placement in the soil, provide the water to the plants depending on the soil moisture, check the water level of the agricultural field by employing water level sensor, and it will also measure the humidity as it is suitable for the working environment to perform specific tasks. The robot will provide the live surveillance using camera by which we can monitor the working of the robot. It can also provide costumer services and apply charges depending on the working hours and the distance covered as well as the number of plants placed in the soil. The service charges will be sent to the costumer's phone number using GSM. The movements of the robot and the arm can be controlled using gestures, one hand will be used to control the movements of the car while the other hand will be used to control the movements of the robotic arm. The controlling of car and arm will be done wirelessly using HC-12 transmitters and receiver. The data of all the sensors connected to the robot will also be displayed on LCD. The movement of the arm will be controlled using a servo motor with 180-degree rotation. The robot will automatically turn on and off the lights depending on the darkness. The robot will also perform the operation of obstacle avoidance using the ultrasonic sensor which will make the robot more accurate and reduce the damage.

Thursday, January 20 3:00 – 4:00 pm

#### **Plenary Talk II**

##### [Prediction, Optimization, and Control Technology: Techniques, Applications and Challenges](#)

Dr. Israr Ullah (Ulster University, UK)

Rooms: [Room A](#), [Room B](#)

Chair: DoHyeun Kim (Jeju National Univeristy, Korea)

Thursday, January 20 4:00 – 4:30 pm

#### **Coffee Break**

Rooms: [Room A](#), [Room B](#)

Thursday, January 20 4:30 – 5:30 pm

#### **MSP: Multimedia and Signal Processing**

## Room A

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

### [Learnable MIMO Detection Networks Based on GDM](#)

Yihong Wang, Chao Dong and Kai Niu (Beijing University of Posts and Telecommunications, China)

In this paper, we optimized the structure of the existing MIMO detection network DetNet, which greatly reduces the number of learnable parameters and complexity. Inspired by DetNet, we present a new iterative MIMO detection algorithm based on gradient descent with momentum (GDM). Numerical results show that the proposed algorithm is more suitable for high-order modulation than DetNet and it achieves near optimal performance close to the sphere decoder in the case of a large number of receiver antennas.

### [A Capacity Controllable Reversible Data Hiding Technology for H.264/AVC Based on Compensational Code Mapping](#)

Jinwoo Kang, Changhee Kang, Sangkyun Im, and Sang-ug Kang (Sangmyung University, Korea)

Reversible data hiding technology is widely used to protect copyright or personal information. Recently, many methods applied to the compressed video domain have been released, but it is still a difficult task to completely control the data hiding of the compressed video domain. In this paper, we propose a method that can control the capacity through a method adaptive to the entropy of the compressed domain. This shows that it is possible to effectively reduce the file size that increases due to the embed payload while maintaining the PSNR based on code mapping.

### [Proposal of Inter - User Interference Cancellation Method for MIMO Systems with Two Nearby Users](#)

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

This paper proposes a novel signal processing method in multiple users (MU) multiple input multiple output (MIMO) systems in case two users are close to each other based on the concept of precoding and equalization. In the proposed method, a set of precoding matrix for two users, and an equalization which is orthogonal to the precoding matrix are designed. In addition, a new linear signal processing method is also devised for inter - user interference (IUI) cancellation. Therefore, interference signals from other users are eliminated according to the orthogonal feature and linear signal processing, and then every user can receive its own signal without IUI. The calculation and simulation results are given to compare the channel capacity of the proposed method with the beamforming and NOMA methods in various scenarios. It is shown that proposed method outperforms other methods. Especially, our novel method works properly in the case two users are close to each other.

### [A Research Project Aimed at Removing Music from a Mixed Spoken and Music Signal](#)

Su Yeong Park and Hyun-Chul Choi (Yeungnam University, Korea)

This paper discusses a study that used the Sudo  $rm-rf$  model to remove music from a mixed voice and music signal, that showed satisfactory results in audio separation. The performance of the Sudo  $rm-rf$  model was measured when separation was conducted on a mixed speech and music signal, and parts of the existing model were updated to increase performance based on the experimental results. It was confirmed that the separation performance was satisfactory even in a signal mixed with voice and music as the model was revised and tested frequently.

### [A Study of Multimedia Streaming Based on Context Awareness in Smart Home](#)

Rashid Ahmad, Anam Nawaz Khan, Atif Rizwan, Naeem Iqbal (Jeju National University, Korea), KyungNam Park, HeeDong Park (Korea Nazarene University, Korea) and DoHyeun Kim (Jeju National University, Korea)

Due to immense importance of real-life applications like e-health and energy efficiency smart home has become the center of attention for many researchers. Recently plethora of techniques and approaches have been proposed by researchers for improving the efficiency of smart homes. Besides, 'Internet of Things' (IoT) also gets enormous attention from the research community due to its wide range applications. Due to enormous growth of smart devices, the amount of data generated by these devices has outgrown the expected limits. In this paper we describe the entertainment enrichment of a smart home by providing seamless and uninterrupted multimedia services. We utilize the IoT architecture for communication between things/objects. Moreover, we also utilize multimedia data as an object of IoT which we called soft thing. We believe that, with the advent of uninterrupted multimedia services, the comfort level of smart home shall be increased for inhabitants. We propose context-aware service provision architecture in the smart home for multimedia services. Our architecture consists of context reasoning-based contents and devices recommendation along with uninterrupted transfer of content between the devices based on the user context.

## SW & HW Design

### Room B

Chair: Hyunsik Ahn (Tongmyong Univ., Korea)

### [Analysis of gm3 Linearization by Self-Body-Biasing in RF CMOS PA](#)

Gwanghyeon Jeong, Jeongheon Kim, Dongin Kang, Shin Cha and Seongbae Eun (Hannam University, Korea)

In this paper, the third-order transconductance ( $gm_3$ ) linearization by Self-Body-Biasing (SBB) of the common source (CS) transistors was analyzed. The threshold voltage of the CS TRs is changed by SBB, thereby reducing the third-order products of  $I_{ds}$  ( $I_{ds3}$ ). It leads to achieve linearization effect by generating a sweet spot of the third order intermodulation distortion ( $IMD_3$ ).

### [Design of Telemedicine System Based on IoT and Android Application](#)

Elgin Nataniel Pranoto and Junita Junita (Universitas Pelita Harapan, Indonesia)

This research aims to design a telemedicine system based on IoT and Android application which can be used to help people have access to healthcare services remotely during COVID-19 crisis. There are two sensors used in this research, which are MAX30100 pulse oximeter is used to read heart rate and oxygen saturation level ( $SpO_2$ ) and a non-invasive blood sugar sensor built from IR LED sensor. In this research, Firebase realtime database and Firestore database are used as cloud database. The Android app is built using Flutter framework. Sensors are connected to Wemos D1 Mini is an integrated ESP8266 microcontroller board. Firebase services is installed both on Wemos D1 Mini and Android app, hence Wemos D1 Mini and Android app is connected through internet via Firebase. The Android app has a Google login function, hence user personal info such as email and display name can be saved inside database. User measurement results are shown in app's user interface (UI). Telemedicine system is built on the app, where user can send their measurement data to their doctor's email. On this research, both sensors are compared to a commercial sensor. From test results, MAX30100 reads  $SpO_2$  with an average level of accuracy of 99%. It takes 60 second for MAX30100 to get accurate heart rate data where the accuracy levels are higher than 95%. Blood sugar sensor tests shows results of correlation between blood sugar levels and sensor's voltage output is 99%. The tests of blood sugar sensor on reading blood sugar levels shows an average accuracy of 98%. Results of app reliability shows that it takes an average of 5 seconds for recipient's email to receive data sent by app and it succeeded to send email to Gmail, Yahoo, and Outlook addresses.

### [The Plug&Play of Sensor/Actuator Modules in Raspberry-Pi](#)

Sunghee Lee, Saeyoung Woo, Shin Cha, Sun-Sup So, Gwanghyeon Jeong, Seongbae Eun (Hannam University, Korea), and Saehyeong Woo (Kongju National University, Korea)

How to develop IoT devices is to install sensors and actuators required by applications on platforms such as Arduino and Raspberry-Pi. Also, their drivers and applications are written. If the manufacturer provides application developers with drivers for the sensor and actuator and the developer accesses the sensors and actuators through a standardized API, the application will be easily developed. Our past studies are difficult to use on current platforms due to the complex interface of sensors/actuators. In this paper, we propose a method in which manufacturers provide application developers with the drivers of sensors and actuators on standard platforms such as Raspberry-Pi. Application developers access sensors and actuators using Linux's standard I/O API. The sensor/actuator module is designed to have an interface such as USB, SPI, GPIO, or the like. When this method is completed, when the application developer plugs the sensor/actuator module into the raspberry-pi, the driver that has already been manufactured will be installed in the raspberry-pi. The application will access the Linux API and plays sensors/actuators. Currently, Plug&Play prototype are being developed based on GPIO and will be expanded to USB in the future.

### [Early Stopping Technique for Unsupervised Spiking Neural Networks](#)

Myeongjin Kwak, Beomjun Kim, Donghui Lee and Yongtae Kim (Kyungpook National University, Korea)

This paper presents a new early stopping scheme for unsupervised spiking neural networks (SNNs) for training speed-up. To reduce the training samples required for training, we leverage adaptive membrane threshold and control the firing and training activity of the neurons in SNNs. The proposed early stopping technique drastically reduces the required training samples and considerably improves the training speed without any meaningful accuracy loss. Specifically, the proposed scheme can reduce the training time up to 99.37% compared to the traditional one.

Friday, January 21 10:30 – 12:00 pm

**BoF: Birds of a Feather**

Rooms: Room A, Room B

Chair: Hyunsik Ahn (Tongmyong University, Korea)