SISA 2020
Program and Abstracts

2020 International Workshop on Smart Info-Media System in Asia

December 17-18, 2020

Soongsil University, Seoul, Korea

Sponsored by

Smart Info-Media System (SIS) Technical Committee, Engineering Science Society (ESS), the Institute of Electronics, Information and Communication Engineers (IEICE)

Contents

1 Messages

1.1 Message from General Chair

It is my great pleasure to welcome you to the IEICE 2020 International Workshop on Smart Info-Media Systems in Asia. The SISA is an annual important conference of the IEICE Engineering Sciences Society and represents large number of gatherings of researchers and industry professionals in the corresponding fields.

This year's conference brings together more than 50 delegates from around the Asian countries to discuss the latest advances in this vibrant and constantly evolving field. Smart Info-Media Systems (SIS) is not only fundamental technology in various signal processing, image processing systems, network and multi-media mobile systems but also can change our society more sustainable in such a way that this technology is able to produce future intelligent Smart systems.

In the SISA2020, it is originally planned to be held in Seoul, Korea but, due to the COVID-19 spread out, the conference is organized by online. Nonetheless this difficulty situation, the committee would thank all participants and paper authors contributing this conference more active. The SISA2020 has been made up by around a hundred of volunteers who contributed to the various processes and it would not be possible for me to name them all in this short message. In particular, the Technical Program Committee, led by our indefatigable TPC Chair and supported by the TPC members, completed a thorough peer-review process of technical and special session papers to select a comprehensive and high-quality technical program for the conference. This program is augmented and complemented by two Keynote Speeches, two special sessions and several regular sessions. In addition, the Organizing Committee, in particular, Special Session, Finance, Publication, Registration, and Secretary, worked tirelessly to ensure the best quality experience for the delegates during the technical sessions and the social programs. Finally, I would also like to thank all participants and supporters for their contribution to the conference. It is a fantastic experience for me to serve as the General Chair of SISA2020 and it is my hope that you find the conference stimulating, fulfilling and enjoyable. Please enjoy the conference!

SISA 2020 General Chair

Hiroshi Ochi
Kyushu Institute of Technology, Japan
Cheong Ghil Kim
Namseoul University, Korea

1.2 Message from Technical Program Chair

On behalf of the technical program committee, it is an honor and our great pleasure to welcome you to the 2020 International Workshop on Smart Info-Media Systems in Asia (SISA 2020) in Seoul, Korea (Online). The technical program of the SISA series consists of two research fields — intelligent signal processing and communication systems. The technical program for SISA 2020 covers topics in all aspects of these two fields from fundamental theory to practical applications and emerging technologies. Both intelligent signal processing and communication systems have been important technologies for a long time, and recent rapid development of personal communication systems, such as mobile computing and smartphones, requires sophisticated solution.

The title of the series, "Smart" Info-Media Systems, is now attracting more and more attention. The SISA series also aims at promoting students and young researches in these research fields. We are planning to organize oral presentations for the regular and two special sessions and two keynote speeches. The total number of paper submission was 40 including both regular and special sessions. The technical program committee finally selected 28 regular papers. In special sessions, 10 papers are presented.

SISA 2020 invites Prof. Tokunbo Ogunfunmi, Santa Clara University, USA and Prof. Joongheon Kim, Korea University, Korea as keynote speakers. Their speech titles are "Algorithms and Architectures for Deep Learning with Applications" and "Trust Computing with Learning-based Auction for Distributed Systems," respectively.

We appreciate the effort of the technical program committee members in the reviewing process. Constructive comments by the reviewers improved the quality of the workshop a lot. We also would like to thank the special session organizers and session chairs for their contributions to the organization of this workshop. Finally, we sincerely appreciate all the contributions of authors for their excellent submissions and participation in this workshop.

SISA2020 Technical Program Chair

Jiman Hong

Soongsil University, Korea

Kyoungro Yoon

Konkuk University, Korea

Masayuki Kurosaki

Kyushu Institute of Technology, Japan

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Youngmo Kim, Soongsil University, Korea

3   SISA Student Paper Awards

SISA Best Student Paper Awards

The SISA student paper awards selection committee carefully selected student paper award candidates during the review process of the submitted papers. The final selection has been carried out based on the camera ready papers. The SISA Best Student Paper Award will be given to one of these candidates. Also, the SISA Excellent Student Paper Award will be given to one of these candidates. The winners will be announced at the SISA Student Paper Awards Ceremony during the closing ceremony.

SISA 2020 Technical Program Chair
SISA Student Paper Awards Selection Committee Chair
Jiman Hong, Soongsil University, Korea
Kyoungro Yoon, Konkuk University, Korea
Masayuki Kurosaki, Kyushu Institute of Technology, Japan

SISA Best Student Paper Awards Selection Committee

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Tomoaki Sato, Hokusei Gakuen UniversityCheong

4 Keynote Speeches

Thursday, 17 December 2020, 9:00 - 10:00

Algorithms and Architectures for Deep Learning with Applications

Prof. Tokunbo Ogunfunmi
Santa Clara University

Abstract

   Deep Learning and Machine Learning are becoming increasingly indispensable tools and methods for learning from data in order to make decisions and interact with our environment. Convolutional Neural Networks (CNNs) are key to several popular applications of deep learning such as image perception, speech recognition, etc. The increasing usage of CNNs in various applications on mobile devices and data centers have led the researchers to explore application specific hardware accelerators for CNNs which typically consist of a number of convolution, activation and pooling layers of which convolution layers is most intensive computationally. Though popular for accelerating CNN training and inference, GPUs are not suitable for embedded applications because they are not energy efficient. ASIC and FPGA accelerators have the potential to run CNNs that are optimized for energy and performance. We present an overview of the key technology areas and research challenges. Key concepts in machine learning theory; Classification vs. Regression models, Supervised and Unsupervised Learning, Linear and Logistic Regression; Regularization; Neural Networks; Machine Learning System Design. Key concepts of Deep Learning. Examples of applications e.g. Handwriting recognition, Recommender Systems, etc. Then we discuss in detail two new methods for two-dimensional (2-D) convolution that offer considerable reduction in power, computational complexity and efficiency and offer a considerably better architecture for hardware implementation of CNNs. The first method computes convolution results using row-wise inputs as opposed to traditional tile-based processing giving considerably reduced latency. The second method Single Partial Product 2-D (SPP2D) Convolution prevents recalculation of partial weights and reduces input reuse. Hardware implementation results and comparisons are presented.

Biography

Tokunbo Ogunfunmi received the B.S. (first class honors) degree from the Obafemi Awolowo University (OAU) (formerly known as the University of Ife), Ile-Ife, Nigeria, and the M.S. and Ph.D. degrees from Stanford University, Stanford, California, all in Electrical Engineering. He is currently a Professor of Electrical and Computer Engineering and Director of the Signal Processing Research Laboratory at Santa Clara University (SCU), Santa Clara, California. From 2010-2014, he served as the Associate Dean for Research and Faculty Development for the SCU School of Engineering. At SCU, he teaches a variety of courses in circuits, systems, signal processing related areas including a new course on autonomous vehicle systems. His current research interests include machine learning, deep

learning, speech and multimedia (audio, video) compression, digital and adaptive signal processing and applications and nonlinear signal processing. He has published four books and 200+ refereed journal and conference papers in these areas. Dr. Ogunfunmi served the IEEE as a Distinguished Lecturer from 2013-2014 for the Circuits and Systems (CAS) Society. He has also served in Editorial Boards of IEEE Transactions on CAS-I, CAS-II, IEEE Signal Processing Letters. He currently serves on the Editorial Boards of the journal Circuits, Systems and Signal Processing and the IEEE Transactions on Signal Processing

Friday, 18 December 2020, 9:00 – 10:00

Trust Computing with Learning-based Auction for Distributed Systems

Prof. Joongheon Kim
Korea University

Abstract

In modern distributed computing systems, econometric theories such as auction and game theory are widely used for resource management. Among them, auction theory is actively used for trust computing in distributed computing under certainty. In conventional auctions, first price auction (FPA) algorithms are revenue-optimal whereas untruthful. On the other hand, second price auction (SPA) algorithms are truthful whereas revenue is not optimal. Therefore, new approaches which are truthful and revenue-optimal, that is called optimal auction. In this talk, optimal auction is designed based on deep learning frameworks and the corresponding applications are introduced in terms of blockchain and unmanned aerial vehicle (UAV) networks.

Biography

Prof. Joongheon Kim has been with the School of Electrical Engineering, Korea University, Seoul, Korea, since September 2019. He received the B.S. and M.S. degrees in computer science and engineering from Korea University, Seoul, Korea, in 2004 and 2006, respectively; and the Ph.D. degree in computer science from the University of Southern California (USC), Los Angeles, CA, USA, in 2014. Before joining Korea University, he was with LG Electronics (Seoul, Korea, 2006–2009), InterDigital (San Diego, CA, USA, 2012), Intel Corporation (Santa Clara in Silicon Valley, CA, USA, 2013–2016), and Chung-Ang University (Seoul, Korea, 2016–2019). He is a senior member of the IEEE, and serves as an associate editor for IEEE Transactions on Vehicular Technology. He internationally published more than 80 journals, 110 conference papers, and 6 book chapters. He also hols more than 50 patents, majorly for 60 GHz millimeter-wave IEEE 802.11ad and IEEE 802.11ay standardization. He was a recipient of Annenberg Graduate Fellowship with his Ph.D. admission from USC (2009), Intel Corporation Next Generation and Standards (NGS) Division Recognition Award (2015), Haedong Young Scholar Award by KICS (2018), IEEE Vehicular Technology Society (VTS) Seoul Chapter Award (2019), Outstanding Contribution Award by KICS (2019), Gold Paper Award from IEEE Seoul Section Student Paper Contest (2019), and IEEE Systems Journal Best Paper Award (2020).

5 Program at a Glance

Thursday, 17th December 2020

9:00 – 9:10	Opening Ceremony
9:10 – 10:10	Keynote Speech (KEY-1): Algorithms and Architectures for Deep Learning with Applications Invited Speaker: Prof. Tokunbo Ogunfunmi 　　　　　　　　　(Santa Clara University, USA) Chair: Hiroshi Ochi (Kyushu Institute of Technology, Japan)
10:10 – 10:30	Break
10:30 – 12:30	Regular Session (RS1): Intelligent Signal and Image Processing 1 Chair: Hakaru Tamukoh (Kyushu Institute of Technology, Japan) Papers: RS1-1, RS1-2, RS1-3, RS1-4, RS1-5, RS1-6
12:30 – 13:30	Lunch
13:30 – 15:10	Special Session (SS1): Intelligent Media Service Organizer & Chair: Woo Chan Park (Sejong University, Korea) Papers: SS1-1, SS1-2, SS1-3, SS1-4, SS1-5
15:10 – 15:30	Break
15:30 – 17:50	Regular Session (RS2): Smart Communication and Systems Chair: Wahyul Shafei Amien (Diponegoro University, Indonesia) Papers: RS2-1, RS2-2, RS2-3, RS2-4, RS2-5, RS2-6, RS2-7

Friday, 18th December 2020

9:00 – 10:00	Keynote Speech (KEY-2): Trust Computing with Learning-based Auction for Distributed Systems Invited Speaker: Prof. Joongheon Kim (Korea University, Korea) Chair: Cheong Ghil Kim (Namseoul University, Korea)
10:00 – 10:20	Break
10:20 – 12:00	Regular Session (RS3): Intelligent Signal and Image Processing 2 Chair: Takayuki Nakachi (NTT Network Innovation Labs., Japan) Papers: RS3-1, RS3-2, RS3-3, RS3-4, RS3-5
12:00 – 13:00	Lunch
13:00 – 15:00	Regular Session (RS4): Intelligent Signal and Image Processing 3 Chair: Yosuke Sugiura (Saitama University, Japan) Papers: RS4-1, RS4-2, RS4-3, RS4-4, RS4-5, RS4-6
15:00 – 15:20	Break
15:20 – 17:00	Special Session (SS2): Smart Media Protection Organizer & Chair: Young Mo Kim (Soongsil University, Korea) Papers: SS2-1, SS2-2, SS2-3, SS2-4, SS2-5
	Regular Session (RS5): Intelligent Speech Processing Chair: Tetsuya Shimamura (Saitama University, Japan) Papers: RS5-1, RS5-2, RS5-3, RS5-4
17:00 – 17:20	Closing

6 Technical Program

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RS1 Regular Session: Intelligent Signal and Image Processing 1

Thursday, 17th December 2020, 10:30 – 12:30

Chair: Hakaru Tamukoh (Kyushu Institute of Technology, Japan)

RS1-1 **Wind turbine blade surface damage recognition based on an improved depth residual classification algorithm** *(pp. 1-6)*

Peng Yang, Chao-Yi Dong, Xiao-Yi Zhao, Zhi-Yun Xiao, Yong-Sheng Qi, Xiao-Yan Chen, Li-Jie Zhang, Shuan-Le Wang (Inner Mongolia University of technology)

RS1-2 **Comparison of Geolocation Precision of UAV Photogrammetry Between the Methods of GCPs and Network RTK** *(pp. 7-11)*

Chaoming Li, Jian Li (Inner Mongolia University of Technology)

RS1-3 **Data Extraction from Printed Data-Embedded Image Using Projectors** *(pp. 12-17)*

Motoki Amami, Mitsuji Muneyasu, Soh Yoshida (Kansai University)

RS1-4 **A Character-region-aware Deep Network for Chinese Character Detection from Wood Slips of the Han Period** *(pp. 18-23)*

Soh Yoshida, Takao Fujita, Mitsuji Muneyasu (Kansai University)

RS1-5 **Generation of Color Palettes with Deep Neural Networks Considering Human Perception** *(pp. 24-29)*

Beiying Liu, Kaoru Arakawa (Meiji University)

RS1-6 **Examination in Improving Machine-Made Charts for Music Games Generated by a Deep Neural Network** *(pp. 30-34)*

Atsuhito Udo, Naofumi Aoki, Yoshinori Dobashi (Hokkaido University)

RS2 Regular Session: Smart Communication and Systems

Thursday, 17th December 2020, 15:40 – 17:50

Chair: Wahyul Shafei Amien (Diponegoro University, Indonesia)

RS2-1 **Optimization of Encoder Setting and Vehicle Communication Networking Parameters in eAVB** *(pp. 35-40)*

Byoungman An, Youngseop Kim (Dankook University)

RS2-2 **A Study of Multipath Error Reduction in Underwater Acoustic Localization** *(pp. 41-44)*

Momoka Tsuruhara, Keisaku Takada, Shingo Yoshizawa (Kitami Institute of Technology)

RS3   Regular Session: Intelligent Signal and Image Processing 2

Friday, 18th December 2020, 10:20 – 12:00

Chair: Takayuki Nakachi (NTT Network Innovation Labs., Japan)

RS4 Regular Session: Intelligent Signal and Image Processing 3

Friday, 18th December 2020, 13:00 – 15:00

Chair: Yosuke Sugiura (Saitama University, Japan)

RS4-1 **Data Augmentation for Cow Behavior Estimation Systems Based on Neural Network Technology** *(pp. 95-100)*

Chao Li, Korkut Kaan Tokgoz, Jim Bartels, Takumi Ohashi, Hiroyuki Ito (Tokyo Institute of Technology), Ayuka Okumura, Ken-ichi Takeda (Shinshu University), Kazuhiro Toda, Hiroaki Matsushima (Information Services International-Dentsu, Ltd.)

RS4-2 **Object Recognition Using Tactile Information in Service Robots** *(pp. 101-104)*

Daiju Kanaoka, Hakaru Tamukoh (Kyushu Institute of Technology), Yutaro Ishida (TOYOTA Motor Corporation Frontier Research Center)

RS4-3 **A Prototyping of Textual Sentiment Classification Preventing Profanity Exposure based on Machine Learning** *(pp. 105-108)*

Chung-Pyo Hong (LG Electronics), Yeon-Seung Yu, Cheong Ghil Kim (Namseoul University)

RS4-4 **Footstep Analysis Through the Footstep Waveform Dataset and the Spectrogram Dataset Using CNN** *(pp. 109-114)*

Yoshiki Goto, Akitoshi Itai (Chubu University)

RS4-5 **Face Recognition Systemon Arduin and Neuromorphic Chips** *(pp. 115-120)*

YeoWool Lee, YoungChan Kim, InPyo Cho, SangYub Lee (Korea Electronics Technology Institute)

RS4-6 **Low-Power Low-Cost Embedded PCB Inspection System Using Neuromorphic Chips** *(pp. 121-124)*

YeoWool Lee, YoungChan Kim, InPyo Cho, SangYub Lee (Korea Electronics Technology Institute)

RS5 Regular Session: Intelligent Speech Processing

Friday, 18th December 2020, 15:20 – 17:00

Chair: Tetsuya Shimamura (Saitama University, Japan)

RS5-1 **Real-Time Target Source Extraction Using Spectral Phase Difference and Its Variance** *(pp. 125-128)*

Eiji Saito, Arata Kawamura (Kyoto Sangyo University)

RS5-2 **Sound Wave Propagation of Parametric Array Loudspeaker with Multiple Carrier Frequency** *(pp. 129-132)*

Kenta Imai, Yoshinobu Kajikawa (Kansai University)

RS5-3 **Possibilities of Visual Communications Using Additive and Subtractive Spectrogram Arts** *(pp. 133-137)*

Naofumi Aoki, Saki Anazawa, Kosei Ozeki, Yoshinori Dobashi (Hokkaido University), Kenichi Ikeda, Hiroshi Yasuda (Smart Solution Technology, Inc.)

RS5-4   **Metric Learning-based Multilevel Parameter Adaptation for Converted and Synthesized Speech Spoofing Detection**   *(pp. 138-143)*

Gyujin Kim, Soonshin Seo, Donghyun Lee, Hosung Park, Changmin Kim, Hyunsoo Son, Ji-Hwan Kim (Sogang University)

SS1   Special Session: Intelligent Media Service

Thursday, 17th December 2020, 13:30 – 15:10

Organizer & Chair: Woo Chan Park (Sejong University, Korea

SS1-1   **Design of a New Caching Layer for Unified Memory-Storage System**   *(pp. 144-149)*

Su-Kyung Yoon (Jeonbuk National University)

SS1-2   **Research and Analysis on User Empathy Factors in Digital Media**   *(pp. 150-153)*

Seungmin Lee (Namseoul University), Sungwon Hwang (Hongik University)

SS1-3   **Effective algorithm to control depth level for performance improvement of sound tracing**   *(pp. 154-156)*

Eunjae Kim, Juwon Yun, Woonam Chung, Woo-Chan Park (Sejong University), Youngsik Kim (Korea Polytechnic University), Cheong Ghil Kim (Namseoul University)

SS1-4   **Counter-Attack against ECU Hacking in CAN Bus**   *(pp. 157-160)*

Taewook Kang, Seongsoo Lee (Soongsil University)

SS1-5   **Mileage-based asymmetric multi-core scheduling**   *(pp. 161-163)*

Se Won Lee, Byoung-Hoon Lee (Pukyong National University), Sung-Hwa Lim (Namseoul University)

SS2   Special Session: Smart Media Protection

Friday, 18th December 2020, 15:20 – 17:00

Organizer & Chair: Young Mo Kim (Soongsil University, Korea)

SS2-1   **A Smart Contract Method for Trusted Digital Document Recordkeeping**   *(pp. 164-166)*

Jungeun Jee (Sungkyunkwan University), Uijin Jang (Soongsil University)

SS2-2   **Hyperledger Fabric-based reliable personal health information sharing model**   *(pp. 167-171)*

Jinsook Bong, Uijin Jang (Soongsil University)

SS2-3   **An Image Frame Extraction Method Using Time Series of RGB Data for Recognizing Immersive Media**   *(pp. 172-174)*

Injae Yoo, Jaechung Lee (Beyound Tech Inc.), Byeongchan Park, Youngmo Kim, Seok-Yoon Kim (Soongsil University)

Injae Yoo, Jaechung Lee (Beyound Tech Inc.), Byeongchan Park, Youngmo Kim, Seok-Yoon Kim (Soongsil University)

Seyoung Jang, Byeongchan Park, Youngmo Kim, Seok-Yoon Kim (Soongsil University)

7   Abstracts

Note: "(pp. xx-xx)" represents the page numbers in the electronic proceeding.

RS1   Regular Session: Intelligent Signal and Image Processing 1

Thursday, 17th December 2020, 10:30 – 12:30

Hakaru Tamukoh (Kyushu Institute of Technology, Japan)

RS1-1   Wind turbine blade surface damage recognition based on an improved depth   *(pp. 1-6)*
residual classification algorithm

Peng Yang	Inner Mongolia University of technology
Chao-Yi Dong	Inner Mongolia University of technology
Xiao-Yi Zhao	Inner Mongolia University of technology
Zhi-Yun Xiao	Inner Mongolia University of technology
Yong-Sheng Qi	Inner Mongolia University of technology
Xiao-Yan Chen	Inner Mongolia University of technology
Li-Jie Zhang	Inner Mongolia University of technology
Shuan-Le Wang	Inner Mongolia University of technology

Aiming at the limitations of traditional wind turbine blade detection, this paper proposes a wind turbine surface damage recognition method based on UAV (Unmanned Aerial Vehicle) machine vision and a deep residual network classification algorithm. In this study, the surface image data of wind turbine blades was collected by UAV, and the training set and the test set were formed after segmentation. The deep residual networks, for examples, ResNet101, DenseNet201 and the improved DenseNet201-FF model under the CNN architecture were used to construct the classifier. When the training parameters are consistent, the accuracy rate are more than 95%. Among them, ResNet101 is 95.55% and DenseNet201 is 96.23%. The proposed improved model DenseNet201-FF consumed only 3.37% more training time than DenseNet201 does, but its accuracy rate achieves 97.15%, which is the highest among the three CNN architectures. The result verifies the effectiveness of the method used in this article.

RS1-2   Comparison of Geolocation Precision of UAV Photogrammetry Between the   *(pp. 7-11)*
Methods of GCPs and Network RTK

Chaoming Li	Inner Mongolia University of technology
Jian Li	Inner Mongolia University of technology

UAV photogrammetry technology has widely used in the 3D reconstruction related fields Geolocation accuracy is a key issue during the process of UAV photogrammetry to make sure that high precision product can be reconstructed. This study conducted three experiments to assess the geolocation accuracy of UAV photogrammetry reconstruction processed by various methods. The results showed that method using the Qianxun FindCM, a kind of centimeter-level accuracy positioning service via cellular network based on RTK technology, can achieve the same geolocation precision as the conventional method depend on GCPs, and is more convenient and efficient.

RS1-3   Data Extraction from Printed Data-Embedded Image Using Projectors   *(pp. 12-17)*

Motoki Amami	Kansai University

| Mitsuji Muneyasu | Kansai University |
| Soh Yoshida | Kansai University |

A method that embeds information in images to extract additional information using the camera of a mobile device has been proposed. It focuses on images included in printed material such as advertisements. Recently, attention has been paid to projection mapping, which projects a moving image onto a three-dimensional object such as a building. The application of the data embedding method to projection mapping can significantly expand the range of utilization of this method. In this paper, we examine the applicability of the technique to the case using a projected image. Furthermore, we focus on the fact that both the projector and the mobile device can handle moving images. Then, we propose a method for increasing the amount of information that can be embedded and evaluate its effectiveness through experiments.

RS1-4   A Character-region-aware Deep Network for Chinese Character Detection from Wood Slips of the Han Period   *(pp. 18-23)*

Soh Yoshida	Kansai University
Takao Fujita	Kansai University
Mitsuji Muneyasu	Kansai University

This paper presents a character-region-aware deep network for Chinese character detection from wood slips of the Han period. Deep learning has been widely applied to many detection tasks. Since Chinese characters are composed of more than one component, character boundaries are often unclear. To overcome the problem, we distinguish those boundaries by not only estimating the character region but also simultaneously estimating the inter-space between characters. In this paper, we propose a method to effectively detect characters by exploring each character and inter-space between characters by extending the U-Net architecture. We conduct experiments on the dataset consists of wood slips of the Han period, and our method can achieve improved H-measure by 5% compared to the general object detection method such as YOLOv3.

RS1-5   Generation of Color Palettes with Deep Neural Networks Considering Human Perception   *(pp. 24-29)*

| Beiying Liu | Meiji University |
| Kaoru Arakawa | Meiji University |

A method for generating color palettes from images is proposed. Here, deep neural networks (DNN) are utilized in order to consider human perception to the images. Two aspects of human perception are considered; one is attention and the other is preference to colors. This method first extracts N regions with dominant color categories from the image considering human attention. Here, N is the number of colors in a color palette. Then, the representative color is obtained from each region considering the human preference to color. Two deep neural-net systems are adopted here, one is for estimating the image area which attracts human attention, and the other is for estimating human preferable colors from image regions to obtain representative colors. The former is trained with target images obtained by an eye tracker, and the latter is trained with database of color selection by human. Computer simulations show preferable performance of this system compared with other color palette generators.

RS1-6   Examination in Improving Machine-Made Charts for Music Games Generated by a Deep Neural Network   *(pp. 30-34)*

Atsuhito Udo	Hokkaido University
Naofumi Aoki	Hokkaido University
Yoshinori Dobashi	Hokkaido University

This study examines the appropriateness of the machine-made charts created for Dance Dance Revolution, one of the most popular music games. From the survey on the conventional software, it is found that the difficulty of the machine-

made charts should be controlled more appropriately to guarantee that the players enjoy the game. Our pilot study suggests the possibility of controlling the difficulty of the game more precisely.

RS2   Regular Session: Smart Communication and Systems

Thursday, 17th December 2020, 15:40 – 17:50

Chair: Wahyul Shafei Amien (Diponegoro University, Indonesia)

RS2-1   Optimization of Encoder Setting and Vehicle Communication Networking Parameters in eAVB   *(pp. 35-40)*

Byoungman An	Dankook University
Youngseop Kim	Dankook University

Today, handling multimedia data has become a very important subject in vehicle network. It is crucial not only for a transmission management but also, for reducing a latency between devices. In this paper, we take advantage of our novel design and optimization algorithm of in-vehicle networking technologies related Ethernet Audio Video Bridge (AVB) technology. A proposal of Latency Reduction System of Ethernet Audio Video Bridge (LRS-EAVB) plays a significant role in reducing the delay between components. The approach on realistic test cases showed that there was a delay reduction about 53%. The results achieved from the experiments on the latency present in each function are reliable because average values are obtained through repeated actual tests for several months. It is expected that the optimization method for the actual automotive environment can greatly shorten the time period in the design and development process. It will greatly benefit the industry since analyzing the latency between each function in a short period of time is very important.

RS2-2   A Study of Multipath Error Reduction in Underwater Acoustic Localization   *(pp. 41-44)*

Momoka Tsuruhara	Kitami Institute of Technology
Keisaku Takada	Kitami Institute of Technology
Keisaku Takada	Kitami Institute of Technology

Underwater acoustic localization is used to know underwater positions in remotely operated vehicles (ROVs) and autonomous underwater vehicles (AUVs). The ultra-short baseline (USBL) method measures a propagation time of sound wave from a transmitter to a receiver, where distance estimation and direction of arrival (DOA) estimation are performed. In the DOA estimation, the conventional time difference of arrival (TDOA) measurement induces a large error for strong sound wave reflections and the countermeasure against multipath interference is requested. In this paper, we introduce a TDOA algorithm that can reduce the multipath errors, and report on the simulation and experimental results in underwater acoustic localization.

RS2-3   Experimental Evaluation of Retrodirective System in Underwater Acoustic Communication   *(pp. 45-48)*

Aoi Nagano	Kitami Institute of Technology
Shingo Yoshizawa	Kitami Institute of Technology

Beamforming is a technology that concentrates wave energy in a specific direction by using an element array. It enables the extension of the communication range and the reduction of acoustic reflection interference. In transmit beamforming, it is important to match a beam direction to a destination terminal when transmitting a signal. The transmit beamforming method is requested to optimize the transmit beam according to surrounding environments. This study introduces a retrodirective system that estimates direction of arrival (DOA) from a sound wave in destination terminal and controls the transmit beam in the opposite direction. In the underwater acoustic communication test, we evaluated

communication performance in line-of-sight and non-line-of-sight conditions and confirmed communication performance of transmit beamforming using the retrodirective system.

RS2-4   An Approach to Maximize SDMA Uplink Communication in an IoT Media Access Control Protocol *(pp. 49-52)*

Atsuki Kuriyama	Hokkaido University
Hiroshi Tsutsui	Hokkaido University

This paper presents a media access control protocol for IoT uplink communication. Our target system is distributed sensor device systems including cameras, which may have good prospects as emerging surveillance systems for local areas. Distributed sensors are regarded as IoT nodes, and they send data to a base station intermittently. Considering the fact that the sensors are distributed, we can utilize space-division multiple access (SDMA) since the channel conditions differ from each other. Utilizing SDMA, it might be possible to increase the amount of data transmission while keeping the bandwidth narrow. In the case of SDMA uplink communications, since it is necessary for the nodes to synchronize with each other since they send requests according to the signal of the access point. In the proposed system, each node selects a request time slot randomly and sends its request at the selected time slot. In this paper, we focus on the request protocol part, and consider the number of request time slots required to optimize the number of nodes accepted to send their data.

RS2-5   Power Allocation Scheme for Wireless Video Streaming over Multiuser MIMO Systems *(pp. 53-58)*

Yuta Yoshikawa	Kyushu Institute of Technology
Yuhei Nagao	Kyushu Institute of Technology
Masayuki Kurosaki	Kyushu Institute of Technology
Hiroshi Ochi	Kyushu Institute of Technology

Due to the spread of sophisticated mobile devices, image and video streaming became a common service. In the use of multiuser multiple-input multiple-output (MU-MIMO) systems, it is important to keep user fairness and increase a system throughput. In this paper, we propose two power allocation schemes for scalable video streaming with MU-MIMO systems. Both schemes are based on a multi-objective optimization aiming to keep user fairness in terms of video quality and to improve video qualities of all users. Simulation results show that the schemes make the difference in peak signal-to-noise ratio (PSNR) between users no more than 3 dB while every user achieves more than 45 dB in PSNR even in the worst usage scenario.

RS2-6   Asymmetric Multi-BSS Environment Analytical Model for IEEE 802.11 Based WLANs *(pp. 59-64)*

Ryuhei Kajihara	Kyushu Institute of Technology
Han Wenkai	Kyushu Institute of Technology
Leonardo Lanante	Kyushu Institute of Technology
Masayuki Kurosaki	Kyushu Institute of Technology
Hiroshi Ochi	Kyushu Institute of Technology

The Markov chain based model by Bianchi for IEEE802.11 distributed controlled access is a highly accurate analytical tool for estimating the system throughput. However, this model can only be used in a single Basic Service Set (BSS) environment. In recent years, a multi-BSS environment with multiple BSSs has become the default network scenario. Based on the Markov chain model, we propose an analysis model that considers the effects of Carrier Sense Range and Interference Range in a multi-BSS environment, and verify it with the network simulator ns-3.

RS2-7   Design of WLAN System for Industrial Communication   *(pp. 65-70)*

Yoshiki Ito	Kyushu Institute of Technology Graduate School of Computer Science and System Engineering
Mizuki Toyofuku	Kyushu Institute of Technology Graduate School of Computer Science and System Engineering
Chiharu Ishimitsu	Kyushu Institute of Technology Graduate School of Computer Science and System Engineering
Tran Thi Thao Nguyen	Kyushu Institute of Technology Graduate School of Computer Science and System Engineering
Yuhei Nagao	Kyushu Institute of Technology Graduate School of Computer Science and System Engineering
Masayuki Kurosaki	Kyushu Institute of Technology Graduate School of Computer Science and System Engineering
Hiroshi Ochi	Kyushu Institute of Technology Graduate School of Computer Science and System Engineering

In this paper, the industrial wireless LAN, which is a wireless version of the industrial communication standard, is described mainly on the MAC and PHY layers. This paper also describes the entire system that combines the proposed system with industrial communication standards. In general, industrial communication standards are divided into two categories: synchronous communication and asynchronous communication. In this paper, EtherCAT and RS-232C are discussed as synchronous and asynchronous communications, respectively. We have confirmed that the proposed system can communicate correctly in these communication standards.

RS3   Regular Session: Intelligent Signal and Image Processing 2

Friday, 18th December 2020, 10:20 – 12:00

Chair: Takayuki Nakachi (NTT Network Innovation Labs., Japan)

RS3-1   A Hardware-Oriented Pigeon-Inspired Optimization and its FPGA Implementation   *(pp. 71-76)*

Tatsuya Hayashi	Kyushu Institute of Technology
Kentaro Honda	Kyushu Institute of Technology
Hakaru Tamukoh	Kyushu Institute of Technology

In this paper, we propose a hardware-oriented pigeon-inspired optimization (PIO) algorithm and a digital hardware implementation of the hardware-oriented PIO algorithm in a field-programmable gate array (FPGA). Because a conventional PIO algorithm requires large hardware resources while a number of hardware resources in an FPGA is limited, the proposed algorithm reduces multiply operations and exponential functions, which require large hardware resources. We implemented the proposed algorithm in the FPGA using high-level synthesis. We evaluateed the performance of the implementation and compared it to PIO software on a central processing unit (CPU) and a conventional PIO circuit. The experimental result indicated that, the proposed FPGA implementation computation speed was 20times faster than CPU, power consumption was reduced by factor of 60 and computational resources were reduced to half than a conventional PIO circuit. Thus, was a substantial improvement over existing implementations.

RS3-2   The Effect of Visual Acuity and Grid Size of Visual Stimulus to SSVEP   *(pp. 77-80)*

Masaki Ohashi	Graduate school of Engineering, Chubu University
Akitoshi Itai	Graduate school of Engineering, Chubu University
Tomohiro Kumazaki	Chubu University

In recent years, Brain Computer Interface(BCI) using Steady State Visually Evoked Potentials(SSVEP) has attracted attention. The SSVEP is the brain wave when a human pays own attention to the flashing light or flickering checkerboard. In the SSVEP based BCI, a flickering visual stimulus is presented on the display to transmit the user's will. The attention and gaze are directed toward the stimulus to evoke the SSVEP. It is known that the SSVEP has the characteristics depending on the grid size of visual stimulus. The conventional research reported that SSVEP is not evoked when the recognition of the flickering of a visual stimulus is difficult. Kato showed the possibility that visual acuity is related to the amount of SSVEP. Kato employs SSVEP evoked by a squared stimulus whose grid size is defined by a Landolt ring. However, in the case of a large grid to yield the greatest SSVEP is not discussed enough. In this paper, we analyze the relationship between visual acuity and SSVEP using a large grid stimulus.

RS3-3   Examination on Computational Cost Reduction of Quantitative Evaluation   *(pp. 81-84)*
**   Method of Contrast Improvement for Dichromats**

| Xi Cheng | Nagoya City University |
| Go Tanaka | Nagoya City University |

Although color is an important factor in visual information, people with color vision deficiency cannot discriminate specific color combinations. In recent years, many methods to improve the contrast for dichromacy by changing colors in images have been proposed. In addition, several quantitative evaluation indices to evaluate contrast improvement results also have been proposed. However, their computational cost is large. In this paper, we examine the computational cost reduction of the quantitative evaluation indices. Experimental results show that the proposed indices realize the computational cost reduction without deterioration of its performance.

RS3-4   Intra Triangular Partitioning Prediction for Screen Contents   *(pp. 85-89)*

Heeji Han	Hanbat National University
Jaeryun Choe	Hanbat National University
Daehyeok Gwon	Hanbat National University
Haechul Choi	Hanbat National University

Versatile Video Coding(VVC) is a new international video coding standard being developed by Joint Video Experts Team and adopts various technologies including screen content coding tools. Screen contents often include text, lines, and computer-generated objects, which have many discrete textures and sharp edges. Therefore, a triangular division coding can increase coding efficiency for the screen contents. This paper introduces an intra triangular prediction method based on VVC to efficiently compress the screen contents. In the similar way of triangular prediction mode of VVC, which is a inter prediction coding tool, the proposed method generates two rectangular prediction blocks using vertical and horizontal prediction modes of intra prediction coding and filters the both blocks with triangular masks. The average of the filtered blocks is used as the final prediction block in the proposed intra prediction mode. The experimental result of the proposed method shows that the BD-rate decreases by an average of 1.86% compared to the VVC test model 6.0 in the All Intra test condition for screen content test sequences.

RS3-5   SHVC based V-PCC Point Cloud Density Scalability   *(pp. 90-94)*

| Yonghae Hwang | Kyung Hee University |
| Junsik Kim | Kyung Hee University |

Kyuheon Kim   Kyung Hee University

Point Cloud, a cluster of numerous points, can express an 3D object beyond the 2D plane. Each point basically has 3D position and color data, and can have additional reflectivity, etc. Video-based Point Cloud Compression (V-PCC) technology in development based on the established video codec provides high compression efficiency for a point cloud. Despite its high effective compression technology, point cloud service will be limited by receiver performance and network conditions. In order to overcome this limitation, this paper proposes a point cloud scalability of using 2D scalable video codec such as SHVC.

RS4   Regular Session: Intelligent Signal and Image Processing 3

Friday, 18th December 2020, 13:00 – 15:00

Chair: Yosuke Sugiura (Saitama University, Japan)

RS4-1   **Data Augmentation for Cow Behavior Estimation Systems Based on Neural Network Technology**   *(pp. 95-100)*

Chao Li	Tokyo Institute of Technology
Korkut Kaan Tokgoz	Tokyo Institute of Technology
Jim Bartels	Tokyo Institute of Technology
Takumi Ohashi	Tokyo Institute of Technology
Hiroyuki Ito	Tokyo Institute of Technology
Ayuka Okumura	Shinshu University
Ken-ichi Takeda	Shinshu University
Kazuhiro Toda	Information Services International-Dentsu, Ltd
Hiroaki Matsushima	Information Services International-Dentsu, Ltd

Real-time monitoring of cow behaviors is critical for understanding the current state of cow welfare and developing an effective planning strategy for pasture management, such as early detection of disease and estrus. One of the most powerful and cost-effective methods is a neural-network-based monitoring system that analyzes time series data from inertial sensors attached to cows. For this method, a significant challenge is to improve the quality and quantity of teaching data in the development of neural network models, which requires us to collect data that can cover various realistic conditions and assign labels to them. As a result, the cost of data collection is significantly high. This work proposes a data augmentation method to solve two major quality problems in the collection process of teaching data. One is the difficulty and randomicity of teaching data acquisition and the other is the sensor position changes during actual operation. The proposed method can computationally emulate different rotating states of the collar-type sensor device from the measured acceleration data. Furthermore, it generates data for actions that occur less frequently. The verification results showed significantly higher estimation performance with an average accuracy of over 98% for five main behaviors (feeding, walking, drinking, rumination, and resting) based on learning with long short-term memory (LSTM) network. Compared with the estimation performance without data augmentation, which was insufficient with a minimum of 60.48%, the recognition rate was improved by 2.52–37.05%.

RS4-2   **Object Recognition Using Tactile Information in Service Robots**   *(pp. 101-104)*

Daiju Kanaoka	Kyushu Institute of Technology
Hakaru Tamukoh	Kyushu Institute of Technology
Yutaro Ishida	TOYOTA Motor Corporation Frontier Research Center

Most object recognition in service robots are based on image information; however, objects with similar appearance can possibly be misrecognized. Therefore, object recognition with other information in addition to the image information is required. This study investigates the effectiveness of object recognition using tactile information. We perform an experiment using the TOYOTA-Human Support Robot to obtain the tactile information of objects and classify them by random forest. The experimental results show that the object recognition accuracy with tactile information is 92.8%, which enables us to classify objects that have been difficult to classify with image formation only.

RS4-3   A Prototyping of Textual Sentiment Classification Preventing Profanity *(pp. 105-108)* Exposure based on Machine Learning

Chung-Pyo Hong	LG Electronics
Yeon-Seung Yu	Namseoul University
Cheong Ghil Kim	Namseoul University

Nowadays numerous user opinions generated via social media are available online. Such user opinions often contain likes and dislikes for specific products or goods. Based on this situation, various studies are being conducted on techniques to analyze emotional elements of online writing and provide them according to user needs. However, depending on the characteristics of social media based on anonymity, there are cases where profanity that should not be exposed to users is included. As a result, the utilization of information useful to the user may be reduced, and further, exposure to inappropriate language may occur. In order to overcome this, this study proposes an efficient method of providing information by preventing profanity exposure when a user searches for text based on emotions online. To this end, we proposed an efficient Text Web Crawling method. And also, we introduce Machine Learning-based positive and negative judgment model for textual sentiment classification which can eliminate profanity expression. As a result, it was confirmed that the overall accuracy of the model for classifying positive and negative excluding profanity was 1.9%. And also, in particular, it shows 4% of accuracy improvement in classifying profanity.

RS4-4   Footstep Analysis Through the Footstep Waveform Dataset and the *(pp. 109-114)* Spectrogram Dataset Using CNN

Yoshiki Goto	Chubu University
Akitoshi Itai	Chubu University

We can identify a pedestrian from walking footsteps in a limited situation. This fact means the footstep includes personal characteristics. If the correct personal identification using footstep is possible, various novel surveillance systems like a crime prevention system, or a biometric system are realized. To improve the recognition performance of identification, the footstep analysis using a time frequency analysis and CNN (convolution neural network) is proposed. However, the traditional CNN of AlexNet is used to find characteristics of footsteps. In this paper, we identify the CNN architecture which yields the highest accuracy. The spectrogram and waveform dataset is adopted as the training and test data of CNN. We analyze the footstep characteristics using the Grad-CAM to the trained CNN.

RS4-5   Face Recognition Systemon Arduin and Neuromorphic Chips *(pp. 115-120)*

YeoWool Lee	Korea Electronics Technology Institute
YoungChan Kim	Korea Electronics Technology Institute
InPyo Cho	Korea Electronics Technology Institute
SangYub Lee	Korea Electronics Technology Institute

Face recognition has a large number of applications in computer vision, and various areas that utilize face recognition are being applied to real life. In face recognition, while high precision in high performance, necessity for high precision in low power and low specification is also increasing. This paper presents a prototype of face recognition system with low power embedded system combine Arduino with neuromorphic chip. This prototype system that recognizes face orientation through learning and classification with RBF-neural network through preprocessing face images. This prototype is expected to be applicable to systems that require low-power facial recognition, such as sleep recognition, e.g.

RS4-6   Low-Power Low-Cost Embedded PCB Inspection System Using *(pp. 121-124)*
Neuromorphic Chips

YeoWool Lee	Korea Electronics Technology Institute
YoungChan Kim	Korea Electronics Technology Institute
InPyo Cho	Korea Electronics Technology Institute
SangYub Lee	Korea Electronics Technology Institute

Proposed PCB(Printed Circuit Boards) inspection system is a low-power, low-cost embedded system using SBC(Single Board Computer) and Neuromorphic chips. Neuromorphic chips provide fast pattern recognition on embedded systems based on RBF(Radial Basis Function), KNN(K-Nearest Neighbor) neural network. In this paper, improves SBC's performance by using neuromorphic chips, and reduces inspection time of proposed system. Visual inspection is an essential part of the quality control of electronic manufacturing industry in PCB assembly process. Production of the board reaches thousands a day with parts-mounting technology for automation level of electronic assembly lines to increase. Accordingly, AOI(Automatic Optical Inspection) is being introduced, but it requires investment that small and medium-sized enterprises cannot afford. Since a low-cost PCB inspection machine is required, this paper proposed low-power, low-cost embedded PCB inspection system based on SBC. As a popular SBC, Raspberry Pi was chosen as the board of proposed systems because it provides camera-interfaceable and Linux-based operating system such as Ubuntu. AOI processes by capturing images of the examined boards first, comparing then using specific algorithms, and then detecting deviations. Proposed system in this paper can detect assembly matching defects such as missing parts, misplaced positioning, and other defects. After extract features using OpenCV(Open Source Computer Vision Library), process was parallelized to reduce processing time using a neuromorphic chip in calculating deviation of images. It also compares matching method of OpenCV with matching method using a neuromorphic chip.

RS5   Regular Session: Intelligent Speech Processing

Friday, 18th December 2020, 15:20 – 17:00

Chair: Tetsuya Shimamura (Saitama University, Japan)

RS5-1   Real-Time Target Source Extraction Using Spectral Phase Difference and Its *(pp. 125-128)*
Variance

Eiji Saito	Kyoto Sangyo University
Arata Kawamura	Kyoto Sangyo University

A hearable device is a kind of wearable device that assists or improves the user's hearing. In this paper, we propose a method to extract only the nearest and front source of hearable device user under the environment with multiple sources. The conventional method has reported that direction and distance of source is estimated using the spectral phase difference and its variance. In the proposed method, we reduce the computational cost in the conventional method and extract the nearest and front source in real time. From the experimental results, we confirmed that the proposed method extracts the nearest and front source in real time.

RS5-2   Sound Wave Propagation of Parametric Array Loudspeaker with Multiple *(pp. 129-132)*
Carrier Frequency

Kenta Imai	Kansai University
Yoshinobu Kajikawa	Kansai University

The parametric array loudspeaker (PAL) has used to form the audio spotting technology. The PAL can achieve a sharper directivity by using ultrasonic wave than conventional loudspeaker. However, it is difficult to make personal audio because the reproduced audible sound can be caught in all on-axis area in front of PAL. It was therefore considered how to make the audio spot in a very small area to use the PAL with multiple carrier frequencies. In this kind of PAL, the

arrangement of ultrasound emitters is very important because the size of the length-limited sound beam depends the arrangement. In this paper, we consider the best arrangement of ultrasound emitters regarding the PAL with multiple carrier frequencies.

**RS5-3   Possibilities of Visual Communications Using Additive and Subtractive   *(pp. 133-137)*
Spectrogram Arts**

Naofumi Aoki	Hokkaido University
Saki Anazawa	Hokkaido University
Kosei Ozeki	Hokkaido University
Yoshinori Dobashi	Hokkaido University
Kenichi Ikeda	Smart Solution Technology, Inc.
Hiroshi Yasuda	Smart Solution Technology, Inc.

This study investigates the possibility of visual communications using spectrogram arts through sound media. This approach increases the readability of the communications that is directly understandable by human users without any advanced decoders. In this paper, we focus on the possibility of additive and subtractive methods to generate spectrogram arts for exchanging text messages. The experimental results of a pilot study indicate that these techniques may have certain appropriateness for enabling the visual communications.

**RS5-4   Metric Learning-based Multilevel Parameter Adaptation for Converted and   *(pp. 138-143)*
Synthesized Speech Spoofing Detection**

Gyujin Kim	Sogang University
Soonshin Seo	Sogang University
Donghyun Lee	Sogang University
Hosung Park	Sogang University
Changmin Kim	Sogang University
Hyunsoo Son	Sogang University
Ji-Hwan Kim	Sogang University

In this study, we propose metric learning-based multilevel parameter adaptation methods for the detection of converted and synthesized audio spoofing. The proposed methods consist of one pre-training and two fine-tuning steps. First, ResNet-based baseline Siamese networks are used to set initial parameters using binary classification. Next, Siamese networks are used to modify the parameters using deep metric learning. Finally, compressed Siamese networks are used to re-modify these parameters via deep metric learning. In addition, we used randomly selected online samples to generate pair-wise sets for each batch, including the process and data of ASVspoofing 2019 logical access. The experimental results exhibited equal error rate and tandem decision cost function of 7.95688% and 0.23259, respectively. These results show that the network of the proposed method enhanced performance compared to the baseline residual networks.

SS1   Special Session: Intelligent Media Service

Thursday, 17th December 2020, 13:30 – 15:10

Organizer & Chair: Woo Chan Park (Sejong University, Korea

SS1-1   Design of a New Caching Layer for Unified Memory-Storage System   *(pp. 144-149)*

Su-Kyung Yoon   Jeonbuk National University

DRAM technology is one of the most fundamental components in the computer architecture for recent decades. However, DRAM has been facing the scaling problem that cannot meet the demanded large capacity, energy efficiency, and cost. In order to overcome limitation of DRAM, the next-generation non-volatile memories have attracted considerable attention recently. The next-generation non-volatile memories can overcome DRAM's shortcomings; besides, they can be used as both working memory and persistent storage at the same time. In this paper, we proposed caching layer system for unified memory–storage systems using next-generation nonvolatile memory (specifically PCM) as both working memory and persistent storage. Although PCM can compensate DRAM's shortcomings, PCM still suffers from some unfavorable features such as higher write access latency, asymmetric read/write access latencies. Thus, by exploiting the proposed caching layer, the unified memory–storage systems can eliminate PCM's unfavorable features and enhance the overall system performance. In order to evaluate proposed system, we implemented a trace-driven simulator system and launched the OpenStack Swift and Redis. Our experimental results show that on average, the proposed system is better access latency than conventional system by 11.6%.

SS1-2   Research and Analysis on User Empathy Factors in Digital Media   *(pp. 150-153)*

Seungmin Lee   Namseoul University

Sungwon Hwang   Hongik University

The purpose of this study is to develop empathic measures that fully reflect the convergent media characteristics by deriving users' empathic factors in digital media. It is expected that the research results will contribute to setting the direction of digital content and establishing a research foundation in the content field.

SS1-3   Effective algorithm to control depth level for performance improvement of sound tracing   *(pp. 154-156)*

Eunjae Kim   Sejong University

Juwon Yun   Sejong University

Woonam Chung   Sejong University

Woo-Chan Park   Sejong University

Youngsik Kim   Korea Polytechnic University

Cheong Ghil Kim   Namseoul University

In this paper, we use sound tracing, a 3D sound rendering technology based on ray tracing that uses a geometric method as an auditory technology to enhance the sense of reality. Sound tracing is expensive to calculate in the sound propagation stage. In order to reduce the cost of sound propagation, the proposed algorithm is a method of finding a valid frame using the characteristics of sound propagation according to space and location, and adjusting the depth based on this frame. As a result of the experiment, when the sound source and the listener were indoors, the reflection path loss rate was 3%, the diffraction path loss rate was 15.4%, and the total frame rate increased by 6.25%. When the listener is outdoors and the sound source is indoors, the reflection path and diffraction path loss rate is 0%, and the total frame rate is increased by 33.33% compared to conventional. Through this, we have confirmed that the rendering performance can be improved while minimizing the path loss rate.

SS1-4   Counter-Attack against ECU Hacking in CAN Bus   *(pp. 157-160)*

Taewook Kang   Soongsil University

Seongsoo Lee   Soongsil University

This paper proposes a novel counter-attach method against ECU hacking in CAN bus. It automatically sets unique node ID to each node when ECU nodes on CAN bus are booted up. This node ID is included in all CAN data frames, so

sender ECU node is identified in data transmission. IDS detects the hacked node by detecting suspicious data contents or the previously known node ID of hacked ECU node. After the hacked ECU node is detected, IDS sends error frame to destroy malicious data frame, so the hacked ECU cannot transmit data frame anymore. If the hacked node continues to transmit data frame, it is permanently expelled from CAN bus. The proposed method can easily prevent both attack types by simple hardware modification of CAN bus controller. The proposed method was implemented in Verilog HDL and verified in FPGA board.

SS1-5   Mileage-based asymmetric multi-core scheduling   *(pp. 161-163)*

Se Won Lee	Pukyong National University
Byoung-Hoon Lee	Pukyong National University
Sung-Hwa Lim	Sung-Hwa Lim

In this paper, we proposed a multi-core processor scheduling principle which is based on the mileage of each core. We considered a big-LITTLE octa-core processor structure,which consists of four LITTLE cores and four big cores. If a task needs to be processed, the processor decides a core type (big or LITTLE) to handle the task, and then investigate the core with the shortest mileage among unoccupied cores. Then assigns the task to the core. We developed a mileage-based balancing algorithm for asymmetric multi-core assignment and showed that the proposed scheduling principle is more cost-effective compared to the traditional scheme from a management perspective. By conducting simulations, we evaluated the performance of our proposed algorithm.

SS2   Special Session: Smart Media Protection

Friday, 18th December 2020, 15:20 – 17:00

Organizer & Chair: Young Mo Kim (Soongsil University, Korea)

SS2-1   A Smart Contract Method for Trusted Digital Document Recordkeeping   *(pp. 164-166)*

Jungeun Jee	Sungkyunkwan University
Uijin Jang	Soongsil University

Digital record documents, which are record information in electronic format, must be managed and preserved as a value as evidence. However, it is difficult to secure reliability in the process of managing digital record documents under central control. In order to secure the reliability of public records, domestic and overseas record management institutions are conducting research to apply blockchain technology to records management. In this paper, we propose a smart contract method based on a consortium blockchain to prevent changes and omissions of information during the life cycle of digital archived documents. The proposed smart contract method creates and stores all information in blocks during the life cycle of a digital record document, so it can reliably manage a digital record document.

SS2-2   Hyperledger Fabric-based reliable personal health information sharing   *(pp. 167-171)*
model

Jinsook Bong	Soongsil University
Uijin Jang	Soongsil University

In order to provide individual-centered and optimized medical services, an open eco system is needed to safely record, manage, share, and view personal health information. However, the data linkage is not well established because the current medical data is being collected and stored by various management entities, and the individual, the subject of medical data, does not have authority over the data. Also, since medical data is electronically recorded and managed, it is vulnerable to forgery and alteration like other electronic documents. This paper proposed a platform for sharing personal health information applying the Hyperledger fabric blockchain technique. The proposed platform enables the creation,

management, and sharing of reliable medical data by designing user-centered personal health information management and access rights based on blockchain.

SS2-3   An Image Frame Extraction Method Using Time Series of RGB Data for Recognizing Immersive Media   *(pp. 172-174)*

Injae Yoo	Beyound Tech Inc.
Jaechung Lee	Beyound Tech Inc.
Byeongchan Park	Soongsil University
Youngmo Kim	Soongsil University
Seok-Yoon Kim	Soongsil University

Immersive media has a problem in that their video size is larger than those of the existing video, and the speed of recognizing the immersive video is slow when using the conventional technique by various rendering methods. For fast video recognition, in this paper, we propose a frame-per-second extraction method according to a time series of RGB data through three preprocessing processes and a preference per pixel derivation method. The method proposed in this paper has the merit of both improving the speed and accuracy of comparison search because the amount of feature information is reduced compared to the existing method.

SS2-4   A Robust Immersive Media Recognition Method Against Various Transformation Attacks   *(pp. 175-178)*

Injae Yoo	Beyound Tech Inc.
Jaechung Lee	Beyound Tech Inc.
Byeongchan Park	Soongsil University
Youngmo Kim	Soongsil University
Seok-Yoon Kim	Soongsil University

Media such as broadcast programs and movies are distributed illegally around the world through the internet environment, causing significant national losses. As the immersive media, which is one of the core technologies in the 4th industry revolution era, is being distributed, in particular, copyright infringement occurs frequently. In this paper, we propose a robust immersive media recognition method against various transformation attacks which also has better recognition rate than the existing method by correcting the distortion. The proposed method has been confirmed to be robust against various transformations.

SS2-5   A Design of Theme, Background and Signal Music Distribution Platform Based on Blockchain   *(pp. 179-181)*

Seyoung Jang	Soongsil University
Byeongchan Park	Soongsil University
Youngmo Kim	Soongsil University
Seok-Yoon Kim	Soongsil University

The current settlement and distribution used in theme, background, and signal music market other than conventional music is being carried out with either the comprehensive settlement method or the measured meter-rate settlement method in the payment process of collecting user fees and compensation depending on the use-permission types. In this settlement and distribution process, however, the reliability issues are often being raised because of the difficulty of tracking rights due to changes in music source rights management information, etc. and the opaque settlement and distribution method itself. This paper proposes a new settlement and distribution model using a block chain for the reliable collection and distribution of copyright fees among music consumers, copyright-related organizations and copyright holders, based the

weekly monitoring information of the theme, background and signal music usage. This model also provides the transparency in settlement and distribution process among stakeholders through smart contract management system.

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