

Program

Time	Eiffel Hall	Lyon A	Lyon B	Lyon D	Lyon E	Poster Area
Monday, September 28						
09:00-10:30	A1: Machine Learning Techniques for Consumer Electronics Applications I	A2: Future Network Technologies for Intelligent Communication Networks	A3: Wearable Technology on the Health and Medical Electronics	A4: Advanced Computing Systems and Applications I	A5: Computer Networks, Sensor Technologies and Big Data Computing I	
10:30-10:50	Coffee Break					
10:50-12:20	B1: Machine Learning Techniques for Consumer Electronics Applications II	B2: Deep Learning-based Multimedia Processing I	B3: QoS/QoE-Related Technologies for Future Communication Systems I	B4: Advanced Computing Systems and Applications II	B5: Computer Networks, Sensor Technologies and Big Data Computing II	Poster A
12:20-13:00	Lunch					
13:00-14:00		C2: Deep Learning-based Multimedia Processing II	C3: QoS/QoE-Related Technologies for Future Communication Systems II	C4: Advanced Computing Systems and Applications III	C5: Computer Networks, Sensor Technologies and Big Data Computing III	
14:00-14:10	Opening Ceremony					
14:10-15:10	Keynote: Jenq-Neng Hwang					
15:10-15:30	Coffee Break					
15:30-17:00	D1: Circuits and Systems for Intelligent Living Technology	D2: Advanced Image Processing and its Applications I	D3: Artificial Intelligence Applications and Technologies in Internet of Things I	D4: Key Entertainment and Information Systems & Consumer Electronics for Health-care & Wellness	D5: Advanced Circuits and Signal Processing Systems	Poster B
17:00-18:30	E1: The Trend of Artificial Intelligence of Things Technology	E2: Advanced Image Processing and its Applications II	E3: Artificial Intelligence Applications and Technologies in Internet of Things II	E4: Smart Integrated Power Driver for Consumer Electronics	E5: Circuits and Systems for Deep-Learning Based Image Processing	
19:00-21:00	Welcome Reception (Versailles Hall)					
Tuesday, September 29						
09:00-10:30	F1: Deep Learning-based Multimedia Signal Analysis and Restoration	F2: Information and Communication Technologies for Consumer Electronics	F3: Intelligent Devices, Circuits, Systems, and Algorithms for Smart Lives	F4: Non-invasive Biomedical Technology and Digital Health Care	F5: Intelligent Circuits and Systems I	
10:30-10:50	Coffee Break					
10:50-11:50	Keynote: Kohei Shiimoto					
11:50-13:00	Lunch					
13:00-14:30	G1: Consumer Electronics and Services for AIoT Technology and Applications	G2: AR/VR Technologies for Beyond 5G	G3: Consumer Electronic IC's Industrial Case Studies, Reviews and Analyses	G4: Best Paper Competition	G5: Intelligent Circuits and Systems II	Demo
14:30-18:30	Tour					
18:30-19:00	Invited: Tihao Chiang (Avignone Hall)					
19:00-21:00	Banquet (Avignone Hall)					
Wednesday, September 30						

09:00-10:30	H1: Intelligent Medical Devices & Partner for the Blind	H2: Enabling Technologies and Others	H3: Intelligent Algorithms, Architectures, and Circuits for Emerging IC Design Techniques	H4: Intelligent Multimedia Computing	H5: Intelligent Multimedia Signal Processing and Applications	
10:30-10:50	Coffee Break					
10:50-11:50	Keynote: Yoshikazu Miyanaga					
11:50-13:00	Lunch					
13:00-14:30	I1: Computer Communications and Signal Processing for Next Generation Media I	I2: Intelligent Video Analytics and Multimedia Systems	I3: Smart Sensing Technologies & Applications for Human Health Promotion	I4: Basic Technologies for Consumer Electronics & Enabling Technologies and Others	I5: Communication and Human-Centered Information Systems for Internet Applications I	
14:30-14:50	Coffee Break					
14:50-16:20	J1: Computer Communications and Signal Processing for Next Generation Media II	J2: Advanced Image Processing (AIP)	J3: Design, Management, and Control Technologies for Future Network Systems	J4: Internet of Energy for Advanced Electric Power Consuming	J5: Communication and Human-Centered Information Systems for Internet Applications II	

Monday, September 28

Monday, September 28 9:00 - 10:30

A1: Machine Learning Techniques for Consumer Electronics Applications I

Room: Eiffel Hall

Chair: Chia-Yu Lin (Yuan Ze University, Taiwan)

9:00 **A Probability-Based Analytical Model Based on Deep Learning for Traffic Information Estimation**

Zhaoshan Sun (Fujian University of Technology, China); Jeng-Shyang Pan (National Kaohsiung University of Applied Sciences, Taiwan); Chi-Hua Chen (Fuzhou University, China); Tsu-Yang Wu (Shandong University of Science and Technology, China)

This paper proposes a probability density function model based on deep learning to analyze the relationships between the number of call arrivals and vehicle speed. Furthermore, a vehicle speed estimation method based on deep learning is proposed to estimate vehicle speed in accordance with the number of call arrivals. A traffic flow estimation method is proposed to estimate traffic flow in accordance with the number of normal location updates. Finally, a traffic density estimation method is proposed to estimate the traffic density in accordance with the estimated vehicle speed and the estimated traffic flow. In experiments, the simulation results showed that the accuracies of estimated vehicle speed and estimated traffic density are 96.36% and 96.45%, respectively.

9:15 **Data Filtering Method for the Optimization of Mobile Positioning Based on Deep Learning**

Yan Wang (Fujian University of Technology, China); Jeng-Shyang Pan (National Kaohsiung University of Applied Sciences, Taiwan); Chi-Hua Chen (Fuzhou University, China); Tsu-Yang Wu (Shandong University of Science and Technology, China)

In this paper, a data filtering method is proposed to filter out the interference of mobile network signals and location errors from global positioning system in training data for the improvement of mobile positioning. Furthermore, a mobile positioning based on deep learning is proposed to analyze the received signal strength indications (RSSIs) from cellular networks and WiFi networks for determining the location of mobile station. In practical experimental environments, a case study of Fujian University of Technology is selected to evaluate the proposed methods. This study collected 3655 records which include 77 different base stations, and 1947 different Wi-Fi access points. The experimental results showed that the average location errors of the proposed method was 4.32m.

9:30 **The Research on Scent and Fragrance in Memory with Machine Learning**

Wei-Yu Chen (Chinese Culture University & Tatung University, Taiwan); Hsin Yu Tsai, Wei Chun Yuan, Chu Ching Huang, Tzu Min Lo and Ting Fang Cheng (Chinese Culture University, Taiwan)

The latest research from Rockefeller University in the United States in 2014 found that humans can smell one trillion fragrances, and smell is one of the best ways to wake up memory. HERMES's exclusive perfumer, Elena, mentioned in his book "Perfume Master's Diary" that in life, smell is everywhere. Fruit vendors in the market, food from exotic restaurants, and so on, may all evoke the waves of imagination and become inspiration for making fragrance. As for the method of remembering scent, Elena used drawing to visually assist olfactory association in the diary to help herself remember the scent. In this research, we applied the GPT-2 algorithm in natural language learning in deep learning to allow computers to learn the method of perfumery by crawling the Internet. Let the computer learn how to scent and produce a formula. Although the computer does not have a sense of smell, it can still summarize and infer through various documents to produce the fragrance in memory for subsequent related research.

9:45 **Prediction of Time Series Data Based on Transformer with Soft Dynamic Time Wrapping**

Kuo-Hao Ho, Pei-Shu Huang, I-Chen Wu and Feng-Jian Wang (National Chiao Tung University, Taiwan)

It is a challenge to predict the long-term future data from time series data. This paper proposes to use a Transformer with soft dynamic time wrapping for early stopping criteria, called a soft-DTW Transformer. Our experiment in an open-source dataset HouseTwenty shows that the average prediction error rate with soft-DTW Transformer is 27.79%, greatly reduced from 45.70% for using SVR, a common time series method.

A2: Future Network Technologies for Intelligent Communication Networks

Room: Lyon A

Chairs: Takuji Tachibana (University of Fukui, Japan), Shih-Hsuan Yang (National Taipei University of Technology, Taiwan)

9:00 **Quality Control for Hybrid Unicast and Multicast Video Transmission Systems**

Shih-Hsuan Yang (National Taipei University of Technology, Taiwan)

The video streaming platforms have recently evolved to provide diversified services, including live video, video on demand, and TV shows premiere. The traditional unicast method may cause a waste of bandwidth when many users watch the same video contents at the same

time. In this study, we realized a hybrid unicast and multicast adaptive streaming system. The system uses ROUTE (Real-time Object delivery over Unidirectional Transport) combined with the MPEG-DASH (Dynamic Adaptive Streaming over HTTP) to simultaneously satisfy the needs of unicast and multicast users. We use the SHVC (Scalable High-efficiency Video Coding) to generate high-quality video of different bitrates. The QoE (Quality of Experience) function is measured by bitrate, PSNR, and server bandwidth. The proposed adaptive algorithm dynamically allocates the bitrates of unicast and multicast users and achieves optimal average viewing quality. Experimental results show that the proposed algorithm effectively improves the system's QoE under various bandwidth models compared to the conventional method. In the hybrid multicast and unicast scenario, the PSNR for the stable, incremental, and decreasing bandwidth models are increased by 0.79 dB, 4.92 dB, and 7.88 dB, respectively. The average quality switching frequency of users is also decreased.

9:15 Distributed Processing Allocation of Machine Learning in Wireless Sensor Networks

Jun Motoyama, Rina Ooka, Takumi Miyoshi and Taku Yamazaki (Shibaura Institute of Technology, Japan); Takuya Asaka (Tokyo Metropolitan University, Japan)

Distributed processing technology in wireless sensor network (WSN) has attracted attention because of the performance improvement of sensor nodes. Although the conventional methods divide and allocate computational processing of machine learning to sensor nodes, appropriate allocation has not been realized from the viewpoint of the whole network. In this paper, assuming that multiple machine learning processes occur simultaneously, we propose a processing division and allocation method to equalize processing load on sensor nodes. The evaluation results show that the method can almost fairly distribute the load to sensor nodes.

9:30 Multipath Routing Method for Large File Transfer with Time Constraint

Rintaro Sozu and Kazuhiko Kinoshita (Tokushima University, Japan)

In recent years, time-constrained file transfer model receives much attention. It promises to complete the requested transfer by its deadline or rejects. On the other hand, multipath routing using two or more routes at the same time is effective for load balancing and throughput improvement. In this paper, we propose to apply multi-path routing technique to the file transfer with time constraint. Finally, the effectiveness of the proposed method was confirmed by simulation experiments.

9:45 Implementation of Dynamic Task Assignment for Smartphone Application with MEC and Cloud Servers

Kazuki Sawada and Takuji Tachibana (University of Fukui, Japan)

In the fifth generation (5G) mobile network, it is necessary to realize ultra-low latency communication. Currently, multi-access edge computing (MEC) is attracted attention as a technology for realizing the ultra-low latency communication by using MEC servers that are placed near users. In this paper, we implement a dynamic task assignment for multi-user information sharing in smartphone application that use MEC and cloud servers. In our implementation, the MEC servers dynamically decide whether each task is processed in the MEC servers or the cloud servers. We evaluate the performance of our dynamic task assignment in our experimental system. From experimental results, we show that our task assignment can decrease a response time of each task according to the processing capability of MEC servers.

10:00 Optimal VNF Placement and Route Selection with Model Predictive Control for Multiple Service Chains

Masaya Kumazaki and Takuji Tachibana (University of Fukui, Japan)

Network function virtualization (NFV) provides several types of network functions by implementing virtual network function (VNF) on a server. In a service chain that utilizes some VNFs, the number of VNF instances and route selection have to be managed for the service chain dynamically according to the amount of traffic. In this paper, we propose an optimal VNF placement and route selection with model predictive control (MPC) for multiple service chains. The proposed method utilizes the predicted amount of injected traffic for each service chain to decide the optimal number of VNF instances. In addition, this method decides the optimal route for each service chain. These processes are performed by using MPC appropriately. We evaluate the performance of the proposed method with simulation and investigate the effectiveness of the proposed method.

A3: Wearable Technology on the Health and Medical Electronics

Room: Lyon B

Chair: Jian-Chiun Liou (Taipei Medical University, Taiwan)

9:00 Designed High-Frequency Operation Piezo Elements for Cardiac Catheter Ablation Systems

Jian-Chiun Liou and Zhen-Xi Chen (Taipei Medical University, Taiwan)

The piezoelectric element resonance is used to generate energy for cardiac catheter ablation systems. The design of piezoelectric vibrators is closely related to the two major directions of material selection and geometry. In terms of standard AC to DC output power, its size is closely related to the external source form, the electromechanical properties of the vibrator (mass, damping, stiffness, force-electricity coupling, parasitic capacitance) and the external load connected to it.

9:15 Biological Living Body Pulse Light Driven Near Infrared Image Recognition

Jian-Chiun Liou and Zhen-Xi Chen (Taipei Medical University, Taiwan)

Bio-living pulsed light-driven near-infrared image recognition system can assist medical personnel to quickly and accurately find and locate veins during venipuncture, especially for patients with difficulty in locating blood vessels such as young children, obesity, edema,

and hairy, which can help in order to improve the success rate of venipuncture, reduce patient suffering, and improve the doctor-patient relationship.

9:30 Difference Frequency (Photoplethysmography) Light Source Blood Vessel Pulse Physiological Information Sensing System

Jian-Chiun Liou and Zhen-Xi Chen (Taipei Medical University, Taiwan)

The heart rate sensing module LED estimates relatively accurate heartbeat data for hundreds of flashes per second. In most cases, PPG technology uses infrared for sensing. When the data obtained by infrared sensing fails to meet the requirements, it automatically switches to acquiring heart rhythm data using the PPG scheme by increasing the pulse driving frequency.

9:45 Transmit Energy Verification of Linear Amplifiers for Medical Doppler Ultrasound Scanners

Deng-Fong Lu, Kun-Chu Lee and Chin Hsia (National Central University, Taiwan)

This article explores the transmit energy of a linear amplifier used in medical Doppler driver systems. In order to verify the mechanical pulse strength of the ultrasonic wave generated by the ultrasonic probe excited by the linear amplifier, the actual weight of the transmitted wave has been measured using an electronic balance, and the relationship between the weight and the amplitude of the transmitted signal. In addition, the acoustic pressure fields was measured using a calibrated hydrophone. The intensities of energy density were calculated and the quality of underwater signals has been verified.

10:00 Quick Placement and Precise Positioning DNA Liquid Jet Technology

Jian-Chiun Liou and Zhen-Xi Chen (Taipei Medical University, Taiwan)

The main working methods of liquid inkjet printers are divided into thermal foam type and ceramic piezoelectric type. The technology of warming liquid jet to maintain stable viscosity and surface tension has also been applied to DNA liquid jet. This study is described Quick Placement and Precise Positioning DNA Liquid Jet Technology. Observed the spray DNA under the microscope and the clear image of the DNA droplets.

10:15 Real Time On Sensor Gait Phase Detection with 0.5KB Deep Learning Model

Yian Chen, Jien-De Sui and Tian-Sheuan Chang (National Chiao Tung University, Taiwan)

Gait phase detection with convolution neural network provides accurate classification but demands high computational cost, which inhibits real time low power on-sensor processing. This paper presents a segmentation based gait phase detection with a width and depth downsampled U-Net like model that only needs 0.5KB model size and 67K operations per second with 95.9% accuracy to be easily fitted into resource limited on sensor microcontroller.

A4: Advanced Computing Systems and Applications I

Room: Lyon D

Chair: Masaru Fukushi (Yamaguchi University, Japan)

9:00 Interleaved Non-Binary LDPC Code for Synchronization Error Correction in DNA Storage

Haruhiko Kaneko (Tokyo Institute of Technology, Japan)

DNA storage devices are generally prone to synchronization errors, and hence these devices will require strong synchronization error correction coding to improve the reliability. This paper presents a insertion/deletion/substitution (IDS) error correction coding based on interleaving of non-binary LDPC codes. We employ an iterative decoding using a belief propagation on drift factor graph and a non-binary sum-product algorithm. This decoding successively recovers synchronization from both ends to center in a received word. Simulation results show that the presented coding of block size $\{4096 \times 100\}$ with rate- $\{3/4\}$ gives decoded block error rate $\{2.0 \times 10^{-3}\}$ for IDS channel of insertion/deletion error probability $\{2.1 \times 10^{-2}\}$ and substitution error probability $\{1.0 \times 10^{-2}\}$.

9:15 Influence of Recognition Performance on Recurrent Neural Network Using Phase-Change Memory as Synapses

Tomohiro Takahashi and Kazuteru Namba (Chiba University, Japan)

This paper simulates the influence of recognition performance of using a phase-change memory as weight of a recurrent neural network. In the first experiment, a neural network did not learn well due to nan error caused by write error in phase-change memory. In the second and later experiments, there was no correlation between the write error rate and the validation loss. However, when the learning results were output, higher write error rate caused the less successful the learning.

9:30 Goal Recognition Using Deep Learning in a Planetary Exploration Rover Developed for a Contest

Miho Akiyama and Takuya Saito (Shonan Institute of Technology, Japan)

We participated in the "A Rocket Launch for International Student Satellites (ARLISS)" competition in which original design planetary exploration rovers competed to reach close to the target using autonomous control. In this competition, the rovers of various teams approached the target position using the global positioning system (GPS). However, they could only approach to within a few meters of the target due to the GPS positioning error. Our rover recognized the red traffic cone, placed at the goal point, by its color and in

the Tanegashima Rocket Contest 2018, the rover was controlled to the point where the distance to the goal was 0 m. However, image recognition of goal objects by their colors suffers from the problem of unstable recognition due to changes in ambient lighting, which occurs due to, for example, weather changes. We therefore attempted to resolve this problem by employing deep learning. However, a considerable amount of calculation time is taken by a general deep learning model to run on a small planetary exploration rover computer and thus cannot be applied as it is. Therefore, we proposed a deep learning model with a short calculation time and high recognition accuracy. Using the proposed method, a recognition rate of over 99 % could be achieved in a few seconds. Furthermore, we won the contest by demonstrating the effectiveness of the rover using the proposed method and thus proved the effectiveness of this method.

9:45 Influence of Radio Waves Generated by XBee Module on GPS Positioning Performance

Miho Akiyama and Takuya Saito (Shonan Institute of Technology, Japan)

In the past, we had positioning problems on a rover equipped with an XBee module. Therefore, we investigated what caused these GPS positioning errors. As a result, we found that the XBee module of our rover affects GPS performance. Furthermore, we found that the precision of the floating-point calculation is not enough for Arduino Uno.

10:00 Inter-Frame Differencing in Training Data for Artificial Intelligence

Yuan EnZe and Yasuyuki Miura (Shonan Institute of Technology, Japan)

We investigate the frame subtraction method in the research of the security surveillance system for old people by artificial intelligence using deep neural networks. The results in low-illumination images become smaller when the conventional inter-frame differencing method is applied. Therefore, we propose an optimal method of inter-frame differencing in various illuminance environments. The accuracy of inter-frame differencing improves when the proposed method using contour processing is applied.

10:15 Training Data Generation for AI Based on Parametric Eigenspace Method

Hiroyuki Toyokura and Yasuyuki Miura (Shonan Institute of Technology, Japan)

In this paper, we propose a method for automatic labeling of captured video images by using parametric eigenspace method for AI learning data. The experimental results showed that about 70% of the categorized data was labeled correctly. We also tried to improve the accuracy of labeling by extracting the moving object regions. The experimental results showed slight improvement in the accuracy of labeling.

A5: Computer Networks, Sensor Technologies and Big Data Computing I

Room: Lyon E

Chair: Tin-Yu Wu (National Ilan University, Taiwan)

9:00 Crowdsensing based Real-time Traffic Condition Assessment Method

Hongchi Wu, Yingzhen Yu and Sina Qian (BJTU, China); Dan Tao (Beijing Jiaotong University, China)

In this paper, we study a real-time traffic condition assessment method on the basis of taxi GPS data of Dongguan city by a new sensing form-crowdsensing. First, data preprocessing is used to clean invalid and noisy data. Second, we propose a road network extraction solution by mixing grid method and least square curve fitting. Third, we present a geometric matching based map matching solution. Finally, a velocity parameter estimation scheme based on self-adaptive traffic flow velocity is employed to assess traffic condition. A series of simulation experiments are carried out to verify the effectiveness of our proposed solutions.

9:15 Entropy based Security Rating Evaluation Scheme for Pattern Lock

Xianzhe Dong, Xinyi He, Tianlin Liang and Dai Shi (BJTU, China); Dan Tao (Beijing Jiaotong University, China)

To better protect users' privacy, various authentication mechanisms have been applied on smartphones. Android pattern lock has been widely used because it is easy to memory, however, simple ones are more vulnerable to attacks such as shoulder surfing attack. In this paper, we propose a security rating evaluation scheme based pattern lock. In particular, an entropy function of a pattern lock can be calculated, which is decided by five kinds of attributes: size, length, angle, overlap and intersection for quantitative evaluation of pattern lock. And thus, the security rating thresholds will be determined according the distribution of entropy values. Finally, we design and develop an APP based on Android Studio, which is used to verify the effectiveness of our proposed security rating evaluation scheme.

9:30 Fine-Grained PM2.5 Detection Method based on Crowdsensing

Pengqi Hao, Min Yang, Shibo Gao and Kunning Sun (BJTU, China); Dan Tao (Beijing Jiaotong University, China)

In this paper, we propose a fine-grained PM2.5 detection method based on crowdsensing technology. Firstly, we perform dark channel processing on sky images which have been collected by mobile users through APP. Secondly, we adopt a train model based on Tensorflow and Keras architecture, and utilize neural network to implement PM2.5 feature extraction and detection. Finally, a series of experiments have been carried out based on a large-scale real dataset to verify the performance of our proposed detection method.

9:45 Research on Disease Identification in Chinese Domain Based on Word Embedding Technology

Chunling Chen and Yunpeng Gao (Nanjing University of Posts and Telecommunications, China); Ming Ye (China Mobile Communications Group Jiangsu Co., Ltd. Nangjing Branch, China); Yongan Guo (Nanjing University of Posts and

Telecommunications, China)

Machine learning technology has been widely used in the field of auxiliary diagnosis. However, existing models ignore the association between words. Therefore, performance improvement is limited when the scale of data is expended. To solve this problem, we use the cw2vec model to process the Chinese medical record text, combine it with the fusion model of Bidirectional Long Short-Term Memory and conditional random field, and propose a new model. This model makes full use of the word embedding technology and improves the existing neural network by combining the semantic connotation of Chinese. The experimental results show that the improved model has higher disease identification rate than the existing models under the same data scale.

10:00 Research on NDN -based Vehicle Network Cache Strategy

Chunling Chen, Haoyang Xi and Yongan Guo (Nanjing University of Posts and Telecommunications, China)

With the rapid development of Internet of Vehicles (IoV), TCP/IP-based IoV encounters problems in mobility, flexibility, and network latency. Thus, this article introduces NDN-based IoV and the related cache strategies, analyzes the challenges in developing NDN-based IoV, and compares several representative cache strategies.

Monday, September 28 10:30 - 10:50

Coffee Break

Monday, September 28 10:50 - 12:20

Poster A

Room: Poster Area

Chairs: Sun Shih-Wei (Taipei National University of the Arts, Taiwan), Jia-Ching Wang (National Central University, Taiwan)

Design of Graph Filter Using Least-Squares Method with Parameter Norm Penalty

Chien-Cheng Tseng (National Kaohsiung University of Science and Technology, Taiwan); Su-Ling Lee (Chang-Jung Christian University, Taiwan)

In this paper, the designs of graph filters using least-squares (LS) method with parameter norm penalty are studied. First, the design problem of the graph filter which can be used to process irregular sensor network data is described. Then, the conventional LS method is employed to design graph filter and its numerical stability problem in high-order filter case is presented. Next, to solve numerical stability problem, the LS method with parameter norm penalty is applied to design the graph filter. Finally, the design examples are demonstrated to show the effectiveness of the proposed design method.

On the Graph Construction of Signal De-Noising Method Using Laplacian Matrix

Chien-Cheng Tseng (National Kaohsiung University of Science and Technology, Taiwan); Su-Ling Lee (Chang-Jung Christian University, Taiwan)

In this paper, the graph construction of signal de-noising method using Laplacian matrix is investigated. First, the four-step procedure to obtain a graph signal representation is described. Then, the details of graph signal de-noising method using Laplacian matrix are presented. Next, four kinds of graph constructions with different connectivities are studied including Hamiltonian cycle, spanning tree, Delaunay triangle and complete graph. Finally, the real temperature data is used to evaluate the performance of the graph signal de-noising method and to show which graph construction is a better choice according to the value of signal to noise ratio (SNR).

Exploring the interface design of smartwatch application menu

Yong-Yu Li and Chun-Ching Chen (National Taipei University of Technology, Taiwan)

This study presents a preliminary study of investigating the interface design of smartwatch application menu and highlights issues at the hierarchical level of a classified application menu interface. After investigating the current smartwatch application menu interface and interviewing interface design experts, the results show that current application menu interface are designed variously according to different product positioning. Therefore, there is no universal and proper information architecture are applied to take care of numerous application menu interface arrangement. Future work will focus on investigating the possibility of designing interface by classifying the application menu to improve the user experience.

Design of a Branch-and-Bound Strategy for Process Scheduling in Multi-core Smartphone

Yi Hsien Lu (National Taiwan Normal University, Taiwan)

With the rise of mobile phones and the popularity of the Internet, 5G, and e-commerce, there should be more various tasks processed on smartphone, which requires a good scheduling strategy to handle running processes. Compared with a single core, one of the biggest advantages of multi-core is the efficiency of running processes. In the multi-core, each core is responsible for serving a process at each moment, hence the performance of smartphone executing programs can become much better. This paper focuses on designing a branch-and-bound strategy for process scheduling in multi-core smartphone. Since the shifts of cores must be allocated by the operating

system (like Android or iOS), the scheduler in the operating system would adopt the proposed scheme to improve efficiency of process scheduling.

Exploring the possibility of adding classification to the application menu interface of Apple Watch

Yong-Yu Li and Chun-Ching Chen (National Taipei University of Technology, Taiwan)

In this study, we aim to explore the presentation of the application menu interface for the Apple Watch in operational tasks and completion of the target experience, through market data induction and classification rendering. Subsequently, four application menu interface presentations were output, and experimental tasks were designed. A total of 26 male and female subjects participated in the experiment of using a wearable smartwatch. Subjective measurements and operational performance of the interactive satisfaction scale provided by the subjects were obtained, and a questionnaire for user interaction satisfaction (QUIS) was created. The results show that for the smartwatch application menu interface, regardless of honeycomb-type or list-type menus, adding classification to the presentation type helps users to complete tasks. Notably, the honeycomb-type menu interface achieved a more significant effect. These research results can be used by relevant business owners as a reference and in applications.

Development of physiological data monitoring system for cancer radiotherapy

Huai-Kuei Wu (Oriental Institute of Technology, Taiwan); Pei-Wei Shueng and Ming-Che Wu (Far Eastern Memorial Hospital, Taiwan); Zheng-Long Li, Min-Xiang Peng, You-Chin Ling, Tei-Wei Hung and Shui-Tian Wu (Oriental Institute of Technology, Taiwan)

The treatment of cancer has always been one of the most important fields in the medical field. Due to the safety of radiation therapy, nearly half of the cancers can be treated with radiation. Radiation therapy uses high-energy electromagnetic waves to illuminate cancer cells, so lead must be used to shield the periphery of the treatment room to improve the safety around the treatment environment. However, such shielding will result in difficulties in the transmission of physiological data. In order to solve the above problems, this paper proposes a physiological data monitoring system for the radiation treatment, includes oximeter integration, gateway development and workstation program. The physiological data of the patient during the treatment process can be displayed in the workstation of the control room, and notified when the physiological data is abnormal. In addition, the data recording function is provided as a reference. Through the system development, the safety of cancer patients undergoing radiation therapy is improved.

The Impact of AR Filter Combines Blockchain Virtual Online Pets and brings Blockchain into our lives

You-Ping Chen and Ju-Chun Ko (National Taipei University of Technology, Taiwan)

This study provides users with increased interaction with blockchain virtual pet cats through mobile devices and augmented reality, and adds more interactivity and fun. To improve users' experience and communication on blockchain applications, and reduce user's operation burden while allowing more people to access blockchain-related applications through the spread of filter sharing.

A Hybrid Scenario Generator and Its Application on Network Simulations

Yen-Chen Chen, Yan-Ting Lin and Chih-Wei Huang (National Central University, Taiwan)

Due to the growing need for virtual reality (VR) in entertainment, medical, and education, there is more and more research going to deal with the problem of next-generation wireless technologies for VR. Moreover, most of them are machine learning algorithms and confronting challenges to collect datasets from multi-user VR applications. In this paper, we propose a hybrid scenario generator based on a real game, providing interaction adjustable scenarios to support the research which wants to solve the multi-user resource allocation problem. The result shows that the scenarios are more comprehensive than a random distribution.

Interactive Medical VR Streaming Service based on Software-Defined Network: Design and Implementation

Hsiao-Kuang Wu (National Central University, Taiwan)

In recent years, with the maturity of virtual reality (VR) hardware devices, many VR software contents have gradually enriched. Existing VR services require level hardware configuration. In the near future, 5G will be able to provide high-bandwidth, low-latency wireless network services, and SDN technology will virtualized mobile network hardware functions, it will be able to create exclusive network transmission services according to different usage scenarios. 5G and SDN are considered the basis for high-quality mobile VR streaming applications. In this study, we developed a VR streaming server prototype exploring the feasibility of managing bandwidth dynamically by SDN functions.

Music Conversion from Synthetic Piano to Chinese Guzheng Using Image-based Deep Learning Technique

Ping-Hsuan Chen, Kai-Wen Liang and Pao-Chi Chang (National Central University, Taiwan)

In this paper, we propose a music conversion method using deep learning technique to improve the generation of Chinese Guzheng music. Based on human perceptual evaluation, the average score is up to 4.3 on a 5.0 full scale, which represents the similarity between the generated Guzheng music by our method and the real music. It shows that the generated Chinese Guzheng music is able to preserve the feature of the real play. Moreover, this method provides a friendly way for users who have never learned any instrument to generate any desired Guzheng music.

Deep-Learning-Based Block Similarity Evaluation for Image Forensics

Po-Chyi Su (National Central University, Taiwan)

Identifying the type of a camera used to capture an investigated image is a useful image forensic tool, which usually employs machine learning or deep learning techniques to train the source camera models. In this research, we propose a forensic scheme to detect

and even locate image manipulations based on deep-learning-based camera model identification. Because of the diversity of image tampering, it's difficult to collect a sufficient amount of tampered images for supervised learning. The proposed method avoids preparing tampered images as the training data but chooses to examine the information of original pictures only. We first train a convolutional neural network to acquire generic features for identifying camera models. Next, the similarity measurement using the Siamese network to evaluate the consistency of image block pairs is used to locate tampered areas. Finally, we refine more accurate tampered areas through a refined segmentation network. The contributions of this research include: (1) extending the study of determining image region consistency to forensics applications, (2) designing a better block comparison algorithm, and (3) improving the accuracy of tampered regions. The proposed scheme is tested by public-available tampered image datasets and our own data to verify the feasibility.

Multi-Modal Deep Learning-Based Violin Bowing Action Recognition

Bao-Yun Liu (National Central University, Taiwan); Yi-Hsin Jen (Academia Sinica, Taiwan); Sun Shih-Wei (Taipei National University of the Arts, Taiwan); Li Su (Academia Sinica, Taiwan); Pao-Chi Chang (National Central University, Taiwan)

In this paper, a deep learning-based violin action recognition is proposed. By fusing the sensing signals from depth camera modality and inertial sensor modalities, violin bowing actions can be recognized by the proposed deep learning scheme. The actions performed by a violinist are captured by a depth camera, and recorded by wearable sensors on the forearm of a violinist. In the proposed system, 3D convolution neural network (3D-CNN) and long short-term memory (LSTM) deep learning algorithms are adopted to generate the action models from depth camera modality and inertial sensor modalities. The features and models obtained from multi-modalities are used to classify different violin bowing actions. A fusion process from different modalities can achieve higher recognition accuracy. In this paper, we generate a violin bowing actions dataset for preliminary study and system performance evaluation.

Transfer Learning for Gender and Age Prediction

Nga Hong Cao (Taiwan & National Central University, Taiwan); Khai-Thinh Nguyen, Tran Nghi and Jia-Ching Wang (National Central University, Taiwan)

In this work, we propose a transfer learning pipeline for gender and age prediction using images from IMDB-WIKI dataset. Firstly, we freeze all layers in pre-trained ImageNet models. Then, the models are trained for four stages with scheduled learning rates and the blocks of layers are unlocked consecutively in accordance to the schedule. We apply multi-output neural network paradigm to predict age and gender simultaneously and the final loss function is based on the combination of age and gender losses. In our approach, the model has better performance than that of the non-pre-trained model because the later stages of our models reuse features extracted from the pre-trained early stages.

A CNN Accelerator on FPGA using Binary Weight Networks

Tsung-Han Tsai (National Central University, Taiwan)

At present, convolutional neural networks have good performance while performing the object recognition tasks, but it relies on GPUs to solve a large number of complex operations. Therefore, the hardware accelerator of the neural network has become a central topic in the hardware researchers. This letter presents the design of an FPGA-based neural network accelerator implemented on the Xilinx Zynq-7020 FPGA. We use the binary LeNet model to achieve 91% accuracy in the MNIST dataset and use binary AlexNet model to achieve 67% accuracy in the CIFAR-10 dataset. Meanwhile the hardware resource is only about 10% usage on FPGA of the original design.

A Wearable Appliance for Jogging Stride Frequency Calibration using Vibration Feedback

Pei-Shan Liu, Wei-Cheng Lin, Yi Ma and Chun-Feng Liao (National Chengchi University, Taiwan)

Recently, fitness and health promotion by doing regular jogging exercises are becoming popular. Having a stable and steady stride frequency is critical for the performance of jogging. This paper reports the progress of the design and implementation of a wearable appliance, namely the Intelligent Socks, for assisting the runner to keep steady stride frequency. The proposed appliance uses a set of pressure sensors to improve the accuracy of stride detection. Moreover, the socks provide vibration and sound feedback to help the runner to synchronize with the reference stride frequency. We have implemented an initial prototype and have conducted experiments to find the best way of providing vibration feedback.

Manipulating Perceived Temperature in Virtual Reality through Interactive Audio

Jun-Cheng Jian (National Taipei University of Technology, Taiwan); Chien-Wen Cheng (National Taipei University of Technology, Taiwan)

Sound can affect human emotions, behavior, and decisions. Furthermore, it can change human perception of direction, distance, size of physical objects, and many more. In this study, experiments were conducted to analyze the influence of Interactive Audio in a virtual reality (VR) environment on human perception of temperature. By experiments, we simulate camping scenes with some campfire in VR environments. The subjects wear VR head-mounted displays, headphones, haptic gloves covered with heating pads and an HTC VIVE mobile locator to feel the campfire temperature. The gloves warm up coupled with a computer-simulated fire sound if the subject's hand reaches the virtual fire. The subjects then categorized the fire's temperature from the experiment. Based on the experiment results, the effect of sound on human perception of temperature can be analyzed.

A Pitch Perception Training Game in VR Environment for Enhancing Music Learning Motivation

Jie-Syu Yang (National Taipei University of Technology, Taiwan); Chien-Wen Cheng (National Taipei University of Technology, Taiwan)

Pitch perception training is one of the important aspects of music learning. Long-term training is required for improving one's sense

of pitch. However, conventional standard pitch perception training is typically monotonous and is therefore prone to be unfavored by students. With advancements in multimedia technology, it is currently possible to utilize digital games in pitch perception training. In recent years, virtual reality has become a technology trend with wide application in various fields. In this paper, a pitch perception training game combining the elements of shooting game in VR environment is proposed. In the proposed game, different monsters correspondingly appear at different game levels along with a specific pitch. The player has to use a gun to select the pitch corresponding to the targeted monster using a piano-keyboard-like bullet magazine, and pull the trigger to defeat the monster. Through this game, it is expected that the player will become more motivated to participate in pitch perception training.

Investigating Consumer Behavioral Intention in smart technology context

Li-Wen Chuang and Shu-Ping Chiu (Lingnan Normal University, Taiwan); He-Wei Tian and Luo-Si Wang (Lingnan Normal University, China)

Today, a growing number of trades are improving the internet and smart technology as the main tool to promote their products and services. Increasing the skill and ability both to attract the new consumers of young and elder in smart business context is an important challenge for trade managers and has described their considerable attention from the academic groups. More recently, driven by advance developments in Information and Communications Technologies (ICTs) and Virtual-Reality, Augmented-Reality, and Mixed-Reality technologies, embodied devices, sensors, mobile terminal device, microchip design, power efficiency and more broadly the Internet of Things (IoT), the chance to remotely connect to physical and virtual objects, mobile devices and products would have given rise to the appearance of smart technologies and smart services. Therefore, these businesses directors imminently want to realize the connections with consumer motivation, trust, security risk and consumer behavioral intention requirement of consumer's using smart technologies, so as to take the crucial chance in future smart business development to find the potential consumers. The main concern of this article would be to understand the need and examine the influences of perceptions on perceived value, reputation, trust and consumer behavioral intention to use these smart technologies. Next, the questionnaire was completed by online survey data (N = 92) collected from active consumers who have participated in using smart technologies. Thus, analyzed with structural equation modeling (SEM), and confirmatory factor analysis (CFA) was also applied, using the software of SmartPLS 2.0, to verify if this empirical questionnaire data would become proper to the proposed model. Lastly, the outcomes of this study would apply the empirical research proof that perceived value, reputation and trust all could affect these consumers behavioral intention to use smart technologies. All these consequences of this article with implications for theory and practice would be further cared enough to keep in mind, too.

Development of herbal tea formulation system tailored to the individual characteristics

Kaito Takama and Tsubasa Yamamoto (National Institute of Technology, Fukui College, Japan); Chika Mori (National Institute of Technology, Fukui Collage, Japan); Sakiko Ogoshi (National Institute of Technology, Fukui College, Japan); Yasuhiro Ogoshi (University of Fukui, Japan)

Herbal tea could maintain our health and handle ill health before symptoms appear, and its usage is easier than taking traditional medicines. Depending on individual characteristics, suitable tea should be different for each individual. To provide effective herbal tea for each one, it is desirable to analyze daily personal behaviors. Combinations of herbs could vary if individual characteristics, effective kinds and amounts are considered. It would be very difficult without very skillful and experienced expertises. We aimed to develop an electrical household equipment even without such expertises. In this study, we would like to introduced our system providing suitable herbal tea for each individual, and case studies of effects of the tea proposed by our system.

Internet of things combined with identity design

Hai Wu Lee and Jin-Xin Wang (Fujian University of Technology)

In recent years, with the continuous development of the sharing economy, people have higher requirements on the reliability and accuracy of identification. In this paper, combined with pervasive computing and other communication perception technologies, a low-cost, efficient and convenient identification system for the Internet of things is designed to replace traditional door locks, improve the security index of access control, realize intelligent unlocking and record user data, so that people's lives become intelligent, professional and integrated.

On the Possibilities of Multi-lingual Application of Voice Tra for Maritime English Education in Marine Technical College

Kenji Tanaka and Kazumi Sugita (Marine Technical College & JMETS, Japan)

This paper presents a scope of maritime English (ME) as a form of English for specific purposes through a web application of Voice Tra with the support of the international instructors of Maritime education, active seafarers and freshmen etc. in Marine Technical College of Japan agency of Maritime Education and Training for Seafarers (JMETS).

Collaborative Mobile Charging Scheme for Wireless Rechargeable Sensor Networks Based on Charging Curve

Chunling Chen, Xiaoqing Liu and Yongan Guo (Nanjing University of Posts and Telecommunications, China); Xuan Yang (Information System Integration Company of China Mobile of Jiangsu, China)

The limited battery capacity of sensor has become the main factor which restricts the lifetime of the whole wireless sensor networks. To solve this problem, prior schemes mainly focus on reducing the travel cost of mobile chargers and have low charging performances. In this paper, we put forward partial collaborative mobile charging scheme based on charging curve (PCLCharge) to reduce time spent in the constant voltage mode to charge more nodes and improve usage of energy. Simulation results show that the proposed algorithm is able to maximize the number of charged nodes and improve the usage of energy.

B1: Machine Learning Techniques for Consumer Electronics Applications II

Room: Eiffel Hall

Chair: Chia-Yu Lin (Yuan Ze University, Taiwan)

10:50 Wedding Dress Question-Answering System

Yiwei Liu and Yizhuo Zhang (Fuzhou University, China); Yu-Chih Wei (National Taipei University of Technology, Taiwan); Chi-Hua Chen (Fuzhou University, China)

This paper proposes an augmented reality (AR)-based question-answering system (QAS) for wedding dress, which applies mobile application to wedding market. Techniques of AR and QAS are proposed to increment users' satisfaction of selecting and buying wedding dress. In experiments, the results show that the accuracy of the proposed QAS is 97% and higher than other methods and systems.

11:05 Machine Learning Method Based on Stream Homomorphic Encryption Computing

Yizhuo Zhang and Yiwei Liu (Fuzhou University, China); Chan-Liang Chung (FuZhou University, China); Yu-Chih Wei (National Taipei University of Technology, Taiwan); Chi-Hua Chen (Fuzhou University, China)

This study proposes a machine learning method based on stream homomorphic encryption computing for improving security and reducing computational time. A case study of mobile positioning based on k nearest neighbors (kNN) is selected to evaluate the proposed method. The results showed the proposed method can save computational resources than others.

11:20 Machine Learning Models to Predict Visual Color Difference of Fluorescent Objects under Various Illumination Conditions

Hung-Chung Li (Academia Sinica, Taiwan); Pei-Li Sun, Wei-Chih Su and Hung-Shing Chen (National Taiwan University of Science and Technology, Taiwan); Chia-Pin Chueh (Printing Technology Research Institute, Taiwan); Yennun Huang (Academia Sinica, Taiwan)

In the study, two machine learning models including the polynomial regression model and artificial neural network (ANN) are proposed based on the result of a visual perception experiment for the application of a user interface (UI). The results indicate that both two models can ideally predict the visual color difference of fluorescent samples under various lighting conditions with high R-squared and acceptable RMSE values by applying CLELAB color space and CIE 1976 color difference as the inputs.

11:35 Realtime Customer Merchandise Engagement Detection and Customer Attribute Estimation with Edge Device

Sanket Nagnath Yerule (National Chiao Tung University, Taiwan); Chih-Chung Kao, Wei-Cheng Sun, Chia-Hui Lin and Chung-Wei Hsieh (Industrial Technology Research Institute, Taiwan)

In this paper, a low-cost computer vision-based system has been developed which detects and monitors the interaction between customer and merchandise. Various computer vision technologies such as real-time object detection, object tracking and person identification have been used in this work. The proposed system has been divided into two subsystems. First, the customer and merchandise interaction detection system while second, the age-gender estimation server. The two subsystems establish their communication through TCP socket. Through extensive evaluation and experiments, our proposed lightweight and low-cost system successfully achieves high accuracy in detecting the interaction in real time.

11:50 A Mesopic Lighting Evaluation Model Based on 1D Convolutional Neural Networks

Hung-Chung Li (Academia Sinica, Taiwan); Pei-Li Sun (National Taiwan University of Science and Technology, Taiwan); Yennun Huang (Academia Sinica, Taiwan)

In the study, a mesopic lighting evaluation model that can be used to predict S/P ratio, mesopic luminance and color gamut volume of a white LED spectrum is proposed. The result shows that the one-dimensional convolutional neural network (CNN) describes all of the indices well especially for mesopic luminance and color gamut volumes with a high coefficient of determination. In contrast, the performance of the S/P ratio is slightly unfavorable.

B2: Deep Learning-based Multimedia Processing I

Room: Lyon A

Chairs: Jieh-weih Hung (National Chi Nan University, Taiwan), Pei-Jun Lee (National Chi Nan University, Taiwan)

10:50 Low-Complexity Neural Network Design for Super-Resolution Imaging

Wei-Ting Chen, Shao-Chieh Liao, Pei-Yin Chen and Hsin-Yu Shih (National Cheng Kung University, Taiwan)

Super-resolution imaging is a widely used technology in consumer electronics, such as 4K TV and portable media players. The convolution neural network (CNN) has confirmed the high quality for super-resolution (SR) imaging. However, in order to pursue better imaging quality and higher PSNR/SSIM, recent researches usually involve high complexity architecture and lead to a large amount of memory usage. To overcome these drawbacks, we propose a low-complexity neural network architecture, which has a significant reduction in resource consumption. Furthermore, it also can serve 2X, 3X, and 4X SR images at the same time with a single architecture. Compared

with similar less complicated architectures [1]-[2], the results show that our architecture can achieve the best imaging quality (PSNR and SSIM) with the lowest parameter usage.

11:05 Exponentiated magnitude spectrogram-based relative-to-maximum masking for speech enhancement in adverse environments

Chen-Li Lin and Zi-Qiang Lin (National Chi Nan University, Taiwan); Syu-Siang Wang and Yu Tsao (Research Center for Information Technology Innovation, Academia Sinica, Taiwan); Jeh-wei Hung (National Chi Nan University, Taiwan)

In this study, we extend the capability of the method of relative-to-maximum masking (RMM) in speech enhancement by further leveraging the importance of each time-frequency unit in the spectrogram of the noise-corrupted signal. Our recently developed RMM is shown to enhance the speech quality in adverse noise situations by pursuing a multiplicative mask for the speech spectrogram in a test data-driven manner. Regardless of its simplicity and no requirement of any learning data and procedure, RMM can behave quite well for speech enhancement especially for low signal-to-noise ratio (SNR) scenarios. This study focuses on refining RMM in order to enhance its speech enhancement ability particularly for speech signals at moderate and high SNRs while maintaining its performance for low-SNR signals. The resulting new algorithm, termed exponential magnitude spectrogram-based RMM (with a short-hand notation "EMS-RMM") differs from the original RMM whereby EMS-RMM uses the exponentiated version of the magnitude spectrogram to determine the used mask, while RMM uses the original magnitude spectrogram. This novel presented method, EMS-RMM, is evaluated on a subset of the TIMIT database, corrupted by three types of noise at six SNRs. The speech quality evaluation results in terms of Perceptual Evaluation of Speech Quality (PESQ) scores reveal that by setting a proper exponent coefficient (power factor), EMS-RMM can outperform the baseline results significantly, and it behaves better than the original RMM.

11:20 Estimation of indoor position and motion direction for smartphones using DNN to BLE beacon signal strength

Kaito Echizenya and Kazuhiro Kondo (Yamagata University, Japan)

We investigated a method to simultaneously detect the location and motion direction of a pedestrian walking indoors. Multiple time instances of Received Signal Strength Indicator (RSSI) readings from multiple Bluetooth Low Energy (BLE) beacons on a smartphone held by a pedestrian, traveling in one of 9 directions, were fed to a trained Deep Neural Network (DNN), and the location of this smartphone, as well as the direction of its motion, was simultaneously estimated. Previous experiments in a 4m x 7m area showed estimated location accuracy of 0.91m, and average estimation accuracy of 83.5% in 5 directions. In this paper, we significantly increased the quality of the RSSI training data, as well as the number of motion direction to nine from five. The estimated location accuracy of 0.439m, and average estimated direction accuracy of 81.2% in 9 directions was shown.

11:35 Modified YOLOv3-Tiny Using Dilated Convolution for Driver Distraction Detection

Robert Chen-Hao Chang (National Chung Hsing University & National Chi Nan University, Taiwan); Chia-Yu Wang and Chun-Han Shen (National Chung Hsing University, Taiwan)

In this paper, the proposed YOLOv3-tiny-dilated network is presented. The well-known YOLO series neural network is famous for its rapidity, and the lightweight version is more suitable for mobile devices or embedded systems. However, the accuracy of one-stage network is slightly lower. Therefore, scale variation problem is investigated in this paper and we replaced the original Feature Pyramid Network (FPN) of the original YOLOv3-tiny network by three dilated convolution branches of different dilation rates to increase the accuracy of the network. As a result, the mean average precision (mAP) was improved by about 2% in the COCO dataset test. Besides, the proposed network was used to identify driving distraction behavior and obtain good accuracy of 95.47%.

B3: QoS/QoE-Related Technologies for Future Communication Systems I

Room: Lyon B

Chairs: Ryo Yamamoto (The University of Electro-Communications, Japan), Nobuhiko Itoh (NEC, Japan)

10:50 Improving QoE Fairness Using the IEEE 802.11e Priority Control Mechanism

Kosuke Shikama (The University of Electro-Communications, Japan); Takahiro Matsuda (Tokyo Metropolitan University, Japan); Takefumi Hiraguri (Nippon Institute of Technology, Japan); Takanori Hayashi (Hiroshima Institute of Technology, Japan); Ryo Yamamoto (The University of Electro-Communications, Japan)

QoE (Quality of Experience) represents the overall acceptability of communication services perceived by end-users. In this paper, we study QoE in a wireless LAN, and propose to use the IEEE 802.11e MAC (Medium Access Control) in order to improve the QoE fairness among users sharing the wireless channel. We assume that users can be classified into several classes according to context parameters affecting QoE, and assign different access categories to different classes. We evaluate our approach with simulation experiments and show that it can improve the QoE fairness.

11:05 Vulnerability Assessment for Machine Learning Based Network Anomaly Detection System

Yuji Ogawa, Tomotaka Kimura and Jun Cheng (Doshisha University, Japan)

In this paper, we assess the vulnerability of network anomaly detection systems that use machine learning methods. Although the performance of these network anomaly detection systems is high in comparison to that of existing methods without machine learning methods, the use of machine learning methods for detecting vulnerabilities is a growing concern among researchers of image processing. If the vulnerabilities of machine learning used in the network anomaly detection method are exploited by attackers, large security threats

are likely to emerge in the near future. Therefore, in this paper we clarify how vulnerability detection of machine learning network anomaly detection methods affects their performance.

11:20 Deadline-aware Emergency Data Resource Allocation Control for IEEE 802.11ax

David González Filoso (Keio University, Japan); Kazutaka Hara and Shinya Tamaki (NTT Access Network Service Systems Laboratories, Japan); Katsuya Minami and Kohji Tsuji (NTT, Japan); Ryogo Kubo (Keio University, Japan)

In the event of a natural disaster, congested wireless access points must transfer emergency messages within a waiting deadline for the starting time of message transmission. This paper proposes a scheduler for resource unit (RU) allocation in IEEE 802.11ax to meet the waiting deadline of emergency messages, such as crucial camera image data for understanding post-disaster situations. A simulation shows that the proposed scheduler is able to allocate the emergency messages in the RUs according to the waiting deadline.

11:35 User Behavior Analysis of WPT Motivated Ad Hoc Networks

Yoshihiro Taniguchi, Taku Yamazaki and Takumi Miyoshi (Shibaura Institute of Technology, Japan); Takuya Asaka (Tokyo Metropolitan University, Japan)

For stimulating cooperation among users in mobile ad hoc network (MANET), an incentive mechanism which offers electric power as incentive in exchange for relaying packets by using wireless power transmission (WPT) technology has been proposed. To evaluate this mechanism, it is important to reveal a relation between the user's willingness to forward packets and the residual battery level. In this paper, we investigated and analyzed user's willingness in several situations through subjective evaluations with and without this incentive model. On the basis of the analysis, we characterize user's willingness to forward packets depending on the residual battery level in each situation. Finally, we confirmed that the incentive mechanism can stimulate user's cooperation in MANET.

B4: Advanced Computing Systems and Applications II

Room: Lyon D

Chairs: Masaru Fukushi (Yamaguchi University, Japan), Tsung-Chu Huang (National Changhua University of Education, Taiwan)

10:50 Virtual-Channel Implementation on Inter-Board Data Transmission

Naohisa Fukase, Akihisa Furuichi and Yasuyuki Miura (Shonan Institute of Technology, Japan)

To improve computer performance, methods using FPGA and FPGA clusters are being researched. We are developing router circuits for FPGA clusters using the Qsys interconnect of Intel FPGA which has high flexibility. In this paper, we report on a virtual channel implementation method for the router circuit we developed in our previous work.

11:05 An Estimation Method of Visibility Level Based on Low Rank Matrix Completion Using GPV Data

Gen Ohkama, Sho Takahashi and Toru Hagiwara (Hokkaido University, Japan)

This paper proposes a method for estimation of visibility level based on low rank matrix completion using GPV data. On snowy day, driving task can be hard because of poor visibility. By presenting visibility information to drivers and road manager, it will lead to safer traffic. To estimate visibility, weather data, which is significantly related to visibility, are used in the proposed method. In the proposed method, Grid point value (GPV) data and visibility data including missing values on unobserved points are arranged to matrix. The missing values are estimated based on low rank matrix completion. Experimental results show the effectiveness of our method.

11:20 Approximate Computing for Batch Learning in Neural Network

Liang-Yu Lin (National Changhua University of Education, Taiwan); Jerrae Schroff (Cogito Academy, Orinda, California, USA); Chia-Cheng Liang and Tsung-Chu Huang (National Changhua University of Education, Taiwan)

Neural Network plays an important role in modern smart cities fulfilled with omnipresent AIoT consumer electronics. However computing acceleration results in issues in power dissipation, area overhead and reliability. In this paper, an arithmetic weight minimization algorithm and approximate computing technique are proposed for power reduction and real time saving. From comprehensive evaluations, about 39% of real time and 56% of energy can be saved.

11:35 A Fault-Tolerant Adaptive Routing Method Based on the Passage of Faulty Nodes

Akari Kawazoe, Yota Kurokawa and Masaru Fukushi (Yamaguchi University, Japan)

Toward the realization of dependable high-end consumer electronics products, it is indispensable to design an efficient fault-tolerant packet routing method to enhance the communication performance of Network-on-Chip (NoC)-based many core processors. In the recent study of fault-tolerant routing, a novel approach has been proposed [1]; packets can pass through faulty nodes, rather than detour them as almost all existing methods do. However, disadvantage of the existing method (called passage-y in this paper) is that routing paths are fixed deterministically once the source and destination nodes of the packets are decided. This will result in large communication latency due to the incapability of avoiding congestion. In this paper, we propose a fault-tolerant adaptive routing method which combines two existing methods, well known west-first and the novel passage-y. Simulation result reveals that our method reduces average communication latency by about 21.5%, compared with the previous passage-y method.

11:50 Residue Number System Design Automation for Neural Network Acceleration

Liang-Yu Lin (National Changhua University of Education, Taiwan); Jerrae Schroff (Cogito Academy, Orinda, California, USA);
Tsu-Ping Lin and Tsung-Chu Huang (National Changhua University of Education, Taiwan)

Residue Number Systems can solve four major problems of neural network including acceleration, power consumption, area overhead and fault tolerance. However, the most recent work remains two major issues: (1) sign detection or magnitude comparison, and (2) long right shifts. In this paper, we develop a systematic approach to design a low power, compact, fast and reliable neural network automatically.

12:05 Range-Lookup Approximate Computing Acceleration for Any Activation Functions in Low-Power Neural Network

Wen-Chang Yang, Shu-Yun Lin and Tsung-Chu Huang (National Changhua University of Education, Taiwan)

Consumer electronics have become versatile for processing a lot of signals in any distribution. This results in that high-speed activating of neural network should fit for any distribution of error functions. In this paper, we propose a set of transistor-level magnitude-comparators. Then we apply them to develop range-addressable memory to design a lightweight-slope lookup table. We then develop an efficient algorithm for constructing a lightweight-slope piecewise line. The proposed techniques are suitable to design any sigmoidal activation functions in neural network. From experiments and comparisons, the proposed LUT can be more efficient effective than previous looking tables. Especially applied in the proposed range-addressable memory, the power-delay product can be reduced by more than 30 folds.

B5: Computer Networks, Sensor Technologies and Big Data Computing II

Room: Lyon E

Chair: Po-Chyi Su (National Central University, Taiwan)

10:50 BiLSTM-LAN based Medical Named Entity Recognition

Chunling Chen, Qianli Niu and Yongan Guo (Nanjing University of Posts and Telecommunications, China)

With the wide application of information technique in the medical field, various medical information systems have produced massive medical data. The problem of mining knowledge from medical data has been extensively studied. For the medical named entity recognition problem, Bidirectional Long-Short-Term Memory model with Conditional Random Field (biLSTM-CRF) is commonly used. However, CRF cannot capture long term output label relations because of the Markov assumptions. To solve this problem, we propose to use a bidirectional Long-Short-Term Memory model with Label Attention Network (biLSTM-LAN) for medical named entity recognition. The experimental results show that using LAN to replace CRF can improve the recognition accuracy when their number of parameters are similar.

11:05 Application Practice of Smart Hospital Based on IoT Cloud Platform

Shenqi Jing (School of Information Management, Nanjing University, China); Ran Xiao (Nanjing University of Posts and Telecommunications, China); Tao Shan and Zhongmin Wang (the First Affiliated Hospital, Nanjing Medical University, China); Yun Liu (Nanjing Medical University, China)

To study the effect of the Internet of Things (IoT) technology on the smart hospitals, we introduce a comprehensive solution for smart hospitals based on the IoT and artificial intelligence technologies. The core of the solution is an intelligent service cloud platform for the whole hospital, which consists of four parts: smart terminals for data collection, a data aggregation network, a smart platform for data analysis, and a smart platform for service integration. The proposed scheme has been practically applied in hospitals, and its main advantages are reflected in four aspects: reducing the workload of medical care, reducing the pressure of medical work, improving the satisfaction of patients in medical treatment, and improving the social influence of the hospital.

11:20 Edge Computing for IoT Sensors Based on DPN

Tomoaki Kanaya (Kogakuin University, Japan); Akihiro Nakao (The University of Tokyo, Japan); Shu Yamamoto (University of Tokyo, Japan); Masato Oguchi (Ochanomizu University, Japan); Saneyasu Yamaguchi (Kogakuin University, Japan)

IoT (Internet of Things) technology enables us to gather a huge amount of data from many sensors in various places. In case every IoT sensor directly sends its data to the server, the load of the server must be too large. Several ideas have been proposed for addressing this issue. Data consolidation at edge computer, which is called edge-computing, is one of the most promising methods. In the cases of the existing methods based on edge computing, edge computing is not transparent. Namely, an IoT sensor connects its edge computer. Thus, this method cannot be utilized in some cases such as the software of the IoT sensor cannot be modified. In this paper, we propose a transparent edge computing based on DPN (Deeply Programmable Network) for non-encrypted IoT data uploading. The programmable switch deeply inspects the payloads of non-encrypted packets with the proposed method. The switch then processes the data and decreases the number of packets that are transmitted to the server. We introduce our prototype systems for calculating top-K and average and show our method works effectively.

11:35 Performance Evaluation of TCP BBR and CUBIC TCP in Smart Devices Downloading on Wi-Fi

Kouto Miyazawa, Saneyasu Yamaguchi and Aki Kobayashi (Kogakuin University, Japan)

A new TCP (transmission control protocol) congestion control algorithm called TCP BBR was proposed by Cardwell et al. in 2016. They showed its excellent performance and TCP BBR has been used in some of Google's services such as Google Cloud and Youtube. They

showed also that it achieved good performance fairness among TCP BBR connections in a wired network. In this paper, we evaluate the performance fairnesses among TCP BBR connections and among TCP BBR and CUBIC TCP connections in a smart device's network in which smart devices, such as smartphones and tablet PCs, are connected to a server via a Wi-Fi network. We then show that sufficient fairness is not achieved in some cases.

Monday, September 28 12:20 - 13:00

Lunch

Monday, September 28 13:00 - 14:00

C2: Deep Learning-based Multimedia Processing II

Room: Lyon A

Chairs: Jieih-weih Hung (National Chi Nan University, Taiwan), Pei-Jun Lee (National Chi Nan University, Taiwan)

13:00 *A Review of PointPillars Architecture for Object Detection from Point Clouds*

Nagaraj Desai and Thomas Schumann (Hochschule Darmstadt-University of Applied Sciences, Germany); Mohamed Alsheakhali (CMORE Automotive GmbH, Germany)

Object detection from point clouds, e.g. 3D LiDAR data, has many applications especially for autonomous driving systems. There have been several approaches to this complex problem, however, PointPillars architecture has the advantage that it can reuse the existing image-based convolution neural networks for object detection from 3D LiDAR data. The performance of the PointPillars architecture is further enhanced in this work by introduction of an additional Pillar Feature Extraction layer. It is observed that this modified PointPillars model trained to detect cars on KITTI dataset shows an improvement of 6.25% in the average precision for the easy cases in KITTI 3D detection benchmark, when tested on a GTX 1080i GPU.

13:15 *Lowpass-filtered relative-to-maximum masking for speech enhancement in noise-corrupted environments*

Zi-Qiang Lin, Chen-Li Lin and Jieih-weih Hung (National Chi Nan University, Taiwan)

In this study, we focus on developing a novel speech enhancement scheme that can improve the quality of speech signals in adverse environments. This novel scheme primarily refines our previously presented method, relative-to-maximum masking (RMM), by applying a moving-average filter to the respective mask matrix on the temporal axis. The underlying idea of this process is to capture the neighboring correlated characteristics of the mask values in RMM. Furthermore, such a moving average process can implicitly highlight the low-varying components of the speech spectrogram, which has been shown to reduce noise effect in the past research. Experiments conducted on a subset of Aurora-2 database show that the newly proposed scheme obtains significantly higher PESQ scores than the baseline results, and it also outperforms the original RMM in all noise levels.

13:30 *SIFT-Enhanced CNN Based Objects Recognition for Satellite Image*

Kuang-Zhe Liu, Pei-Jun Lee, Guo-Cheng Xu and Bo-Hao Chang (National Chi Nan University, Taiwan)

Satellite images usually contain multiple in randomly located objects whose size is minimal since the height of the satellite observation. Because SIFT feature points have the invariant ability the same as CNN feature, to increase the accuracy of satellite images in object recognition, this paper uses the Scale-Invariant feature transform (SIFT) algorithm to locate the objects. Image cropping is applied to get the object region from image features. These images are put into CNN object recognition system. As experiment results, the proposed algorithm can recognize specific objects such as aircraft and ships with accuracy is about 70%.

13:45 *Deep Neural Network and Weighted Ridge Regression Based Pixel Prediction Technique*

Jer-Ming Chang and Jian-Jiun Ding (National Taiwan University, Taiwan)

Lossless image compression consists of two processes, pixel prediction and residue encoding. Recently, deep neural network (DNN) has been widely adopted in signal prediction. In this work, we apply a DNN architecture together with the information of surrounding pixels weighted by their similarities for pixel prediction. Simulations show that, with the proposed algorithm, the pixels can be predicted more precisely, which is very helpful for lossless image compression.

C3: QoS/QoE-Related Technologies for Future Communication Systems II

Room: Lyon B

Chairs: Ryo Yamamoto (The University of Electro-Communications, Japan), Nobuhiko Itoh (NEC, Japan)

13:00 *An Information Sharing Method Using P2P and V2V Communications in VANET*

Shota Ono (University of Tokyo, Japan); Fuga Kikuchi, Taku Yamazaki and Takumi Miyoshi (Shibaura Institute of Technology,

Japan); Kaoru Sezaki (University of Tokyo, Japan)

For realizing information sharing among vehicles, various methods based on P2P (peer-to-peer) and V2V (vehicle-to-vehicle) communications have been proposed. However, in a case of using a P2P-based method, the network load of a source vehicle will increase due to the increase of receivers. On the other hand, in a case of using a V2V-based method, vehicles cannot communicate with each other if vehicles are far apart. In this paper, we propose an information sharing method among vehicles based on V2V and P2P communications.

13:15 A Study on Quality of Experience with Scalable Video Coding Transmission Rate Control in Wireless LAN Multicast Environments with Background Traffic

Hirofumi Iida, Isamu Shitara and Hideaki Yoshino (Nippon Institute of Technology, Japan); Takahiro Matsuda (Tokyo Metropolitan University, Japan); Takefumi Hiraguri (Nippon Institute of Technology, Japan)

In our previous work, the scalable video coding transmission rate control scheme based on quality of experience indication was reported. In this paper we propose an enhanced scheme that assumes a real network environment. This proposed scheme delivers high performance even in a network environment with traffic fluctuations.

13:30 GIS Extension of Location-based P2P and Its Application

Momori Kamata, Takeru Sugiyama, Takumi Miyoshi and Taku Yamazaki (Shibaura Institute of Technology, Japan)

Geo-location oriented network (G-LocON) is a communication framework to construct location-based peer-to-peer (P2P) networks. G-LocON can enable direct communication to other terminals in a specified search area, which is defined as a circular shape in the current implementation. To realize more flexible peer search, this paper proposes an extension of G-LocON with geographic information service (GIS). We also develop an emergency alert system on smartphones using the proposed method. Subjective evaluations show that the proposed method successfully improves the peer search mechanism and that the developed application is useful and practical.

13:45 A Content Registration Method for CCN Routers with Blockchain

Shuichi Tokunaga and Rei Nakagawa (The University of Electro-Communications, Japan); Satoshi Ohzahata (The University of Electro-Communications & Graduate School of Information Systems, Japan); Ryo Yamamoto (The University of Electro-Communications, Japan); Toshihiko Kato (University of Electro-Communications, Japan)

Current IP based network does not always efficiently deliver contents over IP based network even though large size contents greatly increase traffic volume of network. Content Centric Network (CCN) has been proposed as new network architecture to solve this problem. CCN directly use a content identifier to obtain content without a content location in the network. Then, the user has to get a content identifier before requesting the content but a way to get content information including a content identifier has not been well studied in CCN architecture. To solve this problem, we propose a content registration method for CCN routers with a blockchain technology to get content information in the architecture. We design and implement the content registration in CCN software platform Cefore and evaluated content information registration time.

C4: Advanced Computing Systems and Applications III

Room: Lyon D

Chair: Masaru Fukushi (Yamaguchi University, Japan)

13:00 Performance Improvement of Kotlin Program in Consideration of JIT Compiler Optimization

Atsuya Sonoyama (Kogakuin University, Japan); Masato Oguchi (Ochanomizu University, Japan); Takeshi Kamiyama (Nagasaki University, Japan); Akira Fukuda (Kyushu University, Japan); Saneyasu Yamaguchi (Kogakuin University, Japan)

Kotlin is a programming language that has high-level interoperability with Java. It was determined as the first-class language for Android application development in 2019 and is expected to increase its importance in client devices, such as smartphones and PCs, in the consumer electronics field. However, this is a newly emerging language and its performance has not been studied enough. In this paper, we focus on a simple program function, which is a for statement, and discuss its performance. First, we evaluate the performance of iteration with for statement written in Kotlin and Java and show that there is a significant performance difference. We then compare the Java virtual machine (JVM) bytecodes delivered from Kotlin and Java source codes and discuss the cause of this performance. Based on this comparison, we propose a method for improving the performance of an application written in Kotlin in Windows JVM with JIT (Just in time) compiler. We then show that our proposed method can improve the performance of processing a for statement of Kotlin.

13:15 Java Android Application Performance Improvement by Kotlin DEX Bytecode Analysis without JIT Compiler

Ryoichi Shibata and Atsuya Sonoyama (Kogakuin University, Japan); Masato Oguchi (Ochanomizu University, Japan); Takeshi Kamiyama (Nagasaki University, Japan); Akira Fukuda (Kyushu University, Japan); Saneyasu Yamaguchi (Kogakuin University, Japan)

Kotlin, in addition to Java, is increasing its importance in the consumer electronics field in recent years as a language to Android application development. In our previous work, we showed the performance difference between applications written in Java and Kotlin, discussed the cause of this difference in DEX bytecodes derived from both languages, proposed a method for improving the performance of Java application, and showed that the performance of Java-derived application improved slightly. In this paper, we proposed a method for performance improvement of Java applications by modifying DEX bytecode more and demonstrate that the proposed method the

Java application by our evaluation.

13:30 Monitoring System for Optimization based on Analyzing Android Application Launching Behavior

Kazushi Nishinaka (Electrical Engineering and Electronics, Kogakuin University Graduate School, Japan); Atsuya Sonoyama (Kogakuin University, Japan); Takeshi Kamiyama (Nagasaki University, Japan); Akira Fukuda (Kyushu University, Japan); Masato Oguchi (Ochanomizu University, Japan); Saneyasu Yamaguchi (Kogakuin University, Japan)

Android operating system has become one of the most important platforms. Performance analysis and improvement of Android applications are essential. In this paper, we propose a method for analyzing Android application behavior and effectively improving application performance based on the analyzed behavior. We show a prototype system for analyzing behavior by modifying the Android application runtime and then discuss a method of optimizing CPU clock frequency based on the monitored behavior.

13:45 Development and Application of Privacy-preserving Distributed Medical Data Integration System

Kazuhi Nakasho (Yamaguchi University, Japan); Atsuko Miyaji (Osaka University & Japan Advanced Institute of Science and Technology, Japan); Yuuki Takano (Osaka University, Japan); Seitaro Mishima (Yamaguchi University, Japan); Kousuke Takeuchi and Naohiro Hayaishi (KEISUU GIKEN Corporation, Japan)

The privacy protection technology is crucial to utilize big data in the medical field. Privacy-preserving Distributed Data Integration (PDDI) is one of the encryption techniques to match and integrate medical records held in multiple organizations while preserving privacy. The PDDI method is superior to other existing methods in terms of computational complexity and data versatility. This article provides an overview of the PDDI protocol. We also introduce newly developed Web-based applications that make it easier for researchers and healthcare professionals to use the PDDI protocol.

14:00 Observation of Power Consumption of Each Application in an Accelerated Android OS

Ryosuke Onozato (Kogakuin University, Japan); Takeshi Kamiyama (Nagasaki University, Japan); Akira Fukuda (Kyushu University, Japan); Masato Oguchi (Ochanomizu University, Japan); Saneyasu Yamaguchi (Kogakuin University, Japan)

Analyze of smartphone application behavior is one of the important tasks in the consumer electronics field. A dynamic analysis involving an actual execution provides very practical results but requires a very long time. We then previously proposed an accelerated Android operating system that provided an accelerated time flow to the process in the system, in order to reduce this time. In this paper, we evaluate the accuracy of accelerated observation of the power consumption ranking of applications. We show the rankings with and without acceleration. We then show that a similar ranking can be obtained with small acceleration and that the method provides almost accurate, but not completely accurate, application power consumption ranking in a shorter time. In addition, we discuss its side effects, namely the power consumption of display increases by this acceleration.

C5: Computer Networks, Sensor Technologies and Big Data Computing III

Room: Lyon E

Chair: Chang-Yi Yang (National Penghu University of Science and Technology, Taiwan)

13:00 Virtual Full-Duplex Relaying Protocol with Network Interference Cancellation

Enxin Yang, Xu Wen, Rannuo Chen and Jie Wei (Beijing Jiaotong University, China)

Virtual full-duplex relaying is a promising technology to recover the multiplexing loss due to the half-duplex relays, by allowing the concurrent transmission of the source and relays. However, virtual full-duplex relaying creates severe inter-relay interference (IRI). In this paper, a network interference cancellation method was presented, to mitigate the IRI at relays in virtual full-duplex relaying with decode-and-forward (DF) protocol. We analyzed the residual interference power and average capacity and found it achieved better results of mitigating the IRI on the basis of DF protocol, as shown with simulation results.

13:15 Sound sources localization algorithm in shallow sea based on VTRM

Haiyan Song (Heilongjiang Institute of Technology, China); Gong Zhang (University of Winnipeg, Canada); Chang-Yi Yang (National Penghu University of Science and Technology, Taiwan); Hai-Cheng Liu (School of Electrical and Information Engineering, China)

This paper deals with the problem of the sound sources near-field localization in shallow water. It is important to develop algorithm for solving the problem of the non-point sources localization in the multi-path channel. The key work of this paper is to introduce a phase conjugation virtual time reversal mirror (VTRM) anti-multi-path algorithm used in focused beamforming. Because of making full use of the spatial geometric relationship between scanning planar and receiving array in the near-field, the algorithm can estimate the channel impulse response function without any information about the channel and receiving signals, and can match the practical channel effectively.

13:30 Vector ML focused beamforming algorithm for motion parameters estimation

Haiyan Song (Heilongjiang Institute of Technology, China); Chang-Yi Yang (National Penghu University of Science and Technology, Taiwan); Gong Zhang (University of Winnipeg, Canada); Hai-Ying Zou (School of Electrical and Information

Engineering, China)

For the near-field parameters estimation, the propagation delay of different target is quadratically varying with sensor location. The conventional high-resolution DOA estimation methods are no longer applicable directly. This paper deals with near-field localization problem by combining the advantages of the vector sensor array processing and maximum likelihood estimation in the condition of correlated signal, and propose the motion parameters estimation algorithm based on the vector maximum likelihood (ML) focused beamforming. The capability of vector ML focused beamforming algorithm has been validated by simulation results.

13:45 Smart Mobile Positioning by Whale Optimization Algorithm Followed after Weighted GDOP Computations

Chien-Sheng Chen (Tainan University of Technology, Taiwan); Jen-Fa Huang and Guo-Ren Shia (National Cheng Kung University, Taiwan)

Geometric dilution of precision (GDOP) is the judgment criteria for the satellites in the global navigation satellite system (GNSS). Thus, we introduced this criterion and derived the weighted form for selecting the best subset among all the base stations in the wireless communication system. At first, we calculated the weighted GDOP values to choose the best subset for positioning. Then, we utilized the whale optimization algorithm to optimize the estimation position of the mobile station.

Monday, September 28 14:00 - 14:10

Opening Ceremony

Room: Eiffel Hall

Monday, September 28 14:10 - 15:10

Keynote: Jenq-Neng Hwang

Room: Eiffel Hall

Chair: Pao-Chi Chang (National Central University, Taiwan)

Monday, September 28 15:10 - 15:30

Coffee Break

Monday, September 28 15:30 - 17:00

Poster B

Room: Poster Area

Chairs: Hsia Chih-Hsien (National Ilan University, Taiwan), Shyang-Yuh Wang (Chinese Culture University, Taiwan)

Exploring the Syntactic Structures of Mature Group using Virtual Assistant in Taiwan

Yuting Chiu and Chun-Ching Chen (National Taipei University of Technology, Taiwan)

With the rise of artificial intelligence, virtual assistants are becoming common in various smart devices. The mature groups in the aging societies of today will become the senior citizens of tomorrow, and not as many senior citizens use virtual assistants. The objective of this study was to examine the needs and syntactic structures that mature groups have and use when using virtual assistants. We conducted speech task experiments and interviewed the participants. Our results revealed that when mature groups use virtual assistants, they tend to talk to them and explain their needs rather than issue direct commands, and they sometimes use inverted syntactic structures. In many tasks, the responses included both commands and queries.

Cyber-Physical System for Smart Factories: Case Study of the Taiwan Instrument Research Institute of the National Applied Research Laboratories

Shih-Jie Chou (Instrument Technology Research Center, NARLabs, Taiwan)

A small-scale smart factory cyber-physical system (CPS) developed by the Taiwan Instrument Research Institute of the National Applied Research Laboratories uses visualization to decentralize big data searches and log mining. The ELK-acronym for three open source projects, Elasticsearch, Logstash, and Kibana-service effectively handles decentralized storage and processing, full-text searches, log mining, and visualization of big data. The real-time production system may thus be controlled to achieve smart management and factory optimization. This study introduced the construction of CPS, which connects with data obtained from optical factory sensors. Proposed to meet data collection needs, ELK was incorporated with an app to allow operation on mobile phones.

Automatic Content Extraction for Live Streaming Web Page Based on the Comparison Approach

Yenchieh Li, Huiwen Cheng, Pei-Feng Lee and Wei-Xun Kuo (National Central University, Taiwan)

This paper proposes an automatic scheme of web data extraction for live streaming platforms. Based on the similar desired blocks on web pages and corresponding HTML tag structures, the proposed scheme can automatically identify the desired blocks as well as desired content without any visual identification or computational training. The proposed scheme is a general data mining solution for diverse live streaming platforms. Furthermore, it adapts to a certain level of revision on web pages by means of updating its data-extracting parameters.

Long-distance FBG Sensor System for Remote Sensing and Internet of Things (IoT) applications

Stotaw Talbachew Hayle, Bao-Yi Guo, Yibeltal Chanie Manie, Yuan-Ta Hsu, Jyun-Wei Li and Peng-Chun Peng (National Taipei University of Technology, Taiwan)

In this paper, we investigate a novel approach of using FBG sensor in internet of things (IoT) applications for real-time remote sensing system. For a long-distance remote sensing system, a hybrid of Raman amplifier (RA) and erbium-doped fiber amplifier (EDFA) in fiber Bragg grating (FBG) sensor network is proposed. The combination of the fiber sensing technology and the IoT is an important technique for the improvement of current sensing technology. The result of the experiment indicates that an improved gain spectra and spontaneous emission power is achieved using the hybrid amplifier and fiber ring laser. As a result, stable and high peak power is generated. Furthermore, even FBGS positioned after 50 km SMF, a fiber ring laser achieves an output of a stable wavelength of FBGs with an optical signal-to-noise ratio (OSNR) of more than 46 dB.

Non-contacted optical measurement system with 16-channel synchronous laser sensor applied for three-axis machine tool

Hoang The Pham, Dang Quang Vu Hoang, Chi-Chia Sun and Pin-Wei Lu (National Formosa University, Taiwan)

The quality and accuracy are the two main factors of the performance of the cutting tool which are the particularly industrial standard in every almost factories. In this paper, an optical based non-contact machine tool calibration system is presented. It presents a non-contacted optical measurement system with two 8-channels sensor applied for three-axis machine tool with high-speed data accuracy, establishes system connection, and integrates computer interface with a 32-bit MCU to realize optical measurement system of three-axis machine tool. The communication is based on Ethernet network. Hardware architecture contains four sets of laser light source, photoelectric sensors and spherical lens. With the inexpensive price and uncomplicated steps, it can perform the calibration three-axis motor and static error with above average accuracy.

The Analyze of Stagnation Phenomenon and Its' Root Causes in Particle Swarm Optimization

Hsuan-Yu Tseng (Fu Jen Catholic University, Taiwan); Hao-Chun Lu (Information Management, Fu Jen Catholic University, Taiwan)

Evolutionary algorithms (EA) are part of artificial intelligence technology, and EA always suffers from the problem of particle stagnation. Most of the researches on particle stagnation focused on particle stagnation and searched in incorrect regions. However, by observes the particle moving trajectory, the author found that the particle is not only stagnation in a point but also wandering in a region. Therefore, this study analyzing the particle behaviors and break down the stagnating phenomenon to reinforce the understanding of stagnation problems currently. This study summarizes the phenomenon of particle stagnation and detailed discuss the root causes to reinforce the lack of understanding in particle stagnation currently. Finally, the author proposes corresponding strategies for different cases for the related researches in the future to handling the stagnation problem more comprehensively.

Adaptive Congestion Control for Massive MachineType Communications in Cellular Network

Rubbens Boisguene and Chih-Wei Huang (National Central University, Taiwan)

The ubiquitous deployment of massive Machine- Type Communication (mMTC) devices and the traffic diversity of the various IoT applications challenge the network efficiency. It suffers Congestion and signaling overload due to the high probability of collisions, especially in a dense network scenario. In this paper, we propose an adaptive grouping and strategy for the mMTC devices capable of reducing the number of simultaneous transmissions. Hence guarantee the successful transmission of the data in the 5G cellular network.

Comparative Analysis of Maximum Power Point Tracking Algorithm for Photovoltaic Systems

Devita Ayu Larasati (National Taipei University of Technology, Taiwan); Jen Hao Teng (National Sun Yat-sen University, Taiwan); Chao-Rong Chen (National Taipei University of Technology, Taiwan)

This paper provides a comparison between Perturb and Observe (P&O) method, and Particle Swarm Optimization (PSO) method implemented using the weather data from Taiwan Weather Bureau. PVG system is designed with a rated output of 200 W energy to obtain the curve performance and the unharvested energy for different MPPT algorithms. Test results show that in various solar irradiances with single temperature, PSO is better than P&O method in energy production capacity. Whereas, P&O method gives higher result for harvesting energy on the whole day. However, P&O has good ability for tracking time in both conditions.

A Kernel Module Based Mechanism to Establish a TCP/IP Connection When Destination Service Changing

Rui-yi Hung, Fu-hau Hsu and Chia-Hao Lee (National Central University, Taiwan)

In this paper, we would like to change the process of establishing a new connection so that we can transfer a client to another proxy. Therefore, we need to modify the system call `sys_connect`, which is in charge of establishing a new connection. Considering that

reinstalling operating systems on all clients is impractical, we chose to replace the system call table entry with a customized `sys_connect` by a Loadable Kernel Module (LKM).

Chemically-treated screen-printed graphene electrode for electrochemical sensing

Yu-Ming Huang and Kalpana Settu (National Taipei University, Taiwan); Jang-Zern Tsai (National Central University, Taiwan)

In recent years, electrochemical based biosensor has been extensively studied due to its remarkable advantages such as low fabrication cost, small size, high sensitivity and selectivity, low detection limit, and the potential for real-time and on-site analysis. To fabricate high performance electrochemical based biosensor, novel and promising nanostructured materials are highly required. In this study, we presented a chemically-treated, screen-printed, graphene electrode (SPGE) for electrochemical sensing applications.

Locating Texts in Images by Fully Convolutional Network with Bounding Text Labeling

Po-Chyi Su (National Central University, Taiwan)

Texts in images are often viewed as the regions of interest. Locating such areas for further analysis may help to extract image-related information and facilitate many interesting applications. Considering that pixel-based image segmentation is effective in identifying the areas containing texts, we propose a text detection scheme based on the Fully Convolutional Network (FCN), which employs Feature Pyramid Network (FPN) and Atrous Spatial Pyramid Pooling (ASPP) to effectively mark the pixels related to texts in an image. A comparatively efficient labeling approach is adopted to group related letters/characters and separate different words by oval-shaped text labeling masks with boundaries. The experimental results demonstrate feasibility of the proposed text-detection scheme when compared with the state-of-the-art text detection approaches.

An Improvement of RetinaNet for Hand Detection in Intelligent Homecare Systems

Quoc-Viet Hoang, Trung-Hieu Le and Shih-Chia Huang (National Taipei University of Technology, Taiwan)

In this paper, we propose an AC-Retina method, which uses RetinaNet as a base architecture and integrates an atrous convolution (AC) module to extract multiscale context information for hand detection in intelligent homecare (IH) systems. Given that the AC module is adopted in the feature pyramid network (FPN), rich semantic information of higher pyramid layers is added to the lower pyramid layers to improve the detection performance. The experimental results show that our AC-Retina method obtains 82.99% AP and outperforms the original RetinaNet on the Oxford hand dataset.

Data Augmentation for Improving SSD Performance in Rainy Weather Conditions

Quoc-Viet Hoang, Trung-Hieu Le and Shih-Chia Huang (National Taipei University of Technology, Taiwan)

This paper focuses on using data augmentation to improve the performance of Single Shot Multibox Detector (SSD) in rainy weather conditions. Data augmentation is applied by generating synthetic rain on a set of clear images to expand the dataset for training. The experimental results show that the performance of SSD model improves by up to 26.14% when being trained on the proposed augmented synthetic dataset.

Automatic ICEMI time-domain multi-point measurement platform

PoWei Huang and Shih-Yi Yuan (Feng Chia University, Taiwan)

Most of the IC-electromagnetic interference (ICEMI) researches get information in frequency-domain. However, in the EMI leakage research field, the measurement of time-domain is more important. We already purposed a single point time-domain EMI signal for information leakage analysis. But a single point measurement is not enough. This paper proposes an automated measurement platform which can measure, visualize, and plot a time-domain two-dimensional (multi-point) EMI data on Microchip dsPIC33EP512MC202. The purposed automation process can be easily extended and applied to variety of different Devices Under Test (DUTs).

Feasibility analysis of dye color modeling in clothing industries with machine learning models

Wei-Tyng Hong, Bubacarr Jallow and Po-En Chung (Yuan Ze University, Taiwan)

The latest available expert systems used for the dyeing process yields only about 50% accuracy in choosing dye codes from multiple pigments given a targeted sample on cloth. Hence, leading to anomalies in dyeing and ultimately thousands of dollars are lost in the daily process. To counter this state of affairs, we are proposing two methods. Firstly, the expert system is unchanged, and the auxiliary reliability analysis system is added to reduce the wear and collect a large amount of data. Secondly, we establish several machine learning models and the colorist (i.e., combination of dye codes) will get from the dyeing formula in the model. In our evaluation, we try to predict the dye color combinations using both statistical and neural network approaches. The best result was achieved by the SVM approach in which the system gets 7% error rate in prediction of the combination of dye codes from multiple pigments. This indicates a strong potential of our approach in this application.

FBG Sensor Signal Detection Technique Using Multilayer Perceptron Approach for Internet of Things (IoT) Application

Amare Mulatie Dehnow, Yibeltal Chanie Manie, Ya Yu Chen, Jun-Wei Li and Peng-Chun Peng (National Taipei University of Technology, Taiwan)

Precise sensing using fiber Bragg grating (FBG) sensors is crucial, for environment monitoring in Internet of Things (IoT) application. In this paper, we demonstrated effectively the sensor wavelength detection techniques using Multi-Layer Perceptron Approach on the proposed shared Bus Network Architecture. The proposed machine learning model can learn the features of FBGs spectra and the Bragg wavelengths of each FBG can be quickly determined from the overlap spectra. The proposed system proved that higher detection accuracy is achieved even when the spectra of the FBG is partly and entirely overlapped with an adjacent FBGs.

Design of River Monitoring System Based on Video Recognition and Deep Learning Technologies

Kuei-Chung Chang, Hung Yu Chen, Shih-Hong Lin and Chin-Sheng Yu (Feng Chia University, Taiwan)

In recent years, there have been frequent rains and typhoons in Taiwan. Continuous heavy rains can cause river rushed and soared. In addition, terrain problems have caused floods to occur frequently, which will cause flooding, landslides, destroying many facilities and many casualties. In this paper, we proposed a remote video-based river monitoring system that uses some traditional image recognition techniques to obtain river regions. In addition, we also use a deep learning method to find water level to ultimately assess river conditions. The experimental results show that the recall of the water level marker is 94.5%.

A Parking System Based on WiFi Positioning Technology and Bluetooth Access Control

Hsin-Chuan Chen, Wenbin Cheng, Lidan Tian, Xining Su and Haikun Yu (University of Electronic Science and Technology of China, Zhongshan Institute, China)

Since the applications of mobile WiFi and Bluetooth signals are very popular and mature, in this paper, we propose an intelligent parking management system based on the technologies of WiFi positioning and Bluetooth control to manage the vehicles entering or exiting the parking lot. Only a dedicated app for the parking lot needs to be installed on the user's mobile phone, when the user drives near the parking lot, the roadside unit (RSU) end of parking lot can automatically complete the operation of vehicle identification. Based on the convenience and practicability, therefore, such a parking system using WiFi positioning and Bluetooth control is worth popularizing.

Autoencoder-based Image Companding

Alim Wicaksono H. P. and Heri Prasetyo (Universitas Sebelas Maret, Indonesia); Jing-Ming Guo (National Taiwan University of Science and Technology, Taiwan)

This paper presents a deep learning-based method for effective image companding. The autoencoder inherits the effectiveness of Convolutional Neural Networks (CNN) and residual learning framework to transform High Dynamic Range (HDR) images to Low Dynamic Range (LDR) and its reverse process. Since, the image companding task involves the non-differentiable operation, thus the encoder and decoder networks are alternately trained using an iterative approach. The experimental result clearly reveals that the proposed method yields a promising result.

Friendly Appearance of Multiple Secret Sharing

Heri Prasetyo (Universitas Sebelas Maret, Indonesia); Hsia Chih-Hsien and Chu Yu (National Ilan University, Taiwan); Albertus Wirawan (Universitas Sebelas Maret, Indonesia)

This paper presents a new technique for converting the Multiple Secret Sharing (MSS) from noise-like form into more friendly appearance. This technique simply utilizes the Chinese Remainder Theorem (CRT) and eXclusive-OR (XOR) operations on generating a set of shared images and recovering a set of secret image. As reported in the Experimental Section, the proposed method performs well in MSS system with friendly constraint. In addition, the proposed method requires simple operation for MSS task.

End-to-End Rapid FPGA Prototyping for Embedded Proactive BMI Control

Nan-Sheng Huang (The Maersk Mc-Kinney Moller Institute, University of Southern Denmark, Denmark); Jan-Matthias Braun, Ricardo Rodrigues do Carmo and Jørgen Christian Larsen (The Maersk Mc-Kinney Moller Institute University of Southern Denmark, Denmark); Poramate Manoonpong (University of Southern Denmark, Denmark)

This paper presents an end-to-end rapid prototyping methodology that performs automated and efficient mapping of desired neural networks onto FPGA. The design automation agent is considered as Autobot. An early prototype with the hardware decoder generated on the FPGA has been built, and its functionality has been evaluated. The experimental results show that Autobot can offer rapid end-to-end prototyping for neural network hardware generation for proactive BMI control.

Automatic Trace Recognition of Ionogram with YOLOv3

Tai-yuan Gong, Fan Sang, Tian-yu Yang and Zi-wei Chen (Beijing Jiaotong University, China)

The correct trace identification of the ionosphere in ionograms is one of the fundamental steps to the automatic scaling of ionograms. In this paper, a new method based on deep learning network is proposed to identify the traces of ionograms and ionospheric irregularities effectively. 12000 ionograms from the Chinese Academy of Sciences Digital Ionosonde installed at Huailai, Wuhan, Naning, Ganzi, and Xiamen are utilized to train the deep learning network and satisfying results with 83.9% mAP are obtained.

Automatic classification of ionogram with CNN

Wei Yi Cheng, Zi-wei Chen and Yidi Chen (Beijing Jiaotong University, China); Zewen Wan (BJTU, China)

The ionosphere is an essential part of the near-earth environment. Ionosphere classification, especially the irregularities identification via ionograms in real time has significant meaning in the ionospheric research. In this paper, a method based on CNN is proposed to classify the ionograms automatically. To train the CNN, over 20000 ionograms from Chinese Academy of Sciences Digital Ionosonde installed at Huailai, Wuhan, Hengxian, Ganzi and Xiamen are utilized. A good performance over 83% identification accuracy was achieved by the new method.

15:30 Analysis of an Active-Clamp Flyback Converter

Jing-Sheng Wong, Hung-Chia Wang, Chih-Wei Lin, Hao-Yu Xu and Yan-Ying Su (Vehicle Engineer of National Formosa University, Taiwan); Jian-Min Wang (National Formosa University, Taiwan)

This study explored the operation principles of active clamp flyback converters. A control strategy was adopted to achieve strong noise immunity, and a voltage mode was configured to attain advantages such as simple circuit design. Experiments were performed to verify the feasibility of the proposed active clamp circuit. The experiment results facilitated the completion of an active clamp flyback converter with a switching frequency of 300 kHz, an output power of 65 W, and an output voltage of 19 V.

15:45 A Lithium-Ion Battery Charger with Portable Monitoring Function

Sen-Tung Wu (National Formosa University, Taiwan)

This paper proposes a half-bridge LLC converter with center tapped rectifier circuit in secondary to achieve high power output. An output load simulator is utilized to simulate a battery charging situation which includes constant voltage (CV) mode and maximum output conditions. With pulse frequency modulation (PFM) technique, constant output voltage under different load conditions is achieved. Moreover, sensing elements are added to detect output load value. The user can monitor the output voltage and current through mobile phone immediately.

16:00 An Intelligent Fall Detection Design for Mobile Health-Care Applications

Jui-Hung Hsieh, Hui-Lan Zhang and Chih-Hao Lin (National Kaohsiung University of Science and Technology, Taiwan)

With increased aging of the population, concerns regarding the safety of home life continue to increase. However, the reduction in the number of elderly people who are injured in unforeseen events at home is the primary design issue. Additionally, smart homes currently use different fall detection strategies to improve security. Among these strategies, mobile fall detection is widely used in mobile devices to reduce the incidence of accidents. The mobile application processor system-on-a-chip within mobile devices uses intelligent thermal monitoring techniques, such as dynamic voltage frequency scaling (DVFS) mechanisms that provide a beneficial low-power consumption design and overheating protection mechanisms. Consequently, it is necessary to establish a DVFS-aware mobile fall detection design.

16:15 Analysis and Reduction of the Localization Error of the UWB Indoor Positioning System

Kuang-Hao Lin and Hou-Ming Chen (National Formosa University, Taiwan); Guan-Jin Li (National Formosa University, Taiwan); Ssu-Shun Huang (National Formosa University, Taiwan)

Object positioning is a trending topic currently. The global positioning system (GPS) is the most common positioning method. Cars rely on GPS to navigate and plan routes to destinations. Unmanned aerial vehicles employ the GPS to assist flight and achieve cruise functions of automatic altitude and fixed point flights. However, the GPS fails when positioning is conducted indoors because GPS signals cannot be received indoors. Therefore, an indoor positioning system (IPS) should be used for indoor positioning. This paper mainly discusses the localization error of an ultra-wideband (UWB) indoor positioning system. A two-triangle positioning method was used to locate a target point separately through each triangle. Finally, values obtained using the two triangles were calculated using an algorithm to obtain a more accurate position.

16:30 A 1.33 ppm/°C Precision Bandgap Reference with Piecewise-Linear Curvature Compensation

Hou-Ming Chen, Kuang-Hao Lin and Ching-Chie Chen (National Formosa University, Taiwan)

This paper presents a high-precision bandgap reference with a piecewise-linear curvature-compensation (PCC) circuit that produces a low temperature coefficient (TC). The proposed PCC compensation circuit uses six transistors to generate a piecewise-linear temperature voltage to reduce reference voltage variation within a wide range of temperatures. The proposed bandgap reference was designed using standard TSMC 0.18- μm 1P6M CMOS technology. Simulation results indicate that the proposed bandgap reference achieves a TC of 1.33 ppm/°C from -40°C to 140°C with a supply voltage of 1.8 V. The output voltage variation of the proposed circuit improved markedly from 1.13 to 0.24 mV over a temperature range of -40°C to 140°C.

16:45 A Small Remote-Controlled Nearshore Floating Waste Collecting Boat

Chao-Chun Ku (National Penghu University of Science and Technology, Taiwan); Ming-Lin Chuang, Shu Min Tsai and Ming-Tien Wu (National Penghu University of Science and Technology, Taiwan)

This work developed a small remote-controlled boat used to collecting nearshore floating waste. The developed collecting boat is small, low cost, and shallow draft such that is suitable for collecting floating waste in the shallow water, near sandy coast and reef. The boat is equipped with a floating intercepting net to collect waste through it. The web-based interface on the remote-control unit makes the boat can be controlled via smartphone, tablet, laptop, or desktop computer. In additions, the collecting boat uses solar power as an auxiliary power to extend the operation time.

D2: Advanced Image Processing and its Applications I

Room: Lyon A

Chairs: Ting-Lan Lin (National Taipei University of Technology, Taiwan), Shih-Lun Chen (Chung Yuan Christian University, Taiwan)

15:30 Soiling Detection for Photovoltaic Modules Based on an Intelligent Method with Image Processing

Po Ching Hwang and Cooper Cheng-Yuan Ku (National Chiao Tung University, Taiwan); James Chi-Chang Chan (Industrial Technology Research Institute, Taiwan)

The solar energy has grown significantly worldwide over the past few years. Therefore, maintenance of photovoltaic (PV) modules becomes a very important issue. In order to reduce the power loss caused by soiling deposits on the surface of PV modules, we propose an intelligent method to detect soiling situation using the techniques of artificial intelligence (AI) and image processing. This approach can assist operators in determining the schedule of cleaning plan for PV modules, thus reduces the labor and time cost of maintenance of solar plants.

15:45 Automated Dead/Bright Pixel Distance Measurement System on Computer Monitors

Waldir Silva (Universidade Federal do Amazonas, Brazil); Celso Carvalho and Thiago Brito (Federal University of Amazonas, Brazil); Ruan Belem and Caio Cruz (TPV Technology, Brazil); Lucas Coimbra (ICTS, Brazil); Diego A. Amoedo (Universidade Federal do Amazonas & Agência Nacional de Telecomunicações - Anatel, Brazil)

In this work we propose an automated dead/bright pixel distance measurement system for use on monitors and TV screen. The proposed system use Homography transformation and proportion estimation and some simple detection algorithms to detect edge, corners, and contour. As result, the proposed system perform the 700 Euclidean distance in millimeters. As result, the average distance measurement error was 0.44 millimeter.

16:00 Dead Pixel Detection on Liquid Crystal Displays using Random Forest, SVM, and Harris Detector

Celso Carvalho and Thiago Brito (Federal University of Amazonas, Brazil); Waldir Silva (Universidade Federal do Amazonas, Brazil); Caio Cruz and Ruan Belem (TPV Technology, Brazil); Lucas Coimbra (ICTS, Brazil)

Manufacturing TVs and monitors requires an effective method to detect the dead pixels. These defects are usually identified by operators manually. However, manual inspection is susceptible to failure due to human fatigue and generate a high cost for production process. In this work, conducted by three partners (UFAM/CETELI, ICTS and ENVISION/TPV), we propose three methods for automated detection of dead pixels. Two proposed methods were based on machine learning (ML) techniques, random forest (RF) and support vector machine (SVM) algorithms. The third method was based in digital image processing (DIP), Harris algorithm. As result, the SVM obtained the better performance with 92.1% of precision in two of three used image database.

16:15 Automated Video Monitor Screen Extraction using Semantic Segmentation and CNN

Ruan Belem, Caio Cruz and Agemilson Pimentel (TPV Technology, Brazil); Eddie B de Lima Filho (TPV & Universidade Federal do Amazonas - UFAM, Brazil); Lucas Coimbra (ICTS, Brazil); Anderson Jesus (Universidade Federal do Amazonas, Brazil); Andre de Souza Costa and Osmar R. A. Silva (ICTS, Brazil); Wilson Calixto Cordovil Junior (Universidade do Estado do Amazonas, Brazil); Ricardo Paula (ICTS, Brazil)

In the production lines of monitors, there are several types of tests, some of them based on visual inspection. One of the preliminary steps of this type of analysis consists in extracting the area corresponding to the monitor screen and applying the evaluation only in this area. Depending on the technique used, this step can consume much of the total test time. This paper presents an approach that uses semantic segmentation and convolutional neural networks (CNN) for screen segmentation, which allows reducing the total time of visual inspection tests in the monitor production line by at least 27% without compromising the accuracy in the extraction of the screen area.

16:30 Vehicle License Plates Preprocessing Techniques Using Graphical Interface

Lucas B. C. Tribuzy (Universidade Federal do Amazonas, Brazil); Yasmim P Torres and Rafael S Furtado (Federal University of Amazonas, Brazil); Waldir Silva (Universidade Federal do Amazonas, Brazil)

This work consists in the development of a graphical user interaction interface that enables the application of image preprocessing techniques in a region that includes the license plate, so that the input and output of the process are images. Five images preprocessing techniques are contemplated in this paper, to remove noise, enhance the image and detect characters, namely: Gaussian Filter, Sharpness Filter (Unsharp Mask), Otsu Threshold Filter, Sobel Edge Detector and Canny Edge Detector. The interface was built using the GUIDE (Graphical User Interface Development Environment) of the MATLAB software.

16:45 Classification of chroma reconstruction method by machine learning method

Meng-Hsuan Kuo, Yu-Chen Shen, Yih-Shyh Chiou and Shih-Lun Chen (Chung Yuan Christian University, Taiwan); Ting-Lan Lin (National Taipei University of Technology, Taiwan)

This paper talks about chroma reconstruction by using machine learning method. We create the feature matrix through the data from the luma and chroma. Via the feature matrix, we use the classification learner in Matlab to predict the subsample scheme which the encoder uses for reconstructing the chroma image. Additionally, we also discuss how to create the features in this paper.

17:00 Image-Enhancement-Based Data Augmentation for Improving Deep Learning in Image Classification Problem

Weihang Zhang, Yuma Kinoshita and Hitoshi Kiya (Tokyo Metropolitan University, Japan)

In this paper, we propose a novel data augmentation method based on image enhancement. When training CNN models for image classification, it is required to prepare sufficient training data taken in various conditions. However, traditional data augmentation

methods focus only on physical transformation, and shooting conditions of images such as exposure conditions are ignored. Therefore, we utilize an image enhancement method to generate images with different exposures. Experimental results show that the proposed method improves the classification accuracy of a CNN model. The results also demonstrate that combining the proposed method with other existing data augmentation methods provides further improvement of the classification accuracy.

D3: Artificial Intelligence Applications and Technologies in Internet of Things I

Room: Lyon B

Chairs: Chih-Yung Chang (Tamkang University, Taiwan), Wen-Hwa Liao (National Taipei University of Business, Taiwan)

15:30 An Energy Balanced Data Collection Mechanism for Maximizing Throughput using Uncontrolled Mobile Sink in WSNs

Chung-Chih Lin and Chih-Yung Chang (Tamkang University, Taiwan)

Collecting data in WSNs is the critical issue which has been investigated in past years. In literature, many studies proposed data collection algorithms using mobile sink. These studies can be further classified into two classes: controllable mobile sink and uncontrolled mobile sink. This paper considers the bus as the mobile sink and presents a distributed data collection mechanism, aiming to collect maximum data from sensors and prolong the lifetime of the given WSN as long as possible. Performance evaluation reveals that the proposed Energy Balanced Data Collection (EBDC) mechanism outperforms related works in terms of throughput and network lifetime.

15:45 Irregularity Detection of Daily Behavior Patterns Based on Unsupervised Learning

Cuijuan Shang (Chuzhou University, China); Chih-Yung Chang (Tamkang University, Taiwan); Bhargavi Dande (Tamkang University, India)

The irregularity detection of daily behaviors has received lots of attention, especially in homecare. An Irregularity Detection (IRD) algorithm is proposed to identify the irregular behavior patterns using the unsupervised learning. The distance and similarity between daily behavior patterns are designed as important features to build up the irregularity detection model. Experiments demonstrate that the proposed algorithm exceeds the existing unsupervised machine learning algorithms in terms of the numbers of False Negative and False Positive.

16:00 A System for Analyzing Pig's Behavior with AI

Chi-Ting Ni, Kiat Siong Ng and You-Rong Chen (National Cheng Kung University, Taiwan); Shen-Chang Chang and Chin-Bin Hsu (Council of Agriculture/Livestock Research Institute, Taiwan); Pei-Yin Chen and Shao-Chieh Liao (National Cheng Kung University, Taiwan)

In this paper, we combine an Internet of Things (IoT) and Artificial Intelligence (AI) to detect head, tail and body of a pig through the digital image processing and recognition method. Besides, the users can immediately be noticed under any abnormal conditions of the pigs through tracking their behaviors and analyzing their daily living. The users can also observe the environment of the pigsty and the current situation of the pigs through the online user interface.

16:15 Challenge of Anomaly Detection in IoT Analytics

Szu-Hong Wang (National Yunlin University of Science & Technology, Taiwan)

Many studies applied anomaly detection technology to varied areas such as fraud detection for finance activities, fault detection in industrial systems, and so on. However, big data rises to the challenge of performing a large scale of anomaly analytics in IoT. In this paper, we adopt several methods to analyze a real-world dataset on anomalous events in paper and pulp industry. By experiments, we discuss the findings and illustrate the difficulty in identifying anomalies, which provide useful information for further study.

16:30 Research on Real-Time Monitoring System of Miners' Work and Health based on LPWAN

Zhibin Meng (Datong Coal Mine Group Co., Ltd, China); Jing-zhao Li (Anhui University of Science and Technology, China)

The real-time monitoring system based on low-power wide area network (LPWAN) is built for the poor environment, as the high labor intensity, the heavy physical load and the poor health of the coal mine workers. The prediction method of miners' health status is proposed based on the long-term and short-term memory network (LSTM), and an intelligent sensing node with edge computing function is designed. The system can master the physical and working condition of miners in real time, and provide guarantee for the health of miners and the safety production of the coal mine.

16:45 Prediction of Syncope based on Physiological Data Analysis using Decision Tree Algorithm

Utkarsh Saxena (National Institute of Technology, Meghalaya, India); Soumen Moulik (National Institute of Technology, Meghalaya, India); Diptendu Sinha Roy (National Institute of Technology Meghalaya, India)

In this paper, we propose a method to predict the chance of Syncope or falling due to temporary loss of consciousness, based on an analysis of physiological data. We consider an authentic data set containing the measures of electroencephalogram, blood pressure, heart rate and blood circulation during different human activities, including fall. We experiment with this data set by employing supervised learning techniques, in order to predict Syncope efficiently. The proposed model gives an accuracy of 82.514% in Syncope prediction.

D4: Key Entertainment and Information Systems & Consumer Electronics for Health-care & Wellness

Room: Lyon D

Chair: Wai-Chi Fang (National Chiao Tung University, Taiwan)

15:30 A Convolution Neural Network Based Emotion Recognition System using Multimodal Physiological Signals

Cheng-Jie Yang and Nicolas Fahier (National Chiao Tung University, Taiwan); Wei-chih Li (National Chiao-Tung University, Taiwan); Wai-Chi Fang (National Chiao Tung University, Taiwan)

The detection and recognition of human emotional states have raised recent research interests for various applications from e-learning to chronic health conditions prevention. In this paper, we proposed an emotion recognition system based on the electrocardiogram (ECG) and photoplethysmogram (PPG) signals as objectives data input sources. Three emotion states (positive, neutral, negative) were defined as classification outputs. The training and validation data were collected by Kaohsiung Medical University (KMU) from 47 participants aged from 30 to 50 years old diagnosed with chronic cardiovascular health conditions. A convolution neural network (CNN) was built to efficiently map the subject's emotions with the extracted features from both ECG and PPG signals. This emotion recognition system achieved an accuracy of 75.4% for 3 classes outputs higher or similar than other models used in other works.

15:45 Right Light at the Right Time: Development of Innovative To-Do List Mobile Application to Optimize Circadian Lighting

Ya-Chih Wang and Nan-Ching Tai (National Taipei University of Technology, Taiwan)

In this paper, the design concept and theoretical foundation of a to-do list mobile application that can automatically control an in-home smart lighting system are presented. The objective is to create a better circadian lighting environment based on the user's scheduled workload. The system allows the user to concentrate better by emitting a bluish light during work hours and yellowish light later in the night to prepare the user for sleep.

16:00 Light Talks to Light: A Smart Lighting System Adapting to Behaviors of Bedtime Use of Smartphones

Shih-Chin LO and Nan-Ching Tai (National Taipei University of Technology, Taiwan)

This paper presents a design concept and a work-in-progress prototype that utilizes a microcontroller, LED lights, and light detecting sensors to create a smart lighting system suitable for users with behaviors of prolonged bedtime smartphone use. The system can create a balancing light and a small-range ambient light to reduce discomfort when using smartphones in the dark and can automatically turn off the lights in sequence with proper delays after the user falls asleep.

16:15 Implementation of Health Insurance Query Platform for Assisting Elderly People

Meng-Hsuan Fu, Deng-Chan Huang and Peng-Ru Chen (Shih Hsin University, Taiwan)

A health insurance query platform was built based on the goals of a concise interface, a clear description, and a smooth process to assist elderly people. To solve the problems of the lack of information, fraud, or false advertising, this platform provides the function of a health insurance query. This platform is immediately clear and allows searching for multiple insurance options at one time and providing a comparison of the results.

16:30 Development of an Augmented Reality Application for Protecting the Perspectives and Views of Architectural Heritages

Sih-Sian Li and Nan-Ching Tai (National Taipei University of Technology, Taiwan)

This paper presents the design concept and a work in progress prototype of an augmented reality (AR) mobile application to visualize the impact of a proposed building from the perspective of architectural heritage. The tool is made possible by resolving the occlusion between virtual new construction and real-built heritage. The current prototype allows relevant personnel to precisely locate the model of the proposed building on-site and evaluate the heritage architecture in front, along with visual blocks representing government-enforced tall building restrictions.

16:45 In-Depth Learning of Architectural Heritage with Application of Augmented Reality based on Sequential Scenes

Keng-Ho Lin and Nan-Ching Tai (National Taipei University of Technology, Taiwan)

This paper presents a design concept and a working prototype of an augmented reality application to enable the in-depth learning of an architectural design of an existing heritage from a real site. The application uses image recognition to set conditions for displaying different augmented digital contents based on prior location information extracted from the same scene. Consequently, more complex information based on the sequential spatial experience of architectural scenes can be conveyed with the use of the application.

D5: Advanced Circuits and Signal Processing Systems

Room: Lyon E

Chairs: Po-Yu Kuo (National Yunlin University of Science & Technology, Taiwan), Wen-Cheng Lai (National Penghu University of Science and Technology, Taiwan)

15:30 An Improved Recycling Folded-Cascode Amplifier with High Unity-Gain Frequency

Po-Yu Kuo (National Yunlin University of Science & Technology, Taiwan); Hong-Wei Liao and Jing-Siang Peng (National Yunlin University of Science and Technology, Taiwan)

An improved recycling folded cascade (IRFC) operational transconductance amplifier (OTA) is described in this paper. By applying the damping-factor-control (DFC) compensation technique for recycling folded cascade amplifier, the unity-gain frequency and dc gain are improved significantly. The proposed amplifier has been implemented using TSMC 0.18 μ m CMOS process. According to the simulation results, the proposed amplifier achieved 157.82MHz in unity-gain frequency and 90.19dB in dc gain while driving the same 5.6pF load.

15:45 Noise Reduction Using a Plane Microphone Array and a Spatio-temporal Sound Pressure Distribution Image

Kenji Ozawa and Koichiro Shiozawa (University of Yamanashi, Japan); Masanori Morise (Meiji University, Japan); Shuichi Sakamoto (Tohoku University, Japan)

This study proposes a noise-reduction method that utilizes a plane microphone array when the target and the noise sources are in a 2- π (sr) space. Outputs from the microphones are regarded as a 3-dimensional (3D) image, and its spectrum is obtained by the 3D fast Fourier transform. Based on the feature that the spatial spectrum of a target signal concentrates on the direct current (DC) component, we can estimate the noise amplitude. By subtracting it from the observed DC amplitude, we can reduce the noise. The results of a computational experiment performed in this study indicate that the proposed method achieved a noise reduction of approximately 20 dB, which is 15 dB larger than that achieved by a conventional delay and sum beamformer.

16:00 Noise Suppression of Artificial Intelligence Filter for Radio Frequency Interference

Wen Cheng Lai (National Taiwan University of Science and Technology, Taiwan)

This paper discusses design of area effective radio frequency interference noise reduction for low-pass filter using as switched-capacitor (SC) architecture. For noise suppression, noise via the power/ground lines is a serious issue. One of the noise reduction technique is a fully differential SC insertion, since the time constant of SC filter affects the balance of the supply noise and the ground noise, the noise reduction becomes maximum at a certain time constant. A fully differential SC is adopted via the bilinear transform of the corresponding analogue RLC passive prototype. The proposed SC with artificial intelligence method to reach the largest possible input dynamic range and optimized layout, the method of dynamic range scaling and minimum capacitor scaling is used.

16:15 An Implementation of Wireless Powering for Smart Sensor Nodes

Tseng-Yuan Chen, Che-Ting Yeh, Po-Chun Lu and Jia-Shiang Fu (National Central University, Taiwan)

Wireless power technology has gained importance in consumer electronics. In this work, an implementation of wireless power transmission system is demonstrated. A rectenna composed of a CMOS rectifier and a slot-loop antenna is proposed as the receiver for the wireless power transmission, whereas an aperture-coupled patch antenna is adopted in the transmitter. An LED that consumes 2 mA under 1.8-V bias is used as the load at the receiver. Measurement results show that, at frequency of 2.45 GHz and transmission distance of 8 cm, the LED is lighted up when 30 dBm of power is fed into the transmitter antenna. Under this condition, the output voltage of the rectenna is 1.77 V.

16:30 DC-DC Converter and Rectifier with Resonator for Underwater Wireless Power Transfer Module

Wen Cheng Lai (National Taiwan University of Science and Technology, Taiwan)

This paper designs a DC-DC converter and rectifier with resonator for wireless power transfer module (WPTM). The proposed boost DC-DC power converter serving as DC-to-AC converter with an embedded DC rectifier to provide the first-stage DC-DC converter, and charge pump support AC-to-DC converter with an input from the DC rectifier. Two differential, cross-coupled rectifiers as the charge pump circuit mitigate the reverse-leakage issue and they are cascaded to double the output voltage. The resonator uses the coil in multi-mode to drive Bluetooth low energy (BLE) and wireless charging functions for power receiving unit (PRU).

Monday, September 28 17:00 - 18:30

E1: The Trend of Artificial Intelligence of Things Technology

Room: Eiffel Hall

Chair: Ming-Fong Tsai (National United University, Taiwan)

17:00 Product Quality Prediction with Deep Transfer Learning for Smart Factories

Jehn-Ruey Jiang and Zi-Kuan Cheng (National Central University, Taiwan)

This paper proposes to use deep transfer learning (DTL) "layer freezing" method to build deep neural network (DNN) models for a target domain with few data on the basis of well-trained DNN models for a source domain with abundant data. Experiments using the DTL method are conducted for building DNN models to predict product surface roughness of wire electrical discharge machining (WEDM). The experimental results show that DTL indeed can help fast build models with high prediction accuracy for the target domain having few data.

17:15 Machine Learning-based Object Recognition Technology for Bird Identification System

Yu-Quan Ou (National United University, Taiwan); Cheng Hsun Lin (ITRI ICL, Taiwan); Tzu-Chi Huang (Lunghwa University of Science and Technology, Taiwan); Ming-Fong Tsai (National United University, Taiwan)

The object recognition system for machine learning has become widely known recently, and each algorithm of the object recognition system has its own advantages and disadvantages. The disadvantages are that the speed of identification is slow and the accuracy of identification is poor. The purpose of this paper is to identify birds through the YOLO and Custom Vision algorithms. When the user uploads bird photos to the two systems through a smart mobile device, the system will identify the objects according to the algorithm. It judges which bird it may be and, after a final comparison, the result with a higher percentage of accuracy is transmitted back to the user, thereby improving the accuracy of the identification system.

17:30 Smart Vending Machine System Prototyped with Deep- and Machine-Learning Technologies

Chang-Jun Chen and Bo-Ru Lin (National United University, Taiwan); Cheng-Han Lin (Fooyin University, Taiwan); Chi-Feng Chen (Feng Chia University, Taiwan); Ming-Fong Tsai (National United University, Taiwan)

This paper proposes a smart vending machine system combined with deep learning and machine learning technologies. The proposed system is combined with temperature, humidity and camera sensor to obtain consumer without individual information and upload this information to cloud server. The system uses face recognition with deep learning to obtain the gender information. It uses the k nearest neighbors (KNN) machine learning method to group based on temperature, humidity, time, price and gender information. The proposed system relies on grouping information to dynamically adjust price in real time.

17:45 Efficient Deployment Base Station of Beyond 5G Based on Deep Learning Algorithms

Bo-Hong Huang, Ying-Ting Lu, Sheng-Po Lin and Tin-Yu Wu (National Ilan University, Taiwan)

As the fifth generation mobile communication network (5G) is ready for commercial operation, the issues covered by the installation location of 5G base stations need to be solved. How to avoid interference during deployment and deploy in response to data traffic will be an important issue. The direction of consideration, because many interference environments have many complex factors. This study uses deep learning to help analyze the solutions to various interference problems, and find the best solution for base station deployment to reduce the occurrence of interference and improve the overall use. Rate, thereby improving the service quality of the overall system.

18:00 An Indoor Positioning Technique for On-demand AGV Calling System

Yun-Shuai Yu, Yu Pin-Yuan and Chin-Wei Chen (National Formosa University, Taiwan)

Trackless Automated Guided Vehicles (AGVs) are just now emerging in smart manufacturing environments. The trackless AGV can autonomously navigate itself based on an environmental map created by using the data acquired by lidar. In human/AGV collaborative workspaces, users may need to call AGVs to their positions for dynamic tasks. In this study, we developed an on-demand AGV calling system for users to call the AGVs using their handheld devices. The novelty of this study is the automatic conversion of the user position into the corresponding coordinates in the environmental map adopted by the AGV.

E2: Advanced Image Processing and its Applications II

Room: Lyon A

Chairs: Ting-Lan Lin (National Taipei University of Technology, Taiwan), Shih-Lun Chen (Chung Yuan Christian University, Taiwan)

17:00 Estimation of Person-Specific Visual Attention via Selection of Similar Persons

Yuya Moroto, Keisuke Maeda, Takahiro Ogawa and Miki Haseyama (Hokkaido University, Japan)

This paper presents a method for estimation of person-specific visual attention based on estimated similar persons' visual attention. For improving the estimation performance of person-specific visual attention, the proposed method uses the dataset including the large number of images and corresponding gaze data of many persons not including the target person and trains an estimation model based on deep learning. By using the estimated visual attention of similar persons for the target image, the proposed method estimates the visual attention of the target person. Experimental results show that the proposed method is effective.

17:15 Image Retrieval with Data Augmentation of Sentence Labels Based on Paraphrasing

Rintaro Yanagi, Ren Togo, Takahiro Ogawa and Miki Haseyama (Hokkaido University, Japan)

Text-based image retrieval is a fundamental study in the field of information retrieval. Recent text-based image retrieval methods employ deep neural networks (hereinafter referred to as deep neural TBIR) to retrieve a desired image from a sentence query and achieve the state-of-the-art performance in TBIR. To improve the retrieval performance of the deep neural TBIR method further, it is essential to prepare diverse sentence labels in training data. However, it takes a lot of effort to prepare diverse sentence labels in training data. To address this problem, we propose a novel deep neural TBIR method with data augmentation of the sentence labels in training data. Experimental results show the effectiveness of the proposed method.

17:30 Application of Image Detection of Algae on Aquaculture

Shu Min Tsai, Ming-Lin Chuang, Yung-Cheng Yao, Hao-Chen Chiu and Zheng-You Zhang (National Penghu University of

Science and Technology, Taiwan)

Due to the pollution of oceans and overfishing, the catching numbers of wild fish have been greatly reduced. So the aquaculture fishery has gradually become one of the important industries in Taiwan. However, aquaculture still needs to conform to natural ecosystem food chain, and the lowest producer class of the food chain is algae. Hence how much algae feed rotifers has become an important work in aquaculture. This paper proposes a set of algae image detection and measurement system. The system provides high accuracy rate which achieves 86.46%. After image processing and detection algorithm, the amounts of algae are evaluated immediately. In aquaculture industry, the system can reduce the manpower and obtain bio-quantity. It can benefit the aquaculture.

17:45 Color Filter Array Demosaicking Algorithm Based on Convolutional Neural Network

Hsi-Hao Chang, Xin-Hong Lai and Jun-Liang Chen (Chung Yuan Christian University, Taiwan); Ting-Lan Lin (National Taipei University of Technology, Taiwan); Chiung-An Chen (Ming Chi University of Technology, Taiwan); Shih-Lun Chen (Chung Yuan Christian University, Taiwan)

This paper presents a new demosaicking algorithm based on machine learning for color filter array (CFA) images. The proposed algorithm includes two convolutional neural network (CNN) machine learning methodologies. The first is Pooling which provides a method for judgment and the other one is Shared Weights which reduces the parameter requirement and improves the overall performance of machine learning. Five types of patterns and eight interpolation methods of blocks are selected by the machine learning to improve the quality of demosaicking images. The experimental results show that the average PSNR can reach 35.05 dB and the average SSIM can reach 0.9848 by the proposed algorithm.

18:00 SVM-Based Root Identification Algorithm Using Ridge Features and Eroded Masks

Jian-Jiun Ding, Jen-Chieh Cheng, Xian-Cheng Lu, Sheng-Feng Tsai, Hsin-Ju Li, Hung-Chi Liu, Yan-Jyun Liou and Cho-Ying Huang (National Taiwan University, Taiwan)

In botanical image processing, it is challenging to identify roots automatically since roots occupy only a very small part of the image and their colors are similar to those of soil. To address this, we apply three strategies. First, to fit the characteristics of roots, many ridge-like filters are applied. Second, the machine learning method of the support vector machine is applied and the boost mechanism is adopted. Also, morphology is adopted to avoid applying the pixels in the border as the training data. With these techniques, the roots with a variety of colors and widths can be accurately extracted.

18:15 A Low-Complexity and Hardware-Oriented Image Stitching Algorithm

Fu-Jung Wen, Jr-Yu Lin and Yih-Shyh Chiou (Chung Yuan Christian University, Taiwan); Ting-Lan Lin (National Taipei University of Technology, Taiwan); Chiung-An Chen (Ming Chi University of Technology, Taiwan); Shih-Lun Chen (Chung Yuan Christian University, Taiwan)

This paper presents a hardware-oriented image stitching algorithm with the characteristic of low complexity. The proposed algorithm is developed by using the feature from the accelerated segment test (FAST) algorithm to extract feature point, and combines scale invariant feature transform (SIFT) descriptor to perform feature matching. In order to be suitable for hardware implementation, the proposed algorithm was simplified by using the optimal seam algorithm widely used to achieve seamless image stitching and eliminate ghosting. Moreover, the obvious lines at the stitching seam due to the color difference are reduced by the low-pass filter. Experiment results show that the proposed algorithm has benefits of seamless images with high quality and calculation with low complexity.

18:30 Patch-based Painting Style Transfer

Fay Huang and Chia-Lin Chien (National Ilan University, Taiwan)

Approaches based on convolutional neural network framework have proven to be effective in various of style transfer scenario. Most approaches train the network to process the photo as a whole, and gradually transform it into a user specified painting style. In contrast to that, this paper proposed a brush-based concept, which inherits the spirit of the stroke-based rendering. The input photo was first partitioned into small patches. A modified version of the generative adversarial network has been adopted to transform each patch into a brushstroke of a given style. After merging all the generated brushstrokes, it produces the desired style transfer result. The proposed style transfer approach preserves the geometrical structure of the input image; only color and texture are to be altered during the process.

E3: Artificial Intelligence Applications and Technologies in Internet of Things II

Room: Lyon B

Chairs: Chih-Yung Chang (Tamkang University, Taiwan), Wen-Hwa Liao (National Taipei University of Business, Taiwan)

17:00 Cloud-based Real-time and Remote Human Activity Recognition System using Wearable Sensors

Nurul Amin Choudhury and Soumen Moulik (National Institute of Technology, Meghalaya, India); Sanjoy Choudhury (S N Bose National Centre for Basic Sciences, India)

In this paper, we propose a cloud-based real-time human activity recognition system. First, we develop a wearable system that contains an Accelerometer sensor, an analog to digital converter and a WiFi module in order to sense human movement data and transmit the sensed data to cloud. Then we apply Machine Learning algorithm to classify different human activities. The proposed system is able to achieve an average of 93% accuracy in classifying the different activities efficiently.

17:15 Virtual Grid-Based Data Collection Using Mobile Sink in Wireless Sensor Networks

You Xi Lee (Tamkang University, China); Chih-Yung Chang (Tamkang University, Taiwan); Jiazao Lin (Peking University, China)

In wireless sensor networks (WSN), many studies in recent years have considered using mobile sink (MS) for data collection. A large number of studies focused on the collection points (CP) selection and routes construction, aiming to reduce the working loads of data-forwarding among the sensor nodes and prolong the network lifetime. This paper presents a virtual grid-based data collection (VGDC) scheme using mobile sink, aiming at balancing the energy dissipation of sensor nodes. The proposed VGDC partitions the monitoring region into a number of virtual grids. Then it selects a collection point in each grid responsible for collecting data of the other sensor nodes in the grid. To balance the workload of forwarding loads of all sensors, two policies are adopted. First, the VGDC maximizes the total number of CPs by minimizing the grid size under the constraint of predefined path length. Second, the collection points are dynamically changed in different rounds. Performance evaluations reveal that the proposed VGDC outperforms existing studies in terms of energy consumption and network lifetime.

17:30 Water Leakage Detection in Hilly Region PVC Pipes using Wireless Sensors and Machine Learning

Soumen Moulik (National Institute of Technology, Meghalaya, India); Shubhankar Majumdar and Vipin Pal (National Institute of Technology Meghalaya, India); Yogita Thakran (Indian Institute of Technology Roorkee, India)

In this paper, we propose a water leakage or blockage detection system for hilly region. The main approach of the proposed system is to study the differences of vibrations generated through different water levels in pipes. We use wireless sensors to capture the vibration of PVC pipes while water flow through them. We apply machine learning algorithm on these vibration records to identify any interruption in the normal water flow due to leakage and blockage.

17:45 An AI-based Real-Time Roadway-Environment Perception for Autonomous Driving

Shubham Verma and Motahar Reza (National Institute of Science and Technology, India); Sanjoy Choudhury (S N Bose National Centre for Basic Sciences, India); Jatindra Dash (SRM University, India); Diptendu Sinha Roy (National Institute of Technology Meghalaya, India)

Real-time roadway-environment perception is one of the primary applications of IoT based autonomous driving to improve road safety. Roadway-environment insights include on-road detection of any type of moving vehicles, non-vehicle (persons, animals, etc.), curves and lanes. There have been various studies that provided Artificial Intelligence (AI)-based detection approaches, however, most of the methods are atomistic which are not well suited for such real-time autonomous driving owing to high detection latency and low accuracy. Therefore, in this paper, we propose a holistic AI-based roadway-environment learning system for simultaneous real-time detection of various on-road objects with high accuracy (more than 90%) at reduced computation complexity.

18:00 An Energy Recharging Mechanism for Maximizing Surveillance Quality Using Mobile Charger in WSNs

Yuanping Kan (Tamkang University, Taiwan); Chih-Yung Chang (Tamkang University, Taiwan)

In recent years, it has become a popular way to extend the lifetime of wireless sensor networks (WSNs) by using mobile charger. The coverage and connectivity of the WSNs are two important factors influencing the lifetime of WSNs, which have not been well considered. An energy recharging mechanism (ERMMS) using coverage and connectivity to decide which sensors to be charged, is proposed to make the WSN network have cumulative maximum coverage. The simulation results show that the proposed method makes the WSNs have more coverage and the charger charging more sensors at the same time, which indicates that the proposed algorithm can maximize the surveillance quality of the WSNs.

18:15 Markov Transition Field and Convolutional Long Short-Term Memory Neural Network for Manufacturing Quality Prediction

Jehn-Ruey Jiang and Cheng Tai Yen (National Central University, Taiwan)

This paper proposes a manufacturing quality prediction method, called MTF-CLSTM, to integrate the Markov transition field (MTF) model and the convolutional long short-term memory (CLSTM) neural network for wire electrical discharge machining (WEDM). Experiments are conducted to evaluate the proposed method in terms of the mean absolute percentage error (MAPE). Experimental results show that the proposed method outperforms a related method proposed recently.

E4: Smart Integrated Power Driver for Consumer Electronics

Room: Lyon D

Chair: Chin Hsia (National Central University, Taiwan)

17:00 A Regulated Pulse Current Driver with Spread Spectrum Technique

Ming-Shian Lin (National Taiwan University, Taiwan)

This paper proposes a regulated pulse current driver with spread spectrum technique to lower electromagnetic interference (EMI) effect. A spread spectrum clock generator (SSCG) is used and implemented with triangular wave bias. The results show a 7dBm reduction of the peak power level with a frequency deviation of 10%, demonstrating that the driver effectively reduces peak power and EMI.

17:15 Improving the ESD Robustness of an Ultra-high voltage nLDMOS Device with the Embedded Schottky diode

Po-Lin Lin, Shen-Li Chen, Fan Sheng Kai, Tien-Yu Lan, Yu-Jie Zhou and Shi-Zhe Hong (National United University, Taiwan)

In this paper, ultra-high voltage (UHV) nLDMOS devices with drain-side embedded Schottky diode for improving ESD ability via TSMC 0.5- μm 300-V BCD process has been proposed and verified. In order to improve the ESD ability without extra layout area adding, the embedded layout skill is known as the area-efficient method to increase the ESD ability. The proposed new structure of nLDMOS is embedded Schottky diodes at the drain side, and the drain side is divided into three concentric circles. The influence of these embedded Schottky diodes and the original LDMOS with different arrangement on the ESD ability is discussed. Compared with the Reference pure LDMOS, which show that the HBM values of the pure Schottky diodes (MMM-type) and embedded Schottky diodes in the middle and outer circles (NMM-type) increased from 1000-V to 5500 / 5000-V, respectively.

17:30 Dimmable flicker-free Linear LED Driver

Ching-Ning Jao, Li-Jie Huang and Chin Hsia (National Central University, Taiwan)

The paper presents the design of a linear dimmable flicker-free LED driver. The driver consists of a preamplifier in series with a linear regulator and forms a drive loop with the LED string. The output current of the pre-amplifier adjusts adaptively with the amplitude of the AC input bus and therefore, the voltage across the linear regulator remains at the minimum required to maintain the desired string current while reducing the power variation on the LEDs. In addition, the linear regulator detects and provides a constant current to the LEDs based on fluctuations in the input voltage, which effectively eliminates flicker and maintains high system efficiency. The designed driver is compatible with a variety of triac circuits and achieves flicker-free in all dimming situations. Operating across an AC input voltage of 110~150 V, with an input power of 4.5 W, the LED driver achieves larger than 85% efficiency, percent flicker of 0.03%, and power factor of 72%.

17:45 Novel High-Voltage Power Driver with an Active Floating Gate Bias for Medical Ultrasound Pulse Generators

Li-Jie Huang, Chin Hsia and Deng-Fong Lu (National Central University, Taiwan); Yen-Chung Huang (Industrial Technology Research Institute, Taiwan)

The article presents a novel high-voltage power driver circuit that can be used to drive a variety of capacitive or resistive loads, applied for medical ultrasound pulse generators. The output stage of this circuit employs a pair of stacked power inverters and the novel active floating gate bias circuit, which can adaptively switch the power devices between low and high voltage conditions. Therefore, the output stage can generate rail-to-rail high-voltage signals within a safe operating range. The circuit architecture has been implemented to drive a 100-pF capacitor in parallel with a 1-K ohm resistor load. With an operating frequency of 20 kHz, the circuit can produce a three-level high-voltage pulse signal with the maximum peak-to-peak voltage of larger than 120 volts.

18:00 ESD-capability Influences of UHV Circular nLDMOS Transistors by the Drain-side Ladder-Step STI

Tien-Yu Lan, Shen-Li Chen, Fan Sheng Kai, Po-Lin Lin, Yu-Jie Zhou, Shi-Zhe Hong and Hung-Wei Chen (National United University, Taiwan)

In this paper, the ladder-step STI and ladder-step STI with parasitic silicon controlled rectifiers (SCRs) of 0.5- μm circular ultra-high-voltage n-channel laterally diffused MOSFETs (UHV-nLDMOSs) were modulated to explore the different ESD-capability influence in the different testing samples. Finally, we can find that as the ladder-step STI become deeper, the HBM immunity will be better. In addition, the embedding SCR path with ladder-step STI also can improve HBM a lot. Almost modulations of the ladder-step STI and the ladder-step STI with parasitic SCR have better HBM-capability than that of the pure nLDMOS reference device.

18:15 A Novel SCR-based Schottky Diode and Lightly P-well Additions of HV 60V nLDMOS on ESD Capability

Fan Sheng Kai, Shen-Li Chen, Po-Lin Lin, Shi-Zhe Hong, Tien-Yu Lan and Yu-Jie Zhou (National United University, Taiwan)

Using an embedded silicon-controlled rectifier (SCR) on the protection element was often used in the high-voltage electrostatic discharge (ESD) protection design. In this paper, a novel structure of embedded SCR on HV n-channel lateral diffused MOS (nLDMOS) is proposed, which has a higher secondary break current (I_{t2}) than the original structure of embedded SCR by embedding an SCR in the drain middle zone, and it can significantly improve the risk of the too low holding voltage. In addition, by the drain-side heavily doped (N+) removed equivalent a Schottky diode addition, which is helpful for improving the discharge current capability. Moreover, adding the lightly P-type well below the P+ region of the embedded SCR can more improve the capability of discharge ESD current. The elements after adjustment, the proposed embedded SCR element can have higher Latch-up immunity and greatly improve the ESD immunity of the protection elements.

E5: Circuits and Systems for Deep-Learning Based Image Processing

Room: Lyon E

Chairs: Kuan Hung Chen (Feng Chia University, Taiwan), Chih-Peng Fan (National Chung Hsing University, Taiwan)

17:00 Biometric Authentication with Combined Iris and Sclera Information by YOLO-based Deep-Learning Network

Chia-Wei Chuang and Chih-Peng Fan (National Chung Hsing University, Taiwan)

In this work, the effective YOLO-based iris and sclera deep-learning classifier is studied for biometric authentication. By joint the partial iris and sclera information, the traditional sclera and iris segmentation pre-process is not required. By the YOLO-based model, the visible-

light eye images are labelled with the jointly partial iris and sclera region, and the identity classifier is trained to inference the person's identity. By the UBIRIS image database for performance evaluations, the proposed YOLOv2 based joint iris and sclera identity classifier achieves the mean average precision (mAP) up to 99.83%, and the average inference time per one image of the YOLO model can be also reduced by using less number of anchor boxes. Compared with the previous works, the proposed design is more effective without any iris and sclera segmentation computations.

17:15 Cordic Based Hardware Implementation for Object Region Layer of Yolo V2

Chung-Bin Wu (NCHU, Taiwan); Yu-Kuan Hsiao (National Chung-Hsing University, Taiwan)

This paper proposes the hardware architecture design and implementation for the region layer of Tiny Yolo V2 by calculating Softmax and Bounding Box to get the classification and the location of the object. The proposed architecture is composed of three units: Sigmoid unit, Softmax unit, and Bounding Box unit. To reduce the calculation complexity, data reordering of thresholding confidence score is provided to reduce the numbers of input of the Sigmoid unit. Moreover, reducing class and coordinate as the input of the Softmax unit and Bounding Box unit to calculate the accurate classification and location of the object is also presented. Furthermore, Coordinate Rotation Digital Computer (Cordic) based operation is adopted to the process of Exponential and Natural Log to reduce the complexity of the operation and speed up the operation time in our design. Experiment results show the proposed architecture can achieve real-time operation in Yolo-v2.

17:30 3D Pose Estimation based on Deep Learning without Real World Data Training

Chen-Ruei Sin and Wei-Liang Lin (National Chung Hsing University, Taiwan)

This paper proposes a new methodology to carry out the 3D pose estimation of an object. We assume a single lens camera environment, and use a game engine to generate virtual world datasets in order to assist a deep learning model. Using only the virtual world datasets to conduct training has been tested with the real world data and the accuracy can be achieved up to 84.22% with 30M parameters.

17:45 Perception Module Design of Self-Driving Vehicles for Navigation in People-Rich Environments

Kuan Hung Chen, De-Sheng Chen and Yang-Ru Chen (Feng Chia University, Taiwan)

Indoor vehicles move on overlapping zones with people indoor makes navigation in environment with crowds become a much more challenging task than moving in outdoor. The perception module should detect the locations of all surrounded objects and know their distances. Hence, this paper presents a Camera-LiDAR-fused perception system for indoor self-driving vehicles. This paper presents the calibration method for fusing camera and LiDAR data together in details. The calibration method may be applied to other kinds of sensors. In addition, the paper provides accuracy analysis of predicted distances of objects. The prediction results are able to be guiding information for the autonomous vehicle.

18:00 An Efficient Accelerator for Deep Convolutional Neural Networks

Yeong-Kang Lai and Yi-Xian Kuo (National Chung Hsing University, Taiwan)

Convolutional neural networks (CNN) in deep learning have become popular in many recent applications, from speech recognition to image classification and object detection. Among them, YOLO (You only look once) is a fairly well-known algorithm in object detection. YOLO convolutional neural networks require a large number of multiplication and accumulation calculations. On the edge side, special hardware needs to be designed to speed up the calculation. In order to reduce the hard-ware cost, a new distributed arithmetic (DA) architecture similar to NEDA is proposed. The multiplier is re-placed by adders. The purpose is to reduce the cost of power consumption and area, while maintaining the high speed and accuracy. Mathematical analysis proves that DA can only use addition to implement multiplication in the form of two's complement, and then perform data shift at the end to achieve the operation of the adder instead of the multiplier. In addition, in this paper, after Convolution, Max-Pooling is performed to reduce Bandwidth. Finally, the biggest feature of this paper is that a PE can perform a MAC operation of 1.78 under a clock cycle. The three methods proposed above are more specific ideas for this paper. The papers that have been studied so far do not have similar related ideas and technologies.

18:15 AdaGrad gradient descent method for AI Image Management

Peng Yang (Advanced Semiconductor Engineering Inc., Taiwan)

In this study, we used AdaGrad gradient descent method in optimizer for image deep learning, and compare with Adam gradient descent methods. After processing over six thousand huge database of through silicon via images, AdaGrad shows a fast convergence and less generalization errors than Adam, the result help Artificial Intelligence make the management of image judgment more accurate and faster.

18:30 No-Reference Video Quality Assessment by Multilayer Selected Deep Features and Neural Networks

Zheng-Lung Chu and Tsung-Jung Liu (National Chung Hsing University, Taiwan); Kuan-Hsien Liu (National Taichung University of Science and Technology, Taiwan)

In this work, we propose a general-purpose no-reference (NR) video quality assessment (VQA) metric based on the cascade combination of 2D convolutional neural network (CNN), multi-layer perceptron (MLP), and support vector regression (SVR) model. The features are extracted from both spatial and spatiotemporal domains by using a 2D CNN. These features can capture different aspects of video frames. We take these features as inputs of the MLP to obtain estimated quality scores on different perspectives. Finally, these quality scores are combined as a final quality score by an SVR model. The proposed method is evaluated on the well-known LIVE Video quality database with other state-of-the-art VQA metrics. And the experimental result demonstrates that our method is competitive with other full-reference and NR VQA metrics.

Monday, September 28 19:00 - 21:00

Welcome Reception (Versailles Hall)

Tuesday, September 29

Tuesday, September 29 9:00 - 10:30

F1: Deep Learning-based Multimedia Signal Analysis and Restoration

Room: Eiffel Hall

Chair: Li-Wei Kang (National Taiwan Normal University, Taiwan)

9:00 Position-Aware Communication via Self-Attention for Multi-Agent Reinforcement Learning

Tsan-hua Shih (National Taipei University of Technology, Taiwan); Hsien-I Lin (National Taipei Institute of Technology, Taiwan)

Multi-agent reinforcement learning is important for real-world applications but is still a challenging problem. A feasible way is to share information among all agents via a communication channel. In recent years, attentional communication emerged in order to differentiate valuable information especially with a large number of agents. However, existing attentional communication, which relies on long short-term memory (LSTM) units with attention mechanism, makes parallelization difficult. Another problem is that the output of LSTM is dependent on the sequence of agents, but the relationship between agents, in general, is not sequential. In this paper, we proposed using multi-head self-attention layer, which is proposed from a well-known net "Transformer", as a communication channel for parallelization. Attention mechanism is independent of the sequence of agents. In addition, we also incorporate position information via positional encoding. In our experiments, the proposed method achieves improvements in terms of reward compared with existing approaches.

9:15 An Application of Text Detection and Recognition for Electronic Design Automation

Chih Chang Yu, Hsiao-Wei Chen, Tzu-Ying Chen and Po-Hao Chen (Chung Yuan Christian University, Taiwan); Hsu-Yung Cheng (National Central University, Taiwan)

This work proposed an application of text detection and character recognition which is used for improving electronic design automation (EDA). Images used in this work contain colored regions and texts enclosed by an external boundary such as a circle or a polygon. Instead of using complicated methods, this work adopts several efficient image processing methods to extract true text regions followed by optical text recognition (OCR). Since the desired texts are not in normal form, we proposed some mechanisms to classify the characters into several types: normal, superscript, and subscript. In the experiments, the accuracy of judging the location information of block text can reach 93.36%. The proposed design can significantly improve the application of text detection and recognition in EDA.

9:30 Thermal Image based Remote Heart Rate Measurement on Dynamic Subjects Using Deep Learning

Duan-Yu Chen (Department of Electrical Engineering, Yuan Ze University, Taiwan); Hwei-Siang Zou and An-Ting Hsieh (Yuan Ze University, Taiwan)

In this work, we propose a method of heart rate estimation by using the infrared thermal images as input. When the heart beats that causes the blood vessels to periodically vasoconstriction and vasodilation, there will be a tiny periodic temperature change on face area. Therefore, the temporal signal from thermal images is considered as the input to our designed DEWNet (DenseWave Net) CNN model for heart rate estimation. In the experiment, we collected a dataset containing 24 subjects who were running on the treadmill with five different running speeds. Consequently, using this dataset the average error is 13.592 bpm, which shows its feasibility for real-world applications.

9:45 Deep Learning-based Moiré Pattern Removal from a Single Image: A Survey and Comparative Study

Li-Wei Kang and Chen Lo (National Taiwan Normal University, Taiwan); Chia-Hung Yeh (National Sun Yat-Sen University, Taiwan)

Moiré pattern in a single image is common in image visual quality degradation induced by frequency aliasing between cameras and monitors when taking a screen-shot photo. It is mainly resulted from the interference between the pixel grids of the camera sensor and the device screen. However, removal of the Moiré patterns is challenging based on the complex frequency distribution and imbalanced magnitude in color channels. Only a few studies in the literature focused on the solution of Moiré pattern removal from a single image. Traditional studies usually treated the problem as an image denoising problem and applied some filtering or signal decomposition operations based on some image priors (e.g., sparsity). Relying on the rapid development of the deep learning techniques, some deep learning-based approaches of Moiré pattern removal have been presented recently. This paper presents a brief survey and comparative study for the recent deep learning-based research works on Moiré pattern removal and discusses possible further research directions.

10:00 Siamese Networks Based People Tracking for 360-degree Videos with Equi-angular Cubemap Format

Kuan-Chen Tai and Chih-Wei Tang (National Central University, Taiwan)

This paper proposes a deep learning based pedestrian tracking scheme for 360-degree videos using equi-angular cubemap (EAC) format. To be robust against content discontinuity of EAC images, this paper proposes an efficient face stitching scheme such that the tracker keeps tracking across adjacent faces and avoids raising geometric deformation simultaneously. By referring to statistics of score maps from efficient fully-convolutional siamese networks, the proposed mechanism of template update determines the timing of update. Experimental results show that the proposed tracker operates at 60 fps and outperforms the fully convolutional siamese networks based tracker on 360-degree videos with EAC format both in precision plots and success plots.

10:15 Foreign Objects Removal for Self-driving Mapping

Augustine Tsai (Institute for Information Industry, Taiwan); Fay Huang (National Ilan University, Taiwan); Jheng-Lun Liou and Ming Chun Tseng (National Taiwan University, Taiwan); Pu-Sheng Hu (National Ilan University, Taiwan)

A clean map free of foreign objects is essential for self-driving car navigation without compromising localization accuracy. An idea map scanning is to start with a static environment, but it is less likely to prevent cars, cyclists and pedestrians from entering the scene. The situation can result in unwanted noises in the final maps. In this paper, we propose an end-to-end deep learning method to mitigate the problems. The foreign objects are detected and removed in each raw point cloud frame before map generation. Qualitative experiments show the efficacy of the method.

F2: Information and Communication Technologies for Consumer Electronics

Room: Lyon A

Chair: Cheng-Yuan Chang (National United University, Taiwan)

9:00 Device-Free Indoor Human Activity Recognition Using Wi-Fi RSSI: Machine Learning Approaches

Chao-Feng Hsieh, Yi-Chu Chen, Cheng-Ying Hsieh and Meng-Lin Ku (National Central University, Taiwan)

A device-free methodology is proposed to recognize the human activity in indoor environments using WiFi received signal strength indication (RSSI), and several machine learning (ML) approaches are investigated to realize the activity detection. With multiple access points (APs), the RSSIs are synchronously collected at multiple mobile phones (MPs) with different locations over a time duration and served as input data for training the detectors, enabling us to recognize the human activities of either moving or stationary. Extensive real experiments are conducted in the frequency bands of 2.4 GHz and 5 GHz, and the results show that the proposed methods can achieve over 95% recognition accuracy in the 5 GHz frequency band.

9:15 Hardware Implementation and Performance Evaluation of DOCSIS 3.1 Upstream System

Kwanwoong Ryu and Joon-Young Jung (ETRI, Korea (South)); Han-Jae Im (Huton Co. Ltd, Korea (South))

DOCSIS 3.1 is designed to enable data services up to 10 Gbps down to 1 Gbps for high-speed data services such as 4K UHD, multi-screen video streaming services, and cable IPTV. In this paper, we design and implement such an upstream system of DOCSIS 3.1. In addition, the BER characteristics of the DOCSIS 3.1 upstream module implemented through various laboratory tests are compared and analyzed.

9:30 A Modified Phase Generation Mechanism for PAPR Reduction in SLM-OFDM Systems

Sheng-Qiang You (Chaoyang University of Technology, Taiwan); Cheng-Ying Yang (University of Taipei, Taiwan); Hsin-Ying Liang (Chaoyang University of Technology, Taiwan)

In this paper, we proposed an modified phase generation mechanism used in the selective mapping (SLM) scheme for peak to average power ratio (PAPR) reduction in QPSK-OFDM systems. Ali et al. proposed the modified phase generation mechanism used in the SLM scheme, called PRS-SLM, which based on the architecture of the seed matrix reduces the PAPR of OFDM signals and the large amount of computation. Two modified mechanisms for phase generation proposed in this paper to improve the PAPR performance of the PRS-SLM scheme, also based on the architecture of the PRS-SLM scheme, called them the single-point mode and the interleaved mode respectively. According to the simulation results, the proposed method has systematic structure and the better PAPR reduction performance than the PRS-SLM scheme.

9:45 Implementation of Smart Animal Tracking System Based on Artificial Intelligence Technique

Wei-Tse Peng and Cheng-Yuan Chang (National United University, Taiwan)

In the traditional zoos, ecological parks and wildlife preserves, the animal signboards are usually set up to guide the visitors to recognize the current animals. However, these traditional animal nameplates just only provide simple profiles and introductions of the animals, but cannot let the visitors know where the desired animals are (i.e., their current location) immediately, which lacks of interactivity and convenience. In view of the above problems, a smart animal tracking system based on deep learning technique is proposed in this paper. The proposed system is mainly implemented by using image recognition and tracking techniques, Arduino development board and image processor, thus it can achieve the purpose of allowing the users to observe animals which they want to look for much more conveniently and quickly.

10:00 Trends and Challenges for the Spectrum Sensing in the Next Generation of Communication Systems

Myke D. M. Valadão and Waldir Silva (Universidade Federal do Amazonas, Brazil); Celso Barbosa Carvalho (Federal University of Amazonas, Brazil)

In order to obtain efficient ways to use the spectrum frequency the cognitive radio (CR) uses spectrum sensing techniques to allocate

secondary users (SU) dynamically. Exist two classes of spectrum sensing techniques, narrowband and wideband sensing. But, with the increase of demand of spectrum and new technologies like 5G, techniques based on narrowband sensing begin to become inefficient. For achieve high data rates, needed for the next generation of communication systems, the wideband sensing techniques became promising. In this article, we present the most promising techniques of the wideband sensing.

F3: Intelligent Devices, Circuits, Systems, and Algorithms for Smart Lives

Room: Lyon B

Chairs: Chien-Cheng Tseng (National Kaohsiung First University of Science and Technology, Taiwan), Cheng-Ming Huang (National Taipei University of Technology (TaipeiTech), Taiwan)

9:00 Real-Time Lighter Sound Recognition System for IoT Applications

Che-Wei Chen, Szu-Hong Wang and Ming-Hwa Sheu (National Yunlin University of Science & Technology, Taiwan); Tzu-Hsiung Chen (Taipei Chengshih University of Science & Technology, Taiwan)

Governments set up smoke detectors and signs to prevent people from smoking in public, however it didn't work out. Therefore, we came up this idea that detect the lighter sounds at some corners and blind spots. If the device confirmed the sound matches sample sounds, it will trigger the alarm, record the video, and inform managers immediately. This system applied sound recognition, Fast Fourier Transform, Zero-crossing rate, OpenEAR, PortAudio, OpenSMILE, LibSVM, MFCC, SVM-scale, and IoT. We used Raspberry Pi 3 and ReSpeaker 2-Mics Pi HAT to achieve our goal. The averaging recognition rate is 92.63% at 3m distance.

9:15 A Low-Cost Vital-Sign Sensor Based on Bluetooth System

Kang-Chun Peng and Jen-Hao Lee (National Kaohsiung University of Science and Technology, Taiwan)

In this work, a low-cost vital-sign sensor based on Bluetooth system is developed. The sensor transmits a standard Bluetooth signal toward a human chest. The Bluetooth signal is Doppler-modulated and reflected by the human chest. After receive the reflected signal, the sensor cancels out the Bluetooth information by applying the correlation technique and then obtains the human vital signs. Therefore, the sensor can shares its transceiver with a Bluetooth system and concurrent operates. Experimental results demonstrate that the developed vital-sign sensor can successfully detect the heartbeat and respiration of the human under test using Bluetooth system. The detection range is up to 1 m.

9:30 Study of Deep Metric Learning on Character Classification

Po-Hsuan Yen and Chien-Cheng Tseng (National Kaohsiung University of Science and Technology, Taiwan); Su-Ling Lee (Chang-Jung Christian University, Taiwan); Zong-Zheng Hong (National Kaohsiung University of Science and Technology, Taiwan)

In this paper, traditional one-hot encoded network is compared with three deep metric learning methods by using contrastive loss, triplet loss, and quadruplet loss on character classification task. Experimental results show that deep metric learning methods provide similar performance to one-hot encoded network, but have more advantages and less label requirements. On the other hand, by comparing these well-known deep metric learning methods under the same number of parameters, their differences are also summarized.

9:45 Gesture recognition system with aging awareness based on tactile perception

Jin Yang (Beijing Jiaotong University, China); Zheyu Liu (Tsinghua University, China); Xinzhi Sheng (Beijing Jiaotong University, China); Fei Qiao, Qi Wei, Huichan Zhao and Xinjun Liu (Tsinghua University, China)

Human gestures can express rich information, so gesture recognition technology is more and more widely used in human-computer interaction. In the gesture recognition system designed with piezo-resistive sensor, the accuracy rate will decrease due to the aging of sensor. In this paper, a wearable gesture recognition system with piezo-resistive sensor was designed. By collecting a small number of data sets at different aging stages of the sensor, we retrained the algorithm and extended the service time of the system.

10:00 Using CNN to Predict the Transformed Spatial Distance for a Pair of Image Patches

Chin-Hung Teng and Zhen-Hao Yang (Yuan Ze University, Taiwan); Ching-Hu Lu (National Taiwan University of Science & Technology, Taiwan)

Matching image feature points is a very fundamental task in computer vision. Unlike the previous approaches that were designed from the viewpoint of classification, our study instead employs convolutional neural network (CNN) to estimate the transformed spatial distance of two features in the image plane. This spatial distance can not only be used to classify a match into correct or incorrect, but it also provides additional information about the equality of the match. To evaluate the performance of the proposed CNN, we have generated a large dataset for network training and testing. The experimental results show that if the true transformed spatial distance of a pair of corresponding features is between 0 and 5 pixels, the root mean square error produced by our network is 0.97 pixels.

10:15 Image Classification Using Convolutional Neural Networks with Different Convolution Operations

Chi-Yi Hsu and Chien-Cheng Tseng (National Kaohsiung University of Science and Technology, Taiwan); Su-Ling Lee (Chang-Jung Christian University, Taiwan); Bing-Yu Xiao (National Kaohsiung University of Science and Technology, Taiwan)

In this paper, three types of convolution operations in convolutional neural networks (CNNs) are studied including regular convolution,

separable convolution and group convolution. For regular convolution case, the modified VGG-19 is used to construct the deep networks. For separable convolution case, the MobileNet is applied to build deep model. For group convolution, the VGG-like plain network is used to construct the model. The experimental results of image classification on the CIFAR-10 and Flower102 datasets are used to evaluate the performance of CNNs and to demonstrate which convolution operation is a better choice according to accuracy and complexity.

F4: Non-invasive Biomedical Technology and Digital Health Care

Room: Lyon D

Chairs: Pao-Cheng Huang (Fujian Agriculture and Forestry University, China), Liang-Hung Wang (Fuzhou University, China), Chi-Chia Sun (National Formosa University, Taiwan)

9:00 Real-time personalized cardiovascular monitoring system with arrhythmia classification method

Liang-Hung Wang (Fuzhou University, China)

This study proposes a personal healthcare system to monitor, identify ectopic heartbeats, and provide services to patients with heart diseases. The proposed system includes three subsystems: (1) an electrocardiography (ECG) signal acquisition device to acquire ECG signals accurately; (2) an Android-based smartphone to display the actual ECG waveform and upload the signal to the Web platform for analysis of cardiac disorder events; and (3) a Web platform for feature selection and arrhythmia classification with the support vector machine algorithm. The classification algorithm can identify three types of heartbeats, namely, normal, atrial premature beat, and premature ventricular contraction. The average sensitivity, specificity, and accuracy of the classification algorithm over the training set are 98.5%, 96.7%, and 97.7%, respectively.

9:15 A Power Management Unit Design for a Wearable ECG Application

Hao Jiang (FuZhou University, FUZHOU, China)

Power efficiency and stability are critical for wearable ECG application. The paper presents a Pulse-Width-Modulation (PWM) voltage type DC-DC converter, which has a small area of 0.32 mm² on active chip, output voltage range of 0.8V to 3.5V, output power up to 7.5 mW, and peak efficiency of 95.8%. The simulation results show that the output voltage of the system is 1.8V, the output current is 4mA, the ripple voltage is 13mV and the efficiency is 86.1%, which meets the requirements of a presented system. The circuit will be fabricated by the SMIC in the near future with 0.18 μ m Bipolar-CMOS-DMOS (BCD) process.

9:30 Ratio of HbA1c to Hemoglobin on Ring-shaped Interdigital Electrode Arrays Based COMSOL simulation

Min Haw Wang, Chun-I Liu, Hsiao-Tung Hsu, Zin-Yin Chao and Yu-Chi Su (Chinese Culture University, Taiwan)

The study provide a comprehensive discussion of glycosylated hemoglobin and calculate the proportion of glycated hemoglobin. The impedance model of the device was constructed to calculate the relationship between the influence of impedance and the rate of change caused by different concentrations of glycated hemoglobin. Finally, we establish a impedance model using COMSOL simulation that accurately distinguishes the proportion of glycated hemoglobin.

9:45 ECG Automatic Classification Model Based on Convolutional Neural Network

Liang-Hung Wang (Fuzhou University, China)

This study proposed a classification method of premature ventricular contraction based on single lead electrocardiograph (ECG), and compared the classification results of AlexNet and convolutional neural network (CNN) model based on AlexNet. The results showed that the sensitivity, specificity, accuracy and positive predictive value of AlexNet on MIT-BIH dataset are 94.88%, 94.66%, 97.76% and 95.87%, respectively. The average specificity and positive predictive value of the improved model were 99.55% and 99.27%, respectively.

10:00 The Effect of Extremely Low Frequency Electromagnetic Field on Weight Gain of Preterm Babies

Chia-Ying Lee (Chung Shan Medical University, Taiwan); Jing-Yau Tang (National Cheng Kung University, Taiwan); Pen-Jan Chen (China Medical University, Taiwan); Ling-Sheng Jang (National Cheng Kung University, Taiwan); Hsiao-Ling Chuang (Chung Shan Medical University, Taiwan)

This is an interim report of one-year randomized controlled trial study to investigate the effect of extremely low frequency electromagnetic field (ELF-EMF) on weight gain of the preterm babies. The ELF-EMF device operated at 7.83 Hz, which is known as the Schumann Resonance. After exposing to ELF-EMF for a week, both of the average body-weight gain and weight gain rate are improved. The results show that ELF-EMF has the potential to develop a new method for helping preterm babies.

10:15 Extracting Respiration Signals from A Portable ECG Acquisition Device

Pao-Cheng Huang (Fujian Agriculture and Forestry University, China); Liang-Ji Chen and Liang-Hung Wang (Fuzhou University, China); Riqing Chen (Fujian Agriculture and Forestry University, China)

In this study, a dynamic respiratory signal acquisition method based on portable ECG acquisition device was proposed. Most EDR algorithms are suitable for static signal acquisition. ECG signal acquisition and EDR signal analysis in motion state has affected by motion artifact, resulting in low accuracy. The ambulate ECG signal analyzer proposed in this study uses a digital algorithm to remove the motion artifacts in the acquisition process, so that the stability of the ECG signal is close to that of the static signal, thus obtaining the dynamic respiratory signal with high accuracy.

F5: Intelligent Circuits and Systems I

Room: Lyon E

Chair: Chang-Ming Wu (Chung Yuan Christian University, Taiwan)

9:00 A DBN Hardware Accelerator for Auditory Scene Classification

Ching-Che Chung, Huai-Xiang Zhang, Ming-You Hung and Hong-Jin Jian (National Chung Cheng University, Taiwan)

As the population ages and enters the aging society, related medical problems are gradually being taken seriously, and the deterioration of hearing due to aging is also a common problem. However, hearing aids are easily affected by different auditory scene, and different compensation methods are needed in the different auditory scene. In this paper, the deep belief network (DBN) is used to identify the scene of the auditory scenes. After the deep neural network operation, the current auditory scene is judged. In this paper, the memory requirement for the DBN is reduced in post-training quantization using the K-mean clustering algorithm, and 93.743% memory space of the DBN is reduced with only 1.65% accuracy loss.

9:15 Architecture Design of Overlap-Add FFT on the Convolution Neural Networks

Wei-Kai Cheng, Yuan-Chih Lo and Hsia-Tsung Wang (Chung Yuan Christian University, Taiwan)

As the computation demand of CNNs is dominated by convolution layers, some researches exploit the duality between spatial domain and frequency domain through fast Fourier transform (FFT) to replace convolutions with pointwise multiplications. However, the FFT approach requires zero padding to enlarge the filter kernel to be the same size of input feature map. In this paper, we apply the overlap-add FFT algorithm to resolve the large zero padding problem in full FFT model. We propose an architecture design to implement the overlap-add FFT algorithm with 2D FFT technique. Our design targets to filter size $3 \times 3 \sim 7 \times 7$ and is implemented with four 8×4 PE architecture. Experiments on ResNet-34 shows that in average, our overlap-add FFT scheme achieves near to 80% of multiplication reduction in comparison with the convolution approach.

9:30 Dataflow Design of Overlap-Add FFT on the Convolution Neural Networks

Wei-Kai Cheng, Xiang-Yi Liu and Tsai-Yu Tsai (Chung Yuan Christian University, Taiwan)

As the computation demand of CNNs is dominated by convolution layers, many researches exploit the duality between spatial domain and frequency domain through fast Fourier transform (FFT) to replace convolutions with pointwise multiplications. Also, some of them apply the overlap-add FFT algorithm to resolve the large zero padding problem in full FFT model. However, none of them discuss the dataflow problem in the overlap-add FFT technique. In this paper, we propose an integration of output stationary and filter reuse dataflow to minimize output buffer size and amount of data migration between internal buffer and external memory. Experiments on ResNet-34 shows that the proposed integration of output stationary and filter reuse dataflow reduces almost 50% of data migration in comparison with the output stationary and input reuse dataflow.

9:45 Current-Mode First-Order Highpass, Lowpass, and Allpass Filters Using Two ICCIIs

Chang-Ming Wu (Chung Yuan Christian University, Taiwan)

In this paper, a new current-mode first-order filter circuit using two inverting second-generation current conveyors (ICCIIs) is presented. The proposed circuit employs two ICCIIs, one capacitor and one resistor. It can realize all first-order filter functions, which are, highpass, lowpass, and allpass responses. Filter performances are simulated by HSPICE to verify the theoretical predictions.

10:00 Low-Power Small-Area 3x3 Convolution Hardware Design

Xin-Jia Chen and Shih-Hsu Huang (Chung Yuan Christian University, Taiwan)

The two-dimensional (2-D) convolution has a large influence on the overall performance of a neural network. Typically, a 3×3 convolution (i.e., the kernel size is 3×3) requires nine multipliers and one adder tree. In this paper, we propose a low-power high-speed 3×3 convolution hardware design. Different from previous works, we merge 9 multipliers' final additions with an adder tree. Compared with a conventional 3×3 convolution design, experimental results show that the proposed 3×3 convolution design can reduce 14.9% power consumption and save 10.6% circuit area.

Tuesday, September 29 10:30 - 10:50

Coffee Break

Tuesday, September 29 10:50 - 11:50

Keynote: Kohei Shiimoto

Room: Eiffel Hall

Chair: Wen-Chung Kao (National Taiwan Normal University, Taiwan)

Tuesday, September 29 11:50 - 13:00

Lunch

Tuesday, September 29 13:00 - 14:30

Demo

Room: Poster Area

Chairs: Chih-Peng Fan (National Chung Hsing University, Taiwan), Yen-Lin Chen (National Taipei University of Technology, Taiwan)

Semiautomatic Annotation Framework Based on Annotator Habit for Digital Breast Tomosynthesis

Yi-Chong Zeng (Institute for Information Industry, Taiwan)

Annotation is an essential task before training a model of classifier in machine learning. In general, people use a photo editor to draw contours represented as annotated results. However, most photo editors are limited to decode medical images with specified formats, such as Digital Imaging and Communication in Medicine (DICOM). In this paper, we propose a semiautomatic annotation framework for digital breast tomosynthesis (DBT). The challenge is to annotate multiple images of DBT simultaneously and keep annotation consistent within the adjacent images. First, we analyze the manual-annotated results in mammograms. Then, the proposed framework is established by referring to the analytics of manual annotation, which is composed of three phases, namely lesion pre-detection, extendable annotation, and key-points generation. Finally, an annotation tool is developed based on the proposed framework. The experiment results demonstrate that our tool is capable of achieving simultaneous annotation and result consistency to multiple images in DBT.

A Baseband All-Digital Clock and Data Recovery Circuit with A Limited Range Binary Search FSM

Jia-ken Li (Yuan Ze University, Taiwan); Hung-Wen Lin (YuanZe University, Taiwan)

This paper proposes an all-digital-phase-locked-loop (ADPLL)-based clock-and-data-recovery circuit (CDR) for the baseband circuit system. To apply for different data-rate, a programmable digital-control-clock-phase-generator (DCPG) was designed to generate the recovery clock with different phase resolution. To perform binary search at an arbitrary phase number, a limited-range binary search flow was added into the phase-frequency-control finite state machine (PFCFSM). The proposed CDR was verified in 0.18um CMOS process and occupied 200um by 225um of core area. With 1V of supply voltage, 200MHz of reference clock and +-500ppm of data frequency offset, the chip results shows the data rate from 1Mbps to 5.5Mbps and consumes a total power of 0.22mW. At 5.5Mbps, the recovery clock and data are with 0.025UI and 0.0475UI of timing jitter, respectively.

Jean Joseph ZERO: Let Memories Come to Life with Music

Ker-Jiun Wang (University of Pittsburgh, USA); Caroline Yan Zheng (Royal College of Art, United Kingdom (Great Britain)); Maitreyee Wairagkar (Imperial College London, United Kingdom (Great Britain)); Mariana von Mohr (University College London, USA)

Jean Joseph ZERO is a Brain-Computer Interface (BCI) technology that transforms music induced memories, reflected as EEG brainwaves, into visualized experiences. The entire framework consists of one earbud-like BCI device to collect EEG signals, a deep learning decoder to extract the data features using Long Short-Term Memory (LSTM) Recurrent Neural Network (RNN), and a Generative Adversarial Network (GAN) to reconstruct/visualize human images recalled from listening to the music. In this paper, we have used Jean Joseph ZERO to develop a telepathy method that allows two persons staying far away can communicate with each other by thinking and haptic feedbacks. With music-induced memories, such information can be conveyed remotely to his/her friend through soft wearable haptic interface. This method provides on-the-fly mind communications and peaceful feelings when people are segregated from their families, close friends, or loved ones.

Developing Cross-platform Web-based Virtual Reality Innovative Services

Sheng-Ming Wang (National Taipei University of Technology, Taiwan); Yu-Chen Wang (National Taipei University of Technology, Taipei Tech, Taiwan); Wei-Jie Pan (National Taipei University of Technology, Taipei Tech, China); Cheng-Yen Lin (National Taipei University of Technology, Taipei Tech, Taiwan)

Virtual reality - where users wear a headset and are fully immersed in computer-generated environments - has been developed to meet design, marketing, education, training, and retail needs. However, the scenarios and modes of the stand alone system have their bottleneck and limit the VR applications. This research begins with applying the service design method to analyzes the scenarios of future cross-platform virtual reality applications development. It then uses HTML and A-Frame web VR components to develop a cross-platform VR independent modular prototype system. The system can integrate the HTC VIVE stand-alone and mobile device operation simultaneously with digital content for learning. The results and evaluation of this research show that the technologies developed by this research can provide a service model for the future development of multi-person cross-platform virtual reality applications. The subsequent studies plan to explore the technology to create a mechanism for multi-person interaction in virtual reality applications.

An AI-based Real-Time Roadway-Environment Perception for Autonomous Driving

Shubham Verma and Motahar Reza (National Institute of Science and Technology, India); Sanjoy Choudhury (S N Bose National Centre for Basic Sciences, India); Jatindra Dash (SRM University, India); Diptendu Sinha Roy (National Institute of Technology Meghalaya, India)

Real-time roadway-environment perception is one of the primary applications of IoT based autonomous driving to improve road safety. Roadway-environment insights include on-road detection of any type of moving vehicles, non-vehicle (persons, animals, etc.), curves and lanes. There have been various studies that provided Artificial Intelligence (AI)-based detection approaches, however, most of the methods are atomistic which are not well suited for such real-time autonomous driving owing to high detection latency and low accuracy. Therefore, in this paper, we propose a holistic AI-based roadway-environment learning system for simultaneous real-time detection of various on-road objects with high accuracy (more than 90%) at reduced computation complexity.

G1: Consumer Electronics and Services for AIoT Technology and Applications

Room: Eiffel Hall

Chairs: Chiu-Chin Chen (Zhao Qing University, China), Hsiao-Ting Tseng (National Central University, Taiwan)

13:00 Deep Reinforcement Learning for Collision Avoidance of Autonomous Vehicle

Hsiao-Ting Tseng (National Central University, Taiwan); [Chen-Chiung Hsieh](#), Wei-Ting Lin and Jyun-Ting Lin (Tatung University, Taiwan)

To save training efforts, reinforcement learning approach is applied to the autonomous vehicle for obstacle avoidance. Therefore, this study is aimed to let the autonomous vehicle to learn from mistakes and readdress its movement accuracy for collision avoidance in working environment. An enhanced learning method Q-learning is used to record and update the Q values for different movement through a table that the autonomous vehicle can use it to determine how and where to move. The Q table is learned through the deep learning neural network which may encounter innumerable situations from the environments and the different actions performed by the autonomous vehicle. In the experiments, the depth camera is adopted as the input device to be not affected by light intensity and road color. The Q table is ready to use after 9000 epochs or about 3.5 hours training. Let the autonomous vehicle run for 3 minutes at a time in three different environments with lights on and off 10 times each. The success rate of obstacle avoidance is as high as 95% which proves the feasibility of proposed approach.

13:15 Research the Financial Networking Market Trading Behavior and Physics

Chiu-Chin Chen and Chia-Chun Liao (Zhao Qing University, China)

Due to deep find-out the financial market trading behavior and physics. This study applies the back-propagation neural network (BPNN) and grey system methods to compute stochastic (KD), moving average convergence-divergence (MACD), money flow index (MFI), value area rotation factor (VARF) and quantitative market profile data to extrapolate the market logic, and knowledge rules that influence the Taiwan capitalization weighted stock index (TAIEX) futures networking market structure via an integral physical quantities assessment. The experimental results show that using the proposed model to measure the momentum of value area over the past few days improves the prediction model accuracy and profit. This implies that the momentum trend over the past few days is important for predicting the price direction in one day. This study compares the experimental group with random trading and finds the proposed model obtains more profit than random trading. Therefore, financial networking market trading behavior patterns are not random.

13:30 Design and Evaluation of Electric Scooter Innovative Service

Kuan-Hua Liu and Sheng-Ming Wang (National Taipei University of Technology, Taiwan)

Faced with today's global environmental sustainability issues, air pollution has always been one of the problems people want to solve. In Taiwan, the government is also actively promoting electric scooters (E-Scooters) to replace traditional bikes to reduce the accompanying air pollution. Although some major manufacturers have launched products of E-Scooters, related services such as the parking priority service, are still underdeveloped. This study will use the service design method to establish innovative parking services for E-Scooters users. First, we use focus group interviews to understand the pain points faced by today's users and use a persona to present the situation of users. Then we analyze the user's scenario and needs through the user journey map. The third step is to analyze the user's needs and technology through quality function deployment (QFD) to obtain the corresponding priority level. After completing the above steps, we will construct related design prototypes and service blueprints. Finally, we made a preliminary evaluation through the Kano model. The results of this research show that users are looking forward to enjoying the proposed innovative services, such as the two functions of charging/battery exchange services and parking records. With this study, the government or enterprises in the future can have a reference when constructing E-Scooter services, and have a elementary understanding of the priority of technology development.

13:45 Developing Social Internet of Vehicles Innovative Services

Hui-Lin Fan and Sheng-Ming Wang (National Taipei University of Technology, Taiwan)

This research proposes innovative service design for Social Internet of Vehicle (SIoV). First of all, this research based on the human-centered design thinking to introduce agent-based mechanism to create the service model. Then, this research proposes the integration of the Artificial Intelligent and Internet of Things (AIoT) for data collection, analysis, and service strategies design. In addition to use the Quality Function Deployment (QFD) to converge the results of innovative service design, this research also uses the Analytic Hierarchy Process (AHP) method to implement the pilot evaluation the design results. This research contributes to the integration of services and

technology applications and provide innovative and secure service experiences to future users of SIOV.

14:00 Using Collaborative Physics Technologies to Integrate Enterprise Cloud Services

Chia-Chun Liao and Chiu-Chin Chen (Zhao Qing University, China)

The front of the global foundry industry growth slow times, strong competitors joined Samsung Electronics, Global Foundries, IBM, and other outstanding companies, especially to manufacture components companies are outsourcing services. This study investigates the emerging cloud services systems, analyzes the future trends for foundry collaboration that will impact physics factors and import gray relational theory, the SWOT survey results in the case company, to enhance foundry industry competitiveness and the advantages for industry reference.

14:15 The development and implementation of driving information collection and recording system for driving behavior analysis

Chien-Chung Wu (Southern Taiwan University of Science and Technology, Taiwan)

The occurrence of traffic accidents usually comes from drivers' bad driving behaviors and habits. By analyzing driving behaviors of the drivers, it can help to improve dangerous driving conditions, and will also help reduce car accidents. In order to examine drivers' driving behaviors more specifically, collecting sufficient and diverse information will help to analyze them more accurately. A system has been designed in the project that can simultaneously collect images of the road ahead of the driver, and real-time images of the head, eyes, and face of the driver while driving. The message packets of Blinker, Gear, Brake, Accelerator pedal, Steering angle, Driving speed and Engine RPM in the driving computer ECU can also be recorded through real-time analysis, and these decoded ECU text and digital information can be transmitted through the MQTT protocol. Together with Node-RED and the Dashboard package, a system for presenting the above data with a graphical interface has been developed. At the same time, the above-mentioned ECU, image streaming and its historical information can be viewed through web browsing, which is convenient for analyzing driving behaviors.

G2: AR/VR Technologies for Beyond 5G

Room: Lyon A

Chair: Cih-Wei Huang (National Central University, Taiwan)

13:00 Developing Cross-platform Web-based Virtual Reality Innovative Services

Sheng-Ming Wang (National Taipei University of Technology, Taiwan); Yu-Chen Wang (National Taipei University of Technology, Taipei Tech, Taiwan); Wei-Jie Pan (National Taipei University of Technology, Taipei Tech, China); Cheng-Yen Lin (National Taipei University of Technology, Taipei Tech, Taiwan)

Virtual reality - where users wear a headset and are fully immersed in computer-generated environments - has been developed to meet design, marketing, education, training, and retail needs. However, the scenarios and modes of the stand along system have their bottleneck and limit the VR applications. This research begins with applying the service design method to analyzes the scenarios of future cross-platform virtual reality applications development. It then uses HTML and A-Frame web VR components to develop a cross-platform VR independent modular prototype system. The system can integrate the HTC VIVE stand-alone and mobile device operation simultaneously with digital content for learning. The results and evaluation of this research show that the technologies developed by this research can provide a service model for the future development of multi-person cross-platform virtual reality applications. The subsequent studies plan to explore the technology to create a mechanism for multi-person interaction in virtual reality applications.

13:15 Development and Evaluation of Virtual Reality Induction Electricity Prevention Education and Training Tools for Construction Industry

Tsung-wei Shen, Tsung-Lin Ho and Lai-Chung Lee (National Taipei University of Technology, Taiwan)

This research will specialize in the development of virtual reality induction education training tools for the construction industry, combining a physical handheld cement mixer with a virtual reality helmet, and simulating a possible electric shock situation under safe voltage. In addition, we'll use the service blueprint to record each activity before, during and after the experience in a flow chart, and discuss the relationship between each activity and solve possible problems. Finally, the Kano model is used to analyze the nine functions of the prototype system, analyze which function has the highest customer satisfaction, and use the function as an important basis for future development of the system.

13:30 On Deep Learning Based Feedback and Precoding For Multi-user Millimeter-Wave Enabled VR/AR

Hong-Yunn Chen (National Taiwan University Graduate Institute of Networking and Multimedia (GINM), Taiwan); [Chen-Yu Yang](#) (National Taiwan University, Taiwan); Xu-Ying Liu (Southeast University, China); Cheng-Fu Chou (NTU, Taiwan)

Virtual reality (VR)/augmented reality (AR) and its applications have attracted significant and increasing attention recently. However, the stringent quality of service (QoS) requirements and better spectral efficiency have posed the challenges such as higher bandwidth, lower latency and better reliability on the VR/AR communication system. This paper proposes a deep-learning-based (DL-based) precoding and feedback method for mitigating the channel interference of multi-users VR/AR environments. That is, our DL-based method uses the VR/AR channel state information (CSI) to do radio resource allocation for maximizing the millimeter-wave network throughput. Numerical results show that our DL-based design could significantly enhance the throughput.

13:45 Automatic Generation of Training Data for Deep Learning in AR-based Transportation Support System

Takayuki Abe, Sho Takahashi and Toru Hagiwara (Hokkaido University, Japan)

In this paper, we propose a method that automatically generates training data necessary for construction of deep learning-based model which supports indication of traffic data on augmented reality (AR). In the case of the data indication to road user by AR, there is a risk that important objects are hidden by the data. Thus, locations of the data indication should be adaptively determined. Therefore, accurate determination of the locations which recognizes the important objects via deep learning is expected. However, for deep learning, a large amounts of training data need to be prepared. In our method, the large amount of training data is automatically generated. Therefore, supporting location determination of the data indication via deep learning is realized. Experimental results show the effectiveness of our method.

14:00 NTU Smart Edge for Wireless Virtual Reality

Yi-Huai Hsu, Jen-Hao Cheng, Keh-Yeun Liao, Yong-Siang Wang, Te-Hsin Chen, Hung-Yeh Chen, Chih-Kuan Yen and Wanjiun Liao (National Taiwan University, Taiwan)

The efficiency of 3D image rendering is an important factor for immerse experience of wireless virtual reality (VR). However, performing image rendering in wireless VR headset is inefficient due to its limited computing capability and battery life. 5G Mobile Edge Computing (MEC) could enable immerse experience with good user experience for wireless VR players thanks to its offering high data-rate wireless connections with low latency and taking advantage of high computational capability in the proximity to wireless VR players for such real-time and computationally intensive task. In this paper, we study the performance of edge rendering capability at NTU 5G MEC testbed as compared with local rendering. We implement a multiplayer VR dancing game scenario in which two wireless VR players can interact with each other in a virtual space. We compare the performance achieved by local rendering and edge rendering when the wireless VR players are turning his head around. The results shows that edge rendering can allow better quality of user experience in the game.

14:15 Developing Immersion Virtual Reality for Supporting the Students to Learn Concepts of Starry Sky Unit

Ah-Fur Lai, Yi-Sin Guo and Yen-Hung Chen (University of Taipei, Taiwan)

The students often encounter many learning dilemma in astronomy concepts. Due to its immersion and situated cognition in the learning process, VR technology has a promising potential for reducing science misconception from macro view to micro view. The purpose of this study was to develop an immersion VR for supporting the learners to learn basic astronomy concepts in elementary school. This study employed HTC vive as immersive head-mounted VR devices, and adopted ADDIE model to develop VR learning system of virtual astronomy museum. After the system was finished, an initial evaluation was conducted by inviting the elementary school's students to test and experts to assess its suitability in science learning. The results revealed that this system is suitable for applying in learning of Starry Sky Unit if the classroom equipped with enough HTC vive devices. In the future, this study will launch a learning experiment in an elementary school for assessing its effectiveness including learning achievement and attitudes.

14:30 A Virtual Reality Based System for Drug Addiction and Diagnosis

Hsiao-Kuang Wu (National Central University, Taiwan)

By integrating virtual reality (VR) technique with flavor simulator, our research intended to create an immersed virtual environment (VE) that is composed of multiple VR tasks with varied intensities of drug-temptation therefore to gradually induce the craving of addiction patients. Moreover, multi-model sensors, including electrocardiography (ECG), electroencephalography (EEG), galvanic skin response (GSR) and eye tracking, were synchronized with the VE system and utilized to measure the neuro-behavior of the addiction patients before, during and after the exposure to the virtual environment. Further, data of multi-model neuro behaviors and VR task performance were analyzed by statistics and machine learning method in order to evaluate the intensity of craving induced and judge the dependence on the drug so as to make an assessment to the addiction patients.

G3: Consumer Electronic IC's Industrial Case Studies, Reviews and Analyses

Room: Lyon B

Chairs: Shao Chang Huang (Vanguard International Semiconductor Corporation, Taiwan), Yu-Guang Chen (National Central University, Taiwan)

13:00 The Correlations between ESD and TLP in Large Array Devices

Shao Chang Huang (Vanguard International Semiconductor Corporation, Taiwan); Ching-Ho Li, Li-Fan Chen, Chun-Chih Chen, Ting-You Lin, Kai-Chieh Hsu, Gong-Kai Lin and Jian-Hsing Lee (VIS, Taiwan); Yu-Yung Kao and Ke-Horng Chen (NCTU, Taiwan)

Transmission Line Pulse (TLP) is often applied for ESD devices' characteristics researches. It indicates the devices' triggering-on behaviors, holding performances and thermal run-away results. In normal cases, the thermal run-away data should correlate to Electrostatic Discharge (ESD) [1]. However, the non-correlations between TLP and ESD can be observed in the gate driving circuits [2], silicide devices [3] and poly fuses [4]. In this paper, analyses for the relations between ESD and TLP are taken into discussions for large array device (LAD).

13:15 Signal control switching for improving Large Array Devices' ESD performances

Shao Chang Huang (Vanguard International Semiconductor Corporation, Taiwan); Ching-Ho Li, Gong-Kai Lin, Chun-Chih

Chen, Kai-Chieh Hsu, Ting-You Lin, Li-Fan Chen and Jian-Hsing Lee (VIS, Taiwan); Yu-Yung Kao and Ke-Horng Chen (NCTU, Taiwan); Chih-Hsuan Lin (VIS, Taiwan)

Electrostatic Discharge (ESD) performance of large array device (LAD) is a big challenge since the common ESD skill cannot be use. A novel signal control switching (SCS) architecture for adding LAD's ESD robustness is proposed in this paper. A little layout area is increased, but a huge ESD robustness increase can be obtained.

13:30 Characteristic Comparison between Passive and Active Capacitive Fingerprint Sensors

Ye-Hsuan Yan (National Chiao Tung University, Taiwan)

In this paper, two common architectures of passive and active capacitive fingerprint sensors are introduced which are implemented by VIS 0.18 μ m process. The advantages and drawbacks of each technology are also reviewed.

13:45 Privacy-Preserving Delegation of Decision Tree Classification

Che-Chia Chang, Jian-Feng Lin, Song-Yi Hsu and Yu-Chi Chen (Yuan Ze University, Taiwan)

In the era of cloud computing with security, how to outsource a trained model to the server but preserve the model privacy is a significant problem for decision tree classification (DTC). In this paper, we aim for constructing an interactive system to realize privacy-preserving delegation for DTC. We focus on a basic structure of DTC, and believe that it can be generalization. The main technique to preserve privacy is to build secret sharing-based protocols for the model owner, user, and server. However, to overcome communication issues between the model owner and user, we achieve compression by using pseudorandom generators.

14:00 An Artificial Neuron Network Based Chip Health Assessment Framework for IC Recycling

Yu-Guang Chen (National Central University, Taiwan)

In the past decade smart devices have become a major driving force behind the growth of semiconductor industry. The fierce competition for market shares and profits has rendered frequent release of new generations with fancier designs, more functionalities and better performance. On the other hand, the chips inside these smart devices are designed with lifetime typically spanning a few generations at least. As a result, many smart devices are thrown away with their chips still functioning. Conventional recycling business simply aims at recovering copper, silver, gold, palladium and other materials, and does not take into consideration the potentially functioning chips. We argue that a much better recycling framework should properly classify and bin the functioning chips from recycled smart devices for reuse so that additional profit can be generated and environment can be better protected. In this paper, we propose the concept of integrated circuit recycling, and demonstrate a statistical health assessment method using artificial neuron network (ANN) based search tree along with an optimal price-binning framework with low-cost measurements. Experimental results show that with the simple measurement of Iddq and Vmin, our health assessment can eliminate lifetime overestimation, while flat ANN has that up to 13%. In addition, our price-binning algorithm can obtain up to extra 51% profit compared with an intuitive maximum-likelihood based approach.

G4: Best Paper Competition

Room: Lyon D

Chair: Yeong-Kang Lai (National Chung Hsing University, Taiwan)

13:00 Important Scene Detection Based on Anomaly Detection using Long Short-Term Memory for Baseball Highlight Generation

Kaito Hirasawa, Keisuke Maeda, Takahiro Ogawa and Miki Haseyama (Hokkaido University, Japan)

This paper presents an important scene detection method based on anomaly detection using a Long Short-Term Memory (LSTM) for baseball highlight generation. In order to deal with multi-view time series features calculated from tweets and videos, we adopt an anomaly detection method using LSTM. LSTM which can maintain a long-term memory is effective for training such features. Introduction of LSTM into important scene detection of baseball videos is the biggest contribution of this paper. Experimental results show high detection performance by our method.

13:15 Multi-User ACO-OFDM Based Optical Wireless Communications

Cheng-Yuan Chang, Shih-Chang Chien and Tsai-Che Chen (National United University, Taiwan)

In this paper, a new asymmetrically clipped optical orthogonal frequency-division multiplexing (ACO-OFDM) based optical wireless communication system which uses code-division multiple-access (CDMA) technique to satisfy the requirement of the multi-user transmission is proposed. In the proposed system, each user is assigned one of modified maximum length sequence (modified m-sequence) which is mainly constructed by performing both cyclic-shifted copy and zero-padding operations on the traditional m-sequence, as the spreading sequence for supporting the (synchronous) downlink transmission of the system.

13:30 An Estimation Method of Visibility Level on Winter Road Based on Multiple Features in CCTV Images

Shotaro Kawata, Sho Takahashi and Toru Hagiwara (Hokkaido University, Japan)

Since drivers acquire a lot of information with eyes, the estimation of the level of visibility (visibility level) on the winter roads contributes toward enhancing traffic safety. Therefore, this paper proposes a method for estimating the visibility level on the winter roads from closed-circuit television (CCTV) images. In the proposed method, the visibility level of each image is estimated based on features acquired via Fourier transform and Convolutional Neural Network (CNN). Specifically, by constructing support vector machines (SVMs) for each

feature, the probabilities of the visibility level are calculated. Furthermore, based on comparison of calculated probabilities of SVMs, the proposed method estimates the visibility level accurately. Experimental results show the effectiveness of the proposed method.

13:45 Multi-Target Detection and Tracking with Semantic Segmentation by Using LiDAR Sensor

Jian-Jie Sun and [Cheng-Ming Huang](#) (National Taipei University of Technology, Taiwan)

This paper constructs a 3D multi-target semantic segmentation, detection and tracking framework by using the point cloud data captured from a LiDAR sensor in the outdoor traffic scene. This paper proposes the 3D multi-target detection by using scene segmentation results of PointNet++ to improve the loss of point cloud data when extracting the spatial features of point cloud data after it converting to the voxel space. The spatial features and the scene segmentation results are also represented as a 2D data by bird's-eye view in which the objects does not overlap in the traffic scene. Since the processing time of detection system is much slower than the data acquisition time. The detected target in the point clouds at each time instant are directly tracked by utilizing the local detection with the intersection-over-union ratio in a prediction region.

14:00 Comparison of Stabilization Control in Remote Control System with Haptics

Lu Chen, Limin Wen and Yutaka Ishibashi (Nagoya Institute of Technology, Japan); Pingguo Huang (Gifu Shotoku Gakuen University, Japan); Yuichiro Tateiwa (Nagoya Institute of Technology, Japan)

This paper makes a comparison of two types of stabilization control in a remote control system with haptics. By using a haptic interface device, a user manipulates another haptic interface device at a remote location while watching video. One is the adaptive viscosity control, and the other is the stabilization control by viscosity. By QoE (Quality of Experience) assessment, we clarify which type of control is better than the other type in terms of the operability of haptic interface device. As a result, we demonstrate that the adaptive viscosity control is better than the stabilization control by viscosity when the network delay is short, and the latter is superior to the former when the network delay is long. However, when the network delay is too long, they are almost the same.

14:15 Efficient Finger Vein Technology Based on Fast Binary Robust Independent Elementary Feature Combined with Multi-Image Quality Assessment Verification

Jing-Ming Guo, Chong-Sheng Wu and Li-Ying Chang (National Taiwan University of Science and Technology, Taiwan)

Recent years, fingerprint recognition has a high market share in biometrics, but humans' hands are often covered with oil and sweat that they secrete, rainwater or dirt, which often affect the accuracy of fingerprint recognition. This work proposed a finger vein identification technology for low response time that can be implemented in a cost-efficient embedded system using the binary robust invariant elementary feature. In this method allows the features matching with binary robust invariant elementary feature and verification with multi-quality assessment process. In experimental results, that the EER performance are 0.13% and 0.69%, using homemade and public (FVUSM) datasets when the data were collected with training and testing. The method is very suitable for real-time finger vein recognition applications.

G5: Intelligent Circuits and Systems II

Room: Lyon E

Chair: Chang-Ming Wu (Chung Yuan Christian University, Taiwan)

13:00 Low-Power Hardware Architecture for Depthwise Separable Convolution Unit Design

Shi-Rou Lin, Wei-Hung Lin and [Shih-Hsu Huang](#) (Chung Yuan Christian University, Taiwan); Chun-Lung Hsu and Chitien Sun (Industrial Technology Research Institute, Taiwan)

Depthwise separable convolution is useful for building small and lightweight networks. However, the hardware design of depthwise separable convolution unit has not been well studied. With an analysis, we find that many multiplications in depthwise separable convolution can be omitted. Based on this observation, in this paper, we present a novel hardware design to avoid unnecessary multiplications (by using the clock gating technique) for power saving. Experiments on MobileNetV1 model show that the proposed hardware unit can greatly reduce power consumption.

13:15 A Simple Yet Accurate Method for The Unsigned Fixed-Width Multiplier Design

En-Hui Zhang and [Shih-Hsu Huang](#) (Chung Yuan Christian University, Taiwan)

Fixed-width multipliers are widely used in digital signal processing applications. In this paper, we propose a novel unsigned fixed-width multiplier design. The main advantage of the proposed architecture is that it uses a simple yet accurate method for error correction. As a consequence, both low-power and high-accuracy can be achieved at the same time. Compared with an exact (i.e., accurate) multiplier, implementation results show that the proposed approach can save 40.8% circuit area with only 4.6% mean relative error distance.

13:30 Low-Power Hardware Implementation for Parametric Rectified Linear Unit Function

Yu-Hsuan Wu, Wei-Hung Lin and [Shih-Hsu Huang](#) (Chung Yuan Christian University, Taiwan)

PReLU (Parametric ReLU) function is an advanced ReLU (Rectified Linear Unit) for improving the accuracy of the neural network. However, up to now, there is no special attention to the hardware design of PReLU function. Based on the characteristics of PReLU function, in this paper, we propose a dedicated multiplier for PReLU function. With this dedicated multiplier, we develop a low-power PReLU hardware implementation. Experimental results show that the proposed approach can significantly reduce power consumption with small accuracy

loss.

13:45 Real-Time Threshold-based Landslide Prediction System for Hilly Region using Wireless Sensor Networks

Kamal Das (National Institute of Technology, Meghalaya, India); Shubhankar Majumdar (National Institute of Technology Meghalaya, India); Soumen Moulik (National Institute of Technology, Meghalaya, India); Masahiro Fujita (University of Tokyo, Japan)

In this paper, we propose a real-time monitoring system for prediction of landslide caused by rainfall using wireless sensor networks (WSNs). In the proposed work, multiple wireless sensors together periodically monitor the environmental condition and collect related information, then transfer it to a hub. The hub then measures a landslide index based on the collected information and sends an alarm for a possible landslide to a remote cloud server in case the landslide index exceeds a predefined threshold for early landslide prevention.

14:00 Robust On-Chip Processing Unit with Parallelized ECC Block for Lightweight Instruction Execution

Myeongjin Kang (Kyungpook National University, Korea (South)); Daejin Park (Kyungpook National University (KNU), Korea (South))

A tiny processing unit (TPU) activated with insufficient power always has a problem with data protection. To solve this problem, many TPUs and embedded systems use error-correcting code (ECC), especially Hamming code. However, adding an ECC decoding block to the TPU can cause a bottleneck. Most TPUs that follow a Von Neumann structure spend large amounts of time in the instruction fetch stage. The instruction fetch time increases due to ECC decoding intensifying the bottleneck. In this paper, we propose an architecture for a parallelized ECC decoding block. Although it increases memory usage, the parallelized ECC decoding block speeds up the entire TPU by more quickly processing the ECC decoding. This architecture was synthesized and validated with Design Compiler and showed successful performance improvements using proposed architecture.

Tuesday, September 29 14:30 - 18:30

Tour

Tuesday, September 29 18:30 - 19:00

Invited: Tihao Chiang (Avignone Hall)

Chair: Pao-Chi Chang (National Central University, Taiwan)

Tuesday, September 29 19:00 - 21:00

Banquet (Avignone Hall)

Wednesday, September 30

Wednesday, September 30 9:00 - 10:30

H1: Intelligent Medical Devices & Partner for the Blind

Room: Eiffel Hall

Chair: Po-Lei Lee (National Central University, Taiwan)

9:00 An Implementation of Cloud-Based System for AF Screening: Lessons Learned from Real-World Evidence

Men-Tzung Lo (National Central University, Taiwan)

Atrial fibrillation (AFib) is a commonly encountered arrhythmia, and patients with AFib raise the risk for stroke to fivefold. The prevalence is around 10% for the population over 65 years old. However, the occurrence of AFib can be paroxysmal and sometimes asymptomatic, thereby making detection with conventional ECG methods difficult. To develop an efficient and sustainable approach for detecting undiagnosed AFib, we propose a cloud-based system for arrhythmia screening, especially for AFib. This system incorporates both the cloud-based architecture and the mobile ECG wristband. It can be leveraged in different scenarios including health examination with real-time feedback and home-based monitoring with 7-14 days screening. We have applied this system for arrhythmia screening since Oct 2018 and over 2000 people had been screened with 13.4% arrhythmia detection rate.

9:15 Analyzing EEG Signals for Post-Stroke Epilepsy Detection: A Preliminary Exploration

Lung-Hao Lee and Ting-Chun Hung (National Central University, Taiwan); Chien-Chen Chou (Taipei Veterans General Hospital, Taiwan); Po-Lei Lee and Kao-Kai Shyu (National Central University, Taiwan)

This paper describes our preliminary exploration of EEG signal analysis for post-stroke epilepsy detection. The EEG data is measured and collected from stroke patients at Taipei Veterans General Hospital. A series of signal processing steps is used to extract features into a pipeline of principal component analysis, L2 normalization and the classification for detecting epilepsy seizures. Experimental results show that none of the basic classification models achieved superior performance using different evaluation metrics indicating the difficulty of developing intelligent systems for effectively diagnosing post-stroke epilepsy.

9:30 Improving Fuzzy Syndrome Differentiation for Deficiency Syndromes in Traditional Chinese Medicine

Po-Shen Lin and Nai-Wei Lin (National Chung Cheng University, Taiwan); Ming-Hsien Yeh (Buddhist Tsu Chi General Hospital, Taiwan); Chia-Chou Yeh (Tsu Chi University, Taiwan); Hung-Pin Chiu (NanHua University, Taiwan)

The diseases in traditional Chinese medicine are defined as syndromes. The diagnosis of syndromes in traditional Chinese medicine is called syndrome differentiation. Our previous work proposes a fuzzy classification approach to solve the syndrome differentiation for 20 deficiency syndromes. This paper proposes an improved version of the previous fuzzy classification approach. This paper also presents a preliminary evaluation of the improvement based on the baseline differentiation coefficient of these 20 deficiency syndromes and the Jaccard similarity coefficient of 40 case reports from traditional Chinese medicine journal papers.

9:45 The Assisted Environment Information for Blind based on Video Captioning Method

Hsieh Michael (National Taiwan Ocean University, Taiwan)

Our proposed system is to help the blind to recognize the environment information. In view of the booming development of image recognition technology, many different models of recent video description methods have been developed. However, there is still a problem that the generated subtitles are not accurate enough to describe the image. In this paper, we propose a model RNN-LSTM to identify objects in a movie and generate correct subtitles. Our model uses a layer of RNN to provide the function of identifying images, and a layer of LSTM to analyze and generate subtitles. This paper uses the MSVD data set and thirty customized movie data sets for experiments, and compares the results of the S2VT model and the RNN-LSTM model on the data set.

10:00 A Navigation Aid for Blind People Based on Visual Simultaneous Localization and Mapping

Ching-Han Chen (National Central University, Taiwan); Chien Chun Wang (National Central University & Computer Science, Taiwan); Sian-Fong Lin (National Central University, Taiwan)

Most navigation aids for blind people require users to equip various equipment and multi-sensor subsystems for environmental detection. This study integrates the visual simultaneous localization and mapping system with pre-established maps to develop a navigation aid system for blind people. The system operates similarly to how Google Map uses pre-established environmental maps and landmarks. While the user walks, the system reads the map in the database and synchronizes feature points from the visual simultaneous localization and mapping system onto the environment map. In addition, the aid employs audio cues to notify users of signpost information and enables users to make inquiries on specific destinations via human-machine interaction.

10:15 Smart guiding glasses with descriptive video service and spoken dialogue system for visually impaired

Ming Fang Shiu and Chin Han Chen (National Central University, Taiwan)

This project proposes a wearable device for walking navigation to help the visually impaired people. It is a pair of glasses combining 3D vision and microphone, which can help the visually impaired to be convenient in outdoor. First year, we used 3D detection and recognition to handle visual understanding. Next year, a dialogue system will be developed. In the last year, the software and hardware integration of smart guiding glasses will be finished. We will invite blind people to use in real environment for improving.

H2: Enabling Technologies and Others

Room: Lyon A

Chair: Ching-Han Chen (National Central University, Taiwan)

9:00 Nature Plant Edge Computing for Phytosensing Applications

Fu-Chun Chan, Afaraj Ahamad and Chi-Chia Sun (National Formosa University, Taiwan)

Climate change caused by the greenhouse effect derived from economic opportunities related to the productivity of 4.0. One of them is proposed in this paper can be applied to design a method of photo-sensing allow to measure certain aspects of internal states of natural plants. An example is a so-called electrophysiology, where a differential electrical potential of the plant is measured. This method is intrusive as it is required to insert patch clamps as electrodes into the plant's tissue. While previous experiments [1] have shown that there are clearly measurable effects, such as a reaction of the plant to light, the scientific interpretation of the obtained data in terms of plant science is still challenging.

9:15 Platform Utilizing Others' Behavior Data to Detect Anomalous Operation Hiding Private Information

Masaaki Yamauchi, Yuichi Ohsita and Masayuki Murata (Osaka University, Japan)

As the number of IoT consumer electronics is increasing, cyberattacks to IoT devices are increasing. In particular, operating IoT devices by attackers make users feeling unsafe and may harm users physically. Therefore, we have proposed a method to detect anomalous operations by learning users' behavior. However, this method misdetects many legitimate operations if a sufficient amount of data on the users' behavior. One approach to avoid misdetections even if a sufficient amount of data cannot be obtained from each user is to use the data collected from the others. But users do not want to share their private information with others. In this paper, we proposed an anomaly detection platform that utilizes the dataset of similar users without sharing their private information.

9:30 Thermal Unit Commitment with Wind Farms Using Taguchi-Immune Algorithm

Faouzi Brice Ouedraogo, Wei-Liang Liu and Chao-Rong Chen (National Taipei University of Technology, Taiwan)

In this paper, Taguchi - immune algorithm (TAIA) is deployed for thermal units when wind turbines are operating to find the global optimal solution. The immune algorithms' affinity screening will avoid computing similar solutions effectively in order to reduce the number of operations. In addition, to enhance the search result of finding the optimal solution, the Taguchi orthogonal array experiment is inserted between crossover and mutation of the immune algorithm. The proposed idea has been applied to the IEEE 30-Bus system and compares to the immune algorithm and genetic algorithm to validate the effectiveness and the performance of the proposed method.

9:45 A Warning System with Multiple Sensors for Avoiding Collision of Bicycles

Kotaro Iwamoto and Satoshi Ohtake (Oita University, Japan)

In recent years, traffic accidents relating to bicycles have been declining. The reason for this is that the improvement in car safety has greatly reduced the number of accidents between bicycles and cars. However, contact accidents between bicycles have not been reduced, and measures for that are necessary. In this study, We focuses on the safety performance of car and propose a warning system for avoid collision between bicycles. Recent automobiles have introduced an accident avoidance system using sensors. Even in accidents between bicycles, It hope that the number of accidents will be reduced by using sensors to detect and notify the presence of other bicycles. More specifically, multiple sensors installed on the road detect the bicycle, and the control device predicts the possibility of collision from data such as distance and time, and output device alerts the driver. The usefulness of the warning and the appropriate timing of warning are shown by experiments.

10:00 Bitrate selection for MPEG-DASH considering QoE by queueing theory

Daisuke Kasuya and Sumiko Miyata (Shibaura Institute of Technology, Japan)

In recent years, video streaming data is increasing. Therefore, MPEG-DASH (Moving Picture Experts Group-Dynamic Adaptive Streaming over HTTP), which is one of the protocols changing the video bit rate adaptively according to the user's network throughput in the video streaming service, has been developed. In the research on DASH, it is pointed out that the loss of the segment which is a video playing unit affects the video quality of multicast environment. It has also been pointed out that the occurrence of buffer underrun, which means that video playback stops, leads to user dissatisfaction. In this paper, we propose an evaluation function for QoE (Quality of Experience) considering segment loss and buffer underrun probability. Moreover, we derive an optimal video bit rate to maximize the QoE value. The characteristics are analyzed by the simulation using the M/D/1/K model of queueing theory.

10:15 Machining Learning for 2D-SLAM Object Classification and Recognition

Chao-Chung Peng and Chun-Yen Yu (National Cheng Kung University, Taiwan)

Artificial intelligence has being widely used in the last decade, and the relevant machine learning (ML) topics are also attracted more and more attention. Therefore, in this note, certain ML related algorithms are integrated into two dimensional simultaneous localization and mapping (2D-SLAM) technology in order to give meaningful labels to certain specific objects in the environment. For the 2D-SLAM technology, the main objective is to reconstruct a binary map of the unknown environment. However, 2D-SLAM itself does not have the capability of recognizing scanning objects. To extend the application of 2DSLAM, in this study, point cloud clustering in conjunction with image preprocessing are used in the ML methods. The proposed method can predict the label of the clustered point clouds. Consequently, the 2D-SLAM could achieve environment awareness applications, for example, forest tree counting use. Based on a given bunch of training data, this research show that the model training accuracy is 99.89%, the validation accuracy is 97.96%, and the testing accuracy could achieve 95.96%; Finally, the predicted accuracy for the given SLAM map can be up to 80%.

10:30 Experimental Study of Material Classification and Recognition by a LiDAR Scanning

Chao-Chung Peng and Chien-Ru Yu (National Cheng Kung University, Taiwan)

In this short note, a method is presented to classify metal, wood and glass objects by using the measurement of light detection and ranging (LiDAR). It is found that those objects can be easily distinguished if the incident angle, which is formed by a laser bin and a normal vector of the reflection surface, is near zero. However, for practical application, it would be quite difficult to guarantee the zero-incident-angle condition. Therefore, a bunch of data from arbitrary view were collected and used for training and classification. Experiments show that the incident angle affect the reflection intensity of the LiDAR significantly and therefore cause the performance degradation of object recognition.

H3: Intelligent Algorithms, Architectures, and Circuits for Emerging IC Design Techniques

Room: Lyon B

Chair: Yu-Hsuan Lee (Multimedia Circuit and System Lab, Department of Electrical Engineering, Yuan-Ze University, Taiwan)

9:00 Smooth Dark Channel Prior Technique for Image Dehazing Applications

Hsuan-Yu Chang and Chia-Cheng Hsu (Yuan-Ze University, Taiwan); Yu-Hsuan Lee (Multimedia Circuit and System Lab, Department of Electrical Engineering, Yuan-Ze University, Taiwan)

Image dehazing algorithm can restore a hazed image back to a haze-free image. Dark channel prior (DCP) is an efficient technique to estimate an airlight owing to its effectiveness. However, DCP causes considerable computation burdens, limiting its hardware efficiencies. To overcome this limitation, a smooth DCP (SDCP) technique is proposed in this study. The experimental results show that this study can save computation burdens by 70.9% with a minor loss of 1.03% on the accuracy of airlight estimation. Consequently, this study can greatly reduce computation burdens of DCP while keeping an accurate airlight estimation.

9:15 High-Timing-Resolution and Low-Complexity Cell-Based Digitally Controlled Oscillator

Duo Sheng, Wei-Yen Chen, Yu-Hsiang Chang and Hao-Ting Huang (Fu Jen Catholic University, Taiwan)

A digitally controlled oscillator (DCO) with cell-based design for all-digital phase-locked loop (ADPLL) in System-on-Chip (SoC) applications is presented. The proposed DCO not only can achieve high timing resolution, but also have small area. Simulation results of DCO show that timing resolution can be improved to 4.4ps with 0.0018mm² area in 0.18 μ m CMOS technology. In addition, the proposed design can be implemented with standard cells, making it easily portable to different processes and very suitable for SoC applications.

9:30 Improved Normalized Probabilistic Minimum Summation Algorithm for LDPC decoding

Chen-Xuan Wang and Cheng-Hung Lin (Yuan Ze University, Taiwan)

An improved method for simplified min-sum algorithm is proposed in this paper. The hardware design of the probabilistic min-sum algorithm can be efficiently realized by grouping searching. Although it can accelerate calculation and reduce hardware complexity, it will cause decoding capability to be declined. In order to recover the decoding capability, we apply the perfect first minimum for adjusting the reliability of the probabilistic second minimum. Maintaining the value of the first minimum and proportionally combining the first two minima can flexibly improve the reliability of probabilistic second minimum. Compared with the original simplified min-sum algorithm, the improved method can not only gain the efficient hardware design but also obtain the better decoding performance.

9:45 A Baseband All-Digital Clock and Data Recovery Circuit with A Limited Range Binary Search FSM

Jia-ken Li (Yuan Ze University, Taiwan); Hung-Wen Lin (YuanZe University, Taiwan)

This paper proposes an all-digital-phase-locked-loop (ADPLL)-based clock-and-data-recovery circuit (CDR) for the baseband circuit system. To apply for different data-rate, a programmable digital-control-clock-phase-generator (DCPG) was designed to generate the recovery clock with different phase resolution. To perform binary search at an arbitrary phase number, a limited-range binary search flow was added into the phase-frequency-control finite state machine (PFCFSM). The proposed CDR was verified in 0.18 μ m CMOS process and occupied 200 μ m by 225 μ m of core area. With 1V of supply voltage, 200MHz of reference clock and \pm 500ppm of data frequency offset, the chip results shows the data rate from 1Mbps to 5.5Mbps and consumes a total power of 0.22mW. At 5.5Mbps, the recovery clock and data are with 0.025UI and 0.0475UI of timing jitter, respectively.

10:00 Reconfigurable MAC Systolic Array Architecture Design for Three-Dimensional Convolution Neural Network

Shu-Yen Lin (Yuan Ze University, Taiwan); Kuan-Han Lin, Chun-Kuan Tsai and Po-Hsiang Tseng (Yuan-Ze University, Taiwan)

Nowadays, Convolutional Neural Network (CNN) is widely used in many applications. Plenty of MAC operations may cause long latency for CNN. To solve this problem, 3D stacking of CNN (3D CNN) is applied. However, 3D CNN may lead to the thermal problem. In this work, we propose a reconfigurable MAC systolic array architecture (RMACA) for 3D CNN. If the hotspot in the 3D CNN occurs, partial MACs can be turned off by using RMACA. Thus, the heat accumulation can be reduced and the hotspot can be removed. RMACA is implemented by TSMC 90-nm CMOS technology, 21,670 gates is required to realize 4x4 CNN with RMACA.

H4: Intelligent Multimedia Computing

Room: Lyon D

Chair: Chih-Yang Lin (Yuan Ze University, Taiwan)

9:00 Limited-Anchor Deep Neural Network for Moving Object Detection

Chih-Yang Lin (Yuan Ze University, Taiwan); Han-Yi Huang and Wei-Yang Lin (National Chung Cheng University, Taiwan); Chuan-Yu Chang (National Yunlin University of Science and Technology, Taiwan); Wen-Thong Chang (Asia University, Taiwan); Yih-Kuen Jan (University of Illinois at Urbana-Champaign, USA)

This paper proposes a new method that integrates a deep learning based object detection network into traditional background modeling to detect moving objects. The proposed method allows us to efficiently identify candidates that contain moving objects while only setting a small number of anchors in the moving area of the image through guidance from the traditional background modeling method. This paper overcomes the disadvantages of conventional background modeling methods and conventional deep learning based object detection methods in terms of dynamic backgrounds and objects' motion states.

9:15 BERT-Based Stock Market Sentiment Analysis

Chien-Cheng Lee and Zhongjian Gao (Yuan Ze University, Taiwan); Chunli Tsai (Taiwan)

This paper explores the performance of natural language processing in financial sentiment classification. We collected people's views on U.S. stocks from the Stocktwits website. The messages on this website reflect investors' views on the stock. These messages are classified into positive or negative sentiments using a BERT-based language model. Investor sentiment can be further analyzed to help more investors, businesses or organizations make effective decisions. The experimental results show that the pre-trained BERT model has been fine-tuned on the labeled sentiment dataset, and can recognize the sentiment of investors with an accuracy of more than 87.3%.

9:30 Clothing Brand Prediction via Logo Recognition

Kuan-Hsien Liu (National Taichung University of Science and Technology, Taiwan); Fei Wang and Tsung-Jung Liu (National Chung Hsing University, Taiwan); Guan-Hong Chen (National Taichung University of Science and Technology, Taiwan)

To deeper and more accurately to learn convolutional neural networks, dense blocks can be incorporated into convolutional networks to shorten connections between layers. In this paper, we proposed a new clothing brand prediction method based on a dense-block deep convolutional neural network for logo detection and recognition. Several dense blocks are designed to improve prediction accuracy on clothing brand logo. We also constructed a new clothing dataset with brand and logo information to facilitate this task. In the experiment, we show our method can achieve better performance than some state-of-the-art methods.

9:45 Event-Based Surveillance Video Retrieval Through Trajectory Analysis using Fisheye Camera

I-Cheng Yeh, Sebastian Chung and Yung-Peng Hsu (Yuan Ze University, Taiwan); Chung-I Huang (National Center for High Performance Computing, Taiwan)

For a long time, traffic surveillance cameras have been of great help in dealing with traffic incidents, monitoring, and analyzing driver behavior, and urban traffic planning. However, traffic monitoring video data are vast and so often have a high computational cost in post analysis and statistics, and the responsiveness is also an issue. In order to more comprehensively obtain vehicle behavior information at intersections, more and more surveillance cameras are being replaced by fisheye cameras, which makes traditional vehicle identification and tracking more difficult. Therefore, this study proposes a system architecture designed for the management of fisheye video data at intersections in scenarios of police traffic monitoring. Automatically identifying and tracking vehicles and processing their trajectories into subsequent semi-structured data that can be easily searched and counted, increases the possibilities of data usage.

H5: Intelligent Multimedia Signal Processing and Applications

Room: Lyon E

Chair: Ching-Chun Huang (National Chiao Tung University, Taiwan)

9:00 Learning to Predict Risky Driving Behaviors for Autonomous Driving

Chih-Chung Hsu, Wen-Hai Tseng and Hao-Ting Yang (National Pingtung University of Science and Technology, Taiwan)

The most critical issue in the autonomous car is safety. Many kinds of research were proposed in recent years, such as car accident, obstacle, lane detection, and sign recognition, to study this issue. However, we can observe that some clues can be seen before the crash occurs. Several large-scale datasets were established by different research groups in recent years to study the driving behaviors to obtain better driving experience for the autonomous car. However, no dataset focuses on risky driving behaviors. Risky and dangerous driving behavior will directly lead to car accidents. Once we can discover the risky driving behaviors in advance, it is possible to make more response time. In this paper, we collect 400 our own videos with car accidents and carefully annotate the dangerous behaviors, car accidents, and object contextual information for each video. We also investigate the preliminary approach to discover the cues of the common risky behaviors from the collected dataset. The initial experiments also show that the common dangerous behaviors mining can effectively increase the response time before the car accident occurs.

9:15 Multi-View Clothing Image Searching Based on Deep Neural Network

Mutia Fadhilla, Jen-Yung Lin and Wen-Jan Chen (Da-Yeh University, Taiwan); Guo-Shiang Lin (National Chin-Yi University of Technology, Taiwan)

Searching clothing product from different views is a challenging problem. In this paper, we proposed a clothing image searching method based on deep neural network. The category and attribute information are used as the target to obtain a suitable network for clothing image searching. The feature vector of each clothing product image is the combination of convolutional neural network and fully connected layer. Based on cosine similarity measurement, similar clothing images can be found. For multi-view clothing searching, the searching accuracy can reach 96.23%.

9:30 A motion analysis-based mental stress assessment method through a smartphone carrier for patients need radiotherapy

Yi-ting Wu (National Chung Cheng University, Taiwan); Shih-Kai Hung, Hon-Yi Lin, Moon-Sing Lee, Wen-Yen Chiou, Liang-Cheng Chen and Li-Wen Huang (Dalin Tzu Chi Hospital, Taiwan); Wei-Min Liu (National Chung Cheng University, Taiwan)

Radiotherapy uses high-energy radiation to eradicate cancer cells and requires high precision and accuracy. However, the negative psychological and physiological conditions of cancer patients could introduce instability in the treatment. In the study, we explore the connection between mental stress and the severity of the instability. A smartphone is utilized to perform simultaneous measurements and a specific experimental setting and data analysis method are designed. A potential advantage of the assessment is that if a cancer patient cannot maintain good stability in the test, it is also not safe for him/her to receive the radiotherapy due to the higher risk of

missing the cancerous site and damaging the normal tissue.

9:45 *Outside the Box: New Style Discovering via Generative Adversarial Network for Shoes Design*

Hao-Ting Li, Wen-Hsiu Yang and Chen-Kuo Chiang (National Chung Cheng University, Taiwan)

In this paper, a GAN-based method to discover new style without manually labelling for styles. The experimental results show that we can successfully generate creative sneakers on the shoes dataset, which can be used as an inspiration-provider for shoe designers.

10:00 *Turning Digital Signal Processing into Graph Signal Processing: Overview and Applications*

Pierre Vilar Dantas (Universidade Federal do Amazonas - UFAM, Brazil); Waldir Silva (Universidade Federal do Amazonas, Brazil); Celso Barbosa Carvalho (Federal University of Amazonas, Brazil)

Digital signal processing on graphs (DSPG) exploits signals whose domain, represented by a graph, is irregular. In this article, we present an overview and some applications of a graph. We also present some approaches used to process data in graphs, highlighting the application of Fourier transform, frequency analysis, filtering, sampling and data classification, presenting their connection to conventional digital signal processing.

Wednesday, September 30 10:30 - 10:50

Coffee Break

Wednesday, September 30 10:50 - 11:50

Keynote: Yoshikazu Miyanaga

Room: Eiffel Hall

Chair: Tsung-Han Tsai (National Central University, Taiwan)

Wednesday, September 30 11:50 - 13:00

Lunch

Wednesday, September 30 13:00 - 14:30

I1: Computer Communications and Signal Processing for Next Generation Media I

Room: Eiffel Hall

Chairs: Yutaka Ishibashi (Nagoya Institute of Technology, Japan), Pingguo Huang (Gifu Shotoku Gakuen University, Japan)

13:00 *Towards the Optimal Control of Haptic Communication*

Hitoshi Watanabe (Tokyo University of Science & Faculty of Engineering, Japan); Pingguo Huang (Gifu Shotoku Gakuen University, Japan); Yutaka Ishibashi (Nagoya Institute of Technology, Japan)

This paper describes the investigation for establishing the optimal control of the stability and the operability of the remote robot systems using haptic communication under the communication delay. Firstly, this method describes the behavior of remote robot systems by difference differential equation. Secondly, the parameters contained in the equation are estimated through the experiment. Then, the optimal control is realized by using the estimated parameters. This paper summarizes the results of our previous work and adds the new results. Moreover, the future issues are discussed.

13:15 *QoS Comparison of Application-Level and MAC-Level Retransmission Mechanisms on Audiovisual Multicast over Wireless LANs*

Toshiro Nunome and Shuhei Tanaka (Nagoya Institute of Technology, Japan)

This paper evaluates application-level QoS (Quality of Service) of audio and video reliable multicast over a wireless LAN by experiment. We employ two strategies for reliable transmission: an application-level retransmission mechanism and a MAC-level one. The application-level mechanism considers the output deadline for the decision of retransmission. As the MAC-level mechanism, we employ IEEE 802.11aa Unsolicited Retry. We perform an experiment for the application-level QoS comparison in which a media server multicasts audiovisual streams to two media receivers.

13:30 *Effects of Stabilization Control and QoS Control for Cooperation between Remote Robot Systems with Force*

Feedback

Kazuya Kanaishi (Nagoya Institute of Technology, Japan); Yutaka Ishibashi (Nagoya Institute of Technology, Japan); Pingguo Huang (Gifu Shotoku Gakuen University, Japan); Takanori Miyoshi (Nagaoka University of Technology, Japan)
By experiment, this paper investigates effects of stabilization control to suppress instability phenomena and QoS (Quality of Service) control to improve QoE (Quality of Experience) for remote robot systems with force feedback. We carry out the stabilization control with filters as the former control and the adaptive Δ -causality control as the later control. In our experiment, we employ the two systems, and two robot arms carry a wooden stick together by gripping both ends of the stick. Experimental results illustrate that the stabilization control with filters can suppress instability phenomena, and the adaptive Δ -causality control can reduce force applied to the object.

13:45 Remote Control of Haptic-enabled Robotic Manipulator

Ho Chi Kwan (Toyoashi University of Technology, Japan); Takanori Miyoshi (Nagaoka University of Technology, Japan); Yutaka Ishibashi (Nagoya Institute of Technology, Japan); Pingguo Huang (Gifu Shotoku Gakuen University, Japan)
By experiment, this paper investigates the performance of kinematics stability of a master-slave manipulator system targeting for haptic-enabled remote control. Experiment of master-slave motion reflection was carried out, and the trajectories on both ends were recorded by motion capture cameras. Experimental results illustrated inverse kinematics algorithm using Pieper's Solution can facilitate motion reflection with adequate stability and accuracy.

14:00 A Performance Evaluation of Queueing Systems by Machine Learning

Suguru Nii, Takashi Okuda and Takuya Wakita (Aichi Prefectural University, Japan)
This paper presents a performance evaluation of queueing systems by machine learning. The number of devices connected to the internet is going up in the Internet of Things (IoT) era. Hence, it is useful for designing telecommunication systems to evaluate a performance of general queueing systems which distributions of inter-arrival time and processing time are general. However, the exact solutions of general queueing systems have not been developed. Alternatively, we can apply the discrete simulation to evaluate the performance. However, it takes much time. In this paper, we propose the performance evaluation method by machine learning to solve the problems.

14:15 Throughput Measurement of IEEE 802.11ad with Various Interferences on Vehicles

Tomonori Hirata and Tutomu Murase (Nagoya University, Japan)
IEEE802.11ad wireless LAN (WLAN) set in a vehicle was examined in order to know how much throughput quality was observed in congestion cases. As such a congestion case, two WLAN were used to measure throughput when vehicle frames and windows of a vehicle mitigate interference from other WLANs of other vehicles. Experiments by using real 802.11ad devices were performed and provided many useful qualitative results. For example, throughput degradation by interference is very large, 71.9% with door opened and is still large, 32.1% through glass windows. The results also revealed that steel frame doors are effective enough to shield the interference regardless of glass windows being opened or closed.

12: Intelligent Video Analytics and Multimedia Systems

Room: Lyon A

Chairs: Yen-Lin Chen (National Taipei University of Technology, Taiwan), Yu-Cheng Fan (National Taipei University of Technology, Taiwan)

13:00 Self-driving Deep Learning System based on Depth Image Based Rendering and LiDAR Point Cloud

Guo-Han Lin, Chun-Hsiang Chang, Ming-Chun Chung and Yu-Cheng Fan (National Taipei University of Technology, Taiwan)
We present a "Self-driving deep learning system based on depth image based rendering and LiDAR point clouds" in this paper. Using the depth image based rendering (DIBR) to obtain complete point clouds, combining with the color image modified by histogram equalization and optimal profile compression (HEOPC), and further using MobileNet-YOLO neural network to achieve accurate 3D environment detection and identification. Using the DIBR to generate parallax map information, and obtaining the depth image through the conversion formula. Then combining LiDAR point cloud and the depth image to repair the objects in the point cloud image. We combine HEOPC and the accuracy of deep learning to optimize the color image enhancement of the night environment. According to the restored point cloud information, we perform a cutting algorithm to divide the area of interest. Then through MobileNet-YOLO neural network training, to identify the area of interest, including people, cars and bus.

13:15 A traffic recognition based on artificial neural networks in SDN systems

Kai-Wei Ke (National Taipei University of Technology, Taiwan); Yu-Shan Zhou (National Taipei University of Technology, Taipei, Taiwan, ROC, Taiwan); Ho-Ting Wu (National Taipei University of Technology, Taiwan)
This paper presents a traffic recognition, the basis of QoS, based on artificial neural networks in SDN systems. To the design methodology of systems, this paper applied successive semi-supervised learning and based upon Convolutional Neural Network (CNN) to enabling packet identification and determine the traffic type of a flow. The resulting reveals up to ninety-five percent of correctness of given/labelled flow recognition and a ninety-two percent of correctness for unknown flows.

13:30 Multi-view Vehicle Re-Identification Method Based on Siamese Convolutional Neural Network Structure

Lam Mai, Xiu-Zhi Chen, Chao-Wei Yu and Yen-Lin Chen (National Taipei University of Technology, Taiwan)

Vehicle re-identification is a popular issue in intelligent traffic research. A lot of proposed method achieve vehicle re-identification by recognizing their license plate, because of the uniqueness. However, license plate can be stolen and pinned to different vehicles by criminals to hide their identities. In addition, the license plate number might be covered by dirt or stain, even hided from different viewpoints, makes the character recognition result might be wrong or unrecognizd. To get more robust re-identification result, not only the license plate should be considered, but also the appearance. In this paper, we adopt Siamese Convolutional Neural Network structure, take license plate and vehicle appearance as input, come up with a neural network for vehicle re-identification task. We validate our proposed method on VeRi-776 dataset, and proof that it can deal with vehicle re-identification task well, even under variant viewpoints scenarios.

13:45 The Eye Tracking and Gaze Estimation System by Low Cost Wearable Devices

Yen-Lin Chen, Ko-Fong Lee, Chao-Wei Yu and Cheng-Han Wu (National Taipei University of Technology, Taiwan)

This study develop a wearable eye tracking and gaze estimation low cost devices. This devices use infrared camera and design by integration of elastic mechanism adaptable. The use of cheap endoscope camera for mobile and 3D print technique for building up the devices, which results in be a low cost solution. This device can effectively extract and estimate pupil ellipse from few camera-captured samples of an eye and compute the corresponding 3D eye model. And this device use multiple point's calibration method to solve the related polynomial formula for future angle-to-gaze mapping. This wearable device is a low-cost which can be used for virtual reality and auxiliary equipment.

14:00 E Learning System Based on Multimedia and Game Mechanics

Yen-Lin Chen (National Taipei University of Technology, Taiwan); Kai-Yi Chin (Soochow University, Taiwan); Ko-Fong Lee (National Taipei University of Technology, Taiwan)

This study proposed a learning system combining multimedia technology and game mechanics based on multimedia and game mechanics that included a guide module, story module, question module, learning module, feedback module, and scoring module. These modules were used to guide users who were learning a course. This system could assist users in learning and reviewing the history of Tamsui's development. It was hoped that this system could be used as a teaching aid that allows learners to gain knowledge through games and achieve the effect of teaching and entertainment.

14:15 Cost-Effective Person Identity Recognition based on Plantar Pressure Images

Chao-Hsien Lee and Li-Ting Li (National Taipei University of Technology, Taiwan)

With the aging of world population structure, it is an important issue to identify patients in the long-term care environment. In order to keep privacy, this paper studies plantar pressure images as biometric features. However, most high-accuracy deep learning models require high computation resources. This paper proposed one cost-effective person identity recognition model. According to the initial experimental results, the proposed model has lower FLOPs and higher accuracy.

13: Smart Sensing Technologies & Applications for Human Health Promotion

Room: Lyon B

Chair: Wan-Jung Chang (Southern Taiwan University of Science and Technology, Taiwan)

13:00 A portable remote emergency support system (PRESS) for worker safety in noisy working environments

HangHong Kuo, Aaron Raymond A. See and Chun-Hung Yang (Southern Taiwan University of Science and Technology, Taiwan)

Operators in factories are often fatigued due to long working hours causing them to have a reduced attention and ignore visible warning signs that has led to numerous accidents at work. However, many of these factories are huge and have noisy environments, thus when an accident happens there have been times that immediate help cannot be given since no one knows the location or condition of the injured worker. One method is through the use of a wireless transceiver to notify the office. Thus, the proposed project will develop a portable remote emergency support system (PRESS) that is connected to a main office to provide warning and communication for individual workers in the work area. The portable device would also have a personalized intercom, so that staff can use this system to clearly communicate with the worker. In addition, another important issue of Gong'an is the delay in rescue, so a monitoring function such as fall detection and automated call for help is included. The device can report and ask for help at the first time when an accident occurs. Furthermore, this system can use a remote data access, to let staff have a grasp of information for specific machines even if they are not near it, hence fulfilling a holistic industry 4.0 information application. This system will integrate mobile wireless transmitters, smart phones, voice prompts, voice walkie-talkies, emergency help, and other functions to complete a work safety portable warning and emergency support system. The proposed system can provide a more convenient information dissemination system in a factory environment, and take into account the safety of the workers that consummates in a more secure and relaxed working environment.

13:15 A Music Recommendation System for Depression Therapy Based on EEG

Shih Hsiung Lee (National Kaohsiung University of Science and Technology, Taiwan)

Depression is a civilized disease that commonly exists in human society. Music therapy can help relieve emotional and psychological stress. How to monitor and capture human psychological conditions can be understood through brainwave signals. With the advancement of technology and the spread of communication technology, wearable devices are becoming more comfortable and applied to people's lives. This paper will use a commercially available EEG Bluetooth headset that can capture brain wave changes (such as alpha and beta wave) through sensors. Through the Bluetooth transmission function, data can be transmitted securely with the mobile device. The EEG signal can provide a wide range of information about various cognitive dysfunctions and diseases. Further analysis of the EEG signal, classification and classification of depression level, in addition to providing medical staff as a reference for treatment, can also be used as an evaluation basis for music therapy. Therefore, this paper will implement a music recommendation system to provide users with a list of soothing emotions according to different symptoms and degrees. In music analysis, this paper will collect a variety of different types of music, through field verification and algorithm combination, to achieve a more robust depression music therapy recommendation system.

13:30 A Wearable Devices-Based Home Sports Recording System for Health Management

Wan-Jung Chang and [Chia-Hao Hsu](#) (Southern Taiwan University of Science and Technology, Taiwan); Liang-Bi Chen (National Penghu University of Science and Technology, Taiwan); Jian-Ping Su and Ming-Che Chen (Southern Taiwan University of Science and Technology, Taiwan)

This paper proposes a wearable devices-based home sports recording system, which is composed of wearable devices, a mobile device app, and a cloud-based management platform. The proposed system can analyze five regular sports behaviors (walking, jogging, hula hoops, sit-ups, and push-up) taken by the sports person during a day. These five regular sports behaviors can be converted into calorie consumption so that the sportsmen can further understand how much exercise they need to reach the target of calories burned in a day.

13:45 Piezoresistive tactile sensor with tongue pressure measurement capability for dysphagia assessment

Cheng-Huan Lu and Muhammad Omar Shaikh (National Sun Yat-sen University, Taiwan); Hsiu-Yueh Liu (Kaohsiung Medical University, Taiwan); Cheng-Hsin Chuang (National Sun Yat-sen University, Taiwan)

Diagnosis of dysphagia or difficulty in swallowing begins with suspecting its presence. When dysphagia is suspected, patients with high risks should be screened by means of simplified examinations for dysphagia. Highly sensitive yet simple screening tests are extremely useful when examining patients in both clinical and point-of-care settings. In particular, orthodontists are increasingly interested in analyzing the pressure of the tongue against the hard palate since it gives valuable information on several vital functions, including swallowing and speaking. In this study, we report on the development of a soft and flexible piezoresistive tactile sensor for quantitative measurement of tongue pressure. The sensing layer is made of a grid type MWCNT/PDMS nanocomposite and is attached onto screen-printed interdigitated microelectrodes (IDMs). As the tongue pressure is applied and the sensing layer is deformed, the resistance across the IDMs decreases due to the piezoresistive properties of the nanocomposite. The observed sensor response is highly repeatable and shows an increasing trend as the applied force is varied from 1 to 33 N, which covers the complete required range for measuring human tongue pressure. Furthermore, to ensure practical applicability, the sensor was tested on 30 volunteers to measure their tongue pressure. The obtained sensor output was compared with a commercial pneumatic tongue press device and a high correlation (Pearson's $r = 0.8941829$) was obtained. Consequently the proposed tactile sensor shows promise for applicability in measuring tongue pressure.

14:00 Image-based Skin Temperature and Pulse Rate Measuring System

Yi-Tao Chuang (National Taiwan University of Science and Technology, Taiwan); Sheng-Jie Lai (Taiwan); Tzu Fan Chang and Yuan Hsiang Lin (National Taiwan University of Science and Technology, Taiwan)

In this study, we developed a skin temperature and pulse rate measuring system with a thermal camera and a RGB camera. Combining image processing and digital signal processing technology, we expect to provide a contactless physiological signal measurement system for baby care, medical care or highly infectious disease.

14:15 Active Surveillance for COVID-19 Through Artificial Intelligence Using Real-Time Speech-Recognition Mobile Application

[Mohammad Zafar Iqbal](#) (North Eastern Indira Gandhi Regional Institute of Health and Medical Sciences, India); Mohammad Faiz Iqbal Faiz (North Eastern Regional Institute of Science and Technology, India)

We propose a novel model of active surveillance for COVID-19 through artificial intelligence. Both past and recent events of viral disease outbreaks have shown us that we do not have effective methods to screen the whole population, and efforts are failing to stop the pandemics. Moreover, at this stage, social distancing and home quarantine are only measures to stop the spread of COVID-19 infection. The purpose of our project is to introduce a robust method of using speech-recognition techniques through a mobile application in analyzing cough sounds of suspected people who previously were healthy, suffering from a respiratory ailment, and actively monitor the progress of their symptoms in real-time.

14: Basic Technologies for Consumer Electronics & Enabling Technologies and Others

Room: Lyon D

Chair: Shingchern D You (National Taipei University of Technology, Taiwan)

13:00 A Lossless auxiliary circuit for Interleaved Boost Converters

Binxin Zhu, Yujin Yang and Xiaoli She (China Three Gorges University, China); Lei Liu (Queensland University of Technology, Australia)

This paper proposes a novel lossless auxiliary circuit for interleaved boost converter which provides zero voltage switching condition (ZVS) for switches at turn off instant, and the auxiliary circuit uses no magnetic components or active switches, so that high efficiency and high-power density can be achieved.

13:15 A heterogeneous integration management for semiconductor package

Peng Yang (Advanced Semiconductor Engineering Inc., Taiwan)

The 5th Generation (5G) wireless systems popularity will push the package development into a high performance and heterogeneous integration form. For high I/O density and high performance packages, the promising Fan-Out Chip on Substrate (FOCoS) provides a solution to match Outsourced Semiconductor Assembly and Testing (OSAT) capability. In this paper, to reduce the panel warpage effect, we used three dimensional finite element method (3D-FEM) and advanced Metrology Analyzer (aMA) to find the optimum thickness and Coefficient of Thermal Expansion (CTE) of the glass carrier. About FOCoS device, packages with 9 complex chips especially with fine line RDL and multi-size μ bump joint structures inside have been successfully developed. In reliability examination, the test vehicle also passed the JEDEC qualification, respectively. Finally, ASE further developed it in a larger area and higher integration complexity for future 5G connectivity devices application.

13:30 Duration-selectable Story Generation Using Route Planning and Graph-to-text Conversion

Yi-Chong Zeng (Institute for Information Industry, Taiwan)

Every story is more than the collection of texts. In the past, people created stories depending on a storyline and designed various events in episodes of the story. Recently, researchers investigate story generation using the computer instead of the human being. In this paper, we propose a scheme to produce stories with various descriptions. The produced graph represents a storyline, and route planning is applied to it to find the proper route. According to the selected route, the graph-to-text conversion transforms characters' action as sentences. The experiment results demonstrate that the proposed scheme is capable of generating duration-selectable stories.

13:45 Trading ETFs with Deep Q-Learning Algorithm

Shao-Yan Hong, Chien-Hung Liu, Woei-Kae Chen and Shingchern D You (National Taipei University of Technology, Taiwan)

This paper reports the use of double deep Q-learning (DDQN) for trading exchange-traded funds (ETFs). When compared with the buy-and-hold strategy, the proposed approach has better return in a downtrend market and comparable return in a sideways market. The buy-and-hold has some advantage in an uptrend market.

14:00 Weight Quantization in Spiking Neural Network for Hardware Implementation

Muhammad Bintang Gemintang Sulaiman and Kai-Cheung Juang (Industrial Technology Research Institute, Taiwan); Chih-Cheng Lu (ITRI, Taiwan)

Spiking Neural Network (SNN) is the third generation of Artificial Neural Network (ANN), which is potentially an efficient way to reduce the computation load as well as the power consumption on hardware due to the sparse activation and event-driven behavior of its neuron. In this paper, we have trained an SNN by using Spike Timing Dependent Plasticity in an unsupervised manner. The training process is optimized by using the quantization method on its weights, performed at the regular intervals during training. From the simulation results, the SNN with the 4-bit weights received an accuracy drop of 0.09%. The behavioral simulation result with the same bit-width weight quantization received an accuracy drop of 0.28%.

14:15 A Fast Intra Mode Decision Method for HEVC

Wei-Ting Chen and Pei-Yin Chen (National Cheng Kung University, Taiwan); Salim Prayogo (National Cheng Kung University, Indonesia)

The High Efficiency Video Coding (HEVC) standard can achieve approximately 50% bit-rate reduction that compares with H.264. To enhance intra coding efficiency in HEVC, an increase in the number of intra modes from 9 to 35 is adopted. However, this technique drastically increases computational complexity of intra mode selection. In this paper, we propose two novel techniques to reduce the number of candidate intra modes. One is block texture detection and the other is Sum of absolute transformed differences (SATD) classification. The results indicate that the proposed method can reduce the encoding time by approximately 44% on average under all intra configurations.

15: Communication and Human-Centered Information Systems for Internet Applications I

Room: Lyon E

Chairs: Nobuo Funabiki (Okayama University, Japan), Shinji Sugawara (Chiba Institute of Technology, Japan)

13:00 A Message Transmission Method Based on Gossip Protocol and Anti-Packets in DTN Environment

Yusuke Ishibayashi and Shinji Sugawara (Chiba Institute of Technology, Japan)

This paper proposes an efficient message transmission method based on Gossip Protocol with Anti-Packets in DTN environment. In the previous research, we proposed a new message transmission method based on Epidemic Routing, called "Anti-packet Prime," and showed the efficiency of the method by using the ONE simulator. This time, the method is applied to one of Gossip Protocols (or Probability Routing Protocols), PROPHET, and evaluate the efficiency of this combined method with using the same simulator.

13:15 Person Recognition Using Wi-Fi Channel State Information in an Indoor Environment

Taishin Mabuchi, Yoshiaki Taniguchi and Kimiaki Shirahama (Kindai University, Japan)

Indoor person recognition technologies have potential for applications such as smart home services and room-specific security. This paper aims to verify whether person recognition is possible using Channel State Information (CSI) data obtained from Wi-Fi devices. We obtained CSI data from communications between a computer and an access point placed in our office. Person recognition was performed by applying machine learning technologies to the CSI data. The results show that an accuracy of about 93% was achieved using a non-linear SVM with an RBF kernel.

13:30 Botnet Defense System and Its Basic Strategy Against Malicious Botnet

Shingo Yamaguchi (Yamaguchi University, Japan)

This paper proposes a basic strategy for Botnet Defense System (BDS). BDS is a cybersecurity system that utilizes white-hat botnets to defend IoT systems against malicious botnets. Once a BDS detects a malicious botnet, it launches white-hat worms in order to drive out the malicious botnet. The proposed strategy aims at the proper use of the worms based on the worms' capability such as lifespan and secondary infectivity. If the worms have high secondary infectivity or a long lifespan, the BDS only has to launch a few worms. Otherwise, it should launch as many worms as possible. The effectiveness of the strategy was confirmed through the simulation evaluation using agent-oriented Petri nets.

13:45 A Proposal of Transmission Power Optimization Method for Concurrently Communicating Two Access-Points in Wireless Local-Area Network

Hendy Briantoro, Nobuo Funabiki, Kwenga Ismael Munene, Rahardhita Widyatra Sudibyoy and Minoru Kuribayashi (Okayama University, Japan); Wen-Chung Kao (National Taiwan Normal University, Taiwan)

Currently, IEEE 802.11n wireless local-area network (WLAN) has been popular around the world, where each host is connected to an access-point (AP) using wireless signal. Thus, the AP transmission power should be optimized to improve the performance considering the capacity and interference. In this paper, we present an AP transmission power optimization method for two concurrently communicating APs. Either the maximum or minimum power is selected for each AP that can maximize the signal-to-noise ratio (SNR). The effectiveness of the proposal is verified through experiments using Raspberry Pi APs.

14:00 A Study of Throughput-Drop Estimation Model for Concurrently Communicating Two Links without Channel Bonding in IEEE 802.11n Wireless Local-Area Network

Ismael Kwenga, Nobuo Funabiki, Rahardhita Widyatra Sudibyoy, Hendy Briantoro and Md. Mahbubur Rahman (Okayama University, Japan); Wen-Chung Kao (National Taiwan Normal University, Taiwan)

Nowadays, IEEE802.11n wireless local-area networks (WLANs) have been widely deployed with the advantage of the high-speed data transmission. The channel bonding is one of the key technologies to realize it. However, the data transmission throughput can be dropped when nearby multiple links are concurrently communicating due to their interferences. Previously, we have studied the throughput-drop estimation model for the links using the channel bonding, which considers the channel distance and the received signal strength (RSS) of the interfered links. In this paper, we study the throughput-drop estimation model for concurrently communicating two links without the channel bonding by extending the previous model. The effectiveness of the proposal is confirmed through experiments where the estimated throughput well matches the measured throughput.

14:15 Extracting Markers from Video Image for Self Localization System Based on Blinking LED and Omni-Camera

Kazuyuki Kojima and Takuya Ito (Shonan Institute of Technology, Japan)

This paper describes an improvement of our proposed self-localization method utilizing LEDs and an omnidirectional camera. In our previous work, image and signal processing needed high calculation cost. For this reason, the framework could not achieve real-time position estimation. In this paper, we applied machine learning to reduce the calculation cost, especially for extracting the LED pixels from a captured video image in shorter time.

Wednesday, September 30 14:30 - 14:50

Coffee Break

Wednesday, September 30 14:50 - 16:20

J1: Computer Communications and Signal Processing for Next Generation Media II

Room: Eiffel Hall

Chairs: Pingguo Huang (Gifu Shotoku Gakuen University, Japan), Shih-Ching Yeh (National Central University, Taiwan), Yutaka Ishibashi (Nagoya Institute of Technology, Japan)

14:50 Simple authentication methods with pseudo IDs and derivative passwords

Yuji Suga (Internet Initiative Japan Inc., Japan)

Nowadays, the endless stream of unauthorized login incidents that were thought to use a list of user IDs and passwords continued to leak in ID incidents. As a result, there is a growing awareness of the dangers of authentication methods that use only IDs and passwords, and new identity management technologies that incorporate other authentication methods are drawing attention [1]. Consequently, there is a wide variety of specifications related to the management and coordination of IDs used on the Internet. Because each is developed based on different concepts, it is necessary to select the one most appropriate for the environment it will be used in. It also encompasses an extremely diverse range of approaches, such as user authentication, issuing, and usage of credentials, management and circulation of attribute information, access control for various resources [2], and delegation of authority [3], as well as technology for coordinating this information between different entities. This paper discusses simple authentication methods with pseudo IDs and derivative passwords and we also organize the Identity technology, propose a new concept called derivative Tokens and IDs.

15:05 A Risk Evaluation of Password Management Strategies

Kohei Sakashita (Aichi Prefectural University, Japan); Akira Kawagoe and Takashi Okuda (Aichi Prefectural University, Japan)

So many online account users don't follow safety password management guidelines because of neglect or not knowing. We present a method to evaluate the risk of unsafe password management them to rethink own password management.

15:20 Proposal of an event visualization system for debugging in software-defined networking exercises using Trema

Yuichiro Tateiwa, Akifumi Asano, Yonghwan Kim and Yoshiaki Katayama (Nagoya Institute of Technology, Japan); Masaaki Niimura (Shinshu University, Japan)

In SDN exercises, several students fail to debug their controller programs of Trema. This paper proposes a support tool that collects information about statement executions in the programs and packets in the networks, and then visualizes them with sequence diagram. It is expected that the students find errors in their programs and collects them by analyzing the diagrams.

15:35 A Clock Synchronization Technique for OFDM-based Communications

Chien-Yao Hsiao (National Central University, Taiwan); Chii Shyang Kuo (National Central University, Taipei, Taiwan); Chih-Feng Wu (National Chin-Yi University of Technology, Taiwan); Muh-Tian Shiue (Nation Central University, Taiwan)

A clock synchronization scheme for the OFDM-based Communications will be presented in this paper. The clock synchronization function is composed of a phase-locked loop to compensate the sampling clock offset. The boundary estimation for triggering FFT functions as the initial acquisition of the phase-locked loop. The information of clock offset will be estimated in the frequency domain and feedback to adjust the phase of interpolation filter in the time domain. Simulation results will be shown to demonstrate this design.

15:50 Effects of Adaptive Viscoelasticity Control in Remote Penmanship System

Pingguo Huang (Gifu Shotoku Gakuen University, Japan); Yutaka Ishibashi and Yuichiro Tateiwa (Nagoya Institute of Technology, Japan)

In this paper, we investigate effects of the adaptive viscoelasticity control by Quality of Experience (QoE) assessment for a remote penmanship system in which a teacher can teach a student how to write characters while feeling the reaction force from each other and watching video. We assess the operability, reproducibility, interactivity and the comprehensive quality as QoE. We also carry out multiple regression analysis to investigate which quality is the most important for users. Assessment results illustrate that the adaptive viscoelasticity control is effective and the reproducibility is the most important quality.

J2: Advanced Image Processing (AIP)

Room: Lyon A

Chairs: Tomio Goto (Nagoya Institute of Technology, Japan), Yi-Chong Zeng (Institute for Information Industry, Taiwan)

14:50 Semiautomatic Annotation Framework Based on Annotator Habit for Digital Breast Tomosynthesis

Yi-Chong Zeng (Institute for Information Industry, Taiwan)

Annotation is an essential task before training a model of classifier in machine learning. In general, people use a photo editor to draw contours represented as annotated results. However, most photo editors are limited to decode medical images with specified formats, such as Digital Imaging and Communication in Medicine (DICOM). In this paper, we propose a semiautomatic annotation framework for digital breast tomosynthesis (DBT). The challenge is to annotate multiple images of DBT simultaneously and keep annotation consistent within the adjacent images. First, we analyze the manual-annotated results in mammograms. Then, the proposed framework is established by referring to the analytics of manual annotation, which is composed of three phases, namely lesion pre-detection, extendable annotation, and key-points generation. Finally, an annotation tool is developed based on the proposed framework. The experiment results demonstrate that our tool is capable of achieving simultaneous annotation and result consistency to multiple images in DBT.

15:05 Noise Removal Method with Super-resolution for Surveillance Camera Images

Tomio Goto and Shogo Terai (Nagoya Institute of Technology, Japan)

It is necessary to remove noise from images in order to prevent deterioration due to noise during super-resolution for surveillance camera images. We propose to apply time-domain Total Variation regularization, and it is possible to separate noise and moving objects, and we have achieved to remove noise before super-resolution by applying noise removable process to surveillance camera images.

15:20 A Study on Avoidance Behavior on Bicycle Trips Detection Using Multiple Features for Improvement Road Management

Masahiro Yagi, Sho Takahashi and Toru Hagiwara (Hokkaido University, Japan)

This paper proposes a method for detecting avoidance behavior on bicycle trips in videos using multiple features. Our previous method detected the avoidance behavior on bicycle trips by using single feature based on rider's body parts. Also, the collaborative use of multiple features is effective for video analysis tasks. Thus, the proposed method introduces two new features for detection performance improvement. The introduced features are based on optical flow and Convolutional Neural Network (CNN), which are widely used in video analysis. Consequently, more accurate detection is realized. Experimental results show the effectiveness of the proposed method.

15:35 Hue Correction Scheme for Multi-Exposure Image Fusion Considering Hue Distortion in Input Images

Kouki Seo, Chihiro Go, Yuma Kinoshita and Hitoshi Kiya (Tokyo Metropolitan University, Japan)

We propose a novel hue-correction scheme for multi-exposure image fusion (MEF). Various MEF methods have so far been studied to generate higher-quality images. However, there are few MEF methods considering hue distortion unlike other fields of image processing, due to a lack of a reference image that has correct hue. In the proposed scheme, we generate an HDR image as a reference for hue correction, from input multi-exposure images. After that, hue distortion in an image fused by an MEF method is removed by using hue information of the HDR one, on the basis of the constant-hue plane in the RGB color space. In simulations, the proposed scheme is demonstrated to be effective to correct hue-distortion caused by conventional MEF methods. Experimental results also show that the proposed scheme can generate high-quality images, regardless of exposure conditions of input multi-exposure images.

15:50 An Estimation Method of Candidate Region for Superimposing Information Based on Gaze Tracking Data in Soccer Videos

Genki Suzuki, Sho Takahashi, Takahiro Ogawa and Miki Haseyama (Hokkaido University, Japan)

A novel method estimating candidate regions for superimposing information in soccer videos based on gaze tracking data is presented in this paper. The proposed method generates a likelihood map based on visual attention regions based on the gaze tracking data and detection results of objects such as players and soccer goals in soccer videos. Candidate regions for superimposing information are estimated by using the likelihood map. Experimental results show that the proposed method realizes effective candidate region estimation.

J3: Design, Management, and Control Technologies for Future Network Systems

Room: Lyon B

Chair: Kouji Hirata (Kansai University, Japan)

14:50 Performance Evaluation of Hierarchical Slotted ALOHA for IoT Applications

Takafumi Oku, Tomotaka Kimura and Jun Cheng (Doshisha University, Japan)

In this paper, we consider a hierarchical slotted ALOHA in which nodes are classified into several groups that have one head node and several member nodes. The member nodes transmit the packets to their head node in device-to-device transmission using slotted ALOHA, which is one type of random access scheme. The head node integrates the packets received from the member nodes and then transmits the integrated packet to the base station with slotted ALOHA. When hierarchical slotted ALOHA is used for IoT applications (e.g., real-time monitoring system), in which the sensing data are generated periodically, the freshness of the sensing data is important. Recently, to evaluate this freshness, the age of information (AoI), which is defined as the difference between the current time and the generation time of the latest information, was proposed. Through simulation experiments, we show that hierarchical slotted ALOHA outperforms conventional slotted ALOHA in terms of the AoI.

15:05 Modeling of malware diffusion with the FLIPIT game

Hideyoshi Miura (Kansai University, Japan); Tomotaka Kimura (Doshisha University, Japan); Kouji Hirata (Kansai University, Japan)

In this paper, we examine the optimal strategy to control the spread of the infection by applying the FLIPIT game to malware epidemic models. In the FLIPIT game for the epidemic models, an attacker and a defender compete for computing resources of hosts. The attacker infects the hosts with malware and abuses their computing resources for illegal attacks. On the other hand, the defender protects the hosts from the attacker by removing vulnerabilities and malware. We calculate the payoff obtained by the FLIPIT game through simulation experiments. Furthermore, based on the best response strategy and the Nash equilibrium derived from the results, we examine the optimal behavior for the attacker and the defender.

15:20 Estimation method of malware infection spreading with graph convolutional networks

Katsuki Uno (Kansai University, Japan); Tomotaka Kimura (Doshisha University, Japan); Kouji Hirata (Kansai University, Japan)

In this paper, we propose an estimation method of malware infection spreading with graph convolutional networks (GCN) for the epidemic model of future botnet malware. GCN is a machine learning technique that applies convolution operation for network structures. The infection spreading of malware depends on the network structures and infection source. The proposed method estimate the infection spreading level based on the network structures and the infection states of hosts, which are used as input data to GCN. In this paper, through numerical experiments, we show the effectiveness of the proposed method.

15:35 Channel Assignment for Coexistence of WiFi and LTE using Unlicensed Band Considering Uplink Communications

Ryoga Okaichi (Japan & Tokushima University, Japan); Kazuhiko Kinoshita (Tokushima University, Japan)

In recent years, LAA (Licensed Assisted Access using LTE), which is an LTE system using unlicensed bands, has been studied. Since the frequency utilization efficiency of LAA is higher than that of WiFi, LAA achieves higher throughput. However, LAA can cause significant interference with WiFi, since they use the same frequency band. The existing research derives a proportional allocation method for fair coexistence between LTE-U and WiFi by using a method that dynamically adapts the probability that an LTE-U network will access a channel. But, it considers downlink traffic only. When both downlink/uplink communications are ongoing via common AP, the downlink throughput decreases due to CSMA/CA. In this paper, considering the uplink communication, we propose a method to assign LAA channels to improve the average throughput while maintaining the minimum throughput.

15:50 Virtual Access Point Configuration Method Considering Uplink Communications

Jun Kishiue (Japan & Tokushima University, Japan); Kazuhiko Kinoshita (Tokushima University, Japan)

In recent years, high-performance mobile terminals have become widespread, and the amount of mobile data traffic has increased rapidly. For this reason, expectations for bandwidth guaranteed services are increasing. The existing method that makes virtual AP for each BE (Best Effort) service and GBR (Guaranteed Bit Rate) service receives much attention. It dynamically changes the physical AP assigned to each virtual AP, thereby keeping the call blocking probability GBR users below the target value and improving the satisfaction of BE users. However, it considers downlink traffic only. In uplink communications, some packet losses due to CSMA/CA decrease the effective throughput. This results in the misestimation of reserved bandwidth. This paper extends the existing method to consider uplink communications.

16:05 A Caching Scheme Based on Popularity and Generation Time of Feedback Information in Edge Computing

Yusuke Ito and Yusuke Wada (Tokyo University of Science, Japan); Tomotaka Kimura (Doshisha University, Japan); Kouji Hirata (Kansai University, Japan); Masahiro Muraguchi (Tokyo University of Science, Japan)

In this paper, we propose a caching scheme based on popularity and generation time of feedback information to provide real-time Internet of Things services in edge computing. This scheme preferentially stores feedback information with the long generation time as well as high popularity on edge servers. The simulation results show that the proposed scheme can improve feedback time for each user.

16:20 Prioritization method of link protection with convolutional neural networks

Yurina Nagasawa (Kansai University, Japan); Tomotaka Kimura (Doshisha University, Japan); Kouji Hirata (Kansai University, Japan)

In order to provide high quality services to users, communication networks need to keep high reliability. Therefore, they are operated so as to have tolerance to node and link failures. In this paper, we propose a prioritization method of link protection using convolutional neural networks, which are applied to a lot of research fields owing to its dramatic performance. To decide which links should be protected, we calculate the network availability. However, in general, the calculation time of the network availability exponentially increases as the number of links increases. The proposed method gives the priority of link to be protected in a short time by convolutional neural networks, where weighted adjacency matrices of nodes are used as input data. Through numerical experiments with CNN, we show the fundamental efficiency of our prioritization method.

J4: Internet of Energy for Advanced Electric Power Consuming

Room: Lyon D

Chairs: Chih-Peng Fan (National Chung Hsing University, Taiwan), Saher Javaid (Japan Advanced Institute of Science and Technology (JAIST), Japan)

14:50 Deep Q-Network Based Global Maximum Power Point Tracking for Partially Shaded PV System

Kuan-Yu Chou, Chia-Shiou Yang and Yon-Ping Chen (National Chiao Tung University, Taiwan)

Under the sun insolation in the daytime, the partially shaded effect would easily happen in a photovoltaic (PV) array due to clouds, trees, buildings, etc. To deal with the partially shaded effect, this paper proposes solar global maximum power point tracking (GMPPPT) method based on Deep Q-Network. Maximum power point tracking (MPPT) is often used to achieve the maximum power in the PV system. The Perturbation and Observation (P&O) method is one of the most popular MPPT techniques in practice. However, due to the use of fixed step size, the P&O method may cause undesired oscillation around the maximum power point (MPP). With the partially shaded effect,

the characteristic P-V curve of a PV array may possess multi-peaks, which often results in tracking of a local maximum, not the expected global maximum. Demonstrated by experiment results, the proposed Deep Q-Network based solar GMPPT method indeed can track the global MPP faster and more precisely without oscillation.

15:05 System Condition for Controllable Power Flow System Considering Reaction Delay

Saher Javaid (Japan Advanced Institute of Science and Technology (JAIST), Japan); Kaneko Mineo (Japan Advanced Institute of Science and Technology, Japan); Yasuo Tan (Japan Advanced Institute of Science and Technology & National Institute of Information and Communications Technology, Japan)

To mitigate the effects of power fluctuations, a power flow control problem is introduced which assigns power levels to controllable power devices and connections between power sources and loads. However, due to power device limitations the power balance may not be achieved. This paper proposes a system condition to guarantee the feasible solution which achieves power balance under power level and change speed limitations.

15:20 Study of Home Energy Management System for DC-based Nanogrid

Yuto Lim (Japan Advanced Institute of Science and Technology (JAIST) & School of Information Science, Japan); Jakaria Hossain (Japan Advanced Institute of Science and Technology, Japan); Saher Javaid (Japan Advanced Institute of Science and Technology (JAIST), Japan); Yasuo Tan (Japan Advanced Institute of Science and Technology & National Institute of Information and Communications Technology, Japan)

Efficiency has become a key parameter of development when designing any electrical power distribution system. Meanwhile, a significant attention has been paid to the design of nanogrid, which is comprising a residential house with renewable energy sources. A direct current (DC) distribution system with high and low voltage home appliances and devices within a house is called a DC-based nanogrid. For such distribution system, an efficient, stable and robust power management system is required. This paper proposes a novel 4-level DC-based home energy management system (DC HEMS), which is considering the efficiency of both energy conversion loss and cost. Numerical simulation results reveal that the proposed 4-level DC HEMS for DC-based nanogrid can achieve the efficiency improvement of 24.9% compared to the conventional 3-level DC HEMS in smart home environment.

15:35 Short-Term Sky Image Prediction using LSTMs from the Past Frames of Sky Images and Synthesized Images by Optical Flow Extrapolation

Takekazu Kato and [Takaya Nakagawa](#) (Shizuoka Institute of Science and Technology, Japan)

This paper describes a short-term sky image prediction method. Predicting cloud flow in the sky image is a useful technique that can be applied to forecasting solar power generation and forecasting sudden downpours. We propose LSTM based predicting method which uses optical flow vectors as input for the network. The flow obtained from sky images masked around sun are to cope with extreme high-brightness object (the sun). We implemented two way to merge the flow information with the sky image for inputs of the LSTMs and compared with baseline method which inputs past frames of sky images for the LSTMs.

15:50 Individual PV Cell Control based on Time Division Power Transmission System

[Takekazu Kato](#) and Yuki Ihara (Shizuoka Institute of Science and Technology, Japan)

This paper describes a new control mechanism for a photovoltaic power generation system. For the photovoltaic power generation system, partial shadowing is a serious problem because it makes the remarkably performance loss of the generating power, and further, it causes a hot spot of the cells. To solve this problem, we propose an individual cell control method using a time division transmission circuit. Proposed method switches the circuit over time to create a circuit of individual wiring for each cell and maintaining the optimal voltage for each cell. Experiments show that the proposed method achieves more power generation against partial shadows than a general circuit in a small system with three cells.

16:05 SOH Estimation of Battery Pack Composed on Reused Li-Ion Cells based on Adaptive ANN Machine Learning Algorithm

[Minella Bezha](#) (Doshisha University, Japan); Klara Bezha (Polytechnic University of Tirana, Albania); Naoto Nagaoka (Doshisha University, unknown)

An innovative state of health (SoH) estimation of the battery pack for the reused Li-Ion cells is presented in this paper. Its accuracy and calculation time are improved and accelerated using an online modeling approach (during operation) with optimal generalization. This model is based on the voltage and current characteristic data of a Li-Ion battery. By the voltage and current as the main inputs and with the help of secondary information as cycle usage, it can be possible to describe the actual quantity of energy, which is a key factor in applications. In this paper, the SoH estimation time is reduced to 40%, peak error and average error are reduced by 20% and 22%, comparing with the previous proposal. The number of input cells required for the ANN is 5000 also it is confirmed on this study that the proposed method can be applicable to a single cell as well to a battery pack. In simple words, this study proposes an alternative and cost-effective SoH estimation and diagnosis approach for the deteriorated battery, comparing to high-cost industrial devices.

16:20 An Intelligent Maintenance and Repair Informing System Using Machine Learning Techniques for Solar Power Generation Equipment

Wan-Jung Chang, [Ching-Hsiang Yang](#), Ming-Che Chen and Jian-Ping Su (Southern Taiwan University of Science and Technology, Taiwan); Liang-Bi Chen (National Penghu University of Science and Technology, Taiwan)

This paper proposes an intelligent maintenance and repair informing system for solar power generation equipment, which the machine-learning techniques adopted to improve the time for manually judging the abnormal operation of the equipment. Thereby the maintenance efficiency of the equipment can be enhanced to reduce solar power generation losses. Based on the current environmental sensing data and power generation data of equipment, the proposed system infers whether the status of the solar power generation of each equipment is abnormal and its possible causes. Moreover, the maintenance and repair informing procedures can be processed and decided within 15 minutes.

J5: Communication and Human-Centered Information Systems for Internet Applications II

Room: Lyon E

Chairs: Shinji Sugawara (Chiba Institute of Technology, Japan), Wen-Chung Kao (National Taiwan Normal University, Taiwan)

14:50 A Practical Exercise System Using Virtual Machines for Learning Cross-Site Scripting Countermeasures

Kazuri Kishimoto, Yoshiaki Taniguchi and Nobukazu Iguchi (Kindai University, Japan)

Cross-site scripting (XSS) is an often-occurring major attack that developers should consider when developing web applications. We develop a system that can provide practical exercises for learning how to create web applications that are secure against XSS. Our system utilizes free software and virtual machines, allowing low-cost, safe, and practical exercises. By using two virtual machines as the web server and the attacker host, the learner can conduct exercises demonstrating both XSS countermeasures and XSS attacks. In our system, learners use a web browser to learn and perform exercises related to XSS. Experimental evaluations confirm that the proposed system can support learning of XSS countermeasures.

15:05 A System for Supporting Creation of Procedure Manuals for Network Device Configuration

Kohei Yamaura, Yoshiaki Taniguchi and Nobukazu Iguchi (Kindai University, Japan)

When constructing networks or changing network designs, workers follow a procedure manual to issue commands to network devices. Procedure manuals are usually created manually, and may include mistakes. We therefore extend Graphical Network Simulator~3 for supporting creation of procedure manuals for network device configurations. In our system, users first use a virtual network to construct a target network, then verify the network using verification functions. Users then produce a manual from a procedure-manual creation function. Using our system, procedure manuals can be created while suppressing human errors and variation in user experience. Experimental evaluations confirm that procedure manuals created by our system can be used for configuring network devices.

15:20 Jean Joseph ZERO: Let Memories Come to Life with Music

Ker-Jiun Wang (University of Pittsburgh, USA); Caroline Yan Zheng (Royal College of Art, United Kingdom (Great Britain)); Maitreyee Wairagkar (Imperial College London, United Kingdom (Great Britain)); Mariana von Mohr (University College London, USA)

Jean Joseph ZERO is a Brain-Computer Interface (BCI) technology that transforms music induced memories, reflected as EEG brainwaves, into visualized experiences. The entire framework consists of one earbud-like BCI device to collect EEG signals, a deep learning decoder to extract the data features using Long Short-Term Memory (LSTM) Recurrent Neural Network (RNN), and a Generative Adversarial Network (GAN) to reconstruct/visualize human images recalled from listening to the music. In this paper, we have used Jean Joseph ZERO to develop a telepathy method that allows two persons staying far away can communicate with each other by thinking and haptic feedbacks. With music-induced memories, such information can be conveyed remotely to his/her friend through soft wearable haptic interface. This method provides on-the-fly mind communications and peaceful feelings when people are segregated from their families, close friends, or loved ones.

15:35 An Effective Seat Belt Detection System on the Bus

Hsiao-Chu Cheng (National Central University, Taiwan); Chih-Chuan Chang (National Chiao Tung University, Taiwan); Wen-June Wang (National Central University, Taiwan)

According to the "Regulations of the Automobile Transportation" of Taiwan, any passenger on the bus who is over 4 years old must fasten seat belts when the bus is driving on the free high way. In order to enforce passengers to follow the regulation, this study designs and implements a smart seat belt warning system by which the driver of the bus can detect whether each passenger fastens the seat belt and the detection result will be displayed on the smart cell phone. The implemented achievement includes a new seat belt buckle which includes a WIFI module and a designed APP. It only uses one WIFI module, and rewrite the module into STA mode. As long as the seat belt buckle is locked in, the WIFI modules on all seats can be connected such that the bus driver can know the belt of the seat is fastened from the APP of the cell phone. Otherwise, if any seat belt is not fastened, the driver also can find it. The advantages of the product are that it is very cheap and the original seat structure does not need to be changed.