

2020 Asia-Pacific Signal and Information Processing Association Annual Summit and Conference (APSIPA ASC 2020)

**Auckland, New Zealand
7-10 December 2020**

Pages 1-577



**IEEE Catalog Number: CFP2014U-POD
ISBN: 978-1-7281-8130-1**

**Copyright © 2020, Asia Pacific Signal and Information Processing Association
(APSIPA)
All Rights Reserved**

****** This is a print representation of what appears in the IEEE Digital Library. Some format issues inherent in the e-media version may also appear in this print version.***

IEEE Catalog Number:	CFP2014U-POD
ISBN (Print-On-Demand):	978-1-7281-8130-1
ISBN (Online):	978-988-14768-8-3
ISSN:	2640-009X

Additional Copies of This Publication Are Available From:

Curran Associates, Inc
57 Morehouse Lane
Red Hook, NY 12571 USA
Phone: (845) 758-0400
Fax: (845) 758-2633
E-mail: curran@proceedings.com
Web: www.proceedings.com

CURRAN ASSOCIATES INC.
proceedings
.com

TABLE OF CONTENTS

B-1-1: ELECTRICAL SIGNALS IN HUMAN

B-1-1.1: CLASSIFICATION OF SEIZURE EEGS BASED ON SHORT-TIME FOURIER TRANSFORM AND HIDDEN MARKOV MODEL	875
--	-----

Yuwei Du, Jing Jin, Harbin Institute of Technology, China; Yan Liu, Suzhou Institute of Biomedical Engineering and Technology, Chinese Academy of Science, China; Qiang Wang, Harbin Institute of Technology, China

B-1-1.2: A MULTI-SUBJECT TEMPORAL-SPATIAL HYPER-ALIGNMENT METHOD FOR EEG-BASED NEURAL ENTRAINMENT TO SPEECH	881
--	-----

Di Zhou, Japan advanced institute of science and technology, Japan; Gaoyan Zhang, Tianjin University, China; Jianwu Dang, Japan Advanced Institute of Science and Technology, Japan; Shuang Wu, Zhuo Zhang, Tianjin University, China

B-1-1.3: DECODING AUDITORY FREQUENCIES AND DIRECTIONS BASED ON BRAIN FUNCTIONAL FEATURES	888
---	-----

Mingxi Wang, Gaoyan Zhang, Tianjin University, China

B-1-1.4: A TEMPORAL ENVELOPE-BASED SPEECH RECONSTRUCTION APPROACH WITH EEG SIGNALS DURING SPEECH IMAGERY	894
---	-----

Hongde Wu, Fei Chen, Southern University of Science and Technology, China

B-1-1.5: FROM INTENDED TO SUBJECTIVE: A CONDITIONAL TENSOR FUSION NETWORK FOR RECOGNIZING SELF-REPORTED EMOTION USING PHYSIOLOGY	900
---	-----

Hao-Chun Yang, Chi-Chun Lee, National Tsing Hua University, Taiwan

B-1-1.6: GEOMETRIC FEATURES BASED MUSCLE FATIGUE ANALYSIS USING LOW FREQUENCY BAND IN SURFACE ELECTROMYOGRAPHIC SIGNALS	905
--	-----

Divya Bharathi Krishnamani, Indian Institute of Technology Madras, India; Karthick P.A., National Institute of Technology Tiruchirappalli, India; Ramakrishnan Swaminathan, Indian Institute of Technology Madras, India

C-1-1: WIRELESS COMMUNICATIONS AND NETWORKING

C-1-1.2: CONSTRUCTION OF CYCLICALLY PERMUTABLE CODES FROM PRIME LENGTH CYCLIC CODES	1448
--	------

Keng-Pei Cho, Chun-Long Lin, Houshou Chen, Ting-Ya Yang, National Chung Hsing University, Taiwan

C-1-1.3: LOW-COMPLEXITY ROBUST BEAMFORMING WITH BLOCKAGE PREDICTION FOR MILLIMETER-WAVE COMMUNICATIONS	1453
---	------

Ryo Okabe, The University of Electro-Communications, Japan; Hiroki Iimori, Jacobs University Bremen, Germany; Koji Ishibashi, The University of Electro-Communications, Japan

C-1-1.4: AUTONOMOUS DECENTRALIZED TRANSMISSION TIMING CONTROL IN WIRELESS SENSOR NETWORK	1460
---	------

Aoto Kaburaki, Koichi Adachi, The University of Electro-Communications, Japan; Osamu Takyu, Shinshu University, Japan; Mai Ohta, Fukuoka University, Japan; Takeo Fujii, The University of Electro-Communications, Japan

C-1-1.5: PACKET AGGREGATION BASED ON ENCRYPTION-THEN-COMPRESSION FOR HIGHLY EFFICIENT MULTI-HOP TRANSMISSION	1466
---	------

Ryota Yatsu, Takanori Hara, Koji Ishibashi, The University of Electro-Communications, Japan; Sota Tsuchiya, Hideki Endo, Tokyo Gas Co., Ltd., Japan

C-1-1.6: 24 GHZ FLEXIBLE LCP ANTENNA ARRAY FOR RADAR-BASED NONCONTACT VITAL SIGN MONITORING	1472
--	------

Nitin Kathuria, Boon-Chong Seet, Auckland University of Technology, New Zealand

D-1-1: IMAGE/VIDEO RECOGNITION

D-1-1.1: CLOUD RECOGNITION BASED ON LIGHTWEIGHT NEURAL NETWORK	1033
<i>Liang Zhang, Kebin Jia, Pengyu Liu, Chunyao Fang, Beijing University of Technology, China</i>	
D-1-1.2: MICRO-EXPRESSION RECOGNITION BASED ON MULTIPLE AGGREGATION	1043
NETWORKS	
<i>Wenxiang She, Zhao Lv, Anhui University, China; Jianhua Tao, Bin Liu, Mingyue Niu, Institute of Automation, Chinese Academy of Sciences, China</i>	
D-1-1.3: ATTENTIVELY-COUPLED LONG SHORT-TERM MEMORY FOR AUDIO-VISUAL	1048
EMOTION RECOGNITION	
<i>Jia-Hao Hsu, Chung-Hsien Wu, National Cheng Kung University, Taiwan</i>	
D-1-1.4: UNSUPERVISED DOMAIN ADVERSARIAL TRAINING IN ANGULAR SPACE FOR	1054
FACIAL EXPRESSION RECOGNITION	
<i>Akihiko Takashima, Naoki Makishima, Mana Ihori, Tomohiro Tanaka, Shota Orihashi, Ryo Masumura, NTT Corporation, Japan</i>	
D-1-1.5: 3D SKELETAL MOVEMENT ENHANCED EMOTION RECOGNITION NETWORK	1060
<i>Jiaqi Shi, Osaka University, Japan; Chaoran Liu, Carlos Toshinori Ishi, Advanced Telecommunications Research Institute International, Japan; Hiroshi Ishiguro, Osaka University, Japan</i>	

E-1-1: ACTIVE NOISE CONTROL

E-1-1.1: STUDY ON FEEDFORWARD ACTIVE NOISE CONTROL SYSTEM WITH OPTICAL	266
LASER MICROPHONE TO DETECT REFERENCE SIGNAL WITH SHORT DELAY	
<i>Kenta Iwai, Takanobu Nishiura, Ritsumeikan University, Japan</i>	
E-1-1.2: FEEDFORWARD ACTIVE NOISE CONTROL WITH COHERENCE-ADJUSTING	272
FILTER FOR IMPROVING NOISE REDUCTION PERFORMANCE UNDER LOW-COHERENCE CONDITION	
<i>Kenta Iwai, Takanobu Nishiura, Ritsumeikan University, Japan</i>	
E-1-1.3: EFFECT OF CROSS-CHANNEL CONTROL FILTERS IN MULTI-CHANNEL	278
FEEDBACK ACTIVE NOISE CONTROL	
<i>Chuang Shi, Zhuoying Jia, Rong Xie, Huiyong Li, University of Electronic Science and Technology of China, China</i>	
E-1-1.4: SIMULTANEOUS VARIABLE PERTURBATION METHOD FOR THE ACTIVE NOISE	283
CONTROL SYSTEM WITH A WIRELESS ERROR MICROPHONE	
<i>Chuang Shi, Zhongxing Yuan, Rong Xie, Huiyong Li, University of Electronic Science and Technology of China, China</i>	
E-1-1.5: ACTIVE NOISE CONTROL OVER MULTIPLE ZONES: ADAPTIVE ALGORITHM IN	288
TIME DOMAIN	
<i>Xiaoli Tang, Jihui Zhang, Thushara Abhayapala, The Australian National University, Australia</i>	
E-1-1.6: IMPLEMENTATION OF FEEDFORWARD ACTIVE NOISE CONTROL TECHNIQUES	293
FOR HEADPHONES	
<i>Chong-Rui Huang, Cheng-Yuan Chang, Sen M. Kuo, Chung Yuan Christian University, Taiwan</i>	

F-1-1: EMOTION, DIALECT, AND AGE RECOGNITION

F-1-1.1: DIALECT-AWARE MODELING FOR END-TO-END JAPANESE DIALECT SPEECH	297
RECOGNITION	
<i>Ryo Imaizumi, Tokyo Metropolitan University, Japan; Ryo Masumura, Nippon Telegraph and Telephone Corporation, Japan; Sayaka Shiota, Hitoshi Kiya, Tokyo Metropolitan University, Japan</i>	

F-1-1.2: ACOUSTIC AND TEXTUAL DATA AUGMENTATION FOR CODE-SWITCHING SPEECH 302
RECOGNITION IN UNDER-RESOURCED LANGUAGE

I-Ting Hsieh, Chung-Hsien Wu, Chun-Huang Wang, National Cheng Kung University, Taiwan

F-1-1.3: SPEAKER-INVARIANT PSYCHOLOGICAL STRESS DETECTION USING 308
ATTENTION-BASED NETWORK

Hyeon-Kyeong Shin, Hyewon Han, Kyunggeun Byun, Hong-Goo Kang, Yonsei University, Korea (South)

F-1-1.4: SENSING WITH CONTEXTS: CRYING REASON CLASSIFICATION FOR INFANT 314
CARE CENTER WITH ENVIRONMENTAL FUSION

Chun-Min Chang, Huan-Yu Chen, Hsiang-Chun Chen, Chi-Chun Lee, National Tsing Hua University, Taiwan

F-1-1.5: SPEAKER AGE ESTIMATION USING AGE-DEPENDENT INSENSITIVE LOSS 319
Yuki Kitagishi, Hosana Kamiyama, Atsushi Ando, Naohiro Tawara, Takeshi Mori, Satoshi Kobashikawa, NTT, Japan

F-1-1.6: DEEP MULTILAYER PERCEPTRONS FOR DIMENSIONAL SPEECH EMOTION 325
RECOGNITION

Bagus Tris Atmaja, JAIST, Japan; Masato Akagi, Japan Advanced Institute of Science and Technology, Japan

B-1-2: ADAPTIVE AND INTELLIGENT SIGNAL PROCESSING

B-1-2.1: LEARNING GRAPHS WITH MULTIPLE TEMPORAL RESOLUTIONS 139
Koki Yamada, Yuichi Tanaka, Tokyo University of Agriculture and Technology, Japan

B-1-2.2: A PARALLEL ADAPTIVE FILTERING ALGORITHM BASED ON THE MEAN-SQUARE 143
DEVIATION ANALYSIS FOR LARGE-SCALE DATA
Sang Mok Jung, Agency for Defense Development, Korea (South)

B-1-2.3: CLASS ATTENTION NETWORK FOR SEMANTIC SEGMENTATION OF REMOTE 150
SENSING IMAGES

Zhibo Rao, Mingyi He, Yuchao Dai, Northwestern Polytechnical University, China

B-1-2.4: ESTIMATING DRONE MOTOR RELATED ACOUSTIC TRANSFER FUNCTION: A 156
PRELIMINARY INVESTIGATION

Wageesha Manamperi, Thushara Abhayapala, Jihui Zhang, Prasanga Samarasinghe, Australian National University, Australia

B-1-2.5: AN EVOLUTIONARY GAME THEORETICAL FRAMEWORK FOR DECISION FUSION 161
IN THE PRESENCE OF BYZANTINES

Yiqing Lin, Hong Hu, H. Vicky Zhao, Tsinghua University, China; Yan Chen, University of Science and Technology of China, China

B-1-2.6: A MATCH PURSUIT BASED METHOD ADAPTED TO OVERCOMPLETE DICTIONARY 170
FOR COMPRESSIVE SPECTRAL IMAGING

Jianchen Zhu, Shengjie Zhao, Rongqing Zhang, Tongji University, China

C-1-2: ADVANCED SIGNAL PROCESSING AND DATA ANALYSIS FOR ENVIRONMENTAL
RECOGNITION IN WIRELESS COMMUNICATION

C-1-2.1: COMPENSATION METHOD OF RECEIVED SIGNAL POWER OBSERVED BY 1477
SMARTPHONE FOR CROWDSENSED SPECTRUM DATABASE

Taiki Matsushima, Takeo Fujii, The University of Electro-Communications, Japan

C-1-2.2: 3D CONVOLUTIONAL NEURAL NETWORK-AIDED INDOOR POSITIONING BASED 1483
ON FINGERPRINTS OF BLE RSSI

Kodai Tasaki, Takumi Takahashi, Osaka University, Japan; Shinsuke Ibi, Doshisha University, Japan; Seiichi Sampei, Osaka University, Japan

C-1-2.3: AN OVERLOADED IOT SIGNAL DETECTION METHOD USING NON-CONVEX SPARSE REGULARIZERS	1490
<i>Kazunori Hayashi, Ayano Nakai-Kasai, Kyoto University, Japan; Atsuya Hirayama, Hiroki Honda, Tetsuya Sasaki, Hideki Yasukawa, Osaka City University, Japan; Ryo Hayakawa, Osaka University, Japan</i>	
C-1-2.4: SPECIFICATION OF LINK QUALITY DEGRADATION IN WLAN BASED ON MCS AND RETRANSMISSION FLAG	1497
<i>Hirotaka Senda, Akinori Kamio, Osamu Takyu, Shinshu University, Japan; Mai Ohta, Fukuoka University, Japan; Takeo Fujii, The University of Electro-Communications, Japan</i>	
D-1-2: MACHINE LEARNING TECHNIQUES FOR IMAGE & VIDEO	
D-1-2.1: LOCAL BACKLIGHT DIMMING FOR LIQUID CRYSTAL DISPLAYS VIA CONVOLUTIONAL NEURAL NETWORK	1067
<i>JUNHO JO, JAE WOONG SOH, Seoul National University, Korea (South); JAE SUNG PARK, Samsung Electronics, Ltd., Korea (South); NAM IK CHO, Seoul National University, Korea (South)</i>	
D-1-2.2: HALLUCINATING SCENES.....	1075
<i>Ting-I Hsieh, Hwann-Tzong Chen, National Tsing Hua University, Taiwan; Chia-Ming Cheng, MediaTek Inc., Taiwan; Yan-Hao Huang, Industrial Technology Research Institute, Taiwan</i>	
D-1-2.3: VISUAL SENTIMENT ANALYSIS FOR FEW-SHOT IMAGE CLASSIFICATION BASED ON METRIC LEARNING	1081
<i>Tetsuya Asakawa, Masai Aono, Toyohashi University of Technology, Japan</i>	
D-1-2.4: LEARNING DENSE CORRESPONDENCES VIA LOCAL AND NON-LOCAL FEATURE FUSION	1087
<i>Wen-Chi Chin, National Tsing Hua University, Taiwan; Zih-Jian Jhang, Yan-Hao Huang, Industrial Technology Research Institute, Taiwan; Koichi Ito, Tohoku University, Japan; Hwann-Tzong Chen, National Tsing Hua University, Taiwan</i>	
D-1-2.5: BLIND TONE-MAPPED IMAGE QUALITY ASSESSMENT AND ENHANCEMENT VIA DISENTANGLED REPRESENTATION LEARNING	1096
<i>Lei Wang, Qingbo Wu, King Ngi Ngan, Hongliang Li, Fanman Meng, Linfeng Xu, University of Electronic Science and Technology of China, China</i>	
D-1-2.6: FIXATIONAL FEATURE-BASED GAZE PATTERN RECOGNITION USING LONG SHORT-TERM MEMORY	1103
<i>Suparat Yeamkuan, Kosin Chamnongthai, King Mongkut's University of Technology Thonburi, Thailand</i>	
E-1-2: MUSIC INFORMATION PROCESSING 1, AUDIO SCENE CLASSIFICATION	
E-1-2.1: A DEEP MUSIC GENRES CLASSIFICATION MODEL BASED ON CNN WITH SQUEEZE & EXCITATION BLOCK	332
<i>Yijie Xu, Wuneng Zhou, Donghua University, China</i>	
E-1-2.2: DEEP NEURAL NETWORK MODELING OF DISTORTION STOMP BOX USING SPECTRAL FEATURES	339
<i>Kento Yoshimoto, Hiroki Kuroda, Daichi Kitahara, Akira Hirabayashi, Ritsumeikan University, Japan</i>	
E-1-2.3: BEAT AND DOWNBEAT TRACKING OF SYMBOLIC MUSIC DATA USING DEEP RECURRENT NEURAL NETWORKS	346
<i>Yi-Chin Chuang, National Chung Hsing University, Taiwan; Li Su, Academia Sinica, Taiwan</i>	
E-1-2.4: SYMMETRY IN THE STRUCTURE OF MUSICAL NODES.....	353
<i>Kirtana Sunil Phatnani, Hemant A. Patil, Dhirubhai Ambani Institute of Information and Communication Technology, India</i>	

**E-1-2.5: TATUM-LEVEL DRUM TRANSCRIPTION BASED ON A CONVOLUTIONAL 359
RECURRENT NEURAL NETWORK WITH LANGUAGE MODEL-BASED REGULARIZED
TRAINING**

Ryoto Ishizuka, Ryo Nishikimi, Eita Nakamura, Kazuyoshi Yoshii, Graduate School of Informatics, Kyoto University, Japan

**E-1-2.6: DEEP SEMANTIC ENCODER-DECODER NETWORK FOR ACOUSTIC SCENE 365
CLASSIFICATION WITH MULTIPLE DEVICES**

Xinxin Ma, Jiangsu Normal University, China; Yunfei Shao, Tsinghua University, China; Yong Ma, Jiangsu Normal University, China; Wei-Qiang Zhang, Tsinghua University, China

F-1-2: NATURAL LANGUAGE AND SPOKEN DIALOGUE

**F-1-2.1: LANGUAGE MODEL ADAPTATION FOR EMOTIONAL SPEECH RECOGNITION 371
USING TWEET DATA**

Kazuya Saeki, Masaharu Kato, Tetsuo Kosaka, Yamagata University, Japan

**F-1-2.2: SIMULTANEOUS FAKE NEWS AND TOPIC CLASSIFICATION VIA AUXILIARY TASK 376
LEARNING**

Tsun-hin Cheung, Kin-man Lam, The Hong Kong Polytechnic University, Hong Kong (SAR of China)

**F-1-2.3: OPENNLU: OPEN-SOURCE WEB-INTERFACE NLU TOOLKIT FOR 381
DEVELOPMENT OF CONVERSATIONAL AGENT**

Yi Fan Ong, Maulik Madhavi, National University of Singapore, Singapore; Ken Chan, ST Engineering Land Systems Ltd, Singapore, Singapore

**F-1-2.4: SPOKEN MULTIPLE-CHOICE QUESTION ANSWERING USING MULTI-TURN 386
AUDIO-EXTRACTER BERT**

Shang-Bao Luo, Chia-Chih Kuo, Kuan-Yu Chen, National Taiwan University of Science and Technology, Taiwan

**F-1-2.5: “YOUR BEHAVIOR MAKES ME THINK IT IS A LIE”: RECOGNIZING PERCEIVED 393
DECEPTION USING MULTIMODAL DATA IN DIALOG GAMES**

Huang-Cheng Chou, Chi-Chun Lee, National Tsing Hua University, Taiwan

**F-1-2.6: SPOKEN DIALOG TRAINING SYSTEM FOR CUSTOMER SERVICE 403
IMPROVEMENT**

Yuta Sano, Chee Siang Leow, University of Yamanashi, Japan; Soichiro Iida, Takehito Utsuro, Junichi Hoshino, University of Tsukuba, Japan; Akio Kobayashi, Tsukuba University of Technology, Japan; Hiromitsu Nishizaki, University of Yamanashi, Japan

A-1-3: SIGNAL PROCESSING SYSTEMS FOR COMMUNICATION AND MULTIMEDIA

**A-1-3.1: AN IMPROVED METHOD FOR INSTANTANEOUS FREQUENCY ESTIMATION 1
USING A FINITE ORDER HILBERT TRANSFORMER**

Keisuke Takao, Takahiro Natori, Tokyo University of Science, Japan; Toma Miyata, Salesian Polytechnic, Japan; Naoyuki Aikawa, Tokyo University of Science, Japan

**A-1-3.2: A NEW ALGORITHM TO DERIVE HARDWARE EFFICIENT INTEGER DISCRETE 6
COSINE TRANSFORM FOR HEVC**

Boyu Qin, Jiajia Chen, Nanjing University of Aeronautics and Astronautics, China

A-1-3.3: NON-LINE-OF-SIGHT IMAGING WITH RADIO SIGNALS 11

Ying He, Dongheng Zhang, University of Electronic Science and Technology of China, China; Yang Hu, Yan Chen, University of Science and Technology of China, China

**A-1-3.4: CONSTRAINED DESIGN OF TWO-DIMENSIONAL FIR FILTERS WITH SPARSE 17
COEFFICIENTS**

Tatsuki Itasaka, Ryo Matsuoka, The University of Kitakyushu, Japan; Masahiro Okuda, Doshisha University, Japan

A-1-3.5: BARK FREQUENCY SPECTRUM IN PARALLEL-FORM REMOTE ACTIVE NOISE CONTROL	22
<i>Muhammad Waqas Munir, Waleed Abdulla, University of Auckland, New Zealand</i>	
A-1-3.6: AN EFFICIENT DESCRIPTION WITH HALIDE FOR IIR GAUSSIAN FILTER	28
<i>Hiroyasu Takagi, Norishige Fukushima, Nagoya Institute of Technology, Japan</i>	
A-1-3.7: DOPPLER CENTROID ESTIMATION WITH QUALITY ASSESSMENT FOR REAL-TIME SAR IMAGING	36
<i>Yu-Chieh Lee, Pei-Yun Tsai, National Central University, Taiwan; Sz-Yuan Lee, National Applied Research Laboratory, Taiwan</i>	
A-1-3.8: DRIVER ARRIVAL SENSING FOR SMART CAR USING WIFI FINE TIME MEASUREMENTS	41
<i>Xiaolu Zeng, Beibei Wang, K. J. Ray Liu, University of Maryland, United States</i>	
B-1-3: SIGNAL PROCESSING IN MEDICAL/CLINICAL SCIENCES	
B-1-3.1: DEEP-LEARNING-BASED MR COMPRESSED SENSING USING NON-RANDOMLY UNDER-SAMPLED SIGNAL IN NONLINEAR PHASE ENCODING IMAGING	909
<i>Satoshi ITO, Shohei OUCHI, Utsunomiya University, Japan</i>	
B-1-3.2: CONSTRUCTION OF EFFECTIVE HMMS FOR CLASSIFICATION BETWEEN NORMAL AND ABNORMAL RESPIRATION	914
<i>Masaru Yamashita, Nagasaki University, Japan</i>	
B-1-3.3: COMPARISON OF PSG SIGNALS AND RESPIRATORY MOVEMENT SIGNAL VIA 3D CAMERA IN DETECTING SLEEP RESPIRATORY EVENTS BY LSTM MODELS	919
<i>Carmina Coronel, Christoph Wiesmeyr, Heinrich Garn, Bernhard Kohn, Anahid Naghibzadeh-Jalali, Alexander Schindler, AIT Austrian Institute of Technology GmbH, Austria; Markus Wimmer, Magdalena Mandl, Kepler University Hospital, Austria; Martin Glos, Thomas Penzel, Advanced Sleep Research GmbH, Germany; Gerhard Kloesch, Andrijana Stefanic-Kejik, Marion Boeck, Medical University of Vienna, Austria; Eugenijus Kanudasas, Technical University of Vienna, Austria; Stefan Seidel, Medical University of Vienna, Austria</i>	
B-1-3.4: PERFORMANCE EVALUATION OF BINARY CLASSIFICATION OF TUBERCULOSIS THROUGH UNSHARP MASKING AND DEEP LEARNING TECHNIQUE	924
<i>Kahlil Muchtar, Khairul Munadi, Novi Maulina, Syiah Kuala University, Indonesia; Biswajeet Pradhan, University of Technology Sydney, Sydney, NSW, Australia, Australia; Fitri Arnia, Budi Yanti, Syiah Kuala University, Indonesia</i>	
B-1-3.5: HYPERPARAMETER TUNING OF THE SHUNT-MURMUR DISCRIMINATION ALGORITHM USING BAYESIAN OPTIMIZATION	929
<i>Fumiya Noda, Keisuke Nishijima, Ken'ichi Furuya, Oita University, Japan</i>	
B-1-3.6: COMPARISON OF IMAGE FEATURES DESCRIPTIONS FOR DIAGNOSIS OF LEAF DISEASES	934
<i>Muhammad Waqas, Norishige Fukushima, Nagoya Institute of Technology, Japan</i>	
C-1-3: EMERGING TECHNOLOGIES BASED ON SIGNAL PROCESSING FOR WIRELESS SENSOR NETWORKS	
C-1-3.1: PROBABILISTIC BINARY OFFLOADING FOR WIRELESS POWERED MOBILE EDGE COMPUTING SYSTEM	1502
<i>Takuya Kobayashi, Koichi Adachi, The University of Electro-Communications, Japan</i>	
C-1-3.2: SCHEDULING ALGORITHM CONSIDERING INTERFERENCE INTERVAL FOR LPWA	1507
<i>Yudai Yamazaki, Takeo Fujii, The University of Electro-Communications, Japan</i>	

**C-1-3.3: ESTIMATION OF DESIRED POWER AND UNDESIRED POWER USING CHIRP 1513
DEMODULATION AND EVALUATION OF ACCURACY**

*Gaku Kobayashi, Osamu Takyu, Shinshu University, Japan; Koichi Adachi, The University of Electro-Communications, Japan;
Mai Ohta, Fukuoka University, Japan; Takeo Fujii, The University of Electro-Communications, Japan*

**C-1-3.4: ON PLACEMENT OF END DEVICES IN LPWAN BASED WSN FOR 1519
ENVIRONMENTAL MONITORING APPLICATIONS**

*Ayumi Kaichi, Shusuke Narieda, Mie University, Japan; Takeo Fujii, The University of Electro-Communications, Japan; Kenta
Umebayashi, Tokyo University of Agriculture and Technology, Japan; Hiroshi Naruse, Mie University, Japan*

**C-1-3.5: SPECTRUM SHARING FOR INTERNET OF THINGS SYSTEM IN PERIODIC 1523
TRANSMISSION**

Mai Ohta, Masaki Amano, Makoto Taromaru, Fukuoka University, Japan

D-1-3: IMAGE/VIDEO CODING

**D-1-3.1: SUBJECTIVE QUALITY DRIVEN IMAGE ENCODING METHOD USING IMAGE 1107
COMPLETION**

Shota Orihashi, Shinobu Kudo, Ryuichi Tanida, Hideaki Kimata, NTT Corporation, Japan

D-1-3.2: ULTRA FAST SCREEN CONTENT CODING VIA RANDOM FOREST..... 1112

Sik-Ho Tsang, Ngai-Wing Kwong, Yui-Lam Chan, The Hong Kong Polytechnic University, Hong Kong (SAR of China)

**D-1-3.3: TWO-LAYER LOSSLESS CODING OF HDR IMAGES SPECIALIZED FOR RADIANCE 1118
FORMAT**

Kai Yang, Taizo Suzuki, University of Tsukuba, Japan; Taichi Yoshida, The University of Electro-Communications, Japan

D-1-3.4: SSIM MOTIVATED QUALITY CONTROL FOR VERSATILE VIDEO CODING 1122

*Meng Wang, Shiqi Wang, City University of Hong Kong, Hong Kong (SAR of China); Junru Li, Peking University, China; Li
Zhang, Bytedance Inc., United States; Yue Wang, Bytedance (HK) Limited., Hong Kong (SAR of China); Siwei Ma, Peking
University, China*

**D-1-3.5: RATE-DISTORTION OPTIMIZATION FOR 360-DEGREE IMAGE CONSIDERING 1128
VISUAL ATTENTION**

Cheng-Yu Yang, Jui-Chiu Chiang, Wen-Nung Lie, National Chung Cheng University, Tanzania

**D-1-3.6: EVALUATION OF THE ENCODING ACCURACY OF THE PQ BASED HDR CONTENT 1132
DELIVERY FORMATS**

*Asif Siddiq, Riphah International University, Pakistan; Ishhtiaq Rasool Khan, University of Jeddah, Saudi Arabia; Jameel Ahmed,
Riphah International University Islamabad, Pakistan*

**D-1-3.7: CHECKERBOARD-ARTIFACT-FREE IMAGE-ENHANCEMENT NETWORK 1139
CONSIDERING LOCAL AND GLOBAL FEATURES**

Yuma Kinoshita, Hitoshi Kiya, Tokyo Metropolitan University, Japan

E-1-3: ARRAY PROCESSING OF MICROPHONES AND LOUD SPEAKERS

**E-1-3.1: EVALUATION OF A MULTI-WAY PARAMETRIC ARRAY LOUDSPEAKER BASED ON 409
MULTIPLEXED DOUBLE SIDEBAND MODULATION**

*Yuting GENG, Ritsumeikan University, Japan; Masato NAKAYAMA, Osaka Sangyo University, Japan; Takanobu NISHIURA,
Ritsumeikan University, Japan*

**E-1-3.2: MULTI-BEAM DESIGN METHOD FOR A STEERABLE PARAMETRIC ARRAY 416
LOUDSPEAKER**

Chuang Shi, Ruyu Bai, Jiacheng Gou, Jiangnan Liang, University of Electronic Science and Technology of China, China

E-1-3.3: APPLYING VIRTUAL MICROPHONES TO TRIANGULAR MICROPHONE ARRAY IN IN-CAR COMMUNICATION	421
<i>Hanako Segawa, Riki Takahashi, Ryoga Jinzai, Shoji Makino, Takeshi Yamada, University of Tsukuba, Japan</i>	
E-1-3.4: SEMI-ADAPTIVE BEAMFORMING FOR CO-PRIME CIRCULAR MICROPHONE ARRAYS	426
<i>Jiahong Zhao, Christian Ritz, University of Wollongong, Australia</i>	
E-1-3.5: FULL-SPHERE BINAURAL SOUND SOURCE LOCALIZATION USING MULTI-TASK NEURAL NETWORK	432
<i>Yichen Yang, Jingwei Xi, Wen Zhang, Lijun Zhang, Northwestern Polytechnical University, China</i>	
E-1-3.6: LEARNING BASED DOA ESTIMATION IN ADVERSE ACOUSTIC ENVIRONMENT USING CO-PRIME CIRCULAR MICROPHONE ARRAY	437
<i>Raj Gohil, IIT Kanpur, India; Aditya Raikar, TCS Research and Innovation, India; Gyanajyoti Routray, Rajesh Hegde, IIT Kanpur, India</i>	
E-1-3.7: ENERGY-BASED MULTIPLE SOURCE LOCALIZATION WITH BLINKIES	443
<i>Daiki Horiike, Robin Scheibler, Yuma Kinoshita, Yukoh Wakabayashi, Nobutaka Ono, Tokyo Metropolitan University, Japan</i>	
F-1-3: SPEECH ENHANCEMENT 1	
F-1-3.1: SPEECH ENHANCEMENT FOR OPTICAL LASER MICROPHONE WITH DEEP NEURAL NETWORK	449
<i>Chengkai CAI, Kenta Iwai, Takanobu Nishiura, Yoichi Yamashita, Ritsumeikan University, Japan</i>	
F-1-3.2: BOOSTING OBJECTIVE SCORES OF A SPEECH ENHANCEMENT MODEL BY METRICGAN POST-PROCESSING	455
<i>Szu-Wei Fu, Chien-Feng Liao, Tsun-An Hsieh, Kuo-Hsuan Hung, Syu-Siang Wang, Cheng Yu, Heng-Cheng Kuo, Ryandhimas E. Zezario, You-Jin Li, Shang-Yi Chuang, Yen-Ju Lu, Yu-Chen Lin, Yu Tsao, Academia Sinica, Taiwan</i>	
F-1-3.3: SPEECH ENHANCEMENT FOR DEMODULATED SIGNALS UNDER MULTIPATH FADING COMMUNICATION CHANNELS	460
<i>Akio Kobayashi, Tsukuba University of Technology, Japan</i>	
F-1-3.4: FREQUENCY GATING: IMPROVED CONVOLUTIONAL NEURAL NETWORKS FOR SPEECH ENHANCEMENT IN THE TIME-FREQUENCY DOMAIN	465
<i>Koen Oostermeijer, Qing Wang, Jun Du, University of Science and Technology of China, China</i>	
F-1-3.5: GAMMA BOLTZMANN MACHINE FOR SIMULTANEOUSLY MODELING LINEAR- AND LOG-AMPLITUDE SPECTRA	471
<i>Toru Nakashika, The University of Electro-Communications, Japan; Kohei Yatabe, Waseda University, Japan</i>	
F-1-3.6: A DEEP LEARNING-BASED TIME-DOMAIN APPROACH FOR NON-INTRUSIVE SPEECH QUALITY ASSESSMENT	477
<i>Xupeng Jia, Dongmei Li, Tsinghua University, China</i>	
F-1-3.7: STOI-NET: A DEEP LEARNING BASED NON-INTRUSIVE SPEECH INTELLIGIBILITY ASSESSMENT MODEL	482
<i>Ryandhimas Zezario, National Taiwan University, Taiwan; Szu-Wei Fu, Academia Sinica, Taiwan; Chiou-Shann Fuh, National Taiwan University, Taiwan; Yu Tsao, Hsin-Min Wang, Academia Sinica, Taiwan</i>	

B-2-1: MULTIDIMENSIONAL BIOMEDICAL SIGNAL AND IMAGE PROCESSING

B-2-1.1: DEEP-LEARNING BASED MOTION-CORRECTED IMAGE RECONSTRUCTION IN 4D 976 MAGNETIC RESONANCE IMAGING OF THE BODY TRUNK

Thomas Küstner, University Hospital Tübingen, Germany; Jiazen Pan, University of Stuttgart, Germany; Christopher Gilliam, RMIT University, Australia; Haikun Qi, Gastao Cruz, King's College London, United Kingdom; Kerstin Hammernik, Imperial College London, United Kingdom; Bin Yang, University of Stuttgart, Germany; Thierry Blu, Chinese University of Hong Kong, Hong Kong (SAR of China); Daniel Rueckert, Imperial College London, United Kingdom; René Botnar, Claudia Prieto, King's College London, United Kingdom; Sergios Gatidis, University Hospital Tübingen, Germany

B-2-1.2: FRI SENSING: 2D LOCALIZATION FROM 1D MOBILE SENSOR DATA 986 Ruiming Guo, Thierry Blu, The Chinese university of Hong Kong, Hong Kong (SAR of China)

B-2-1.3: APPLICATION OF IMAGE PROCESSING AND CIRCULAR STATISTICS TO 3D 992 CELLULAR ALIGNMENT

Beth Jelfs, Christopher Gilliam, RMIT University, Australia

C-2-1: SIGNAL AND INFORMATION PROCESSING METHODS

C-2-1.1: SIMULTANEOUS MEASUREMENT OF TIME-INVARIANT LINEAR AND NONLINEAR, 174 AND RANDOM AND EXTRA RESPONSES USING FREQUENCY DOMAIN VARIANT OF VELVET NOISE

Hideki Kawahara, Wakayama University, Japan; Ken-Ichi Sakakibara, Health Science University of Hokkaido, Japan; Mitsunori Mizumachi, Kyushu Institute of Technology, Japan; Masanori Morise, Meiji University, Japan; Hideki Banno, Meijo University, Japan

C-2-1.2: AGE CLASSIFICATION OF EVACUEES AT TIMES OF DISASTER USING A VIBRATION 184 SENSOR

Toru Yamashita, Futoshi Asano, Kogakuin University, Japan; Kazuhiro Nakadai, Honda Research Institute Japan, Japan

C-2-1.3: ON THE BEHAVIOUR OF PERMUTATION ENTROPY ON FRACTIONAL BROWNIAN 189 MOTION IN A MULTIVARIATE SETTING

Marisa Mohr, Nils Finke, Ralf Moeller, University of Luebeck, Germany

C-2-1.4: MODELING DECISION PROCESS IN MULTI-AGENT SYSTEMS: A GRAPHICAL 197 MARKOV GAME BASED APPROACH

Hao Li, Yuejiang Li, H.Vicky Zhao, Tsinghua University, China

C-2-1.5: SAMPLING POLICY DESIGN FOR TRACKING TIME-VARYING GRAPH SIGNALS 205 WITH ADAPTIVE BUDGET ALLOCATION

Xuan Xie, Hui Feng, Bo Hu, Fudan University, China

C-2-1.6: DIFFERENTIATED PROSODIC ADAPTION OF CHINESE AND ENGLISH POETRY: 211 AN ACOUSTIC APPROACH TO READING OF CHINESE TANG POETRY AND SHAKESPEAREAN SONNETS

Yizhong Xu, Siyi Cao, Jiafang Ji, Qin Xiao, Anqi Wu, Xiuyuan Wang, Nanjing University of Aeronautics and Astronautics, China

D-2-1: DIGITAL CONVERGENCE OF 5G, AIOT AND SECURITY I

D-2-1.1: DUAL ADAPTIVE MODULATION AND CODING FOR MITIGATING UE-UE 1527 INTERFERENCE IN HETEROGENEOUS TDD SLOT CONFIGURATIONS

Jen-Yi Pan, Chih-Yang Chen, Wen-Hsueh Lin, National Chung Cheng University, Taiwan; Wei-Chen Pao, Industrial Technology Research Institute, Taiwan; Jhe-Hao Liang, Bo-Yen Wu, National Chung Cheng University, Taiwan

D-2-1.2: OPTIMIZATION OF VIRTUAL MACHINE PLACEMENT FOR BALANCING NETWORK 1536 AND SERVER LOAD IN EDGE COMPUTING ENVIRONMENTS

Shota Nangu, Kansai University, Japan; Tomotaka Kimura, Doshisha University, Japan; Kouji Hirata, Kansai University, Japan

D-2-1.3: PREDICTION METHOD OF MALWARE INFECTION SPREADING CONSIDERING NETWORK SCALE 1541

Yurina Nagasawa, Keita Kishioka, Kansai University, Japan; Tomotaka Kimura, Doshisha University, Japan; Kouji Hirata, Kansai University, Japan

**D-2-1.4: JOINT OPTIMIZATION OF EDGE SERVER AND VIRTUAL MACHINE PLACEMENT 1545
IN EDGE COMPUTING ENVIRONMENTS**

Ayaka Takeda, Kansai University, Japan; Tomotaka Kimura, Doshisha University, Japan; Kouji Hirata, Kansai University, Japan

D-2-1.5: REALIZATION OF 5G NETWORK SLICING USING OPEN SOURCE SOFTWARES 1549

Sheng Chen, Chung-Nan Lee, Ming-Feng Lee, National Sun Yat-sen University, Taiwan, Taiwan

D-2-1.6: CELL OUTAGE DETECTION USING DEEP CONVOLUTIONAL AUTOENCODER IN MOBILE COMMUNICATION NETWORKS 1557

Yeh-Hong Ping, Po-Chiang Lin, Yuan Ze University, Taiwan

E-2-1: MUSIC INFORMATION PROCESSING 2, VOICE CONVERSION

E-2-1.1: PJS: PHONEME-BALANCED JAPANESE SINGING-VOICE CORPUS 487

Junya Koguchi, Meiji University, Japan; Shinnosuke Takamichi, The University of Tokyo, Japan; Masanori Morise, Meiji University, Japan

**E-2-1.2: SPECTRAL FEATURES AND PITCH HISTOGRAM FOR AUTOMATIC SINGING 492
QUALITY EVALUATION WITH CRNN**

Lin Huang, Chitralekha Gupta, Haizhou Li, National University of Singapore, Singapore

**E-2-1.3: A VARIATIONAL AUTOENCODER FOR JOINT CHORD AND KEY ESTIMATION FROM 500
AUDIO CHROMAGRAMS**

Yiming Wu, Eita Nakamura, Kazuyoshi Yoshii, Kyoto University, Japan

**E-2-1.4: SPECTRUM AND PROSODY CONVERSION FOR CROSS-LINGUAL VOICE 507
CONVERSION WITH CYCLEGAN**

Zongyang Du, Kun Zhou, National University of Singapore, Singapore; Berrak Sisman, Singapore University of Technology and Design, Singapore; Haizhou Li, National University of Singapore, Singapore

**E-2-1.5: VAW-GAN FOR SINGING VOICE CONVERSION WITH NON-PARALLEL TRAINING 514
DATA**

Junchen Lu, Kun Zhou, National University of Singapore, Singapore; Berrak Sisman, Singapore University of Technology and Design, Singapore; Haizhou Li, National University of Singapore, Singapore

**E-2-1.6: CROSS-LINGUAL VOICE CONVERSION USING A CYCLIC VARIATIONAL 520
AUTO-ENCODER AND A WAVENET VOCODER**

Hikaru Nakatani, Patrick Lumbar Tobing, Kazuya Takeda, Tomoki Toda, Nagoya University, Japan

F-2-1: SPEAKER RECOGNITION 1, LANGUAGE RECOGNITION

F-2-1.1: QUASI-NEWTON ADVERSARIAL ATTACKS ON SPEAKER VERIFICATION SYSTEMS 527

Keita Goto, Nakamasa Inoue, Tokyo Institute of Technology, Japan

F-2-1.2: SIGNIFICANCE OF CMVN FOR REPLAY SPOOF DETECTION 532

Ankur T. Patil, Hemant A. Patil, Dhirubhai Ambani Institute of Information and Communication Technology, India

**F-2-1.3: SUBBAND CHANNEL SELECTION USING TEO FOR REPLAY SPOOF DETECTION 538
IN VOICE ASSISTANTS**

Harsh Kotta, Ankur T. Patil, Rajul Acharya, Hemant A. Patil, Dhirubhai Ambani Institute of Information and Communication Technology, India

F-2-1.4: DESIGN OF VOICE PRIVACY SYSTEM USING LINEAR PREDICTION 543
Priyanka Gupta, Gauri Prajapati, Shrishti Singh, Madhu Kamble, Hemant A. Patil, Dhirubhai Ambani Institute of Information and Communication Technology, India

F-2-1.5: AP20-OLR CHALLENGE: THREE TASKS AND THEIR BASELINES..... 550
Zheng Li, Miao Zhao, Qingyang Hong, Lin Li, Xiamen University, China; Zhiyuan Tang, Dong Wang, Tsinghua University, China; Liming Song, Cheng Yang, Speechocean, China

F-2-1.6: ADVERSARIAL POST-PROCESSING OF VOICE CONVERSION AGAINST SPOOFING 556
DETECTION

Yi-Yang Ding, Jing-Xuan Zhang, University of Science and Technology of China, China; Li-Juan Liu, Yuan Jiang, Yu Hu, iFLYTEK Co., Ltd., China; Zhen-Hua Ling, University of Science and Technology of China, China

B-2-2: DATA HIDING IN MULTIMEDIA CONTENT AND UNCONVENTIONAL DOMAIN

B-2-2.1: DEEPWATERMARK: EMBEDDING WATERMARK INTO DNN MODEL..... 1340
Minoru Kurabayashi, Takuro Tanaka, Nobuo Funabiki, Okayama University, Japan

B-2-2.2: FLEXIBLE DATA HIDING AND EXTRACTION IN ETC IMAGES..... 1347
Ryoichi HIRASAWA, Shoko IMAIZUMI, Chiba University, Japan; Hitoshi KIYA, Tokyo Metropolitan University, Japan

B-2-2.3: DENSELY CONNECTED CONVOLUTIONAL NETWORK FOR AUDIO SPOOFING 1352
DETECTION

Zheng Wang, Sanshuai Cui, Xiangui Kang, Wei Sun, Zhonghua Li, Sun Yat-sen University, China

B-2-2.4: DATA EMBEDDING METHOD USING PHOTO EFFECTS WITH RESISTANCE TO 1361
COMPRESSION

William K.W. Yeong, Simying Ong, University of Malaya, Malaysia; KokSheik Wong, Monash University Malaysia, Malaysia

C-2-2: ADVANCED TOPICS IN SIGNAL PROCESSING & MACHINE LEARNING - ACOUSTIC & BIOMEDICAL APPLICATIONS

C-2-2.1: LOW COMPLEXITY IMPLEMENTATION METHOD FOR THE ADAPTIVE FILTERS 216
BASED ON THE GAUSSIAN MODEL

Kai Yokoyama, Kiyoshi Nishikawa, Tokyo Metropolitan University, Japan

C-2-2.2: COMPARISON OF GENERIC AND SUBJECT-SPECIFIC TRAINING FOR FEATURES 222
CLASSIFICATION IN P300 SPELLER

Ayana Mussabayeva, Prashant Kumar Jamwal, Muhammad Tahir Akhtar, Nazarbayev University, Kazakhstan

C-2-2.3: OPTIMAL COMBINATION WEIGHT FOR SPARSE DIFFUSION LEAST-MEAN-SQUARE 228
BASED ON CONSENSUS PROPAGATION

Ayano Nakai-Kasai, Kazunori Hayashi, Kyoto University, Japan

C-2-2.4: EXPLOITING THE RULES OF THE TF-MUSIC AND SPATIAL SMOOTHING TO 236
ENHANCE THE DOA ESTIMATION FOR COHERENT AND NON-STATIONARY SOURCES

Ruslan Zhagypar, Kalamkas Zhagyparova, Muhammad Tahir Akhtar, Nazarbayev University, Kazakhstan

C-2-2.5: ADVERSARIAL TRAINING USING INTER/INTRA-ATTENTION ARCHITECTURE FOR 242
SPEECH ENHANCEMENT NETWORK

Yosuke SUGIURA, Tetsuya SHIMAMURA, Saitama University, Japan

D-2-2: RECENT ADVANCES IN DEEP LEARNING WITH MULTIMEDIA APPLICATIONS

D-2-2.1: FUSION TECHNOLOGY OF RADAR AND RGB CAMERA SENSORS FOR OBJECT 1234 DETECTION AND TRACKING AND ITS EMBEDDED SYSTEM IMPLEMENTATION

Jian Xian Lu, Jia Cheng Lin, Vinay Malligere Shivanna, National Chiao Tung University, Taiwan; Po-Yu Chen, MediaTek Inc., Taiwan; Jiun-In Guo, National Chiao Tung University, Taiwan

D-2-2.2: CHROMA COMPONENT GENERATION OF GRAY IMAGES USING MULTI-SCALE 1243 CONVOLUTIONAL NEURAL NETWORK

Tien-Ying Kuo, Yu-Jen Wei, Bin-Yen You, National Taipei University of Technology, Taiwan

D-2-2.3: SCENE TEXT-LINE EXTRACTION WITH FULLY CONVOLUTIONAL NETWORK 1247 AND REFINED PROPOSALS

Guan-Xin Zeng, Yu-Hong Hou, Po-Chyi Su, National Central University, Taiwan; Li-Wei Kang, National Taiwan Normal University, Taiwan

E-2-2: SPEECH ANALYSIS

E-2-2.1: HARMONIC PRESERVING NEURAL NETWORKS FOR EFFICIENT AND ROBUST 561 MULTIPICTH ESTIMATION

Chin-Yun Yu, Jing-Hua Lin, Li Su, Academia Sinica, Taiwan

E-2-2.2: TV-CAR SPEECH ANALYSIS BASED ON THE L2-NORM REGULARIZATION IN THE 568 TIME-DOMAIN AND FREQUENCY DOMAIN

KEIICHI FUNAKI, University of the Ryukyus, Japan

E-2-2.3: PHONEME EMBEDDINGS ON PREDICTING FUNDAMENTAL FREQUENCY 572 PATTERN FOR ELECTROLARYNGEAL SPEECH

Mohammad Eshghi, Kazuhiro Kobayashi, Nagoya University, Japan; Kou Tanaka, Hirokazu Kameoka, Nippon Telegraph and Telephone Corporation, Japan; Tomoki Toda, Nagoya University, Japan

E-2-2.4: A DATA AUGMENTATION TECHNIQUE FOR AUTOMATIC DETECTION OF 578 CHEWING SIDE AND SWALLOWING

Akihiro Nakamura, Shizuoka University, Japan; Takato Saito, Daizo Ikeda, Ken Ohta, NTT DOCOMO, INC., Japan; Hiroshi Mineno, Masafumi Nishimura, Shizuoka University, Japan

E-2-2.5: ACOUSTIC ANALYSIS OF NASALIZATION IN MANDARIN PRENASAL VOWELS 584 PRODUCED BY WENZHOU AND RUGAO SPEAKERS

Xinya Zhang, Yanyang Chen, Jiazheng Wang, Ying Chen, Nanjing University of Science and Technology, China

E-2-2.6: TEMPORAL AND FORMANT TRAJECTORY ANALYSIS OF ENGLISH TENSE-LAX 589 VOWELS PRODUCED BY NATIVE CHINESE SPEAKERS

Jian Gong, Jiangsu University of Science and Technology, China; Di Xue, SIP Xingwan School, China; Bellamy William, Feng Wang, Xiaoli Ji, Jiangsu University of Science and Technology, China

F-2-2: SPEAKER RECOGNITION 2, SOUND CLASSIFICATION

F-2-2.1: CONTEXT-ADAPTIVE GAUSSIAN ATTENTION FOR TEXT-INDEPENDENT SPEAKER 595 VERIFICATION

Junyi Peng, Rongzhi Gu, Haoran Zhang, Yuejian Zou, Peking University Shenzhen Graduate School, China

F-2-2.2: OPTIMIZING SPEAKER EMBEDDINGS USING META-TRAINING SETS 600

Nakamasa Inoue, Keita Goto, Tokyo Institute of Technology, Japan

F-2-2.3: HLT-NUS SUBMISSION FOR 2019 NIST MULTIMEDIA SPEAKER RECOGNITION 605 EVALUATION

Rohan Kumar Das, Ruijie Tao, Jichen Yang, Wei Rao, Cheng Yu, Haizhou Li, National University of Singapore, Singapore

**F-2-2.4: EMOTION INVARIANT SPEAKER EMBEDDINGS FOR SPEAKER IDENTIFICATION 610
WITH EMOTIONAL SPEECH**

Biswajit Dev Sarma, Indian Institute of Technology Guwahati, India; Rohan Kumar Das, National University of Singapore, Singapore

F-2-2.5: A PITCH-AWARE SPEAKER EXTRACTION SERIAL NETWORK 616

Yu Jiang, Meng Ge, Longbiao Wang, TianJin University, China; Jianwu Dang, Japan Advanced Institute of Science and Technology&Tianjin University, Japan; Kiyoshi Honda, TianJin University, China; Sulin Zhang, Bo Yu, Automotive Data of China Co., Ltd, China

F-2-2.6: ANALYSIS OF BIT SEQUENCE REPRESENTATION FOR SOUND CLASSIFICATION 621

Yikang Wang, Masaki Okawa, Hiromitsu Nishizaki, University of Yamanashi, Japan

A-2-3: DESIGN AND IMPLEMENTATION FOR ADVANCED WIRELESS COMMUNICATION SYSTEMS

**A-2-3.1: AN EVALUATION OF A CNN-BASED PARKING DETECTION SYSTEM WITH 100
WEBCAMS**

Takuto Fukusaki, Hiroshi Tsutsui, Takeo Ohgane, Hokkaido University, Japan

**A-2-3.2: AN EVALUATION OF DESIGN FRAMEWORK FOR MIN-SUM IRREGULAR LDPC 110
DECODERS**

Jimpu Suzuki, Hiroshi Tsutsui, Takeo Ohgane, Hokkaido University, Japan

**A-2-3.3: AN EVALUATION OF HIGH-THROUGHPUT SCALABLE RADIX-4 FFT PROCESSOR 114
ARCHITECTURE USING FIXED-POINT ARITHMETIC**

Tomotaka Kawabata, Hiroshi Tsutsui, Hokkaido University, Japan

**A-2-3.4: WIRELESS CHANNEL MEASUREMENT SYSTEM USING ZYNQ ULTRASCALE+ 135
RFSOC FOR MIMO AND D2D COMMUNICATION SYSTEMS**

Haruki Inaba, Hiroshi Tsutsui, Takuya Yasugi, Hokkaido University, Japan

A-2-3: RECONFIGURABLE COMPUTING AND PERFORMANCE EVALUATION

**A-2-3.5: A PARALLELIZATION METHOD OF INCEPTION ARCHITECTURE BASED ON ARRAY 92
PROCESSOR**

Xiaoyan Xie, Zhuolin Du, Chuanzhan Hu, Kun Yang, Anqi Wang, Xi'an University of Posts and Telecommunications, China

**A-2-3.6: RSP-BT:AN ADVANCED PARALLEL METHOD FOR DEPTH MAP MOTION 104
ESTIMATION**

Xiaoyan Xie, Anqi Wang, Yun Zhu, Chuanzhan Hu, Zhuolin Du, Xi'an University of Posts and Telecommunications, China

**A-2-3.7: FAST INTER-FRAME PREDICTION BASED ARRAY PROCESSOR FOR DEPTH MAPS 118
IN 3D-HEVC**

Yun Zhu, Xi'an University of Posts and Telecommunications, China; Lin Jiang, Xi'an University of Science and Technology, China; Hui Song, Xiaoyan Xie, Anqi Wang, Xi'an University of Posts and Telecommunications, China; Xubang Shen, Xi'an Microelectronic Technology Research Institute, China

**A-2-3.8: OPTIMIZATION OF FALSE-OVERLAP DETECTION OF TILE ASSEMBLY IN 126
TILE-BASED RENDERING**

Bowen Yang, Northwestern Polytechnical University, China; Meng Fan, Mengqiao Han, Yurong Geng, Xi'an University of Posts and Telecommunications, China

B-2-3: DEEP GENERATIVE MODELS FOR MEDIA CLONES AND ITS DETECTION

B-2-3.1: AN EXTENSION OF ENCRYPTION-INSPIRED ADVERSARIAL DEFENSE WITH SECRET KEYS AGAINST ADVERSARIAL EXAMPLES	1369
<i>AprilPyone MaungMaung, Hitoshi Kiya, Tokyo Metropolitan University, Japan</i>	
B-2-3.2: DETECTION OF CLONED RECOGNIZERS: A DEFENDING METHOD AGAINST RECOGNIZER CLONING ATTACK	1375
<i>Yuto Mori, Kazuaki Nakamura, Naoko Nitta, Noboru Babaguchi, Osaka University, Japan</i>	
B-2-3.3: CLASSIFICATION OF VIDEO RECAPTURED FROM DISPLAY DEVICE	1381
<i>Minoru Kuribayashi, Kodai Kamakari, Kento Kawata, Nobuo Funabiki, Okayama University, Japan</i>	
B-2-3.4: DETECTION OF ADVERSARIAL EXAMPLES BASED ON SENSITIVITIES TO NOISE REMOVAL FILTER	1386
<i>Akinori Higashi, Minoru Kuribayashi, Nobuo Funabiki, Okayama University, Japan; Huy Nguyen, Isao Echizen, National Institute of Informatics, Japan</i>	
B-2-3.5: A QR SYMBOL WITH ECDSA FOR BOTH PUBLIC AND SECRET AREAS USING RHOMBIC SUB-CELLS	1392
<i>Nobuyuki Teraura, Terrara Code Research Institute, Japan; Isao Echizen, National Institute of Informatics, Japan; Keiichi Iwamura, Tokyo University of Science, Japan</i>	
B-2-3.6: DEEP FACE RECOGNIZER PRIVACY ATTACK: MODEL INVERSION INITIALIZATION BY A DEEP GENERATIVE ADVERSARIAL DATA SPACE DISCRIMINATOR	1400
<i>Mahdi Khosravy, Kazuki Nakamura, Naoko Nitta, Noboru Babaguchi, Osaka University, Japan</i>	
B-2-3.7: COLOR TRANSFER TO ANONYMIZED GAIT IMAGES WHILE MAINTAINING ANONYMIZATION	1406
<i>Ngoc-Dung T. Tieu, Junichi Yamagishi, Isao Echizen, National Institute of Informatics, Japan</i>	

C-2-3: MACHINE LEARNING AND DATA ANALYSIS 1

C-2-3.1: MERGING WELL-TRAINED DEEP CNN MODELS FOR EFFICIENT INFERENCE	1594
<i>Cheng-En Wu, Jia-Hong Lee, Timmy S.T. Wan, Yi-Ming Chan, Chu-Song Chen, Academia Sinica, Taiwan</i>	
C-2-3.2: EFFICIENT DIVERSE RESPONSE GENERATION IN ATTENTION-BASED NEURAL CONVERSATIONAL MODEL WITH MAXIMUM MUTUAL INFORMATION	1601
<i>Yuki Kishida, Tsuneo Kato, Doshisha University, Japan; Yanan Wang, Jianming Wu, Gen Hattori, KDDI Research, Inc., China</i>	
C-2-3.3: EXTENDING CONDITIONAL CONVOLUTION STRUCTURES FOR ENHANCING MULTITASKING CONTINUAL LEARNING	1605
<i>Cheng-Hao Tu, Cheng-En Wu, Chu-Song Chen, Academia Sinica, Taiwan</i>	
C-2-3.4: MULTIPLE TARGET PREDICTION FOR DEEP REINFORCEMENT LEARNING	1611
<i>Jen-Tzung Chien, Po-Yen Hung, National Chiao Tung University, Taiwan</i>	
C-2-3.5: CAN-SIN: A CROSS-LAYER HETEROGENEOUS ACADEMIC NETWORK WITH SEMANTIC INFORMATION	1617
<i>Yufei Tian, Hong Hu, Yuejiang Li, H. Vicky Zhao, Tsinghua University, China; Yan Chen, University of Science and Technology of China, China</i>	
C-2-3.6: NATURAL LANGUAGE PROCESSING METHODS FOR DETECTION OF INFLUENZA-LIKE ILLNESS FROM CHIEF COMPLAINTS	1626
<i>Jia-Hao Hsu, Ting-Chia Weng, Chung-Hsien Wu, Tzong-Shiann Ho, National Cheng Kung University, Taiwan</i>	
C-2-3.7: GENERALISATION TECHNIQUES USING A VARIATIONAL CEAE FOR CLASSIFYING MANUKA HONEY QUALITY	1631
<i>Tessa Phillips, Waleed Abdulla, University of Auckland, New Zealand</i>	

D-2-3: IMAGE ANALYSIS

D-2-3.1: VISUAL TRACKING VIA SPATIAL-TEMPORAL REGULARIZED CORRELATION FILTERS WITH ADVANCED STATE ESTIMATION	1145
<i>ZHAO-QIAN TANG, Kaoru Arakawa, Meiji University, Japan</i>	
D-2-3.2: A NEW POLARIZED IMAGE FUSION ALGORITHM BASED ON TWO-SCALE GUIDED FILTERING	1150
<i>Fei Xie, JIAJIA CHEN, Nanjing University of Aeronautics and Astronautics, China</i>	
D-2-3.3: AN IMPROVED GUIDED FILTERING ALGORITHM FOR POLARIZED IMAGES BY USING LOG OPERATOR	1156
<i>Le Zhan, Jiajia Chen, Nanjing University of Aeronautics and Astronautics, China</i>	
D-2-3.4: DYNAMIC MATCHING OF LOCAL FEATURES FOR RE-IDENTIFICATION OF PEDESTRIANS	1161
<i>Seokhyun Ahn, Nam Ik Cho, INMC, Seoul National University, Korea (South)</i>	
D-2-3.5: IMPLEMENTATION OF BI-RADS CLASSIFICATION AND PRIORITY PREDICTION FOR MAMMOGRAM PRE-SCREENING BASED ON MULTI-DECISION FRAMEWORK	1170
<i>Yi-Chong Zeng, Kai-Hsuan Chan, Yu-Hao Chen, Hsin-Yi Lai, Institute for Information Industry, Taiwan</i>	
D-2-3.6: VARIATIONAL MODE DECOMPOSITION BASED IMAGE SEGMENTATION USING SINE COSINE ALGORITHM	1177
<i>Mausam Chouksey, Rajib Kumar Jha, Indian Institute of Technology Patna, India</i>	
D-2-3.7: IMAGE RESTORATION BY GROUP SPARSITY WITH UNION OF HIERARCHICAL DIRLOTS	1182
<i>Kazuki Sakashita, Shogo Muramatsu, Niigata University, Japan</i>	

E-2-3: SPEECH RECOGNITION

E-2-3.1: PRIVACY PRESERVING ACOUSTIC MODEL TRAINING FOR SPEECH RECOGNITION	627
<i>Yuuki Tachioka, Denso IT Laboratory, Japan</i>	
E-2-3.2: END-TO-END AUTOMATIC SPEECH RECOGNITION WITH DEEP MUTUAL LEARNING	632
<i>Ryo Masumura, Mana Ihori, Akihiko Takashima, Tomohiro Tanaka, Takanori Ashihara, NTT Corporation, Japan</i>	
E-2-3.3: ATTENTIVE FUSION ENHANCED AUDIO-VISUAL ENCODING FOR TRANSFORMER BASED ROBUST SPEECH RECOGNITION	638
<i>Liangfa Wei, Jie Zhang, Junfeng Hou, Lirong Dai, University of Science and Technology of China, China</i>	
E-2-3.4: QUERY-BY-EXAMPLE SPOKEN TERM DETECTION USING GENERATIVE ADVERSARIAL NETWORK	644
<i>Neil Shah, Sreeraj R, Dhirubhai Ambani Institute of Information and Communication Technology, India; Maulik Madhavi, National University of Singapore, Singapore; Nirmesh Shah, Hemant Patil, Dhirubhai Ambani Institute of Information and Communication Technology, India</i>	
E-2-3.5: REDUCTION OF SPEECH DATA POSTERIORGRAMS BY COMPRESSING MAXIMUM-LIKELIHOOD STATE SEQUENCES IN QUERY BY EXAMPLE	649
<i>Takashi Yokota, Kazunori Kojima, Iwate Prefectural University, Japan; Shi-wook Lee, National Institute of Advanced Industrial Science and Technology, Japan; Yoshiaki Itoh, Iwate Prefectural University, Japan</i>	
E-2-3.6: EFFECTS OF END-TO-END ASR AND SCORE FUSION MODEL LEARNING FOR IMPROVED QUERY-BY-EXAMPLE SPOKEN TERM DETECTION	654
<i>Takumi Kurokawa, Atsuhiko Kai, Hiroki Kondo, Shizuoka University, Japan</i>	

F-2-3: SPEECH ENHANCEMENT 2

F-2-3.1: HARMONIC STRUCTURE MASK FOR SPEECH ENHANCEMENT USING SPARSITY 662

REGULARIZATION

Haonan Wang, Kenta Iwai, Takanobu Nishiura, Ritsumeikan University, Japan

F-2-3.2: DEEP RESIDUAL NETWORK-BASED AUGMENTED KALMAN FILTER FOR SPEECH 667

ENHANCEMENT

Sujan Kumar Roy, Kuldip K. Paliwal, Griffith University, Australia

F-2-3.3: A STUDY ON MORE REALISTIC ROOM SIMULATION FOR FAR-FIELD KEYWORD 674

SPOTTING

Eric Bezzam, Sonos Inc., France; Robin Scheibler, Line Corporation, Japan; Cyril Cadoux, École Polytechnique Fédérale de Lausanne, Switzerland; Thibault Gisselbrecht, Sonos Inc., France

F-2-3.4: A VARIABLE STEP SIZE IMPROVED MULTIBAND-STRUCTURED SUBBAND 681

ADAPTIVE FEEDBACK CANCELLATION SCHEME FOR HEARING AIDS

Somanath Pradhan, Xiaojun Qiu, Jinchen Ji, University of Technology Sydney, Australia

F-2-3.5: LOCALIZATION CUES PRESERVATION IN HEARING AIDS BY COMBINING NOISE 686

REDUCTION AND DYNAMIC RANGE COMPRESSION

Adrien Llave, Simon Leglaive, Renaud Séguier, CentraleSupélec/IETR, France

F-2-3.6: MODELLING ROOM REVERBERATION DIRECTIVITY USING VON MISES-FISHER MIXTURE DISTRIBUTION 694

Amy Bastine, Thushara Abhayapala, Jihui Zhang, Huiyuan Sun, The Australian National University, Australia

F-2-3.7: EXPERIMENTAL INVESTIGATION OF ROBUSTNESS OF SPATIAL CEPSTRUM 701

FEATURES UNDER VARIOUS RECORDING CONDITIONS

Taiga Kawamura, Ryoichi Miyazaki, National Institute of Technology, Tokuyama College, Japan; Keisuke Imoto, Doshisha University, Japan; Nobutaka Ono, Tokyo Metropolitan University, Japan

B-3-1: INFORMATION PROCESSING FOR UNDERSTANDING HUMAN ATTENTIONAL AND AFFECTIVE STATES

B-3-1.1: PREDICTION OF SOCIAL MALADAPTATION USING EMOTIONAL ENTRAINMENT OF 1001

DISGUST DURING COMPREHENSIVE PSYCHIATRIC INTERVIEWS

Kenji Yokotani, Tokushima University, Japan; Gen Takagi, Tohoku Fukushi University, Japan; Kobun Wakashima, Tohoku University, Japan

B-3-1.2: PREDICTING EXPERTISE AMONG NOVICE PROGRAMMERS WITH PRIOR 1008

KNOWLEDGE ON PROGRAMMING TASKS

Zubair Ahsan, Unaizah Obaidellah, University of Malaya, Malaysia

B-3-1.3: DISCOVERY OF EVENT-RELATED POTENTIALS DURING A COGNITIVE PROCESS 1017

OF COMPARISON OPERATION

Keisuke Murai, Uwano Hidetake, National Institute of Technology, Nara College, Japan; Yoshiharu Ikutani, Takatomi Kubo, Nara Institute of Science and Technology, Japan

B-3-1.4: MAXIMUM CREDIBILITY VOTING (MCV): AN INTEGRATIVE APPROACH FOR 1023

ACCURATE DIAGNOSIS OF MAJOR DEPRESSIVE DISORDER FROM CLINICALLY READILY

AVAILABLE DATA

Yu Shimizu, Okinawa Institute of Science and Technology, Japan; Junichiro Yoshimoto, Nara Institute of Science and Technology, Japan; Masahiro Takamura, Go Okada, Tomoya Matsumoto, Manabu Fuchikami, Satoshi Okada, Shigeru Morinobu, Yasumasa Okamoto, Shigeto Yamawaki, Hiroshima University, Japan; Kenji Doya, Okinawa Institute of Science and Technology, Japan

C-3-1: RECENT DEVELOPMENTS ON SIGNAL PROCESSING THEORY AND TECHNIQUES IN FRACTIONAL FOURIER AND LINEAR CANONICAL DOMAIN

C-3-1.1: IMAGE SEGMENTATION METHOD BASED ON FRACTIONAL VARYING-ORDER DIFFERENTIAL 247

Yuru Tian, China University of Petroleum, China; Yanshan Zhang, Zhengzhou University of Aeronautics, China

C-3-1.2: WINDOWED FRACTIONAL FOURIER TRANSFORM ON GRAPHS: FRACTIONAL TRANSLATION OPERATOR AND HAUSDORFF-YOUNG INEQUALITY 255

Fang-Jia Yan, Wen-Biao Gao, Bing-Zhao Li, Beijing Institute of Technology, China

C-3-1.3: A NOVEL ISAR IMAGING ALGORITHM FOR MANEUVERING TARGET BASED ON PARAMETER ESTIMATION METHOD 260

Hong-cai Xin, Bing-zhao Li, Beijing Institute of Technology, China

D-3-1: DIGITAL CONVERGENCE OF 5G, AIOT AND SECURITY II

D-3-1.1: LORA-BASED AIR QUALITY MONITORING SYSTEM USING CHATBOT 1561

Yao-Chiang Kan, Yuan Ze University, Taiwan; Hsueh-Chun Lin, China Medical University Hospital and College of Medicine, Taiwan; Han-Yu Wu, Junghsi Lee, Yuan Ze University, Taiwan

D-3-1.2: REAL-TIME DDOS ATTACK DETECTION USING SKETCH-BASED ENTROPY 1566
ESTIMATION ON THE NETFPGA SUME PLATFORM

Yu-Kuen Lai, Po-Yu Huang, Ho-Ping Lee, Cheng-Lin Tsai, Cheng-Sheng Chang, Manh Hung Nguyen, Yu-Jau Lin, Chung-Yuan Christian University, Taiwan; Te-Lung Liu, National Center for High Performance Computing, Taiwan; Jim Hao Chen, Northwestern University, United States

D-3-1.3: A DESIGN FRAMEWORK OF AUTOMATIC DEPLOYMENT FOR 5G NETWORK SLICING 1571

Wen-Ping Lai, Hong-Lun Lai, Yuan Ze University, Taiwan; Ming-Jay Lai, National Central University, Taiwan

D-3-1.4: PRIVACY-PRESERVING DATA SHARING WITH ATTRIBUTE-BASED PRIVATE MATCHING BASED ON EDGE COMPUTATION IN THE INTERNET-OF-THINGS 1578

Ruei-Hau Hsu, Yu-Hsiaing Hu, Guan-Wei Lin, Bing-Cheng Ko, National Sun Yat-sen University, Taiwan

D-3-1.5: COORDINATED DOWNLINK/UPLINK TRANSMISSION ASSIGNMENT AND DYNAMIC SWITCHING IN HYBRID TDD SYSTEM 1588

Chun-Tai Liu, Jen-Yi Pan, Chun-Kai Huang, National Chung Cheng University, Taiwan; Wei-Chen Pao, Industrial Technology Research Institute, Taiwan

E-3-1: SPEECH SEPARATION 1

E-3-1.1: OVER-DETERMINED SPEECH SOURCE SEPARATION AND DEREVERBERATION 705

Masahito Togami, Robin Scheibler, Line corporation, Japan

E-3-1.2: OPTIMAL SCALE-INVARIANT SIGNAL-TO-NOISE RATIO AND CURRICULUM LEARNING FOR MONAURAL MULTI-SPEAKER SPEECH SEPARATION IN NOISY ENVIRONMENT 711

Chao Ma, Dongmei Li, Xupeng Jia, Tsinghua University, China

E-3-1.3: MULTI-CHANNEL SPEECH SEPARATION USING DEEP EMBEDDING WITH MULTILAYER BOOTSTRAP NETWORKS 716

Ziye Yang, Northwestern Polytechnical University, China; Xiao-Lei Zhang, Zhonghua Fu, Northwestern Polytechnic University, China

E-3-1.4: INDEPENDENT VECTOR ANALYSIS FOR BLIND SPEECH SEPARATION USING COMPLEX GENERALIZED GAUSSIAN MIXTURE MODEL WITH WEIGHTED VARIANCE 720

Xinyu Tang, Chongqing University of Posts and Telecommunications, China; Rilin Chen, Tencent, China; Xiyuan Wang, Beijing Information Science and Technology University, China; Yi Zhou, Chongqing University of Posts and Telecommunications, China; Dan Su, Tencent, China

E-3-1.5: IMPACT OF MINIMUM HYPERSPHERICAL ENERGY REGULARIZATION ON TIME-FREQUENCY DOMAIN NETWORKS FOR SINGING VOICE SEPARATION 727

Neil Shah, Dharmeshkumar Agrawal, TCS Research, Tata Consultancy Services Pvt. Ltd., Pune, India, India

E-3-1.6: ON THE USE OF THE RELATIVE TRANSFER FUNCTION FOR SOURCE SEPARATION USING TWO-CHANNEL RECORDINGS 734

Alice Bates, Daniel Grixiti-Cheng, Prasanga Samarasinghe, Thushara Abhayapala, Australian National University, Australia

F-3-1: SPEECH ENHANCEMENT 3

F-3-1.1: DYNAMIC NOISE EMBEDDING: NOISE AWARE TRAINING AND ADAPTATION FOR SPEECH ENHANCEMENT 739

Joohyung Lee, Youngmoon Jung, Myunghun Jung, Hoirin Kim, KAIST, Korea (South)

F-3-1.2: CLASSIFICATION OF SPEECH WITH AND WITHOUT FACE MASK USING ACOUSTIC FEATURES 747

Rohan Kumar Das, Haizhou Li, National University of Singapore, Singapore

F-3-1.3: ENHANCEMENT OF SPEECH INTELLIGIBILITY UNDER NOISY REVERBERANT CONDITIONS BASED ON MODULATION SPECTRUM CONCEPT 753

Thuanvan Ngo, Tuanvu Ho, Masashi Unoki, Japan Advanced Institute of Science and Technology, Japan; Rieko Kubo, National Institute of Information and Communications Technology, Japan; Masato Akagi, Japan Advanced Institute of Science and Technology, Japan

F-3-1.4: EXPLORING FEATURE ENHANCEMENT IN THE MODULATION SPECTRUM DOMAIN VIA IDEAL RATIO MASK FOR ROBUST SPEECH RECOGNITION 759

Bi-Cheng Yan, National Taiwan Normal University, Taiwan, Taiwan; Meng-Che Wu, ASUS, Taiwan; Berlin chen, National Taiwan Normal University, Taiwan, Taiwan

F-3-1.5: AN INTEGRATED CNN-GRU FRAMEWORK FOR COMPLEX RATIO MASK ESTIMATION IN SPEECH ENHANCEMENT 764

Mojtaba Hasannezhad, Zhiheng Ouyang, Wei-Ping Zhu, Concordia University, Canada; Benoit Champagne, McGill University, Canada

F-3-1.6: A TIME-DOMAIN MONAURAL SPEECH ENHANCEMENT WITH FEEDBACK LEARNING 769

Andong Li, Chengshi Zheng, Linjuan Cheng, Renhua Peng, Xiaodong Li, Institute of Acoustics, Chinese Academy of Sciences, China

B-3-2: THE FUTURE OF BIOMETRICS BEYOND RECOGNITION AND SECURITY

B-3-2.1: PERFORMANCE EVALUATION OF FACE ANTI-SPOOFING METHOD USING DEEP METRIC LEARNING FROM A FEW FRAMES OF FACE VIDEO 1414

Koichi Ito, Asateru Kimura, Takafumi Aoki, Tohoku University, Japan

B-3-2.2: STUDY ON POSSIBILITY OF ESTIMATING SMARTPHONE INPUTS FROM TAP SOUNDS 1425

Yumo Ouchi, Ryosuke Okudera, Yuya Shiomi, Kota Uehara, Ayaka Sugimoto, Tetsushi Ohki, Masakatsu Nishigaki, Shizuoka University, Japan

B-3-2.3: A NOVEL QUALITY ASSESSMENT METHOD FOR EYE MOVEMENT AUTHENTICATION	1430
---	-------	------

Narishige Abe, Shigefumi Yamada, FUJITSU LABORATORIES LTD., Japan

B-3-2: PRIVACY PRESERVING AND MULTIMEDIA SECURITY

B-3-2.4: A FRAMEWORK FOR TRANSFORMATION NETWORK TRAINING IN COORDINATION WITH SEMI-TRUSTED CLOUD PROVIDER FOR PRIVACY-PRESERVING DEEP NEURAL NETWORKS	1420
--	-------	------

Hiroki Ito, Yuma Kinoshita, Hitoshi Kiya, Tokyo Metropolitan University, Japan

B-3-2.6: A PRIVACY-PRESERVING CONTENT-BASED IMAGE RETRIEVAL SCHEME ALLOWING MIXED USE OF ENCRYPTED AND PLAIN IMAGES	1436
--	-------	------

Kenta Iida, Hitoshi Kiya, Tokyo Metropolitan University, Japan

B-3-2.7: A GENERATIVE ADVERSARIAL NETWORK FRAMEWORK FOR JPEG ANTI-FORENSICS	1442
--	-------	------

Jianyuan Wu, Sun Yat-Sen University, China; Li Liu, Kwai Incorporated, United States; Xiangui Kang, Sun Yat-Sen University, China; Wei Sun, Sun Yat-sen University, China

C-3-2: MACHINE LEARNING AND DATA ANALYSIS 2

C-3-2.1: SEMI-SUPERVISED CONTRASTIVE LEARNING WITH GENERALIZED CONTRASTIVE LOSS AND ITS APPLICATION TO SPEAKER RECOGNITION	1641
---	-------	------

Nakamasa Inoue, Keita Goto, Tokyo Institute of Technology, Japan

C-3-2.2: MPOP600: A MANDARIN POPULAR SONG DATABASE WITH ALIGNED AUDIO, LYRICS, AND MUSICAL SCORES FOR SINGING VOICE SYNTHESIS	1647
--	-------	------

Chan-Chuan Chu, Fu-Rong Yang, Yi-Jhe Lee, Yi-Wen Liu, Shan-Hung Wu, National Tsing Hua University, Taiwan

C-3-2.3: IMPROVING KEYWORDS SPOTTING PERFORMANCE IN NOISE WITH AUGMENTED DATASET FROM VOCODED SPEECH	1653
---	-------	------

Ruohao Li, Kaibao Nie, University of Washington Bothell, United States

C-3-2.4: DECODING MUSIC GENRES BASED ON HIGH RESOLUTION BRAIN ACTIVITY INFORMATION	1657
---	-------	------

Qinhan Hou, Gaoyan Zhang, Tianjin University, China

C-3-2.5: 3D POINT CLOUD LABELING TOOL FOR DRIVING AUTOMATICALLY	1666
--	-------	------

MingHui Li, Shenzhen Unity-Drive Innovation Technology Co, Ltd, China; Yanshan Zhang, Zhengzhou University of Aeronautics, China

C-3-2.6: DETECTING OBJECT SURFACE KEYPOINTS FROM A SINGLE RGB IMAGE VIA DEEP LEARNING NETWORK FOR 6DOF POSE ESTIMATION	1673
---	-------	------

Wen-Nung Lie, Lee Aing, National Chung Cheng University, Taiwan

C-3-2.7: INTERVENTION FORCE-BASED IMITATION LEARNING FOR AUTONOMOUS NAVIGATION IN DYNAMIC ENVIRONMENTS	1679
---	-------	------

Tomoya Yokoyama, Shunya Seiya, Nagoya University, Japan; Eijiro Takeuchi, Kazuya Takeda, Nagoya University / Tier IV, Japan

D-3-2: MULTIMEDIA ANALYSIS AND OTHERS

D-3-2.1: DIVERSE AUDIO-TO-IMAGE GENERATION VIA SEMANTICS AND FEATURE CONSISTENCY	1188
---	-------	------

Pei-Tse Yang, Feng-Guang Su, Yu-Chiang Frank Wang, National Taiwan University, Taiwan

D-3-2.2: MULTISCALE SALIENCY DETECTION FOR COLORED 3D POINT CLOUDS BASED ON RANDOM WALK 1193

Se-Won Jeong, Jae-Seong Yun, Jae-Young Sim, Ulsan National Institute of Science and Technology, Korea (South)

D-3-2.3: THE VALIDITY OF A DUAL AZURE KINECT-BASED MOTION CAPTURE SYSTEM FOR GAIT ANALYSIS: A PRELIMINARY STUDY 1201

Yunru Ma, Bo Sheng, Rylea Hart, Yanxin Zhang, The University of Auckland, New Zealand

D-3-2.4: PART-IN-WHOLE TYPE 3D PARTIAL SHAPE RETREIVAL BASED ON CONNECTED FACES WITH POINTNET FEATURES 1207

Masaki Aono, Wataru Iwabuchi, Toyohashi University of Technology, Japan

D-3-2.5: FIXED-POINT ARITHMETIC OF L2-NORM APPROXIMATION FOR 2-TUPLE ARRAYS WITH ROTATED L1-NORM EVALUATION 1216

Yuya Kodama, Shogo Muramatsu, Hiroyoshi Yamada, Niigata University, Japan

D-3-2.6: RAPID AND ACCURATE LOCAL GAUSSIAN NOISE REMOVAL 1222

shogo seta, Yusuke Nakahara, Takuro Yamaguchi, Masaaki ikehara, Keio University, Japan

D-3-2.7: EFFICIENT HUMAN-IN-THE-LOOP OBJECT DETECTION USING BI-DIRECTIONAL DEEP SORT AND ANNOTATION-FREE SEGMENT IDENTIFICATION 1226

Koki Madono, Waseda University, Japan; Teppei Nakano, Waseda University, Intelligent Framework Lab, Japan; Tetsunori Kobayashi, Tetsuji Ogawa, Waseda University, Japan

E-3-2: SPEECH SEPARATION 2, SOUND SOURCE SEPARATION

E-3-2.1: INTEGRATION OF SEMI-BLIND SPEECH SOURCE SEPARATION AND VOICE ACTIVITY DETECTION FOR FLEXIBLE SPOKEN DIALOGUE 775

Masaya Wake, Graduate School of Informatics, Kyoto University, Japan; Masahito Togami, LINE Corporation, Japan; Kazuyoshi Yoshii, Tatsuya Kawahara, Graduate School of Informatics, Kyoto University, Japan

E-3-2.2: DNN-BASED PERMUTATION SOLVER FOR FREQUENCY-DOMAIN INDEPENDENT COMPONENT ANALYSIS IN TWO-SOURCE MIXTURE CASE 781

Shuhei Yamaji, Daichi Kitamura, National Institute of Technology, Kagawa College, Japan

E-3-2.3: COMPUTER-RESOURCE-AWARE DEEP SPEECH SEPARATION WITH A RUN-TIME-SPECIFIED NUMBER OF BLSTM LAYERS 788

Masahito Togami, Line corporation, Japan; Yoshiki Masuyama, Waseda University, Japan; Tatsuya Komatsu, Line corporation, Japan; Kazuyoshi Yoshii, Tatsuya Kawahara, Kyoto University, Japan

E-3-2.4: SELF-ATTENTION FOR MULTI-CHANNEL SPEECH SEPARATION IN NOISY AND REVERBERANT ENVIRONMENTS 794

Conggui Liu, Yoshinao Sato, Fairy Devices, Japan

E-3-2.5: END-TO-END MUSIC-MIXED SPEECH RECOGNITION 800

Jeongwoo Woo, Masato Mimura, Kazuyoshi Yoshii, Tatsuya Kawahara, Kyoto University, Japan

E-3-2.6: ADAPTIVE NOISE SUPPRESSION FOR WAKE-WORD DETECTION BY TEMPORAL-DIFFERENCE GENERALIZED EIGENVALUE BEAMFORMER 805

Takehiko Kagoshima, Ning Ding, Hiroshi Fujimura, Toshiba Corporation, Japan

F-3-2: SPEECH SYNTHESIS

F-3-2.1: LP-WAVENET: LINEAR PREDICTION-BASED WAVENET SPEECH SYNTHESIS 810

Min-Jae Hwang, Search Solution, Korea (South); Frank Soong, Microsoft, China; Eunwoo Song, Naver, Korea (South); Xi Wang, Microsoft, China; Hong-Goo Kang, Yonsei University, Korea (South)

F-3-2.2: ONLINE SPEAKER ADAPTATION FOR WAVENET-BASED NEURAL VOCODERS 815

Qiuchen Huang, Yang Ai, Zhenhua Ling, University of Science and Technology of China, China

F-3-2.3: IMPLEMENTATION OF SEQUENTIAL REAL-TIME WAVEFORM GENERATOR FOR HIGH-QUALITY VOCODER	.....	821
<i>Masanori Morise, Meiji University, Japan</i>		
F-3-2.4: MODULE COMPARISON OF TRANSFORMER-TTS FOR SPEAKER ADAPTATION BASED ON FINE-TUNING	.....	826
<i>Katsuki Inoue, Sunao Hara, Masanobu Abe, Okayama university, Japan</i>		
F-3-2.5: EXCITGLOW: IMPROVING A WAVEGLOW-BASED NEURAL VOCODER WITH LINEAR PREDICTION ANALYSIS	.....	831
<i>Suhyeon Oh, Hyungseob Lim, Kyungguen Byun, Yonsei University, Korea (South); Min-Jae Hwang, Search Solutions, Incorporated, Korea (South); Eunwoo Song, Naver Corporation, Korea (South); Hong-Goo Kang, Yonsei University, Korea (South)</i>		
F-3-2.6: PERSONALIZED END-TO-END MANDARIN SPEECH SYNTHESIS USING SMALL-SIZED CORPUS	.....	837
<i>Chenhan Yuan, Virginia Polytechnic Institute and State University, China; Yi-Chin Huang, National Pingtung University, Taiwan</i>		
A-3-3: BEHAVIOR MEASUREMENT AND ANALYSIS		
A-3-3.1: MATHEMATICAL MODEL OF HORSE AND RIDER INTERACTION DURING HORSE JUMPING	.....	939
<i>Asahi Tsuruo, Nara Institute of Science and Technology, Japan; Monamie Ringhofer, Shinya Yamamoto, Kyoto University, Japan; Kazushi Ikeda, Nara Institute of Science and Technology, Japan</i>		
A-3-3.2: HUMAN HAND MOVEMENT RECOGNITION BASED ON HMM WITH HYPERPARAMETERS OPTIMIZED BY MAXIMUM MUTUAL INFORMATION	.....	944
<i>Ruoshi Wen, Qiang Wang, Xiang Ma, Harbin Institute of Technology, China; Zhibin Li, The University of Edinburgh, United Kingdom</i>		
A-3-3.3: QUANTIFICATION ANALYSIS OF BEHAVIORAL CHANGES AFTER SCIATIC NERVE LIGATION IN RATS	.....	952
<i>Panyawut Sri-iesaranusorn, Nara Institute of Science and Technology, Japan; Saeka Shimochi, University of Turku, Finland; Naoki Ono, Nara Institute of Science and Technology, Japan; Emrah Yatkin, Hidehiro Iida, University of Turku, Finland; Kazushi Ikeda, Junichiro Yoshimoto, Nara Institute of Science and Technology, Japan</i>		
A-3-3.4: SHEET-TYPE DEVICE FOR UNCONSTRAINED HEART SOUND MEASUREMENT AND WHITE NOISE REDUCTION BY WIENER FILTER	.....	958
<i>Keita Nishio, Toshiyuki Matsumoto, Satoshi Kumagai, Yosuke Kurihara, Aoyama Gakuin University, Japan; Takashi Kaburagi, International Christian University, Japan; Yuri Hamada, Aoyama Gakuin University, Japan</i>		
A-3-3.5: BOWEL MOVEMENT SIGNAL MODELING AND PARAMETERS EXTRACTION	.....	963
<i>Zhaoqi ChenWebert Montlouis, Johns Hopkins University, United States</i>		
A-3-3.6: A NEURAL NETWORK APPROACH FOR ANOMALY DETECTION IN GENOMIC SIGNALS	.....	968
<i>Erica Sawyer, Mario Banuelos, California State University, Fresno, United States; Roummel Marcia, Suzanne Sindi, University of California, Merced, United States</i>		
A-3-3.7: EVALUATION OF THE PRESSURE MEASUREMENT FUNCTION OF AN IMPLANTABLE MULTIMODALITY PROBE	.....	972
<i>Manami Wakuya, Toshitaka Yamakawa, Kumamoto University, Japan; Takao Inoue, Michiyasu Suzuki, Yamaguchi University, Japan</i>		

B-3-3: RECENT ADVANCES IN MULTIMEDIA SECURITY AND FORENSICS

B-3-3.1: A METHOD FOR IDENTIFYING ORIGIN OF DIGITAL IMAGES USING A CONVOLUTIONAL NEURAL NETWORK	1293
<i>Rong Huang, Donghua University, China; Fuming Fang, National Institute of Informatics, Japan; Huy H. Nguyen, SOKENDAI (The Graduate University for Advanced Studies), Japan; Junichi Yamagishi, Isao Echizen, National Institute of Informatics, Japan</i>	
B-3-3.2: COST SENSITIVE OPTIMIZATION OF DEEPFAKE DETECTOR	1300
<i>Ivan Kukanov, A*STAR, Singapore; Janne Karttunen, Hannu Sillanpää, Ville Hautamäki, University of Eastern Finland, Finland</i>	
B-3-3.3: VISUAL SECURITY EVALUATION OF LEARNABLE IMAGE ENCRYPTION METHODS AGAINST CIPHERTEXT-ONLY ATTACKS	1304
<i>Warit Sirichotendumrong, Hitoshi Kiya, Tokyo Metropolitan University, Japan</i>	
B-3-3.4: VEIN PATTERN VISUALISATION USING CONDITIONAL GENERATIVE ADVERSARIAL NETWORKS	1310
<i>Ali Keivanmarz, Hamid Sharifzadeh, Unitec Institute of Technology, New Zealand; Rachel Fleming, Institute of Environmental Science and Research (ESR), New Zealand</i>	
B-3-3.5: MULTIMODAL PERSONAL EAR AUTHENTICATION USING MULTIPLE SENSOR INFORMATION	1317
<i>Shunji Itani, Kansai University, Japan; Shunsuke Kita, Osaka Research Institute of Industrial Science and Technology, Japan; Yoshinobu Kajikawa, Kansai University, Japan</i>	
B-3-3.6: SPEECH INFORMATION HIDING BY MODIFICATION OF LSF QUANTIZATION INDEX IN CELP CODEC	1321
<i>Candy Olivia Mawalim, Japan Advanced Institute of Science and Technology, Japan; Shengbei Wang, Tianjin Polytechnic University, China; Masashi Unoki, Japan Advanced Institute of Science and Technology, Japan</i>	
B-3-3.7: A SECURE OPUS PULSE STEGANOGRAPHIC SCHEME BASED ON MESSAGE TRANSFORM	1331
<i>Yanzhen Ren, Shan Zhong, Weiping Tu, Lina Wang, Wuhan University, China</i>	

C-3-3: MACHINE LEARNING FOR SMALL-SAMPLE DATA ANALYSIS

C-3-3.1: SPEAKER VERIFICATION SYSTEM BASED ON DEFORMABLE CNN AND TIME-FREQUENCY ATTENTION	1689
<i>Yiming Zhang, Beijing University of Posts and Telecommunications, China; Hong Yu, Ludong University, China; Zhanyu Ma, Beijing University of Posts and Telecommunications, China</i>	
C-3-3.2: CLOSED-FORM PRE-TRAINING FOR SMALL-SAMPLE ENVIRONMENTAL SOUND RECOGNITION	1693
<i>Nakamasa Inoue, Keita Goto, Tokyo Institute of Technology, Japan</i>	
C-3-3.3: NITES: A NON-PARAMETRIC INTERPRETABLE TEXTURE SYNTHESIS METHOD	1698
<i>Xuejing Lei, Ganning Zhao, C.-C. Jay Kuo, University of Southern California, United States</i>	
C-3-3.4: ADAPTIVE MULTI-PROTOTYPE RELATION NETWORK	1707
<i>Xiaoxu Li, Tao Tian, Lanzhou University of Technology, China; Yuxin Liu, The University of Melbourne, Australia; Hong Yu, Ludong University, China; Jie Cao, Lanzhou University of Technology, China; Zhanyu Ma, Beijing University of Posts and Telecommunications, China</i>	
C-3-3.5: SUPPORTIVE AND SELF ATTENTIONS FOR IMAGE CAPTION	1713
<i>Jen-Tzung Chien, Ting-An Lin, National Chiao Tung University, Taiwan</i>	

C-3-3.6: ANTI-NOISE RELATION NETWORK FOR FEW-SHOT LEARNING 1719
Xiaoxu Li, Jintao Yan, Jijie Wu, Lanzhou University of Technology, China; Yuxin Liu, University of Melbourne, Australia;
Xiaochen Yang, University College London, United Kingdom; Zhanyu Ma, Beijing University of Posts and Telecommunications,
China

C-3-3.7: SMALL DATA-DRIVEN ELECTRICAL INSULATOR DEFECT DETECTION 1725
YuXin Song, Dingkai Susun, Beijing University of Posts and Telecommunications, China; Lei Pan, Institute of Microelectronics
of the Chinese academy of Sciences, University of the Chinese academy of Sciences, China; Ming Wu, Beijing University of Posts
and Telecommunications, China; Shengli Zhu, Hui Ma, Beijing Ikingtec intelligent technology Co., Ltd, China

D-3-3: IMAGE AND VIDEO PROCESSING BASED ON DEEP LEARNING

D-3-3.1: DEEP LEARNING BASED DEPTH ESTIMATION AND RECONSTRUCTION OF 1252
LIGHT FIELD IMAGES

Jae-Seong Yun, Jae-Young Sim, UNIST, Korea (South)

D-3-3.2: PROGRESSIVE DEEP NETWORK WITH CHANNEL BACK-PROJECTION FOR 1257
HYPERSPECTRAL RECOVERY FROM RGB

Sang-Ho Lee, Min-Je Park, Jong-Ok Kim, Korea University, Korea (South)

D-3-3.3: IMAGE INPAINTING USING WEIGHTED MASK CONVOLUTION..... 1262
Jiwoo Kang, Seongmin Lee, Suwoong Heo, Sanghoon Lee, Yonsei University, Korea (South)

D-3-3.4: MOIRÉ ARTIFACTS REMOVAL IN SCREEN-SHOT IMAGES VIA MULTIPLE DOMAIN 1268
LEARNING

An Gia Vien, Hyunkook Park, Chul Lee, Dongguk University, Korea (South)

D-3-3.5: DATA REDUCTION USING CLUSTER SAMPLING..... 1274
Ye seung Park, Mingyu Jang, Jungwoo Huh, Kyoungoh Lee, Sanghoon Lee, Yonsei University, Republic of Korea, Korea (South)

D-3-3.6: TEMPORAL ATTENTION FEATURE ENCODING FOR VIDEO CAPTIONING 1279
*Nayoung Kim, Ewha W. University, Korea (South); Seong Jong Ha, NCSoft, Korea (South); Jewon Kang, Ewha W. University,
Korea (South)*

D-3-3.7: SUPER-RESOLUTION OF MULTI-VIEW ERP 360-DEGREE IMAGES WITH 1283
TWO-STAGE DISPARITY REFINEMENT

Hee-Jae Kim, Jewon Kang, Byung-Uk Lee, Ewha W. University, Korea (South)

D-3-3.8: HUMAN POSE ESTIMATION USING SKELETAL HEATMAPS..... 1287
Jinyoung Jun, Jae-Han Lee, Chang-Su Kim, Korea University, Korea (South)

E-3-3: ADVANCED SIGNAL PROCESSING AND MACHINE LEARNING FOR AUDIO AND SPEECH APPLICATIONS

E-3-3.1: A JOINT-LOSS APPROACH FOR SPEECH ENHANCEMENT VIA SINGLE-CHANNEL 841
NEURAL NETWORK AND MVDR BEAMFORMER

Zhi-Wei Tan, Anh H. T. Nguyen, Linh T. T. Tran, Andy W. H. Khong, Nanyang Technological University, Singapore

E-3-3.2: SOURCE ENHANCEMENT FOR UNMANNED AERIAL VEHICLE RECORDING 850
USING MULTI-SENSORY INFORMATION

Benjamin Yen, Yusuke Hioka, Brian Mace, University of Auckland, New Zealand

E-3-3.3: A STUDY ON GEOMETRICALLY CONSTRAINED IVA WITH AUXILIARY FUNCTION 858
APPROACH AND VCD FOR IN-CAR COMMUNICATION

Kana Goto, Li Li, Riki Takahashi, Shoji Makino, Takeshi Yamada, University of Tsukuba, Japan

E-3-3.4: DYNAMIC SYNCHRONOUS AVERAGING FOR ENHANCEMENT OF PERIODIC SIGNAL UNDER SAMPLING FREQUENCY VARIATION	863
---	-----

Kyosuke Sumiyoshi, Yukoh Wakabayashi, Nobutaka Ono, Tokyo Metropolitan University, Japan

E-3-3.5: JOINT-DIAGONALIZABILITY-CONSTRAINED MULTICHANNEL NONNEGATIVE MATRIX FACTORIZATION BASED ON MULTIVARIATE COMPLEX STUDENT'S T-DISTRIBUTION	869
--	-----

Keigo Kamo, Yuki Kubo, Norihiro Takamune, The University of Tokyo, Japan; Daichi Kitamura, National Institute of Technology, Kagawa Collage, Japan; Hiroshi Saruwatari, The University of Tokyo, Japan; Yu Takahashi, Kazunobu Kondo, Yamaha Corporation, Japan

F-3-3: SIGNAL PROCESSING SYSTEMS FOR AI

F-3-3.1: NOISE SUPPRESSION USING A DIFFERENTIAL-TYPE MICROPHONE ARRAY AND TWO-DIMENSIONAL AMPLITUDE AND PHASE SPECTRA	46
--	----

Koichiro Shiozawa, Kenji Ozawa, University of Yamanashi, Japan; Tomohiko Ise, Alps Alpine Co., Ltd., Japan

F-3-3.2: ROBUST SPEECH DEREVERBERATION BASED ON WPE AND DEEP LEARNING	52
--	----

Hao Li, Inner Mongolia University, China; Xueliang Zhang, Guanglai Gao, Professor, China

F-3-3.3: AN ACOUSTIC SIGNAL PROCESSING SYSTEM FOR IDENTIFICATION OF QUEEN-LESS BEEHIVES	57
--	----

Rui Peng, Iman Ardekani, Hamid Sharifzadeh, Unitec Institute of Technology, New Zealand

F-3-3.4: SEGMENTATION OF PALM VEIN IMAGES USING U-NET	64
--	----

Felix Marattukalam, Waleed H. Abdulla, The University of Auckland, New Zealand

F-3-3.5: DEEP NEURAL NETWORK COMPRESSION WITH KNOWLEDGE DISTILLATION USING CROSS-LAYER MATRIX, KL DIVERGENCE AND OFFLINE ENSEMBLE	71
--	----

Hsing-Hung Chou, Ching-Te Chiu, Yi-Ping Liao, National Tsing Hua University, Taiwan

F-3-3.6: ENHANCED CHANNEL TRACKING IN THZ BEAMSPACE MASSIVE MIMO: A DEEP CNN APPROACH	76
--	----

Navjot Kaur, Seyyed Saleh Hosseini, Benoit Champagne, McGill University, Canada

F-3-3.7: PROCESSING ELEMENT ARCHITECTURE DESIGN FOR DEEP REINFORCEMENT LEARNING WITH FLEXIBLE BLOCK FLOATING POINT EXPLOITING SIGNAL STATISTICS	82
--	----

Juyn-Da Su, Pei-Yun Tsai, National Central University, Taiwan

F-3-3.8: ACOUSTIC ECHO CANCELLATION BASED ON RECURRENT NEURAL NETWORK	88
--	----

Yao Cheng Tsai, Kai Wen Liang, Pao Chi Chang, National Central University, Taiwan