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<b>DISPS-P3.7: A NOVEL DETERMINISTIC SENSING MATRIX BASED ON KASAMI CODES FOR CLUSTER STRUCTURED SPARSE SIGNALS</b>	<b>1592</b>
<i>Hamid Nouasria, Mohamed Et-tolba, INPT, Morocco</i>	
<b>DISPS-P3.8: PASSIVE DETECTION AND DISCRIMINATION OF BODY MOVEMENTS IN THE SUB-THZ BAND: A CASE STUDY</b>	<b>1597</b>
<i>Sanaz Kianoush, Stefano Savazzi, Vittorio Rampa, National Research Council of Italy-CNR, Italy</i>	

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*Xi Zhang, Shanghai Jiao Tong University, China; Xiaolin Wu, McMaster University, Canada*

### IVMSP-L1.2: CONVOLUTIONAL NEURAL NETWORKS FOR VIDEO INTRA PREDICTION USING CROSS-COMPONENT ADAPTATION ..... 1607

*Maria Meyer, Jonathan Wiesner, Jens Schneider, Christian Rohlfing, RWTH Aachen University, Germany*

### IVMSP-L1.3: COMPRESSION IMPROVEMENT VIA REFERENCE ORGANIZATION FOR 2D-MULTIVIEW CONTENT ..... 1612

*Pavel Nikitin, Orange Labs, France; Marco Cagnazzo, Telecom ParisTech, Laboratoire Traitement et Communication de l'Information, France; Joel Jung, Orange Labs, France*

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*Jiawen Gu, Jiangtao Wen, Tsinghua University, China*

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*Di Chen, Qingshuang Chen, Fengqing Zhu, Purdue University, United States*

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*Jieon Kim, Queen Mary University of London, United Kingdom; Saverio Blasi, Andre Seixas Dias, Marta Mrak, BBC, United Kingdom; Ebroul Izquierdo, Queen Mary University of London, United Kingdom*

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*Mina Bishay, Stefan Priebe, Ioannis Patras, Queen Mary University of London, United Kingdom*

### IVMSP-L2.2: SIGN LANGUAGE DETECTION “IN THE WILD” WITH RECURRENT NEURAL NETWORKS ..... 1637

*Mark Borg, Kenneth P. Camilleri, University of Malta, Malta*

### IVMSP-L2.3: BOUNDARY INFORMATION MATTERS MORE: ACCURATE TEMPORAL ACTION DETECTION WITH TEMPORAL BOUNDARY NETWORK ..... 1642

*Tao Zhang, Peking University, China, China; Shan Liu, Tencent, China; Thomas Li, Ge Li, Peking University, China*

### IVMSP-L2.4: BLP - BOUNDARY LIKELIHOOD PINPOINTING NETWORKS FOR ACCURATE TEMPORAL ACTION LOCALIZATION ..... 1647

*Weijie Kong, Nannan Li, Peking University, China; Shan Liu, Tencent, China; Thomas Li, Ge Li, Peking University, China*

### IVMSP-L2.5: RADIAL LOSS FOR LEARNING FINE-GRAINED VIDEO SIMILARITY METRIC ..... 1652

*Abhinav Jain, Prerna Agarwal, Shashank Mujumdar, Nitin Gupta, Sameep Mehta, Chiranjoy Chattopadhyay, IBM Research, India*

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*Pengyu Zhao, Yuanxing Zhang, Kaigui Bian, Peking University, China; Hu Tuo, iQIYI Co. Ltd., China; Lingyang Song, Peking University, China*

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*Bo Li, Zhengxing Sun, Lv Tang, Anqi Hu, Nanjing University, China*

### IVMSP-L3.2: LEARNING THE SPIRAL SHARING NETWORK WITH MINIMUM ..... 1667 SALIENT REGION REGRESSION FOR SALIENCY DETECTION

*Zukai Chen, Xin Tan, Hengliang Zhu, Shanghai Jiao Tong University, China; Shouhong Ding, Tencent Youtu Lab, China;  
Lizhuang Ma, Shanghai Jiao Tong University, China; Haichuan Song, East China Normal University, China*

### IVMSP-L3.3: IMAGE RECONSTRUCTION BY ORTHOGONAL MOMENTS DERIVED ..... 1672 BY THE PARITY OF POLYNOMIALS

*Bo Yang, Wei Tang, Xiaofeng Chen, Northwestern Polytechnical University, China*

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*Perla Sai Raj Kishore, Institute of Engineering & Management, India; Ayan Kumar Bhunia, Nanyang Technological University, Singapore; Shuvojit Ghose, Institute of Engineering & Management, India; Partha Pratim Roy, Indian Institute of Technology, Roorkee, India*

### IVMSP-L3.5: DECOUPLING CATEGORY-WISE INDEPENDENCE AND RELEVANCE ..... 1682 WITH SELF-ATTENTION FOR MULTI-LABEL IMAGE CLASSIFICATION

*Luchen Liu, Malong Technologies, University of Chinese Academy of Sciences, China; Sheng Guo, Weilin Huang, Malong Technologies, China*

### IVMSP-L3.6: HIGH ACCURACY IMAGE ROTATION AND SCALE ESTIMATION USING ..... 1687 RADON TRANSFORM AND SUB-PIXEL SHIFT ESTIMATION

*Takanori Fujisawa, Masaaki Ikehara, Keio University, Japan*

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*Pierre Allain, Inria, France; Laurent Guillo, CNRS, France; Christine Guillemot, Inria, France*

### IVMSP-L4.2: SPATIALLY ADAPTIVE LOSSES FOR VIDEO SUPER-RESOLUTION ..... 1697 WITH GANS

*Xijun Wang, Alice Lucas, Northwestern University, United States; Santiago Lopez-Tapia, Universidad de Granada, Spain;  
Xinyi Wu, Northwestern University, United States; Rafael Molina, Universidad de Granada, Spain; Aggelos K. Katsaggelos, Northwestern University, United States*

### IVMSP-L4.3: IMAGE DEMOSAICKING VIA CHROMINANCE IMAGES WITH PARALLEL ..... 1702 CONVOLUTIONAL NEURAL NETWORKS

*Takuro Yamaguchi, Masaaki Ikehara, Keio University, Japan*

### IVMSP-L4.4: MULTI-SPECTRAL IMAGE DENOISING WITH SHARED DICTIONARIES ..... 1707 AND LOW-RANK REPRESENTATION

*Xiao Gong, WEI CHEN, Beijing Jiaotong University, China*

### IVMSP-L4.5: BAYESIAN IMAGE RESTORATION UNDER POISSON NOISE AND ..... 1712 LOG-CONCAVE PRIOR

*Maxime Vono, Nicolas Dobigeon, University of Toulouse, France; Pierre Chainais, Centrale Lille, France*

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*Lantao Yu, Michael Orchard, Rice University, United States*

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*Peiqi Duan, Anlong Ming, Xuesong Zhang, Xuejing Kang, Beijing University of Posts and Telecommunications, China*

### **IVMSP-L5.4: PERCEPTUAL QUALITY PRESERVING IMAGE SUPER-RESOLUTION VIA CHANNEL ATTENTION ..... 1737**

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*Chia-Yang Chang, Shao-Yi Chien, National Taiwan University, Taiwan*

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### **IVMSP-L6.2: ASYMMETRIC CYCLEGAN FOR UNPAIRED NIR-TO-RGB FACE IMAGE TRANSLATION ..... 1757**

*Hao Dou, Chen Chen, Xiyuan Hu, Institute of Automation, Chinese Academy of Sciences; University of Chinese Academy of Sciences, China; Silong Peng, Institute of Automation, Chinese Academy of Sciences; University of Chinese Academy of Sciences; Visystem Co.Ltd, China*

### **IVMSP-L6.3: TWO-STREAM MULTI-FOCUS IMAGE FUSION BASED ON THE LATENT DECISION MAP ..... 1762**

*Weihong Zeng, Fei Li, Hongyu Huang, Yue Huang, Xinghao Ding, Xiamen University, China*

### **IVMSP-L6.4: RAIN STREAK REMOVAL VIA MULTI-SCALE MIXTURE EXPONENTIAL POWER MODEL ..... 1767**

*Xiaofen Wang, Jun Chen, Wuhan university, China; Zhen Han, Wuhan University, China; Mingfu Xiong, Wuhan Textile University, China; Chao Liang, Qi Zhen, Zhongyuan Wang, Wuhan university, China*

### **IVMSP-L6.5: PROPER GUIDANCE IMAGE GENERATION BASED ON SALIENCY FACTOR FOR BETTER TRANSMISSION REFINEMENT IN IMAGE DEHAZING ..... 1772**

*Libao Zhang, Xiaohan Wang, Beijing Normal University, China*

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*Seangbae Bang, Wonha Kim, Kyunghee University, Korea (South)*

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*Daniela Lanz, Christian Herbert, André Kaup, Multimedia Communications and Signal Processing, Germany*

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<i>Yu Chen, Ruimin Hu, Jing Xiao, Zhongyuan Wang, Wuhan University, China</i>	
<b>IVMSP-P1.3: TRANSFORM COEFFICIENT CODING FOR SCREEN CONTENT IN VERSATILE VIDEO CODING (VVC)</b>	<b>1792</b>
<i>Mohsen Abdoli, Felix Henry, Orange Labs, France; Patrice Brault, Frederic Dufaux, Pierre Duhamel, L2S, CentraleSupélec, France</i>	
<b>IVMSP-P1.4: IMAGE COMPRESSION USING GMM MODEL OPTIMIZATION</b>	<b>1797</b>
<i>Jianjun Sun, Yan Zhao, Shigang Wang, Jilin University, China</i>	
<b>IVMSP-P1.5: CODING TREE EARLY TERMINATION FOR FAST HEVC TRANSCODING BASED ON RANDOM FORESTS</b>	<b>1802</b>
<i>Thiago Bubolz, Federal University of Pelotas, Brazil; Mateus Grellert, Catholic University of Pelotas, Brazil; Bruno Zatt, Guilherme Correa, Federal University of Pelotas, Brazil</i>	
<b>IVMSP-P1.6: AN IMAGE CODING APPROACH BASED ON MIXTURE-OF-EXPERTS REGRESSION USING EPANECHNIKOV KERNEL</b>	<b>1807</b>
<i>Boning Liu, Yan Zhao, Xiaomeng Jiang, Shigang Wang, Jilin University, China</i>	
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<i>Maurizio Masera, Giulia Fracastoro, Maurizio Martina, Enrico Magli, Politecnico di Torino, Italy</i>	
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<i>Karina Jaskolka, André Kaup, Friedrich-Alexander-Universität Erlangen-Nürnberg, Germany</i>	
<b>IVMSP-P1.9: LONG TERM BACKGROUND REFERENCE BASED SATELLITE VIDEO CODING</b>	<b>1822</b>
<i>Xu Wang, Ruimin Hu, Zhongyuan Wang, Wuhan University, China; Jing Xiao, Collaborative Innovation Center of Geospatial Technology, China; Yuhui Zhang, Wuhan University, China</i>	
<b>IVMSP-P1.10: GENERATIVE ADVERSARIAL NETWORKS BASED ERROR CONCEALMENT FOR LOW RESOLUTION VIDEO</b>	<b>1827</b>
<i>Chong yang Xiang, Jiajun Xu, Chuan Yan, Qiang Peng, Xiao Wu, Southwest Jiaotong University, China</i>	
<b>IVMSP-P1.11: MULTIPLE LINEAR REGRESSION FOR HIGH EFFICIENCY VIDEO INTRA CODING</b>	<b>1832</b>
<i>ZHAOBIN ZHANG, University of Missouri - Kansas City, United States; Yue Li, University of Science and Technology of China, China; Li Li, Zhu Li, University of Missouri - Kansas City, United States; Shan Liu, Tencent America, United States</i>	
<b>IVMSP-P1.12: RANDOM FOREST ORIENTED FAST QTBT FRAME PARTITIONING</b>	<b>1837</b>
<i>Thomas Amestoy, Univ Rennes, INSA Rennes, Thales SIX GTS France, France; Alexandre Mercat, Laboratory of Pervasive Computing, Finland; Wassim Hamidouche, Univ Rennes, INSA Rennes, France; Cyril Bergeron, Thales SIX GTS France, France; Daniel Menard, Univ Rennes, INSA Rennes, France</i>	
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<i>Juan Berón, Hernán Darío Benítez Restrepo, Pontificia Universidad Javeriana Cali, Colombia; Alan C. Bovik, The University of Texas at Austin, United States</i>	
<b>IVMSP-P2.2: ALTERNATELY GUIDED DEPTH SUPER-RESOLUTION USING WEIGHTED LEAST SQUARES AND ZERO-ORDER REVERSE FILTERING</b>	<b>1847</b>
<i>Kailong Zhou, Shengtao Yu, Cheolkon Jung, Xidian University, China</i>	

<b>IVMSP-P2.3: A CONVEX LIFTING APPROACH TO IMAGE PHASE UNWRAPPING .....</b>	<b>1852</b>
<i>Laurent Condat, CNRS and Univ. Grenoble Alpes, France; Daichi Kitahara, Akira Hirabayashi, Ritsumeikan University, Japan</i>	
<b>IVMSP-P2.4: ROBUST SUPER-RESOLUTION USING MULTIPLE BASES AND 3D FILTERING .....</b>	<b>1857</b>
<i>Naushad Ansari, Weisi Lin, Nanyang Technological University, Singapore, Singapore</i>	
<b>IVMSP-P2.5: COUPLED ISTA NETWORK FOR MULTI-MODAL IMAGE SUPER-RESOLUTION .....</b>	<b>1862</b>
<i>Xin Deng, Pier Luigi Dragotti, Imperial College London, United Kingdom</i>	
<b>IVMSP-P2.6: MULTISCALE STRUCTURE TENSOR TOTAL VARIATION FOR IMAGE RECOVERY .....</b>	<b>1867</b>
<i>Makoto Watanabe, The University of Kitakyushu, Japan; Ryo Matsuoka, Kagawa University, Japan; Seisuke Kyochi, The University of Kitakyushu, Japan; Shunsuke Ono, Tokyo Institute of Technology, Japan; Masahiro Okuda, The University of Kitakyushu, Japan</i>	
<b>IVMSP-P2.7: CONVOLUTIONAL-SPARSE-CODED DYNAMIC MODE DECOMPOSITION AND ITS APPLICATION TO RIVER STATE ESTIMATION .....</b>	<b>1872</b>
<i>Yuhei Kaneko, Shogo Muramatsu, Hiroyasu Yasuda, Kiyoshi Hayasaka, Yu Otake, Niigata University, Japan; Shunsuke Ono, Tokyo Institute of Technology, Japan; Masahiro Yukawa, Keio University, Japan</i>	
<b>IVMSP-P2.8: FAST EDGE PRESERVING 2D SMOOTHING FILTER USING INDICATOR FUNCTION .....</b>	<b>1877</b>
<i>Ryo Abiko, Masaaki Ikehara, Keio University, Japan</i>	
<b>IVMSP-P2.9: DENOISING OF 3D POINT CLOUDS CONSTRUCTED FROM LIGHT FIELDS .....</b>	<b>1882</b>
<i>Christian Galea, Christine Guillemot, INRIA, France</i>	
<b>IVMSP-P2.10: INTERACTIVE DEEP COLORIZATION USING SIMULTANEOUS GLOBAL AND LOCAL INPUTS .....</b>	<b>1887</b>
<i>Yi Xiao, Peiyao Zhou, Yan Zheng, Hunan University, China; Chi-Sing Leung, City University of Hong Kong, China</i>	
<b>IVMSP-P3: SEGMENTATION AND TRACKING</b>	
<b>IVMSP-P3.1: CAN: CONTEXTUAL AGGREGATING NETWORK FOR SEMANTIC SEGMENTATION .....</b>	<b>1892</b>
<i>Dechun Cong, Quan Zhou, Nanjing University of Posts &amp; Telecommunications, China; Jie Cheng, Huawei Technologies Co. Ltd., China; Xiaofu Wu, Suofei Zhang, Nanjing University of Posts &amp; Telecommunications, China; Weihua Ou, Guizhou Normal University, China; Huimin Lu, Kyushu Institute of Technology, Japan</i>	
<b>IVMSP-P3.2: AN IMPROVED APPROACH TO WEAKLY SUPERVISED SEMANTIC SEGMENTATION .....</b>	<b>1897</b>
<i>Lian Xu, Mohammed Bennamoun, Farid Boussaid, The University of Western Australia, Australia; Senjian An, Curtin University, Australia; Ferdous Sohel, Murdoch University, Australia</i>	
<b>IVMSP-P3.3: PIXEL LEVEL DATA AUGMENTATION FOR SEMANTIC IMAGE SEGMENTATION USING GENERATIVE ADVERSARIAL NETWORKS .....</b>	<b>1902</b>
<i>Shuangting Liu, Jiaqi Zhang, Yuxin Chen, Yifan Liu, Zengchang Qin, Tao Wan, Beihang University, China</i>	
<b>IVMSP-P3.4: SALIENCY AWARE: WEAKLY SUPERVISED OBJECT LOCALIZATION .....</b>	<b>1907</b>
<i>Yun-Chun Chen, Winston H. Hsu, National Taiwan University, Taiwan</i>	
<b>IVMSP-P3.5: A DATA-CENTRIC APPROACH TO UNSUPERVISED TEXTURE SEGMENTATION USING PRINCIPLE REPRESENTATIVE PATTERNS .....</b>	<b>1912</b>
<i>Kaitai Zhang, University of Southern California, United States; Hong-Shuo Chen, National Chiao Tung University, Taiwan; Xinfeng Zhang, Ye Wang, C.-C. Jay Kuo, University of Southern California, United States</i>	

<b>IVMSP-P3.6: WEAKLY SUPERVISED INSTANCE SEGMENTATION USING HYBRID NETWORKS</b>	<b>1917</b>
<i>Shisha Liao, Chongqing University of Posts and Telecommunications, China; Yongqing Sun, NTT Media Intelligence Laboratories, Japan; Chenqiang Gao, Chongqing University of Posts and Telecommunications, China; Pranav Shenoy K P, Georgia Institute of Technology, United States; Song Mu, Chongqing University of Posts and Telecommunications, China; Jun Shimamura, Atsushi Sagata, NTT Media Intelligence Laboratories, Japan</i>	
<b>IVMSP-P3.7: DISCRIMINATIVE FEATURES RECONSTRUCTION NETWORK FOR SEMANTIC SEGMENTATION</b>	<b>1922</b>
<i>Qiuha Zhou, Yanbo Ma, Haihua Lu, Xuesong Chen, Yong Zhao, Shenzhen Graduate School of Peking University, China</i>	
<b>IVMSP-P3.8: ONLINE SINGLE PERSON TRACKING FOR UNMANNED AERIAL VEHICLES: BENCHMARK AND NEW BASELINE</b>	<b>1927</b>
<i>Zhihui Wang, Zihao Liu, Dong Wang, Dalian University of Technology, China; Shuang Wang, Yunwei Qi, Alibaba Group, China; Huchuan Lu, Dalian University of Technology, China</i>	
<b>IVMSP-P3.9: REAL-TIME TRACKER WITH FAST RECOVERY FROM TARGET LOSS</b>	<b>1932</b>
<i>Alessandro Bay, Panagiotis Sidiropoulos, Eduard Vazquez, Michele Sasdelli, Cortexica Vision System Ltd, United Kingdom</i>	
<b>IVMSP-P3.10: SHOT TYPE FEASIBILITY IN AUTONOMOUS UAV CINEMATOGRAPHY</b>	<b>1937</b>
<i>Iason Karakostas, Ioannis Mademlis, Nikos Nikolaidis, Ioannis Pitas, Aristotle University of Thessaloniki, Greece</i>	
<b>IVMSP-P3.11: ADVERSARIAL LEARNING-BASED DATA AUGMENTATION FOR ROTATION-ROBUST HUMAN TRACKING</b>	<b>1942</b>
<i>Kexin Chen, Xue Zhou, Qidong Zhou, Hongbing Xu, University of Electronic Science and Technology of China, China</i>	
<b>IVMSP-P4: IMAGE/VIDEO ANALYSIS I</b>	
<b>IVMSP-P4.1: ADAPTIVE GRAPH FORMULATION FOR 3D SHAPE REPRESENTATION</b>	<b>1947</b>
<i>Basheer Alwaely, Charith Abhayaratne, The University of Sheffield, United Kingdom</i>	
<b>IVMSP-P4.2: DOD-CNN: DOUBLY-INJECTING OBJECT INFORMATION FOR EVENT RECOGNITION</b>	<b>1952</b>
<i>Hyungtae Lee, Sungmin Eum, Booz Allen Hamilton Inc., United States; Heesung Kwon, U.S. Army Research Laboratory, United States</i>	
<b>IVMSP-P4.3: SCORE-SPECIFIC NON-MAXIMUM SUPPRESSION AND COEXISTENCE PRIOR FOR MULTI-SCALE FACE DETECTION</b>	<b>1957</b>
<i>Tianpeng Wu, Dong Liang, Jiaxing Pan, Han Sun, Nanjing University of Aeronautics and Astronautics, China; Bin Kang, Nanjing University of Posts and Telecommunications, China; Shun'ichi Kaneko, Graduate School of Information Science and Technology, Hokkaido University, Japan; Huiyu Zhou, University of Leicester, United Kingdom</i>	
<b>IVMSP-P4.4: ADVERSARIAL WATERMARKING TO ATTACK DEEP NEURAL NETWORKS</b>	<b>1962</b>
<i>Gengxing Wang, The University of Sydney, Australia; Xinyuan Chen, Shanghai Jiao Tong University, China; Chang Xu, The University of Sydney, Australia</i>	
<b>IVMSP-P4.5: LEARNING SEARCH PATH FOR REGION-LEVEL IMAGE MATCHING</b>	<b>1967</b>
<i>Onkar Krishna, Go Irie, Xiaomeng Wu, Takahito Kawanishi, Kunio Kashino, NTT Corporation, Japan, Japan</i>	
<b>IVMSP-P4.6: VEHICLE POSE ESTIMATION USING MASK MATCHING</b>	<b>1972</b>
<i>Qingnan Li, Ruimin Hu, Yu Chen, Yixin Chen, Wuhan University, China</i>	
<b>IVMSP-P4.7: NOSE, EYES AND EARS: HEAD POSE ESTIMATION BY LOCATING FACIAL KEYPOINTS</b>	<b>1977</b>
<i>Aryaman Gupta, Kalpit Thakkar, Vineet Gandhi, PJ Narayanan, IIIT Hyderabad, India</i>	

<b>IVMSP-P4.8: CASCADED POINT NETWORK FOR 3D HAND POSE ESTIMATION .....</b>	<b>1982</b>
<i>Yikun Dou, Xuguang Wang, Department of Automation, North China Electric Power University, China; Yuying Zhu, Xiaoming Deng, Cuixia Ma, Institute of Software, Chinese Academy of Sciences, China; Liang Chang, College of Information Science and Technology, Beijing Normal University, China; Hongan Wang, Institute of Software, Chinese Academy of Sciences, China</i>	
<b>IVMSP-P4.9: MULTI-MODAL IMAGE STITCHING WITH NONLINEAR OPTIMIZATION .....</b>	<b>1987</b>
<i>Arindam Saha, Soumyadip Maity, Brojeshwar Bhowmick, Embedded Systems and Robotics, TCS Research and Innovation, Kolkata, India, India</i>	
<b>IVMSP-P4.11: SCANET: SPATIAL-CHANNEL ATTENTION NETWORK FOR 3D OBJECT DETECTION .....</b>	<b>1992</b>
<i>Haihua Lu, Xuesong Chen, Guiying Zhang, Qiu hao Zhou, Yanbo Ma, Yong Zhao, Peking University Shenzhen Graduate School, China</i>	
<b>IVMSP-P5: IMAGE/VIDEO ANALYSIS II</b>	
<b>IVMSP-P5.1: A NOVEL FRACTIONAL ORDER DERIVATE BASED LOG-DEMONS WITH DRIVING FORCE FOR HIGH ACCURATE IMAGE REGISTRATION .....</b>	<b>1997</b>
<i>Cheng Xu, Ying Wen, East China Normal University, China; Bing He, Shanghai Inspection &amp; Maintenance of Power Company, China</i>	
<b>IVMSP-P5.2: DUAL-MODALITY SEQ2SEQ NETWORK FOR AUDIO-VISUAL EVENT LOCALIZATION .....</b>	<b>2002</b>
<i>Yan-Bo Lin, Yu-Jhe Li, Yu-Chiang Frank Wang, National Taiwan University, Taiwan</i>	
<b>IVMSP-P5.3: MULTIPLE AGENTS REPRESENTATION USING MOTION FIELDS.....</b>	<b>2007</b>
<i>Catarina Barata, Jacinto C. Nascimento, Jorge S. Marques, IST, Portugal</i>	
<b>IVMSP-P5.4: TOWARDS GENERATING AMBISONICS USING AUDIO-VISUAL CUE FOR VIRTUAL REALITY .....</b>	<b>2012</b>
<i>Aakanksha Rana, Cagri Ozcinar, Aljosa Smolic, Trinity College Dublin, Ireland</i>	
<b>IVMSP-P5.5: TEMPORAL SALIENCE BASED HUMAN ACTION RECOGNITION .....</b>	<b>2017</b>
<i>Salah Al-Obaidi, Charith Abhayaratne, The University of Sheffield, United Kingdom</i>	
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