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**Proceedings**

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#### Communications

#### **COMMIL:Antennas and Propagation**

Session Code : [COMMIL.1 - Paper ID 0099](#)

Paper Title : **ANALYSIS OF FEEDING TECHNIQUES OF RECTANGULAR MICROSTRIP ANTENNA 26**

Author : *Mandal Aditi; Ghosal Antara; Majumdar Anurima; Ghosh Avali; Das Annapurna; Das Sisir K - Guru Nanak Institute of Technology, India*

Abstract : Microstrip antennas are excited for radiation modes using different techniques which lead to best impedance matching between the feed line and the patch. This paper describes two techniques which use microstrip line and also coaxial line as feed line for a rectangular patch. The analysis was carried out using ANSOFT High frequency structure simulator (HFSS). By changing the position of the feed point and using inset feed design, the return loss at the feed point was determined at 2.4GHz and the results were compared with those obtained for coaxial line feed from HFSS analysis. It is

concluded that coaxial line feed is best of all techniques if bandwidth is not a factor.

Session Code : [COMMIL.2 - Paper ID 0146](#)

Paper Title : **SYNTHESIS OF FLAT TOP BEAM PATTERN THROUGH TIME MODULATION OF LINEAR ARRAY 32**

Author : *Mandal, S. K., Mahanti, G. K., Ghatak, Rowdra - National Institute of Technology, Durgapur, India*

Abstract : In this paper, a flat-top beam pattern is generated through time modulation of linear array. Three parameters; side lobe level (SLL), ripple (R) and transition width (T) related are obtained as -30.2dB, 0.1dB and 6.40 respectively. To simplify the complexity of the feeding network, only two states of static phase shift ( $0, \pi$ ) is considered. The maximum side band radiation level of the first two sidebands are also reduced to less than -33.4dB and -34.4dB respectively. Artificial Bee colony algorithm is used as the searching and optimizing algorithm for getting the desired results.

Session Code : [COMMIL.3 - Paper ID 1044](#)

Paper Title : **RAPID ESTIMATION OF TRUE DIRECTION OF ARRIVAL FOR DIELECTRIC LENS BASED ADAPTIVE ARRAY ANTENNAS 38**

Author : *S Ravishankar, B S Darshak - R.V.College of Engineering, Bangalore-560059, India.*

Abstract : Smart antenna involves array processing to manipulate the signals induced on various antenna elements to accomplish beam steering and improve interference rejection. To improve directivity a shaped dielectric lens is used to further collimate the rays in a specified direction and help reduce interference. Direction Of Arrival (DOA) estimation algorithms specifically Multiple Signal Classification (MUSIC) and Minimum Variance Distortionless Response (MVDR) are employed for a planar array – shaped dielectric lens combination to locate a desired user. Refractive effect of the lens has to be compensated for in these algorithms rapidly in real time to extract the true arrival angles. Geometrical optics is employed to trace the rays from an aperture in front of the lens through the shaped lens boundaries to the individual antenna elements to determine the DOA of the user signal. Angle dependent modifications for the DOA of the signal in both elevation and azimuth planes have been introduced to correct for the refractive effects of the lens and extract the correct angle of arrival using a new mapped column peak search technique.

Session Code : [COMMIL.4 - Paper ID 0115](#)

Paper Title : **AN MMSE-BSD TECHNIQUE FOR WIRELESS MESH NETWORKS WITH TDOAS 43**

Author : *Park, Chang Hwan, Lee, Mina, So, A-Rom, Yoo, Hyun-Jong, Kim, Han-Seong, Cho, Yong Soo - Chung-Ang University, Korea*

Abstract : In this paper, a minimum mean square error - bidirectional successive detection (MMSE-BSD) technique is proposed to mitigate the effects of interferences caused by time difference of arrivals (TDoAs) in wireless mesh networks (WMNs) based on orthogonal frequency division multiple access (OFDMA). The proposed BSD technique can successfully reduce the error propagation phenomenon in successive detection with a low computational complexity by exploiting the subframe structure used in WMNs.

Session Code : [COMMIL.5 - Paper ID 1071](#)

Paper Title : **CLUTTER SPATIAL-TEMPORAL CHARACTERISTICS FOR FORWARD-LOOKING MISSILE-BORNE DIVING RADAR 47**

Author : *Xu Jingwei, Liao Guisheng, Zhu Shengqi, Zhang Xuepan - Xidian University, Xi'an, China*

Abstract : A multi-channel forward-looking missile-borne radar diving model is proposed in this paper with a formulation characterizing the relationship of clutter angle-Doppler response. The difference between the horizontal and diving platform is that an additional Doppler frequency is induced by the diving velocity. We show that the diving Doppler frequency leads to the clutter spectrum serious varying across range which increases the non-homogeneity of the secondary data and degrades the

performance of the space-time adaptive processing (STAP). We numerically characterize the spatial-temporal clutter spectrum of forward-looking missile-borne diving array radar and discuss the influence of additional Doppler frequency caused by the diving velocity component.

#### COMMIP:Wireless Communications and Networks

Session Code : [COMMIP.1 - Paper ID 0144](#)

Paper Title : **BER ANALYSIS OF PHYSICAL LAYER NETWORK CODING WITH PSK MODULATIONS FOR TWO-WAY RELAY CHANNELS 484**

Author : *Lei. Wang, Zhuo. Wu - Shanghai University, China*

Abstract : In this paper, the bit error rate (BER) performances of the physical layer network coding (PLNC) without channel coding in bidirectional relay networks with different PSK modulation schemes over Rayleigh fading channels are investigated. A bidirectional relay system where the two source nodes exchange information via a single relay node is considered. Several transmission scenarios, including both symmetric and asymmetric relaying, where the two source nodes use the same modulation and different modulation schemes in the multiple access channel transmission phase, are analysed. And an end-to-end BER analysis for each transmission mode is then given. Simulation results show that our derived BER analysis accurately matches with the simulation results for both symmetric and asymmetric relaying under various modulation schemes.

Session Code : [COMMIP.2 - Paper ID 0057](#)

Paper Title : **IMPROVED RLS POSITIONING ALGORITHM FOR SATELLITE NAVIGATION SYSTEMS 490**

Author : *Ling Wang, Liguo Chen, Rugui Yao, Yanbo Bi - Northwestern Polytechnical University, China*

Abstract : The calculating algorithm of the receiver of satellite navigation systems has important effect on positioning accuracy. In this paper, the novel Weight Least Square (WLS) by weighting processing for Recursive Least Square (RLS) algorithm is proposed to improve the positioning accuracy of the receiver. The associated weight of the proposed algorithm exploits the elevation angle to make the satellite data of larger elevation play a more important role in the application of WLS. The performance comparison between the proposed algorithm and RLS are given by numerical simulations. Simulation results show that the improved algorithm can effectively eliminate some error factors and improve the accuracy of positioning.

Session Code : [COMMIP.3 - Paper ID 1062](#)

Paper Title : **FAST ACQUISITION IMPLEMENTATION AND ANALYSIS WITH MULTI-CHANNEL SEARCH ON FPGA FOR GNSS SYSTEMS 495**

Author : *Feng Zeming, Yao Rugui, Wang Ling, Huang Dengshan - School of Electronics and Information Northwestern Polytechnical University Xi'an, China*

Abstract : The acquisition of pseudorandom noise code (PN code) plays an important part in the Spread Spectrum Communication System. It is found that the combination of multi-parallel channels and FFT is faster than the traditional serial-search and parallel-frequency search algorithm through the result of simulation. The algorithm fully utilizes multiple parallel channels to accelerate the acquisition of chip phase and adopts the method of FFT to obtain the Doppler frequency rapidly.

Session Code : [COMMIP.4 - Paper ID 0066](#)

Paper Title : **AN EFFICIENT AND ROBUST APPROACH FOR WIDEBAND COMPRESSIVE SPECTRUM SENSING 499**

Author : *Wu,Honglin, Wang,Shu - Huazhong University of Science & Technology, China*

Abstract : Compressive sensing (CS), which exploits the spectral sparsity of wideband signals, is a powerful approach to wideband spectrum acquisition at sub-Nyquist sampling rates. In this paper, we propose a modified CoSaMP method for fast and accurate wideband compressive spectrum sensing in noisy environments. We exploit the priori knowledge of noise variance to enhance the robustness of spectrum reconstruction to

noise. In addition, to improve the efficiency of spectrum sensing, we utilize the residual changes to adjust halting conditions and introduce feasible fast solutions to the essential step least-squares estimation. Simulation results show that the modified CoSaMP algorithm outperforms the original CoSaMP and the generic convex relaxation algorithm basis pursuit denoising (BPDN) with respect to approximation performance and robustness. Moreover, it executes much faster than BPDN and CoSaMP.

Session Code : [COMM1P.5 - Paper ID 1032](#)

Paper Title : **IMPROVED CIRCULAR STRAIGHT CONE CHANNEL MODEL FOR HIGH ALTITUDE PLATFORM IN URBAN ENVIRONMENT 503**

Author : *Xi Liu, Xinru Ma - School of Electronics and Information Engineering Harbin Institute of Technology Harbin, China*

Abstract : To revise the fallacies of the straight circular cone channel model for high altitude platform (HAP), an improved model is proposed by introducing the concept of blockage theory. The improved model successfully revised the wrong delay spread in the straight circular cone channel model and provided the revised delay spread, which is consistent with measured data. The improved model also gives the existing probability of single bounce echoes in three-dimensional space, which is also useful in other analysis of multipath effects. The revised cumulative distribution function, the power spread profile and the coherence bandwidth is obtained by applying the improved model, which proves the new model is more approximate to actual situations and more accurate in the analysis of the channel for HAP.

#### COMM2L:MIMO Systems and ST Coding

Session Code : [COMM2L.1 - Paper ID 1142](#)

Paper Title : **DEGREES OF FREEDOM IN THE MISO BC WITH DELAYED-CSIT AND FINITE COHERENCE TIME: A SIMPLE OPTIMAL SCHEME 180**

Author : *Yohan Lejosne, Yi Yuan-Wu - Orange Labs, RESA/WASA, France; Yohan Lejosne, Dirk Slock - EURECOM, France*

Abstract : We consider the multi-input single-output (MISO) Broadcast Channel (BC), the multi-user (MU) downlink in a cell with a multi-antenna base station and mobile terminals equipped with a single antenna. Most techniques designed for this channel require accurate current channel state information at the transmitter (CSIT). However, a radically different approach has been proposed by Maddah-Ali and Tse (MAT), in which significant gain can be obtained by solely relying on perfect but outdated CSIT. This approach is proven to yield the optimal multiplexing gain when the channel current state is completely independent of the fed back channel state. A recent work focused on an intermediate case, channels exhibiting some temporal correlation, proposed a complex scheme shown to be optimal in terms of multiplexing gain for the 2-user case. Using a different but equivalent channel model, we propose a simple transmission scheme for the general case  $K \geq 2$  that reaches the optimal number of degrees of freedom.

Session Code : [COMM2L.2 - Paper ID 0125](#)

Paper Title : **COST REDUCTION ALGORITHM FOR 8 x 8 LATTICE REDUCTION AIDED K-BEST MIMO DETECTOR 186**

Author : *Liao, Chun-Fu, Huang, Yuan-Hao - National Tsing Hua University, Taiwan,*

Abstract : This paper proposes a cost reduction algorithm for 8 x 8 lattice-reduction aided K-best multiple-input multiple-output (MIMO) detector. As the MIMO dimension increases, the cost growth and the performance degradation from ML performance become important issues for MIMO detector. This research presents boundary violation decision (BVD), simplified complex enumeration, and differential number (DN) representation to lower the complexity of complex valued lattice reduction aided K-Best detector. The analysis results show that the proposed techniques saves 58% bit registers and 53% combinational circuits with negligible performance degradation compared to ML performance.

Session Code : [COMM2L.3 - Paper ID 1003](#)

Paper Title : **A CLOSED FORM SOLUTION TO SEMI-BLIND JOINT SYMBOL AND CHANNEL ESTIMATION IN MIMO-OFDM SYSTEMS 191**

Author : *Liu, Kefei, So, H.C. - City University of Hong Kong, Hong Kong*  
*Da Costa, Joao Paulo C. L. - University of Brasilia, Brazil*  
*Andre L. F. de Almeida - Federal University of Ceara, Brazil*

Abstract : Due to the scarcity of the electromagnetic spectrum, multidimensional signaling schemes that take into account several signal dimensions such as space, time, frequency and constellation, are good candidates for increasing the data rate and/or improving the link reliability in future communication systems. Recently a new space-time-frequency diversity based MIMO-OFDM system has been proposed where transmit signal design combines frequency-domain Vandermonde spreading with a time-varying linear constellation precoding, while the received signal is formulated as a nested parallel factor (PARAFAC) model. A joint channel estimation and symbol decoding process has been developed for this system based on the alternating least squares (ALS) algorithm. In this paper, we propose a low-complexity blind receiver based on the least squares Khatri-Rao factorization (LS-KRF) for joint channel estimation and symbol decoding. Our proposed LS-KRF receiver is a closed-form solution which provides the same performance as that of the ALS solution while being less complex since no iteration is needed. Simulation results are included to verify the benefits of the proposed receiver.

Session Code : [COMM2L.4 - Paper ID 0108](#)

Paper Title : **PAPR REDUCTION TECHNIQUES WITH CROSS SLM SCHEMES FOR MIMO-OFDM SYSTEMS 197**

Author : *Tung Chun, Hsueh, Ping You, Lin, Jung Shan, Lin - National Chi Nan University, Taiwan*

Abstract : The multiple-input multiple-output (MIMO) orthogonal frequency division multiplexing (OFDM) transmission strategy has been appointed to be a standard of fourth-generation (4G) wireless communication systems, but it still has to cope with the main weakness and challenge of OFDM-based techniques, including the high peak-to-average power ratio (PAPR). This paper proposes the cross-modified MIMO selected mapping (SLM) algorithm to obtain superior PAPR reduction performance and reduce system complexity compared with conventional SLM schemes. The algorithm combines a novel SLM scheme, called cross-individual SLM, with modified-individual SLM to create more alternative OFDM signal sequences for overall transmitters. As a result, with increasing the number of transmitting antennas, our proposed technique would have potentials to provide better PAPR reduction performance.

Session Code : [COMM2L.5 - Paper ID 1082](#)

Paper Title : **BACKOFF ALGORITHMIC DESIGN FOR MULTI-RADIO MULTI-CHANNEL WIRELESS NETWORKS 203**

Author : *Ng, Benjamin; Lam, Chan Tong - Macao Polytechnic Institute Macao; Law, K. L. Eddie, - Kirin Cloud Solutions Hong Kong*

Abstract : With the standardization of IEEE 802.11s, wireless mesh networks may likely be deployed in future as the wireless networking infrastructures in cities and rural areas, due to their low budgeting needs upon comparing to those in wired networks. In 802.11, frame collisions occur in shared wireless medium, and the protocol executes truncated binary exponential backoff (BEB) algorithm for frame retransmissions. However, it has been known to give low overall 802.11 throughput performance. With the advent of multi-radio multi-channel 802.11s infrastructure, the traditional BEB algorithm should be modified to run in such a model with multiple frequency channels. In this paper, a novel backoff mechanism is designed to operate in a protocol for multi-channel wireless networks. In our design, a simple frame counting mechanism for detecting neighboring devices within one transmission hop is deployed. Through thorough simulations, the resulting multi-channel backoff algorithm provides sustainable high throughput performance.

Session Code : [COMM2P.1 - Paper ID 0032](#)

Paper Title : **ENERGY LEVEL PERFORMANCE OF MULTI HOP CDMA WIRELESS SENSOR NETWORK WITH ERROR CONTROL 521**

Author : *Uma Datta, Sumit Kundu - N.I.T Durgapur, India*

Abstract : Energy level performance of a multi hop CDMA wireless sensor networks is analyzed incorporating two popular error control schemes. Decoding is considered only at the sink which has enough power to run the complex decoding algorithms. In one case we consider a simple end-to-end ARQ, while the other case is based on hybrid ARQ type I (HARQ-I) using BCH code. The performance of the network is assessed in terms of energy consumption, and energy efficiency involved in successful transmission of a packet from source to sink via a number of hops. Two kinds of interference namely multiple access interference (MAI) and node interference (NI) are considered. The effects of several network parameters such as node density, packet length, error correcting capability on packet error rate (PER), energy consumption, and energy efficiency for successful reception of a packet at sink are investigated and compared for different error control strategies. Performance of the network system using hop by hop ARQ mechanism, where decoding is performed at every node, is also compared with the proposed schemes.

Session Code : [COMM2P.2 - Paper ID 0117](#)

Paper Title : **DESIGN AND IMPLEMENTATION OF HINOC NETWORK MANAGEMENT SYSTEM BASED ON SNMP 527**

Author : *Cui, Wenwen, Duan, Xiaohui, Yuan, Wu, Wang, Daoxian - Peking University, China*

Abstract : HINOC (High performance Network Over Coax) is an access network technology aimed at solving the bandwidth limit in user area. With the development of HINOC technology, it is significant to build an effective and efficient management system for HINOC network. After introduction to the basic principles of HINOC, this paper demonstrates a HINOC management system based on SNMP (Simple Network Management Protocol), of which we implemented SNMP agent. Through comparison with the proxy agent scheme in several aspects, we find that the embedded agent scheme is more suitable for HINOC. To meet the detailed management requirements for HINOC, a set of HINOC-MGMT-MIB is defined and implemented in HB/HM software system, which enables monitoring of base information and network status, access control, QoS management, software automated upgrade, etc. The lab trial results manifest the agent functions properly on HINOC device.

Session Code : [COMM2P.3 - Paper ID 1102](#)

Paper Title : **CHANNEL ALLOCATION FOR LOW-POWER NOC DESIGN BASED ON IMPROVED ASYMMETRIC MULTI-CHANNEL ROUTER 533**

Author : *Ren, Xianglong; Gao Deyuan; An Jianfeng; Yao Tao; Han Limin; Fan Xiaoya - Northwestern Polytechnical University, Xi'an, China*

Abstract : The Improved Asymmetric Multi-Channel Structure can effectively reduce the head of line blocking and provide an efficient promotion for the router performance. However, allocating channels in channel groups (CGs) uniformly will cause the buffer wasting and the power significant increasing. To resolve this issue, we present a novel channel planning algorithm which can customize the router design in Network-on-Chip (NoC). More precisely, given the traffic characteristics of the target application and the channel budget, our algorithm automatically assigns the channel number for each CG, in different input ports across each router, to match the traffic pattern, such that the overall power consumption is minimized. Experimental results show that, compared with channel uniform allocation, about 15~27% savings in power consumed by buffer can be achieved by our algorithm, while having the similar performance meanwhile.

Session Code : [COMM2P.4 - Paper ID 0017](#)

Paper Title : **IMPROVED SPACE-TIME-FREQUENCY BLOCK CODE FOR MIMO-**

## OFDM WIRELESS COMMUNICATIONS 538

Author : *Bao, Tao - Northwestern Polytechnical University, China*  
*Liang Yongling - Criminal Intelligence China Criminal Police University Shenyang, China*

Abstract : This paper presents an improved STF (space-time - frequency) coded MIMO - OFDM (multiple - input and multiple - output, orthogonal frequency - division multiplexing) system for two transmit antennas. In this system, we devise an interleaving method which can maximize diversity gain and achieve optimal system performance with a moderate decoding complexity. Complete characterization of the proposed STF - OFDM scheme is provided and its BER (bit error rate), BLER (block error rate) and spectral efficiency performance is evaluated. Result of the simulation shows that the proposed scheme significantly improves the system performance.

Session Code : [COMM2P.5 - Paper ID 0129](#)

Paper Title : **PERFORMANCE EVALUATION OF RATELESS CHANNEL CODING FOR MU-MIMO OFDM-LTE SYSTEMS 542**

Author : *P.Krishna - Talla Padmavathi College Of Engineering*  
*Prof.K.Kishan Rao - Vaagdevi College Of Engineering*  
*Prof.T.Anil Kumar - TRR Engineering College*  
*K.Praveen Kumar - NRSC, Hyderabad, India*

Abstract : 3GPP Long term evolution (LTE) wireless broadband is intended to provide higher data rates and throughput with less latency. Due to the channel impairments of the radio channel and higher order modulation techniques, the probabilities of errors are high. Using belief propagation algorithm both irregular and regular Low Density Parity Codes (LDPC) have showed to achieve rates close to the capacity on the other channels like Binary Symmetric channel (BSC) and Additive White Gaussian Noise Channel (AWGNC) with channel state information (CSI) available at both transmitter and receiver. Furthermore, Rate less codes is a class of codes without a predefined number of encoding symbols. Luby Transform (LT) code a class of rate less codes provides an efficient way to transfer information over erasure channels like Internet. In this paper, the performance of LDPC (irregular, regular) and LT codes are investigated and the results illustrate the performance gains of LT codes for Multi user Multiple Inputs and Multiple Outputs in combination with orthogonal frequency division multiplexing system over LDPC codes with the Binary erasure channel (BEC).

Session Code : [COMM2P.6 - Paper ID 0083](#)

Paper Title : **REALIZATION OF SINGLE FFT SCHEME FOR STBC-OFDM SYSTEM ON FPGA 548**

Author : *Sheu Meng Lieh; Wu Yan Ting - National Chi-Nan University, Taiwan*

Abstract : Space-time block codes are considered as one of the prominent technologies for spatial diversity which is widely used to improve wireless system performance. However, an OFDM system with space-time block codes needs multiple fast Fourier transforms (FFT) posing an adverse effect on system computational load as the number of antennas and sub-carriers grows. Therefore, in this paper we employ a single FFT scheme for the implementation of multiple transceivers on field programmable gate array (FPGA). The results showed that the hardware complexity is significantly reduced. In the case of two transmitters and two receivers, the number of logic elements and registers are reduced by about 47%, the memory is reduced by about 16%, and the number of multipliers is reduced by 50%.

## COMM3L: Wireless and Sensor Networks I

Session Code : [COMM3L.1 - Paper ID 1061](#)

Paper Title : **SPARSE CHANNEL ESTIMATION AND MEASUREMENT MATRIX OPTIMIZATION FOR ZERO PADDED SCBT SYSTEM USING COMPRESSED SENSING 254**

Author : *Meng Qingwei, Huang Jianguo, Han Jing, He Chengbing - Northwestern Polytechnical University Xi'an China ; Sun Jun - Telecommunication Engineering*

*Institute Air Force Engineering University*

Abstract : A sparse channel estimation method using compressed sensing (CS) is proposed for zero padded single carrier block transmission (ZP-SCBT) system employed in sparse wireless channels. We formulate the sparse channel estimation in ZP-SCBT system as a canonical CS problem, and optimize the measurement matrix by minimizing the mutual incoherence property (MIP), binary sequences with optimal aperiodic autocorrelation are utilized for constructing deterministic Toeplitz structured measurement matrices (TSMM) used for sparse channel estimation, which can greatly improve the estimation accuracy compared to Gaussian and Bernoulli distributed random TSMM. Numerical results show that the proposed sparse channel estimation method outperforms traditional least square (LS) estimation scheme when employed in sparse channels, and the channel estimation accuracy of the optimized deterministic TSMM outperforms Gaussian and Bernoulli distributed random TSMM.

Session Code : [COMM3L.2 - Paper ID 0049](#)

Paper Title : **VISUALIZATION OF THE SOUND PRESSURE DISTRIBUTION IN MONITORING SYSTEM OF WIRELESS SENSOR NETWORK 258**

Author : *Tian Ma - Xi'an University of Science & Technology, Xi'an, China; Jianguo Huang, Ziliang Qiao, Wei Gao - Northwestern Polytechnical University, Xi'an, China*

Abstract : In order to show the sound pressure distribution in monitoring system of wireless sensor network, a two-dimensional visualization method is proposed according to the positions and pressures of the sensor nodes and target. An expansion and smooth method of the convex hull is presented, which is used to calculate the positions of the boundary points of drawing region. The positions and pressures of the points within the region are calculated through bi-cubic interpolation. Then the Delaunay-triangulation is made on these points and the pressures are mapped into colors. Lastly, the sound pressure distribution plane is drawn through the OpenGL triangle primitives. The application result shows that the visualization method could meet the monitoring system's requirements in real time interaction.

Session Code : [COMM3L.3 - Paper ID 0079](#)

Paper Title : **COOPERATIVE SPECTRUM SENSING WITH CENSORING OF COGNITIVE RADIOS AND IMPROVED ENERGY DETECTOR UNDER MAJORITY LOGIC FUSION 262**

Author : *Srinivas Nallagonda, Sudheer.S, Sanjay Dhar Roy, Sumit Kundu - N.I.T Durgapur, India*

Abstract : In this paper, performance of cooperative spectrum sensing (CSS) has been assessed in the presence of Rayleigh fading. Cognitive radio (CR) users which employ improved energy detectors (IEDs) are censored depending on the quality of radio channels between them and a fusion center (FC). A training based channel estimator is used at the FC to estimate the fading coefficients characterizing the channels between the CRs and the FC. The CRs utilize selection combining (SC) of the decision statistics obtained by IEDs with multiple antennas for making hard decisions about the presence of primary user (PU) and transmit the information to the FC using BPSK signaling if the CR is selected to transmit. The majority logic fusion is applied at the FC for estimating the performance in terms of missed detection and total error probability for both perfect and imperfect channel estimation under different channel and network parameter conditions

Session Code : [COMM3L.4 - Paper ID 0133](#)

Paper Title : **A HOP-BY-HOP NETWORK CODING ALGORITHM FOR AVIATION COMMUNICATIONS NETWORKS 268**

Author : *Wang Yuan, Xu Hua, Jia Pei-Fa - Tsinghua University, Beijing, China*

Abstract : Considering the feature of intensive node mobility in aviation communication networks, a hop-by-hop network coding algorithm based on Ad Hoc networks is proposed in this paper. A typical network was built in a network simulator, and receiving accuracy rate and receiving delay were collected, to analyze the performance of the proposed algorithm in scalable networks with different traffic modeling. The simulation results prove that the presented algorithm has better performance in enhancing receiving accuracy rate and shortening receiving delay,

compared with traditional networks without network coding. It also applies to both bidirectional and directional traffic flows, and achieves better performance in large-scale networks. Therefore, this algorithm has great potentials in large-scale multi-hop aviation communication networks.

Session Code : [COMM3L.5 - Paper ID 1045](#)

Paper Title : **SCALABLE VIDEO STREAMING TRANSMISSION OVER COOPERATIVE COMMUNICATION NETWORKS BASED ON FRAME SIGNIFICANCE ANALYSIS 274**

Author : *Wu Yi-Stan; Yeh Chia-Hung; Tseng Wen-Yu - National Sun Yat-sen University; Chang Min-Kuan - National Chung Hsing University, Taichung, Taiwan*

Abstract : A new resource allocation algorithm based on frame significance analysis is presented in this paper for scalable video streaming transmission over cooperative communication networks. First, by introducing frame significance analysis, the video quality dependency between coding frame and its references is explored for hierarchical b-picture (HBP) structure. Second, the cooperative communication networks which can provide various channels are used to transmit the scalable video streaming. The proposed algorithm allocates the relay and sub-band to each layer based on channel conditions and the priority of layered videos. Experimental results indicate that the proposed algorithm is superior to random allocation cooperative schemes and non-cooperative schemes.

### COMM3P: Microwave, Antennas and Propagation

Session Code : [COMM3P.1 - Paper ID 0018](#)

Paper Title : **PLACEMENT OF WIDE NULLS IN THE RADIATION PATTERN OF A LINEAR ARRAY ANTENNA USING ITERATIVE FAST FOURIER TRANSFORM 552**

Author : *G.K.Mahanti ,V.V.Bhargav Bikkani and S.K.Mandal - National Institute of Technology, India*

Abstract : Obtaining a wide null over a certain angular range and lower values of side lobe levels finds extensive applications in communication and radar engineering. The high side lobe level can degrade the system performance as well as antenna power efficiency significantly. In this paper, we present the iterative Fast Fourier technique to generate wide nulls while keeping the side lobe level to its minimum value. Advantage of this technique is very high computational speed. This is because of the fact that the core calculations are based on direct and inverse fast Fourier transforms (FFT). The simulation results have shown that this technique is able to find suitable weights vector to reduce the side lobe power for the given null depth.

Session Code : [COMM3P.2 - Paper ID 1104](#)

Paper Title : **OPTIMIZING TIME DELAY OF TIME MODULATED LINEAR ARRAY ELEMENTS TO REDUCE THE SIDE BAND RADIATION LEVEL 556**

Author : *Mandal, S. K., Mahanti, G. K., Ghatak, Rowdra - National Institute of Technology Durgapur West Bengal, India*

Abstract : In this paper, a new approach to reduce the side band radiation level of time modulated linear array is presented. Keeping normalized on-time duration of the array elements at each modulation period remains unchanged for a given pattern at fundamental radiation, a suitable time delay is provided before the switch-on instants of the array elements. The method is applied to the pattern where the fundamental radiation is a static Dolph-Tschebyscheff (DT) pattern with SLL of -40dB. The optimum time delay required for the array elements are explored through particle swarm optimization technique and it reduces the maximum of first side band radiation level from -12.7dB to -18.7dB and that of second side band from -17.5 dB to -22.1 dB.

Session Code : [COMM3P.3 - Paper ID 1066](#)

Paper Title : **EFFICIENCY ANALYSIS FOR SIGNAL COMBINING OF ANTENNA ARRAYING IN DEEP SPACE TT&C SYSTEM 560**

Author : *Lu Manhong, Zhou Sanwen, Huang Jianguo, Meng Qingwei* - *College of Marine Engineering Northwestern Polytechnical University, China*

Abstract : Antenna arraying is an efficient method to increase antenna equivalent gain in deep space telemetry tracking and command (TT&C) applications where the signal to noise ratio (SNR) is so low that the received signals from the space craft can not be efficiently processed at the receiver. Combining efficiency is the key factor to determine which combining method can be employed for antenna arraying in deep space communications. However, no related researches have been carried out in the literatures. In this paper, detailed theoretic analysis is carried out for the combining efficiency for full-spectrum combining (FSC) methods, which can provide reference for TT&C receiver designers. Analysis results show that the SUMPLE correlation algorithm is optimal in combining efficiency, higher combining efficiency can be gained with higher SNR at each antenna, more antennas, narrower correlation bandwidth and narrower phase difference loop bandwidth.

Session Code : [COMM3P.4 - Paper ID 0141](#)

Paper Title : **COMPACT PRINTED DIPOLE ANTENNA WITH FOLDING ELEMENT FOR 2.4 GHZ WLAN COMMUNICATIONS 565**

Author : *Zhang Beidou; Gao Guoping* - *Lanzhou University, Lanzhou, China*  
*Lin Dongmei* - *Lanzhou University of Technology Lanzhou, China*

Abstract : A novel printed dipole antenna suitable for 2.4 GHz WLAN application is presented and investigated in this paper. A folding structure in the end of dipole antenna is designed so that the antenna length has a reduction of 46.43 % compared to traditional printed dipole antenna. The effects of some important parameters on the return loss of the proposed antenna have been investigated. In order to operate as WLAN device, the printed dipole antenna should be characterized by a low profile and cover the operation bandwidth of the 2.400-2.484 GHz. The radiation pattern is similar to those conventional dipole antennas and the measured gain variation is less than 0.3dBi.

#### COMM4L: Wireless and Sensor Networks II

Session Code : [COMM4L.1 - Paper ID 1012](#)

Paper Title : **RECEIVED SIGNAL STRENGTH BASED VERTICAL HANDOFF ALGORITHM IN 3G CELLULAR NETWORK 326**

Author : *Dhar Roy Sanjay, Sadhukhan Anup* - *ECE Department, NIT, Durgapur, India*

Abstract : Next generation wireless networks need seamless handoff between different wireless networks. Suitable vertical handoff algorithm may make seamless handoff possible in heterogeneous networks. We evaluate performance of received signal strength (RSS) based vertical handoff (VHO) in a new heterogeneous network model. To compare RSS of different network, the method based on corresponding bandwidth in each network has been considered in this paper. Further the RSS based VHO algorithm has been modified considering averaging of RSS. We evaluate the performance of the modified VHO algorithms in our proposed network model in terms of decision delay and number of handoff. For comparison purposes, the performance of the VHO algorithm that does not consider averaging of RSS has also been shown.

Session Code : [COMM4L.2 - Paper ID 1053](#)

Paper Title : **ALGEBRAIC DECODING OF A CLASS OF TERNARY CYCLIC CODES 331**

Author : *Lee, Chong-Dao, Jing, Ming-Haw, Miao, Jin-Hao* - *I-Shou University, Kaohsiung City, Taiwan*

Abstract : Recently, it has been shown that an explicit expression of the classical/general error locator polynomial for a class of binary cyclic codes can be determined by Lagrange interpolation formula. In this paper we extend it to the case of ternary cyclic codes and give an upper bound on the term numbers of the general error locator polynomial. Based on the obtained classical/general error-locator polynomials, we propose the algebraic decoding of the (11, 6, 5) and (23, 12, 8) ternary cyclic codes.

Session Code : [COMM4L.3 - Paper ID 1048](#)

Paper Title : **OPTIMAL TRAINING DESIGN FOR CHANNEL ESTIMATION IN INHOMOGENEOUS DISTRIBUTED SENSOR NETWORKS 337**

Author : *Zhang Li; Wang Xinyuan; Pan Yue - Systems Engineering Research Institute, China*

Abstract : This paper investigates the optimal training design for channel estimation in an inhomogeneous distributed sensor network, which is used to estimate a unknown parameter. The training design includes the power allocated for each sensor and the power scheduling between training pilots and sensor observations. In addition to the total power constraint on all the sensors, we introduce individual power constraint for each sensor, which reflects the practical scenario where all sensors are separated from one another. Since the final average mean square error (MSE) depends on the unknown parameter, a lower bound of the MSE is derived to compensate the channel estimation error (CEE). The Multilevel and "cave" waterfilling type solutions are proposed for the optimal training design to minimize the lower bound MSE, with only the sum power constraint and both the sum and individual power constraints, respectively. Simulation results demonstrate the performance of the proposed training design.

#### COMM4P:Communication Systems

Session Code : [COMM4P.1 - Paper ID 0074](#)

Paper Title : **IMPROVED TRANSMITTER POWER CONTROL SCHEMES FOR FADING CHANNEL COMPENSATION 569**

Author : *Chingshun, Lin; Shancheng, Chen - National Taiwan University of Science and Technology, Taiwan,*

Abstract : The purpose of this paper is to design a compensator that can adaptively change the power of the transmitter to reduce the transmitting error owing to the fading effect. This compensator is based on the technique of linear prediction filter (LPF). Owing to the magnitude of the fading coefficient might be close to zero, the receiver performance will be poor without any fade compensation at the transmitter. In this study, we use LPF and the delayed channel fade data to predict the following fading strength. Therefore the transmitted signals can be enhanced previously with a finite power, which in turn results in the raise the transmitting precision. We have implemented and compared different factors of the unbiased, biased, and least-mean-square based estimators. Several experimental results and detailed discussions are also provided to verify the characteristics of the proposal system.

Session Code : [COMM4P.2 - Paper ID 0101](#)

Paper Title : **A NOVEL SEGMENTAL LINEARIZATION POWER AMPLIFIER IN HIGH PEAK-TO-AVERAGE-POWER RATIO SYSTEM 573**

Author : *Zhiyuan Ren, Danping Li, Yongzhao Li, Hailin Zhang - Xidian University, China*

Abstract : In high PAPR system, Power Amplifier(PA) causes nonlinear and saturate distortions to signals seriously, which decrease the BER performance in the receiver. To solve this problem, a novel segmental linearization PA is proposed, which uses two combined PAs parallelly to extend the saturate point of PA in order to eliminate the saturate distortion. Furthermore, a signal decomposer is adopted to eliminate nonlinear distortion by using update algorithm. The simulation results indicate that the novel structure can remarkably increase the BER performance in the receiver.

Session Code : [COMM4P.3 - Paper ID 1033](#)

Paper Title : **A NOVEL BLOCK SLM SCHEME FOR PAPR REDUCTION OF OFDM SYSTEMS 578**

Author : *Ping-You, Lin, Jung-Shan, Lin - National Chi Nan University, Taiwan*

Abstract : This paper proposes a novel block selected mapping (SLM) scheme to obtain better PAPR reduction performance with lower computational complexity compared with conventional SLM strategy. The proposed algorithm is capable of partitioning the OFDM symbol sequence into several blocks multiplied by various phase rotation sequences in frequency domain, and further employs appropriate combination of block signals to create more alternative OFDM signal sequences. As a result, with the same

phase rotation sequences, our proposed scheme has the potentials to provide better PAPR reduction performance with lower computational complexity. In addition, the PAPR reduction performance could be further enhanced with more partition blocks.

Session Code : [COMM4P.4 - Paper ID 1103](#)

Paper Title : **Design and Implementation of Automatic Gain Control Loops 583**

Author : *Zhou Sanwen; Lu Manhong; Huang Jianguo - Northwestern Polytechnical University, China*

Abstract : Based on the analysis of automatic gain control (AGC) loops, we propose a simple and applicable method for the design and implementation of AGC loops. This proposed method offers the designer an effortless way to specify the performance of AGC loops, such as the time constant, as result reducing the huge task of testing before construction. The theoretical designing method is validated by experiment results with close agreement and this method is shown to be very efficient.

#### **COMM5L:Underwater Communications and Protocols**

Session Code : [COMM5L.1 - Paper ID 1030](#)

Paper Title : **RESEARCH ON UNDERWATER ACOUSTIC NETWORKS ROUTING USING SIMULATIONS 384**

Author : *Zhao Ruiqin; Hu Yufei; Shen Xiaohong; Wang Haiyan - Northwestern Polytechnical University, China*

Abstract : Owing to their broad applications and huge potentials, Underwater Acoustic Networks (UAN) have drawn growing interests from researchers of science, industry and government. The complex underwater environment and unique acoustic channel lead to the difference between UAN and traditional RF Ad Hoc networks. This paper studies the performances of UAN based on Dynamic Source Routing (DSR) utilizing OPNET Modeler. Simulation results show that traditional DSR causes the incredible phenomenon of much more received packets at destination than packets sent from source in UAN. Based on the features of UAN and acoustic channel, a revised DSR is proposed in this paper. The revised DSR not only resolves the problem of much more received packets than packets sent from source in UAN, but also enhances the performances of UAN in delay and routing overhead. The complex underwater environment and unique acoustic channel not only affect physical layer performance but impact the protocol design on data link layer and network layer of UAN.

Session Code : [COMM5L.2 - Paper ID 1039](#)

Paper Title : **DUAL BUNCHING PERFORMANCE OF UNDERWATER UWB SIGNAL 388**

Author : *Hao Liu, Qunfei Zhang, Kaizhuo Lei, Yixi Fang, Xiaolong Liu, Ziliang Qiao - College of Marine Engineering Northwestern Polytechnical University Xi'an, China*

Abstract : Using the ellipsoid surface radiator to reflect underwater UWB (Ultra Wide Band) signal is one of the effective methods to improve the propagation distance. But single-source bunching is affected by many factors and the efficiency has reached the limit. This paper analyzes the principle of dual-source bunching and establishes a focused sound field experimental system based on underwater plasma sound source (UPSS). The waveform and peak pressure of the UWB signal on the acoustic axis and the second focus plane were measured to reveal the distribution characteristics of the focused sound field. Analysis of the experimental results indicates that the dual-source bunching can significantly increase the peak pressure of the UWB signal with 3dB more than that of the single-source bunching. This research provides a basis for the design and implementation of multiple arrays bunching for underwater UWB signal.

Session Code : [COMM5L.3 - Paper ID 1054](#)

Paper Title : **RESEARCH ON SHALLOW WATER ACOUSTIC COMMUNICATION BASED ON FREQUENCY HOPPING 392**

Author : *Lv Shu - Xi'an Jiaotong University, Xi'an, China*

*Shen Xiaohong - Northwestern Polytechnical University, Xi'an, China*

Abstract : In this paper, an underwater acoustic (UWA) channel model characterized by

multipath propagation, time-varying fading and additive Gaussian white noise (AWGN) is analyzed. Based on the model, a UWA frequency-shift keying (FSK) frequency-hopped spread-spectrum (FHSS) scheme which combines the FM sequence of prime numbers-based frequency hopping (FH) and multi-frequency shift keying (MFSK) is proposed. The performance of presented scheme is analyzed under conditions of shallow water acoustic channel, building the foundation of parameters selection and performance optimization for FH/MFSK system. In addition, our proposed schemes are robust and reliable with respect to multipath interference, which is demonstrated through simulation results.

### **COMM5P: Underwater Acoustic Signal Processing and Communication**

Session Code : [COMM5P.1 - Paper ID 0156](#)

Paper Title : **INFLUENCE OF UNDERWATER ACOUSTIC MULTIPATH STRUCTURE ON TIME REVERSAL PASSIVE DETECTION 779**

Author : *Gu Jiang-Jian; Wang Hai-Yan; Sheng Xiao-Hong; Yang Fu-Zhou - Northwestern Polytechnical University, China*

Abstract : According to the current situation that underwater multipath structure are mostly assumed to be constant in time reversal passive detection, based on the characteristic of time reversal processing, the influence of variation of underwater multipath structure, which is caused by horizontal range and sound velocity, on time reversal passive detection performance is simulated and analyzed with ray propagation theory. The conclusions indicate that, in low SNR area, the detection performance declines with the increase of horizontal range, however, compared with the signal without time reversal, time reversal processing reduces the negative influence of range on detection performance; time reversal passive detection performance well when the sound velocity changes slowly, while its performance will decline when the sound velocity changes dramatically.

Session Code : [COMM5P.2 - Paper ID 1027](#)

Paper Title : **A DOUBLE RATE POSITIONING ALGORITHM FOR UNDERWATER ACOUSTIC NETWORKS 783**

Author : *Gao Jingjie, Shen Xiaohong, Wang Haiyan, Zhao Ruiqin - Northwestern Polytechnical University, Xi'an, China*

Abstract : Localization is a major issue for Underwater Acoustic Networks (UANs). UANs have some special characteristics different from terrestrial networks such as acoustic communication, inconvenience of using GPS and few anchors (nodes which know their coordinates). Due to these problems, people have proposed some algorithms, however, some of them will raise the cost and some of them cannot get high positioning accuracy with few anchors. In this paper, we proposed a double rate poisoning scheme (DRP) which separates the localization procedure into 2 modes by changing the symbol duration. One mode is used to measure the distance precisely; the other mode is to transmit a great amount of data quickly. From the simulation, we can see that it can get high positioning accuracy with only one anchor by this way.

Session Code : [COMM5P.3 - Paper ID 1085](#)

Paper Title : **UNDERWATER WIDEBAND DOA ESTIMATION BASED ON PMC METHOD 787**

Author : *Chen Zhao; Wang Haiyan; Liu Zhengguo; Shen Xiaohong; Hua Fei - Northwestern Polytechnical University; Liu Zheng-guo - China Shipbuilding Industry Corporation Beijing, China*

Abstract : A new wideband DOA estimation method based on a time-domain wideband signal model is proposed, which uses population Monte Carlo (PMC) method for the Bayesian calculation. This method needs few snapshots and only requires real arithmetic compared to conventional subspace class method because of use of the time-domain signal model. The PMC method outperforms other MCMC methods due to its parallel processing ability which can reduce the time of the procedure. Computer simulation shows that this method gives a good performance of the DOA estimation.

Session Code : [COMM5P.4 - Paper ID 1015](#)

Paper Title : **INNOVATION-BASED DETECTOR USING SECOND-ORDER APPROXIMATION MODEL IN OCEAN ACOUSTIC SIGNAL PROCESSING** 792

Author : *Du, Jin-Yan; Sun, Chao; Liu, Zong-Wei; Xiang, Long-Feng - Northwestern Polytechnical University, China*

Abstract : The model-based approach is applied in the shallow ocean acoustic signal detection problem. Based on a state-space representation of the normal mode propagation model and a vertical linear array measurement system, the extended Kalman filter (EKF) is used to accomplish the shallow ocean environment identification process, in which one of the outputs is the innovation sequence. When the model does not match the environment, the innovation sequence becomes non-zero mean and/or non-white. A second-order approximation state-space model is proposed in the model-based processing scheme, resulting in smaller amount of computation and better model accuracy. Several statistics for testing the properties of the innovation sequence are outlined and analyzed, composing an innovation-based detector which will declare a model mismatch if an anomaly (possibly a target) emerges. Simulations under a typical shallow ocean environment are performed, giving the receiver operating characteristic (ROC) curves with regard to different SNRs and parameters in the test statistic weighted sum squared residual (WSSR), showing the overall detection performances of these test statistics of the innovation sequence.

Session Code : [COMM5P.5 - Paper ID 1031](#)

Paper Title : **CYCLIC SHIFT KEYING SPREAD SPECTRUM OFDM METHOD OVER UNDERWATER ACOUSTIC CHANNEL** 798

Author : *Jing Lianyou; Huang Jianguo - Northwestern Polytechnical University, China*

Abstract : Aimed at solving the problem of low data rate of direct sequence spread spectrum underwater acoustic communication and that of complexity of the receivers of M-ary spread spectrum underwater acoustic communication, cyclic shift keying spread spectrum OFDM (CSK-SS-OFDM) method is proposed to improve bandwidth efficiency and bit rates. This method has high data rate compared with conventional direct sequence spread spectrum underwater acoustic communication. The performance analysis and simulation comparison of OFDM and DSSS-OFDM is provided in this paper. Compared with conventional OFDM, CSK-SS-OFDM can obviate the PAPR problem and obtain a robust link at a lower SNR; Compared with DSSS-OFDM method, CSK-SS-OFDM can improve the bandwidth efficiency with losing a little BER performance.

Session Code : [COMM5P.6 - Paper ID 0086](#)

Paper Title : **UNDERWATER TRANSIENT SIGNAL DETECTION BASED ON ORTHOGONAL EMPIRICAL MODE DECOMPOSITION** 802

Author : *Ni Yunlu; Chen Hang - Northwestern Polytechnical University, China*

Abstract : Once widely used for UWB radar with the advantages of high resolution on range and direction, transient carrier-free signal with short pulse and Gaussian waveform fit for underwater transmission is imported for Sonar system. Because of relative wide band and capability of all-range detection, the spectrum of such short pulse spreads transiently over low frequency domain. The signal for detection in this paper is cylinder target echo in anechoic pool. The target echo is denoised via Orthogonal Empirical Mode Decomposition(OEMD) and threshold. The detection presents peak time fast and precisely after target echo recomposition. The special characteristics for underwater body target detection represent more radiation points without distance extension.

## COMM6L: Transmitter and Receiver Design

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[COMM6L.2 - Paper ID 1011](#)

Session Code :

Paper Title : **A MULTI-RESOLUTION FILTER BANK AND FUZZY LOGIC BASED CHANNEL EDGE DETECTOR FOR MILITARY WIDEBAND RADIO RECEIVERS** 442

Author : *Dhabu, Sumedh, K. G., Smitha, A. P., Vinod - Nanyang Technological University, Singapore*

Abstract : In a typical multi-standard military radio receiver, the radio channels (frequency bands) of interest have time varying bandwidth and locations in the wideband signal. Thus the receiver needs to detect the desired channels from the wideband input signal, which involves determining bandwidths of the channels and their locations (center frequencies) within the wideband signal. In this paper we propose a multi-resolution filter bank based spectrum sensor and a fuzzy logic based algorithm for channel edge detection in the wideband signal. For the same sensing resolution, the proposed edge detector has low complexity compared to other methods available in literature. The error in channel edge detection is reduced using fuzzy logic based algorithm. Simulation results show that our method offers an average channel edge detection accuracy of 99%.

Session Code : [COMM6L.3 - Paper ID 0047](#)

Paper Title : **REDUCED-COMPLEXITY EQUALIZER FOR TWO-DIMENSIONAL MODULATIONS WITH COHERENT DEMODULATION 447**

Author : *Ching-Haur Chang - Asia University, Taiwan*

Abstract : A reduced-complexity equalizer capable of correcting channel distortion for two-dimensional modulations with coherent demodulation is presented in this paper. Based on the fact that the phase of the in-phase and quadrature sinusoids in the receiver must be synchronized to that of the carrier received, a structure using a pair of real-valued equalizers, one for the in-phase and the other for the quadrature channels, is proved to be appropriate. Conventional approaches in this regard use structures with complex-valued arithmetic and thus call for a much higher computational complexity. Due to the fact that only real-valued arithmetic is needed for the new structure, a saving of 50% multiplications, compared to its complex-valued counterpart, is thus achieved even with better symbol error rate performance. Computer simulation results justify the assertions made in this paper.

Session Code : [COMM6L.4 - Paper ID 0093](#)

Paper Title : **PRACTICAL DESIGN METHOD FOR INTERFERENCES BETWEEN BACKHAUL AND ACCESS LINKS IN FIBER-OPTIC RELAY NODE 451**

Author : *Akiyuki, Nakajima, Hiroki, Masuda, Hiroyuki, Otsuka - Kogakuin University, Japan*

Abstract : This paper presents how to design fiber-optic relay node considering interferences between backhaul and access links. The way of proper arrangement of two different antennas is described as parameters of optical fiber length and radio frequency. Theoretical DUR due to the interference is provided relating to CNR performance mainly determined by the optical link. Provided that the radio frequency is 3.4 GHz and the antenna facing to eNB is positioned at high-SNR environments, optical fiber length (antenna separation) of 200 meters is enough to meet DUR of 30 dB. This will provide a solution of relaying without interference canceller for in-band relaying.

## Computing

### **COMPIL:Computer Architecture and Methods**

Session Code : [COMPIL.1 - Paper ID 1110](#)

Paper Title : **BIDIRECTIONAL TWO-DIMENSIONAL ALGORITHM BASED ON DIVISOR METHOD 104**

Author : *Jia Peiyan; Du Haishun; Jin Yong; Zhang Fan - Henan University, China*

Abstract : In recent years, the subspace learning methods based on the bidirectional two-dimensional are widely used in extracting features of face image. However, the existing bidirectional two-dimensional subspace learning methods always assume that the numbers of two mapping matrices' projection vectors are equal. Although this can simplify the computation, it will possibly cause the following two questions: (1) Get rid of information with classification properties; (2) Reserve information without classification properties. In order to solve the problem, this paper proposes a method called Divisor method and use it in bidirectional two-dimensional subspace learning

method. This method calculates the percentage loss of mapping matrix in both row and column directions firstly, and then use the Divisor method to select the numbers of two mapping matrices' projection vectors, which base on the principle of minimum total percentage loss. The experimental results on ORL and YALE face database show that the propose

Session Code : [COMPIL.2 - Paper ID 1100](#)

Paper Title : **A NOVEL FLOATING-POINT FUNCTION UNIT COMBINING MAF AND 3-INPUT ADDER 109**

Author : *Yao Tao; Gao Deyuan; Ren Xianglong; Han Limin; Fan Xiaoya - Northwestern Polytechnical University, China  
Yang Lei - College of Information Science and Engineering Shandong Agricultural University, China*

Abstract : The multi-input floating-point (FP) adder is one of attractive solutions to accelerate algorithms including a lot of addition operations. However, a specialized multi-input adder will increase too much area to the floating-point unit. In this paper, we propose a novel FP function unit combing a 3-input FP adder with a traditional Multiply-Add-Fused (MAF) unit which is widely employed in many general processors and stream processors. Namely, the new FP function unit could perform both A B C and A B C. An improved architecture of the 3-input FP adder is proposed firstly which has the same accuracy with a FP adder that has an infinite internal width and only once rounding operation for two additions. Secondly, the architecture combining 3-input FP adder and Multiply-Add-Fused unit is presented which is compatible with IEEE-Std754. Lastly, the implementation results in single-precision data format are given with 180nm CMOS technology. Comparing with the MAF unit, the proposed function unit only increases delay and area by 2.8% and 30% respectively, which means the new function unit could accelerate A B C nearly 2 times than a MAF does. A small data format version of the proposed architecture has been verified by an exhaustive testing.

Session Code : [COMPIL.3 - Paper ID 1112](#)

Paper Title : **A SURVEY ON CACHE COHERENCE FOR TILED MANY-CORE PROCESSOR 114**

Author : *Han Limin; AN JIANFENG; GAO DEYUAN; FAN XIAOYA; REN XIANGLONG; YAO TAO - Northwestern Polytechnical University, China*

Abstract : Due to technological parameters and constraints entailed in many-core processor with shared memory systems, it demands new solutions to the cache coherence problem. Directory-based coherence protocols have recently seemed as a possible scalable alternative for CMP designs. Unfortunately, with the number of on-chip cores increasing, many directory design strategies do not scale beyond a dozen cores due to huge energy and area costs for scaling the directories. We explored different NUCA design schemes for tiled many-core architecture, compared several conventional directory protocols, such as full-map directory protocol, sparse directory protocol, duplicate-tag-based directory protocol etc. and analyzed several novel cache protocols designed for many-core processor. At the end, we propose several design directions for scalable and adaptive cache coherence protocols for many-core processor.

Session Code : [COMPIL.4 - Paper ID 1109](#)

Paper Title : **SOFTWARE-AS-A-SERVICE EVALUATION IN CLOUD PARADIGM: PRIMITIVE COGNITIVE NETWORK PROCESS APPROACH 119**

Author : *Yuen, Kevin Kam Fung - Xi' An Jiaotong-Liverpool University, China*

Abstract : With rapid growth of Software-as-a-Services (SaaS) products in cloud paradigm, evaluation of SaaS product is essential for an enterprise to purchase a software service whilst there are a number of alternatives. This paper proposes the primitive cognitive network process (P-CNP) approach to measure the SaaS products in multi-criteria decision making aspect. The P-CNP is the rectified approach of the Analytic Hierarchy Process (AHP) in the aspects of paired interval scale and the corresponding mathematical development. The proposed approach can support the business decision maker to select the best cloud service product through user experiences and preferences.

Session Code : [COMP2L.1 - Paper ID 1099](#)

Paper Title : **HIGH SURFACE QUALITY TOOL PATH GENERATION STRATEGY FOR SCULPTURED SURFACES MACHINING 396**

Author : *Long Chen; - University of Science And Technology of China, China  
Dong Yu;- National Engineering Research Centre for High-end CNC Shenyang  
Institute of Computing Technology of Chinese Academy of Sciences, China  
Cong Geng; Yue Sun; Feng Wang - Shenyang Institute of Computing Technology  
of Chinese Academy of Sciences, China*

Abstract : In five-axis computer numerically controlled (CNC) machining of sculptured surface parts, the application of high surface quality machining is recognized as an economically viable manufacturing technology. Compared with the traditional CNC machining, high surface quality machining can effectively improve the surface quality. To meet the demands of high surface quality machining, this paper presents a toolpath generation strategy. Based on the constant scallop height and the interference detection, the initial smallest-posture-changes tool path is firstly created. Then, the other tool paths is generated as a kind of the diagonal curve between the offset curves by the initial tool path. At last, the tool path smoothing technology is applied to the generated tool path. This path strategy can ensure higher level of quality of the surface being machined, and less tool path sharp corners. Therefore, the high surface quality tool path can maintain the needs of machining. Based on these techniques, experimental results are given to verify the proposed approach.

Session Code : [COMP2L.2 - Paper ID 0104](#)

Paper Title : **A COMMUNICATION SYSTEM FOR MASSIVE MULTIPLAYER ONLINE GAME 400**

Author : *Wan Calvin; Cheung Ronnie; Wong Simon; Ng Mei Po - The Hong Kong  
Polytechnic University, China*

Abstract : The existing client-server architecture has certain limitations to support a large volume of users in the virtual environment. To broadcast all data to all users, the network traffic becomes very high when the number of users increased. Therefore, it takes longer time for data to transmit between clients and server and the performance of server decreased. In this project, a new approach based on interest management is proposed to solve the problems. A client-server communication system is developed based on interest management concept, region-based filtering, which enables scalability and reduces the amount of data communication. The system divides the game world into different regions. The players will be grouped based on the region. The system only broadcast the data to the players within the same group. The experiment results have demonstrated the effectiveness of the proposed approach.

Session Code : [COMP2L.3 - Paper ID 0111](#)

Paper Title : **DELEGATING THE KERNEL FUNCTIONS TO AN APPLICATION PROGRAM IN UV6 406**

Author : *Oikawa, Shuichi - University of Tsukuba, Japan*

Abstract : While processor cores available on a single system gradually but steadily increase every year, they are extremely underutilized except for well configured servers. The existence of such surplus processors can impact the operating system (OS) design and organization. We would like to use those processors to change the OS organization in order to increase the productivity of the OS kernel code by delegating the kernel functions to an application program. We designed and implemented UV6, of which kernel runs as an application program and manages a real processor with its native interface. The experiment results running micro benchmark programs show that 1) the frequently used simple kernel functions can perform comparably by leaving them in the proxy kernel, 2) a communication cost between the UV6 application kernel and its user process is negligible, and 3) there are cases where UV6 outperforms the original XV6. We also showed the acceleration of the UV6 kernel is possible by utilizing a SIMD unit of a processor.

Session Code : [COMP2L4 - Paper ID 0120](#)

Paper Title : **STUDENT'S T-DISTRIBUTION MIXTURE BACKGROUND MODEL FOR EFFICIENT OBJECT DETECTION 410**

Author : *Guo Ling; Du Ming-Hui - South China University of Technology, China*

Abstract : Background subtraction is an essential technique for moving object segmentation in vision surveillance system. To acquire an exact background, Gaussian mixture modeling (GMM) is a popular method for its adaptation to background variations. However, limited training samples and complex scenes result in heavy tails for GMM, which significantly affect the moving object detection accuracy. By reviewing the formulations of GMM, we construct a student's t-distribution mixture background model (SMBM) on the basis of fuzzy c-means clustering partition algorithm. Then, we present a method for moving object segmentation based on confidence analysis. Experimental results show that the background model can reflect complex scenes; our method achieves efficient object detection than conventional GMM approaches.

### **Signal Processing**

#### **SP1L:Radar and Sonar Systems**

Session Code : [SP1L.1 - Paper ID 0139](#)

Paper Title : **TRANSMIT BEAMPATTERN SYNTHESIS FOR SUB-ARRAYED MIMO RADAR 1**

Author : *Wang Wei; Ma Yuehua; Li Xin - Harbin Engineering University, China*

Abstract : Sub-arrayed multiple-input multiple-output (MIMO) radar is a new architecture of MIMO radar, which can exploit jointly the benefits of the coherent processing gain and waveform diversity, and has received extensive attention of researchers. An approach to synthesize the desired transmit beampattern for sub-arrayed MIMO radar is proposed in this paper. The essence of this approach is that the transmit beampattern is equal to the weighted sum of sub-arrays' beampatterns. First the beam-pattern of each sub-array with certain steering direction and low side lobe level is obtained by using traditional constrained optimization technique. Then under the constant total transmit energy constraint, convex optimization technique is utilized to design the optimal weight of each sub-array's beampattern, so that the synthesized beampattern can approximate the desired transmit beampattern exactly. Both analytical and simulation results validate the effectiveness of the proposed approach.

Session Code : [SP1L.2 - Paper ID 0152](#)

Paper Title : **RADAR TARGET RECOGNITION METHOD BASED ON PHYSICAL-STATISTICAL MODEL 5**

Author : *Feng Dejun; Xu Letao; Zhang Wenming - National University of Defense Technology, China*

Abstract : A novel radar target recognition method based on physical-statistical model is proposed, which uses sequences of full-polarization high resolution radar range-profiles (HRRP). The HRRP of target is modeled as a Middleton's Class A non-Gaussian distribution through a physical consideration. It is found that the model parameters describe the scattering physical characteristics of radar target and can be chosen as feature vector for radar target recognition. The Parzen window is adopted to estimate the probability distribution function of model parameter and the classifier is designed via Bayes theorem. The approach is applied to the classification of measured data. Numerical results have shown that the approach can extract the features which are not sensitive to target orientation and are effective to radar target recognition.

Session Code : [SP1L.3 - Paper ID 1068](#)

Paper Title : **PASSIVE REVERBERATION NULLING FOR TARGET ENHANCEMENT BASED ON REVERBERATION SUBSPACE**

## ESTIMATION 11

Author : *Wang Xiao Yu; Yang Yi Xin; Wu Yao Zhen; Tian Feng; Wang Yong* - *Northwestern Polytechnical University, China*

Abstract : Current passive reverberation methods have certain limitations when applied into practice, which would null boundary reverberation and target echo simultaneously. As a solution, a passive reverberation nulling method based on reverberation subspace estimation for target enhancement is proposed in this paper. In this method, the reverberation subspace for target range cell is not obtained directly by the return signals scattered from the target range cell but from the range cells located neighboring the target range cell. So that the reverberation components embodied in target echo is suppressed by passive reverberation nulling. Experimental results demonstrate the efficacy performance of the proposed method for echo-to-reverberation enhancement.

Session Code : [SP1L.4 - Paper ID 0046](#)

Paper Title : **PHASED-MIMO RADAR WITH FREQUENCY DIVERSITY FOR INCREASED SYSTEM FLEXIBILITY 16**

Author : *Wang Wen-Qin; Huaizong Shao* - *University of Electronic Science And Technology of China, China*

Abstract : Phased-multiple-input-multiple-output (MIMO) radar enjoys the advantages of MIMO radar in diversity gain without sacrificing the main advantage of phased-array radar in coherent transmit gain. However, a limitation of the phased-MIMO radar is that the beam steering is fixed in an angle for all the ranges. This limits the system performance to mitigate non-desirable range-dependent interferences. To overcome this disadvantage, this paper proposes a flexible phased-MIMO radar with frequency diversity. This approach divides the transmit antenna array into multiple subarrays that are allowed to overlap, each subarray coherently transmits a distinct waveform, which is orthogonal to the waveforms transmitted by other subarrays, at a distinct transmit frequency. Each subarray forms a range-dependent beam and all beams may be steered to different ranges or directions. The subarrays jointly offer flexible operating modes such as MIMO radar, phased-array radar, and phased-MIMO radar.

Session Code : [SP1L.5 - Paper ID 0151](#)

Paper Title : **FMCW MIMO TRANSCIEVER FOR MIDDLE-RANGE OVER-THE-HORIZON RADAR 20**

Author : *Huang, Chung-Jung; Dai, Chia-Wei; Tsai, Tsung-Yu; Lee, Ta-Sung* - *National Chiao Tung University, Taiwan*

Abstract : In the high frequency (HF) band, a continuum bandwidth for achieving the desired range resolution is difficult to find. Besides, the power which returns from ship targets is usually lower than the levels of sea clutters at higher sea states. Therefore, it is difficult to distinguish desired targets by conventional approaches. In this paper, a multi-frequency frequency modulated continuous wave (FMCW) transceiver with optimal resource allocation based on the minimal transmit power constraint is proposed to mitigate sea clutters. Multiple-input-multiple-output (MIMO) signal processing is adopted to detect signals from different spatial directions. Simulation results show that the proposed method can provide diversity gain for discriminating targets under practical sea clutter environments.

## SP1P:Signal Detection and Tracking

Session Code : [SP1P.1 - Paper ID 0021](#)

Paper Title : **TWO-DIMENSIONAL FREQUENCY ESTIMATION USING A MODIFIED VERSION OF THE TWO-STAGE SEPARATED VIRTUAL STEERING VECTOR-BASED ALGORITHM 509**

Author : *Qadir, Shahida G.; Yangyu, Fan* - *Northwestern Polytechnical University,*

*China*

Abstract : In this paper, we have proposed a modified version of the two-stage separated virtual steering vector-based algorithm. Our proposed algorithm has solved the problem encountered in the two-stage separated virtual steering vector-based algorithm (SVSV) without significant increase in the computational load. SVSV could not resolve the multiple two-dimensional (2D) frequency components having equivalent , ( ). Computer simulations are given to demonstrate the effectiveness of the proposed algorithm over SVSV algorithm. Noise performance of the modified SVSV is also analyzed through Monte Carlos simulations.

Session Code : [SP1P.2 - Paper ID 0075](#)

Paper Title : **LASER-BASED SERVO DETECTION SYSTEM FOR SMART CAR 513**

Author : *Youjie Li; Yan Piao - Changchun University of Science And Technology, China*

Abstract : In this paper, A laser-based servo detection system and its servo control algorithm are proposed to overcome the disadvantage that smart car based on fixed sensors could easily lose road information when tracking at a high speed. To fix a laser sensor on a servo actuator, MCU (Micro Controller Unit) can process the feedbacks of the sensor and then control the servo to adjust the direction of the sensor to detect road. Thus the closed-loop control ensures that the system can track the road automatically. Experiments in this paper show that smart cars based on servo detection system can achieve lower tracking error and a higher average speed when compared to those based on fixed sensors. Therefore, the laser-based servo detection system not only improves smart car's speed but also promotes its systemic stability.

Session Code : [SP1P.3 - Paper ID 1002](#)

Paper Title : **NEW TRACKING METHODS OF UNMANNED UNDERWATER VEHICLES(UUVS) 806**

Author : *Wang Xinyuan - System Engineering Research Institute, China*

Abstract : Unmanned Underwater Vehicles (UUVs) are of great importance in ocean robotics, because of the wide industrial and military application range they span. Tracking a undersea moving object is frequently encountered in the UUV applications, such as tracking a halobios. To achieve this, the UUV needs to follow the target in certain distance based on the mother ship's sensor information. The traditional tracking methods perform poor in controlling the distance, the value of which depends on the random sensor observation noise. Based on the noise model of the sensor observation, this paper proposes a tracking method to minimize the mean squared-error (MSE) of the distance, which reduces the effect of the sensor observation noise on the distance. As the optimal tracking method may be too computationally intensive to implement in practice, we derived a suboptimal tracking method, which has a closed form. Simulation results verify the improvement of tracking precision of the optimal tracking method. In addition, the suboptimal tracking method, which is practical and easy-to-implement, performs very close to the optimal tracking method.

Session Code : [SP1P.5 - Paper ID 0052](#)

Paper Title : **A TDI CCD BASED METHOD FOR LIGHT TARGET LOCATION IN LARGE FIELD OF VIEW 517**

Author : *Wang Xiaoyue; Song Ping; Wu Jiangpeng; Cheng Yang - Beijing Institute of Technology, China*

Abstract : In this paper, the method of two TDI (Time Delay Integration) CCD intersection is proposed to achieve the location of light target in a large field. Frame difference method combined with OTSU threshold segmentation algorithm is proposed to identify the image with light target. Besides, in order to reduce the

storage capacity, we carry out binarization processing on target image. For getting the position of the light target in target image, the grayscale centroid algorithm is presented. In this paper, TDI CCD with high-speed and high-sensitivity is utilized as image sensor, and MATLAB is selected as image processing software. In our test, we carry on image processing by using the above algorithm with the images of 8192\*32 pixels acquired from the 320m\*240m field by two TDI CCD cameras in MATLAB. With the method of intersection of two TDI CCD, the location error is within 5% compared with the result achieved by total station instrument.

## SP2L:3D and Video Signal Processing

Session Code : [SP2L.1 - Paper ID 1000](#)

Paper Title : **A VISUAL COMFORT METRIC FOR STEREOSCOPIC 3D VIDEO BASED ON SMDE APPROACH 72**

Author : *Bi Ye; Zhou Jun; - Shanghai Jiao Tong University, Shanghai 200240, China*

Abstract : Visual comfort assessment for stereoscopic video is playing an important role for stereoscopic safety issue. In this paper, we propose a novel visual comfort assessment metric that utilizes interest regions detection approach, which is called Salient Motion Depth Extraction approach in our algorithm. In stereoscopic video shots, salient motion regions where human subjects focus on should have more weights in visual comfort assessment. To achieve better performance, our approach combines salient cues, motion cues with depth cues in order to extract salient motion regions in consideration of depth context. Our visual comfort assessment utilizes local analytical method based on attention model by analyzing disparity features in interest regions extracted by Salient Motion Depth Extraction approach. The experimental results have demonstrated that our proposed visual comfort assessment improves the correlation with the subjective assessment.

Session Code : [SP2L.2 - Paper ID 1049](#)

Paper Title : **EFFECTIVE COMPLEXITY CONTROL BY INTER-LAYER MOTION ANALYSIS FOR SPATIAL SCALABILITY VIDEO CODING 78**

Author : *Jian-Sheng Wu; Mei-Juan Chen - National Dong Hwa University, Taiwan Gwo-Long Li; - Industrial Technology Research Institute Hsinchu, Taiwan*

Abstract : Scalable video coding incorporated with computation-aware concept is an interesting issue in video coding due to its ability to achieve quality as well as computation scalable. This paper presents a computation-aware algorithm for scalable video coding with spatial scalability to aim at best trade-off between rate distortion performance and computational consumption. We first observe and analyze the motion vector difference relationship between scalable base and enhancement layers to find out whether the motion vector difference of the base layer can be used for showing some information about the motion behavior of the enhancement layer. Afterwards, a linear model is proposed to establish the motion vector difference relationship between base and enhancement layers. By using the modeling results, a linear algorithm for computation distribution is thus proposed to allocate the computation of the search process for each macroblock in the enhancement layer. In addition, the rate distortion costs of the base layer are also taken into account for the computation allocation process to further improve the coding performance. Simulation results demonstrate that our proposed computation-aware algorithm not only achieves better rate distortion performance than other works under the same computational constraints but also achieves less computation necessities.

Session Code : [SP2L.3 - Paper ID 0050](#)

Paper Title : **WATERSHED AND RANDOM WALKS BASED DEPTH ESTIMATION**

#### **FOR SEMI-AUTOMATIC 2D TO 3D IMAGE CONVERSION 84**

Author : *Xuyuan Xu; Lai-Man Po; Ka-Ho Ng; Ka-Man Wong; Chi-Wang Ting* -  
*City University of Hong Kong, China*

*Kwok-Wai Cheung - Chu Hai College of Higher Education, China*

Abstract : Depth map estimation from a single image is the key problem for the 2D to 3D image conversion. Many 2D to 3D converting processes, either automatic or semi-automatic, are proposed before. Quality of the depth map from automatic methods is low and there exists wrong depth values due to errors estimation in depth cue extraction. The semi-automatic approaches can generate a better quality of depth map based on the user-defined labels, which indicate a rough estimation of depth values in the scene, to generate the rest of depth value and reconstruct the stereoscopic image. However, they require complexity system and are very computational intensive. A simplified approach is to combine the depth maps from Graph Cuts and Random Walks to persevering the sharp boundary and fine detail inside the objects. The drawback is the time consuming of the energy minimization in the Graph Cuts. In this paper, a fast Watershed segmentation based on the priority queue, which indicates the neighbor distance relationship, is used to replace the Graph Cuts to generate the hard constraints depth map. It is appended to the neighbor cost in the Random Walks to generate the final depth map with hard constraints in the objects boundaries regions and fine detail inside objects. The Watershed and Random Walks are low computational intensive and can achieve approximate real time estimation which results in a fast stereoscopic conversion process. Experimental results demonstrate that it can produce good quality stereoscopic image in very short time.

Session Code : [SP2L.4 - Paper ID 0091](#)

Paper Title : **PARALLEL VIEW SYNTHESIS PROGRAMMING FOR FREE VIEWPOINT TELEVISION 88**

Author : *Jung, Jae-Il; Ho, Yo-Sung* - *Gwangju Institute of Science And Technology, Korea*

Abstract : View synthesis is one of the important techniques for free-viewpoint 3D image services. Unfortunately, computational complexity of depth image-based view synthesis is high, since it includes numerous matrix calculations and complex filters. In this paper, we implement the depth image-based rendering algorithm on a graphics processing unit (GPU) using the compute unified device architecture (CUDA). We perform memory uploads to the global memory of the GPU, and compute matrix calculations of all pixels in parallel. We also simplify the filters of rendering to reduce complexity and analyze performance according to block and image sizes. Experimental results show that our implementation is faster than conventional methods while preserving visual quality.

Session Code : [SP2L.5 - Paper ID 0072](#)

Paper Title : **QUALITY-EFFICIENT DE-INTERLACING FOR H.264-CODED VIDEOS 92**

Author : *Wei-Jen Yang; Kuo-Liang Chung; Le-Chung Lin* - *National Taiwan University of Science and Technology, Taiwan;*

*Yong-Huai Huang - Jinwen University of Science And Technology, Taiwan*

Abstract : In this paper, we propose an efficient de-interlacing method for H.264-coded video sequences with different resolutions. In our proposed method, using the syntax elements (SEs) in the H.264 bitstreams, two new strategies are delivered to improve the deinterlacing quality. The first strategy is based on the intra mode to improve the quality of the regions with skewed edges. The second strategy is based on the inter mode to refine the quality of de-interlaced videos as well as alleviate the error propagation side effect. Experimental results on popular test video sequences with the resolutions of common international format (CIF), quarter CIF (QCIF), standard-definition (SD), and full highdefinition (HD)

demonstrate the superiority of the proposed de-interlacing method in terms of both the objective video quality measure and subjective visual effect when compared with the state-of-the-art method by Dong and Ngan.

Session Code : [SP2L.6 - Paper ID 0042](#)

Paper Title : **ENHANCED ADAPTIVE INTRA MODE BIT SKIP FOR H.264/AVC** 98

Author : *Po, Lai-Man; Wang, Liping; Feng, Litong; Ng, Ka-Ho; Wong, Ka-Man - City University of Hong Kong, China*  
*Cheung, Kwok-Wai - Chu Hai College of Higher Education, China*

Abstract : Adaptive intra mode bit skip (AIMBS) can improve the coding efficiency of intra coding in H.264/AVC. However, it has two shortcomings: one is that DC mode is not effectively handled in AIMBS as DC mode is duplicated in both Single-Prediction and Multiple-Prediction processing; the other is that AIMBS does not well match the most probable mode (MPM) estimation scheme of H.264/AVC. To tackle these two shortcomings, an enhanced AIMBS (EAIMBS) scheme with larger bitrate reduction and better QP robustness is presented. In addition, EAIMBS almost maintains as low computational complexity as AIMBS. The proposed technique introduces distance-based weighted prediction (DWP) to replace DC mode in Multiple-Prediction and it calculates the MPM by simplified L-shaped most probable mode estimation (SLMPME) method. Experimental results show that EAIMBS gives in average 3.97% bit-rate reduction and 51% computation reduction at QP=32 compared with H.264/AVC.

#### SP2P:Multimedia Signal Processing

Session Code : [SP2P.1 - Paper ID 1119](#)

Paper Title : **PERFORMANCE COMPARISON OF JPEG COMPRESSED DOMAIN IMAGE RETRIEVAL TECHNIQUES** 587

Author : *Edmundson David; Schaefer Gerald - Loughborough University, U.K.*

Abstract : Although content-based image retrieval (CBIR) has been an active research area for more than two decades, relatively little work takes into account that virtually all images exist in compressed form, mostly in (lossy) JPEG format. In this paper, we benchmark eight state-of-the-art CBIR algorithms that operate directly in the compressed domain of JPEG by performing retrieval based on DCT coefficients. We analyse their performance on a benchmark dataset, compare them against common pixel-domain techniques, investigate whether they are affected by compression ratio, and measure their computational complexity. We conclude that several of the JPEG CBIR techniques allow much faster feature calculation and faster image retrieval, while providing retrieval performance similar to common pixel-domain algorithms.

Session Code : [SP2P.2 - Paper ID 0100](#)

Paper Title : **THREE DIMENSIONAL LUNG NODULE SEGMENTATION AND ESTIMATION USING THRESHOLDING ON LOCAL THICKNESS** 593

Author : *Janetheerapong Akaraphan; Cooharajanone Nagul; Lipikorn Rajalida - Chulalongkorn University, Thailand*  
*Wattanathum Anan - Phramonkgutklao Hospital, Thailand*

Abstract : A fast alternative user-selection procedure to semi-automatic Philips Extended Brilliance Workspace's Lung Nodule Assessment(TM) is presented. By using modified Local Thickness algorithm which utilizes 3D Region Growing algorithm and IsoData auto-thresholding algorithm, the user can perform fewer steps to semi-automatically segment and estimate a respective nodule more accurately, especially on irregular shape nodules. Attached blood vessels and extruding thorn-like features of the selected nodule are also automatically excluded in segmentation with the proposed method. By using correlation comparison on the same lung nodule dataset between our proposed method and

Philips Extended Brilliance Workspace's Lung Nodule Assessment™'s semi-automatic method, we can see that the correlation is 0.9887.

Session Code : [SP2P.3 - Paper ID 0113](#)

Paper Title : **AN AUTOMOTIVE APPLICATION OF REAL-TIME ADAPTIVE WIENER FILTER FOR NON-STATIONARY NOISE CANCELLATION IN A CAR ENVIRONMENT 597**

Author : *Chen, Yen-Hsiang; Ruan, Shanq-Jang; - National Taiwan University of Science and Technology  
Qi, Tom - Building and Engineering Otago Polytechnic*

Abstract : Wiener filter is one of the most fundamental noise-reduction approaches among numerous techniques. The speech recognition in an in-vehicle environment needs a non-stationary noise cancellation to eliminate the background noise. However, few efforts have been reported to show the effectiveness of Wiener filter. Not much has been evaluated how the Wiener filter really works for reducing the non-stationary noise in real-time. In this paper, a real-time adaptive Wiener filter with two microphones is implemented to reduce noisy speech when noise signals and desired speech are incoming simultaneously. Furthermore, in order to build a real-time noise canceller, this paper also gives an analysis of different matrix sizes of the Wiener filter so as to enable the possibility of real-time implementation. The performance of the proposed design is measured by as much as 20dB noise reduction, and the proposed adaptive Wiener matrix update speed achieves a 28.6 ms/frame, with a matrix size of 200.

Session Code : [SP2P.4 - Paper ID 0136](#)

Paper Title : **ONE-CLICK VOCAL TRACT MAPPING INTERFACE FOR VOWELS AND ITS USEFULNESS AS A SIGNAL CONVERTER 602**

Author : *Ogata, Kohichi; Yamashita, Kentaro - Kumamoto University, Japan*

Abstract : This paper describes an effective application of a vocal tract mapping interface to signal conversion. The vocal tract mapping interface is a kind of vocal tract shape generator that provides users with easy and effective setting of the vocal tract shape with a simple mouse click on its interface window. Utilizing a one-click operation to generate the vocal tract shape, an incoming signal can be easily converted into vowel sounds through the vocal tract shape. In this paper, signals obtained from finger motions during a finger-nose test were converted into vowel sounds as an application of the vocal tract mapping interface. Paired comparison experiments showed that vowel sounds generated from the finger motions are useful to judge the severity of movement disorders of patients.

Session Code : [SP2P.5 - Paper ID 1113](#)

Paper Title : **MAPPING LOOPS OF MULTIMEDIA ALGORITHMS FOR COARSE-GRAINED RECONFIGURABLE ARCHITECTURES 608**

Author : *Yang, Ziyu; Peng, Zhao; Guanwu, Wang; Sikun, Li - National University Of Defense Technology, China*

Abstract : Coarse-Grained Reconfigurable Architectures (CGRAs) are widely used as coprocessors to accelerate data-intensive applications. However, the parallelization of sequential programs and the optimization of critical loops are still challenging issues, since the access delay introduced by the massive memory accesses contained in those loops has become the bottleneck of CGRA's performance. In this paper we focus on the parallel optimization of applications by considering the critical loops mapping under the CGRA's resource constraints. We first propose a novel approach to parallelize loops by multi-level tiling. Then a genetic algorithm is introduced to schedule tiled loops with memory-aware object functions. Data locality and communication cost are optimized during the parallel processing as well. Experimental results show that our approach can generate more effective parallel tasks to improve the data locality and load-balanced execution, while obtains 9.6% better speedup compared with

the memory-unaware parallel processing.

Session Code : [SP2P.6 - Paper ID 1060](#)

Paper Title : **GRID SEEDED REGION GROWING WITH MIXED ART FOR ROAD EXTRACTION ON DSM DATA 613**

Author : *Herumurti, Darlis; Uchimura, Keiichi; Koutaki, Gou; - Kumamoto University, Japan*  
*Uemura, Takumi - Sojo University, Japan;*

Abstract : Region Growing with Mixed ART is one of the methods for road extraction based on segmentation processing. The method is based on Region Growing method but using ART approach as homogeneity measurement. However, a drawback of this method is time consuming. For road extraction problem, it is unnecessary to separate all the regions as in general segmentation approach. We only need some of the road data and then grow it to obtain the road network. In this paper, we proposed a grid seeded region growing with Mixed ART. Since the road will cross the grid, we can obtain the road network based on growing from these seed points. The experimental result shows that the proposed method performs faster up to four times than the conventional seed point with the similar quality. The accuracy of extracted road and non-road are 74% and 77% respectively.

Session Code : [SP2P.7 - Paper ID 0054](#)

Paper Title : **THE RESEARCH OF IDENTIFICATION METHOD OF CROWD CONVERGENCE AND DIVERGENCE IN SURVEILLANCE VIDEO 618**

Author : *Weihua.Chen; - Hebei Software Institute, China*  
*Jiancheng.Yang - Fiber Inspection Institute Quality and Technical Supervision Bureau ,China*

Abstract : This paper proposes an improved method that based on motion corner statistical properties of the crowd convergence and divergence event. This method uses Harris corner detection method to detects the corner, target template is used to extract object corner, and introduce Corner coordinates Covariance matrix to represent the crowd corner cloud area. In the end by analyzing the curve of the corner Cloud area, it completed to identify crowd convergence and divergence and given a specific identification programs. The experimental results show that this method can identify the crowd convergence and divergence in video sequence effectively.

### SP3L: Detection, Estimation and Classification

Session Code : [SP3L.1 - Paper ID 1035](#)

Paper Title : **BAYESIAN DOA ESTIMATION METHOD USING POPULATION MONTE CARLO 158**

Author : *Hua Fei; Shen Xiao-Hong; Chen Zhao; Yang Fu-Zhou; Gu Jiang-Jian - Northwestern Polytechnical University, China*

Abstract : Bayesian maximum a posteriori (BMAP) DOA estimation method has a better performance than MUSIC method at low signal to noise ratio (SNR) and few snapshots. However, it suffers a heavy computational complexity due to multi-dimensional search. Monte Carlo methods such as Markov Chain Monte Carlo (MCMC) method can effectively solve this problem. MCMC method may provide a local optimization for it is difficult to assess when the Markov Chain has reached the stationary state. Population Monte Carlo (PMC) which uses sequential techniques draws a set of particles and provides an unbiased estimate at each iteration. Thus provides a global optimization and can enhance the computational efficiency. In this paper, the PMC method is introduced and used for Bayesian DOA estimation in order to reduce the complexity. Simulation results show that it has better performance than MUSIC method at low SNR or

few snapshots. Compared with BMAP, it can reduce the computation and keep high resolution performance at low SNR.

Session Code : [SP3L.2 - Paper ID 0085](#)

Paper Title : **BAYESIAN-BASED PARAMETER ESTIMATION OF K DISTRIBUTION USING METHOD OF LOGARITHMIC CUMULANTS 162**

Author : *Cui, Yi; Yamaguchi, Yoshio; - Niigata University, Japan; Yang, Jian - Tsinghua University, Beijing, China*

Abstract : In this paper, the problem of using the method of logarithmic cumulants (MoLC) for parameter estimation of the K distribution is addressed. Specifically, we have pointed out that the MoLC is likely to suffer from non-invertible equations. In order to overcome such difficulty, a prior distribution is introduced to the estimated term in the log-cumulant equation and closed-form Bayesian estimation is obtained. Numerical experiments demonstrate that this approach not only provides an always-solvable equation, but also universally improves the estimation accuracy. Finally, the application of the MoLC for ship detection in synthetic aperture radar (SAR) images is demonstrated. Experimental results with the RADARSAT-2 data show that the proposed method leads to better sea clutter modeling in terms of more accurate constant false alarm rate (CFAR) control.

Session Code : [SP3L.3 - Paper ID 1106](#)

Paper Title : **FAST VANISHING POINT DETECTION FOR UNSTRUCTURED ROAD USING HAAR TEXTURE 167**

Author : *Wang, Yongzhong; Xiaoyun Wang; Chenglin Wen - Hangzhou Dianzi University, . China*

Abstract : The unstructured road detection is a challenging problem by the fact that many rural or desert roads are not well-paved, lack clear lane markers or boundaries. However, the ruts and tracks left by previous vehicles on the path commonly appear to converge into a single point, called as vanishing point, which is successfully used to determine the road region. In this paper, we propose a novel and fast texture extraction method by utilizing the carefully designed Haar templates and the orthogonal rectification technique, and based on which the vanishing point of unstructured road is reliably estimated by the diversity voting method. Compared with the state-of-the-art algorithms in a variety of difficult conditions ranging from desert to snow environments, the experiment results demonstrate the effectiveness and efficiency of the proposed methodology in quantitative and qualitative analyses.

Session Code : [SP3L.4 - Paper ID 1037](#)

Paper Title : **EFFICIENT CONVEX OPTIMIZATION METHOD FOR UNDERWATER PASSIVE SOURCE LOCALIZATION BASED ON RSS WITH WSN 171**

Author : *Yan Yong-Sheng; Wang Hai-Yan; Shen Xiao-Hong; Yang Fu-Zhou; Chen Zhao - Northwestern Polytechnical University, China*

Abstract : The widespread applications of wireless sensor network (WSN) and the advancement of the micro-electro-mechanical systems (MEMS) technology, and wireless communication develop the underwater wireless sensor network (UWSN). The passive source localization application which is an important application in underwater signal processing is focused on in this paper. We model that the underwater source radiates acoustic noise or energy isotropically and utilize the receiving signal energy (RSS) taken at individual sensors of the UWSN to estimate passively the location of the source. Firstly, we choose the node whose energy is maximal as the reference node to decrease the computational complexity compared to our previous work which use division between pairs of sensor energy output. Secondly, the one-step least-square (OS) method is reviewed and another description based on maximum likelihood source location estimator (MLE) is given. Thirdly, a semidefinite programming (SDP) method is developed to convert the nonconvex problem into the convex

optimization problem (CVX). Compared to the least-square (LS) method, this CVX-SDP method based on RSS achieves more accurate results and has better robustness with less number of sensor nodes and with lower SNR.

Session Code : [SP3L.5 - Paper ID 1116](#)

Paper Title : **MAMMOGRAM MICROCALCIFICATION CLUSTER DETECTION BY LOCATING KEY INSTANCES IN A MULTI-INSTANCE LEARNING FRAMEWORK 175**

Author : *Li, Chao; Lam, Kin Man; Zhang, Lei; - The Hong Kong Polytechnic University, China; Li, Chao; Zhang, Su; Hui, Chun - The Shanghai Jiao Tong University, China*

Abstract : A new scheme for the computer-aided diagnosis (CAD) of microcalcification clusters (MCCs) detection in a Multi-Instance Learning (MIL) framework is proposed in this paper. To achieve a satisfactory performance, our algorithm first searches for possible candidates of microcalcification clusters using the mean-shift algorithm. Then, features are extracted from the potential candidates based on a constructed graph. Finally, a multi-instance learning method which locates the key instance in each bag of features is used to classify the possible candidates. Experimental results show that our scheme can achieve a superior performance on public datasets, and the computation is efficient.

### SP3P: Video Coding and Transmission

Session Code : [SP3P.1 - Paper ID 0059](#)

Paper Title : **BOUNDARY-AIDED EXTREME VALUE DETECTION BASED PRE-PROCESSING ALGORITHM FOR H.264/AVC FAST INTRA MODE PREDICTION 623**

Author : *Miao, Chen-Hsien; Fan, Chih-Peng - National Chung Hsing University, Taiwan*

Abstract : The mode decision in the intra prediction of an H.264/AVC encoder requires complex computations and a significant amount of time to select the best mode that achieves the minimum rate-distortion (RD). The complex computations for the mode decision cause difficulty in real-time applications, especially for software-based H.264/AVC encoders. This study proposes an efficient fast algorithm called Boundary-aided Extreme Value Detection (BEVD) to predict the best direction mode, excluding the DC mode, for fast intra-mode decision. The BEVD-based edge detection can predict luma-4x4, luma-16x16, and chroma-8x8 modes effectively. The first step involves using the pre-processing mode selection algorithm to find the primary mode that can be selected for fast prediction. The second step requires applying the selected fewer high-potential candidate modes to calculate the RD cost for the mode decision. The encoding time is largely reduced, and similar video quality is also maintained. Simulation results show that the proposed BEVD method reduces encoding time by 63 %, and requires a bit-rate increase of approximately 1.7 %, and a decrease in peak signal-to-noise ratio (PSNR) by approximately 0.06 dB in QCIF and CIF sequences, compared with the H.264/AVC JM 14.2 software. The proposed method achieves less PSNR degradation and bit-rate increase compared to previous methods with more encoding time reduction.

Session Code : [SP3P.2 - Paper ID 0070](#)

Paper Title : **EDGE INFORMATION BASED EFFECTIVE INTRA MODE DECISION ALGORITHM 628**

Author : *Yuan Yule; Sun Xiaohang - Peking University Shenzhen Graduate School, China*

Abstract : In this paper, we present very simple, yet efficient, algorithms for intra mode decision algorithms in AVS video coding based on edges detection and neural

network. The technique uses the SOBEL operator to check the edge information from the total image before its intra prediction. Then the prediction mode of each 8x8 block can be decided based on its edges. In our paper, we design two schemes to decide the intra mode. In our first method, the intra mode is determined by compare the total number the feature points in each sub-blocks. It can save the encoding time of AVS part 2 between 30 to 40%. It is a very fast method, but the bit stream is correspondingly increased. To reduce the gain of the bit rate, we design another effective method employing neural network classifier which trained by the edge points to decide the mode of the block for AVS intra prediction. Because only one prediction mode is chosen for RDO calculation using the proposed algorithm, simulation results also show that the proposed scheme achieves up to 9% computational saving with no video quality degradation, compared with results of the existing method.

Session Code : [SP3P.3 - Paper ID 1007](#)

Paper Title : **UNEQUAL ERROR PROTECTION OF H.264/AVC VIDEO BITSTREAMS BASED ON DATA PARTITIONING AND MOTION INFORMATION OF SLICES 634**

Author : *Pham, Huu Dung, Vafi, Sina - Charles Darwin University, NT, Australia*

Abstract : This paper presents new schemes of Unequal Error Protection (UEP) for video bitstreams compressed by H.264/AVC standard. Proposed UEPs are implemented in two levels. The first level is performed based on specifications of data partitioning recognized as one of the most important and conventional error resilience tools for wireless video transmission systems. The second level is based on determining the size of motion information, which are allocated to the most important partition of a frame or slice. Suitable Forward Error Correcting (FEC) codes with various rates are applied for different partitions according to their importance. Conducted simulations confirm that presented techniques significantly improve performance of video bitstreams, while their overall transmission rates are maintained at the same rate as Equal Error Protection (EEP) technique. Improvements are mainly achieved for videos with the high number of motion information.

#### SP4L: Image and Pattern Recognition

Session Code : [SP4L.1 - Paper ID 1004](#)

Paper Title : **OBJECT DETECTION BASED ON LOCAL FEATURE MATCHING AND SEGMENTATION 208**

Author : *Qinkun Xiao; Yichuang Luo; Xiaoxia Hu - Xi'an Technological University*

Abstract : An object detection method is developed based on combining top-down recognition with bottom-up image segmentation. There are three main steps in this method: a shape learning step, a hypothesis generation step and a verification step. In the shape learning step, training images are used to building codebook dictionary, and matching template is also constructed based on codebook dictionary. In the top-down hypothesis generation step, the Probability Shape Context (PSC) is used to generate a set of hypotheses of object locations. In the verification step, the hypotheses of object locations are segmented based on Partial Differential Equation (PDE). Based on segmented outlines and matching template, the inference is used to prune out false positives. Experimental results demonstrate that our proposed approach is able to accurately detect objects with only a few positive training examples.

Session Code : [SP4L.2 - Paper ID 0037](#)

Paper Title : **HANDWRITTEN SIGNATURE VERIFICATION USING WEIGHTED FRACTIONAL DISTANCE CLASSIFICATION 212**

Author : *Moolla, Yaseen; Viriri, Serestina; Nelwamondo, Fulufhelo; Tapamo, Jules - University of Kwazulu-Natal, South Africa*

Abstract : Signatures are one of the behavioural biometric traits, which are widely used as a means of personal verification. Therefore, they require efficient and accurate methods of authenticating users. The use of a single distance-based classification technique normally results in a lower accuracy compared to supervised learning techniques. This paper investigates the use of a combination of multiple distance-based classification techniques, namely individually optimized re-sampling, weighted Euclidean distance, fractional distance and weighted fractional distance. Results are compared to a similar system that uses support vector machines. It is shown that competitive levels of accuracy can be obtained using distance-based classification. The best accuracy obtained is 89.2%.

Session Code : [SP4L.3 - Paper ID 1120](#)

Paper Title : **A SPECTRAL FEATURE BASED APPROACH FOR FACE RECOGNITION WITH ONE TRAINING SAMPLE 218**

Author : *Lam Kin-Man; - Anhui University, China, Sun Zhan-Li; Lam Kin-Man; - Hong Kong Polytechnic University, Hong Kong Dong Zhao-Yang; - University of Newcastle, Australia Wang Han - Technological University, Singapore*

Abstract : In this paper, a novel spectral feature image-based 2DLDA (two-dimensional linear discriminant analysis) ensemble algorithm is proposed for face recognition with one sample image per person. In our algorithm, multi-resolution spectral feature images are constructed to represent the face images. The proposed method is inspired by our finding that, among these spectral feature images, features extracted from some orientations and scales using 2DLDA are not sensitive to variations of illumination and expression. In order to maintain the positive characteristics of these filters and to make correct category assignments, the strategy of classifier committee learning (CCL) is designed to combine the results obtained from different spectral feature images. Experimental results on the standard databases demonstrate the feasibility and efficiency of the proposed method.

Session Code : [SP4L.4 - Paper ID 0105](#)

Paper Title : **MULTI-INSTANCE LOCAL EXEMPLAR COMPARISON FOR PEDESTRIAN DETECTION 223**

Author : *Sun, Chensheng; Hu, Jiwei; Lam, Kin-Man - The Hong Kong Polytechnic University, China; Zhao, Sanyuan - Beijing Institute of Technology, Beijing, China*

Abstract : We propose to use the partial similarity between a sample and a number of exemplars as the image features for visual object detection. Define a part of the object as a sub-window inside the object bounding box, for each part of the object, a codebook of local appearance templates is learned. By using multiple templates for each part, and allowing the template to be compared with a bag of part instances in the neighborhood of the canonical location, the deformable and multi-aspect properties can be captured. A linear classifier is learned with feature selection, selecting a subset of the templates. To improve the efficiency of the detector, a rejection cascade is built by calibrating the linear classifier; the rejection cascade makes decisions using partial scores. Experimental results show that our method substantially improves the performance for human detection.

Session Code : [SP4L.5 - Paper ID 0087](#)

Paper Title : **AN APPROACH OF REGION OF INTEREST DETECTION BASED ON VISUAL ATTENTION AND GAZE TRACKING 228**

Author : *Zhang Jing; Zhuo Li; Li Zhenwei; Zhao Yingdi - Beijing University of Technology, China*

Abstract : Different from previous work, the study reported in this paper attempts to

simulate a more real and complex approach for region of interest (ROI) detection and quantitatively analyze the correlation between human visual system (HVS) and ROI. In this paper, an approach of ROI detection based on visual attention and gaze tracking is proposed. The works include pre-ROI estimation using visual attention model, gaze data collection and ROI detection. Pre-ROIs are segmented by the visual attention model. Since eye feature extraction is critical to the accuracy and performance of gaze tracking, adaptive eye template and neural network is employed to predict gaze points. By computing the density of the gaze points, ROIs are ranked. Experimental results show that the accuracy of our ROI detection method can be raised as high as 97% and our approach can efficiently adapt to users' interests and match the objective ROI.

#### SP4P:Sensor Systems and Detection

Session Code : [SP4P.1 - Paper ID 1040](#)

Paper Title : **AUGMENTING INERTIAL NAVIGATION SYSTEM WITH RADAR SEEKER MAINLOBE CLUTTER TRACKING 640**

Author : *Zhao Jing; Feng De-jun; Wang Wei - National University of Defense Technology, Changsha, China,*

Abstract : This paper explores the possibility of using velocity or Doppler measurement provided by radar seeker clutter tracking loop for an aided Inertial Navigation System (INS) in the missile midcourse guidance application. A loosely coupled system approach is implemented, wherein the INS navigation error is estimated by using a least square estimator (LSE) and the direct feedback architecture is used. A hardware-in-the-loop testbed is built for assessments and good augmentation performance is reported in the field test.

Session Code : [SP4P.2 - Paper ID 1083](#)

Paper Title : **INERTIAL NAVIGATION SYSTEM AIDING BY PASSIVE SEEKER ANGLE TRACKING 644**

Author : *Zhao Jing; Feng De-jun; Zhang Wen-ming; Wang Wei - National University of Defense Technology, Hunan, China*

Abstract : A novel inertial navigation system (INS) aiding approach is raised by exploring the possibility of using seeker bearings-only measurement in the missile midcourse guidance. INS error model was formulated, and line-of-sight (LOS) angles were solved. The error model of angle solution was derived, which was applied in Cramer-Rao lower bound derivation for the proposed INS aiding problem. A sequential square root Kalman filter was designed for the optimal INS error estimation. Simulation in typical trajectory was carried out to verify the aiding performance. A loosely coupled system was implemented to realize INS feedback augmentation in flight. Hardware-in-the-loop testbed is built for assessments and good performance is reported in the simulation test by using statistics of missile auto-control termination error.

Session Code : [SP4P.3 - Paper ID 0150](#)

Paper Title : **THE PERFORMANCE OF TIME REVERSAL BEAM-FORMING BY LINEAR ARRAY 650**

Author : *Yang Fu-Zhou; Wang Hai-Yan; Shen Xiao-Hong; Hua Fei - Northwest Polytechnical University, China*

Abstract : The target orientation performance of time reversal by uniformed linear array is discussed over the ocean acoustic multi-path channel. Based on time reversal process, the signal detection system model is derived, and together with the self-adaptively beam-forming the algorithm is proposed. Comparing to the conventional array signal processing method, simulation result shows that time reversal could self-adaptively revise signal transmission delay due to multi-path channel, compensating the same phase correspond to each path wave-front, which reflects through target to each element of array, and strengthening receive

signal absolute energy value which raises two orders of magnitude. Under conditions of the same max-SNR criterion whose level is -14.3dB, with the time reversal process combined with self-adaptively beam-forming method the ratio between main lobe and side lobe is improved by 2dB compared to conventional beam-forming. In a conclusion, the uniformed liner array under time reversal process improves the performance of target orientation compared to conventional beam-forming, especially under low signal to noise level(Abtract)

Session Code : [SP4P.4 - Paper ID 1073](#)

Paper Title : **KNOWLEDGE-AIDED ADAPTIVE BEAMFORMING AGAINST SIGNAL STEERING VECTOR MISMATCH WITH SMALL SAMPLE SUPPORT 654**

Author : *Yongchan Gao, Guisheng Liao, Shengqi Zhu, Xuepan Zhang - Xidian University, China*

Abstract : In this paper, a knowledge-aided adaptive beamforming approach against signal steering vector mismatch with small sample support is proposed. First, a combination covariance matrix of the prior covariance matrix, the sample covariance matrix and an identity matrix is obtained by the minimum mean-square error criterion. Then the mismatch between the actual and the presumed signal steering vector is modeled as a worst-case performance optimization constraint. Based on the combination covariance matrix and the constraint, the adaptive beamformer is formulated. The validity of the proposed beamformer is evaluated by simulation results, when the sample support is small and the signal steer vector mismatch exists.

#### SP5L: Image and Video Retrieval

Session Code : [SP5L.1 - Paper ID 1118](#)

Paper Title : **FAST JPEG IMAGE RETRIEVAL USING TUNED QUANTISATION TABLES 234**

Author : *Edmundson David; Schaefer Gerald - Loughborough University, U.K.*

Abstract : In this paper, we present an extremely fast method for online image retrieval of JPEG compressed images. We exploit minimal perceptual error image compression which optimises JPEG quantisation tables to improve the resulting image quality. In particular, we demonstrate that thus tuned quantisation tables can be used as image descriptors for performing content-based image retrieval. Image similarity is expressed as similarity between the respective quantisation tables and feature extraction and comparison be performed in an extremely fast fashion as it is based on information only from the JPEG headers. We show that our method takes only about 2-2.5% of the time of standard compressed domain algorithms, yet achieves retrieval accuracy within 3.5% of these techniques on a large dataset.

Session Code : [SP5L.3 - Paper ID 1005](#)

Paper Title : **MOTION RETRIEVAL BASED ON MULTI-VIEW INFORMATION AND GRAPH MODEL 240**

Author : *Qinkun Xiao; Yichuang Luo; Xiaoxia Hu; Song Gao - Xi'an Technological University, China*

Abstract : Matching and retrieval of motion sequences has become an important research area in recent years, due to the increasing availability and popularity of motion capture data. In this paper, we propose a novel content-based method for retrieving of this human motion captured data. The proposed method includes two key steps, one is motion descriptor construction, and the other is retrieval based on query. Firstly, for representing motion by images, multi-view information is captured, and then switching liner dynamic system (SLDS) is built based on image fusion and light stream technology. Secondly, through inferring

and coding of SLDS, a graph-based motion descriptor can be obtained. Lastly, based on proposed motion descriptor, the motion retrieval would be operated through direct matching between motion descriptors. Experiment results show our method is effectiveness.

Session Code : [SP5L.4 - Paper ID 1001](#)

Paper Title : **TF-RNF: A NOVEL TERM WEIGHTING SCHEME FOR SPORTS VIDEO CLASSIFICATION 244**

Author : *Prisana Mutchima - Department of Information Technology Suan Dusit Rajabhat University, Thailand; Parinya Sanguansat - Faculty of Engineering and Technology Panyapiwat Institute of Management, Thailand*

Abstract : Determination of content importance is very important in achieving high quality classification. Term weighting schemes in text classification will be applied to classify videos by measuring importance of video contents. In other words, a video sequence can be treated as a document, and frames of a video are considered as words or terms which identify contents of a video. And to enhance the efficiency of video classification, this paper proposes a novel term weighting scheme, called the Term Frequency - Relevance and Non-relevance Frequency (TF-RNF) weighting. This technique can filter both relevant and non-relevant contents so as to reduce classification errors. Empirical evaluations of results show that the proposed technique significantly outperforms traditional techniques in sports video classification.

Session Code : [SP5L.5 - Paper ID 0092](#)

Paper Title : **SEGMENTATION OF THE SAME OBJECT IN DIFFERENT VIEW 250**

Author : *Han, Ying Li; Ju, Hae Jin; Park, Rae-Hong - Sogang University, South Korea*

Abstract : In this paper, we propose an object segmentation method to extract the same object from images that are captured from different views. Using matting method, the target object can be easily segmented with simple strokes given by a user to the desired object and background in the reference image. Then, homography is estimated after keypoint matching between the segmented object image and the target image, which is acquired from a different viewpoint, containing the same object. Using homography, the strokes are transformed to fit to a target image. Finally, the identical object is segmented from the target image using matting method with transformed strokes. The proposed method can be used to increase the accuracy of segmentation for extracting the same desired object from a target image.

#### SP5P: Visual Signal Processing

Session Code : [SP5P.1 - Paper ID 1069](#)

Paper Title : **DEPTH HOLE FILLING USING THE DEPTH DISTRIBUTION OF NEIGHBORING REGIONS OF DEPTH HOLES IN THE KINECT SENSOR 658**

Author : *Yang, Na-Eun; Kim, Young-Gon; Park, Rae-Hong - Sogang University, South Korea*

Abstract : This paper proposes a depth hole filling method for RGBD images obtained from the Microsoft Kinect sensor. First, the proposed method labels depth holes based on 8-connectivity. For each labeled depth hole, the proposed method fills depth hole using the depth distribution of neighboring pixels of the depth hole. Then, we refine the hole filling result with cross-bilateral filtering. In experiments, by simply using the depth distribution of neighboring pixels, the proposed method improves the acquired depth map and reduces false filling caused by incorrect depth-color fusion.

Session Code : [SP5P.3 - Paper ID 1096](#)

Paper Title : **A SEMIBLIND APPROACH TO DECONVOLUTION OF MOTION BLURRED IMAGES USING SUBBAND DECOMPOSITION AND INDEPENDENT COMPONENT ANALYSIS 662**

Author : *Mirajkar, Gayatri - Shivaji University, India*

Abstract : The application of multivariate data analysis methods such as ICA to solve the blind deconvolution problem requires the source images to be statistically independent. Since this is not always true, a subband decomposition approach is taken. Here it is assumed that the wideband source signals are dependent, but there exist some narrow subbands where they are independent. These subbands are determined by finding those subbands with minimum mutual information between corresponding nodes of the subband decomposition scheme. Subband decomposition is brought about by undecimated wavelet transform as well as Gabor wavelets. Patches are selected randomly from these subband images and given as inputs to the ICA algorithm. The ICA algorithm gives as its output the independent components which resemble short edges and capture the blurring information in the image around edges and corners. These are used as PSFs given to the blind Richardson-Lucy algorithm for deconvolution of the blurred image. The results obtained are comparable to those obtained by the blind Richardson-Lucy algorithm.

Session Code : [SP5P.4 - Paper ID 0078](#)

Paper Title : **EXPAND VARIANCE MEAN SORTING FOR REVERSIBLE WATERMARKING 668**

Author : *Kotvicha, Aekawit; Kasemsan, M.L.Kunthorn - Rangsit University, Thailand Sanguansat, Parinya - Panyapiwat Institute of Management, Thailand*

Abstract : Prediction Error Expansion is one of Reversible Watermarking (RW) techniques that gives effective results and has been continuously developed over the years. Among those techniques, Sorting Absolute Prediction Error (APE) is an important step used to reduce image distortion; so in this research we focus on developing the technique of sorting APE in ascending order more accurately. We can use local variance values in predicting APE and these values are calculated from means so they are suitable for predicting which areas contains high or low APE values. Consequently, we have improved this parameter by using Expand Variance Mean which can increase efficiency of sorting process and raise PSNR values.

#### **SP6L: Sensor Array and Multi-channel SP**

Session Code : [SP6L.1 - Paper ID 1080](#)

Paper Title : **ROBUST MINIMUM SIDELobe BEAMFORMING IN MODE SPACE FOR CIRCULAR ARRAYS 300**

Author : *Wang, Yong; Yang, Yixin; Ma, Yuanliang; Wang, Xiaoyu - Northwestern Polytechnical University, China*

Abstract : Beamformer with low sidelobe is important in many applications, but its performance will degrade in the presence of errors in sensor array characteristics, such as position, gain and phase errors. White noise gain constraint is always used to improve the robustness, but it is not clear how to choose the related parameters according to the given level of errors. The robust method based on worst-case performance optimization can use the a priori knowledge of the error levels, but not sufficiently. The bounds of the manifold vector uncertainty set cannot be easily obtained. In this paper, a feasible way is used to derive the bounds considering the errors in sensor array characteristics together, and then a robust minimum sidelobe beamforming method based on worst-case performance optimization in mode space for circular arrays is presented. This problem can be transformed to convex optimization and solved by second-order cone

programming. Simulation results show the computation load of this method is effectively reduced and the results are more reliable.

Session Code : [SP6L.2 - Paper ID 0116](#)

Paper Title : **DOA ESTIMATION FOR COHERENT SOURCES IN THE PRESENCE OF UNKNOWN CORRELATED NOISE 305**

Author : *Haiqiang Wang; Jianguo Huang; Wei Gao - Northwestern Polytechnical University, China*

Abstract : A new direction of arrival (DOA) estimation method is proposed for coherent sources in the presence of spatially unknown correlated noise. The proposed method can fully eliminate the noise component by applying spatial smoothing technique to a new covariance matrix, and the new covariance matrix is the difference between the forward/backward spatial smoothing covariance and its rotation. The unknown correlated noise fields are supposed to be in a complex symmetric Toeplitz form, situations where this assumption is valid is common in sonar applications. Simulation results have shown that the proposed method can fully eliminate noise component and provide significant performance improvement over the conventional forward/backward spatial smoothing algorithm.

Session Code : [SP6L.3 - Paper ID 0127](#)

Paper Title : **DESIGN OF A SOUND LOCALIZATION SYSTEM BASED ON SOPC 310**

Author : *Weiwei Wang; Tiande Gao; Shuxia Guo - Northwestern Polytechnical University, China; Xujun Wang; - Yichang Testing Technique R&D Institute, Yichang, China*

Abstract : According to the direction estimation problem encountered in radar, sonar and other acoustic fields, the paper introduces a design of a sound localization system based on SOPC. This system works on the FPGA platform of Altera Cyclone III family by building a SOPC system, which can take full advantage of the flexible customization specifications of the SOPC and the powerful parallel signal processing capacities of FPGA. Time Difference of Arrival (TDOA) algorithm is used to localize the source. The localization results are shown on the LabVIEW front panel. The test results show that the system has a high accuracy with the deviation of target direction less than  $3^\circ$ , and it is stable and real-time. So it will become more accessible to many engineers and as a result, more practical.

Session Code : [SP6L.4 - Paper ID 1078](#)

Paper Title : **PERFORMANCE ANALYSIS OF MULTIPLE SPARSE SOURCE LOCALIZATION WITH TRIANGULAR PYRAMID MICROPHONE ARRAY IN NOISE ENVIRONMENT 315**

Author : *Ren, Mengqi; Zou, Yuexian - Peking University Shenzhen Graduate School, China*

Abstract : Direction of arrival (DOA) estimation for multiple speakers using a small microphone array is one challenging research topic and has vast promising applications. One efficient solution is transforming the problem of estimating DOAs of multiple sources simultaneously to estimate DOA of one source at each time-frequency (TF) point by using the sparsity attribute of speech signal. The TPMA-RIPD algorithm proposed in [1] is one multiple sources DOA estimation algorithm following this route, which has shown high DOA estimation accuracy and robustness to additive white noise from the experimental results. In this paper, the robustness of the TPMA-RIPD algorithm is analyzed. The TPMA-RIPD algorithm under the real setup experiments has been evaluated, which further validates the good accuracy and robustness of the proposed algorithm.

Session Code : [SP6L.5 - Paper ID 0080](#)

Paper Title : **JOINT FREQUENCY-ELEVATION-AZIMUTH ESTIMATION WITHOUT PAIRING USING L-SHAPED ARRAY 320**

Author : *Wang Hai; Wu Yuntao; Zhang Yanbin; Cao Hui - Wuhan Institute of Technology, China*

Abstract : A new method for joint frequency, azimuth and elevation estimation of multiple narrow-band sources with L-shape array is presented. The key idea is based on subspace method with time-domain rotation and the estimations of the frequency parameter are firstly obtained from the eigenvalues of a constructed matrix, an estimation of array manifold matrix is given by the corresponding eigenvectors. Then the estimations of azimuth and elevation angle are obtained from the resultant array manifold. Compared to the available 2-D ESPRIT or the Propagator Method(PM), this method does not need any parameter matching, especially, this proposed method works well in case of lower signal to noise ratio(SNR)through a noise power reduction procedure.

#### SP6P: Audio and Speech Processing

Session Code : [SP6P.1 - Paper ID 0112](#)

Paper Title : **ACOUSTIC DISTANCE MEASUREMENT METHOD BASED ON INTERFERENCE OF SPEECH PRESENTED BY A DIALOGUE SYSTEM 674**

Author : *Nakayama, Masato; Nishiura, Takanobu - Ritsumeikan University, Japan  
Nakayama, Masato; Neki, Yuma; Nakasako, Noboru; Uebo, Tetsuji - Kinki University, Japan  
Uebo, Tetsuji - WIRE AUTOMATIC DEVICE Co.,Ltd., Japan*

Abstract : The distance to talkers is very important information for both hands-free speech interfaces and nursing-care robots. We have proposed an acoustic distance measurement method based on interference between the transmitted and reflected waves, which can measure distance in a short range. In the present paper, we propose an acoustic distance measurement method based on interference of speech presented by a dialogue system. In a dialogue system, dry sources of presented speech are known. Therefore, we can easily perform voice activity detection (VAD) for presented speech using a phoneme segmentation with a hidden Markov model. The proposed method estimates the distance to talkers in speech segments using the results of VAD. Finally, we confirmed the effectiveness of the proposed method through experiments in real environments.

Session Code : [SP6P.2 - Paper ID 1014](#)

Paper Title : **ACOUSTIC DISTANCE MEASUREMENT METHOD MEASURABLE FROM 0 M BASED ON THE INTERFERENCE BETWEEN TRANSMITTED AND REFLECTED WAVES USING POWER AND PHASE SPECTRA OF SINGLE CHANNEL OBSERVATIONS 680**

Author : *Nakasako, Noboru; Kawanishi, Keiji; Shinohara, Toshihiro; Nakayama, Masato; Uebo, Tetsuji - Kinki University, Japan  
Nakayama, Masato - Ritsumeikan University, Japan  
Uebo, Tetsuji - WIRE AUTOMATIC DEVICE Co.,Ltd., Japan*

Abstract : Since the distance to target is very important information, we have proposed an acoustic distance measurement using a standing wave, which is generated by interference between transmitted and reflected waves. This method is given in a very simple form such that the distance between microphone and target is estimated as a peak value of the range spectrum (i.e., the absolute value of Fourier transform with respect to the power spectrum of the observed wave). However, to measure the short distance, the wide bandwidth of the transmitted wave is required. This paper describes a new distance estimation method measurable from 0 m based on the interference between transmitted and reflected audible sound, especially using only a single microphone (i.e., single channel observations). More concretely, we introduce an analytic signal instead of the

power spectrum and examine the validity and effectiveness of our method through computer simulation and by applying it to an actual sound field with a band-limited impulse sound.

Session Code : [SP6P.3 - Paper ID 0058](#)

Paper Title : **AN IMPROVED TIME DELAY ESTIMATION METHOD BASED ON CROSS-POWER SPECTRUM PHASE 686**

Author : *Kou Wenzhen; Duan Weijun; Li Mingyuan - Northwestern Polytechnical University, China*

Abstract : In the application context of Anti-sniper acoustic detection positioning system, to solve the problems of lower accuracy and larger relative errors which appear when using those common correlation methods, an improved method based on the overlap add window segment and subsection de-noising cross-power spectrum phase is put forward in this paper. The experiments show that this method can improve the accuracy of time delay estimation and reduce the relative errors of six estimated values in the four-element array simultaneously.

Session Code : [SP6P.4 - Paper ID 0030](#)

Paper Title : **A STUDY OF VOICE ONSET TIME FOR MODERN STANDARD ARABIC AND CLASSICAL ARABIC 691**

Author : *Sulaiman S. Aldahri - King Abdulaziz City For Science And Technology, Saudi Arabia*

Abstract : Voice Onset Time (VOT) is an important feature in signal sound. This feature appears only in stop sounds. VOT can be utilized by human auditory system to distinguish between voiced and unvoiced stops such as /p/ and /b/ in case of English. Similarly, VOT can be adopted by digital systems to classify and recognize stop sounds and their carried syllables and words. This paper focuses on computing and analyzing VOT of two main standard Arabic languages and comparing them with other languages. These two main standard languages are Modern Standard Arabic (MSA) and Classical Arabic (CA). We built a database using a carrier word structure of CV-CV-CV. This database was utilized to conduct our experiments. One of the main outcomes of the experiments is that the VOT is always positive regardless of the stop voicing. In addition, we found that the VOT is short for voiced sounds and long for unvoiced sounds. Moreover, the VOT values showed different values for different Arabic dialects.

Session Code : [SP6P.5 - Paper ID 1091](#)

Paper Title : **SECOND ORDER CONE OPTIMIZED UNDERWATER ACOUSTIC CHANNEL FREQUENCY DOMAIN EQUALIZATION 696**

Author : *Zhang, Lingling; Tang, Chengkai; He, Chengbing; Huang, Jianguo - Northwestern Polytechnical University, China*

Abstract : Underwater acoustic channel is assumed to be one of the most challenging communication channels because of its variable multipath effect. To reduce the receiver complexity, we proposed a second order cone optimized underwater acoustic channel frequency domain equalization (SOC-UAFDE), which adjust the equalization coefficients by minimum the mean square error of the frequency domain equalization algorithm through second order cone programming. Meanwhile, to avoid the high peak to average power ratio in orthogonal frequency division multiplexing(OFDM) communication, single carrier block transmission based on pseudo noise(PN) extension is adopted, which shows great advantage in synchronization and channel estimation. Simulation result shows that the proposed algorithm speeds up the convergence and reduces the bit error ratio(BER) effectively.

**SP7L:Signal Processing Algorithms**

Session Code : [SP7L.1 - Paper ID 0082](#)

Paper Title : **MULTI-FOCUS COLOR IMAGE FUSION BASED ON BIVARIATE AND COMPLEX BIDIMENSIONAL EMPIRICAL MODE DECOMPOSITIONS** 358

Author : *Min-Hung Yeh - National Ilan University, Taiwan*

Abstract : Although the empirical mode decomposition has been successfully applied to signal analysis, and the fusion applications, there is currently no efficient solution for color images fusion. This paper proposes a method based upon the combination of the bivariate and the complex bidimensional empirical mode decomposition for color image fusion. The proposed method can have good fusion result and is efficient in computation.

Session Code : [SP7L.2 - Paper ID 1023](#)

Paper Title : **MODIFIED EIGENSPACE PROJECTION APPROACH FOR SIGNAL SEPARATION** 364

Author : *Yuejiao Hui; Jianguo Huang; Zhe Wei - Northwestern Polytechnical University, China*

Abstract : For multiple targets signal separation problem, the separation effect will degrade dramatically with the existence of the signal steering vector error. To solve this problem, a modified eigenspace projection beamforming algorithm (MESB) is proposed and applied in the signal separation issue in this paper. First, a more accurate covariance matrix estimate is obtained based on a shrinkage method according to the MMSE criterion. Then, the signal steering vector is projected onto the signal subspace which is estimated from the eigenvectors of the enhanced covariance matrix, and a calibrated steering vector of the desired signal is obtained corresponding to the signal direction with the biggest projection value. Finally, the robust adaptive beamformer weight is obtained from the estimated covariance matrix and the calibrated steering vector. Simulation results show that compared with traditional methods, the MESB approach has greater output SINR and similarity coefficient, robustness has also been better improved, which could separate the desired target signal more accurately.

Session Code : [SP7L.3 - Paper ID 1038](#)

Paper Title : **FINITE RATE OF INNOVATION WITH NON-UNIFORM SAMPLES** 369

Author : *Wei, Xiaoyao; Blu, Thierry; Dragotti, Pier-Luigi - The Chinese University of Hong Kong, China*

Abstract : In this paper, we investigate the problem of retrieving the innovation parameters (time and amplitude) of a stream of Diracs from non-uniform samples taken with a novel kernel (a hyperbolic secant). We devise a non-iterative, exact algorithm that allows perfect reconstruction of 2K innovations from as few as 2K non-uniform samples. We also investigate noise issues and compute the Cramer-Rao lower bounds for this problem. A simple total least-squares extension of the algorithm proves to be efficient in reconstructing the location of a single Dirac from noisy measurements.

Session Code : [SP7L.4 - Paper ID 1034](#)

Paper Title : **SURE-BASED MOTION BLUR ESTIMATION** 373

Author : *Xue Feng; Blu Thierry - The Chinese University of Hong Kong, China*

Abstract : We propose a novel approach to estimate the parameters of motion blur (blur length and orientation) from an observed image. The estimation of the motion blur parameters is based on a novel criterion --- the minimization of an unbiased estimate of a filtered MSE ("blur-SURE"). By finding the best Wiener filter for this criterion, we automatically find the blur parameters with high accuracy. We then use these parameters in a recent (non-blind) deblurring algorithm that we have proposed and that achieves the state-of-the art in deconvolution. The results obtained are quite competitive with other standard algorithms under various range of scenarios: high noise level, short blur length, etc.

Session Code : [SP7L.5 - Paper ID 1079](#)

Paper Title : **ENHANCED INTEGRATED GRADIENT AND ITS APPLICATIONS TO COLOR DEMOSAICING 378**

Author : *Chung, King Hong; Chan, Yuk Hee - The Hong Kong Polytechnic University, China*

Abstract : In this paper, an effective decision-based demosaicing algorithm for Bayer images is presented. An enhanced edge-sensing measure called enhanced integrated gradient (EIG) is exploited to guide the interpolation along the edges. This measure improves the recently proposed integrated gradient (IG) and hence can support more gradient information from various color intensity and color difference planes under the directional compatibility constraint. An adaptive green plane enhancement which works with the EIG is also proposed to further improve the efficiency of the algorithm.

#### SP7P:Sensor Networks and Multi-channel SP

Session Code : [SP7P.1 - Paper ID 1050](#)

Paper Title : **Study of Improved Fuzzy Control Anti-collision Method 700**

Author : *Wang Xuan; Shen Xiaohong; Yan Yongsheng - Northwestern Polytechnical University, China*

Abstract : There are 37 million blind people in this world which calls for an urgent need of a real-time and intelligent guiding device. Based on the blind's walking characteristics, this paper builds a multi-ultrasonic sensors guiding hardware platform for the blind, proposes an improved anti-collision guiding algorithm based on improved fuzzy control, and realizes the algorithm by programming on the hardware platform. This algorithm uses the distance and orientation information of obstacles gained by multi-sensors as the input of fuzzy logic, and finally gives out the guiding information for the blind as output. It makes full use of all the output information of the fuzzy control. Besides, the algorithm doesn't only provide the blind walking direction information, but also provides the blind walking angle as auxiliary information. Experiment shows that this algorithm can effectively guide the blind people to avoid obstacles.

Session Code : [SP7P.2 - Paper ID 1075](#)

Paper Title : **ROBUSTNESS ANALYSIS OF ADAPTIVE ANTI-JAMMING ALGORITHMS WITH CHANNEL MISMATCH AND MUTUAL COUPLING FOR GNSS SYSTEMS 705**

Author : *Ling Wang; Yuling Li; Shaobo Xu; Wei Zeng; Kun Wei - Northwestern Polytechnical University, China*

Abstract : The robustness of adaptive anti-jamming algorithms in a GNSS receiver will degrade in the presence of channel mismatch and antenna mutual coupling. In this paper, the effects of amplitude-phase errors and antenna mutual coupling on anti-jamming performance based on linearly constrained minimum variance (LCMV) algorithm with two different constraints are analyzed. Computer simulation results show the distinct extent of weakening in beamforming pattern and acquisition ability if different constraints are used.

Session Code : [SP7P.3 - Paper ID 1065](#)

Paper Title : **HIGH DENSITY IMPULSE NOISE REMOVAL BY FUZZY MEAN LINEAR ALIASING WINDOW KERNEL 711**

Author : *Utaminigrum,Fitri; Uchimura,Keiichi; Koutaki,Gou - Kumamoto University, Japan*

Abstract : Fuzzy Mean Linear Aliasing Window Kernel (FMLAWK) filter method proposed to reducing the high-density impulse noise interference and generating the smooth image performance. FMLAWK filter is a spatial filter, which combined from fuzzy method and Linear Aliasing Filter (LAF). The initial step

is finding the degree of membership function (m) value of each matrix element on the corrupted image which use the fuzzy method. Furthermore, the m value of the corrupted image processed by LAF method which using 3x3 window. The reducing of 3x3 windows on LAF process will be obtain one pixel data based on Linear method. Our research also provides kernel algorithms. Preprocessing Kernel algorithm used for checking of each element matrix on the 3x3 window. If the matrix element contaminated by impulse noise, so the matrix element replaced with a new element data. Our simulation result shows the image filtering better and smoother quality than the comparison method.

Session Code : [SP7P.4 - Paper ID 1097](#)

Paper Title : **VIBRATION DATA COMPRESSION IN WIRELESS SENSORS NETWORK 717**

Author : *Alsalaet, Jaafar; Najim, Saleh; Ali, Abduladhem - University of Basrah, Iraq*

Abstract : Wireless sensors networks are acquiring more attention in the last years due to their application in many fields such as health monitoring and machinery fault diagnosis. However, they suffer from limited bandwidth as compared to wired networks or cables which affect their usage in data streaming tasks especially when high sampling rates are required. Therefore, data compression becomes relevant solution not only to increase sampling rates but also to save valuable power. In this work, a Modified Discrete Cosine Transform (MDCT) based compression scheme is proposed to compress vibration signals. Some enhancements to the algorithm of implementation of the MDCT are proposed to make it more suitable to the limited resources of wireless nodes. Three wireless nodes, made by the authors, are employed to host the compression scheme. The accuracy and efficiency of the proposed scheme are investigated by conducting several experimental tests on actual vibration signals generated by a machinery vibration simulator (MVS-1).

#### **SP8L:Multimedia Information Processing**

Session Code : [SP8L.1 - Paper ID 0095](#)

Paper Title : **PROJECTIVE NON-NEGATIVE MATRIX FACTORIZATION WITH BREGMAN DIVERGENCE FOR MUSICAL INSTRUMENT CLASSIFICATION 415**

Author : *Rui Rui; Bao Chang-Chun - Beijing University of Technology, China*

Abstract : In this paper, the projective non-negative matrix factorization (PNMF) with Bregman divergence is applied into the musical instrument classification. A novel supervised learning algorithm for automatic classification of individual musical instrument sounds is addressed inspiring from PNMf with several versions of Bregman divergence. Moreover, the orthogonality of basis matrices between PNMf and conventional non-negative matrix factorization (NMF) is compared. In addition, three classifiers based on nearest neighbors (NN), Gaussian mixture model (GMM) and radial basis function (RBF) are added to evaluate the performance of PNMf classifier. The results indicate that the classification accuracy of the proposed PNMf classifier outperforms the classifiers derived from conventional NMF and machine learning.

Session Code : [SP8L.2 - Paper ID 0098](#)

Paper Title : **AN OBJECT-BASED UNEQUAL ENCRYPTION METHOD FOR H.264 COMPRESSED SURVEILLANCE VIDEOS 419**

Author : *Zhao Yingdi; Zhuo Li; Mao Niansheng; Zhang Jing; Li Xiaoguang - Beijing University of Technology, China*

Abstract : Multimedia information security has become a research hot topic in recent years. In this paper, an object-based unequal encryption method for H.264 compressed surveillance videos is proposed on the basis of bit-sensitivity analysis of bitstream. In the proposed method, moving object detection and segmentation is

performed first, thus location information of the objects can be directly extracted from the H.264 bitstream. Then object regions and background in the surveillance video are encrypted unequally. The bits with the highest sensitivity in the macroblocks covering the object region are thoroughly encrypted while those in the background macroblocks are selectively encrypted. Experimental results have shown that the proposed object-based unequal encryption method is able to effectively ensure the security of surveillance scenes, while the required complexity is low. Furthermore, object detection and encryption are entirely operated in the compressed domain and the output encrypted bitstream remains format-compliant with H.264 standard and the compression ratio can also be maintained.

Session Code : [SP8L.3 - Paper ID 1121](#)

Paper Title : **FACIAL SHAPE AND ALBEDO RECONSTRUCTION BASED ON A TRAINED PROTOTYPE 425**

Author : *Sun Yujuan; Dong Junyu; - Ocean University of China, China  
Jian Muwei; Kin-Man Lam - The Hong Kong Polytechnic University, China  
Sun Yujuan; - Ludong University, China  
Yang Haozhi; - Shandong University At Weihai, China*

Abstract : Facial shape and albedo can be estimated under unknown lighting conditions according to a facial prototype, which is generated by using Photometric Stereo. However, the prototype is seriously affected by shadows, ambient light, and noises. A solution to this problem is to train the prototype based on a facial database. In our algorithm, the facial shape and the albedo of a novel human face under unknown lighting conditions are reconstructed based on the trained prototype and singular value decomposition. Extensive experiments have proven that using our proposed trained prototype is more robust than other methods when a face is under shadow.

Session Code : [SP8L.4 - Paper ID 1016](#)

Paper Title : **MULTIMODAL AFFECT RECOGNITION IN SPONTANEOUS HCI ENVIRONMENT 430**

Author : *Axel Panning; Ingo Siegert; Ayoub Al-Hamadi; Andreas Wendemuth; Dietmar Rosner; J Frommer; G.Krell; B.Michaelis - Otto-von-Guericke University, Germany*

Abstract : Human Computer Interaction (HCI) is known to be a multimodal process. In this paper we will show results of experiments for affect recognition, with non-acted, affective multimodal data from the new Last Minute Corpus (LMC). This corpus is more related to real HCI applications than other known data sets where affective behavior is elicited untypically for HCI. We utilize features from three modalities: facial expressions, prosody and gesture. The results show, that even simple fusion architectures can reach respectable results compared to other approaches. Further we could show, that probably not all features and modalities contribute substantially to the classification process, where prosody and eye blink frequency seem most contributing in the analyzed dataset.

Session Code : [SP8L.5 - Paper ID 1058](#)

Paper Title : **LOW COMPLEXITY SIDE INFORMATION FOR DISTRIBUTED COMPRESSED VIDEO CODING 436**

Author : *Baig, Muhammad Yousuf; Lai, Edmund M-K; Punchihewa, Amal - Massey University, New Zealand*

Abstract : Distributed Video coding based on compressed sensing is considered in this paper. Side information plays an important role in the quality of decoded non-key video frames. Existing systems generate side information based on the decoded key frames and the processes are quite complicated, increasing the computation burden at the decoder. We propose a side information generation method that is founded on the high statistical correlation between compressed

sensing measurements of key frames and non-key frames. The proposed technique is simple and simulation results show that better rate distortion performance can be obtained in comparison with motion compensated interpolation.

#### SP8P:Biometric Identification and Bioinformatics

Session Code : [SP8P.1 - Paper ID 1077](#)

Paper Title : **PERFORMANCE EVALUATION OF L1-NORM-BASED MICROARRAY MISSING VALUE IMPUTATION 723**

Author : *Meng, Fanchi; Cai, Cheng; Li, Shuqin - Northwest A&F University, China*

Abstract : l1-norm minimization was utilized in the imputation of microarray missing values, which is an important procedure in bioinformatics experiments. Two l1 approaches, based on the framework of local least squares (LLS) and iterative bicluster-based least squares (bicluster-iLLS) respectively, were employed. Imputed datasets of the l1 approaches were compared with those of traditional l2 methods. The imputation error rates showed that the assumption of sparsity is not supported by the microarray datasets. Singular value decompositions in biclusters and in the neighborhoods of target genes were computed to show the structure of a microarray dataset. The coefficients of l1 minimization solutions were also analyzed to reveal possible reasons for the performance of l1 approaches.

Session Code : [SP8P.2 - Paper ID 0034](#)

Paper Title : **VIDEO-BASED BIOMETRIC IDENTIFICATION USING EYE TRACKING TECHNIQUE 728**

Author : *Liang, Zhen; Tan, Fei; Chi, Zheru - The Hong Kong Polytechnic University, China*

Abstract : Recently, biometric identification techniques have attracted great attention due to increasing demand of high-performance security systems. Compared with conventional identification methods, biometric techniques provide more reliable and robust solutions. In this paper, a novel video-based biometric identification model based on eye tracking technique is proposed. Inspired by visual attention, video clips are designed for subjects to view in order to capture eye tracking data reflecting their physiological and behavioral characteristics. Various visual attention characteristics, including acceleration, geometric, and muscle properties, are extracted from eye gaze data and used as biometric features to identify persons. An algorithm based on mutual information of features is adopted to perform feature evaluation for obtaining a set of the most discriminative features for biometric identification. Experiments are conducted by using two types of classifiers, Back-Propagation (BP) neural network and Support Vector Machine (SVM). Experimental results show that using video-based eye tracking data for biometric identification is feasible. In particular, eye tracking can be used as an additional biometric modal to enhance the performance of current biometric person identification systems.

Session Code : [SP8P.3 - Paper ID 1036](#)

Paper Title : **PARTICLE SWARM OPTIMIZATION WITH BACKTRACKING IN PROTEIN STRUCTURE PREDICTION PROBLEM 734**

Author : *Nanda Dulal Jana; - National Institute of Technology, Durgapur, India  
Jaya Sil - Bengal Engineering and Science University, India*

Abstract : Several population based search algorithms are developed by the researchers to predict the native state of protein from its primary sequences. The paper aims at predicting the native conformation of proteins in lattice model using PSO based searching method. However, stuck at local minima and generating illegal conformation are the main drawbacks of applying the search algorithm in protein structure prediction. Adaptive Polynomial Mutation (APM) is performed to

remove local minima while illegal conformations are repaired using backtracking method. Benchmark sequences with different length are applied to verify the proposed algorithm showing better results compare to the earlier approaches.

Session Code : [SP8P.4 - Paper ID 1084](#)

Paper Title : **ONLINE MULTISCALE ENTROPY ESTIMATION USING DISTRIBUTION STATISTICS 739**

Author : *Ting, Chuan-Wei; Wang, Ching-Yao - Industrial Technology Research Institute, Taiwan*

Abstract : Multiscale entropy (MSE) is a measurement for quantifying the randomness of a sequence of data. Recently, it has been proven to be the most effective way to analyze the complexity of physiological signals in biomedicine and other fields. The implementation of MSE is computationally expensive because it considers multiple complexities of several data sequences with multiple scales and the computation of entropy for each data sequence is time consuming. A large number of original observed data for computing MSE is necessary because the number of data reduces when the scale increases. We must confirm that the data for each scale is enough to robustly obtain entropy. The large data problem makes MSE difficult for online application of processing sequential data. This paper provides a new online MSE computation method to improve computation efficiency of MSE. Furthermore, we apply distribution statistics in online MSE computation procedure to reduce the storage space of a system. In addition to segmenting the original data sequence into several non-overlapped sliding windows to reduce the data amount of each computation, different kinds of metadata are defined for metadata updating algorithm to accelerate computation time and save storage space. Experiments analyses with electrocardiogram (ECG) revealed that the proposed MSE estimation methods achieved significant improvement of more than 15 times faster than the conventional method for  $N = 60,000$ . Moreover, the proposed method only uses about  $1/500,000$  storage space compared to the conventional method.

#### SP9L: Image Enhancement and Super-resolution

Session Code : [SP9L.1 - Paper ID 0035](#)

Paper Title : **A FAST DYNAMIC RANGE COMPRESSION WITH LOCAL CONTRAST PRESERVATION ALGORITHM FOR LOW DYNAMIC RANGE IMAGE ENHANCEMENT 456**

Author : *Chi-Yi Tsai - Tamkang University, Taiwan*

Abstract : This paper presents a new fast dynamic range compression format with a local-contrast-preservation (FDRCLCP) algorithm to efficiently resolve low dynamic range (LDR) image enhancement problem for natural color images. The proposed FDRCLCP algorithm can combine with any continuously differentiable intensity transfer function to achieve LDR image enhancement. In combination with the FDRCLCP algorithm, a new intensity-transfer function that achieves satisfactory dynamic-range compression while preventing over enhancement in dark regions of the image is proposed. Experimental results validate that the proposed method provides better visual representation in comparison with two existing methods.

Session Code : [SP9L.2 - Paper ID 0064](#)

Paper Title : **A FACE HALLUCINATION ALGORITHM VIA KPLS-EIGENTRANSFORMATION MODEL 462**

Author : *Li, Xiaoguang; Xia, Qing; Zhuo Li; - Beijing University Of Technology, Kin Man Lam - The Hong Kong Polytechnic University Hong Kong, China*

Abstract : In this paper, we present a novel eigentransformation based algorithm for face hallucination. The traditional eigentransformation method is a linear subspace

approach, which represents an image as a linear combination of training samples. Consequently, it cannot effectively represent the relationship between the low resolution facial images and the corresponding high-resolution version. In our algorithm, a Kernel Partial Least Squares (KPLS) predictor is introduced into the eigentransformation model for solving the High Resolution (HR) image form a Low Resolution (LR) facial image. We have compared our proposed method with some current Super Resolution (SR) algorithms using different zooming factors. Experimental results show that our algorithm provides improved performances over the compared methods in terms of both visual quality and numerical errors.

Session Code : [SP9L.3 - Paper ID 0067](#)

Paper Title : **THREE-STEP-APPROACH WITH VALIDATION FOR FACE HALLUCINATION 468**

Author : *Boonim Kanjana - Institute of Physical Education Bangkok Campus Faculty of Sport Science and Health; Sanguansat Parinya - Panyapiwat Institute of Management Faculty of Engineering and Technology Thailand*

Abstract : In this paper, we propose a novel face hallucination framework using validation based on three-step-approach. In order to improve the performance of facial image reconstruction, we included validation in our framework for correcting error. That is the final result should be more accurate than the result before the validation process. In this paper, the 2D framework is applied that means the image can directly process without requiring the vectorization. Moreover, the spatial information can be preserved. Our framework is based on a three-step-approach. In the first step, error of face image reconstruction is learnt from training data set by Bilateral Two Dimensional Principal Component Analysis (B2DPCA). In this step, the validation is obtained from the error of Low-Resolution (LR) and error of High-Resolution (HR). In the second step, the global image is reconstructed by using Maximum a Posteriori (MAP) estimator and the final step is using Regression Model for Tensor (RM-T) to learn from samples data set by applying error regression analysis. The experimental results on a well-known face database demonstrate that the proposed methods can improve the face reconstruction. The results show that our method enhances the resolution and improves the quality of the face hallucination in comparison with the conventional method.

Session Code : [SP9L.4 - Paper ID 1064](#)

Paper Title : **IMAGE ENLARGEMENT USING ADAPTIVE MANIPULATION INTERPOATION KERNEL BASED ON LOCAL IMAGE DATA 474**

Author : *Somawirata, I Komang; Uchimura, Keiichi; Koutaki, Gou - Kumamoto University, Japan*

Abstract : This paper proposed Adaptive Manipulation Interpolation Kernel (AMIK) based on local image data. The adaptive interpolation kernel used closed loop system. The previous output result  $fo'(i,j)$  also be used as reference for the next interpolation calculation. Closed loop applied in the system, if the interpolation system performed between two pixels for horizontal or vertical directions. Furthermore,  $fo'(i,j)$  filtered by Three Mean Median Filter (TMMF). That method used to increase image quality. TMMF is the average value of three median nearest pixels in the 3x3 window size. The test results shown good results compared to the Bilinear, Bicubic, Lanczos 2, Lanczos 3 and Pyramid step. PSNR is the quantitative analysis, which used to measure image performance. Our method has the highest PSNR value in the gray and RGB image, which compared to the comparison methods.

Session Code : [SP9L.5 - Paper ID 0036](#)

Paper Title : **ENHANCING IMAGE OBJECTS RESOLUTION WITH WALSH-CODED SPATIAL-LIGHT MODULATORS EMBEDDED INTO MACH-**

## **ZEHNDER INTERFEROMETRY 479**

Author : *Huang, Jen-Fa; He, Yu-Chang - National Cheng Kung University, Taiwan*

Abstract : In this paper, we use Mach-Zehnder interferometry (MZI) technique to enhance image objects resolution. We take sample's correlation characteristics over Walsh-Hadamard (WH)-coded spatial-light modulator (SLM) to boost the image resolution of sample objects detection. Comparing the spectral interferences with and without WH-coded SLM, we get more contrast difference on the correlation magnitudes. Through with computer simulations, we find that the interference correlations under coded-SLM have a contrast ratio of 2.0 which is larger than the contrast ratio of 1.49 for sample measurement without SLM coding. The image objects resolution enhancement does assured in this paper.

## **SP9P:Detection and Recognition**

Session Code : [SP9P.1 - Paper ID 0102](#)

Paper Title : **FEATURE MATRICIZATION FOR DOCUMENT CLASSIFICATION 745**

Author : *Parinya Sanguansat - Panyapiwat Institute of Management, Thailand*

Abstract : Generally, the dimension of feature vector in text classification depends on the number of words in the specific domain. Many documents of considered categories make it numerous. Therefore, the dimension of feature vector is very high that makes it consumes a lot of time and memory to process. Moreover, it is a cause of the small sample size problem when the number of available training documents is far smaller than the dimension of these feature vectors. This paper proposes the alternative technique of dimensionality reduction for the feature vector in two-dimensional manner by previously transforming the feature vector to the feature matrix and then using Two-Dimensional Principal Component Analysis (2DPCA) for reducing the dimension of this feature matrix. Based on 2DPCA, the original weighted term matrix is not necessary to store in the memory anymore because the scatter matrix of 2DPCA can be computed incrementally. The small reduction in matrix form impacts to the plenty of dimensionality reduction in vector form. From the experimental results on well-known dataset, the proposed method not only significantly reduce the dimensionality but also achieve the higher accuracy rate than the original feature space.

Session Code : [SP9P.2 - Paper ID 1025](#)

Paper Title : **SPEECH RECOGNITION FOR RESOURCE DEFICIENT LANGUAGES USING FRUGAL SPEECH CORPUS 750**

Author : *Ahmed Imran; Kopparapu Sunil - Tata Consultancy Services Ltd., India*

Abstract : Building speech recognition application for resource deficient languages is a challenge because of the unavailability of a speech corpus. Speech corpus is a central element for training the acoustic models used in a speech recognition engine. Constructing a speech corpus for a language is an expensive, time consuming and laborious process. This paper addresses a mechanism to develop an inexpensive speech corpus, for resource deficient languages Indian English and Hindi, by exploiting existing collections of online speech data to build a frugal speech corpus. For the purpose of demonstration we use online audio news archives to build a frugal speech corpus. We then use this speech corpus to train acoustic models and evaluate the performance of speech recognition on Indian English and Hindi speech.

Session Code : [SP9P.3 - Paper ID 0132](#)

Paper Title : **LESION DETECTION OF ELECTRONIC GASTROSCOPE IMAGES BASED ON MULTISCALE TEXTURE FEATURE 756**

Author : *Shen Xing; Sun Kai; Zhang Su - Shanghai Jiaotong University; Cheng Shidan - Shanghai Jiao Tong University, China*

Abstract : Electronic gastroscope has been playing an important role in the examination of gastrointestinal tract. However, due to its great dependence on the doctor's experience and skills, the rate of misdiagnosis is still high. Therefore, an automatic lesion detection system is a huge help for doctors. In this paper, we design a new scheme for gastroscopic image lesion detection. Two new multiscale texture features are utilized and compared which combine contourlet transform with gray level co-occurrence matrix (GLCM) and local binary pattern (LBP) respectively. Combined with color feature and with AdaBoost as a classifier, experiments show that it is promising to utilize the proposed scheme to detect lesions in gastroscopic images. The best performance comes from the combination of color feature and contourlet based local binary pattern feature with false negative rate of 11.94%, false positive rate of 16.10%, and error rate of 13.99%.

Session Code : [SP9P.4 - Paper ID 1051](#)

Paper Title : **A ROBUST VISION-BASED HAND GESTURE RECOGNITION SYSTEM FOR APPLIANCE CONTROL IN SMART HOMES 760**

Author : *Senanayake, Ransalu - Sri Lanka Institute of Information Technology, Sri Lanka*  
*Kumarawadu, Sisil - University of Moratuwa, Sri Lanka*

Abstract : Adopting a hand gesture based appliance control system would be a virtuous idea for smart homes. However, complexity of the home background makes it challenging to work such systems in real home environments. In this paper, we present developing a robust system which can practically be used in complex backgrounds. The users are required to wear neither wristbands nor long-sleeved garments. In order to achieve this, we use TRS moment invariants combined with Viola-Jones object detection framework. We demonstrate the performance of the system in different complex backgrounds by controlling a pedestal fan.

Session Code : [SP9P.5 - Paper ID 0122](#)

Paper Title : **HIGH RESOLUTION DIRECTION-OF-ARRIVAL ESTIMATION BASED ON COMPRESSIVE SENSING WITH NOVAL COMPRESSION MATRIX 764**

Author : *Chen Yufeng; Huang Jianguo; Chengbing He - Northwestern Polytechnical University, China*

Abstract : In this paper, the narrowband DOA estimation problem is studied in compressive sensing (CS) perspective. A novel compression perception model is proposed making use of the spatial sparsity. Two novel approaches for constructing the compression matrix are also presented. The one is to design a new random compression matrix; the other is to apply approximate QR decomposition to form a main diagonal compression matrix. Moreover, singular value decomposition (SVD) is explored on the data matrix in order to lighten computational burden. We also propose two different kinds of methods for direction-of-arrival (DOA) estimation based on new compression matrices: I.CS recovery: QR-SVD-MFOCUSS; II.CS beamforming: Random-SVD CS beamforming (RSVD-CSB) and QR-SVD CS beamforming (QRSVD-CSB). Simulation results demonstrate that the proposed methods possess high resolution, robust to additive noise, reduction computational burden and so on.

Session Code : [SP9P.6 - Paper ID 1008](#)

Paper Title : **A WAVELET TRANSFORM-BASED DETECTION ALGORITHM FOR ELECTROCARDIOGRAM 768**

Author : *Oya, Hidetoshi; Tanaka, Kosuke; Hirose, Katsuhiro; Nakano, Kazushi; Yamaguchi, Yoshihiro; Miyauchi, Hiroshi - The University of Tokushima, Japan*

Abstract : Sudden cardiac arrest is a major public health problem and Ventricular Fibrillation (VF) is the serious arrhythmic event in most of patients suffering

from sudden cardiac arrest. For this serious arrhythmic event, the timely employment of an electrical defibrillator may lead to successful results. Ventricular fibrillation (VF) is the most serious variety of arrhythmia which requires accurate and quick detection to save lives, and a pivotal component in automated external defibrillators (AEDs) is the detection of VF signal by means of appropriate detection algorithm. In this paper, on the basis of Continuous Wavelet Transform (CWT) we propose a wavelet transform-based detection algorithm for electrocardiograms (ECG) such as sinus rhythm (SR), VF and so on.

Session Code : [SP9P.7 - Paper ID 0061](#)

Paper Title : **A REAL-TIME TARGET DETECTION ALGORITHM FOR INFRARED SEARCH AND TRACK SYSTEM BASED ON ROI EXTRACTION 774**

Author : *Wang Weihua; He Yan; Li Zhijun; Chen Zengping - National University of Defence Technology, China*

Abstract : With regard to the difficulties confronted in the target detection of circumferential scan infrared search system, such as large image data quantity, low detection probability of weak target, high false detection rate, et al. a real-time target detection algorithm is proposed based on region of interest (ROI) extraction. Firstly, it extracts the ROI of the suspected targets by quick real-time algorithm in the whole panorama image, based on the high frequency and movement characteristics of the target pixels. And then, focusing on the suspected target sliced images of ROI, it has further delicate detection and recognition to exclude those false jamming. The detection result of the test images shows, the algorithm has realized stable detection with low-rate false alarm for distant dim targets, and has been applied to the engineering sample of the Panorama Infrared Search and Tracking system.

### Special Sessions

#### **SS1L:Emerging Signal Processing Applications in Healthcare and Life Sciences**

Session Code : [SS1L.1 - Paper ID 1074](#)

Paper Title : **RESEARCH ON MEDICAL IMAGE RETRIEVAL BASED ON TEXTURE FEATURE 51**

Author : *Wang Mingquan; Cai Guohua; Zhang Shi - Northeastern University, China*

Abstract : Feature extraction is one of the most important steps in content-based medical image retrieval (CBMIR). In this paper, we propose a new method of improved Gray Level Co-occurrence Matrix (GLCM). In this method, we apply the Gradient Phase Mutual Information (GP-MI) combined with the method of masked image to overcome the shortcoming that the traditional GLCM is impacted greatly by the rotation angle and the background region. The method of GP-MI is applied to compute the angle between two images and the method of masked image is applied to remove the background of the image. After these two steps, we divide the image into several blocks equally and calculate the GLCM of every block. Then we sum the GLCM of every block by different weights as the final texture feature. Lastly medical image retrieval was executed according to the similarity calculation. The results of the test indicate that the proposed method has a promising effect.

Session Code : [SS1L.2 - Paper ID 1046](#)

Paper Title : **CHARACTERIZATION OF SURFACE EMG WITH CUMULATIVE RESIDUAL ENTROPY 55**

Author : *Cai Yin; Shi Jun; Zhong Jin - Shanghai University, China  
Wang Fei - IBM Almaden Research Center, China  
Hu Yong - The University of Hong Kong, China*

Abstract : The cumulative residual entropy (CREn) is an alternative measure of uncertainty in a

random variable. In this paper, we applied CREn as a feature extraction method to characterize six hand and wrist motions from four-channel surface electromyography (SEMG) signals. For comparison, fuzzy entropy, sample entropy and approximate entropy were also used to characterize the SEMG signals. The support vector machine (SVM) and linear discriminant analysis (LDA) were used to discriminate six hand and wrist motions in order to evaluate the performance of different entropies. The experimental results indicate that the CREn-based classification outperforms other entropy based methods with the best classification accuracy of is  $97.17 \pm 1.97\%$  by SVM and  $93.56 \pm 4.13$  by LDA. Furthermore, the computational complexity of CREn is lower than those of other entropies. It suggests that CREn has the potential to be applied as an effective feature extraction method in the control of SEMG-based multifunctional prosthesis.

Session Code : [SS1L.3 - Paper ID 1090](#)

Paper Title : **IN VIVO BEHAVIOR OF HUMAN MUSCLE DURING ISOMETRIC RAMP CONTRACTION: A SIMULTANEOUS EMG, MMG AND ULTRASONOGRAPHY INVESTIGATION 59**

Author : *Ni, Dong; Chen, Xin; Yi, Wanguan; - National-Regional Key Technology Engineering Laboratory for Medical Ultrasound, Shenzhen, China; Zheng, Yong-Ping - The Hong Kong Polytechnic University, China; Zhu, Zhenyu; Chan Shing-Chow - The University of Hong Kong, China*

Abstract : The purpose of this study was to investigate the electromyography (EMG), mechanomyography (MMG), and the muscle architecture, i.e. cross-sectional area (CSA), amplitude versus torque relationships during voluntary isometric ramp contractions. The ultrasound images, EMG and MMG signals were simultaneously recorded from the rectus femoris (RF) muscle. A novel image processing algorithm was developed to automatically extract cross-sectional area (CSA) from ultrasound images. The root mean square (RMS) amplitudes of the EMG and MMG were computed on adjacent epochs in synchronization with the ultrasound images. Polynomial regression analyses indicated that both EMG and MMG amplitudes increased and CSA decreased curvilinearly with torque increment, and the change fashion of CSA was significantly different from those of EMG and MMG. The results demonstrated that the continuous change of CSA can provide useful information about muscle contractions. It may therefore complement EMG and MMG for studying muscle activation strategies.

Session Code : [SS1L.4 - Paper ID 1047](#)

Paper Title : **A P300-SPELLER BASED ON EVENT-RELATED SPECTRAL PERTURBATION (ERSP) 63**

Author : *Ming Dong; An Xingwei; Wan Baikun; Qi Hongzhi- College of Precision Instruments and Optoelectronics Engineering, Tianjin University, China; Zhang Zhiguo; Hu Yong - Chinese Academy of Medical Sciences & Peking Union Medical College, China; Zhang Zhiguo - The University of Hong Kong, China*

Abstract : **A P300-SPELLER BASED ON EVENT-RELATED SPECTRAL PERTURBATION (ERSP)** Dong Ming<sup>1</sup>, Xingwei An<sup>1</sup>, Baikun Wan<sup>1</sup>, Hongzhi Qi<sup>1</sup>, Zhiguo Zhang<sup>3</sup>, Yong Hu<sup>2</sup> <sup>1</sup> Department of Biomedical Engineering, College of Precision Instruments and Optoelectronics Engineering, Tianjin University, Tianjin, China <sup>2</sup> Institute of Biomedical Engineering, Chinese Academy of Medical Sciences & Peking Union Medical College <sup>3</sup> Department of Electrical and Electronic Engineering, University of Hong Kong, Hong Kong, China **ABSTRACT** A brain-computer interface (BCI) P300 speller is a novel technique that helps people spell words using the electroencephalography (EEG) without the involvement of muscle activities. However, only time domain ERP features (P300) are used for controlling of the BCI speller. In this paper, we investigated the time-frequency EEG features for the P300-based brain-computer interface speller. A signal preprocessing method integrated ensemble average, principal component analysis, and independent component analysis to remove noise and artifacts in the EEG data. A time-frequency analysis based on wavelet transform was carried out to extract event-related spectral perturbation (ERSP) and inter-trial coherence (ITC) features. Results showed that the proposed signal processing method can effectively extract EEG time-frequency features in the

P300 speller, suggesting that ERSP and ITC may be useful for improving the performance of BCI P300 speller. Index Terms— Brain-computer interface, event-related potentials, event-related spectral perturbation; inter-trial coherence, P300

Session Code : [SS1L.5 - Paper ID 1041](#)

Paper Title : **DETECTION OF PAIN FROM NOCICEPTIVE LASER-EVOKED POTENTIALS USING SINGLE-TRIAL ANALYSIS AND PATTERN RECOGNITION 67**

Author : *Hu Li - Southwest University, Chongqing, China; Zhang Zhiguo - The University of Hong Kong, China*

Abstract : Pain is an unpleasant multidimensional experience, which could be largely influenced by various peripheral and cognitive factors. Therefore, the pain experience and the related brain responses exhibit high variability from time to time and from condition to condition. The availability of an objective assessment of pain perception would be of great importance for both basic and clinical applications. In the present study, we combined single-trial analysis and pattern recognition techniques to differentiate nociceptive laserevoked brain responses (LEPs) and resting electroencephalographical recordings (EEG). We found that quadratic classifier significantly outperformed linear classifier when separating LEP trials from resting EEG trials. Across subjects, the error rates of quadratic classifier, when it was tested on all trials (I1+I2), trials with low ratings (I1), and trials with high rating (I2), are respectively  $17.5\pm 3.5\%$ ,  $20.6\pm 4.3\%$ , and  $9.1\pm 4.9\%$ .

### SS2L:Advanced Technology on Distant Speech Capturing for Human Listening and Automatic Speech Recognition

Session Code : [SS2L.1 - Paper ID 1125](#)

Paper Title : **ROBOT AUDITION FOR DYNAMIC ENVIRONMENTS 125**

Author : *Kazuhiro Nakadai; Gokhan Ince; Keisuke Nakamura; Hirofumi Nakajima - Honda Research Inst. Japan Co., Ltd., Japan*

Abstract : This paper addresses robot audition for dynamic environments, where speakers and/or a robot is moving within a dynamically-changing acoustic environment. Robot Audition studied so far assumed only stationary human-robot interaction scenes, and thus they have difficulties in coping with such dynamic environments. We recently developed new techniques for a robot to listen to several things simultaneously using its own ears even in dynamic environments; Multiple Signal Classification based on Generalized Eigen-Value Decomposition (GEVD-MUSIC), Geometrically constrained High-order Decorrelation based Source Separation with Adaptive Step-size control (GHDSS-AS), Histogram-based Recursive Level Estimation (HRLE), and Template-based Ego Noise Suppression (TENS). GEVD-MUSIC provides noise-robust sound source localization. GHDSS-AS is a new sound source separation method which quickly adapts its sound source separation parameters to dynamic changes. HRLE is a practical post-filtering method with a small number of parameters. ENS estimates the motor noise of the robot by using templates recorded in advance and eliminates it. These methods are implemented as modules for our open-source robot audition software HARK to be easily integrated. We show that each of these methods and their combinations are effective to cope with dynamic environments through off-line experiments and on-line real-time demonstrations.

Session Code : [SS2L.2 - Paper ID 1128](#)

Paper Title : **ON THE IMPACT OF SIGNAL PREPROCESSING FOR ROBUST DISTANT SPEECH RECOGNITION IN ADVERSE ACOUSTIC ENVIRONMENTS 131**

Author : *Klaus Reindl; Yuanhang Zheng; Stefan Meier; Andreas Schwarz; Walter Kellermann - University of Erlangen-Nuremberg, Germany*

Abstract : In this contribution, a two-channel acoustic front-end for robust automatic speech recognition (ASR) in adverse acoustic environments is analyzed. The source signal extraction scheme combines a blocking matrix based on semi-blind source separation, which provides a continuously updated reference of all undesired components separated from the desired signal and its reflections, and a single-channel Wiener postfilter. The postfilter is directly derived from the obtained noise and interference

reference signal and hence, generalizes well-known postfilter realizations. The proposed front-end and its integration into an ASR system are analyzed and evaluated with respect to keyword accuracy under reverberant conditions with unpredictable and nonstationary interferences, and for different target source distances. Evaluating a simplified front-end based on free-field assumptions, an ideal front-end, where knowledge about the true undesired components is assumed, and comparing the proposed scheme with the competitive approach of solely using multistyle training, demonstrates the importance of an adequate signal preprocessing for robust distant speech recognition.

Session Code : [SS2L.3 - Paper ID 1126](#)

Paper Title : **ONLINE SPEECH DEREVERBERATION WITH TIME-VARYING ASSUMPTION OF ACOUSTIC TRANSFER FUNCTIONS FOR TELECONFERENCING SYSTEMS 136**

Author : *Masahito Togami; Yohei Kawaguchi; Nobuo Nukaga - Central Research Laboratory Hitachi Ltd., Japan*

Abstract : This paper deals with an online dereverberation technique for teleconferencing systems, which is robust against fluctuation of acoustic transfer functions (ATFs). The proposed method divides fluctuations into two classes. The first class is instantaneous fluctuation of the ATF of each speaker, e.g. movement of human head. Instead of the time-invariant assumption for the ATF in the conventional dereverberation techniques, the proposed method assumes that the ATF of each speaker is a probabilistic variable, and the dereverberated signal is obtained by integrating out of parameters related with the ATFs. The second class of fluctuations is fluctuation related with turn-taking of the active speaker. To be robust against the turn-taking, the proposed method utilizes multiple parameters which is estimated in different time-periods and selects the best parameter which maximizes the likelihood value at each time-frequency point. Experimental results under time-varying conditions show that the proposed method is effective.

Session Code : [SS2L.4 - Paper ID 1127](#)

Paper Title : **A STATISTICAL OBSERVATION MODEL FOR NOISY REVERBERANT SPEECH FEATURES AND ITS APPLICATION TO ROBUST ASR 142**

Author : *Volker Leutnant; Reinhold Haeb-Umbach - University of Paderborn, Germany Alexander Krueger; - Technicolor, Germany*

Abstract : In this work, an observation model for the joint compensation of noise and reverberation in the logarithmic mel power spectral density domain is considered. It relates the features of the noisy reverberant speech to those of the non-reverberant speech and the noise. In contrast to enhancement of features only corrupted by reverberation (reverberant features), enhancement of noisy reverberant features requires a more sophisticated model for the error introduced by the proposed observation model. In a first consideration, it will be shown that this error is highly dependent on the instantaneous ratio of the power of reverberant speech to the power of the noise and, moreover, sensitive to the phase between reverberant speech and noise in the short-time discrete Fourier domain. Afterwards, a statistically motivated approach will be presented allowing for the model of the observation error to be inferred from the error model previously used for the reverberation only case. Finally, the developed observation error model will be utilized in a Bayesian feature enhancement scheme, leading to improvements in word accuracy on the AURORA5 database.

Session Code : [SS2L.5 - Paper ID 1124](#)

Paper Title : **A RELIABLE DATA SELECTION FOR MODEL-BASED NOISE SUPPRESSION USING UNSUPERVISED JOINT SPEAKER ADAPTATION AND NOISE MODEL ESTIMATION 148**

Author : *Fujimoto, Masakiyo; Nakatani, Tomohiro - Ntt Corporation, Japan*

Abstract : The performance of model-based noise suppression is significantly affected by variations in speaker characteristics and the modeling accuracy of the noise. As regards this problem, the joint processing of speaker adaptation and accurate noise model estimation are crucial factors for improving model-based noise suppression.

However, this joint processing is computationally intractable due to the direct unobservability of clean speech and noise signals in the conventional approach, which incorporates a vector Taylor series-based approach. To overcome this problem, we investigate a way of achieving joint processing by utilizing minimum mean squared error (MMSE) estimates of clean speech and noise. The MMSE estimates allow the flexible estimation of accurate parameters for the joint processing without intractable computation or any approximation. Here, since the MMSE estimates of clean speech and noise include some estimation errors, the estimation errors often degrade the accuracy of parameter estimation. Thus, we also employ a reliable data selection technique based on voice activity detection to estimate the joint processing parameters. The evaluation result reveals that the proposed reliable data selection method successfully improves both parameter estimation and speech recognition accuracy.

Session Code : [SS2L.6 - Paper ID 1129](#)

Paper Title : **AN OPTIMIZED PARAMETRIC MODEL FOR THE SIMULATION OF REVERBERANT MICROPHONE SIGNALS 154**

Author : *Sebastian Gergen; Christian Borss; Nilesh Madhu; Rainer Martin - Institute of Communication Acoustics, Ruhr-University Bochum, Germany*

Abstract : In 2011, Bor? introduced a parametric model for the design of virtual acoustics, which creates a natural sounding virtual environment for applications requiring virtualization e.g., in teleconferencing systems and computer games. In this work we refine this model to make it applicable for the simulation of room acoustics and reverberation to aid in the development of single- and multi-channel audio signal enhancement systems. The model takes early reflections with a frequency-dependent attenuation and the diffuse character of late reverberation with its coherence characteristics into account and provides predefined rooms and reverberation times according to a norm defined by the German Institute for Standardization, to ensure a high degree of realism and usability. Compared to the standard image source model for generating virtual acoustics, the proposed system generates a more realistic virtual acoustic environment.

### SS3L:New Developmentn of AVS I

Session Code : [SS3L.1 - Paper ID 1136](#)

Paper Title : **A TWO STAGE PARALLEL ENCODER SCHEME FOR REAL TIME VIDEO ENCODER 280**

Author : *Dong,Shengfu; Wang, Ronggang; Wang, Zhenyu - Peking University Shenzhen Graduate School, China*  
*Wang Zhihang, Gao Wen - Peking University, China*

Abstract : With the development of hardware technologies, multi-core processor becomes more and more popular. At the same time, the performance of video encoding technologies is greatly improved at the cost of complexity. How to exploit the computing capacity of the multi-core processors efficiently to meet the demand of video encoding technology is a challenging task. Traditional work usually split the frame into slices to enable parallel encoding. But the coding efficiency will lose especially when there are more slices. In this paper, first we propose a two stage real time encoding scheme without splitting the frame into slices. Secondly, some modules in the hybrid video coding scheme, such as interpolation and loop filter, are split into independent modules that can be processed in parallel. A simple and effective task scheduling strategy is also proposed to fully exploit the CPU capacity. Finally, fast algorithms suitable for this architecture are developed. Experimental results show that we can encode the 720p sequence at about 50 fps with little loss in the rate distortion performance

Session Code : [SS3L.2 - Paper ID 1137](#)

Paper Title : **AVS 3D VIDEO STREAMING SYSTEM OVER INTERNET 286**

Author : *Xin.Baicheng; Wang, Ronggang, Zhenyu Wang, Wenmin Wang - Peking University Shenzhen Graduate School, Chenchen Gu, Quanzhan Zheng - Tecent*

*Technology(ShenZhen)Co., Ltd.; Wen Gao - Peking University, China*

Abstract : The progresses on PC based 3D video display technology have made it feasible to provide 3D video streaming service over internet. Compared with 2D video streaming, 3D video streaming system demands more network bandwidth, computing power, and more complex transmission mechanism. There are rarely online 3D video services. In this paper, we describe a 3D video streaming services developed by our team cooperated with CNTV and NVIDIA. The main features of the proposed system are high compression performance of 3D video with low complexity both on processing and transmission. The system has been used to distribute 3D content for the 16th Asian Games Guangzhou.

Session Code : [SS3L.3 - Paper ID 1138](#)

Paper Title : **AVS VIDEO DECODING ACCELERATION ON ARM CORTEX-A WITH NEON 290**

Author : *Wan.Jie; Wang, Ronggang; Hao Lv, Lei Zhang, Wenmin Wang - Peking University Shenzhen Graduate School, Wen Gao - Peking University; Chenchen Gu, Quanzhan Zheng - Tecent Technology(ShenZhen)Co., Ltd., China*

Abstract : Acceleration of Audio Video coding Standard (AVS) Jizhun profile decoder has been proposed for ARM Cortex-A with NEON. Data level parallelism is utilized to effectively use the SIMD capability of NEON. Key modules are redesigned to make them SIMD friendly. Our optimized C implementation is set as start point for the acceleration. Thanks to effective use of ARM Cortex-Ax architecture and NEON SIMD engine, AVS decoding has been accelerated considerably. Results are provided for the overall acceleration in decoding and individual acceleration for key modules of AVS decoder.

Session Code : [SS3L.4 - Paper ID 0128](#)

Paper Title : **A NOVEL METHOD OF VIDEO NOISE ESTIMATION BASED ON MOTION ESTIMATION 295**

Author : *Yin.Wenjie; Zhao.Haiwu - Shanghai University, China*

Abstract : Random noise exists in various kinds of video signals, influencing the efficiency of the image and video signal processing algorithms. A novel method of video noise estimation method based on motion estimation with low computation complexity is given in this paper in order to give a more accurate estimation of the parameters of the Additive Gaussian White Noise (AGWN). Combined with the video encoder, this method can adapt different video signals polluted by noise, with an improved performance of estimation.

## SS4L: New Developmentn of AVS II

Session Code : [SS4L.1 - Paper ID 0140](#)

Paper Title : **MBAFFF, AN ADAPTIVE INTERPOLATION TO AVS VIDEO 341**

Author : *Li, Shao; He, Yun - Tsinghua University, China*

Abstract : Although the MBPAFF technique adopted in AVS X-profile has an explicit coding gain over the MBAFF of H.264/AVC technique, the complexity in implementation remains an issue, especially when the field and frame MacroBlock pairs are randomly distributed. To resolve this problem, we propose a MacroBlock-based Adaptive Field and Frame coding method based on adaptive interpolation using fixed filters (MBAFFF) and thus keep the RD performance of the MBPAFF. The proposed interpolation schemes include directional interpolation and extra interpolation filters which efficiently increase the inter prediction accuracy.

Session Code : [SS4L.3 - Paper ID 1144](#)

Paper Title : **FLEXIBLE SLICE STRUCTURE FOR ROI CODING 345**

Author : *Jianhua Zheng, Xiaozhen Zhen - HiSilicon Technologies Co., Ltd., Shenzhen, China*

Abstract : At current video coding layer, video data can be divided into different coding layers, e.g. sequence, picture, slice and macroblock. A coding layer contains same properties of video data. At slice layer, a certain amount of macroblocks are grouped to a slice,

and coded as raster order within the slice. The slice structure can be used at rate control, error resilience and video transmission areas. Base on the concept of slice, the slice structure is extended at this paper. A so-called slice set structure groups slices that have some same properties together. The slices within a slice set can share and exchange data. Due to this superior feature, the proposed slice set structure can be used at ROI coding, and further improve error resilience capability.

Session Code : [SS4L.3 - Paper ID 1146](#)

Paper Title : **PERCEPTUAL BASED ADAPTIVE FREQUENCY WEIGHTING FOR SUBJECTIVE QUALITY IMPROVEMENT 349**

Author : *Jianhua Zheng, Xiaozhen Zhen - HiSilicon Technologies Co., Ltd., Shenzhen, China*

Abstract : Since different regions in picture have different sorts of texture, non-uniform quantization should be considered in macroblock level to meet the picture content. A parameterized frequency weighting and non-uniform macroblock level weighting scheme is proposed to improve the subjective quality of compressed video. This scheme is targeted to preserve texture details as well as region edge of video content in quantization process, which brings better subjective performance for the high definition video content coding.

Session Code : [SS4L.4 - Paper ID 1145](#)

Paper Title : **ON THE DESIGN AND IMPLEMENTATION OF A HIGH DEFINITION MULTIVIEW INTELLIGENT VIDEO SURVEILLANCE SYSTEM 353**

Author : *S. Zhang; S. C. Chan; K. T. Ng; Y. S. Hung - The University of Hong Kong, China; R. D. Qiu; W. Lu - Tianjin University, China*

Abstract : This paper proposes a distributed architecture for high definition (HD) multi-view video surveillance system. It adopts a modular design where multiple intelligent Internet Protocol (IP)-based video surveillance cameras are connected to a local video server. Each server is equipped with storage and optional graphics processing units (GPUs) for supporting high-level video analytics and processing algorithms such as real-time decoding and tracking for the video captured. The servers are connected to the IP network for supporting distributed processing and remote data access. The DSP-based surveillance camera is equipped with real-time algorithms for streaming compressed videos to the server and performing simple video analytics functions. We also developed video analytics algorithms for security monitoring. Both publicly available data set and real video data that are captured under indoor and outdoor scenarios are used to validate our algorithms. Experimental results show that our distributed system can support real-time video applications with high definition resolution.