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Introduction of Recent Advanced Hybrid Information Processing

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Editorial:

Because of the variety of applications in information time, information processing has acted as an important research part in computer science, signal processing, and many other research domains for decades. Though there are more achievements in this research domain, recently, there are more remaining issues waiting for solving. For example, there are lots existed problems in classification and systemization of hybrid data, processing and content understanding of hybrid multimedia information (speech, text or image), hybrid information compression, classification and recognition of huge online hybrid information, et al. These entire problems need our more attention to solve. Therefore, we need more effective thoughts and methods to solve problems in hybrid information processing. In particular, the uses of sophisticated and robust mathematical methods are also important in huge information processing. Meantime, emerging methods which can improve the efficiency of this domain are also encouraged in this conference.

So, this theme issue is proposed to provide an opportunity for researchers to publish their gifted theoretical and technological studies of advanced method in hybrid information processing, and their novel engineering applications within this domain. The main focus of this issue is for the state-of-the-art advances in the studies and emerging applications in following topics. In this theme issue, 12 in 31 submissions are accepted with accepted ratio 38.9%.

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The first article, "A New Method of Cognitive Signal Recognition Based on Hybrid Information Entropy and D-S Evidence Theory", authored by Yun Lin from Harbin Engineering University, China, proposed a novel automatic modulation recognition of communication and radar signal based on information entropy features and Dempster-Shafer evidence theory (D-S theory) [1]. This method was applied to recognize the modulation in modern complex electromagnetic environment as accurate as possible. Detailedly, by applied Rényi entropy and singular entropy to get the modulation feature of signal, an acquisition method of basic probability assignment (BPA) was presented based on the normal test theory with classifier based on D-S evidence theory. Experiment and simulation results illustrated that the proposed method can get a higher recognition result than traditional methods.

The second article titled "Analysis of Measurement and Application of Digital to Analog Converters for Software Defined Radio Hybrid System", authored by He Yu from Harbin Institute of Technology, China, analyzed the digital to analog (DAC) system based on software defined radio applications [2]. This measurement had the merit of lower power consumption and higher efficiency for communication system with procedure and calibration technique for hybrid signal system. The paper provided a sub-Nyquist rate DAC system with different construction modes to maximized the utilization of the image spectrum and achieved better performance for communication. The two-phase holding reconstruction mode utilized higher order image spectrum by adjusting duty cycle of the two phases.

The third article titled "Data Aggregation Point Placement Problem in Neighborhood Area Networks of Smart Grid", authored by Guodong Wang from South Dakota School of Mines and Technology, USA, investigated the Data Aggregation Point (DAP) placement problem and proposed solutions to reduce the distance between DAPs and smart meters [3]. These DAPs and smart meters consisted to a neighborhood area networks, which was regarded as "the last mile network" and recognized to play a significant role for communications in smart grid by

collected energy consumption or billing information from smart meters and forwarded the information to wide area network gateways via wireless communications. The simulation results verified that the proposed solutions are able to remarkably reduce the communication distance between DAPs and their associated smart meters.

The forth article titled "The Individual Identification method of Wireless Device Based on A Robust dimensionality reduction model of Hybrid Feature Information", authored by Jingchao Li from Shanghai Dianji University, China, provided a robust algorithm to identify the wireless device with fingerprint features by used integral envelope and Hilbert transform theory based PCA analysis algorithm [4]. This algorithm was applied to accurately identify different wireless devices through hybrid information processing method for the Internet of things because of the huge increment of number of mobile, as well as embedded and wearable devices, which was due to the limitations of traditional network security control. When integral envelope and Hilbert transform theory were applied to process signals respectively, principal component features could be extracted by PCA analysis algorithm, and gray relation classifier could be used to identify the signals. Effectiveness of the proposed algorithm was experimentally demonstrated to differentiate between 10 numbers of wireless device with the accuracy in excess of 99%.

The fifth article titled "Information Diffusion Model based on Social Big Data", authored by Yin Zhang from Zhongnan University of Economics and Law and State Key Laboratory for Novel Software Technology, China, described an information diffusion model based on the Weibo platform (a widely used social network platform, through mobile clients or PCs at any time for social interaction), which was used to measure information diffusion based on the extent of reposting on Weibo [5]. The description analyzed the information diffusion of a Weibo post created in the evening, as well as conducted a quantitative analysis on the information diffusion within a particular period of time of night. The analysis targeted user behavior characteristics during that time for further improvement of model's accuracy of the presented information diffusion model based on superposition theory with respect to the participation of key users in the information diffusion process.

The sixth article titled "A Novel Whale Optimization Algorithm for Cryptanalysis in Merkle-Hellman Cryptosystem", authored by Arun Kumar Sangaiah from Vellore Institute of Technology, India, provided MWOA, a novel Modified version of Whale Optimization Algorithm (WOA), for cryptanalysis of Merkle–Hellman Knapsack Cryptosystem (MHKC), one of the most known cryptosystems [6]. This novel algorithm was applied to secure communication between the sender and the receiver because confidentiality of the transmitted information was urgent kept due to the advance of the communication technology and the massive flow of information across the internet today. The novel method used sigmoid function to map the continuous values into discrete one, as well as added penalty function to evaluation function to deal with the infeasible solutions, which were employed for improving the solutions. The results showed that MWOA was more effective and robust than other algorithms in recent literature.

The seventh article titled "A novel hybrid information security scheme for 2D vector map", authored by Ruolin Zhou from Western New England University, USA, proposed a novel hybrid information security scheme for 2D vector map, which was an effective information hiding object that contained a wealth of hybrid information and required verification of authenticity and integrity [7]. This paper first divided features of vector map into disjoint groups to ensure the accuracy of tamper localization. In order to locate the batch features deletion attack, this paper then designed a feature group correlation technique based on vertex insertion, and generated a fragile watermark robust to resist rotation, uniform scaling and translation (RST) operations. Moreover, two datasets were constructed for experimentation by embed the watermark with an RST invariant watermarking method. Experimental results indicated that the proposed scheme had better invisibility and higher tampering localization accuracy on the feature addition and deletion attack than previous methods.

The eighth article titled "DOA estimation to mixed signals in the presence of gain-phase perturbation", authored by Jiaqi Zhen from Heilongjiang University, China, addressed the problem of direction of arrival (DOA) estimation to mixed far-filed and near-field signals in the presence of gain-phase perturbation, which can effectively calculate the DOA of far-field signal (FS) and location of near-field signal (NS) [8]. This estimation was provided because traditional DOA estimation method was very sensitive to the array perturbation, which can not use in real application because there were various errors or perturbations in real application which directly influenced the estimation seriously. The novel estimation simplified spatial spectrum of FS and obtained DOA by roots of corresponding determinant. Then, DOA of NS was acquired through matrix transformation with determined gain-phase perturbation. Simulation results of location estimation demonstrated the effectiveness of the proposed method.

The ninth article titled "A Route Optimized Distributed IP-based Mobility Management Protocol for Seamless Handoff across Wireless Mesh Networks", authored by Irfan Mehmood from Sejong University, Republic of Korea, proposed a Distributed IP-based Mobility Management Protocol (DIMMP) that provided seamless mobility with service continuation for mobile nodes when

they roam across WMNs [9]. This protocol was provided because existing mobility management protocols were designed for single hop networks and centralized, which resulted in service disruption and packet loss when the mobility of mobile nodes crossed access networks in Wireless Mesh Networks (WMNs). This paper provided distributed mobility functionality at multiple nodes in a WMN in order to reduce the chances of potential single point of failure. Simulation results show that this work has contributed by improving the performance of handoff procedure with respect to handoff latency, packet loss and signalling overhead, as compared to the existing protocols.

The tenth article titled "Collaborative Fall Detection Using Smart Phone and Kinect", authored by Xianzhi Wang from Singapore Management University, Singapore, proposed a collaborative detection platform that combined two subsystems: a threshold-based fall detection subsystem using mobile phones and a support vector machine (SVM)-based fall detection subsystem using Kinects [10]. This platform is proposed to increase accuracy of Human-fall detection, which had attracted broad attentions as sensors and mobile devices were increasingly adopted in real-life scenarios and was at a low level because of complexity of activities in home environments. With respective confidence models of the two subsystems, the platform detected falls by fusing the data of both subsystems using logical rules-based and D-S evidence fusion theory-based methods. This detection approach achieved the best accuracy of 100% by compared with two confidence models based on mobile phone and Kinect which achieved accuracy of 84.17% and 97.08%.

The eleven article titled "Internet Traffic Classification Based on Incremental Support Vector Machines", authored by Chenglong Li from National Computer Network Emergency Response Technical Team/Coordination Center of China (CNCERT/CC), China, introduced incremental support vector machine (ISVM) model to reduce the high training cost of memory and CPU, as well as realize traffic classifier's high-frequency and quick updates [11]. Moreover, the model AISVM, which was modified with attenuation factor of ISVM, was used to utilize valuable information in the previous training data sets. These models were applied to solve limitations of traditional SVMs-based traffic classifier, which were generally impractical applied with high training complexity and computation cost on both memory and CPU. Experimental results had proved the effectiveness of ISVM and AISVM models in traffic classification.

The twelve article titled "Gesture recognition based on Kinect and sEMG signal fusion", authored by Gongfa Li from Wuhan University of Science and Technology, China and Zhigao Zheng from Huazhong University of Science and Technology, China, proposed a weighted fusion method of D-S evidence theory in decision making to aim at the problem of lacking in the distribution of trust, data processing and precision in D-S evidential theory [12]. This method of gesture recognition based on Kinect and sEMG signal were established by used weighted D-S evidence theory to fuse Kinect and sEMG signals. Stimulation results showed that the decision fusion method based on weighted D-S evidence theory had higher utilization efficiency and recognition rate by compared other experimental methods.

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