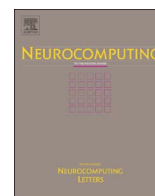




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Editorial

Editorial: recent research in medical technology based on multimedia and pattern recognition

Nowadays, Multimedia and Pattern Recognition based medical technology is becoming a hot topic, which can explore and utilize multimedia information from multiple sources, including video streams, images, voice, heartbeat and blood pressure data. Based on these kinds of technologies, medical device is able to percept, process in real-time, analyze and evaluate multi-source and multi-dimensional data, thus has been widely used in disease diagnosis, rehabilitation, health monitoring, assisted surgery and other medical area. Many of these applications require the multimedia and pattern recognition paradigm using medical sensors. The notion of neurocomputing is becoming a reality with the development of variety of multimedia technologies. The intelligence functions of multimedia and pattern recognition technologies can be applied to Smart Hospital, Smart Clinic, Smart Medical Application for Individual. Accordingly, the assessment and evaluation methods need to be developed and involved into the iterative designing process.

Remote medical resources configuration and management involves complex combinatorial Multi-Objective Optimization problem, whose computational complexity is a typical NP problem. Based on the MOEA/D framework, **'A MOEA/D-based Multi-objective Optimization Algorithm for Remote Medical'** applies the two-way local search strategy and the new selection strategy based on domination amount and proposes the IMOEA/D framework, following which each individual produces two individuals in mutation. By using a new selection strategy, the parent individual is compared with two mutated offspring individuals, and the more excellent one is selected for the next generation of evolution. The proposed algorithm IMOEA/D is compared with eMOEA, MOEA/D and NSGA-II, and experimental results show that for most test functions, IMOEA/D proposed is superior to the other three algorithms in terms of convergence rate and distribution.

Unmarked tracking of hands and fingers is a promising enabler for human-computer interaction. It can also be applied to medical monitoring and handicap aids. This will give much help to the deaf-mutes who have trouble in communicating with others or interact with the computers. **'3D character recognition using binocular camera for medical assist'** presents a 3D hand tracking and character recognition algorithm using binocular stereo camera, which can get the crucial depth information of the target. To precisely understand the characters that the user writes in the air, an effective gesture is defined indicating that the user is inputting useful information and a null gesture indicating that corresponding movements are not necessary in the characters. The proposed approach can adapt to angle variation and make the writing freer. It shows the benefits of proposed method by evaluating on several videos.

An accurate determination of the network structure of gene regulatory systems from high-throughput gene expression data is an essential yet challenging step in studying how the expression of endogenous genes is controlled through a complex interaction of gene products and DNA. While numerous methods have been proposed to infer the structure of gene regulatory networks, none of them seem to work consistently over different data sets with high accuracy. A recent study to compare gene network inference methods showed that an average-ranking based consensus method consistently performs well over various settings. **'Learning gene regulatory networks from gene expression data using weighted consensus'** proposes a linear programming-based consensus method for the inference of gene regulatory networks. Unlike the average-ranking-based one, which treats the contribution of each individual method equally, the new consensus method assigns a weight to each method based on its credibility. The results show that proposed weighted consensus method achieves superior performance over the unweighted one, suggesting that assigning weights to different individual methods rather than giving them equal weights improves the accuracy.

Contrast sensitivity function (CSF), which is a quick and valid index to measure human visual performance, can be applied into medical monitoring and various retinal disease diagnosis. However, there is a lack of researches on CSF in three-dimensional (3D) space. In **'Research on medical applications of contrast sensitivity function to red-green gratings in 3D space'**, CSF of human color vision to red-green chromatic gratings in 3D space is fully investigated. Based on the typical chromatic contrast sensitivity test system, in which the screen is parallel to human face, four inclined planes in 3D space are taken into consideration. Contrast thresholds for chromatic gratings of inclined planes are measured within 20 individual subjects. Experimental results show that the contrast sensitivity of each inclined plane is a low-pass function for red-green gratings. In order to fully utilize chromatic contrast sensitivity in 3D space, a visual model of red-green contrast sensitivity in 3D space is well fitted. Simulation results demonstrate that the proposed model achieves high consistency with human chromatic visual characteristics.

With the advent of multimedia and pattern recognition based medical technology, intelligence medical applications in smart hospital, smart clinic, and smart medical for individual, such as disease diagnosis, rehabilitation, health monitoring, and so on, have received extensive attentions. However, the communication infrastructure of supporting these applications is facing a larger challenge. **'Maximum Connectivity-Based Channel Allocation Algorithm in Cognitive Wireless Networks for Medical Applications'** studies the channel allocation problem in

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cognitive wireless networks for these medical applications. Channel allocations are of importance for cognitive wireless networks. How to assign the appropriate channels to each cognitive user is fairly challenging. Here this problem is studied by combining collaborations of network nodes.

The protein structure classification problem, which is to assign a protein structure to a cluster of similar proteins, is one of the most fundamental problems in the construction and application of the protein structure space. The authors observed that the SCOP superfamilies are highly consistent with clustering trees representing hierarchical clustering procedures, but the tree cutting is very challenging and becomes the bottleneck of clustering accuracy. To overcome this challenge, **'K-nearest uphill clustering in the protein structure space'** proposed a novel density-based K-nearest uphill clustering method that effectively eliminates noisy pair-wise protein structure similarities and identifies density peaks as cluster centers. Specifically, the density peaks are identified based on K-nearest uphill (i.e., proteins with higher densities) and K-nearest neighbors. The results show that proposed density-based clustering method outperforms the state-of-the-art clustering methods previously applied to the problem.

Hybrid load in e-health services is composed of online e-health service applications and offline jobs. Previous methods overlooked the impact of system performance for the fine-grained service components. In **'Effective Hybrid Load Scheduling of Online & Offline Clusters for E-health Service'**, a hybrid load scheduling scheme is proposed in which scheduling is performed not only at the level of the component, but also within components. To improve both execution efficiency and searching accuracy, the proposed algorithm searches the compressing method of the Lucene index and then filters that index. Simulations are conducted on a storm platform to evaluate the performance of the proposed scheme. Simulation results demonstrate that the proposed scheme can increase the response speed by 67.79% with an accuracy of 95.94%, and the response speed decreases by 11.6–53.2%.

Cardiovascular disease has become an increasingly serious threat to human health. Holter monitoring is essential in the prevention and treatment of cardiovascular disease. When combined with a variety of sensors, a traditional Holter becomes a mobile health device. Based on Holter data and sensor data, **'Smart assisted diagnosis solution with multi-sensor Holter'** proposes a supplementary diagnosis and treatment program. With the help of these components, the innovative approach is able to integrate the Holter data and sensor data, meanwhile, doctors are encouraged to participate in the process of clustering algorithm.

Wireless sensor networks are utilized in medical area to gather multimedia information from multiple sources, such as video streams, images, voice, heartbeat and blood pressure data, which call for higher bandwidth and more available spectrum. To solve the distributed power control issues in CWSN with imperfect information, in **'A Game-Theoretic Power Control Mechanism Based on Hidden Markov Model in Cognitive Wireless Sensor Network with Imperfect Information'** a game-theoretic power control mechanism based on Hidden Markov Model (HMM) is proposed according to the difference and independence of channel sensing results among users of cognitive wireless sensor network (UCWSNs). UCWSNs can use HMM to infer whether its competitors take part in the game, which improves the information accuracy of game and leads to an optimal transmission power.

'Localized Active Contour Model with Background Intensity Compensation Applied on Automatic MR Brain Tumor Segmentation' presents a Localized Active Contour Model (LACM) integrating an additional step of background intensity compensation. The region-based active contour models that use statistical intensity information are more sensitive to the high mean intensity distance between consecutive regions. In Magnetic Resonance Imaging (MRI) this distance is great between the foreground and the background, hence it leads to an incorrect delineation of the target. In order to resolve this problem, an automatic process is introduced in the proposed model for balancing the mean intensity distance between an image foreground and its background. The aim is to minimize the attraction effect of the active contour model to the undesired borderlines defined by these two mentioned image regions. By using this approach not only the obtained accuracy outperforms the traditional localized mean separation active contour model, but also it reduces the computation time of the segmentation task. The computation time of the methods was also measured for comparison purposes. The obtained results show that the proposed model outperforms the accuracy of the selected state of the art methods. Moreover, it is also faster than the comparative methods in the medical image segmentation task.

Computer-Aided Diagnosis (CAD) of Alzheimer's disease (AD) has drawn the attention of computer vision research community over the last few years. Several attempts have been made to adapt pattern recognition approaches to specific neuroimaging data such as Structural MRI (sMRI) for early AD diagnosis. The proposed strategy in **'Recognition of Alzheimer's Disease and Mild Cognitive Impairment with multimodal image-derived biomarkers and Multiple Kernel Learning'** is to boost the discrimination power of such approaches by integrating complementary imaging modalities in a single learning framework. The results indicate that the proposed multimodal approach yields significant improvement in accuracy over using each single modality independently. The classification accuracies obtained by the proposed method are 90:2%, 79:42% and 76:63% for respectively AD versus NC, MCI versus NC and AD versus MCI binary classification problems. For the MCI classification problem, the proposed fusion framework leads to an average increase about at least 9% for the accuracy, 5% for the specificity and 15% for the sensitivity.

Visual tracking is a fundamental research topic in computer vision community, which is of great importance in many application areas including augmented reality, traffic control, medical imaging and video editing. **'Ordered Over-relaxation based Langevin Monte Carlo Sampling for Visual Tracking'** presents an ordered over-relaxation Langevin Monte Carlo sampling (ORLMC) based tracking method within the Bayesian filtering framework, in which the traditional object state variable is augmented with an auxiliary momentum variable. At the proposal step, the proposal distribution is designed by simulation of the Hamiltonian dynamics. The proposed tracking method could ensure that the tracker will not be trapped in local optimum of the state space. Experimental results show that the proposed tracking method successfully tracks the objects in different video sequences and outperforms several conventional methods.

In order to effectively exploit the intra-class and inter-class structure information, a new class-wise dictionary learning method for hyperspectral image classification is proposed in **'Class-wise dictionary learning for hyperspectral image classification'**. The experimental results obtained on two hyperspectral datasets demonstrate that the proposed method can obtain higher classification accuracy with much lower computational cost compared with other traditional classifiers.

Both subspace learning methods and feature selection methods are often used for removing redundant information and irrelative features from high dimensional data sets. Studies have shown that feature selection methods have interpretation ability and subspace learning methods always output stable performance. **'Graph Self-representation method for Unsupervised Feature Selection'** proposes a new unsupervised feature selection by integrating a subspace learning method (i.e., Locality Preserving Projection (LPP)) into a novel feature selection method (i.e., a sparse feature level self-representation method), aim at simultaneously receiving stable performance and interpretation ability. Different from traditional sample-level self-representation where each sample is represented by all samples and has been popularly used in machine learning and computer vision. The experimental results showed that the proposed approach outperformed all comparison algorithms.

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