

Efficient Approaches to Computer Vision and Pattern Recognition

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1. Introduction

The *Journal of Information Processing Systems* (JIPS) publishes a wide range of topics related to a wide variety of advanced information and communication technologies, including systems, networks, architectures, algorithms, applications, and security. JIPS is the official international journal published by the Korea Information Processing Society and is the world's leading academic journal indexed by ESCI, SCOPUS, EI COMPENDEX, DOI, DBLP, EBSCO, Google Scholar, and CrossRef. The purpose of JIPS is to provide an outstanding, influential forum where researchers and experts gather to promote, share, and discuss crucial research issues and developments. The published theoretical and practical articles contribute to the relevant research area by presenting cutting-edge techniques related to information processing including new theories, approaches, concepts, analysis, functional experience reports, implementations, and applications. Topics covered in this journal include, but are not limited to, computer systems and theory, multimedia systems and graphics, communication systems and security, software systems, and applications.

This issue features 25 diverse peer-reviewed papers addressing the area of computer vision and pattern recognition, such as image retrieval, image restoration, object tracking, speech recognition, camera collaboration, text processing and so forth. It also describes novel approaches including Internet of Things, graph analysis, genetic algorithm, security, and wireless networks. In addition, the papers propose experience reports and experiments that involve the implementation and application of new theories on state-of-the-art technologies related to information processing systems.

2. Related Works

Jiang et al. [1] suggested a novel approach to text advertising based on the Deep Neural Network. The general payment method of text advertising on the Internet uses cost per click (CPC) [2]. In the CPC model, the click-through rate (CTR) is an important index for measuring the effect of advertising

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placement. CTR prediction for Internet text advertising is one of the complicated matters due to the tripartite properties of advertisement, user, and context environment. In this paper, their approach applies greedy layer-by-layer for pre-learning without supervision to construct automatic stack autoencoder (SAE) for extracting the abstract characteristics of the original input data. Then, those features regarded as input for the logistic regression model in the deep neural network and the click-through rate of the user to the advertisement under the context environment can be obtained. According to their experiments, the proposed approach can process CTR prediction efficiently compared with other methods.

The most widely known technique among multiple-input multiple-output (MIMO) techniques for achieving full diversity is the orthogonal space-time block code (OSTBC) and transmit antenna selection (TAS) schemes [3,4]. Lee et al. [5] proposed SDF-OSTBC/TAS, which is designed to achieve asymptotically performance identical to DF-TAS while requiring lower feedback overhead. Their proposal describes a selective relaying scheme that uses OSTBC and TAS with maximal-ratio combining (MRC) or vice versa at the first and second hops, respectively. The selection criteria are based on the antenna configuration and average channel powers for the first and second hops assuming Rayleigh fading channels.

As we know, software testing is an important part in producing reliable software systems and maintaining quality control. According to statistical analysis, more than 50% of software development resources are being spent on testing [6]. Sabharwal and Aggarwal [7] proposed an approach to software testing generating pairwise test sets based on genetic algorithms. Such proposed approach is capable of covering all of the pairwise interactions of the input set in a lesser number of generations. Two mutation strategies including value occurrences and pair occurrences mutation have been applied to this approach, and those are modified to improve their efficiency using a similarity matrix (overlap coefficient).

Pechsiri et al. [8] proposed a method of extracting ObjectProperty-UsageMethod relation from documents, particularly the HerbalMedicinalProperty-UsageMethod relation of the herb-plant object. It may be dangerous to apply a different treatment to patients despite the same herbal medicine. Thus, this relation between herbal medicine and usage method is an important issue for proper treatment. It can cause side effects or health problems due to inconsistent treatment/solution knowledge. This paper proposes N-Word-Co on the verb phrase with the medicinal-property/usage-method concept to solve those problems, where the N-Word-Co size is determined by the learning of maximum entropy, support vector machine, and naïve Bayes. This proposal is based on two related sets—herbal-medicinal-property concept set and usage-method concept set—from several web documents to extract semantic relation.

Kwon and Shin [9] presented 3D segmentation for high-resolution image datasets for medical service applications. This paper focuses on the dataset of the Visible Korean project in Korea. The purpose of this project is to make high-resolution image datasets to prepare MRIs, CTs, sectioned images, and segmented images, which are reconstructed to build 3D images. Those images would be the source of virtual dissection, virtual operation, and virtual endoscopy to contribute in the medical, informatics, and industrial fields [10]. Such image segmentation is an important issue in the computer vision area to identify meaningful regions from the target images. Still, it is a new and challenging technique in high-resolution color 3D images, because conventional methods have been based on gray value and shape in the 2D image. The proposed method can segment significant regions in the coronal and sagittal planes

from the 3D image, verifying the performance interactively with a multi-planar reconstruction view and a 3D view.

Iswarya and Radha [11] proposed a new approach to speech query recognition using wavelet packet; they called it combined thresholding for noise removal. It concentrates on improving the mel frequency cepstral coefficients (MFCC) features by introducing discrete wavelet packet transform (DWPT) in place of the discrete Fourier transformation (DFT) block to provide efficient signal analysis. Since the feature vectors vary in size, this paper uses self-organizing map (SOM) to select the exact length of the feature vector. Moreover, they propose an ensemble support vector machine (ESVM) classifier that provides a fixed length property vector from SOM because a single classifier does not provide sufficient accuracy. The experimental results showed that the proposed method provides better results than the conventional method.

Xu [12] presented an algorithm based on complete improved extension rule (CIER) to solve the satisfiability problem in artificial intelligence. Improving the efficiency of AI is a similar issue in solving the satisfiability problem. The efficiency of ER algorithm depends on atom number m and clause number. Therefore, the efficiency of algorithm ER can be improved by reducing “ m ” and “ n ” with DPLL (Davis–Putnam–Logemann–Loveland) rules. Moreover, this proposal has the MOAMD (maximum occurrences and maximum difference) strategy for CIER to acquire better arrangement of atoms.

Hao et al. [13] described a novel approach to graphs analysis using similarity evaluation between graphs based on formal concept analysis. As we know, similarity evaluation between graphs is a popular issue in many fields such as graph searching, pattern recognition, neuroscience, machine learning and so forth [14]. The concept of this approach is able to distinguish the relationships between nodes and reveal the similarity between graphs. This proposal has been evaluated for effectiveness in detecting and measuring the similarity between graphs.

The total variation model has drawn much attention among various image regularization methods during the past decades [15]. The reasons for such interest are low computational complexity and well-understood mathematical behavior. Nonetheless, estimating the regularization parameters for the total variation model remains a task to be solved. Zheng et al. [16] proposed a novel adaptive regularization parameter selection scheme by means of local spectral response in a content-aware way. The experiment results showed that, relatively, their proposal can yield satisfying denoised images with higher PSNR values and lower time consumption.

Borole and Bonde [17] proposed a new approach that allows for the simultaneous fill-in of different structures and textures by processing in a wavelet domain. A combination of structure inpainting and patch-based texture synthesis is carried out in this proposal for filling and updating the target region. The wavelet transform is used for very good multi-resolution functions. The proposed algorithm utilizes wavelet domain subbands to solve the structure and texture components in smooth approximation and high-frequency structure details.

Tama and Rhee [18] surveyed and evaluated classifier ensembles for intrusion detection systems (IDSs) in IEEE 802.11 wireless network. This research was based on two ensemble techniques (voting and stacking) to combine three base classifiers: decision tree (DT), random forest (RF), and support vector machine (SVM). Their research utilizes performance metrics by the area under the ROC curve (AUC) value. Finally, two statistical significance tests were conducted to evaluate the performance differences among classifiers.

The popular matching algorithm for content-based music data retrieval has used pitch tracking

techniques. Existing research improvements [19,20] are available for creating good t-distribution, using the instantaneous robust algorithm for the pitch tracking framework. Boonmatham et al. [21] suggested a new approach to music matching techniques using t-distribution on the instantaneous robust algorithm for Thai classical music. For the improvement of the detection method, this proposal applies a statistical method based on pitch track and a sequence of frequency bin numbers to detect the pitch of the music. The experimental results revealed a 99.01% accuracy in the retrieval of Thai classical music using this proposal for pitch tracking (t-IRAPT).

Kakarla et al. [22] proposed a new protocol for wireless sensor and actor networks (WSANs), called interference-aware distributed multi-channel MAC (IDMMAC) protocol. WSAN consists of a huge number of sensors and an ample number of actors. The proposed IDMMAC protocol supports a lightweight channel selection mechanism to enhance the lifetime of the sensor. The IDMMAC protocol divides the beacon interval into two phases: adhoc traffic indication message (ATIM) window phase and data transmission phase. The simulation results suggest that their protocol performs well compared to the existing MAC protocols.

Lv et al. [23] presented a new scheduling system for medical materials and its modeling method for complex rescue. The proposed system uses both BeiDou Satellite Communication System (BSCS) and Special Fiber-optic Communication Network (SFCN) to collect the rescue requirements and location information of disaster areas. All these messages are displayed on special medical software terminals on this system. They use the bipartite graph model to calculate the optimal scheduling of the medical material. Experiment analysis with simulation and applications have proven the correctness of the proposed technique and system compared to other similar systems.

Kim [24] described a novel spatial-temporal query processing system for the efficient processing of spatial-temporal sensor data in a sensor network. The spatial query processing systems of GeoSensor have been actively studied to process spatial sensor data [25] efficiently, such as TinyDB, TikiriDB, etc. Note, however, that the existing spatial query processing systems do not support a spatial-temporal data type and a spatial-temporal operator for processing spatial-temporal sensor data. This paper verified the utility of the proposed system based on a simulation scenario, and performance is better than existing systems through the performance assessment of performance time and memory usage.

The skyline query involves discovering dominating tuples from a set of tuples, where each defines an object in several dimensions [26]. Traditionally, a skyline query defined single-instance data or instance for each object associated with a single instance. In some cases, however, the object is associated with multiple instances rather than a single instance. Chiu and Hsu [27] proposed an algorithm to reduce computational cost with dominance calculation based on multi-instance data for efficient skyline queries. This proposal uses synthetic and real data to evaluate the proposed methods, and the results showed their utility.

Hong et al. [28] presented sector-based multiple camera collaboration for active tracking applications in large areas. The proposed approach is based on the distributed mechanism by emulating the master-slave mechanism. The collaboration among the cameras utilizes global and local sectors corresponding to different determined cameras. The proposed method combines the local information to construct global information for emulating the master-slave operations. The dynamics of all objects visible in the local camera view are estimated for the effective range scheduling of the camera. Active trace synchronization based on timing information makes selections to maximize the overall monitoring time for typical monitoring operations and to minimize errors in active tracking.

Wireless sensor networks (WSNs) have grown rapidly in recent years and have made significant advances in many applications. Note, however, that the limited power of the wireless sensor nodes restricts the development and application of WSN, which requires a very long lifetime to improve performance [29]. Zhang et al. [30] suggested a power management scheme that combines dynamic duty cycle scheduling at the network layer to plan node duty time to reduce energy consumption. Dynamic duty cycle scheduling is based on a tier structure wherein the network is concentrically organized around the sink node. The scheme has the benefits of both routing and duty cycling of sensor nodes for forest monitoring in a rechargeable sensor network.

Kasana et al. [31] proposed the data hiding algorithm using discrete wavelet transform (DWT) and Arnold transform. The secret data uses Arnold transform to enhance security, and the wavelet subband of the cover image can be obtained by DWT. The scrambled secret data are embedded in the important wavelet coefficients of the subbands of the cover image. The experimental results showed that the PSNR of the composite image is 1.05 dB, and the capacity is 25% higher than existing algorithms.

Hwang and Kim [32] presented a prototype reduction procedure by selecting representative samples from a data set; it discusses the methods for selecting prototypes in a pattern classification framework. The proposed method provides a way of summarizing data sets by seeking quick learning and equivalent generalization functions compared to the non-prototype-based results of the problem. The proposed data reduction method can be applied for any classification, and it has expandability to any distance metrics.

Yan et al. [33] describes the simulation analysis of the relationship between parameters and ampacity, which is regarded as a functional dependency that can provide an effective basis for designing and studying overhead transmission lines. They described the simulation of current capacity changes of different rating scales as determined from real-time measurement data and conductor state parameters. Their study built a sensitivity simulator to analyze the relationship between input and conductor current. The presented results showed that wind speed and ambient temperature have a great effect on the carrying capacity of the conductor. The simulations of ampacity change at various grades obtained with significant changes in gas input.

Bu et al. [34] proposed a texture feature extraction method based on local energy and local correlation from Gabor transformed images for an image retrieval system. The Gabor wavelet is similar to the human visual system in terms of the response mechanism, and its outputs are robust for variants of object size and illumination. Their proposed method was confirmed to improve results in the aspect of precision versus recall over the conventional Gabor method; such is expected to lead to advances in the texture image retrieval system compared with existing methods.

Zhang et al. [35] described analysis from the existing semi-fragile watermarking schemes based on local binary pattern (LBP) operators and concluded that there is a fundamental flaw in the design. In this work, a binary watermark is embedded into image blocks by modifying the neighborhood pixels according to the LBP pattern. Note, however, that different image blocks may have the same LBP pattern, which may result in erroneous detection in the watermark extraction process. This paper suggests an improved semi-fragile watermarking based on LBP operators to solve these problems. The experimental results showed that the improved watermarking scheme can overcome the defects above and locate the tampered region effectively.

Fattah [36] presented a novel statistical feature selection method for text classification.

For text categorization, it is important to choose a unique text feature because of the high dimensional

nature of the feature space. Another important task is to reduce processing space by decreasing processing time for accuracy enhancement. The proposed method specifies a unique text function and removes the missing information. The experimental results showed that such approach provides competitive performance compared with other known methods according to processing time, classification accuracy and others.

Han et al. [37] proposed a hierarchical location caching scheme for object tracking in IoT, which acclimates the existing location caching scheme to a hierarchical architecture of location databases. As with the location of moving objects (such as mobile agents, mobile software, mobile objects, or wireless hardware users), movement on the IoT network occurs naturally. Current location tracking is essential for mobile computing. This paper proposes the hierarchical architectures of location databases to overcome the scalability problem. The performance analysis shows that the adjustment of such threshold affects cost savings in the proposed method.

3. Conclusion

In this issue, we present 25 novel and original papers from around the world. We introduce novel efficient approaches to subjects ranging from pattern recognition, image retrieval, image restoration, computer vision related to surveillance, object tracking, wireless sensor networks, and IoT to security techniques. More than anything else, however, we want to convey our deepest appreciation to all of the authors who have contributed to this issue by sharing their valuable research outcomes with us. We also would like to thank all the reviewers who kindly accepted our review invitations. Without their hard work, putting together this high-quality journal would not have been possible.

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