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Advanced Big Data Analysis, Artificial Intelligence & Communication Systems

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Abstract
Recently, big data and artificial intelligence (AI) based on communication systems have become one of the hottest issues in the technology sector, and methods of analyzing big data using AI approaches are now considered essential. This paper presents diverse paradigms to subjects which deal with diverse research areas, such as image segmentation, fingerprint matching, human tracking techniques, malware distribution networks, methods of intrusion detection, digital image watermarking, wireless sensor networks, probabilistic neural networks, query processing of encrypted data, the semantic web, decision-making, software engineering, and so on.

Keywords
Artificial Intelligence, Big Data, Communication System

1. Introduction

The *Journal of Information Processing Systems* (JIPS) is the official international journal published by the Korean Information Processing Society (KIPS), and has such indices as ESCI, SCOPUS, EI-COMPENDEX, DOI, DBLP, EBSCO, and Google Scholar. The journal broadly covers four main areas of research, namely, Computer Systems and Theory, Multimedia Systems and Graphics, Communication Systems and Security, and Information Systems and Applications.

This issue comprises eighteen peer-reviewed papers that introduce innovative ideas, paradigms, frameworks, and algorithms in the fields of big data analysis, artificial intelligence, and deep learning, and the communication systems required to advance them.

2. Related Works

In this section, diverse kinds of approaches, processes, and frameworks for user-oriented applications are introduced as regular papers published by the JIPS.

Wang and Xu [1] proposed a saliency level set image segmentation scheme based on local Renyi

entropy to advance the edge segmentation effect of level set image segmentation. A saliency detection paradigm was used to extract a saliency map of the original image. Canny operator and local Renyi entropy were employed to obtain the local energy and edge energy of the image. The authors also constructed a new boundary indication function and an adaptive weight coefficient, and conducted an experimental evaluation of the image database. The experimental results demonstrated the proposed paradigm for the image segmentation in terms of intensity inhomogeneity.

Khongkraphan [2] proposed an efficient scheme for fingerprint matching that relies on multiple reference minutiae points. To address the issue of establishing minutiae correspondences between two fingerprints, the authors also introduced an innovative paradigm based on the concept of linear classification. The experimental evaluation of the proposed scheme was performed on the fingerprint databases, FVC2004 and FVC2002. The comparison of the proposed scheme with other existing schemes demonstrated that it outperforms the existing schemes in terms of its matching accuracy.

To support the automatic protection of mods during molding production, Zhu et al. [3] proposed a foreign detection approach based on scatter games. The proposed method employs wavelet transform foreign detection to recognize foreign objects in the tube. The authors evaluated the proposed approach using the Monte Carlo method, which showed the effectiveness of the proposed method compared to the labeled data.

Park and Lee [4] studied the structure and mechanism for the automatic selection of sharp images from the multiple foci of a cell using an automatic multi-focus algorithm. To select brightness and color of light, the authors constructed a lighting control system. In addition, Gaussian and Laplacian filters were employed to determine the instrument and the sharpness of each image. The constructed system was observed to reduce the effort needed to extract suitable cell images, save time, and increase the convenience of cell analysis.

Li and Hou [5] proposed a hybrid recovery approach, called HRSF, to solve the problem of fast recovery from a single disk failure in storage systems and to improve the response time to client requests and recovery, and proposed an optimal algorithm to improve the failure recovery task. The theoretical analysis of the proposed approach demonstrated that the approach reduces the amount of data read, which was around 25% less than the conventional method. The overall results showed that the HRSF method was effective in terms of reducing both the failure recovery time and the amount of data read.

Ramachandra et al. [6] addressed the challenges poised by the analysis and tracking of visual surveillance systems, and human movement using robots. They proposed a human tracking technique based on Consensus and an image segmentation technique based on hierarchical graph. The segmentation technique was described in two phases of object-level segmentation and part-level segmentation for category-consistent regions and color-consistent segments, respectively. The proposed technique was tested using video sequences having 3 to 4 persons, which demonstrated the effectiveness of the proposed work.

Chao et al. [7] proposed a feature extraction technique for tone recognition that relied on a combination of deep neural networks (DBN) and a support vector machine (SVM). The proposed technique was used to extract the articulatory and prosodic features. In the experimental evaluation, a 5-layer-deep DBN was used over the 863-data corpus, and a linear SVM was employed to recognize tones. The results of the evaluation showed that the proposed techniques improved recognition accuracy and achieved a higher tone recognition rate of 83.03%, which is 8.61% greater than that of existing approaches to tone recognition.

Choi et al. [8] found out the distribution technology and internet-based threats that bypass detection

systems, and proposed an automated link tracing technique to classify malicious websites in the malware distribution networks. The proposed technique consisted in employing a link structure to identify a website as either malicious or normal, and in deploying a proxy server and a real web-browser in the malware distribution networks in order to actually implement the technique. A significant number of links, i.e., approximately 20,000, were used to verify the validity of the proposed technique.

Zhao and Long [9] classified multiple power quality disturbance using an improved one-against-one support vector machine approach. They proposed an improved swarm optimization algorithm to solve the issue of parameter selection. The proposed algorithm was effective in executing a local and global search that improved classification accuracy. The algorithm was experimentally evaluated in the context of multiple power quality disturbances, demonstrating the superior accuracy of the algorithm compared to the existing grid search algorithm. Furthermore, it reduced the quantity of support vectors.

Oh and Choi [10] addressed the issue in terms of item-based and user-based approaches to solve the movie recommendation problem. They identified the sparsity issue in the user-based approach and the inability to reflect the user preference issue in the item-based approach. To solve such issues, the authors proposed a combination of item-based and user-based approaches using the notion of similarity. As the proposed method has fewer parameters to calculate, it could solve the problem of the sparsity. The experimental results showed that the proposed method achieved a 6% lower average error rate using the notion of similarity.

Zhang and Xiao [11] introduced an intrusion detection approach relying on the antibody concentration in the immune response to solve the issues of a high false alarm rate and a low detection rate. They proposed a blood family and a blood relative to classify antigens and antibodies, and performed a simulation of correlations between antibodies and antigens. The results of the evaluation showed that the proposed method had a better detection rate and superior performance.

Lee and Park [12] proposed a high-performance memory bus connected storage logical volume manager (MBS-LVM) design to enhance the "write" operations in a NUMA-based server. The address space of each MBS was merged into a single global address space, and latency was reduced when accessing the MBS as each storage space was dynamically accessed. The results of their MBS-LVM benchmarking show that the performance of the proposed system was twenty times better than that of the original method, in which the NUMA server had four cores.

Existing forest fire detection algorithms are inaccurate and emit many false alarms upon detecting objects that share similarities with fires. Mahmoud and Ren [13] proposed a video-based image processing algorithm utilizing a unique wavelet type of analysis to differentiate between an actual fire and an object that resembles a fire. A SVM classifier was implemented to detect a forest fire accurately.

Panyavaraporn and Horkaew [14] proposed a digital watermarking scheme to protect digital signatures from being supplanted or forged. The mechanism prevents forgery and copyright violations of image data when broadcasted. The Lorenz chaotic map was implemented to define embedded positions, which proved to be a more reliable method of defending against deterministic attacks than other wavelet-based watermarking schemes. The results show that the proposed scheme could resist any spatial and frequent adulterations such as noise, filtering, when zooming, and lossy compression.

Sim [15] proposed a six-step model for implementing a smart production system on a printed circuit board (PCB) line by selecting the key functions required and combining the essential functions. The proposed model was configured into seven different modules, whose optimal implementation methodology is flexible and can be applied to diverse businesses. The results obtained by applying the model to a PCB

line showed a 50% reduction of lead time and WIP.

Chen et al. [16] proposed a High-Frequency Electromagnetic Simulation software (HFSS) based on a microwave circular waveguide to detect the crushed coal concentration in the air pipelines of thermal-based powerplants. HFSS experiments were conducted to determine the efficient microwave emission frequency, the installation distance, and the type of antenna probe among other factors. The experiment, which was based on the selected parameters, accurately indicated changes in the concentration of crushed coal.

Terence and Purushothaman [17] proposed a method of detecting grey-hole, black-hole and sinkhole attacks on wireless sensor networks, which they called the warning message counter (WMC) method. Lightweight symmetric key-based cryptography was implemented to determine assess the data modification caused by sinkhole attacks. The results of the WMC-based simulation exhibited 8% fewer false positives and 6% fewer false negatives.

Huh and Seo [18] proposed a digitized seafarers' book for identification and authentication as a security measure for fishers. Beacon-based positioning technology was applied for ease in e-Navigation. Current methods involve carrying certificates shrouded in a cloth designed to survive damages caused by the elements. The proposed method allows maritime police to quickly and easily manage the identification and authentication of a ship using a digitized seafarer's book.

3. Conclusion

This issue contains eighteen novel and enhanced peer-reviewed papers from various countries around the world. We present diverse paradigms to subjects, which deal with diverse research areas such as image segmentation, fingerprint matching, human tracking techniques, malware distribution networks, intrusion detection methods, digital image watermarking, wireless sensor networks, probabilistic neural networks, query processing of encrypted data, the semantic web, decision-making, software engineering, and so on. We would like to thank all the authors who submitted papers for this issue and all the reviewers who accepted our review invitations.

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