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Artificial Intelligence for the Fourth Industrial Revolution

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Abstract

Artificial intelligence is one of the key technologies of the Fourth Industrial Revolution. This paper introduces the diverse kinds of approaches to subjects that tackle diverse kinds of research fields such as model-based MS approach, deep neural network model, image edge detection approach, cross-layer optimization model, LSSVM approach, screen design approach, CPU-GPU hybrid approach and so on. The research on Superintelligence and superconnection for IoT and big data is also described such as 'superintelligence-based systems and infrastructures', 'superconnection-based IoT and big data systems', 'analysis of IoT-based data and big data', 'infrastructure design for IoT and big data', 'artificial intelligence applications', and 'superconnection-based IoT devices'.

Keywords

Artificial Intelligence, Super intelligence, Superconnection

1. Introduction

The *Journal of Information Processing Systems* (*JIPS*) is the official international journal with indices such as ESCI, SCOPUS, Ei Compendex, DOI, DBLP, EBSCO, and Google Scholar and is published by the Korean Information Processing Society (KIPS). There are four divisions: Computer System and Theory; Multimedia Systems and Graphics; Communication Systems and Security; and Information Systems and Application. This issue includes 17 peer-reviewed papers consisting of 11 track papers (regular, fast & future topic) and 6 special session papers.

This issue includes one special session: superintelligence and superconnection for IoT and big data. Since the IoT and big data environments are becoming more and more complex, the solutions of IoT and big data-based systems and infrastructures are becoming increasingly difficult to resolve. Because artificial intelligence, networks, security, databases, and so on are all interconnected and integrated for the solutions, enhanced approaches to integrating two or more fields of research should be developed, such as security-based databases, artificial intelligence-based networks, and so on. In addition, given the increasing demand for and size of intelligent IoT and big data systems and infrastructures, it is essential to promote superintelligence and superconnection-based research. This special section is intended to

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serve as an invaluable platform that allows researchers in the academe and industry to share their latest research ideas and results, development activities, and emerging industry technologies on superintelligence and superconnection in the fields of IoT and big data. The topics are 'superintelligence-based systems and infrastructures', 'superconnection-based IoT and big data systems', 'analysis of IoT-based data and big data', 'infrastructure design for IoT and big data', 'artificial intelligence applications', and 'superconnection-based IoT devices'.

2. Enhanced Artificial Intelligence Approaches

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

Zhang and Wang [1] introduce a regression model-based MS approach for object tracking. In the approach, multiple candidate templates are captured to deal with problems of occlusion, lighting changes, and pose variations. Note, however, that the computing time of the regression model-based MS approach increases according to the number of templates, and this is solved by applying multiple template-based regression model.

Lee and Kim [2] show a deep neural network model, SeFLA, for video captioning. SeFLA uses not only visual features but also semantic features to represent a video effectively. The visual features are extracted using the existing Residual Network and C3D convolutional neural networks.

Wang and Huang [3] introduce an image edge detection approach based on triqubit-state measurement that combines the information on local and global structures of an image. A defect image is smoothened by an enhanced partial differential approach. A triqubit-state is characterized by three elements (pixel saliency, edge statistical characteristics, and gray scale contrast) to obtain the defect image from gray space to quantum space mapping. The edged image is deduced by quantum measurement, local gradient maximization, and 8-neighborhood chain code searching.

Rao et al. [4] describe a cross-layer optimization model based on power control for a sink-based, cross-layered multipath routing protocol subject to certain QoS requirements for the image transmission specified in terms of total end-to-end BER. The sink-based cross-layer multipath routing protocol utilizes the cross-layer information available in RREQ packets to calculate the optimal power vectors and number of packets that can be sent by the source for each disjoint path.

Kim et al. [5] analyze the main concepts, security issues, threats, and solutions of the Cyber Physical System (CPS) and evaluate related research. The concept of CPS raises multiple challenges through the current security markets and security issues. They also address the CPS vulnerabilities and attacks and identify the challenges. Finally, they recommend a solution for each system of CPS security threats and discuss ways of resolving potential future issues.

Wang et al. [6] show a least squares support vector machine (LSSVM) approach to solve the defects. Utilizing the Ward clustering analysis approach to get training samples with high similarity, this approach chooses RBF as kernel function considering the Gaussian radial basis function (RBF) with good simple structure and optimizes related parameters by utilizing particle swarm optimization (PSO). The quantity of samples is reduced by the classification and selection of historical data, and prediction accuracy is improved.

Yong et al. [7] introduce three types of typical HPC structure for container environments built with

HPC container and Docker, which focuses on smooth integration with the existing HPC job framework and Message Passing Interface (MPI). When traditional HPC platforms are provided as a service, users usually suffer from unexpected obstacles in developing and running applications due to restricted development environments and dependencies.

Feng [8] shows an image fusion approach based on the depth model segmentation to overcome the shortcomings of noise interference and artifacts caused by infrared and visible image fusion. The deep Boltzmann machine is utilized to perform the priori learning of infrared and visible target and background contour, and the depth segmentation model of the contour is constructed. The Split Bregman iterative approach is employed to gain the optimal energy segmentation of infrared and visible image contours. The NSCT transform is taken to decompose the source image, and the corresponding rules are utilized to integrate the coefficients in the light of the segmented background contour. The NSCT inverse transform is used to reconstruct the fused image.

Kim et al. [9] describe a screen design approach based on the business process of the applications derived from the business, which designs the screens that appear when actual applications are completed including how the data transfer process in the derived business process is represented and operated on the relevant screens and the screen that is displayed when the actual application is completed.

Suryani et al. [10] introduce two-phase security protection for objects in IoT, which combines authentication and statistical models. The results of the two-phase security protection show that other attacks can be handled in addition to Sybil attacks, such as bad-mouthing attack, good-mouthing attack, and ballot stuffing attack.

Heu [11] describes a semantic-based K-means clustering approach that measures not only the similarity between the tweets represented by a vector space model but also the semantic similarity between the tweets using TagCluster of Flickr for clustering a large number of tweets.

Song et al. [12] show a CPU-GPU hybrid approach to environment perception and 3D reconstruction for UGVs, and the data flows and functions of this system are designed based on sequence diagrams. The system contains three modules: data collection and pre-processing, environment perception, and 3D terrain reconstruction. After removing redundant and noise data, the pre-processing function registers LiDAR point clouds and video sequences into a global terrain model. The environment perception module segments the ground surface from the point clouds and clusters the non-ground points into individual objects by using a connected component labeling approach.

Kwak and Sung [13] introduce a natural path generation method between waypoints based on flight records collected through UAVs flown by users. Bayesian probability is utilized to select paths most similar to the flight records to connect two waypoints. These paths are generated by selecting the center path corresponding to the highest Bayesian probability. While the K-Means algorithm-based, straight-line method-generated paths led to UAV collisions, the proposed method generates paths that allow UAVs to avoid obstacles.

Zhang et al. [14] show a new approach to generating training data and expanding the number of training samples for single category in AR and Labeled Faces in the Wild (LFW) datasets, which improves the recognition accuracy of the models. Four loss functions are adopted to carry out experiments on AR and LFW datasets.

Lim et al. [15] explain an intelligent residual resource monitoring scheme for cloud computing environments. The proposed monitoring scheme can effectively find a host machine for migration, so that the post-migration performance of a virtual machine is consistent with its pre-migration performance.

By collecting monitoring information from host machines in cloud computing environments, the QoS and SLA can be maintained without violation.

Li et al. [16] describe a multi-scale parallel convolutional neural network (MP-CNN) architecture to solve the face recognition problem in a complex environment. The key difficulties here include gray scale change caused by illumination variance, occlusion caused by glasses, hair, or scarf, and self-occlusion and deformation caused by pose variation. To overcome these, many solutions have been proposed. Note, however, that most of them only improve recognition performance under one influence factor, which still cannot meet the real face recognition scenario.

Cao et al. [17] utilize the convolutional neural network (CNN) model to select various input variables that have the necessary correlation and to improve the long-term prediction rate; thus increasing the prediction rate through the LSTM predictive value and the combined structure. In addition, a multiple linear regression model is applied to compile the predicted data of CNN and LSTM, which then confirms the data as the final predicted outcome.

3. Conclusion

This issue featured 17 novel and enhanced peer-reviewed papers from India, China, Korea, and Indonesia. We present diverse kinds of approaches to subjects that tackle diverse kinds of research fields such as model-based MS approach, deep neural network model, image edge detection approach, cross-layer optimization model, LSSVM approach, screen design approach, CPU-GPU hybrid approach and so on. We would like to thank all authors who submitted their papers for this issue and all reviewers who accepted our review invitations.

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