Pattern recognition (PR) is one of the key capabilities in human intelligence. Machines equipped with a PR unit can sense environment, thus PR is often integrated in intelligent systems to acquire information and assist in decisions and human-machine interaction.

PR’s scope includes pattern classification (statistical and structural PR, neural networks, kernel machines, ensemble learning, and multiview learning), clustering, feature extraction and selection, data preprocessing (such as image enhancement and segmentation), visual object recognition, video analysis, applications in document analysis, biometrics, medical imaging, remote sensing image analysis, multimedia, video surveillance, and intelligent transportation. Both applications of and methods for PR have seen tremendous advances in recent years—for example, deep learning has boosted performance in many practical applications such as handwriting recognition, large-scale image recognition, object detection, and facial and speech recognition, just to cite a few.

This special issue reports the state of the art in PR theory, algorithms, and applications. As guest editors, we had a wealth of choices among the 38 full submissions that the call for
papers attracted. All submitted articles underwent a strict peer review process, with each one assigned to at least two reviewers and most undergoing a second-round review. Because so many of the submissions were so good, we’re splitting this topic across two issues, with the first seven articles focusing on basic PR and image analysis issues, along with related applications. The May/June issue will look more closely at computer vision techniques and applications.

In “Cognitive Mechanisms Underlying Enhanced Human and Computer Classification of Reduced Dimensionality, Information Rich (RDIR) Representations of Images,” Kaveri Thakoor proposes a cognitive mechanism-inspired approach for image feature presentation called reduced dimensionality, information rich (RDIR) representation. They’re generated by processing the original image with an algorithm that captures prominent orientation information in the scene, inspired by the way humans capture the gist of a scene upon observing it for 200 milliseconds or less, with a principal components analysis applied to the gist result. A possible cognitive mechanism is proposed for the enhanced recognition accuracy observed with RDIR representations based on the higher decorrelation of image pairs depicted in RDIR format compared to that of their downsampled counterparts.

In “A Stochastic Approach for Finding Optimal Context in Contextual Pattern Analysis Task,” Utpal Garain focuses on contextual pattern analysis tasks using random field models. An underlying random field is represented by a set of parameters that capture spatial dependence, and a Bayesian approach is followed to develop a decision rule for choosing appropriate context. The relevance of this approach is explored for three pattern analysis tasks in which local context plays an important role: handwriting analysis, image compression, and word sense disambiguation.

In “Abnormal Event Detection via Compact Low-Rank Sparse Learning,” Zhong Zhang, Xing Mei, and Bailhua Xiao propose a method called compact low-rank sparse representation (CLSR) for abnormal event detection in video. The method adds compact regularization to the sparse representation model for considering the relationship of coefficient vectors. The low-rank property is exploited to capture the dictionary’s underlying structure. Experiments on three challenging databases demonstrate the superiority of the method in comparison to the current state of the art.

In “Churn Prediction in Customer Relationship Management via GMDH-Based Multiple Classifiers Ensemble,” Jin Xiao and his colleagues address the problem of churn prediction in customer relationship management. Specifically, they propose a novel multiple classifiers ensemble selection model, based on the group method of data handling (GMDH). Experimental results show that this proposed method can perform classification with imbalanced distributions better than existing ensemble methods such as bagging and boosting.

In “DeepWriterID: An End-to-end Online Text-independent Writer Identification System,” Weixin Yang, Lianwen Jin, and Manfei Liu introduce an end-to-end writer identification system called DeepWriterID that employs a deep convolutional neural network (CNN). A key feature of the system is the so-called DropSegment, designed to achieve data augmentation and to improve CNN applicability. Experiments on an online handwriting database achieved
Guest editors’ introduction

Identification rates that outperformed the current state of the art.

In “Monocular Depth Ordering Reasoning with Occlusion Edge Detection and Couple Layers Inference,” Anlong Ming and colleagues present a novel depth-ordering reasoning approach for image analysis. The main contribution lies in two aspects: an occlusion edge detection method for generating precise same-layer relationship judgment and producing reliable region proposals, and an inference method for inferring the final depth order. In the global layer, the inference is executed by finding a valid path on a simple and effective directed graph model.

Finally, in “Brain MR Image Tumor Segmentation with 3D Intracranial Structure Deformation Features,” Shang-Ling Jui and colleagues aim to improve brain tumor segmentation accuracy by using an improved feature extraction algorithm to exploit the correlation between intracranial structure deformation and the compression from brain tumor growth. The component is capable of measuring lateral ventricular deformation in volumetric magnetic resonance images. It was evaluated qualitatively and quantitatively with promising results on 11 datasets comprising real patient and simulated images.

We thank all the authors who submitted their invaluable works to the special issue and all the reviewers for their insightful comments in reviewing the submitted papers. We also thank Daniel Zeng, the editor-in-chief of IEEE Intelligent Systems for giving us the opportunity of guest editing this special issue and for his continuous support in the entire process.

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