Editorial

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Biographical notes: Jiancheng (Kevin) Jia received his MSE and PhD from Purdue University in 1987 and 1991, respectively. He was a faculty member in the School of Electrical and Electronic Engineering at Nanyang Technological University, Singapore, from 1992 to 1997 and currently works at International Game Technology, USA. His research interests include biometrics, data representation with neural networks, pattern recognition and computer vision.

Qinghan Xiao received his BSc and MSc from the Department of Automation, Tsinghua University, Beijing, China, in 1982 and 1985 respectively, and his PhD from the Department of Computer Science, University of Regina, Canada, in 1994. Currently, he is a Defence Scientist at the Defence R&D Canada – Ottawa. His research interests include biometric and RFID technologies. Since 2008, he has been serving as the Chair of the Task Force on Biometrics, Intelligent Systems Applications Technical Committee of the IEEE Computational Intelligence Society (CIS). He is the recipient of 2010 IEEE Ottawa Outstanding Engineer Award for his contributions to the area of biometrics.

Humans use their eyes to observe the world and brains to process the gigabytes of data per second in interacting with their surroundings. Computer vision is a branch of science that focuses on the development of computational methods to perform the same task as human vision. Although it is already at the core of many applications, such as industrial automation, robotics, smart vehicles, biomedicine and biometrics, computer vision is currently a very active research area because it is still a challenge for a computer to match the human performance to see and understand. Therefore, this special issue is devoted to reporting the latest advancements and presenting the current research trends in computer vision. Six papers are presented on various aspects of this growing research and development field.

Although commonly used in industries, robots are regarded as potential replacements for human beings to release from agriculture jobs, such as planting seed and picking fruit. In order to avoid damaging fruit during the harvest process, computer vision is a key element to make a robot able to perform the tasks of detecting and picking up the fruits.

The first article entitled 'Computer vision for fruit harvesting robots – state of the art and challenges ahead' by Kapach et al. presents a comprehensive review on harvesting robots based on three main criteria – the sensory configuration, visual cues, and computational approaches. The authors summarise related literature from the last two decades, identify the major limitations of the existing approaches, and describe the main challenges with possible development directions.

Automatic vehicle type recognition is a critical task in an intelligent transportation system. A classifier ensemble is a group of classifiers that are trained individually but their decisions are combined into one classification prediction. Generally, a classifier ensemble is more accurate than any of the individual classifiers making up the ensemble. The second paper entitled 'Classification of vehicle type and make by combined features and random subspace ensemble' by Zhang et al. proposes an approach to classify the vehicles into car models from a frontal view image. A classifier ensemble was formed to integrate the features extracted from the multiple random subspaces. The experimental results demonstrate that the proposed method outperformed a single classifier, such as the k-nearest neighbour (k-NN), multiple layer perceptron (MLP), and support vector machine (SVM).

Video-based object tracking is a computer vision topic that aims to detect moving objects, filter out noise, and group motion vectors into a meaningful scene representation. The critical issues are grouping the objects that move or change together as a whole, and estimating the approximate size of the moving object at different distances. The third paper entitled 'A multi-resolution framework for multi-object tracking in Daubechies complex wavelet domain' by Jalal and Singh deals with multi-object tracking in complex wavelet domain. They introduce an adaptive moving object segmentation scheme and propose a multi-resolution tracking framework using Daubechies complex wavelet transform. The framework consists of moving object detection and multi-object tracking modules. Several experiments were conducted on indoor and outdoor video sequences. The results illustrate the effectiveness and robustness of the proposed framework.

Since gestures are a powerful means of communication in human life, gesture recognition is an active research domain in computer vision. A key problem is how to make computers understand gestures, thereby using human hand or body motions to replace an input device to perform human-computer interaction. The fourth paper entitled 'A novel approach for gesture control video games based on perceptual features: modelling, tracking and recognition' by Hu and Gao proposes an approach to develop a general 3D visual sensor-based gesture control framework for video games. A proof-of-concept video game has been developed to demonstrate the validity of the proposed method.

The level set method has been proposed to address different problems in computer vision, such as image segmentation, tracking, statistical shape modelling. It is a central problem in computer vision to segment a complex scene into its parts and group these parts into different objects that produce meaningful descriptions of the scene. The fifth paper entitled 'A method for identification and classification of medicinal plant images based on level set segmentation and SVM classification' by Nandyal et al. presents a methodology that applies the level set method to segment medicinal plant images and classify them into different categories, such as Calotropis gigantea, Aloe vera, Azadirachita indica and Cocos nucifera, that are used by practitioners of Ayurveda system of medicine. Classification experiments were conducted with 400 images taken from four different angles of views. The training set consisted of 100 plant images of

each class, while the rest of the images were used for testing. Three classification methods were used to categorise the segmented objects into different medicinal plants. The highest classification accuracies, as reported, were 98%, 97% and 94% for trees, herbs and shrubs, respectively when using level set segmentation and SVM classifier.

Because of security concerns, biometrics has been investigated for smart house applications. The potential application areas include resident access control, visitor registration, and public area surveillance. A challenge is in integrating biometric device with other security components to achieve a robust and accurate solution. The last paper entitled 'Multi-functional intelligent access control system based on hand vein recognition' by Zhong et al. describes a prototype of an access control system that unlocks a door either by the subject pressing an indoor button, or performing hand vein verification on the subject. The major contribution of this work is in hardware design and system configuration in implementing hand vein access control system.

As the field of computer vision grows, more and more sophisticated algorithms will be developed and put into new applications. The papers forming this special issue cover several aspects of computer vision from agriculture robots, gesture analysis to biometric security. The purpose of this special issue is to provide a viewpoint into the current and future state of computer vision technology and applications.