Guest Editorial

Special Issue on
Visual Information Processing for Large Scale Pattern Recognition

Recently, digital cameras have penetrated into almost every corner of our society and personal spaces, ranging from national security to public safety and from commercial digital content service to personal entertainment. This prevalence has set unprecedented challenges to the research community since users are no longer satisfied by passive consumption (e.g. viewing) of the images and video taken by the cameras. On the other hand, the explosive amount of the digital content generated by the cameras makes it impossible for users to store, manage and utilize the data without efficient tools to assist them.

The user demand for efficient tools for effective creation, manipulation, transmission and consumption has naturally bolstered research that aims to use computer and machine learning to analyze the digital data to extract useful information and make decisions in either real-time or non-real time manner. It has given the birth to many flourishing research areas of visual information processing and pattern recognition that are able to deal with large scale data. In particular, object tracking and activity recognition for intelligent video surveillance and digital content analysis for indexing and retrieval are the two active fields which have attracted much research resource and have progressed significantly in the past decade.

This special issue focuses on the latest development and new directions in visual information processing for large scale pattern recognition. It contains one invited paper and 11 representative papers that are selected from many high quality submissions from several countries around the world through a thorough peer-review process in accordance with the guidelines of the Journal.

The first paper by Ogunbona provides a comprehensive overview of visual information processing and management of visual content. It covers both theoretical principles and current challenges of the major modules contained in the visual information processing pipeline including capture, enhancement, transmission, archiving and retrieval. This is an extraordinary paper that analyzes all components of visual information processing pipeline under one context.

The following four articles are dedicated to intelligent video surveillance. Video surveillance systems have gone through three generations. The first generation is CCTV (closed circuit television) that was built upon analogue TV technology. The second generation surveillance systems are remarked by digital technology including digital image sensors, digital transmission and storage. Currently, video surveillance systems are evolving into its third generation that is characterized by intelligence and distributed architecture. Intelligent camera is one of the key components in such a surveillance system. The article by Kharitonenko et al. presents an FPGA based architecture of intelligent surveillance cameras that integrates moving object tracking with digital pan, tilt and zoom. In video surveillance, humans are always one of the most interesting objects. Detection of the presence of humans and automatic recognition of their activities are essential part of the intelligence. Research with
these respects has been extremely active and much progress has been made. In this special issue, we bring readers with two articles that present the latest development in the fields. The article by Phung et al. describes a human detection algorithm by applying the Viola Jones’ Adaboost object detection framework to edge density. Riedel et al. proposes a threshold Dynamic Time Warping (TDTW) method for spatial activity recognition. The authors have demonstrated that TDTW performed more robust and accurate than conventional DTW and discrete Hidden Markov Model (HHM). The last paper in this group is by Ning et al. The paper investigates a very practical and challenging problem of tracking moving objects in surveillance systems consisting of multiple mobile and stationary cameras.

The next set of four papers is about image and video analysis. The article by Lay et al. addresses the most prominent issue, known as semantic gap, in image and video retrieval. Lay et al. propose two multimodal approaches for assessing semantic relevance in video retrieval. In the first approach, audio and visual cues are fused to index video clips. The indices are implicitly associated with the semantic meanings of the video clips. The second approach models the semantic content with element concepts that can be identified using audiovisual cues. As usual, preprocessing, object extraction, feature extraction and compression are often found to be as important components in a visual information processing system. The article by Zhang describes a reliable interpolation scheme for fingerprint orientation fields. This algorithm brings a reference solution that improves the robustness of a fingerprints system in an uncontrolled environment. Wang et al. presents in their article a constrained global optimization approach to extract object contours based on mean field annealing. Xie et al propose a new method to extract qualitative features, such as shape, from time series signal. The idea presented in this paper is inspiring for audio and video analysis. Image and video compression has been well researched and developed, which is evidenced by the release of the JPEG and MPEG standards. However, the desire for more efficient compression has never been ceased. The article by He et al. looks into a newly developed virtual hexagonal image structure and an algorithm to uniformly separate the image into four similar sub-images for efficient fractal based compression.

Finally, the last two articles by Sridharan et al. and Chu et al. respectively in our special issue deal with intelligent control. Color has been always an important cue in controlling robots. However, the robots need to be able to learn the color. Sridharan et al. describes an on-line approach that allows robots simultaneously learn and locates colors for planning motion. The article by Chu et al. concerns with motion control of electrical driven free floating space manipulator and describes an approach to compensating joint coupling, un-modeled uncertainties and external disturbance.

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