

Guest Editorial

Special Issue on Distributed Smart Sensing for Mobile Vision

THE recent advances in hardware and software related to distributed smart sensing have opened unprecedented opportunities for building effective solutions to applications, such as object detection, tracking and recognition for surveillance, mobile medical imaging, distributed video monitoring/retrieval, gesture recognition, etc.

Putting together sensors of very diverse nature poses several challenges, especially when related to vision sensors (e.g., cameras). These challenges include the temporal and spatial synchronization of the sensors, their mutual coordination and/or cooperation, network topology and communication protocols, strategies for exploiting (and saving) limited resources in terms of memory, computational power and battery, as well as the need for dedicated software algorithms which combine efficiency with accuracy under tight constraints in terms of resources.

This innovative field of research brings together multidisciplinary areas and lies at the intersection of image processing/analysis, sensor networks, embedded systems, distributed algorithms, sensor/data fusion and mobile devices.

A classical application of distributed smart visual sensors is concerned with video surveillance. This Special Issue presents three papers on this specific application. The paper “New Object Detection, Tracking and Recognition Approaches for Video Surveillance Over camera Network,” proposes a framework suitable for a non-overlapping multiple camera network by exploiting mean shift segmentation to detect objects, depth information derived from stereo vision to handle occlusions and a Bayesian Kalman filter for tracking objects. The paper “Multitarget Tracking in Nonoverlapping Cameras Using a Reference Set” proposes to associate tracks in different camera views using a novel reference set based appearance model and AdaBoost is used to learn the discriminative power of features. The paper “Cost-Aware Coalitions for Collaborative Tracking in Resource-Constrained Camera Networks” tracks targets where the best cameras among those viewing a target are assigned to a coalition based on marginal utility theory.

The paper “Gesture Recognition Using Wearable Vision Sensors to Enhance Visitors’ Museum Experiences” addresses the topic of distributed smart sensing in the field of cultural heritage by proposing ego-vision embedded devices as a means for interacting in a more natural and entertaining way with the museum contents.

The paper “Hybrid Localization of Microrobotic Endoscopic Capsule Inside Small Intestine by Data Fusion of Vision and RF Sensors” addresses a medical imaging application

that demonstrates the multi-faceted potential of distributed smart sensing. It identifies the positions of the intestinal abnormalities by keeping track of the 3D trajectory of the capsule and performs data fusion to improve localization.

The paper “SIFT-Based Homographies for Efficient Multiview Distributed Visual Sensing” is focused on Distributed Video Coding (DVC) as a means to handle typical constraints in visual sensor networks, such as the limited energy, memory and bandwidth and improves performance with the use of side information creation and fusion.

Finally, the paper “On Demand Retrieval of Crowdsourced Mobile Video” considers the problem of the proliferation of mobile cameras which produce an excessive amount of data to be handled with the bandwidth and energy constraints. The paper proposes a video metadata extraction algorithm running on smartphones that considers both spatio-temporal features, including compass readings and point-of-interest of the content and a video selection algorithm, running on the server that responds to user queries considering both the accuracy of video retrievals and upload cost.

The collection of papers in this Special Issue present several topics with different perspectives for different applications. This cannot be considered as an exhaustive coverage but presents several interesting proposals to tackle the mentioned challenges. We believe this Special Issue will form the basis for further development in this new research area. The guest editors would like to thank all the authors and reviewers who helped us with this Special Issue.

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