Special Issue on Subspace and Manifold Learning for Image and Video Indexing and Search

WITH THE rapid expansion of video and image data repositories available on the Internet, desktops and mobile devices, and multimedia indexing and searching technologies are becoming more and more important and have gained much attention from both academia and industry. Thousands of commercial TV channels and millions of individual grassroots producers, as well as billions of people, are sharing and consuming video and image content. The sheer size and complexity of multimedia repositories and the number of people creating, sharing, and consuming image and video content present a challenge to applications like image/video search (by either textual queries or image queries), browsing, content protection, duplication detection, commercial-ad insertion, and content tracking.

A key to enabling these applications is to find effective and compact representations that capture the essence of visual, syntactic, and semantic information conveyed in the image and video and have an efficient and scalable indexing scheme that supports fast search and mining operations. Subspace and manifold learning has gained significant advances lately for this purpose, particularly in graph embedding, vector subspace modeling, tensor modeling, canonical correlation analysis, etc.

In addition, the dimensionality of these subspace models is typically high; thus, sufficient information can be well preserved. However, high dimensionality brings us difficulties in efficiently indexing and searching data. How to create a compromise between effectiveness and robustness of the feature representation, with the underlying data organization and searching solution, is also a challenging issue. Approximate solutions, such as locality sensitive hashing and approximate search schemes that offer tradeoffs between accuracy and response speed, are promising directions to tackle this difficulty.

Moreover, image and video content does not exist in isolation, particularly for professionally produced media content. For example, a rich set of side information such as closed captions, audio track, and associated program guide, as well as usage statistics, provides crucial information for video search and mining. Due to the popularity of social network applications, online images and video clips are often associated with user-input tags, viewers' comments, as well as other textual information on the Web pages that host the images. How to develop cross-modal modeling and fusion solutions that facilitate more efficient and effective search, bridging the semantic gap, via subspace modeling and learning, is another interesting set of problems.

This Special Issue aims at the emerging applications of image and video indexing and search. It particularly focuses on the novel design and methodology of subspace and manifold learning, which are the best ways to foster original research. In total, 15 original contributions were submitted and evaluated following a rigorous review process. Eventually, four papers were accepted, resulting in an acceptance rate of 26.7%.

Wang *et al.* proposed a semisupervised classification algorithm using manifold regularization. A regularization trick is used to balance a tradeoff between loss and penalty in the objective function. This algorithm can fit the entire path of solutions for every value of the regularization hyperparameters with superior computational efficiency. To overcome the challenges of content variations and spatial dependence in visual data mining, Yuan *et al.* proposed to discover visual collocation patterns based on frequent itemset mining. A self-supervised subspace learning method is presented to refine the visual codebook by feeding back discovered patterns, which can effectively detect semantically meaningful patterns. Tian *et al.* proposed a unified multilinear framework to generalize TensorFace, i.e., view-manifold-based TensorFace and kernelized TensorFace, so that the local distances in the multiview face space and structure of the latent view manifold are all preserved to capture the nonlinearity of the view subspace. It advances the multiview face recognition performance in standard evaluations. Bian *et al.* proposed a transfer topic model for human action recognition from video in the scenario of insufficient training data. The basic idea is to use extra information obtained from an auxiliary domain to assist video representation in the target domain. As each human action is modeled as a mixture of topics, it defines Kullback–Leibler-divergence-based regularization by learning topics from the auxiliary domain to tune the topic estimation in the target domain, which improves the generalization of the cross-domain model.

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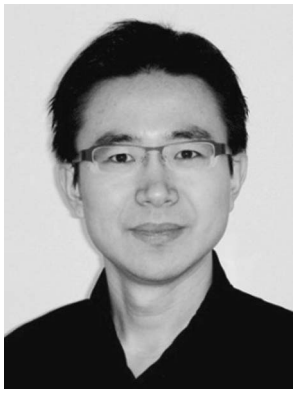

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