

Mobile Social Multimedia Analytics in the Big Data Era: An Introduction to the Special Issue

1. INTRODUCTION

The proliferation of mobile devices has led to a bright new stage in which multimedia search and analysis are increasingly moving from the desktop to the cloud. Nowadays, it has become convenient to capture images and videos on the mobile end and associate them with social and contextual metadata such as comments and Global Positioning System (GPS) tags. Such a hybrid data structure can benefit a wide variety of potential multimedia applications on the mobile end, such as location recognition, landmark search, augmented reality, and commercial recommendations. One intrinsic potential is to explore large-scale social multimedia to assist and facilitate location-related applications, which is further promoted by the evolution of mobile devices. With the combination of social and mobile cues, several problems that previously had been difficult to tackle in multimedia content analysis have become more tractable. For example, multiple images can be captured for accurate object research and recognition. And in the case of visual search, large-scale image repository can be significantly pruned by employing GPS tags to filter out irrelevant images with respect to the query. It has become ever emerging when the analytics of mobile social multimedia face the big data era. Several challenges have been raised, including, for instance, how to design a suitable cloud/distributed architecture, how to carry out online computing efficiently, and how to handle the scalability issue. When being applied to big data applications, many of the existing tools and systems for mobile social multimedia analytics would become questionable. On the other hand, the big data itself has provided a unique opportunity to accomplish the above tasks.

The goals of this special issue will be threefold: (1) present new theories and new application scenarios on mobile social multimedia computing, communication, and application; (2) survey the recent progress in this area; (3) discuss new applications and problems.

2. REVIEW PROCESS

This special issue solicited contributions on a wide range of topics, including cross-model multimedia data management, applications based on mobile social multimedia metadata, and social networks and visualization of mobile social data. We received 13 submissions from Asian universities and research institutes. The majority of the articles were reviewed by at least three experts. The acceptance decision for each article was discussed among the guest editors of Mobile Social Multimedia Analytics, and six articles were accepted for the special issue.

3. GUIDE TO ACCEPTED ARTICLES

The articles in this special issue provide an excellent sampling of the recent work on mobile social multimedia analytics in the big data era. They can be categorized into cross-model multimedia data management (two articles), applications based on mobile social multimedia metadata and social networks (three articles), and visualization of mobile social data (one article) as follows.

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3.1. Cross-Model Multimedia Data Management

Recent years have witnessed the blossoming of online social networks (OSNs), which are becoming an essential platform for sharing information among global individuals. Twitter, one of the largest worldwide OSNs, has 1 billion registered users, 77% of whom are outside the United States. Over 200 million active users send 400 million tweets per day. To store and disseminate these massive messages, content delivery network (CDN) and geo-distributed data centers together constitute the content delivery infrastructure. In particular, static contents, including photos and videos, are stored in CDN providers, whereas all other data sources are stored in geo-distributed data centers. Considering the unprecedented growth of OSN access traffic, Hu et al. propose a novel cache strategy for microblog service systems to reduce the inter-data-center traffic and consistence maintenance cost, while achieving low service latency. Experimental results demonstrate that the system costs by 24.5% against traditional approaches with the same service latency.

Learning user attributes from mobile social media is a fundamental basis for many applications, such as personalized and targeting services. A large and growing body of the literature has investigated the user attributes learning problem. However, far too little attention has been paid to jointly consider the dual heterogeneities of user attributes learning by harvesting multiple social media sources. In particular, user attributes are complementarily and comprehensively characterized by multiple social media sources, including footprints from Foursquare, daily updates from Twitter, professional careers from LinkedIn, and photo posts from Instagram. On the other hand, attributes are inter-correlated in a complex way rather than independent of each other, and highly related attributes may share similar feature sets. Nie et al. propose a unified model to jointly regularize the source consistency and graph-constrained relatedness, and learn the attribute-specific and attribute-sharing features via a graph-guided fused lasso penalty. Extensive evaluations on real-world datasets thoroughly demonstrate the effectiveness of the unified model.

3.2. Applications Based on Mobile Social Multimedia Metadata and Social Networks

The rapid development of social media platforms has led to increasingly large-scale social media data, which has shown remarkable societal and marketing values. There are needs to extract important events in live social media streams. However, microblog event classification is challenging due to two facts: (i) its short/conversational nature and the incompatibility in meanings between the text and the corresponding image in social posts and (ii) rapidly evolving content. Gao et al. propose to conduct event classification via deep learning and social tracking. A Multi-modal Multi-instance Deep Network is first employed for microblog classification and then social tracking is employed to extract social-related auxiliary information to enrich the testing samples. Their method is evaluated on the Brand-Social-Net dataset to demonstrate the superior performance in term of the event classification task.

Having benefited from the tremendous growth of user-generated content, social annotated tags receive more importance in the organization and retrieval of large-scale image databases on Online Sharing Websites (OSW). To obtain high-quality tags from existing community contributed tags with missing information and noise, tag-based annotation or recommendation methods have been proposed for performance promotion of tag prediction. While images from OSW contain rich social attributes, they have not taken full advantage of rich social attributes and auxiliary information associated with social images to construct global information completion models. Zhang et al. propose to take full advantage of the ubiquitous GPS locations and image-user relationships to enhance the accuracy of tag prediction and improve the computational efficiency. To

fit the response time requirement and storage limitations of tag-based image retrieval on mobile devices, Asymmetric Locality Sensitive Hashing is introduced to reduce the time cost and, at the same time, the efficiency of retrieval.

Image annotation assigns relevant tags to query images based on their semantic content. However, most of the efforts have been focused on the representations of images and annotations. The properties of the semantic parts have not been well studied. Tao et al. revisit sparseness constrained nonnegative matrix factorization (SNMF) and propose a new efficient large sparse cone NMF algorithm to optimize the SNMF problem by employing Nesterov's optimal gradient method. Their method is evaluated on the PASCAL VOC07 dataset to demonstrate the effectiveness in terms of the image annotation task.

3.3. Visualization of Mobile Social Data

With a smart phone at hand, it becomes easy now to snap pictures and publish them online with a few lines of texts. The GPS coordinates and User Generated Content data embedded in the shared photos provide opportunities to exploit important knowledge to tackle interesting tasks like geographically organizing photos and location visualization. Sang et al. propose to organize photos both geographically and semantically and investigate the problem of location visualization from multiple semantic themes. The experimental results have validated the proposed method and demonstrated the potentials of location visualization using multiple themes.

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