Multimedia Social Networks

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INTRODUCTION

Nowadays, media technologies have changed the role of individuals from passive content consumers to active content creators/producers. A lot of metadata such as user-provided tags, comments, geo-tags, capture time and EXIF (exchangeable image file format) information, associated to multimedia resources, are available in the social media websites like Flickr and YouTube. The explosive growth of social multimedia content on the Internet is revolutionizing the way of content distribution and social interaction. In this article, we look at social multimedia computing, a new multidisciplinary research area that bridges the social science and multimedia technology. We present the implications of social multimedia computing in various application areas: online content-sharing services, social multimedia search, collective intelligence, surveillance video, and multimedia networking.

BACKGROUND

A multimedia social network is a network in which a group of users share and exchange multimedia content, as well as other resources. Heidemann et al. (2012) provide an overview of online social networks in order to contribute to a better understanding of this worldwide phenomenon. Multimedia social networks can be classified into three categories (Tian et al., 2010):

- **Imagery Social Networks:** These networks capture the social relationships and activities between users through photos, surveillance videos, or wireless sensors. In such networks, face detection and recognition algorithms are used to recover friend networks from data such as photo albums on the Web. In imagery social networks, a major problem is the privacy problem as it is possible to infer the user's location or other private information from these data. Litt (2013) explores how background factors, motivations, and social network site experiences relate to people's use of social network site technology can be exploited to protect their privacy.
- **Gaming-Driven Social Networks:** These networks allow users maximize their own payoff by exchanging and sharing their resources. Network members watch and learn how others play the game and adjust their own strategies accordingly to achieve effective cooperation. Representative examples include peer-to-peer (P2P) social networks and colluder social networks.
- **Interaction-Driven Social Networks:** Such networks characterize relationships based on users' interaction and other activities in online communities. By using interaction-driven social networks, we can effectively develop online social multimedia services such as online video advertising.

By using social multimedia, we can analyze community activity around multimedia resources. We can also derive metadata from social activity and resources, and aggregate data to better reason about their content. In the light of this evidence, De Choudhury et al. (2009) analyze comments on YouTube videos to derive "interests" and topics. Mertens et al. (2006) use community activity for "social navigation" of Web lectures. Shamma et al. (2007) use chat activity in Instant Messenger to reason about the content of shared online videos. Shamma et al. (2010) use the content, volume and trends of Twitter messages about multimedia broadcast to reason about the content of

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the event. In general, researchers focus on various research activities:

- Visualizing Flickr tags over time (Dubinko et al., 2006).
- Reasoning about Flickr groups (Negoescu et al., 2009)
- Extracting semantics of multimedia tags (Rattenbury et al., 2007) and the relationships between them (Wu et al., 2008).

For social media data, vital key information is required at the semantic level. This information is the so-called *5W's and 1H*, i.e., *who, where, when, what, why* and *how*.

- For the "who" issue, the key techniques are face detection and recognition, which have been extensively studied in computer vision research.
- The "where" and "when" issues and the "what" problem are hot topics in multimedia research community, that is, to mining the EXIF and geotag information for multimedia applications. Automatic tools for analyzing and mining the social media should help to understand the first 4W's, namely, who, where, when and what. However, the most challenges are mostly related to the "what" problem.
- Finally, "why" and "how" tend to be abstract, difficult and may not be relevant to most social media applications.

Davis et al. (2009) explore mechanisms by which implied and explicit semantics can be acquired from users interacting with media within social networks. This leads to the gathering of individual user interaction metadata, which is then aggregated to form semantic metadata for a given video. Their techniques have been implemented in a custom Flex application, which is based around the Facebook API. This provides various mechanisms for the collection and then display of descriptions of user interaction with video content.

Researchers also extracted location multimedia summaries and travel suggestions from aggregate social media blog and image data (Hao et al., 2009). Community activities were also used to augment and improve metadata about multimedia resources, like generating and displaying tag suggestions (Naaman & Nair, 2008) and augmentation of personal content using social media sources (Elliott & Ozsoyoglu, 2008).

The social media "context" adds specific additional information to multimedia tools and applications and enables improved content analysis (Naaman, 2012). Recently, the topic of context augmentation of content analysis in multimedia research has been widely discussed (Boll et al. 2004). For example, Luo et al. (2006) used camera settings and/or capture time together with content analysis to improve performance of automated content analysis. In dynamic environments, multimedia applications are potentially adaptive and are aware of their changing contexts. An intelligent context-aware infrastructure is often based on an appropriate context model such as to represent, manage and access context information. Kanellopoulos (2009) proposes an ontology-based context model that supports context reasoning and context management for adaptive multimedia systems. Zhang et al. (2013) propose a user-centric system called "SocConnect" (Social Connect) for aggregating social data from different Social Networking Sites (SNSs) and allowing users to create personalized social and semantic contexts for their social data. Users can blend and group friends on different SNSs, and rate the friends and their activities as favourite, neutral or disliked. Then, SocConnect provides personalized recommendation of friends' activities that may be interesting to each user, using machine-learning techniques.

SOCIAL MULTIMEDIA COMPUTING AND MULTIMEDIA SOCIAL NETWORKS

Social multimedia computing involves cross-disciplinary research between multimedia technology and computational social science. There are two approaches/views of social multimedia computing:

- **Social Computing Over Multimedia:** This approach focuses on using tools to enable more powerful social interaction. By adopting this approach, we can harvest large-scale digital traces and develop methodologies for large-scale validations of social science theories. Moreover, we can study user behavior and so-