

# Emerging Topics on Personalized and Localized Multimedia Information Systems

Yi Yu<sup>1</sup>, Kiyoharu Aizawa<sup>2</sup>, Toshihiko Yamasaki<sup>2</sup>, Roger Zimmermann<sup>1</sup>

<sup>1</sup>School of Computing, National University of Singapore, Singapore

<sup>2</sup>Department of Information and Communication Engineering, The University of Tokyo, Japan

{yuy,rogerz}@comp.nus.edu.sg, {aizawa, yamasaki}@hal.t.u-tokyo.ac.jp

## ABSTRACT

We are experiencing an era with a rapid increase of data relevant to different aspects of users' daily life. On the one hand, such data contains personal information of each individual user. On the other hand, it also reflects user behaviors related to the society as data of more users is aggregated. These data could not only be very beneficial for studying various lifestyle patterns, but also be used to generate more descriptive and explanatory analysis across the landscape of diverse multimedia data. Using personal mobile devices and web services to systematically explore interesting aspects of people world has attracted much attention recently.

This is a full-day tutorial that addresses emerging topics on personalized and localized multimedia technologies and applications and emphasizes knowledge sensing and discovery in multimedia landscape. This tutorial aims to deliver an overall introduction to multimedia landscapes with multimedia processing, contextual data acquisition, people activity logs, data analytics, geographic-aware multimedia sharing and delivery, and serves as an important lecture on fundamental and advanced research areas of personalized and localized multimedia information systems.

## Categories and Subject Descriptors

H.4 [Information Systems Applications]: Miscellaneous; I.4.8 [Image Processing and Computer Vision]: Scene Analysis—*Sensor Fusion*; G.3 [Mathematics of Computing]: Probability and Statistics

## Keywords

Personalization, life-logging, check-ins, location-aware applications and services, geographic popularity, multimedia information systems

## 1. BACKGROUND

Innovations in mobile technology have made it possible for users to interact with various online communities anytime and anywhere. Everyday people create and consume huge amounts of multimedia information and data over the

Permission to make digital or hard copies of part or all of this work for personal or classroom use is granted without fee provided that copies are not made or distributed for profit or commercial advantage and that copies bear this notice and the full citation on the first page. Copyrights for third-party components of this work must be honored. For all other uses, contact the Owner/Author. Copyright is held by the owner/author(s).

MM'14, Nov 03-07 2014, Orlando, FL, USA

ACM 978-1-4503-3063-3/14/11.

<http://dx.doi.org/10.1145/2647868.2654850>

Internet, e.g., fostered by technology innovation and user engagement, more than 100 hours of video are uploaded to YouTube every minute, 700 YouTube video links are shared on Twitter every minute, more than 3.5 million images are uploaded to Flickr daily. This way, every day an immense volume of various user-generated multimedia data is shared on the Internet. Such user-generated data could be a repository that contains different aspects of user's daily life, e.g., a photo on Flickr showing a crane truck working in a construction site could imply "the photographer loves tough trucks", a check-in at Bottega Louie in Downtown Los Angeles could imply "the visitor loves Italian food".

Personal data collected from users could be helpful to mine individual behavioral pattern and provide personalized recommendation and more intelligent services [1][2]. In addition, location as an extra contextual information from individual users is playing an important part in complementing retrieval and recommendation [3]. In particular, trajectories of users are associated with their preferences and can be used for personalized location recommendations. Check-in information at business venues can be used to analyze the geospatial distribution of users [4] and leveraged for geo-fencing services [2] (e.g., mobile advertising), business analytics, and geographic locality of interest [5]. The geospatial distribution of users and social connections between users can be further leveraged to optimize the distributed caching of multimedia data in content delivery networks. In this way, the vast volumes of multimedia data aggregated over time can be used to mine valuable knowledge about user activities in an individual level or a community level.

## 2. MOTIVATION

The increase of various sharing websites and online social networks has encouraged users to share contents, such as blogs, tweets, images, songs and videos. Not surprisingly, we are able to learn various patterns and user behaviors according to these data, which are likely to have important implications of personal preferences [1] and geographic interests [5] and are useful for a variety of multimedia systems and applications [4]. We have witnessed a paradigm shift towards multimedia data technologies and applications that are able to creatively accommodate or be compatible with e.g., multimedia processing and analysis, retrieval and recommendation optimization, online sharing, and physical activities. This shift inspires us to generate more descriptive and explanatory analysis across the multimedia landscape, to better highlight interesting things hidden behind various multimedia datasets, e.g., user relationships, attractiveness, patterns, and to support the critical intelligence

for end users' decision-making. We aim at addressing personalized and localized multimedia knowledge sensing and discovery, e.g., how to collectively form multimedia knowledge based on heterogenous information from users.

### 3. OBJECTIVES

This tutorial aims to introduce to the participants the following topics: i) applications and services on the Internet that have been developed to facilitate users' daily needs by utilizing personal preferences, ii) various geotagged multimedia data which help better understand local interest and popularity of multimedia content, iii) multimedia analysis by leveraging geo-social data, iv) the state-of-the-art approaches for location-aware multimedia content discovery and diffusion on the Internet, v) some comparative studies of existing geo-social multimedia systems, and vi) viewpoints, conclusions and trends of geo-tagged multimedia data.

### 4. TUTORIAL OUTLINE

The tutorial is structured into four main modules. First, we report image and video processing technologies and applications, particularly focusing on analyzing and mining image and video data. Second, we discuss how to discover and recommend personalized events and topics. Third, we give an overview of the latest topics and methods related to socially aware multimedia sharing and diffusion. Finally, we introduce location-aware research trends with various applications and systems in multimedia landscape with demonstration examples.

**Module One (90 minutes)** provides a comprehensive discussion of various challenges in videos and images processing technologies and applications. We have witnessed a surge of mobile device penetration with affordable prices. This leads more and more location-based social applications which try to locate, reach and interact with users on-the-go and provide various services tailored to the needs of specific users. Leveraging personal data with heterogenous data sources to analyze users' lifestyle and habits, however, is a non-trivial task. Heterogenous multimedia data from the users implies different aspects of user activities and interests. In addition, participants will be provided with an extensive overview of multimedia techniques and they will learn how to combine visual events with user's preferences. Moreover, we report various multimedia examples related to recent development on FoodLog, e.g., multimedia tools for dietary assessment, image processing approaches to analyzing user behavioural logs.

**Module Two (90 minutes)** explains why and how we may make use of location-aware media information to infer multimedia landscapes, and why and how we may take into account personalized aspect of user activity logs to find most important events and topics from multimedia scenes that satisfy a particular user's needs. Personalization has been a trend of web searching. A method to personalized search is to exploit the location information. As we know, there is a geographic locality in user's interest and culture. These days, search engines can return most relevant local results to users according to the location information in user profiles, while filtering out irrelevant information. Together with some interesting examples of using large-scale user-generated data, we also discuss fundamental components related to user activities. We review intra/inter-city travel recommendation algorithms and systems and we also

introduce some interesting topics related to personalized retrieval and recommendations.

**Module Three (90 minutes)** covers topics and approaches related to geo-social activities, correlating user-centric preference activities, sensing and discovering location-aware knowledge, and geographic-aware multimedia sharing and diffusion. User-generated geo-social data contains user behaviors in the physical world and denotes whereabouts of their social activities. The data of geo-social behaviors also indicates geographic reach and interest of a geo-category context or a multimedia content across the globe. We share some latest studies with participants. Particularly, we explain geo-fencing, which is a promising technique for user-centric mobile location-based services. We introduce map generalization, which is used in many geographic information system and business mapping applications for creating maps at different scales. We also show some examples related to modeling location-based social impact on business attractiveness, geographic distribution of user activities touching upon geographic locality of interest in video views, and the spreading of geo-social multimedia contents on location-based social networks.

**Module Four (90 minutes)** addresses challenging issues involving the integration of user-centric mobile location-based services and multimedia content sharing platforms on the Internet. We report to the participants various resources covering software tools, public datasets, and crowdsourcing methods applied to the research areas of multimedia, location-based services, and content sharing websites. Every day users create and consume massive amounts of multimedia information and data by recording and transmitting images and videos with mobile devices. We introduce the participants to some developments related to the rapid increase of multimedia data and research on the capacity to store, process, analyze, and understand patterns from multimedia data. We introduce various sensor-rich multimedia technologies, e.g., scene modeling and acquisition, query processing, POI (point of interest) detection and visual distance estimation, and result ranking and presentation. We report various multimedia examples related to recent progress in sensors and integration, e.g., the latest development of GeoVid geo-referenced video smartphone apps and their applications.

### 5. REFERENCES

- [1] K. Aizawa, Y. Maruyama, and H. Li, and C. Morikawa. Food Balance Estimation by Using Personal Dietary Tendencies in Multimedia Food Log. In IEEE Trans. on Multimedia, Vol.15, No.8, pages 2176-2185, 2013.
- [2] Y. Yu, S. Tang, and R. Zimmermann. Edge-Based Locality Sensitive Hashing for Efficient Geo-Fencing Application. In ACM SIGSPATIAL GIS, pages 586-589, 2013.
- [3] T. Yamasaki, A. Gallagher, and T. Chen. Personalized Intra- and Inter-City Recommendation Using Large-Scale Geotags. In GeoMM Workshop of ACM Multimedia, pages 25-30, 2013.
- [4] R. Zimmermann, Y. Yu. Social Interactions over Geographic-Aware Multimedia Systems, A tutorial in Proc. of ACM MM13, pp. 1115-1116, 2013.
- [5] A. Brodersen, S. Scellato, and M. Wattenhofer. YouTube Around the World: Geographic Popularity of Videos. In WWW, pages 241-250, 2012.