

A Study on Photo Recommendation Scheme in Collaborative Video Authoring

Fathoni Arief Musyaffa^{†1} Changhyeon Lee^{†2}
Yong-Moo Kwon^{†3}

Abstract: We are describing collaborative authoring technology over the network. One of the components in our authoring technology is photo recommendation system, in which recommended photos will be used in collaborative video authoring and social album. The recommended photos are derived from Facebook, by referring properties of photos currently available on the authoring library. The photo properties in photo library were provided as additional information in a Collaborative Authoring Metadata (CAM), added when the users upload photo for collaborative authoring. By using information available in CAM, the system recommends photos from user's Facebook friends' photo album during authoring process.

Keywords: recommendation system, event metadata, social metadata, SNS, photo recommendation

1. Introduction

Consider some memorable events such as wedding ceremony, high school graduation or academic fair that involves a group of friends who took photos at the event. Each friend took a photo based on their own perspective and their own point of interest. Each friend tends to have different interest, so photographs taken by different friends will likely cover the event from different perspectives. Hence, collecting the photos from various sources is needed to comprehend the whole event from various perspectives. The resulting photo also tends to be distributed in each photographer's personal drive. It is cumbersome to obtain their photos one by one.

Fortunately, the widespread usage of SNS helps photo sharing among friends. Using the photo content uploaded in the SNS, the users can collaboratively combine the photos to create a video content that has personal meaning. To create narrative video using photos from a certain event, the authors need related photo content. However, to our best knowledge, currently there are no authoring tools which support recommending media content from SNS, such as Facebook. Therefore, an SNS-based content recommendation system for authoring is needed in our collaborative authoring system.

The recommendation module in our system suggests related photos from SNS based on the keyword in the analyzed Collaborative Authoring Metadata (CAM) which was described by Lee and Kwon (2012)[1].

This paper describes Facebook photo recommendation for collaborative social video User Created Content (UCC) authoring tool. Several things are done to achieve this goal, such as (a) Studying the behavior of Facebook users in sharing photo content to their Facebook account, and (b) Designing and implementing recommendation mechanism for getting co-event content from Facebook and prioritizing the result.

The contribution provided in this paper is the analysis of usable social metadata elements in Facebook for determining photos that share the same context. This paper will provide the analysis result as well as how social metadata in Facebook is associated with CAM, which is provided more detail in a paper

by Lee and Kwon [1], and also how to use this association to provide relevant recommendation to the content that is being authored.

2. Related Works

Recommender System is software tool and technique that suggests items to be used by a user (Mahmood & Ricci 2009 [8], Resnick & Varian 1997, Burke 1997 [5]). The term "item" refers to what the system recommends to users. In most cases, a recommendation system only focuses on a specific type of item (e.g., movies, news or music). In the past few years, recommendation system has become a valuable means to cope with the problem of information overload (Ricci et al. 2010) [6].

The interest towards recommender systems has been dramatically increased lately, as indicated by some facts. First, recommender systems play an important role in such highly rated Internet sites (e.g. IMDb, Amazon.com). Second, there are dedicated conferences and workshops related to the recommendation system field (e.g. ACM Recommender Systems - RecSys). Third, college courses that dedicated entirely to recommendation system are offered at institutions of higher education around the world. Lastly, there have been several special issues in academic journals that cover research and developments recommendation (Ricci et al. 2010 [6]).

Recommendation systems have several differences with search engines. The goal of search engine is to answer user's ad hoc queries, while recommender systems is created to recommend services or items to user. The input of a search engine is defined as a query, while recommendation systems rely on user preferences that defined as a profile. Output of a search engine is ranked items relevant to user's need, meanwhile, in recommendation systems, the items is ranked based on user's preferences. Search engines relies mainly in information retrieval-based methods, while recommendation systems relies on several methods, such as information retrieval, machine learning, and user modeling (Shaphira and Rokach 2012 [7]).

There are 2 major approaches for recommendation systems. First, collaborative filtering based recommendation systems as described by Goldberg et al. (1992) [4], and Second, content-based filtering based recommendation systems as explained by Pazzani and Billsus (2007) [9]. Collaborative

^{†1} Korea Institute of Science & Technology

^{†2} Korea Institute of Science & Technology

^{†3} Korea Institute of Science & Technology, ymk@kist.re.kr

filtering uses data from another user with similar preferences (e.g. Amazon.com's item recommendation). Collaborative filtering-based recommendation systems identify users whose preferences are similar to the current user and recommend items that have been liked by identified users (Balabanovic & Shoham 1997 [2]). Meanwhile, content-based filtering is based on the description of the item and a profile of user's interest (e.g. Internet Movie Database movie recommendation). Content-based filtering-based recommendation system tries to recommend similar item to those a given user has liked in the past (Balabanovic & Shoham 1997 [2]). Some works use tags as content descriptors for collaborative filtering, such as work by Firan et al. (2007) [3] which shows that tag-based profile is capable of producing better personal recommendations on Last.fm compared to conventional recommendations. Meanwhile, Guy et al. (2010) [10] uses related people and related tags to recommend social media items (blogs, communities, wikis, bookmarks, files) using hybrid approach (both collaborative filtering & content-based filtering). After evaluating the result, they found that tag-based recommendation provides better item recommendation, and recommendation based on combination of people and tags provides slightly more interesting recommendation with less already-known items.

3. Design & Implementation

Our CAM includes two parts of social metadata, event metadata and social metadata. Event metadata created by users who uploaded the photos to our collaborative authoring system. And then, Social Metadata created automatically by Facebook's system (e.g. upload date). Table 1 and 2 summarize our CAM (event metadata, social metadata) Elements. These elements is used in Facebook to develop recommendation functionality.

We have studied the properties of co-event photos in Facebook and observe the similarities on the photos based on the context of the event. In this case, we observed users' behavior in uploading and interacting on the uploaded similar-event photos from different uploaders or photographers.

Table 1. Description of Event Metadata

XML-Schema	Elements	How to Obtain	How to use
Contents Information	Contents_Type	Manual	To search specific content type
	Creator	Manual	To predict the uploader
	With_Whom	Manual	To search a photo that contains specific user
	Location	Manual	To search a photo that was taken from a specific location
	Event_Name	Manual	To compare with SNS info
	Date_Time	Manual	To compare with SNS info
	Weather	Manual	

Table 2. Description of Social Metadata

XML Schema	Elements	How to Obtain	How to use
SNS	Number_of_Likes	Automatic –	To rank search result

Info		Facebook API	
	Number_of_Comments	Automatic – Facebook API	To rank search result
	Album_Desc	Automatic – Facebook API	To search specific keyword
	Tagged_Person	Automatic – Facebook API	To search a photo that contains specific user
	Comment_Content	Automatic – Facebook API	To search specific keywords form the comment
	Commented_by	Automatic – Facebook API	To rank the result
	Liked_by	Automatic – Facebook API	To rank the result

For our implementation and experiment, we used photos that taken by many users who participate International Culture Exchange (ICE) Festival. ICE was organized by Korea Institute of Science & Technology (KIST). In ICE Festival, there are many attendants from different nationalities and backgrounds that took pictures during the event.

Based on the analysis in ICE event, users are likely to upload photos in certain date range from the actual event. Therefore, information of creation date in CAM and creation date in Facebook is associated. Most users entitle their album containing information such as event name, organizer, and location. Based on this behavior, event name, organization, and location in CAM are associated with album name. CAM also contains information about who are the people tagged inside a photo. This information is associated with tagged users in Facebook's social metadata. Other information (e.g. weather, mood) is associated with comments on the photo. Some other social factor like the information of how many likes and how many comments a photo has tends to reflect how interesting a photo is. Figure 1 summarizes correlation between Facebook social metadata and CAM.

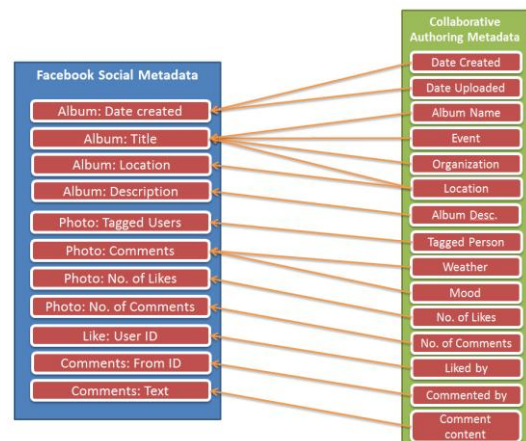


Figure 1. Comparison of CAM and Facebook social metadata

Figure 2 illustrates the filtering process. We use content based filtering and collaborative filtering sequentially. During content based filtering stage, there are four filtering methods, each utilizing keyword provided by the user. In the first method,

the system filters based on the rule “filter any photo that posted between *since* date to *until* date that contains *location*, *event* or *organization* that provided by the users”. In second method, the system filters based on the rule “filter any photo that posted between *since* date to *until* date that tagged with *name* and contains *location*, *event* or *organization*”. Compared to the first method, the second method selects certain name tagged on a photo. In third method, the system filters based on “filter any photo that posted between *since* date to *until* date with *comment* contained in the photo and contain at least one word of *location*, *event* or *organization*”. This method selects photos that contain certain comments. Lastly the system filters based on “filter any photo that posted between *since* date to *until* date with *comment* and *name* contained in the photo and contain at least one word of *location*, *event* or *organization*”. The last method selects certain tagged name and comment content on a photo from the first method.

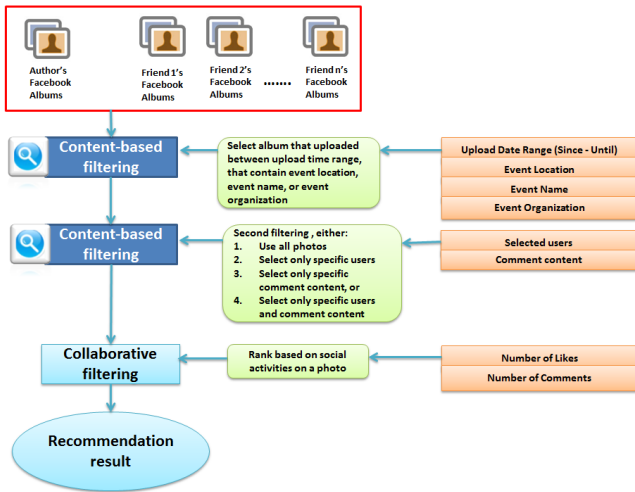


Figure 2. Photo filtering process details.

The recommendation result is ranked using collaborative filtering, utilizing social information available as comments, likes and shares and the relationship measure between current user u and uploader v . This ranking is intended to help the authors selecting which photos are most favorable by users on his(her) Facebook friend network. To rank the resulting recommendation, recommendation score $RS(u, i)$ for user u and item i is calculated by using this formula:

$$RS(u, i) = \alpha * s_f(i) + \beta * p(u, v) + \gamma * t(i, k)$$

where α, β, γ are weights of the each factor and s_f is Social factor of item i , calculated as:

$$s_f(i) = a * \#ofShares(i) + b * \#ofComments(i) + c * \#ofLikes(i)$$

Where a, b, c are weights of the each factor. And, $p(u, v)$ is the measure of how close the relationship between the user u and user v . This is measured by the ratio of mutual friends between user u and user v , and whether user u and v has family relationship, employer similarity, and educational similarity. $p(u, v)$ is calculated by the following formula:

$$p(u, v) = familyRelationship(u, v) + employerSimilarity(u, v) + educationalSimilarity(u, v)$$

When there is any family relationship between user u and v , the score for $familyRelationship(u, v)$ is 1, else the score is 0.

Coherently is the same value is given with $employerSimilarity(u, v)$ and $educationalSimilarity(u, v)$ if there are similarity of employer and education, respectively.

Later, $t(i, k)$ is the weight of the item i relative to the similarity of keyword k entered by the user, compared with given metadata tag in Facebook. This is measured by the similarity of location, comment content, tagged person, event name and event organizer between tag $t_any_metadata$ and keyword $k_any_keyword$.

$$t(i, k) = similarity(k_location, t_location) + similarity(k_comment, t_comment) + similarity(k_tagged, t_taggedPerson) + similarity(k_eventName, t_AlbumTitle) + similarity(k_eventOrganizer, t_albumTitle)$$

The similarity score is also defined as the previous similarity measures in people weighting formula.

The implementation for Facebook recommendation is done by utilizing Facebook API^a. The recommendation system workflow is illustrated in Figure 3. As can be seen in Figure 4, there are three main recommendation sections. First section is the form containing *since-until* date (which defines the range of uploading date), *location*, *event*, and *organizer*. Second section is designed to filter out the result from the first section based on tagged users and comment contents. If the user checks “Recommend Interesting Pictures” checkbox, the system will sort the recommendation result based on its priority score as explained in the previous section, and this is illustrated in Figure 4.

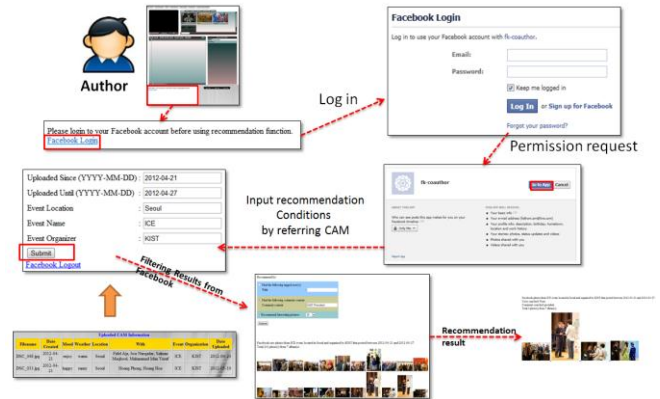


Figure 3. Facebook recommendation system usage.

Facebook photos from ICE event, located in Seoul and organized by KIST that posted between 2012-04-21 and 2012-04-27.
Users searched: None.
Comments searched: president.
Total 4 photo(s) from 7 album(s).



Figure 4. Result of sorted recommendation.

a <http://developers.facebook.com/>

4. Evaluation

The resulting recommendation is evaluated by measuring the ratio between relevant photos and irrelevant photos with the desired event, as illustrated in Figure 5. The photo thumbnails in bold red rectangle is irrelevant photos (some captures of spring flowers at KIST), while the other pictures are relevant photos (ICE event that was held at KIST). The evaluation is measured based on search time range (i.e. the most effective duration to recommend a group of photos from the same event): the date the event was held + 5 days after the event, the date the event was held + 10 days after the event, and the date the event was held + 20 days after the event. The percentage of relevant photos to the event is then calculated.



Figure 5. Relevant and irrelevant recommendation result.

The overall view of the recommendation result relevancy from 11 Facebook users is measured. These users have at least one friend who had attended the event, and uploaded the photos of the event. The result of the relevancy percentage for each user is shown in Figure 6. Later, this percentage is then checked based on the time range. Based on the average relevancy percentage, selection based on the event date + 10 days after the event is the most suitable for obtaining photo recommendation of an event, as can be seen in Figure 7.

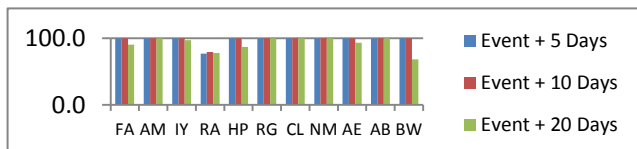


Figure 6. Relevancy percentage for each user and time range

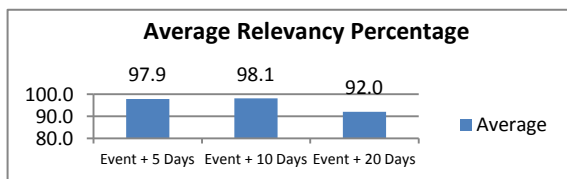


Figure 7. Average relevancy percentage.

The next evaluation is to determine whether the recommendation system can recommend relevant result for another event, instead of only ICE event. In the participant's Facebook network of friends, some data set has already been available, such as KIST Full Moon Day (Chuseok) party event and KIST Graduation Ceremony, and shows 100% relevancy recommendation result for both events.

5. Conclusion

In this work, recommendation system for Facebook photos is developed by using several metadata available on Facebook.

Content-based filtering and Collaborative Filtering is done sequentially to provide the recommendation. Instead of only using relevancy with the context, some social parameters like how close the relationship of the uploader to the user and how many interaction on a photo is measured to determine how interesting a photo is. Hence, it can provide relevant recommendation to be used as content resource for video authoring. After this work has done, web-based collaborative video authoring environment has developed and CAM has been adapted to match with social metadata available in Facebook. User can refer to CAM information to seek content recommendation from Facebook with a good accuracy from various perspective of the content to be authored, and based on this content; they can create content using relevant photo recommendation result.

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