Photo LOI: Browsing Multi-User Photo Collections (Demonstration Description)

Bibliographic Reference:

Rahul Nair, Nick Reid, and Marc Davis. "Photo LOI: Browsing Multi-User Photo Collections (Demonstration Description)." In: *Proceedings of 13th Annual ACM International Conference on Multimedia (MM 2005) in Singapore*, ACM Press, 2005.

Photo LOI: Browsing Multi-User Photo Collections

Rahul Nair[1], Nick Reid[1], and Marc Davis[1, 2]

[1]Yahoo! Research Berkeley
1950 University Avenue, Suite 200
Berkeley, CA 94704-1024, USA
http://research.yahoo.com/berkeley

[2]School of Information Management and Systems
University of California at Berkeley
102 South Hall, Berkeley, CA 94720-4600, USA
http://garage.sims.berkeley.edu

{rnair, nreid, marcd}@yahoo-inc.com

ABSTRACT

The number of digital photographs is growing beyond the abilities of individuals to easily manage and understand their own photo collections. Photo LOI (Level of Interest) is a technique that filters, aggregates, and visualizes photographs taken by multiple users who shared temporal, spatial, and/or social context at the point of photo capture. Photo LOI enables groups of photographers to see and manipulate visualizations of their photographic activities over time and social space in order to help cluster and select photos, and enables researchers to study contextual patterns in the phototaking habits of different users and groups of users. In this paper we give a brief overview of Photo LOI's features and describe some of its applications.

Categories and Subject Descriptors

H.3.1 [**Information Storage and Retrieval**]: Content Analysis and Indexing – *Indexing methods*; H.5.2 [Information Interfaces and Presentation]: User Interfaces

General Terms

Algorithms, Management, Design, Experimentation

Keywords

Photographs, level of interest, social trends, clustering

1. INTRODUCTION

The growth of personal digital photo collections made possible by the adoption of inexpensive digital cameras and accelerated by the advent of cameraphones has created both a challenge and an opportunity for consumers and multimedia researchers: how to manage thousands of personal digital photographs. With cameraphones, the availability of contextual metadata at the point of photo capture (when, where, by and around whom a photo was taken) offers new possibilities for managing personal photo collections by making it possible to easily compare and correlate personal photographic activity to that of other users and groups of users. Imagine thousands of attendees at a rock concert taking cameraphone photos throughout the event. The challenge of finding salient moments in any one photographer's personal collection is a very difficult problem using signal-based analysis techniques, but if we instead analyze the temporal and social correlations in the automatically gathered contextual metadata of the photos taken by multiple users at the concert, we can easily determine salient events, trends, and patterns in the photos taken by groups and individuals. Quite simply, through a temporal histogram representing how many photos collocated users took over time, we can visualize the photographic activity and "level of interest" of individuals and groups in a spatio-temporal cohort (See Figure 1). Visualizing this common contextual record of human attention will enable groups to share and manage very large photo collections as well as individuals to use the record of group interest to help manage their own photo collections.

Photo LOI (Level Of Interest) is a system created to enable users to see patterns and anomalies in contextually-correlated large scale multi-user photo collections. The system was designed as a tool for researchers to explore and understand these photo collections by being able to organize and filter photo collections into events. Automatically gathered contextual metadata is used to temporally cluster the photos to create an LOI histogram (See Figure 1). The peaks and valleys in the LOI histogram show the changing levels of interest, which can be further filtered to find "events" salient to the entire cohort, subgroups, and/or individuals. While Photo LOI can use any sort of correlated metadata associated with a collection of photos, we specifically developed this system to examine the MMM2 [2] photo dataset. This dataset contains over 25,000 photos collected from over 65 cameraphone users over 10 months and has temporal, spatial, and social contextual metadata associated with each photo.

There are other systems that organize photo collections into events using a variety of methods. Photo Compass [3] uses temporal and spatial contextual metadata to view events using GPS and time, while [1] uses temporal clustering to automatically group photographs into events. However, most of these systems have been designed to investigate a single person's photo collection, whereas the Photo LOI system has been designed to use automatically gathered temporal, spatial, and social metadata from multiple users to identify photographic patterns and events in both individual and group photographic behavior and photo collections.

2. PHOTO LOI BROWSER

2.1 LOI Calculation

The Photo LOI curve is a histogram-based technique that shows the number of photos taken in a given period in time. The method used is an extension of the basic LOI technique developed in [4]. The first step in the process is to select only the photos that the user wants to include in the LOI calculation. The Photo LOI browser has the ability to filter photos based on a variety of metadata including capture time, photographer, co-present people (Bluetooth), location tags (user added), and CellID. Once the user

MM'05, November 6–11, 2005, Orchard, Singapore.
ACM 1-59593-044-2/05/0011.

has applied the requisite filters, the browser then calculates the LOI for the photos. We use an exponential moving average of the number of photos taken around a given time to calculate the "level of interest" at that moment. The use of the moving average creates a smoother graph as well as takes into account the number of photographs around a particular time rather than focusing on only one moment in time. The granularity with which the Photo LOI is calculated can vary from minutes to days depending on the total time period covered by the photo set. The user can also adjust the size of the window used to calculate the moving average to increase or decrease the amount of smoothing.

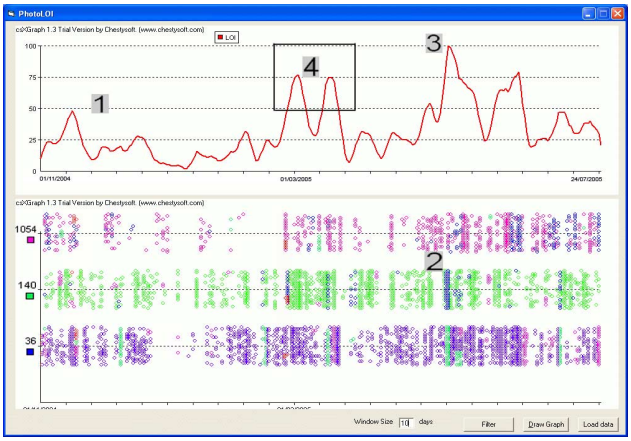

Figure 1. Photo LOI browser: 1) LOI curve; 2) Scatterplot of individual photo captures; 3) Example of an LOI peak event; 4) Selecting a photo subset using the LOI curve

2.2 Multiple Photo Sources

Each horizontal line (Figure 1.2) indicates a different user/photo source while the scatterplot represents individual photographs from that user/source. The horizontal axis represents time on the same scale as the LOI so that the photos that produce an LOI spike can be found directly underneath the spike. The scatterplot has some vertical jitter added to it so that the users can see more photo points at one time. On clicking a photo point, the user is presented with a thumbnail of the photo along with the textual description of the associated metadata. By using this technique the user can quickly examine individual photos within a cluster to learn more about them.

3. PHOTO LOI APPLICATIONS

3.1 Finding Events

Photo LOI is an excellent way to find important events that affect individuals and groups. Each of the spikes in the LOI curve represents a sudden increase in photographic activity which usually corresponds to an important event that the user and/or users wished to record. Since Photo LOI uses information from multiple users, it is especially good at finding events that were significant to many people in a group rather than strictly personal events, e.g., Figure 1.3 shows an event peak from our graduating MIMS students' final project presentations.

3.2 Collocation and Social Networks

The addition of the Bluetooth collocation data allows us to visually inspect the amount of co-presence among groups of users. In Figure 1.2, we see the co-presence information of 3 separate users being shown at the same time. Users 36, 140, and 1054 have been assigned scatterplot colors of purple, green and pink respectively. If one of the other users was detected as being co-present, the photo plot is changed to the color of the sensed user. If all three users were co-present, the plot changes to orange. As we see in Figure 1.2, users 140 and 1054 are often co-present with user 36, but are very rarely co-present only with each other.

3.3 Selecting Photo Subsets

The use of the filters in Photo LOI allows us to identify events and to drill down to specific social, spatial, and temporal photo subsets that we wish to examine in greater detail. Once specific groups of photographs have been identified, then we can directly select the subsets by selecting either sections of the Photo LOI or the scatterplot. Figure 1.4 shows an example where the user has directly selected two peaks of the LOI curve which leads to the creation of an HTML album of the photos that form the peak.

4. CONCLUSION

In this paper we have described the Photo LOI browser which presents a new paradigm in viewing large aggregated and temporally correlated multi-user photo collections. The Photo LOI system uses a variety of metadata to find the social, spatial, and temporal relationships among photos and displays them in a simple and easy to understand manner. The system has many applications including finding important "events" in the lives of the users, identifying usage trends, selecting specific photo subsets, determining collocation, and visualizing social groups. While Photo LOI is currently optimized to visualize temporal and social patterns and events in group photographic behavior, future versions will be extended to make better use of spatial metadata in the Photo LOI visualization.

5. ACKNOWLEDGEMENTS

We wish to thank the MMM2 Team, our MIMS students in IS202, and our MMM2 project sponsors—British Telecom, Hewlett-Packard, Nokia, France Telecom, Ricoh Innovations, TEKES, Opera, HIIT, and the UC Discovery Grant for Digital Media—for their generous support of this work.

6. REFERENCES

[1] Cooper, M., Foote, J., Girgensohn, A., and Wilcox, L., Temporal event clustering for digital photo collections. In *Proc. ACM Multimedia (MM 2003)* (Berkeley, CA, November 2-8, 2003). ACM Press. New York, NY, 2003, 364-373.

[2] Davis, M., et. al. MMM2: Mobile Media Metadata for Media Sharing. In *Proc. ACM Multimedia (MM 2005)* (Orchard, Singapore, November 6-11, 2005). ACM Press, New York, NY, 2005, Forthcoming.

[3] Naaman, M., Harada, S., Wang, Q.Y., Garcia-Molina, and H., Paepcke, A. Context Data in Geo-Referenced Digital Photo Collections. In *Proc. ACM Multimedia (MM 2004)* (New York, NY, October 10-16, 2004). ACM Press, New York, NY, 2004, 196-203.

[4] Nair, R. Calculation of an Aggregated Level of Interest Function for Recorded Events. In *Proc. ACM Multimedia (MM 2004)* (New York, NY, October 10-16, 2004). ACM Press, New York, NY, 2004, 272-275.