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# Location and Photos – A Match Made in Heaven... or Hell?

[Position Paper]

**Mor Naaman**

Yahoo! Research Berkeley  
+1 510 704-2413  
mor@yahoo-inc.com

**Mirjana Spasojevic**

Yahoo! Inc.  
+1 408 349-2883  
mirjana@yahoo-inc.com

**Abstract**

Recently there has been a lot of interest to bring location data and location-based features to mass-market consumer images. The availability of these enhancements can potentially bring a vast improvement in access and change usage patterns of image media. At the same time, direct interaction of users with location-based data, and the implications of such technology, may generate a negative response that will prevent adoption.

We have previously studied social and personal uses of camera phones, and the opportunities that location-based image collections afford. We are currently building and evaluating a system that brings these aspects together. This system utilizes and exposes in various ways location data for camera-phone photos.

**Introduction**

The potential of location and other sources of context information that is attached to consumer images is substantial. The advent of camera phones will make it possible, for the first time, to attach such contextual information to media captured by mass-market users. Such contextual information may include the location where a certain image was captured. Other information may include the exact local time when the photo was

taken, as well as the nearby Bluetooth devices, suggesting presence of their owners.

This contextual information, primarily the location and time data, can aid the access to (and usage of) media in various levels. Location provides very strong metaphors for organization of personal image collections. [1, 2]. In addition, location is a *primary context type*: it serves as an index for additional contextual information. Such useful information originates from other datasets, and can include, to give a few simple examples, nearby landmarks or nearby points of interests like restaurants, stores or parks. Location and time together are indices for information like daylight status and weather information at the time of capture that can serve as reminders and cues for media organization.

Location data is also pivotal as it provides the basis for sharing of images and image metadata in ways that did not exist before. Using location (possibly augmented by time and other contextual data) a system can now easily relate images that form meaningful semantic sets in place and time. Such a set could represent all images taken in the same location, or even the same event (if time data is available). Notice that no explicit user input is needed to make these connections and create these virtual sets. Furthermore, an application [3, 4] could use the location and time data to borrow metadata such as tags from other photos taken in the same location or event. To summarize, location-based sharing systems may obey Metcalf's law: their usefulness grows as the square of the size of network.

Finally, research had shown that contextual data can be used to predict explicit sharing behavior (who the user

shares the photo with) as well as the identities of people that appear in the photos [5, 6].

In the social image exchange context, the location information helps build a *common ground*: what sender and recipient know about each other and each other's current circumstances. The most compelling exchanges of camera phone images observed in our prior research demonstrated heavy dependence on such a common ground [8]. Without it, users need to work extra hard to describe the image context, either by adding text or voice annotations or providing a direct interpretation in a face-to-face conversations.

Indeed, in expressing their wishes and desires for further technology developments, users tend to rank capturing context, including identity of people in the image, the location and the ambient sound, very prominently on their list. This wish was noted for over a quarter of images examined in one of our studies [7].

However, while the potential of location-based context for consumer image application is immense, the risks are considerable. For example, on a personal level, users may reject these developments upon realizing how much private information is stored and potentially revealed. There tends to be a significant gap between a general wish and acceptance of a particular feature once users have a direct experience with it. On a social level, users may be hesitant or unwilling to expose location and other contextual features when sharing photographs. To that end, we have a number of research questions about characteristics of sharing of contextual information with an image:

- Will users explore new ways to organize and share their photos, given the contextual data?
- Who will these images be shared with? Particular individuals or small social groups vs. anonymous audience, such as users visiting a public photo-sharing site?
- What will be the context of sharing these images and in what granularity will they be shared?
- How will the sharing patterns be affected by the new capabilities?
- Will users be concerned about privacy, and if so, which features will trigger that? Will it be the basic level of location disclosure and the fact that it is recorded? Or will it be the powerful features that may feel like active intrusion? For example, with *tag suggestions*, realizing that other people's tags are visible and their personal tags can be exposed may bring a level of concern for some.
- Where will the users draw the line in exposing the location information pertaining to their photos? Will it involve time of day (working hours) or place (home vs. away)? Will they ever lie about their location [10]?

### **Current Projects**

We are currently developing a context-aware camera phone application at the Yahoo! Research Berkeley Lab. This application will be released to the general public in January 2006, and will utilize the location context available from camera phones.

Our goal is to study its adoption and the social exchange patterns that develop along the way, focusing on the research questions listed above. We plan to contrast the findings with our previous camera phone studies. While we anticipate this ongoing research to extend well into 2006, we expect to be able to report on some preliminary findings by the workshop date.

### **Author's Background**

Mor Naaman had been looking at the potential of location data for photo application in his Stanford PhD work. Mor's research was one of the first academic projects to look at location-referenced photographs, and published many of the early works in topics including photo collection organization [1]; enhancing the contextual information of images; predicting the identities of people that appear in photographs using contextual information [5]; and implicit sharing of metadata such as tags using location and time context [4]. Mor Naaman currently leads a research team at Yahoo! Research Berkeley.

Mirjana Spasojevic is the Senior Design Researcher in the Yahoo! Mobile business unit. Over the past few years she has been studying how and why people use camera phones, documenting the current practices and exploring opportunities for new technologies. She has conducted an ethnographic study of camera phone use in the US, as part of a global UK/US project [7]. Also, she has been the lead organizer of the workshop at Ubicomp 2005 on "Pervasive Image Capture and Sharing: New Social Practices and Implications for Technology" (PICS) [9].

## References

- [1] Mor Naaman, Yee Jiun Song, Andreas Paepcke, Hector Garcia-Molina. Automatic Organization for Digital Photographs with Geographic Coordinates. Proc. of JCDL 2004.
- [2] Antoine Pigeau and Marc Gelgon. Organizing a personal image collection with statistical model-based ICL clustering on spatio-temporal camera phone metadata. Visual Communication and Image Representation, 2004.
- [3] Marc Davis, Simon King, Nathan Good, and Risto Sarvas. From Context to Content: Leveraging Context to Infer Media Metadata. Proc. of ACM MM 2004.
- [4] Mor Naaman, Andreas Paepcke, Hector Garcia-Molina. From Where to What: Metadata Sharing for Digital Photographs with Geographic Coordinates. Proc. of COOPIS 2003.
- [5] Mor Naaman, Ron B. Yeh, Hector Garcia-Molina, Andreas Paepcke. Leveraging Context to Resolve Identity in Photo Albums. Proc. of JCDL 2005.
- [6] Marc Davis, Michael Smith, John Canny, Nathan Good, Simon King, and Rajkumar Janakiraman. Towards Context-Aware Face Recognition. Proc. of ACM MM 2005.
- [7] Kindberg, T., Spasojevic, M., Fleck, R., Sellen, A. The Ubiquitous Camera: An In-depth Study of Camera Phone Use. IEEE Pervasive Computing, special issue on The Smart Phone, Apr-Jun 2005.
- [8] Kindberg, T., Spasojevic, M., Fleck, R., Sellen, A. I Saw This and Thought of You: Some Social Uses of Camera Phones. Proc. of CHI 2005.
- [9] Spasojevic, M., et al. Pervasive Image Capture and Sharing: New Social Practices and Implications for Technology. Workshop at The Seventh International Conference on Ubiquitous Computing, Tokyo, Sep 2005. <http://www.spasojevic.org/pics/>
- [10] Giovanni Iachello, Ian Smith, Sunny Consolvo, Gregory Abowd, Jeff Hughes, James Howard, Fred Potter, James Scott, Timothy Sohn, Jeffrey Hightower and Anthony LaMarca. Control, Deception, and Communication: Evaluating the Deployment of a Location-Enhanced Messaging Service. Proc. of Ubicomp 2005.