

Foragr: Collaboratively Tagged Photographs and Social Information Visualization

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ABSTRACT

Foragr is an interactive desktop system for exploring and collecting “interesting” photos on the Flickr photo sharing site. Each day the Flickr system ranks and selects roughly 500 Flickr photographs through an as yet unrevealed process. These photos can be considered an easily navigable, attractive, visual gateway into the massive Flickr photographic community. The web-based presentation of interesting photos is relatively sparse and barely exploits the social nature of Flickr. Foragr is being built to explore denser, more socially oriented navigation schemes.

A key element of Foragr is exploiting the photos’ user applied tags. Tags in Flickr are an important mechanism for social navigation and discovery of new photos. I have taken snapshots of the Flickr interesting pages covering the calendar year 2005, and can report some preliminary descriptive statistics on the tag structure of these photos.

In order to understand how effective tags can be used to better present the interesting photos, clustering experiments are being run against the photo snapshots. Preliminary results of the application of document clustering techniques, applied to photo tags, are presented.

Categories and Subjects

H.4.m [Information Systems]

General Terms

Social navigation, collaborative tagging, information visualization

Flickr, Tags, and Interestingness

Flickr, <http://www.flickr.com/>, is a Web based, online photo management and sharing application. As of this writing, the Flickr development team states two goals for the site:

1. “We want to help people make their photos available to the people who matter to them. ... To do this, we want to get photos into and out of the system in as many ways as we can.”

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2. “We want to enable new ways of organizing photos.”

The Flickr team has been quite successful in luring users to this vision, garnering media attention, and running a successful business. Earlier in 2005, Flickr was acquired by Yahoo! and is clearly a phenomenal hit.

An important aspect of Flickr’s success has been the considered application of collaborative tagging. Flickr allows users, and designated collaborators, to apply an arbitrary number of textual labels, *tags*, to an uploaded photo. Each tag in turn generates an owner specific webfeed and participates in a Flickr global webfeed. Here I use webfeed to refer to documents in any of the many flavors of RSS [14] or Atom [7]. These webfeeds become a means to automatically monitor Flickr for new photos.

While tags are popularly considered a means of classifying media objects [8], I contend that this combination of tags and webfeeds also serves as an important signalling and social navigation mechanism within Flickr. Later in this paper I examine the tag statistics of a small, but important, sample of Flickr’s public photos to demonstrate this point.

The sample examined is Flickr’s top photos as measured by *interestingness*. Each day roughly 500 Flickr photographs are ranked and selected as “interesting” by an as yet unrevealed process. As best determined by amateur investigators, the interestingness of a photo is calculated using the following factors:

- Views, internal and external to Flickr, of the photo
- Number of comments on the photo, and also who comments on the photo
- Tags applied to the photo
- Flickr discussion groups in which the photo appears
- Favorites, a.k.a Flickr bookmarking, of the photo
- Time varying behavior of the above factors

The presentation of these interesting photos can be considered an easily navigable, attractive, visual gateway into the massive Flickr photographic community. Unfortunately, the web-based presentation of interesting photos is relatively sparse and barely exploits the social nature of Flickr.



Figure 1: A screen capture of the Foragr browsing interface. The user has zoomed in on a an interesting photo from September 7, 2005 and is browsing the tags applied to this photo and the public groups in which the photo appears

Foragr

forage

noun 1: animal food for browsing or grazing [syn: eatage, pasture, pasturage, grass] 2: the act of searching for food and provisions [syn: foraging]

verb 1: collect or look around for (food) [syn: scrounge] 2: wander and feed; “The animals forage in the woods” [12]

These deficiencies sparked the development of Foragr, a desktop application built to explore denser, more socially oriented navigation schemes. Foragr works on monthly snapshots of Flickr’s interesting photos, but the techniques being explored could be extended to any large scale collection of tagged media. Figure 1 is a screen capture of Foragr displaying interesting photos from September, 2005. Foragr’s visual presentation is modeled after Bederson et. al’s DateLens [2], using an animated calendar to organize the month’s photos. With an eye towards embedding Foragr in a Web browser page, DateLens’ compact display was attractive.

The capture of Figure 1 illustrates some of the browsing features of the Foragr interface. Once a user selects a given day, thumbnails of interesting photos on that day are displayed. At this level

of focus (not displayed) the day’s space is given over completely to thumbnails of the large size seen in the “Jordan Thinks” cell. The Prev and Next buttons page through groups of these thumbnails. A further selection turns the thumbnail into a micro-visualization of Flickr information on the photo. The thumbnail can be shift clicked to bring up a browser window on the corresponding Flickr photo page. To the right of the thumbnail, a number of text items are displayed in a fisheye view. Items close to the pointer are magnified, those farther away are given a smaller rendering. The blue text, items above Portrait Faces, are user applied tags. The yellow items, Portrait Faces and below, are pool titles. Each textual item can be clicked on to navigate to photos with the same tag, or a photo pool that contains the original photo. Also, as the items are rolled over, if other days contain photos with the same tag or pool identifier, the day is highlighted. Similarly, the text below the thumbnail can be used to open a browser on the photo owner’s page or highlight days with photos from the owner.

The visual design of Foragr is inspired by two concepts from Tufte’s “Envisioning Information” [11]: micro/macro readings and small multiples. Of micro/macro readings Tufte says, “to clarify, add detail,” and, “Panorama, vista, and prospect deliver to viewers the freedom of choice that derives from an overview, a capacity

to compare and sort through detail.” Within the display of a day, Foragr attempts to provide as much detail as possible on the presented photos. In addition, interactive techniques are used to allow the user to surface relationships amongst the photos. For example, hovering a tag will subtly highlight other visible photos and days in which that tag appears. In regards to small multiples Tufte writes, “Small multiple designs, multivariate and data bountiful, answer directly by visually enforcing comparisons of changes, of the differences among objects, of the scope of alternatives.” Foragr uses days, and photos within a day, as the small units.

While currently only usable for navigation, as the above definition of *forage* implies, the eventual aim is to have Foragr be useful for collecting photos and generating new social media. The goal is to support the gathering of photos into discrete collections and then automatically generate a mosaic, montage, or even interactive visual artifact from the collected photos. Examples of such artifacts include Flickr’s own “Daily Zeitgeist” [1], and Watson’s Flickr Toys [13], which generates mosaics, movie posters and magazine covers from Flickr photos. These artifacts, if not simple images, would have to be hosted through another Web application as Flickr only hosts images. However, snapshots of the artifacts could be reinjected into Flickr. In total, this combination would enable a new class of “foraging” Flickr users, who might not have photographic skills (or even a camera) but can serve the community as curators. I hypothesize that the presence of such users is an important element of any large scale, social media system.

Interestingness Snapshots

Foragr is currently a desktop application to avoid reliance on the Flickr site being up and to remove network latency from the interaction. The application works on snapshots of Flickr interesting photographs. The snapshots archive unique photo identifiers, meta information about the photos, and photo thumbnails. The actual original photographs are **not** captured.

Snapshots are taken on a complete month of interesting photos. The Flickr Web Services API provides a call to retrieve the current interesting photos for a given date. The same API is used to retrieve meta-information about each of the photos. For a photo, the Flickr API can return a wealth of information including: the owner, title and description of the photo, tags applied to a photo, sets (owner defined groups of photos) containing the photo, Flickr discussion groups in which the photo has been made visible, and the number of comments on the photo. For each of the discovered interesting photos, this information is recorded in a Berkeley DB style database comprising the snapshot.

A snapshot was taken for each month of 2005 with the caveat that a consistent methodology wasn’t applied across the snapshots. For example some snapshots were taken well after the end of the month since this project did not begin until June of 2005. Other snapshots were taken promptly at the end of a month. However, the process for collecting snapshots has stabilized. Thus a solid body of empirical data is being established. Also, interestingness rankings are dynamic, apparently depending on many aspects of Flickr user behavior. The snapshots described are truly captures of moments in time. A future goal of this project is to examine the longitudinal behavior of interestingness, tracking interestingness behavior of specific dates and photos over a period of time.

Some Tag Statistics of Interesting Photos

The interestingness snapshots provide data for a number of descriptive statistics related to an important part of the Flickr universe. Keeping in mind that the interesting photos are meant to encourage exploration of Flickr photos and the broader Flickr community, here are some observations.

A common position within the tagging community is that tags help categorize media objects. I take the position that tags are also an important social navigation or *signalling* mechanism, easily enabling borderless, ad hoc communities to form. If true, this may have implications for how particular tags are presented or used in offline analysis, e.g. clustering and relevance rankings

The use of *signalling* tags is an observable effect within interesting photos. For September 2005, I analyzed the tag appearances. On the 15,000 photos, 28,718 different tags appeared a total of 135,960 times. Pursuant to Foragr’s calendar organization, tag appearances were broken down day by day, and within a day ranked by the number of appearances. The vast majority of the tags, 18,432 for 65%, only appear once in the entire month. As ranked by number of appearances, only 186 tags appear in the top 20 at any point in the month. On a given day 5% or less of the appearing tags rank in the top 20. The number one tag will typically have between 40 to 50 appearances. The twentieth ranked tag usually appears 8, 9, or 10 times.

Of all the top appearing tags roughly 25 are what I term *signalling* tags, tags that are meant to indicate to other Flickr users to take action on a photo or recognize the importance of the photo. Below is a sampling of these tags

```
delete deleteme deleteme10 deleteme2
deleteme3 deleteme4 deleteme5 deleteme6
deleteme7 deleteme8 deleteme9 save saveme
saveme2 saveme3 saveme4 saveme5 topc50 topf25
topf50 topv111 topv222 topv333 topv555 topv777
```

Figure 2: Some signalling tags from Flickr photos

These tags were extracted simply by looking for top 20 tags that begin with `top`, `delete` and `save`. The tags clearly have little to do with categorization. Tags such as `deleteme...` are participating in a collaborative scheme where Flickr users ruthlessly evaluate each other’s photos. `top...` usually indicate a popularity event according to a metric such as number of views received by the photo, `topv...`, or number of times the photo has been “favorited”, e.g. `topf...`. Many of the above signalling tags consistently appear in the top twenty on a daily basis. Another interesting observation is that a non-trivial number of interesting photos have no tags applied to them. For September, 2005, roughly 1084 of the 15000 photos have not tags. Thus, tagging is not mandatory for a photo to be interesting although it appears to be a strong prerequisite.

I propose two hypotheses regarding signalling tags. They are applied before interestingness ranking, attract other Flickr users, and subsequently contribute to a higher rating. Alternatively, the ranking is independent of the tag, and users literally are signalling other users to the high ranking achievement. In either case, it is safe to say that tags are an important *communication* mechanism in addition to a categorization technique.

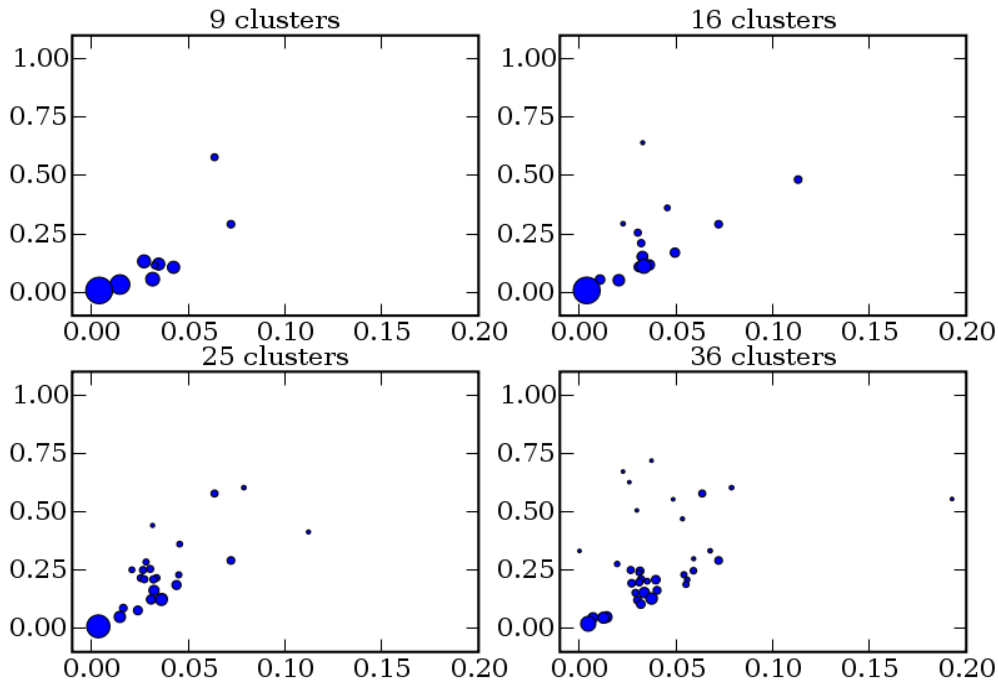


Figure 3: Scatter plots of cluster quality for photo clusterings, based on photo tags, of four different clustering sizes. Internal cluster standard deviation on the x-axis, internal cluster similarity on the y-axis, scatter point size corresponds to cluster size

Clustering Experiments

One goal of Foragr is to make the browsing of 500 interesting photos on a given day as dense and compact as possible. Towards this end, I was interested in searching for useful groupings of photos based upon the tags used to label them. This is in an effort to better deploy precious real estate as well as highlight potential social connections. An approach I am currently investigating is the application of *clustering* techniques to the photos. My initial effort is in straightforwardly translating the task into a text document clustering problem, and using a high quality, stable, toolkit with a wide range of features and options.

In translating to a document clustering model, a set of photos generate a feature space, in this case all the tags that appear on any of the photos. Then a feature vector, the applied tags, is constructed for each photo. Using a measure of feature vector similarity and a criterion for cluster quality, typically based on average similarity within the cluster, a clustering algorithm will collect the feature vectors into groups.

There are a number of challenges and unanswered questions with this model. Can this approach actually generate any good clusters? If so how many and what is their quality? Since the tags are generated in an ad hoc fashion, multiple differing tags for the same term, may arise. Will this confuse a clustering algorithm? A priori, the number of clusters leading to a good clustering is not known. Thus, a sweep through the space of clustering sizes seems appro-

priate. Finally, what do the clusterings look like on a daily basis?

My initial results indicate that there may be potential in this approach, although there is much further investigation needed. In Figure 3, I present results of a trial clustering of the 500 interesting photos from September 7, 2005. The four scatter plots represent clusterings with 9, 16, 25, and 36 clusters, the idea being that a distinctive or representative photo from each cluster could be easily presented in a two dimensional square of thumbnails within Foragr. Each scatter plot displays the internal similarity of the cluster on the y axis, the internal standard deviation of the cluster on the x axis, and the number of photos in the cluster as the size of the scatter point. Internal average similarity and standard deviation are calculated on feature vector similarity, in this case a standard, normalized cosine vector measure. Clusters tending toward the upper left quadrant are better, exhibiting high cohesiveness. The lower left is probably indicative of clusters which are not at the right granularity, having some internal cohesiveness and limited variability. The lower right holds the poor clusters, essentially dumping grounds as the clustering algorithm attempts to cluster all of the items.

In Figure 4, we see some of the descriptive features from the size nine clustering. The clusters are in rank order based upon internal similarity of the clustered items. The terms are the tags that unite the photos within cluster. The number in parentheses is the count of photos that fall into that cluster. The total number clustered is 465 out of 500 as 35 of the photos have no tags applied. This gives a sense of what the images in the cluster represent at least from a

1. deleteme7 deleteme6 deleteme5 deleteme4 (12)
2. selfportrait me self blackandwhite (14)
3. wow topv111 100v10f 1025fav (41)
4. topv111 interestingness macro topc50 (36)
5. saveme over10000views deleteme10 baby (11)
6. portrait bw blackandwhite woman (36)
7. cat macro cats cute (46)
8. blue water nature sky (94)
9. katrina art feet 2005 (175)

Figure 4: Descriptive terms from a photo clustering, 9 clusters generated, based upon the tags of the photos.

tagging perspective.

Constructing photo clusterings is completely automated. I continue to investigate how clustering results vary across the various dimensions of clustering algorithm, clustering size, and feature extraction. On that third aspect, I am interested in understanding the effect using photo pools and sets as features has on the clustering results. Also, how should the features clustered on, a.k.a. the tags, be weighted? In Figure 4, many of the descriptive terms seem to correspond to popular tags. Can more interesting, distinguishing tags be discovered by weighting against these tags?

Implementation Details

This project was primarily implemented in the Python programming language. Code to take the monthly snapshots of interesting photos was written in the C implementation of Python. Michele Campeotto's [3] Python module for the Flickr API was used to retrieve photo information from Flickr. Snapshot data is stored as serialized Python objects in Berkeley DBs, using the Sleepycat implementation [9]. Campeotto's library relies on Aaron Swartz's xmltramp [10] to parse and represent the XML used in the Flickr API. However, I subsequently convert Swartz's representation into Fredrik Lundh's [6] ElementTree format to better support XPath style queries against photo metadata.

Foragr is written in Jython, the Java implementation of Python. Jeffrey Heer's `prefuse` [4] information visualization toolkit provides the graphical foundation. Snapshot data is accessed using Sleepycat's Java bindings for the Berkeley DB API. Thanks to the portability of Berkeley DB files, the snapshots required no conversion for usage under Windows. Python's object serialization mechanism works identically across both Jython and CPython allowing Foragr to straightforwardly internalize the snapshot data.

The clustering experiments were implemented using a home-grown Python wrapping of Karypis' Cluto [5] clustering library. Cluto is an optimization based clustering toolkit that provides a number of different item clustering techniques including divisive and agglomerative schemes for collections represented both as feature vectors and as graphs. The toolkit also provides comprehensive analysis and summarization of the clustering results.

Conclusions and Future Work

In this extended abstract, I have described Foragr, a prototype application for visualizing large collections of photos. The motivation for developing Foragr is the browsing of "interesting" photos from Flickr, a popular online photo service that incorporates collaborative tagging. Flickr's standard display of interesting photos is relatively sparse and limited in its use of social information, including tagging. Foragr was initiated to explore denser and more social information visualizations of the large number of interesting photos collected on a daily basis.

On the path to implementing Foragr, snapshots of the Flickr interesting photo pages were captured for each calendar month of 2005. These snapshots provide a rich basis for empirical studies on the tagging behavior within one particular social environment. For example, a set of non-categorizing, *signalling* tags seems to play a significant role in the life of interesting photos.

Also, preliminary results of applying some standard document clustering techniques to sets of tags gleaned from the interesting photos. While some useful clusters can be discovered, more work is needed to determine what factors affect cluster quality, and improving the results.

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