

# Web-based Image Organization and Search

CS 4440 Database Technologies

Final Project Proposal

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## Motivation and Objectives

As digital cameras continue to drop in price and become more ubiquitous the need for convenient ways to share, search, and browse large collections of images becomes apparent. The existing body of digital media is enormous and continues to grow at an increasing pace. Unlike traditional text-based content images are less-easily indexed. Most web applications that provide image search rely on tags applied by users, contextual information, or other forms of metadata associated with images to index photos while some are beginning to use more advanced machine learning and computer vision algorithms to analyze image content itself. Our objective with this project is to create a useful web application that will support tasks commonly associated with images including searching, browsing, and assembling galleries. This problem is interesting because the image domain provides many interesting challenges for database technology such as how to store images, how to search efficiently, and how to cluster tags to support browsing. It is our intention to investigate different methods of searching including a tag-based approach and possibly an image-based approach as well. Browsing will be accomplished by clustering image descriptors in some way and allowing users to explore images with similar content. In addition the web application will also have to support image uploading and other basic tasks.

## Related work

There are several existing web-based applications that provide image management. Sites like Flickr and Picasa Web Albums by Google allow users to upload images, tag them with keywords, captions, and geographical data. Sites like this allow users to sort their photos into galleries and provide search based primarily on tags. Many social networking sites such as Facebook, Myspace, etc. also feature photo management and tagging capabilities. Some sites also provide a map-based view to browse photos that have been tagged with geographic information indicating where the photo was taken. Many of these sites have enormous databases of images numbering in the hundreds of millions to billions of images. Due to the enormous scale of these databases it seems that almost all search tasks are performed using tags or other text metadata. This is much more efficient because it cuts down on the storage and processing overhead of using image based methods and it performs well if the

tags or metadata is of a high quality. The downside to this method is that tags must be manually entered by people for each image.

To solve this problem much work has been done in the area of content-based image retrieval (1) as well. Several approaches have been used including clustering key points of an image and assigning query images to a cluster (2) and building a vocabulary tree of common features (3). In general these methods depend on detecting and extracting features in images that are invariant to scale and other transformations and then using the presence or absence of these features in a query image to determine how similar the query image is to other images in the database. Other approaches exploit histogram and color information to find images with similar colors (4). Since these techniques rely on color similarity they may have problems when images are taken under varying lighting conditions. Other technologies such as face recognition could also be extended to images of people by detecting and matching a person's face across a body of images (5).

### **Proposed work**

For the project we intend to implement a web-based photo sharing application that will allow users to upload their images, organize them somehow, and search other user's images. There are several possible novel ideas we can choose to implement for the project including:

- Application of clustering algorithms discussed in class to create groups of similar images
- Developing better methods of sharing images possibly including some kind of recommendation system based on images a user likes or dislikes
- Some method of content-based retrieval in which a user supplies a query image and is returned a list of similar images
- Attaching geographic information to images and retrieving all images in a given region

The searching and browsing part of the application offers many possibilities for expansion and could allow users to search based on image properties, applied metadata (such as tags and captions), or possibly the image content itself.

To accomplish these goals we will need to design a database to store all the metadata associated with images as well as store the images themselves (or pointers to the images). We will also need to develop a web interface to support the various tasks. Some of the extensions such as content-based search and clustering, which are processing intensive may need to be implemented as standalone applications that output results or accept queries from the web

interface. Choosing appropriate frameworks for this architecture will also be important.

### **Plan of action (what resources, schedule, plan for evaluation)**

In order to implement this project we will need to acquire a web host to serve the web application and database from. This server will also need to support whatever languages and software we decide to use for the project. Since it is a web application it shouldn't be platform dependent. A rough list of goals follows:

- Design database, architectural decisions
- Implement basic web-based functionality (user creation/log in, upload images, tags)
- Implement advanced functionality (clustering, image feature extraction)
- Integrate clustering results, etc. with web application
- Evaluate result

### **Evaluation and Testing Method**

Evaluating the resulting web application can be accomplished by testing basic functionality as well as determining performance for basic tasks and how performance scales as the size of the database grows. Search could be evaluated by using a test dataset and determining how much error is present in results. Browsing image clusters could be evaluated subjectively using some type of user testing. Finally, if we implement a recommendation system or content-based search we could use a known image dataset to determine how effective these solutions are.

### **Bibliography**

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