

# Collection Understanding Through Streaming Collage

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## ABSTRACT

Collection understanding shifts the traditional focus of retrieval in large collections from locating specific artifacts to gaining a comprehensive view of the collection. Visualization tools are critical to the process of efficient collection understanding. By presenting simple visual interfaces and intuitive ways of interacting with a collection, users come to understand the essence of the collection by focusing on the artifacts. This paper discusses the use of streaming collage to enhance image collection understanding.

## Keywords

Collection understanding, visualization, digital libraries, image collections, streaming collage

## INTRODUCTION

Digital libraries are providing novel means of information access to large collections of digital artifacts. Widely available digital imaging technologies have resulted in a dramatic increase in the number of images one is able to store in digital collections. However, these large image collections pose a challenge for the collection provider when trying to convey the actual contents of these collections. Users cannot effectively understand what constitutes a large image collection if they are unable to see what is in the collection in an efficient manner. Visualization tools are critical to the process of efficient image collection understanding, not only for viewing the images but also for understanding their metadata. By presenting simple visual interfaces and intuitive ways of interacting with a collection, users come to understand the essence of the collection by focusing on the artifacts.

Various methods have been used to express information about desired artifacts in a large image collection [34]. These image retrieval methods include browsing using metadata [35], keyword/phrase searching on specific metadata fields [36], and finding similar images through feature extraction such as contour, texture [24], shape and

color [29]. Directly searching on these image collections traditionally returns pages of thumbnail images [11]. Users scroll through the images and select thumbnails to see additional information (assigned metadata). These methods help the user to search for specific artifacts in the collection.

Collection understanding has a different focus when viewing the collection. The goal here is to understand the entire collection by comprehending the “whole as a sum of its parts.” By “parts,” we mean a subset of artifacts in the collection. The user should be able to iteratively specify subsets and visualize the resulting images easily and efficiently.

Screen space is a key factor in designing visualization tools for image collections. Displays are limited with respect to the number of thumbnail images that may be shown without scrolling or navigating to the next page of results. Scrolling is slow and navigating becomes very tedious for the user [37]. When the images are separated and cannot be seen simultaneously on the same display, users become distracted from their main goal of collection understanding. When the result set is very large, users may find the process of examining the images almost impossible, since they must sequentially go through each page of thumbnail images.

Our research is exploring various techniques, including streaming collage [19], variably gridded thumbnails [6, 30], and ambient slideshows [26], to more effectively use the screen space. By utilizing visualization techniques that eliminate manual scrolling and the process of browsing, collection understanding is enhanced. In this paper, we will discuss the use of streaming collage to enhance collection understanding.

## RELATED WORK

Several means of visualizing image collections have been explored in previous research [4, 5] and this area is currently very active in the digital libraries research community [11, 28, 31, 35]. Our research draws most heavily from the following four areas: photo browsers, image browsers, collage, and ambient displays.

*Photo browsers.* Photo browsers specifically manage collections of photographs. They typically include home photo collections and introduce browsing techniques for

novice users [16]. They allow users to easily digitize and organize their photographs into categories of events, based on metadata created by the user [16, 22], file names and directories [2], and the date and time [11] that the photos were taken.

*Image Browsers.* Image browsers manage a more diverse collection of artifacts, including photographs [22], architectural drawings [8], and museum paintings [3]. They provide effective ways to retrieve artifacts [6], browse large images [23], and provide user interfaces for viewing these collections [3, 10, 30].

*Collage.* Collage is an effective tool for utilizing screen space, allowing a large collection of images to be viewed simultaneously. Collage has been used to provide a novel web browsing technique [17, 18, 19, 20, 21], form aesthetic and dynamic art pieces [9], create a group awareness tool [12], and show a physical information collage connected to an electronic information display [27].

*Ambient Displays.* Ambient displays do not require a user's undivided attention or continuous real-time interaction [26]. Rather, they display non-critical information [33] slowly in the background environment [13, 14]. Through chance encounters, they engage the user's attention without requiring direct focus [15].

#### **CURRENT PRACTICE**

Three main problems plague current digital library interfaces for querying large image collections: querying by metadata is ambiguous, browsing is predefined and inflexible, and scrolling through thumbnails becomes burdensome.

#### **Problems with Querying by Metadata**

While creating metadata is time-consuming for collectors, querying metadata is currently the most used method for accessing images. Users enter a metadata query and matching images are returned from the collection. However, the user is limited with respect to how the creator/maintainer defines the metadata. In addition, most metadata descriptions are vague. They contain few sentences and provide little information about the possible values that satisfy the metadata field. Instead, users are left to guess how the creator categorized the metadata and cannot query the image collection unless they know what is in the collection. This process of trying to decide how to begin a search is inefficient and hampers the users' intention to learn about the collection.

If the user is successful at deriving the values for the metadata fields, the query results generated are specific to the metadata that the user entered and the user never sees similar artifacts in the collection that share some of the metadata values. Relationships between the image elements and the metadata are lost. The user obtains results based on knowing what the metadata values are, but doesn't gather any information about the remainder of the collection,

losing the real benefit of understanding the entire collection.

#### **Problems with Browsing**

Browsing is another popular technique for image access, but browsing categories are usually pre-defined and static, forcing the user to follow a fixed structure with little flexibility for adapting to the user's needs. The user simply "points and clicks" and narrows the collection to a subset of images. This technique is very time-consuming and may involve a large amount of pointing and clicking to get to the actual images.

Collection understanding is not focused on narrowing the view of a collection to a small subset of images. Instead of trying to find specific images, we would like the user to start with some image(s), and then expand that view to more images from the collection, gradually deriving relationships about the complete collection. We want the users to progressively learn about the collection and to dynamically define search categories once they have a better understanding of what the collection contains.

#### **Problems with Scrolling through Thumbnails**

When images are returned from a query, they are typically displayed using thumbnails across and/or down the screen [6, 11, 16]. Users scroll through the results and choose images of interest. With limited screen space, the user must scroll through these images or click the next page link to see more results. With either technique, the previous image matches are no longer in view and the user cannot see the entire result set. Thus, image viewing becomes a limiting task and the collection is more difficult to understand.

#### **VISUALIZING IMAGE COLLECTIONS FOR COLLECTION UNDERSTANDING**

As discussed above, existing digital library interfaces do not provide adequate mechanisms for collection understanding. More perceptive mechanisms are needed to simplify the view of large image collections, allowing users to efficiently grasp the essence of the collection.

#### **Collection Understanding**

Collection understanding is an attempt to view the artifacts that constitute the collection in an extensive sense. We are trying to learn about the general underlying theme of the collection, the features the image elements have in common and the varying qualities that link them as a collection. By increasing our awareness and obtaining a comprehensive outlook, we hope to appreciate the collection builder's (or curator's) point of view about what the collection represents and which characteristics the image elements share as members of the collection, so that we may derive our own perception of the collection.

#### **Image Collection Understanding**

Typical access to image collections consists of querying metadata fields and being presented with responses that match the query. These metadata fields are descriptive fields that characterize the image such as time, title,

photographer, medium, dimension and event [7]. They represent structured information to help manage the images in the collection and to facilitate image description and discovery [35]. However, results that match metadata are specific to the query and give no broad perspective as to what the collection actually contains. For instance, what are the actual artifacts in the collection? What determines whether an artifact belongs to this collection or not? What are the relationships between images that form a subset of the collection?

The curator can provide collection-level metadata describing the motivation for this collection, why the images were chosen for the collection, how the images were collected, and the factors that came into play to decide that these images should be collected together. However, this general descriptive metadata does not answer the question pertaining to the actual artifacts contained in the collection and it gives no concrete visual depiction of how sub-collections are related via various metadata values. We want to be able to vary the metadata values dynamically to see what subset of the collection would be returned.

### Using Streaming Collage for Collection Understanding

The literal meaning of collage is “glued stuff” [19]. A collage is a work created by the combination of materials from different sources. The artist’s purpose in making collage is to evoke some idea or feeling from the audience based on the content of the collage and to invite observers to create their own associations and interactions among the elements that constitute the collage. By streaming collage, we refer to the changing content of the collage - the images are dynamically displayed so that the collage is constructed interactively in time [19].

Through streaming collage, users become aware of the images that constitute the general collection and the relationships among the images shown in the collage. Figure 1 shows a simple streaming collage prototype. On one side of the display, a window collages the images in real time and, on the other side, a query form shows the metadata fields for that collection. Collage places images in the window using the metadata from the query form, making the best use of limited screen resources. Using streaming collage as the visualization mechanism, the user can then use the query form or the collage display to adjust metadata fields to see how those changes affect the results of the collage. We refer to this process as metadata filtering – by gradually removing or adding values for the metadata fields, users come to a better understanding of the collection [1].

A user begins the process of collection understanding using either the entire collection or specific images as the starting point. In the first case, the user may be visiting the image collection for the first time, perhaps not knowing any metadata values to begin querying the collection. When the user selects the “Create Collage” option, the entire collection randomly collages on the display. Once the user spots interesting image elements, the metadata values are displayed to the user with a click of the mouse. The user may then select any of these fields to further filter the metadata, showing more images sharing this metadata value or not sharing this metadata value. For the latter case, users may have a general idea of what they are looking for and begin with a subset of the collection sharing certain metadata values. From this subset of the collection, users may choose to either narrow or expand the image subset by dynamically changing the metadata values as they increasingly come to a better understanding of the

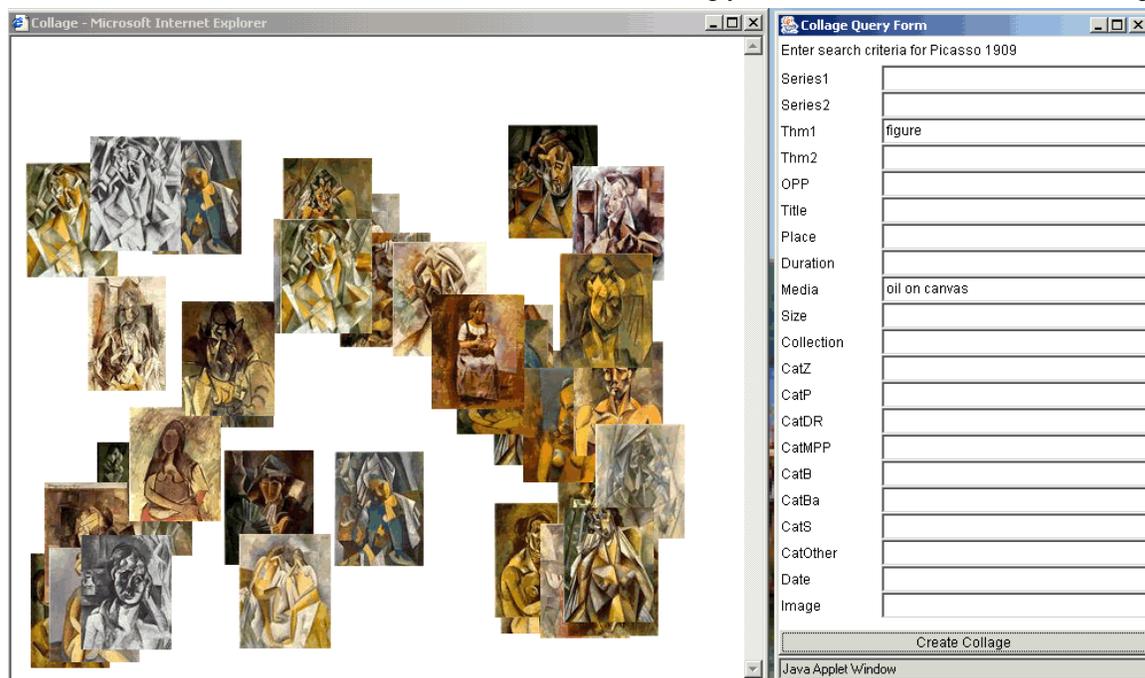


Figure 1. Understanding the Picasso 1909 Collection.

collection. In both cases, the dynamically generated results are shown on the collage display. Additionally, the user can select a high-resolution image of the thumbnail to further examine the image and its metadata as shown in Figure 2.



```

object_id:      26
internal_Date: 1909-05-01 00:00:00
Series1:
Series2:
Thm1:          Figure
Thm2:          Portrait
OPP:           [OPP.09:26]
Title:         Portrait de Manuel Pallarés
Place:         Barcelona
Duration:      May 1909
Media:         Oil on canvas
Size:          68 x 49.5 cm
Collection:    The Detroit Institute of Art
CatZ:          Z.XXVI:425
CatP:          P.II:377
CatDR:         DR:274
CatMPP:
CatB:
CatBa:
CatS:
CatOther:
Date:          May 1909
Image:         opp09-26.jpg

```

Figure 2. Examining a single image and its metadata.

Visually expressing image collections using collages introduces a different technique to maximize information learning. With indeterminacy from the collage display [19], the mind is motivated to creatively form associations between these image elements, thereby improving collection understanding. By also providing a mechanism for users to gradually specify metadata values using the results from the collage display, users vary the content of the collage and visually learn what comprises the entire collection.

### SUMMARY

Collection understanding shifts the traditional focus of image retrieval in large collections from locating specific images to gaining a comprehensive view of the collection. Users visualize the collection by changing metadata values dynamically to create their own understanding of the collection. As users narrow or expand their view, they acquire the general gist of why the images belong to the collection and what characteristics the images share.

A collage places all the images on one screen and removes the need for scrolling or clicking to a new page. Streaming collage varies the placement of the images on the screen in real time, creating different collages of the images in the collection. When users interactively filter metadata and perceive varying viewpoints of the images, they are then inspired to derive their own relationships among the images and come to a fuller understanding of the collection.

Through novel visualizations, users will be able to efficiently understand what specific collections have to offer. Collection insight will increase and this will enhance information access, making digital collections more valuable knowledge assets.

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