Search by image is reality: implications for digital publishing & digital libraries

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(note: BIBLIO and not biblio)
• Introduction / context

1. Searching for images, using text as query

2. Searching for images, using an image as query

3. Implications for digital publishers & digital libraries
Introduction / Context
Introduction:

Images become more important as information sources, due to
--increasing number of digital cameras
--increasing number of digital photos on the WWW,
available in open access
Introduction:

images

→ Searching for images becomes more important
Searching for images, using **text** as query
Introduction:
finding images and information

Searching for images on the WWW has become an attractive starting point to discover information:

- A search query *with text* can be submitted to an “image search engine”.
Introduction:
finding images and information
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- The results come as small “thumbnail images”.

Introduction:
finding images and information
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Searching for images on the WWW has become an attractive starting point to discover information:

• A search query with text is submitted to an “image search engine”.
• The results come as small “thumbnail images”.
• Each small image links to the document where it occurs.
Searching for images: images & their context

Image found on WWW
Searching for images: images & their context

Image found on WWW (+ link to WWW file)
Searching for images: images & their context

Image found on WWW (+ link to WWW file)
Searching for images: images & their context

Their main city is Cape Coast, Ghana. They are one of the Akan peoples, along with the "Asante" or Ashantis, the Akuapem, the Akyem, the Guam, and others. Despite the rapid growth of the Ashanti Empire in historic times, the Fanti have always retained their state to this day. Currently, they number about 2.5 million. Inheritance and succession to public office among the Fanti are determined mostly by matrilineal descent, as is common amongst most Akan peoples.

When the Portuguese arrived in the 15th century, the Fante prevented them from venturing inland and leased properties for Portuguese trading missions. But when the Portuguese objected to Fante rules and regulations the Fante expelled them. Thereafter the Dutch arrived followed by the English, soon to be British. The Fante served as middlemen in the commerce between the Interior and British and Dutch traders on the coast.

Doll / puppet from the Asante / Akan / Fante / Fanti / Agni (or Ewe) people/tribe in Ghana/Ivory Coast

Bought on an auction of tribal art in Antwerpen, ex-collection of African art of a professor from Leuven University, Belgium

NOT available

This particular figure wears very fine beads, even in several places.
The wood has an attractive surface.
It is about 18 cm high.

The photos have been used on a poster to announce an event for Africa in 2010 in Antwerpen.

A photo of this figure is used as book cover:
*Myths and Legends of the Bantu* by Alice Werner
ISBN: 0957193328

The rich traditions of the Bantu. Most of the books below also have material on the Bantu of West Africa. "Myths and Legends of the Bantu is a book by Alice Werner published in 1933. It contains legends and myths from the Bantu culture concerning the gods, the origin of mankind, the afterlife, the heroes and demigods, various creatures, real and mythical, as well as some of the great Bantu epics." Edited by Brian K. Buckner
Introduction: finding images and information

- Search for images is faster than search for texts.
- When a relevant image is found, then also the context of that image is found, and that can yield relevant information.
Searching for images, using *an image* as query
Search(ing) by image: introduction

Besides searching for images with a query that consists of text,
some systems allow us to use as query an image (file).

- Search(ing) by example
- Reverse image lookup = RIL
- Backwards image search(ing)
- Inside search(ing)
- Reverse image search(ing) (used by Google)
- Search(ing) by image!
Searching by image: example

Search with the original image reveals a derived image

Original photo of a sculpture → Book cover
Research problem

Which systems are available free of charge for searching by image through the WWW?
Searching by image: the user interface

A pioneering system, accessible free of charge:
Searching by image: the user interface

A pioneering system, accessible free of charge:

Drag & drop
Searching by image: search engines

Available WWW image search engines:

- TinEye
- Google images

others...

since 2011
Introduction: finding images and information

Drag & drop
Research problem

Which differences among these systems are interesting for a user in practice?
Searching by image:
Conclusion

TinEye
Reverse Image Search

<

Google images
Research problem

To which extent can a system to search by image find an exact copy / duplicate that is present on the WWW?
Searching by image: searching for exact copies

Start from a particular image; search for images that are exact copies = duplicates

Difficult

Easy

← Width indicates expected success of a search →
Searching by image: 
Findings

search by image for copies 
(that exist on the WWW)

Successful
but not completely
Research problem

How effectively can the search system find images on the WWW, which are NOT exact copies of a particular image, but which do have elements in common?
Searching by image: searching for edited copies

Start from a particular image; search for images that are

Difficult

Easy

copies, but NOT exact

exact copies = duplicates

← Width indicates expected success of a search →
Searching by image:
Findings & Discussion

Example:

Google images

Original revealed the derived image:
Searching by image: Findings & Discussion

Example:

Afterwards, the derived image revealed the original:
Searching by image:
Findings & Discussion

Example:

Original image in colours revealed the derived image in black & white, on a poster →
Applications of searching by image:

*Finding copies of your image*

- We can start from a particular image that we have created.

Then we can search by image, to investigate if this image is used and made available from another WWW site.
Applications of searching by image: *Finding copies of your image*

- This can be interesting in several ways:
  - Copyright infringements / plagiarism can be discovered.
  - In a more positive/constructive way: allows us to investigate the impact of some image!

*For example:*

*Curators or owners of a collection of objects can assess the impact and reuse of photos of the physical objects in their collection, on a worldwide scale.*
Applications of searching by image:  
*Finding other versions of an interesting image*

- We can start from an image that we consider as interesting, but that we did not create and that is perhaps not the original version and for which the creator/author is not indicated.
Applications of searching by image: Finding other versions of an interesting image

Then searching by that image may allow us to find

- a more suitable version of that image
- the creator/author
- another version of the image
- and in this way also
- its location on some WWW page and site that can provide us with more information about the image.
Searching by image:

Research problem

Can search by image reveal images that are ‘semantically’ or ‘theme’ or ‘content’ related to the image that is submitted as a query?
Searching by image: searching for related images

Start from a particular image; search & find for images that are
not copies at all, but semantically related, from weak to strong

copies, but NOT exact

exact copies = duplicates

Difficult

Easy

← Width indicates expected success of a search →
Searching by image:

Findings: Example
Searching by image:

*Findings: Example in 2013*
Searching by image: 
Findings: Example in 2014

• Source image:

• Renamed to x.jpg to remove any relation in the form of text to images on the WWW
Searching by image:

**Findings: Example in 2014**

Google finds a good description of the image!

Google finds related images: masks
Searching by image:

Findings: Example

- Source image = famous photo of Congo Kifwebe mask

- Renamed to x.jpg to remove any relation in the form of text to images on the WWW
Searching by image:
Findings: Example in 2014

Google search for "kifwebe mask"

= success!
Applications of searching by image:

Finding semantically similar images

• Starting from a source image, search by image can (even) be successful to find
  » ! a suitable description in words of the image !
  » !! images that are semantically related !!
Searching by image: 

*General conclusion*

- Searching by image is evolving to a powerful, additional method to meet information needs.

- This method exploits the increasing number of images on the WWW plus the related texts.
Information discovery on the Internet, using a search query that consists of text & image

Introduction
Using a search query that consists of text & image:

Introduction

Besides pure, simple search with text only or with a source image only, the freely available search system offered by Google, offers also the possibility to use a search query that consists of a combination of an image with text / words.
Using a search query that consists of text & image:

Research problem

In which way and in which cases can this method be useful to retrieve / discover information?
Using a search query that consists of text & image:

**Research method**

- The performance of the retrieval system is mainly measured / evaluated by considering the highest 20 ranked results & by counting the number of relevant results.
Using a search query that consists of text & image:

**Findings**

*Test case Bwoom:*

- A series of tests started from an image of a mask that was created and used by the Kuba people who live in Africa, in the country that is nowadays named Democratic Republic of Congo. The Kuba produce various types of masks; this particular mask belongs to the type named “Bwoom”, which is a helmet mask made of wood & several other materials.
Using a search query that consists of text & image: *Findings*

Test case Kuba Bwoom:
Using a search query that consists of text & image:

**Findings**

- A simple search by image gave only some visually related images, but no semantically related images → NO information about the content of the image was retrieved.
Using a search query that consists of text & image:

**Findings**

- Here we presume that the user knows that the mask is related to the Kuba people.
- A combination of the image with the unspecific word “Kuba” in 1 query was executed.
Using a search query that consists of text & image: Findings
Using a search query that consists of text & image: *Findings*
Using a search query that consists of text & image:

Findings

- This query gave in the first 20 search results 3 images of other Bwoom masks.
Using a search query that consists of text & image: **Findings**

Search query: **AND kuba**

First 20 Precision: **0/20**!
Using a search query that consists of text & image: 

**Conclusion of all the test cases**

→ combining the image with a few words in 1 query gave again a significant increase of the precision of the search results.
Using a search query that consists of text & image:

**Findings**

- Using only the specific word “Bwoom” as a simple textual query gave in the first 20 search results 20 images of various Bwoom masks.
Using a search query that consists of text & image: **Findings**
Using a search query that consists of text & image:

_Findings_

- The lateral view of those masks is the most famous and remarkable, because it shows the particular, special, remarkable form and large size of the skull; furthermore this property / feature / characteristic is related to the history and meaning of these masks.

- But the first 20 images given do NOT include a lateral view.
Using a search query that consists of text & image: *Findings*

- When we enriched the same text query by adding the image of a lateral view of a Bwoom mask, then the first 20 results included 3 other lateral views.
Using a search query that consists of text & image: 

Findings
Using a search query that consists of text & image: 

Findings

Search query: bwoom

First 20 Precision: 0/20

Search query: bwoom AND

First 20 Precision: 3/20
Using a search query that consists of text & image:

*Conclusion of the test cases*

When a user’s starting position is already comfortable, because this user already knows the subject well enough to formulate a specific, focused textual query, then the precision of the results of such a textual search for images can still be improved by including an image in the search query.
Using a search query that consists of text & image:

Conclusions of the test cases

<table>
<thead>
<tr>
<th>Type of search query:</th>
<th>Expected relevance &amp; precision of search results:</th>
</tr>
</thead>
<tbody>
<tr>
<td>image only</td>
<td>+</td>
</tr>
<tr>
<td>unspecific word(s)</td>
<td>+</td>
</tr>
<tr>
<td>image AND unspecific word(s)</td>
<td>++</td>
</tr>
<tr>
<td>specific words</td>
<td>++</td>
</tr>
<tr>
<td>specific words AND image</td>
<td>+++</td>
</tr>
</tbody>
</table>
Searching for images, using text or *an image* as query

Recommendations
Recommendations

For scholars & musea & digital publishers:

• In general:
  Optimize your WWW site for image search engines, so that you reach your public better with the quality that you can offer.
Recommendations

• More concretely:
  » See that your images can be harvested / copied by Internet search systems.
  » Publish images as separate, individual files & NOT as part of a database that cannot be harvested or as part of a container file such as Word or PDF.
  » Provide textual context for your images.
  » Give meaningful names to your image files.
Searching by image: Recommendations

- To assist their clients, librarians and other information specialists can apply search by image to tackle some information problems.
Searching by image: 

**Recommendations**

→

- Search by image can / should be included in teaching of information literacy.
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Suggestions
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