Image recognition and image similarity

A different approach for accessing large scale digital collections
Numerous digitization projects since 1997
- Manuscripts, incunabula, newspapers, books
- Up to 1 M objects from 8th - 20th century

Deep indexing available only for a part of the books

→ Where are the images?
Seeking for a different approach: The image-based similarity search

- 2011: Start of cooperation with the Fraunhofer Heinrich Hertz Institute Berlin (core technology)
  - Based upon existing expertise of Fraunhofer HHI
  - Initiated by Dr. Markus Brantl (head of Dig. Library Dept.)
- 2012: First prototypical implementation (250 volumes)
  - Optimization for BSB‘s holdings
  - Development of API and web interface
- Online since April 2013
How it works
How it works: Edge detection and description

Edges, ie transitions between areas of different brightness

→ edge histogram
→ image descriptor
How it works: Color distribution
How it works

1. *One-time* processing of each image
   - Analyzing properties
   - Generation of a unique descriptor
   - Filling an index of descriptors

2. Index is loaded into RAM permanently
   - High availability for the application
   - Fast search among millions of images
The similarity search in practice

**Database**

01100110....

**Input image**

Comparison of descriptors

01100110....

11110011....

**Similarity-based image search**

**Search results**
Additional challenges with BSB‘s holdings

- Recognition of images inside of pages
- Image/text separation
Additional challenges with BSB‘s holdings

- Recognition of multiple images per page (segmentation)
Additional challenges with BSB‘s holdings

- Recognition of book illumination, initials, drawings, woodcuts, copperplate engravings, old newspaper photographs, ...
Recognition accuracy
Some examples
Recognition accuracy, example #1

Similar body shape, dress colour and foot position
Recognition accuracy, example #2

Coat of arms: similar shape, similar background - and a striking (red) tongue

Recognition accuracy, example #3

The same printing plate used for different books, with different coloration
Recognition accuracy, example #3

http://bildsuche.digitale-sammlungen.de/index.html?c=suche_sim&bandnummer=bsb00026765&pimage=4&einzelsegmentsuche=1&einzelsegment=1&l=de
Recognition accuracy, example #4
Recognition accuracy, example #5

Church interior and train station halls - similar shapes & lighting conditions
Recognition accuracy, example #6

Four legs on the ground ...
The limits of image recognition

- Stains & ripped pages
- Decorative headlines
- Exceptional shapes
- Table Works
- Newspaper ads
- Sheet music
- ...

The students are engaged in a comprehensive analysis of the text and images on the page. The focus is on understanding the challenges and limitations of image recognition technology, as illustrated by various examples of stained, ripped, or otherwise altered pages.
Web application - Functionalities overview

- Explorative access
- Customizable Simple Search
- Skimming of books
- All images from one book
- Compare your own image - Upload
The Similarity based image search gives you the opportunity to search inside of more than 5 million images identified automatically from manuscripts, old prints, maps and other works from the holdings of the Bavarian State Library, published between the 9th and the 20th century. Please note that you can customize your search.
Motifs

The Similarity based image search gives you the opportunity to search inside of more than 5 million images identified automatically from manuscripts, old prints, maps and other works from the holdings of the Bavarian State Library, published between the 9th and the 20th century. Please note that you can customize your search.

Options

Time frame
1013 - 1945

Color Edge Ratio: This controller weights the color edge ratio of the search. A value of 0.5 considers colors and edges equally.
0.55

Edges

Colors

Minimum similarity: This controller sets the minimum similarity. The higher the value, the higher the similarity, while 1.0 would be congruence. It is recommended to set a value of at least 0.85 but not higher than 0.95.
Minimum similarity 0.85

Results: Maximum number of results to be displayed
50 Results
Motifs

The similarity-based image search gives you the opportunity to search for images identified automatically from manuscripts, old prints, maps, and other works, published between the 9th and the 20th century. Please note:
Search Template: (37v)

of: Tirol, Anton: Wappenbuch - BSB Cod.icon. 310 [Cod.icon. 310], [S.l.] Süddeutschland Ende 15. Jh. - 1540

Results: 49 Similar images
Upload your own image as a template for an image search

Please note:

- use image files of format JPG or JPEG only
- to obtain satisfying results, use a resolution of 150 - 300 ppi
- limit is 1500 KB per file
- timeout of at least 1 minutes after each upload
- the uploaded file will be deleted after the search

Datei auswählen Keine ausgewählt

Enter security code

1658

Upload Search Template

vionlink PHP UploadS
Main benefits of image-based similarity search

- Reliable recognition of images
- Optimized for the specific holdings of the BSB
  - Paintings, woodcuts, copperplate engravings, photographs
  - Color or b/w
- Separation of images from text
- Customizable
- High performance even with large amounts of data
Outlook

Today

- 85,000 digitized works indexed
  - 2,878,261 pages
  - 5,423,025 images available

Planned for 2015/2016

- 1 Mio. digitized works (complete digital collections)
  - 50 M. images assumed
Try it out

http://bildsuche.digitale-sammlungen.de/

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