Visual and textual retrieval of patents

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Overview

- Visual vs. textual retrieval
  - What works and what does not
- System setup
  - Lucene for text retrieval
  - GIFT for image retrieval
- Demonstration
- Conclusions
- Questions and discussion

Domain-specific retrieval

- Many domains create documents containing text and images

  - Medical domain, forensics, patents, …

  - Most often only the text is searchable

- Images can help creating links between documents

  - Visual similarity can be used to link documents via their images

- Visual similarity is harder to calculate than we think and has limitations

  - Semantic gap, our perception is hard to model

Visual retrieval

- Content-based image retrieval
  - Represent images with visual features
  - Then compare visual features of images
  - Query by image Example(s) (QBE)
- Frequently used visual features
  - Colors in the image
  - Textures, fixed image region descriptors
  - Forms found in the image (after segmentation)
  - Salient point-based features, visual words
    - Best in most benchmarks
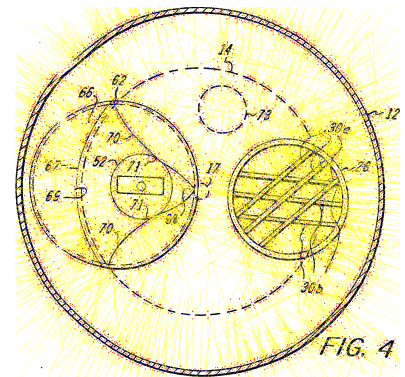
The visual retrieval paradigm
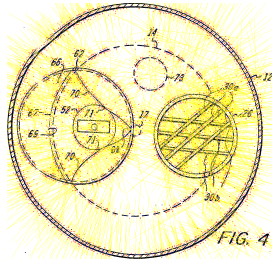
Feature extraction

Feature 1	0.5
Feature 2	0.7
Feature 15	0.1
Feature 25	0.3
…	

Image Database

Relevance feedback
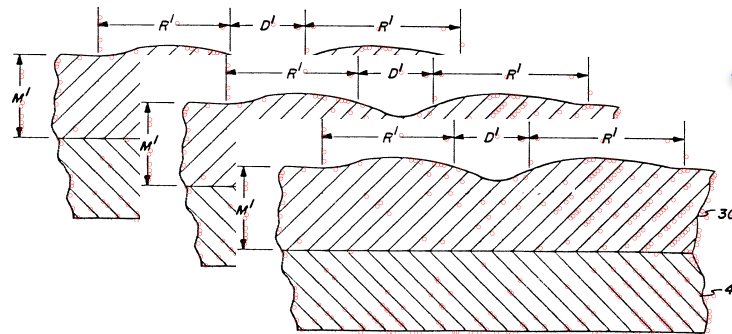
Similarity calculation

Visual retrieval in patents

- Images are most often part of a patent
  - Text most often carries much of the information
  - Sometimes images describe crucial information
- To avoid having conflicts of patents, all similar patents need to be evaluated
  - Recall is important, finding every potentially relevant patent
  - Visual information can be part of this
    - Complementary to text
    - Will not replace text!

Textual retrieval

- Appearance of keywords, or bag of words
  - Tf/idf weighting
- Many refinement steps
  - Stop word removal
  - Stemming
  - Mapping of words onto an ontology
  - …
- Many good tools exist for this
  - Such as Lucene, …
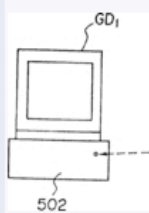
What works for visual retrieval?

- Clear outlines of large forms

- Clear colors

- General layout of an image
  - Preemptive similarity

- … and what does not
  - Figures with similar black and white content where semantic interpretation is necessary
    - Flow charts, histograms, …
  - Abstract symbols with an implied meaning
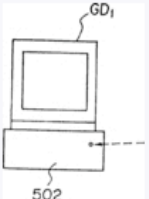   - A stylized face, or Giacometti figure

… and what does not
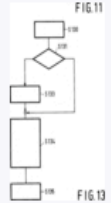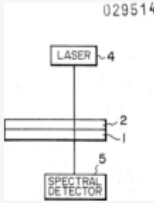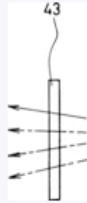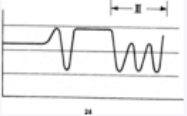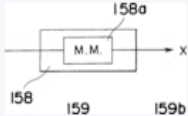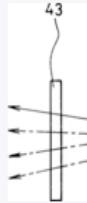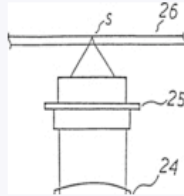
GIFT and Lucene

- GNU Image Finding Tool (GIFT)
  - 10 years old
  - Very simple and basic features
    - Global/local color and global/local texture
    - Gabor filters for texture, simple color histogram
  - Communication interface using MRML
    - Easing integration into applications
- Lucene
  - Simple standard text search engine
  - Stop words, stemming, languages

Combining text/visual features

- Both are complementary
  - Visual with a good early precision, text rather recall-oriented,
  - Can find new patents with different wording or in different languages
- Combinations are the key to success
  - But combinations can be delicate and can reduce retrieval quality
  - More work on fusion strategies is necessary
    - Identify more visual and more textual query types
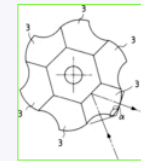
User interface

Demonstration

BioCreative – Announce...   PatentSearch – Patent S...

(A1 B1)Laser scanning apparatus
EP0580545

(A1)Laser scanning apparatus includes a machine frame (2), a first supporting member (4) for supporting a working medium, and a second supporting member (6) for supporting at least the delivery end of a laser beam delivery system. One of the supporting members, preferably the latter one, is a movable carriage mounted in cantilever fashion from one side of the machine frame for effecting relative movement between the working medium and the laser beam delivery system to cause the laser beam to scan the working medium. <IMAGE>

Patent in PDF-Version   View all images / Visual search   Similar articles
Authors: KRAMS ZVI ¢IL!   LIVNI AVIGDOR ¢IL!   DOV ¢IL!   AVIGDOR ¢IL!

(A2 A3 B1)Imaging module mounting apparatus
EP0594365

(A2)imaging module mounting apparatus is provided to improve dynamic performance without creating an overconstraint condition causing misalignment of the imaging module (30). Three solid mounts (170,172,174) are used to establish and maintain critical location datums of the imaging module (30). A single or plurality of variably flexible mounts (180) are used, depending on the size of the module (30), to maintain alignment while minimizing any overconstraint condition caused by and/or static distortion of the mounting frame (40) due to movemen viscosity silicon polymer. Due to the high-viscosity of the medium, appears to be a rigid mount with regard to such movement. The mo by movement of the machine and/or thermal distortion and maintai defects. <IMAGE>

Patent in PDF-Version   View all images / Visual search   Simila
Authors: NOWAK WILLIAM J ¢US!   WILLIAM J ¢US!

(A1 B1)Calibrating a data storage system relative to a

BioCreative – Announce...   Patents – Image search

Queried images(s)

Results

top
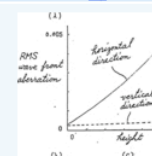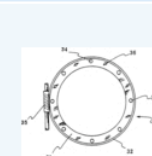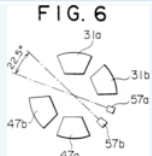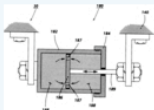
Query image
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Show dedicated Article

Similarity: 0.551546
Show dedicated Article

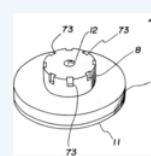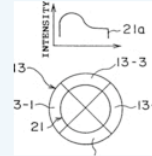Similarity: 0.540806
Show dedicated Article

Similarity: 0.537355
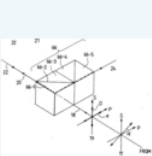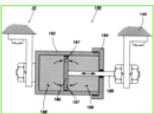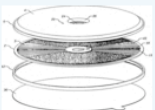Show dedicated Article

Similarity: 0.535785
Show dedicated Article

top

Similarity: 0.531111
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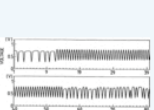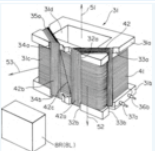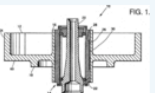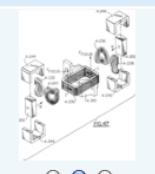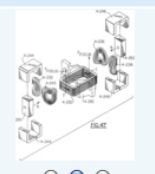
Similarity: 0.520036
Show dedicated Article

Similarity: 0.519559
Show dedicated Article

Similarity: 0.518613
Show dedicated Article

Similarity: 0.518379
Show dedicated Article

top

Next steps

- Pre-classify all images into categories visually
  - Basic information on all the types of images contained in a patent can be used to search for similarity
    - Part of CLEF IP benchmark in 2011
- Use local features based on salient points for calculating similarity between images
  - Inside a specific class
- Calculate similarities between patents, so sets of images and not single images
  - Similar to medical cases, combine text and images

Conclusions

- Visual (content-based) retrieval can be a useful tool for patent search

  – Navigate in the space of visually similar images and the patents they are contained in, browsing

  – Complementary to text

  – Visual retrieval is language-independent

- Purely visual retrieval will not work in many cases

- New features need to be developed and optimized for patent retrieval

  – Including the meaning of graphs

Questions

http://medgift.hevs.ch/