



Image Retrieval

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Introduction

Tutorial on Image Retrieval
Thomas Deselaers / Henning Müller

Overview

- Introduction
- **Content-based** Image Retrieval
 - Visual features
- Text-based Image Retrieval
- Questions & Answers
- Break
- Combinations of Content-based and Text-based Image Retrieval
- Relevance Feedback
- Evaluation of Image Retrieval
- **Demo**/Questions/Answers

Henning Müller

- Diploma in **Medical Informatics**
 - University of Heidelberg (1992-1997)
- Daimler Benz research and technology
 - Portland, OR, USA (1997-1998)
- **PhD** in image analysis (content-based retrieval)
 - University of Geneva (1998-2002)
 - Part of the work in Melbourne, Australia (2001)
- Medical image analysis and information systems
 - University and **Hospitals** of Geneva (2002-)
- Professor at HES SO Valais, Sierre (2007-)



Thomas Deselaers

- Diploma in computer science
 - RWTH Aachen University, 1998 – 2004
- PhD in computer science
 - “Image Retrieval, Object Recognition, and Discriminative Models”, 2004-2008
- Research stays at ITI in Valencia, Spain
- Internship with Microsoft Research, Cambridge, UK
- PostDoc at ETH Zurich since 2009

Questions?

- Please present yourself with name and affiliation.
- What are your expectations from this tutorial?
- Any particular domains of interest?
 - Have you heard of visual retrieval?
- Any questions already at this point?

Introduction and Motivation

The Internet NOW

- Google? FaceBook? Flickr? YouTube? Twitter?
...
- Is the Internet text?
- What are users looking for when searching or browsing?
- What are current problems of Internet search?
 - And also desktop search ...
- Does Google help with everything?

Google


britney spears - Google Search




http://www.google.com/search?hl=en&client=safari&rls=en-us&q=britney+spears&aq=f&oq=&aqi=g10 - angelina jolie




Apple Google Maps YouTube Wikipedia News (512) Popular

Web [Show options...](#) Results 1 - 10 of about 81,500,000 for [britney spears](#). (0.11 seconds)

News results for britney spears

 [As the Britney Spears Circus arrives in London more details emerge ...](#) - 1 hour ago
By Daily Mail Reporter Tonight **Britney Spears** will take to the stage in front of 23000 screaming fans at London's O2 Arena. ...
[Daily Mail](#) - [93 related articles »](#)
[Ex-TMZ photographer sues Britney Spears](#) - [MiamiHerald.com](#) - [364 related articles »](#)
[Britney Spears dating agent](#) - [Screen Weekly](#) - [87 related articles »](#)

Britney Spears - official web site and blog  
1 Jun 2009 ... Access **Britney Spears** photos, galleries and videos. Get the latest news direct from **Britney** on her official blog.
[Tour](#) - [Photos](#) - [Videos](#) - [Music](#)
[www.britneyspears.com/](#) - 41k - [Cached](#) - [Similar pages](#) - 

Britney Spears - Wikipedia, the free encyclopedia  
Britney Jean Spears (born December 2, 1981) is an American singer and entertainer. **Spears** is ranked as the eighth best-selling female recording artist in ...
[en.wikipedia.org/wiki/Britney_Spears](#) - 362k - [Cached](#) - [Similar pages](#) - 








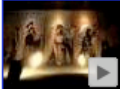

Britney Spears Celebrity Gossip | TMZ.com  
Britney Spears On TMZ.com. Get The Latest **Britney Spears** News, Video's, Photos, And More @ TMZ.com.
[www.tMZ.com/category/britney-spears/](#) - 108k - [Cached](#) - [Similar pages](#) - 



Image results for britney spears - [Report images](#)

Video results for britney spears

 **Britney Spears - Circus**
3 min 34 sec
[www.youtube.com](#)

 **Britney Spears - Womanizer (Director's Cut)**
3 min 46 sec
[www.youtube.com](#)

Britney Spears : [People.com](#)  

SearchMe

The image shows a browser window with the SearchMe website. The address bar contains the URL <http://www.searchme.com/#/&q=swine%20flu>. The search bar contains the text "swine flu". The website header includes navigation links for "apple", "google maps", "youtube", "wikipedia", "news (512)", and "popular". Below the header, there are category filters for "web", "video", "images", "music", "news", and "shopping". The main content area displays search results for "swine flu". The top result is from the CDC (Centers for Disease Control and Prevention) titled "H1N1 Flu (Swine Flu)". The CDC page includes a "H1N1 Flu Situation Update" with a map of the United States showing the spread of the virus. Other search results include "WebMD" and "Atherosclerosis is a progressive disease". The interface also features social media sharing options for Twitter, Facebook, and Email, and a "Plan and Prepare" section for the H1N1 Flu.

Facebook

The screenshot shows the Facebook homepage in French. At the top, the browser address bar displays "http://www.facebook.com/home.php?ref=home" and the search bar contains "angelina jolie". The navigation bar includes "facebook", "Accueil", "Profil", "Amis", "Boîte de réception", "Henning Müller", "Paramètres", "Déconnexion", and a search field.

Left Sidebar:

- Actualités
- Statuts
- Photos
- Liens
- Plus
- Créer

Main Content:

Express yourself: A text input field with a "Partager" button.

Heidi Von Tagen yesterday was my Emma's 9th birthday

Emma!
14 nouvelles photos
Il y a 47 minutes · Commenter · J'aime · Partager

Emma Nowell, à 16:10 le 3 juin
those are great photos!

Rédiger un commentaire...

David McGregor Squire is settling in for Spicks and Specks.
Il y a 4 heures · Commenter · J'aime

David McGregor Squire, à 12:59 le 3 juin
Wow. Michael Smallwood sure has come along since I saw him in Trinity College musicals.

Rédiger un commentaire...

David McGregor Squire Hmm. Some educated guessing in there...

David just took **Guess the Children's Book** and got 9

Right Sidebar:

- Invitations:** Afficher tout. 2 propositions d'ami, 1 invitation à un groupe, 1 demande de l'application what kind of english, 4 autres invitations.
- Suggestions:** Afficher tout. Dongfeng Han, Ajouter comme ami(e).
- Message parrainé:** Partager l'expérience Facebook avec encore plus d'amis. Il vous suffit d'utiliser nos outils pour les inviter et garder le contact. Entrez l'adresse électronique d'un(e) ami(e).
- Morceaux choisis:** Post Tenebras Race Weekend '09 (Aline Fontanet participera), Où va Radio Cité ? par Charles Menger.

Bottom Bar: Applications, Discussion en ligne (5), and a notification icon with the number 2.

What are people searching for?

- **Media**
 - Videos, images, everything connected
- **Social** interactions
 - Same interests, “friends”
- **Interlinked** content
 - User generated
 - Real time, life sensors
 - Answers, stories

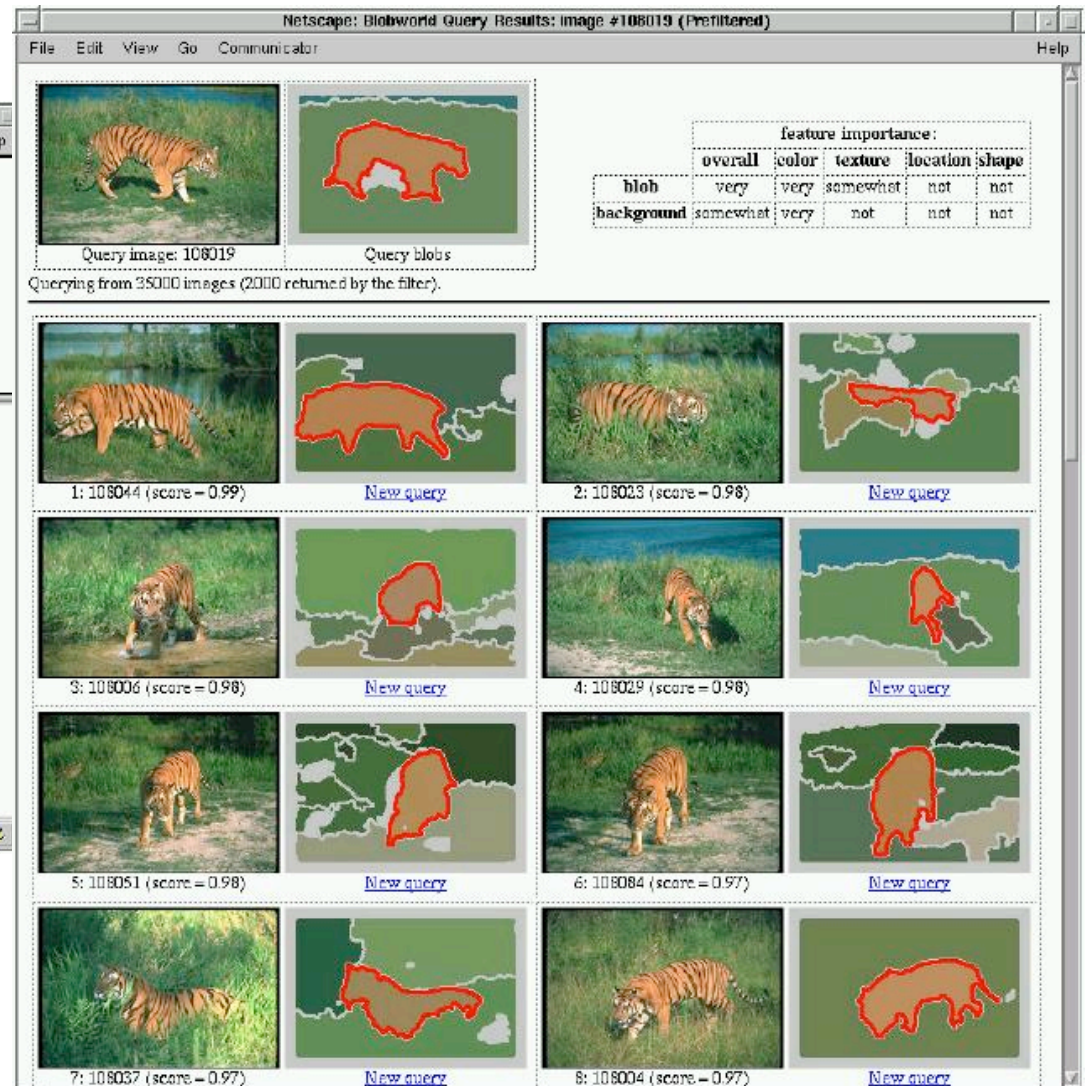
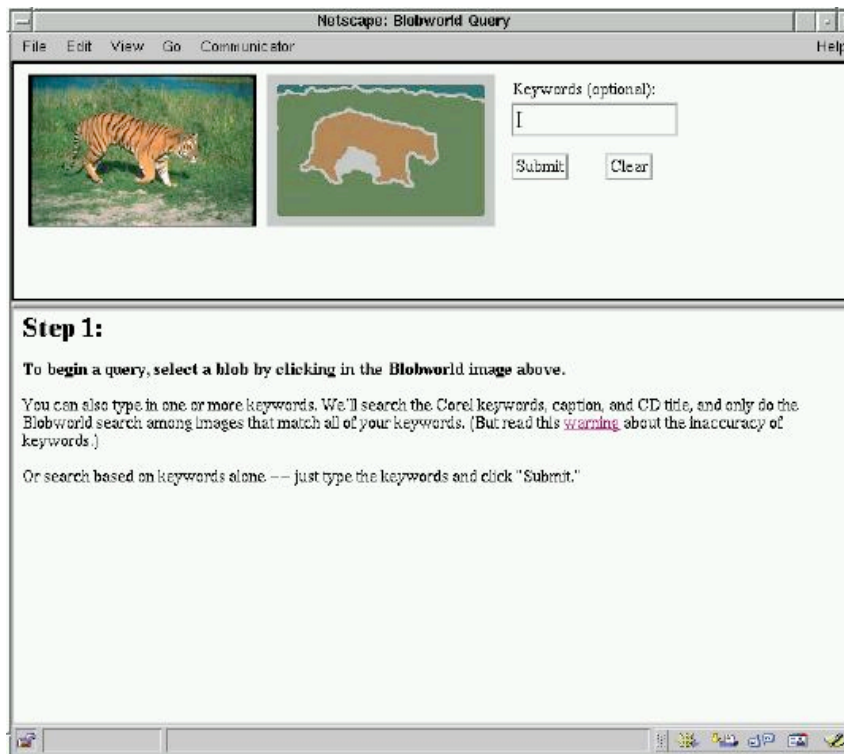
Multilingual?

- Many people understand more than one language
 - But do not want to search in each one separately
- Images are **language-independent**
 - Can help multilingual retrieval
- When searching for visual content with text, the same problems arise as in text retrieval

Motivation for image retrieval (history)

- Exponentially increasing **amount of visual data** produced
 - Availability of cheap digital cameras
 - Social image exchange platforms (FlickrR, ...)
- Manual **annotation** is extremely expensive
 - ... and is subjective (based on person, mood, ...)
 - What is in the image vs. what the image is about
 - Visual features are automatically extracted and thus objective
 - But: social platforms now have millions of annotations and thus semantics free of charge

How we would like to see image retrieval ...



... and how it is perceived



Flickr : Rechercher - Mozilla Firefox

http://www.flickr.com/search/?q=tiger&z=t

Vous n'êtes pas connecté [Connexion](#) [Aide](#)

Accueil La visite Inscription Explorer Rechercher

Rechercher **Photos** Groupes Personnes

tiger **RECHERCHER** Recherche avancée
Rechercher par appareil photo

Texte Tags

Nous avons trouvé **671 694 résultats** correspondant à **tiger**.

Voir : Les plus pertinentes • Les plus récentes • Les plus intéressantes Afficher: Détails • Miniatures Diaporama

Liens promotionnels

[Pet a Tiger](#), [Bathe a Tiger](#), [Walk a Tiger](#)
Travel to Thailand's Tiger Sanctuary. See trip details & photos now.

Mel sur Flickr : partage de photos ! - Mozilla Firefox

http://www.flickr.com/photos/difusa/135964682/

Les notes sont associées à cette photo. Déplacez le curseur sur la photo pour afficher les notes.

Commentaires

< Préc 1 2 3 4 Suiv >

(381 commentaires)

Guestus pro dit :
Vaya ojos más grandes y redondos... parece un peluche!!

Me acabo de dar cuenta de que esto ya lo dije en la anterior foto... me repito, pero es que no puedo evitarlo!!
Con lo poco que me gustan los gatos y las ganas que me dan de acariciar a éste.
Posté il y a 30 mois. ([permalien](#))

Rodolfo Palominos pro dit :
Que lindaaaaaaaaaa!!! :D
está como el gato de Shrek

Cats... (Album) 20 éléments

Mis favoritas (Album) 55 éléments

Fauna (Album) 21 éléments

las más favoritas... (Album) 66 éléments

Vous êtes à la première photo.

Love of the feline! comment the shot on your right! new contest (Pool)

Mascotas Chilenas (Pool)

* La Tengo y Te Reto * (Pool)

* La Tengo y Te Reto x5 * (Pool)

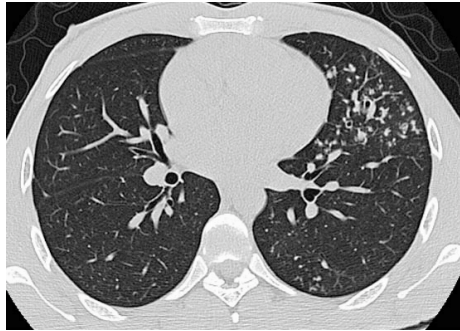
Goals of visual retrieval

- Retrieval of images by visual (**objective**) means
 - **Features** extracted fully automatically
 - Colours,
 - Textures,
 - Shapes,
 - Interest points, ...
- Query by image **example(s)**, QBE
 - “find me images visually similar to this one”

Problems of image retrieval

- Sensory gap
 - Images taken mean a data loss compared to reality (limited resolution, no 3D, ...)
- Semantic gap
 - Features automatically extracted may not correspond to human semantic search categories
- Page zero problem of query formulation
 - How can an image for QBE be found?
- Result: use text wherever available!

Simplified overview



Represented by



Colour 1

Colour 2

...

Texture N

...

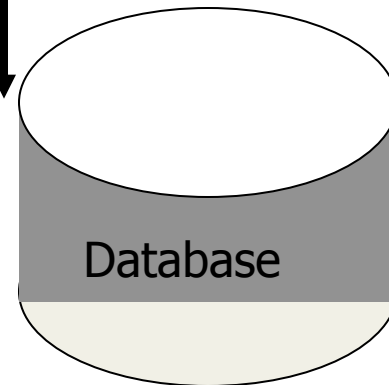


Stored in

User queries



| |
|-----------|
| Colour 1 |
| Colour 2 |
| ... |
| Texture N |
| ... |



Feedback

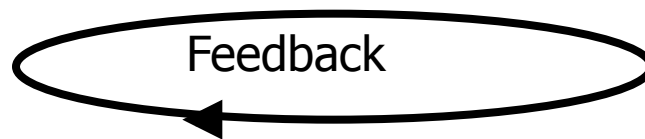
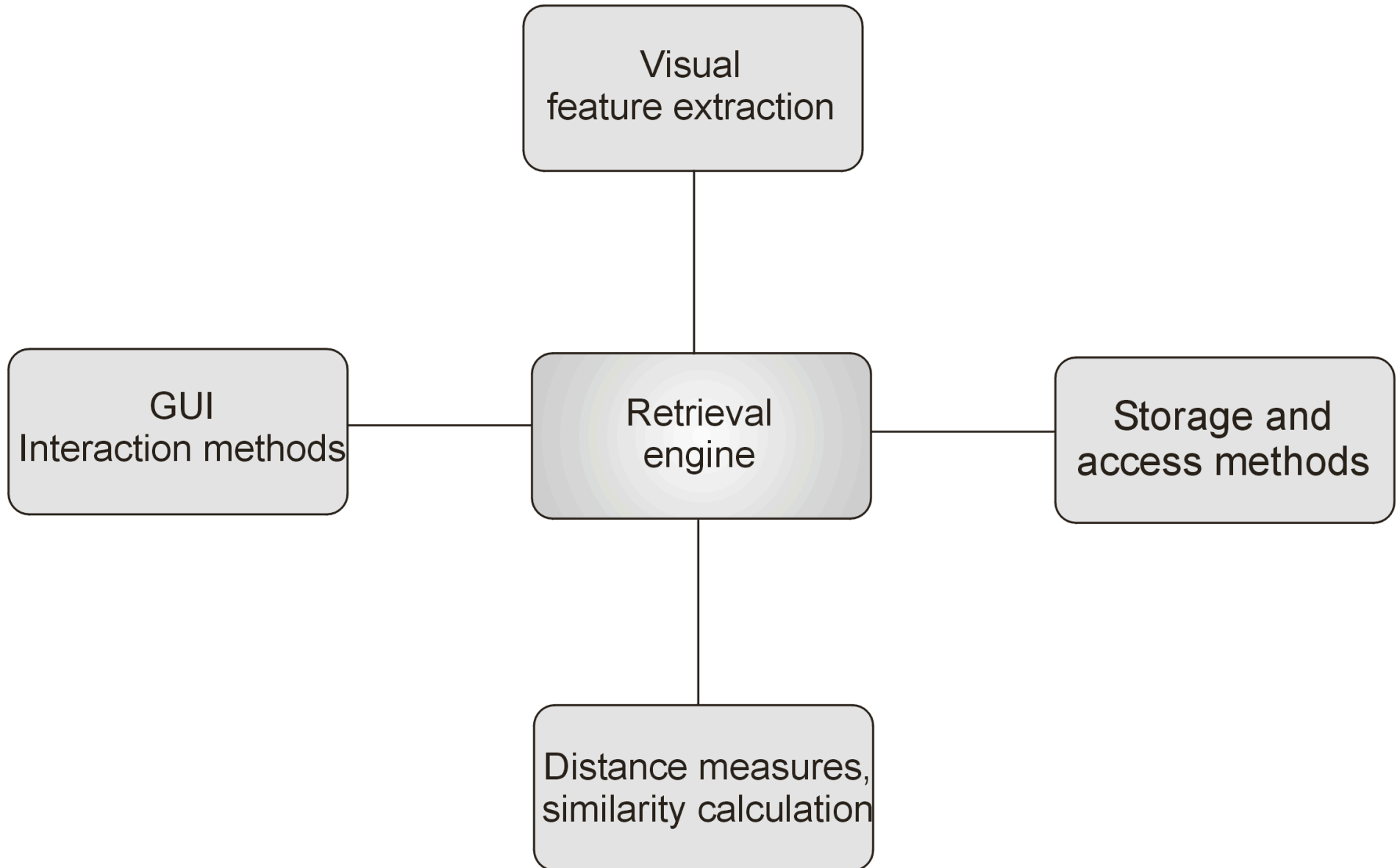


Image retrieval components



Interface (history)

The screenshot shows the 'medGIFT online demo' interface in Mozilla Firefox. The browser address bar shows the URL 'http://medgift.unige.ch/demo/index.php'. The main content area is titled 'Query Image(s) used in the query' and displays a chest CT scan image labeled 'Query image'. Below this is the 'Images result' section, which lists several search results, each with a thumbnail image, a diagnosis, a similarity score, and a user relevance feedback bar (three circles).

Annotations on the interface include:

- A red circle around the 'Query image' with a line pointing to the text 'Query image'.
- A red circle around the first result's thumbnail with a line pointing to the text 'Link to the full size image'.
- A red circle around the first result's feedback bar with a line pointing to the text 'User relevance feedback'.
- A red circle around the similarity score '0.662433' of the first result with a line pointing to the text 'Similarity score'.
- A red circle around the diagnosis 'BOOP / COP' of the fifth result with a line pointing to the text 'Diagnosis & link to teaching file'.

| Thumbnail | Diagnosis | Similarity | Feedback |
|-----------|--------------------------------------|------------------------|----------|
| | Query image | - | - |
| | BOOP (bronchiolite obliteration...) | Similarity: 1.000000 | 3/3 |
| | BOOP / COP | Query Image (1.000000) | 3/3 |
| | BOOP / COP (pneumonie organis...) | Similarity: 1.000000 | 3/3 |
| | BOOP (bronchiolite obliteration...) | Similarity: 0.662433 | 3/3 |
| | BOOP / COP | Similarity: 0.662433 | 3/3 |
| top | | | |
| | BOOP / COP (pneumonie organis...) | Similarity: 0.662433 | 3/3 |
| | Amiodarone lung toxicity | Similarity: 0.638241 | 3/3 |
| | Pneumopathie à l'amiodaron | Similarity: 0.638241 | 3/3 |
| | Abcès pulmonaire | Similarity: 0.636258 | 3/3 |
| | Abcès pulmonaire | Similarity: 0.636258 | 3/3 |
| top | | | |

Terminé

GazoPa – more modern

The screenshot shows a web browser window with the URL <http://www.gazopa.com/similar?file=101573&keyword=¶m=shape>. The page features the GazoPa logo and a search interface. A key image of a stick figure is displayed, with options for trimming, uploading, and searching. The search results section shows a grid of similar images, including a tripod, a stick figure, and a cat, each with a 'Similar search' button and a link to the source.

GazoPa
similar image search
I'm searching for luck

Key image
★★★★★ (0)
<Untitled>
private → public
delete
Your drawings
× Clear image

Trimming
Upload Image
Search Safe search is on

Keyword
× Clear keyword

Search option
 Color - Moderate1 - Moderate2 - Shape | Face

Image size
 All XL L M S

Monochrome only
 Omit same images
× Reset parameters

Search result Video Amazon a ver. Save box Key image history

Results 1 - 30 of 1000 for **key image** view:

Similar search
www.amazon.com
Image ☆ Save

Similar search
mathworld.wol...
Image ☆ Save

Similar search
www.amazon.com
Image ☆ Save

Similar search
www.thenerds.net
Image ☆ Save

Similar search
www.k-pac.org
Image ☆ Save

Similar search
www.actioncat...
Image ☆ Save

Similar search
profile.myspa...
Image ☆ Save

A short demo ...

- <http://MedGIFT.unige.ch/demo/>