MULTIMEDIA SEARCH ENGINES

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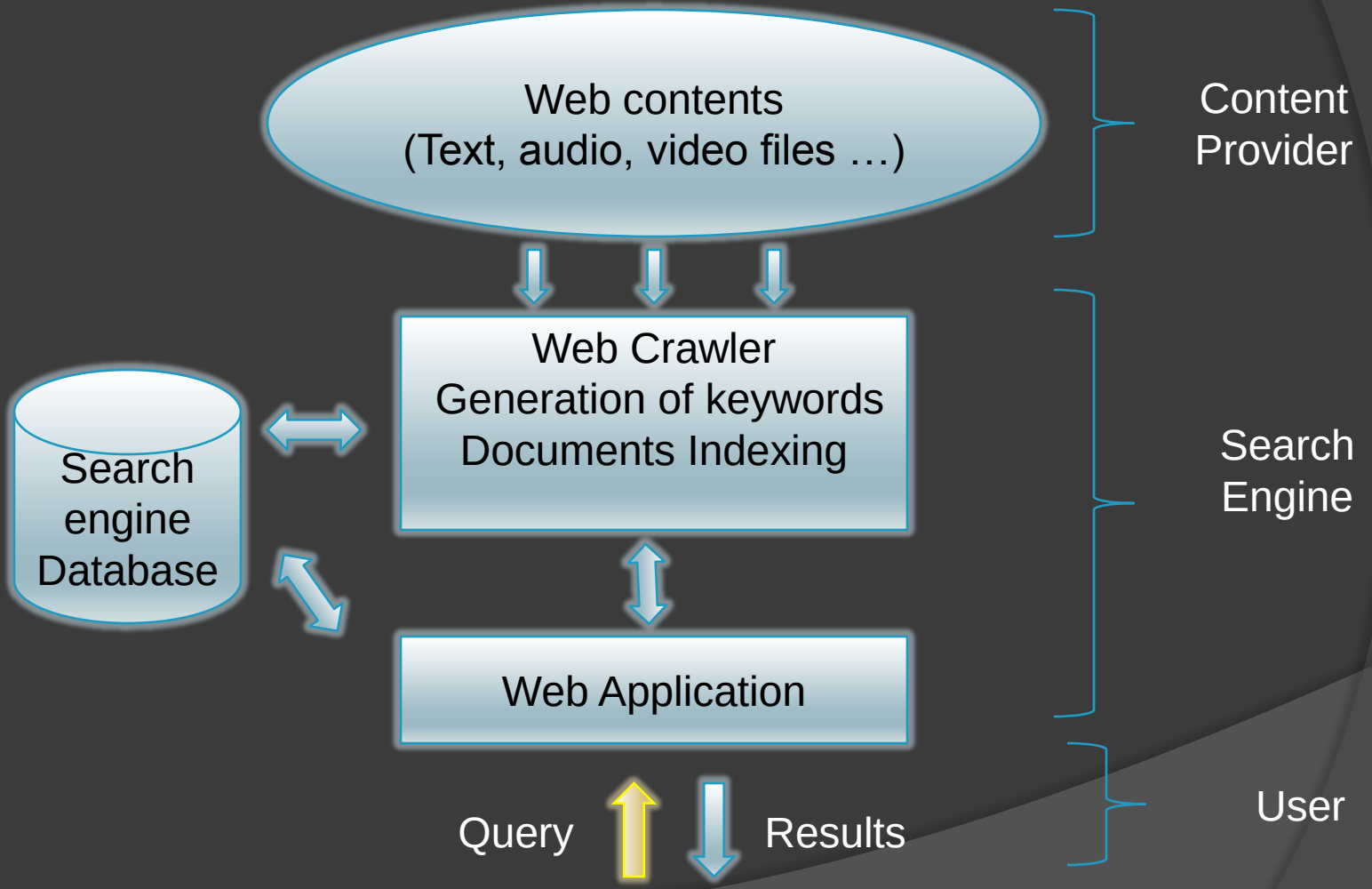
Outline

- **Introduction**
- Image Search Engines
- Audio Search Engines
- Video Search Engines
- Summary

Why using a web search engine ?

- The web :
  - ~ 60 billions of different WebPages (2006)
  - ~ 1000 billions of different WebPages (25th July 2008 – Google index)
- No global database to handle each document
- With the generalization of broadband, many new types of files (audio, video…) downloadable
- How can the user find an information ?

Web Search Engine



A brief history about search engine

- 1993 : First Web Search engines : Aliweb, Wandex
  - First crawler, self learning system
  - Limit the research to the Web Pages title
- 1994- 1998 : Crawler, text analysis improvement
  - WebCrawler first engine to index all the WebPages contents
  - Creation of Yahoo, Alta Vista, Lycos …
- 1998 – 200x : Use of page ranking to calculate the pertinence of the results presented to the user
  - Google, first engine to implement this feature becomes the leader on the market (~60 % of the world queries)

Use text description provided with the multimedia document

Advantage :

- All types of data can be classified
- Indexing tools are already existing

Limits : this type of indexing doesn’t extract any information about the media itself

- Dependant on humans (Risk of errors, very expensive to describe each file)
- Only a few characteristics of the document are described

Limits of classic search engines

- A rapid proliferation of multimedia contents on the internet induces new needs for the search engine :
  - A large amount of information to classify
  - To implement new indexing techniques to analyze audio, video files.
  - Adopt a user's friendly interface to find a multimedia document

➔ The next generation of search engine has to consider these new needs

Semantic Web Search Engine

- New technologies such as XML, RDF enabled the web developers to improve data description
- Semantic web allows to “understand” the type of contents searched by the user
- Use ontology matching to map different keywords with the same meaning
- Restrict the displayed results to WebPages related to the subject asked by the user

Examples of Semantic Search Engine

- Most of semantic search engine are used within major companies
- Examples of Web Search Engines which shows the data analyzing methods :
  - www.ujiko.com , www.kartoo.com

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IMAGE SEARCH ENGINES

Classic Image Search Engines

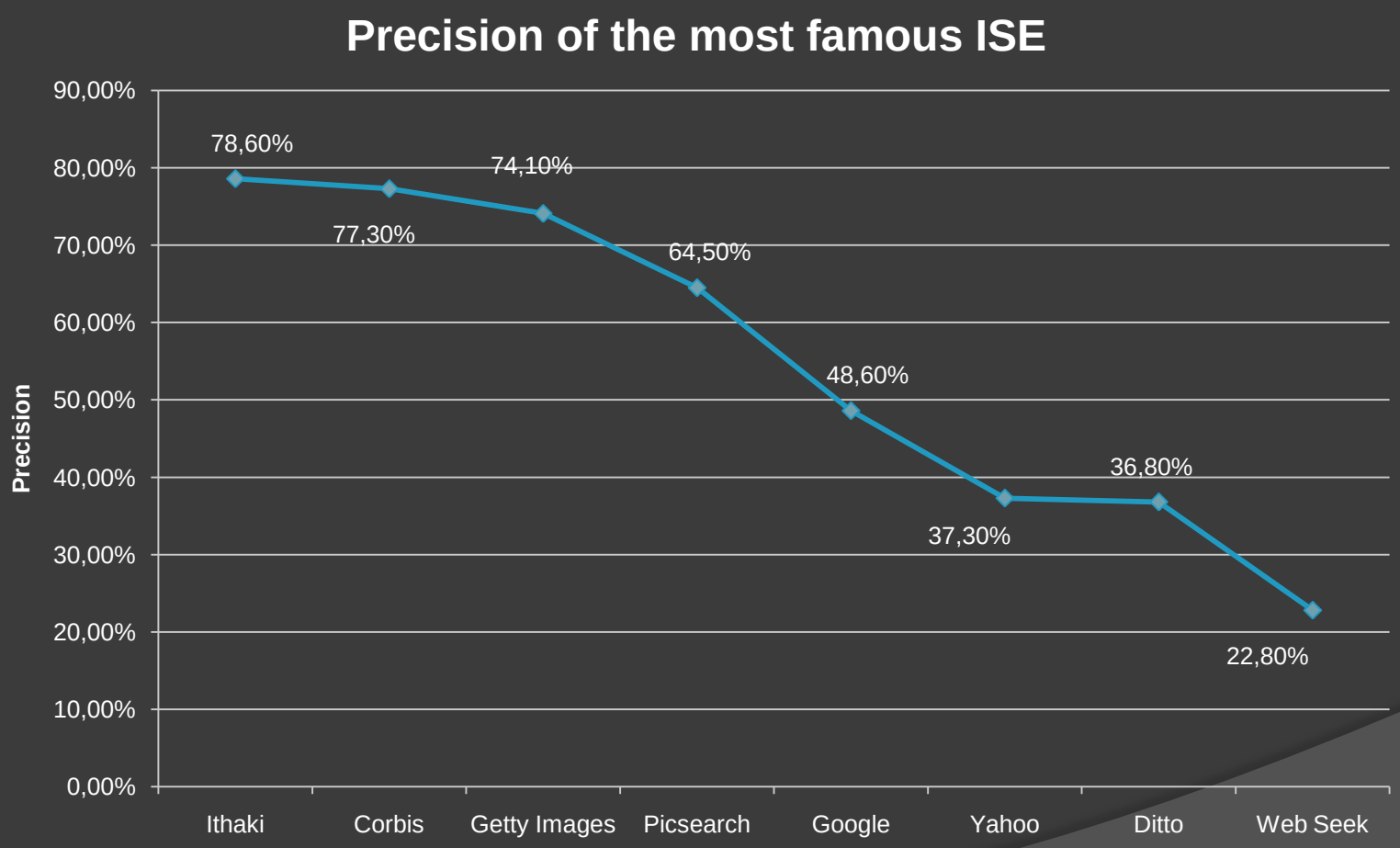
- Text-based search engines
- Not related to the image itself

- Not as accurate as it could be

How do we calculate the relevancy of the results ?

- Calculation of the precision of a SE :
  - Ratio of relevant records retrieved over the total amount of records retrieved.
- Word queries :
  - Must be various and numerous.
  - Must go from common searches to more specific ones.

Survey


Precision of the most famous ISE
Precision
90,00%
80,00%
70,00%
60,00%
50,00%
40,00%
30,00%
20,00%
10,00%
0,00%
78,60%
77,30%
74,10%
64,50%
48,60%
37,30%
36,80%
22,80%
Ithaki
Corbis
Getty Images
Picsearch
Google
Yahoo
Ditto
Web Seek

Some ways to improve SE

- To manually associate images to keywords
  - Requires a lot of human involvement
  - Costs too much money
- To Use ALT tagging
  - Already a requirement in the US with the Americans with Disabilities Act

A new approach

- Searches should be based on the content
- There are different kinds of content-based search engines, based on :
  - Automated Image annotation : Behold
  - The reliability of other SE : MetaSEEk
  - Sample selecting : ImageRover
  - Image Characteristics (colors and layout) : QBIC
  - Image query

Behold !

- Automated image annotation
  - Collects “training images” labeled with keywords
  - Examples of keywords : Building, Animal, Face, Bird, Boat, etc.
  - Associates images from the database to keywords
- Image similarity network construction
  - Creates links between similar images
- http://www.behold.cc/

ImageRover

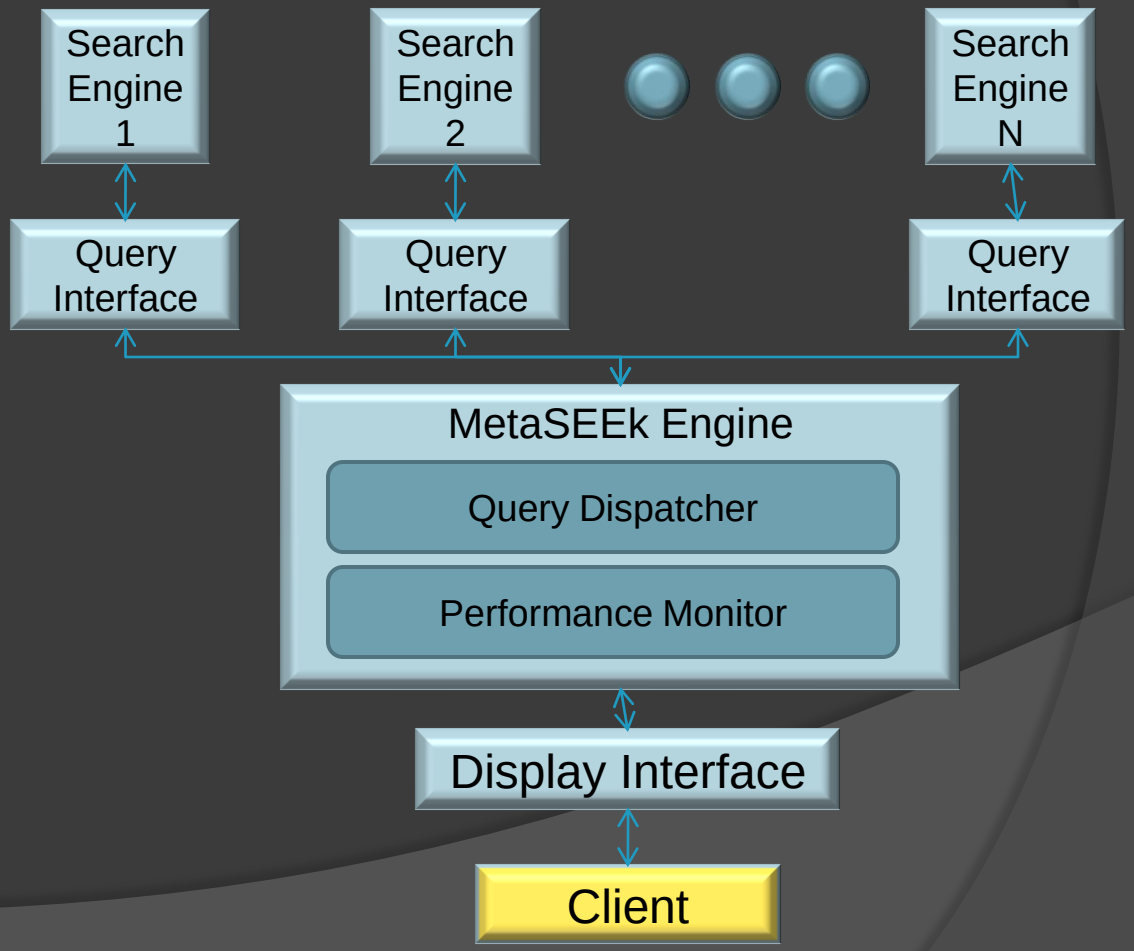
- Associates images together and creates links between similar images.
- Iterative search : the user improves the search results by selecting samples.
- The search engines gives results similar to the samples chosen by the user.

The user selects images in the results list.

ImageRover retrieves images that are similar to those samples.

MetaSEEk

- A search engine based on other search engines.
- Each search engine has a score which reflects its reliability.



MetaSeek : user's feedbacks

- "Like / dislike" feedbacks
  - Changes the rank of the image.
  - Changes the rank of the search engine that retrieved this image.

IBM's QBIC

- ISE based on the characteristics of the image, such as colors or layout.
- The user chooses a color and determines its quantity or its position in the picture.
- QBIC tries to find pictures matching the user's needs.

Query Image

- The user gives an image instead of keywords.
- The ISE answers the query by giving the user a collection of images similar to the query image.
- This involves some image processing to find similarities between images of the database and the query image.

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AUDIO SEARCH ENGINES

Issues

- Same problems as for images : a content-based search is needed.
- Audio search engines can deal with sounds, music, speech, etc.
- An example of sound search engine : FindSound.

Speechbot

- Searches for audio content on the web
- Uses speech recognition to associate those audio stream to keywords.
- The user gives some keywords and Speechbot retrieves corresponding audio stream.

Music Search Engine (Indexing)

- Audio-based similarity : acoustic comparison of music streams.
- Web-based similarity : content of the web-page.
- Association audio-stream / music genre

Music Search Engine (Query)

- Query-by-humming/singing (QBHS)
- Description of the music
  - Rhythm
  - Instruments
  - Lyrics
  - Etc.

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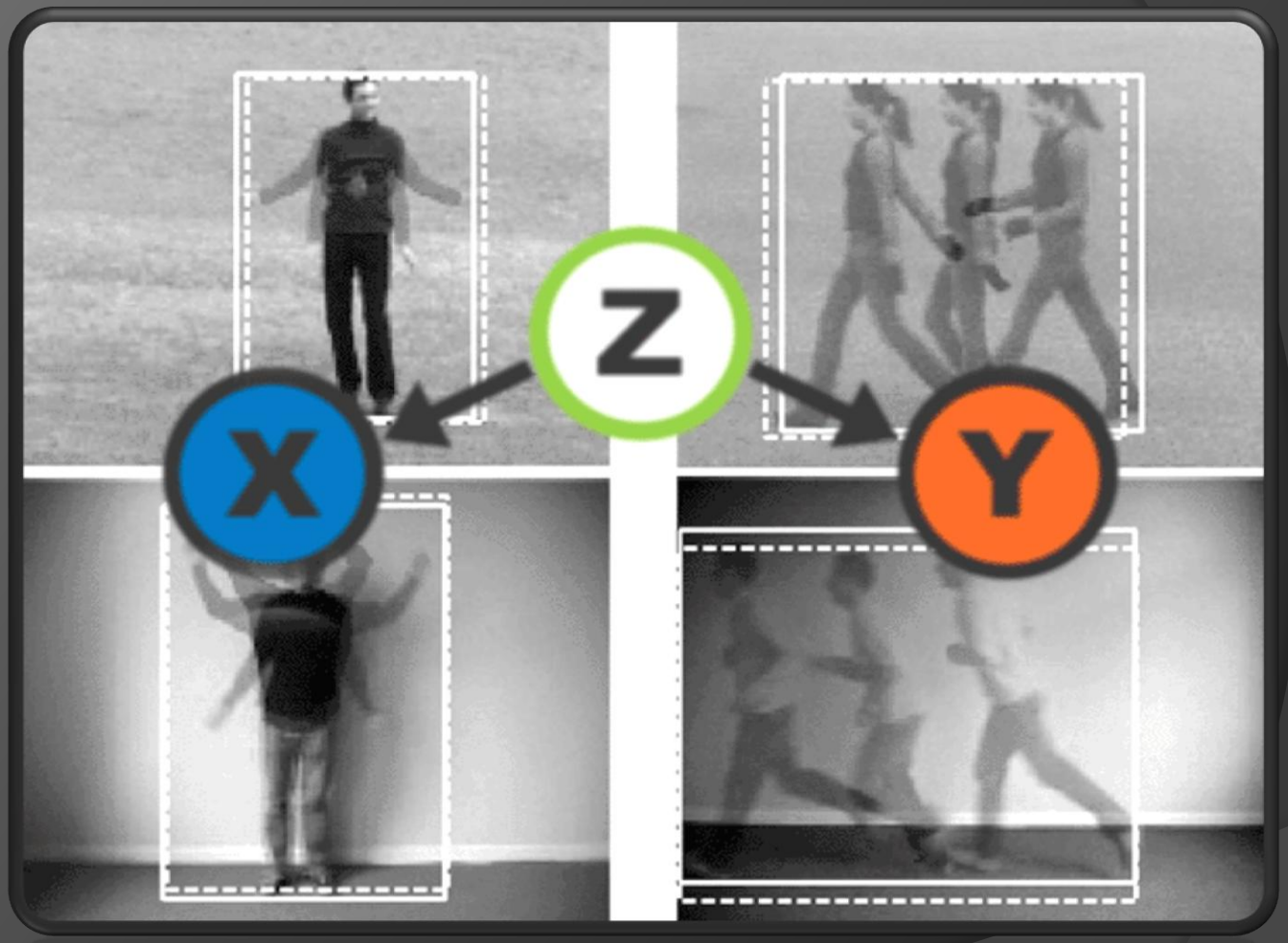
VIDEO SEARCH ENGINES



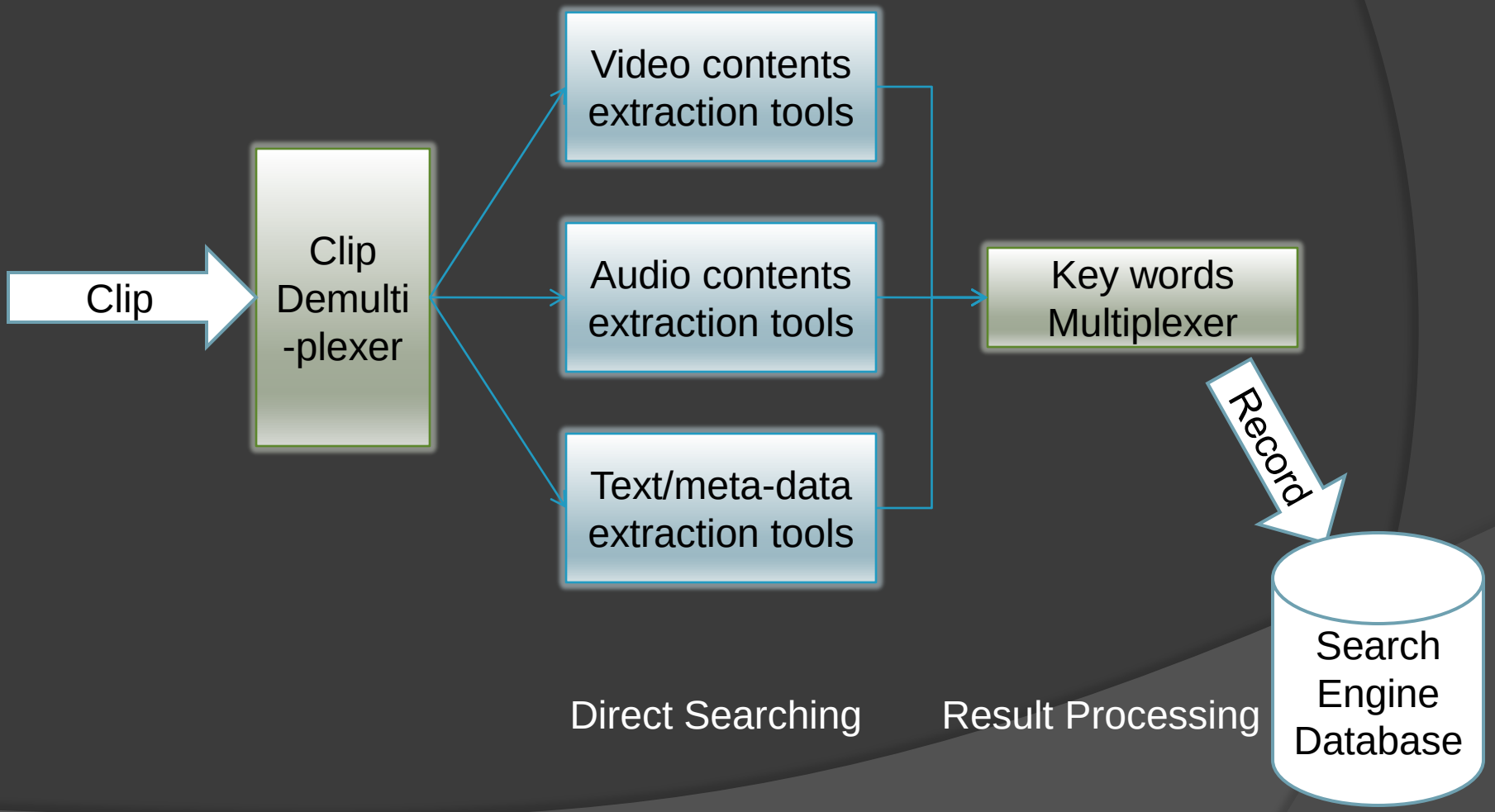
Video Analysis

- Aim : Find the main contents of a file and index them in the search engine database
- Create a record in the engine database relating to each clip with as many keywords as possible
- A video analysis system analyzes all the media related to the clip
- Direct searching must implement parallel research

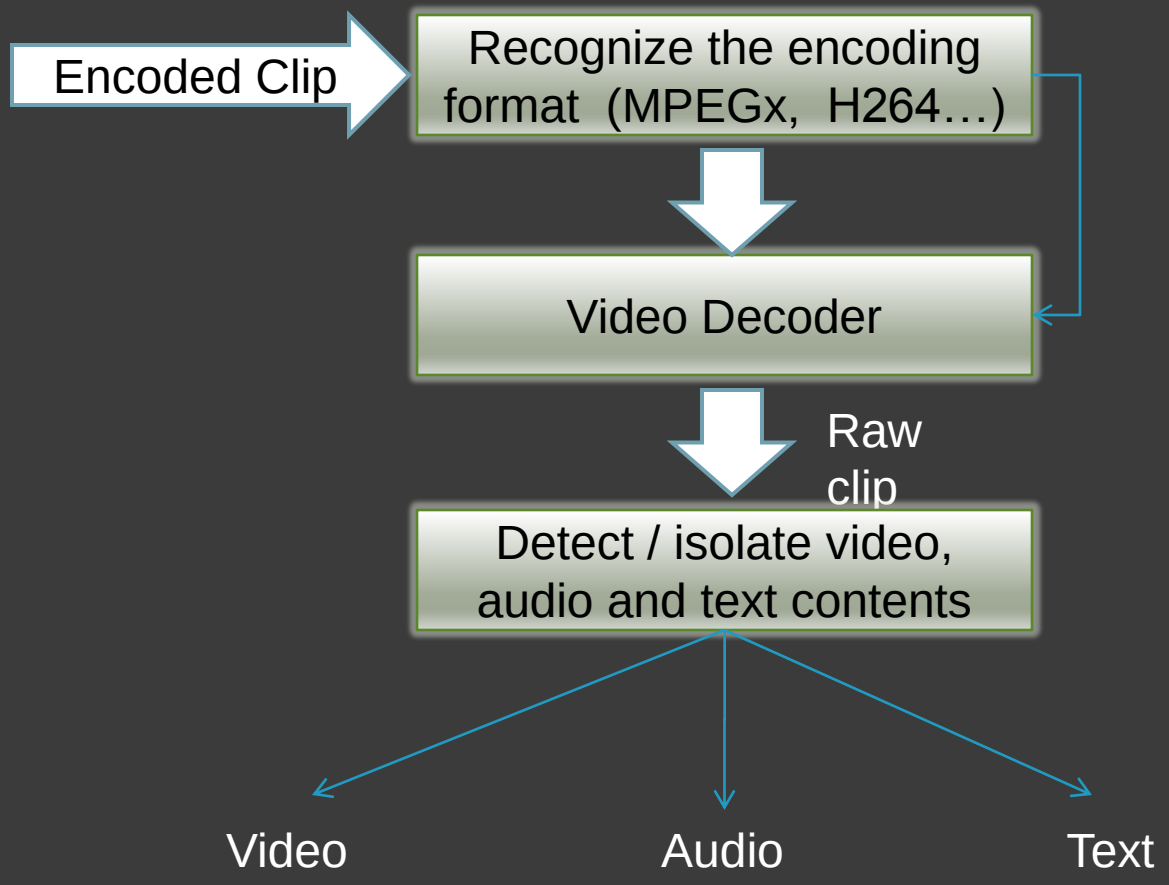
Two complementary methods of indexing video documents

- Semantic Analysis
  - Describe the main contents of the documents using human made description
- Clip Analysis
  - Find all the different contents of the documents using computer assisted processing

A typical video analysis model



Clip Demultiplexer



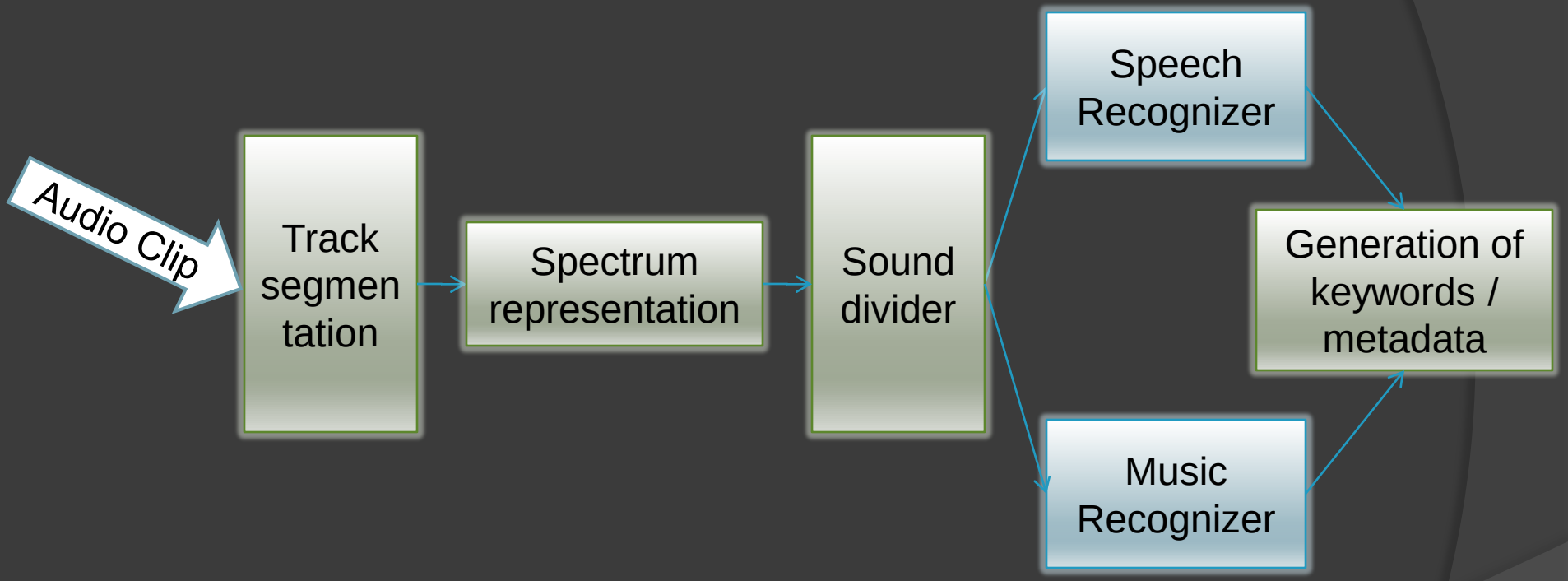
Text extraction tools

- Extract data from texts included in the clip
- Used by the major search engines to handle their multimedia files
- Using text/meta-data feature, some video search engine adapt their video/audio extraction methods

Audio extraction tools

- Aim : to recognize the most important sounds
- Unpredictable environment
- Segment / Divide all the sounds depending on their frequency
- Use a audio low level detection

A typical audio decoder



Video extraction tools : Segmentation

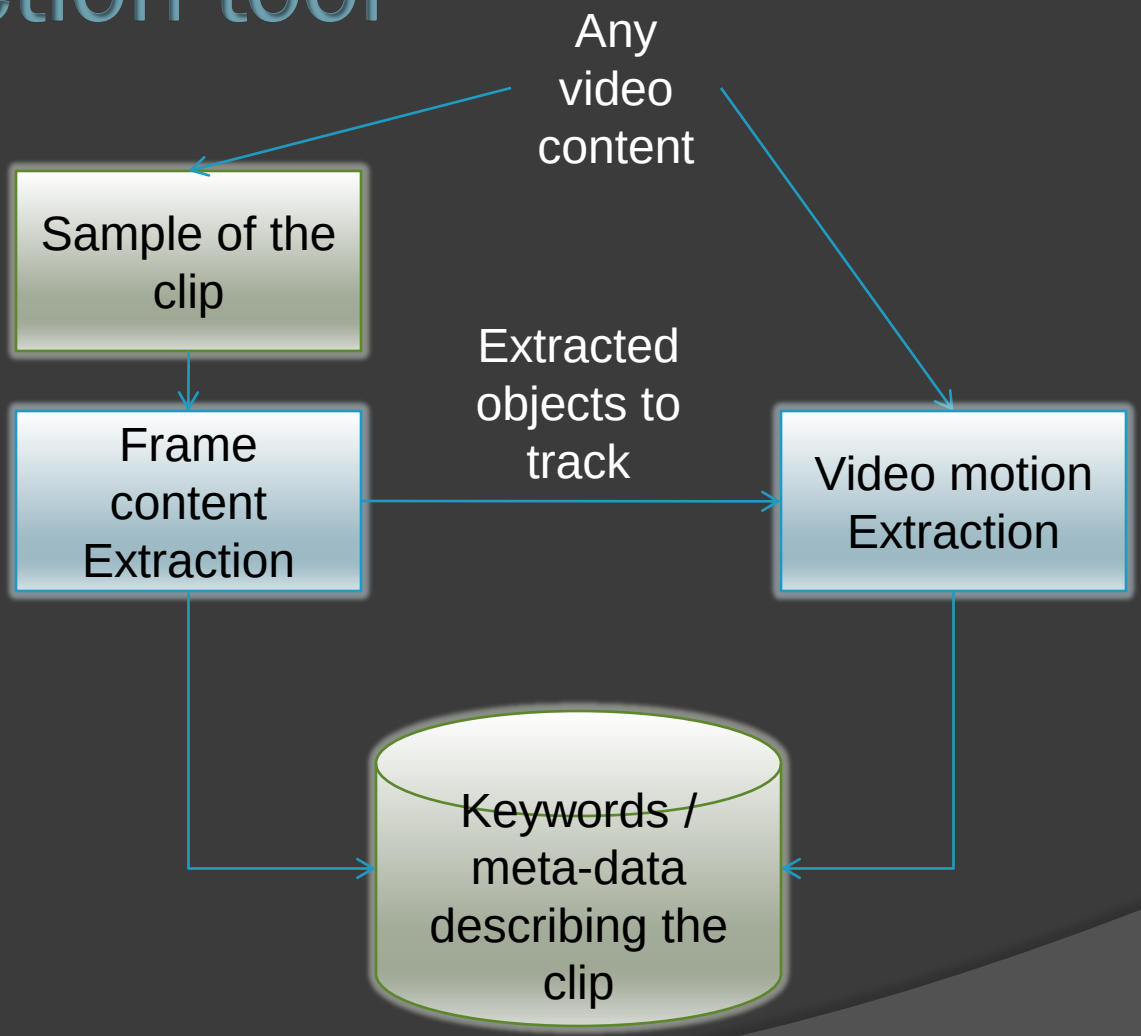
- Image processing
  - Sample the clip and keep only significant frames
  - Reduce the amount of data to process
  - Extraction of objects using numerous recognition algorithms : object recognition, face detection, logo recognition
- Image recognition
  - Compare contents with a shapes database
  - Find keywords / meta data related to the frame

Video extraction improvement : Motion Detection

- Video : Representation of scenes in motion
  - Action is a key description attribute
  - SE must implement motion detection tools

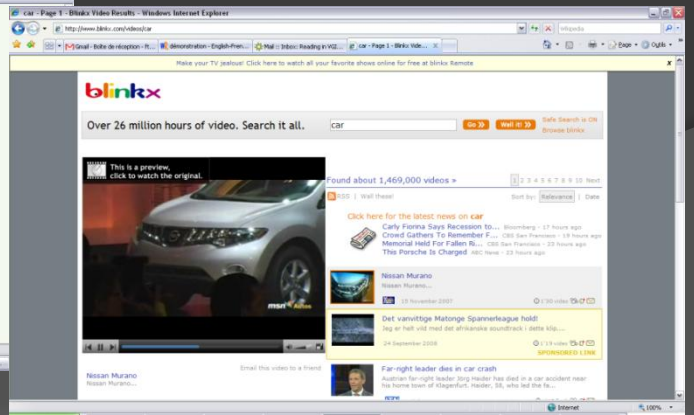
- Use of existing technologies
  - Tracking using frames sequence analysis
  - Model - based recognition and condensation algorithm
  - Similarities to the algorithms used in video surveillance systems
  - Limits : Expensive calculations & requires huge databases

An example of video extraction tool



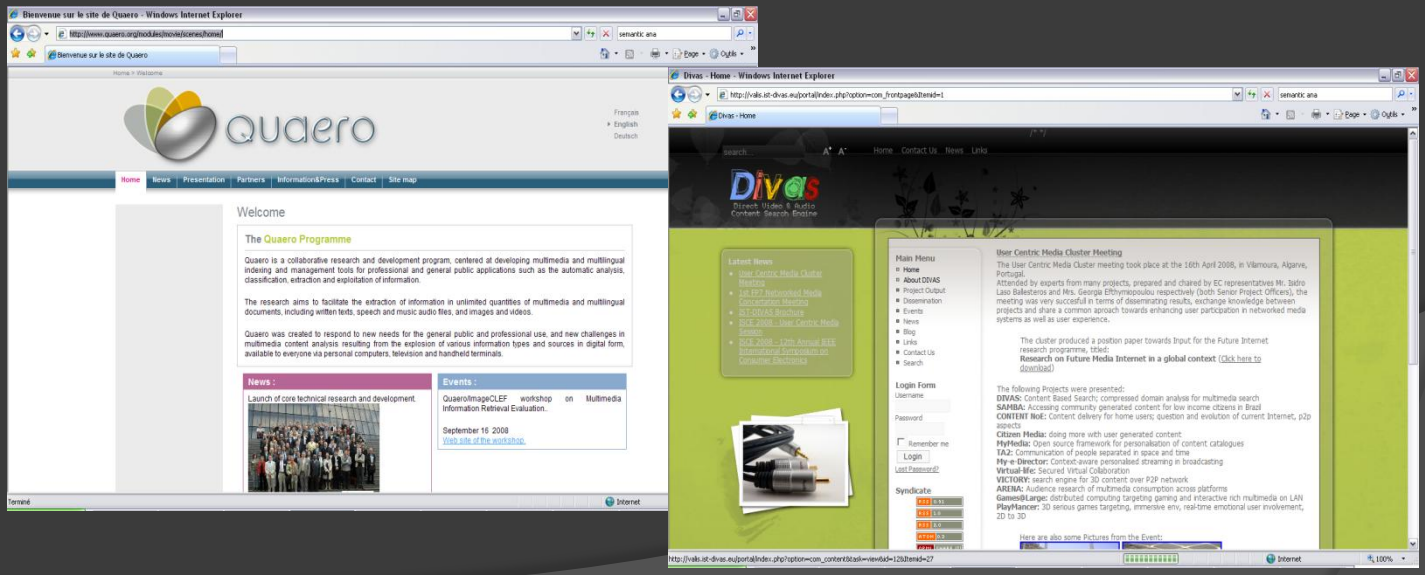
Existing video search engines

- “Classic” tools using text recognition : www.images.google.com , www.yahoo.com ,
- “State of the art“ Multimedia Search Engine : www.tveyes.com/, www.blinkx.com



A market on the rise

- Major web search engines will implement media analyzing in the following years
- Since 2000, numerous projects were launched
  - http://www.quaero.org/ , http://www.ist-divas.eu/portal/



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Summary

- Text-based search engines are limited.
- A lot of different ways to search for content in multimedia files.
- Most content-based search engines use similarity and links between multimedia records and keywords.
- Unfortunately, multimedia search engines still need a lot of improvement.

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