Medical Imaging Processing

Image Storage and Retrieval

By

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Introduction

❖ Due to recent development in technology, there is an increase in the usage of digital cameras, smartphone, and Internet. shared and stored multimedia data are growing,

❖ and to search or to retrieve a relevant image from an archive is a challenging research problem fundamental need of any image retrieval model is to search

❖ and arrange the images that are in a visual semantic relationship with the query given by the user.

Approaches to retrieve images:

➢ Most of the search engines on the Internet retrieve the images on the basis of text-based approaches that require captions as input user submits a query by entering some text or keywords that are matched with the keywords that are placed in the archive. the output is generated on the basis of matching in keywords, and this process can retrieve the images that are not relevant.

➢ The second approach for image retrieval and analysis is to apply an automatic image annotation system that can label image on the basis of image contents.

The approaches based on automatic image annotation are dependent on how accurate a system is in:

- detecting color,

- edges,

- texture,
- spatial layout,
- and shape-related information

Content-based image retrieval (CBIR)

is a framework based on the visual analysis of contents that are part of the query image.

- ❖ To provide a query image as an input is the main requirement of CBIR
- ❖ and it matches the visual contents of query image with the images that are placed in the archive,
- ❖ and closeness in the visual similarity in terms of image feature vector provides a base to find images with similar contents.

 In CBIR, low-level visual features such as:

- ❖ color,
- ❖ shape,
- ❖ texture,
- ❖ and spatial layout

 are computed from the query and matching of these features is performed to sort the output

CBIR applied in various applications such as:

- ✓ medical image analysis,
- ✓ remote sensing,
- ✓ crime detection,

- ✓ video analysis,

- ✓ military surveillance,

- ✓ and textile industry.

The Figure below provides an overview of the basic concepts and mechanism of image retrieval.
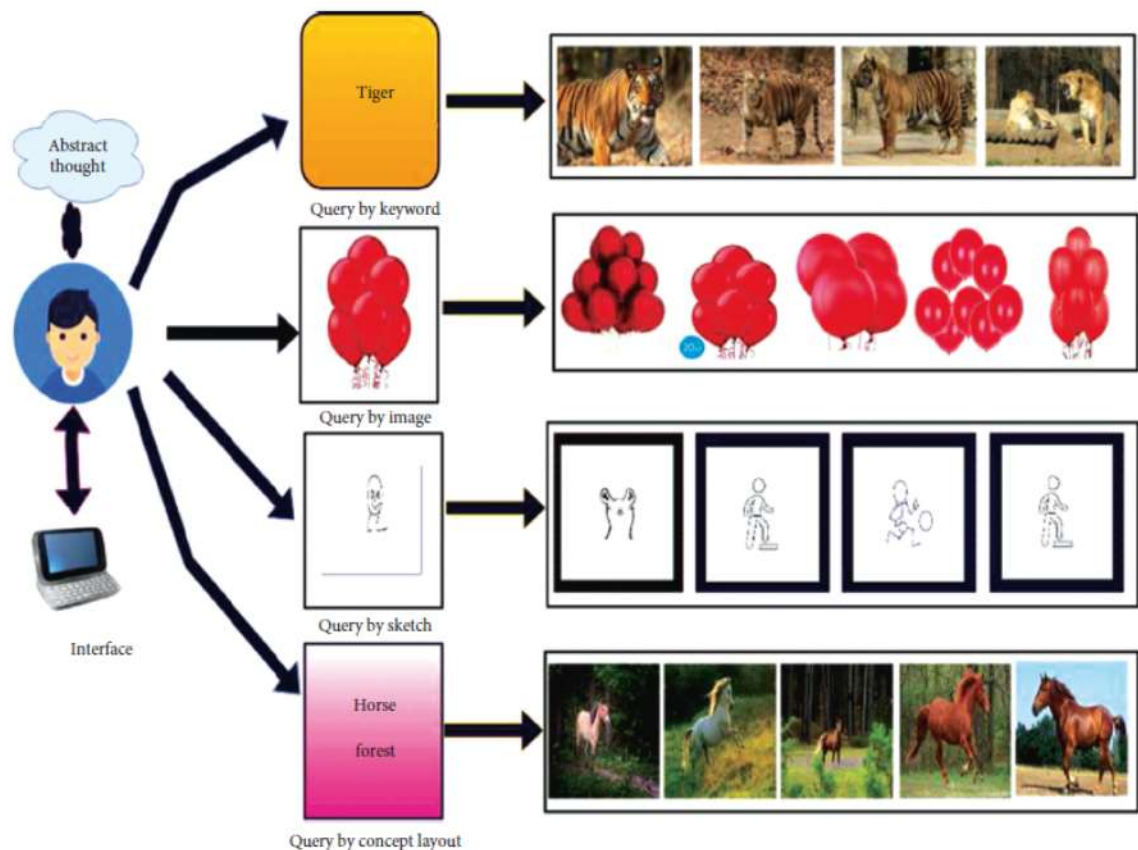

The basic need for any image retrieval system is to search and sort similar images from the archive with minimum human interaction with the machine.

Content−Based Medical Image Retrieval

- In content−based image retrieval systems, images are indexed and retrieved from databases based on their visual content (image features) such as color, texture, shape, etc.

- Commercial content−based image retrieval systems have been developed, such as QBIC, Photobook ,Virage , VisualSEEK has divided these image features into three levels as followings:

- 1) Level 1 − Primitive features such as color, texture, shape or the spatial location of image elements.

- 2) Level 2 − Derived attributes or logical features, involving some degree of inference about the identity of the objects depicted in the image.

- 3) Level 3 − Abstract attributes, involving complex reasoning about the significance of the objects or scenes depicted.

Figure below show the classification of medical image retrieval methods.
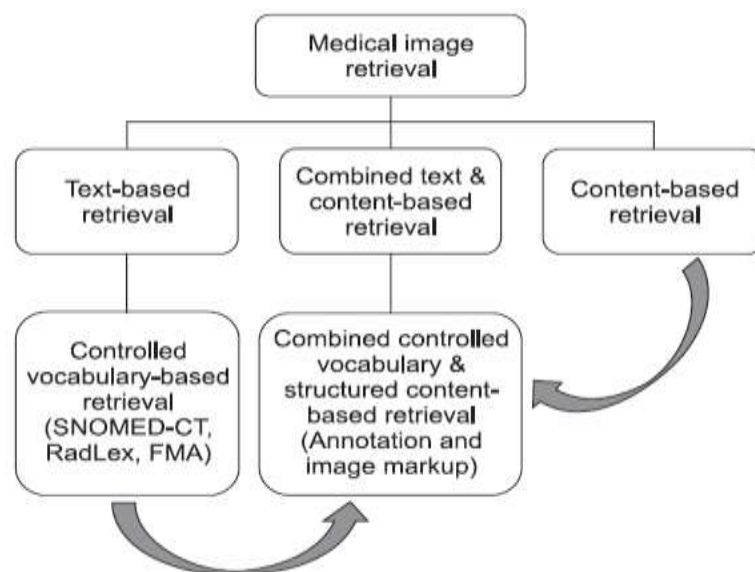
Developed commercial content-based image retrieval systems such as:

ASSERT system for high resolution computed tomography (CT) images of the lung and image retrieval for medical applications (IRMA) system for the classification of images into anatomical areas, modalities and viewpoints.
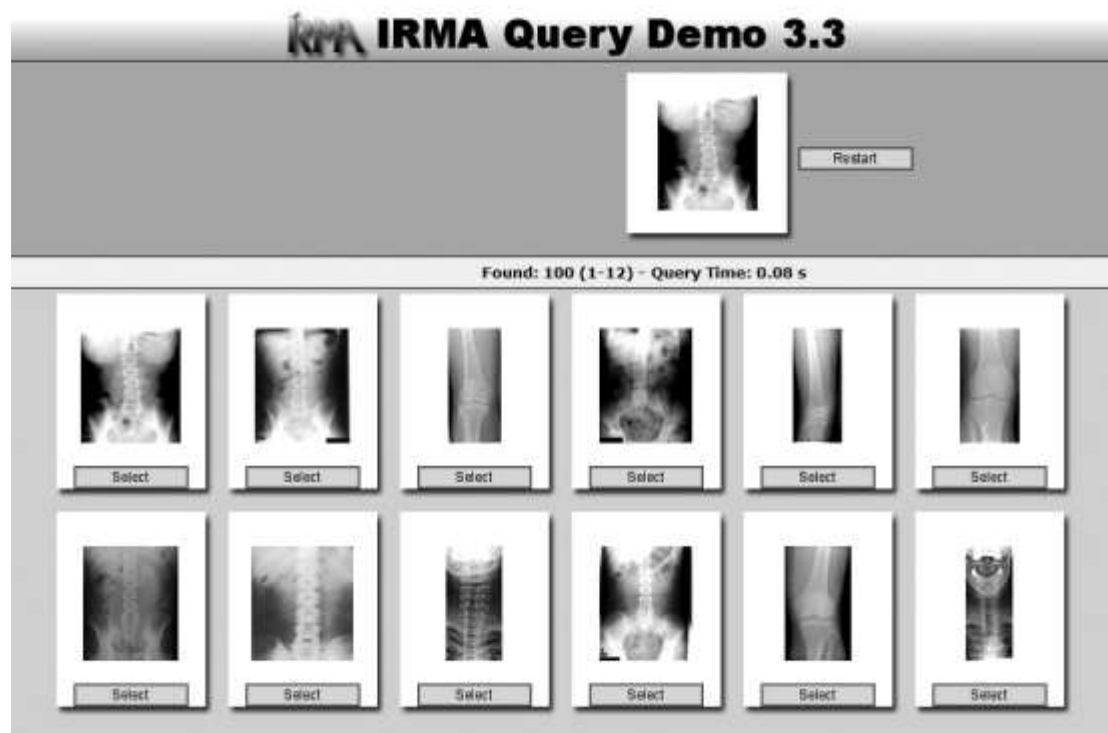
Flexible image retrieval engine (FIRE) system handles different kinds of medical data as well as non−medical data like photographic databases.
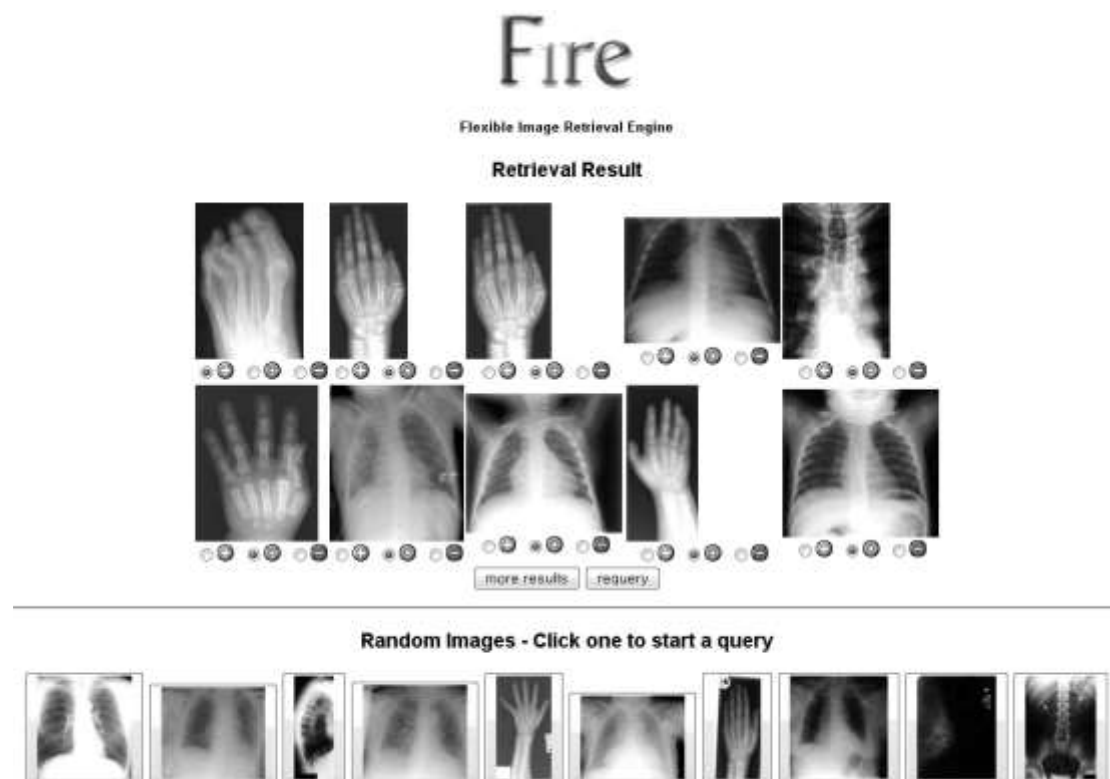
Bubble Sheet Questions

Q1. What is the fundamental need of any image retrieval model?

    a. To retrieve images based on text queries

    b. To search for images based on color and shape

    c. To search and arrange images that are visually related to a user's query

    d. To index images based on their logical features

Answer: c. To search and arrange images that are visually related to a user's query

Q2. Which approach for image retrieval is based on automatically labeling images according to their content?

a. Text-based approach

b. Content-based image retrieval (CBIR)

c. Edge detection approach

d. Shape analysis approach

Answer: b. Content-based image retrieval (CBIR)

Q3. What are some of the low-level visual features used in CBIR?

a. Keywords and captions

b. Color, shape, texture, and spatial layout

c. Logical attributes and inference

d. Level 1, Level 2, and Level 3 features

Answer: b. Color, shape, texture, and spatial layout

Q4. In which applications is CBIR commonly applied?

a. Textile industry and video analysis

b. Remote sensing and military surveillance

c. Medical image analysis and crime detection

d. All of the above

Answer: d. All of the above

Q5. What is the primary goal of a content-based image retrieval system?

    a. To classify images into anatomical areas

    b. To handle different kinds of medical data

    c. To search and sort similar images based on visual content

    d. To develop logical features for image indexing

Answer: c. To search and sort similar images based on visual content