Research Proposal: An Image Retrieval and Annotation System for the Medical Domain

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The increasing rate at which images are generated in many application areas gives rise to the need for image retrieval systems to provide an effective and efficient access to image databases, based on their visual content (color, shape, and/or texture).

There are two main approaches to access an image database: a query driven approach which allows the user to specify either a text query (keywords, annotations, etc) or an image query; on the other hand, a browsing driven approach allows users to navigate through the database until they identify an image of interest and then, initiate a search using that image as the query image. The query driven methodology is more appropriate for experts or users who do not have any difficulties in formulating a query, while browsing driven methodology is important for users who are not very familiar with the image domain characteristics and they would like first to get deeper insights about the image database before formulating their query. In both cases, the users should not only see and accept the computer’s retrieval results, but also easily understand and interpret them. Through our research, we hope to integrate the human mind’s exploration capabilities with the processing power of computers.

The proposed project is an application of some of my current research to the medical domain. The images come from the medical domain and the goal is to build an image retrieval system to enable doctors, residents and students to exploit the medical resources for educational and clinical purposes.

The output of the project consists of a visual interface that will allow doctors to visualize a medical image database in order to:

- Annotate images from the medical database; one of the benefits will be that over time, the hospital will have a medical image database with diagnostics already identified by experts; consequently, a common database will allow the distribution of images among doctors for review or sharing a study. Moreover, an initial manual association of medical terms/keywords/concepts to the abnormalities seen in the images will create a ground for automatic diagnosis (without human supervision) for similar future cases.

- Find other images in the medical database that are most similar with the query image; for example, if a doctor is exposed for the first time to a certain tumor, the system will retrieve images with similar abnormalities of different patients along with their previously identified diagnosis.

- Study the evolution of a tumor for a patient by summarizing and comparing multiple images of the same patient screened over a period of time; for example, it will be very useful for research and educational studies to view the image of a normal heart along with an abnormal one for a patient with same physical conditions.

A student working on this project will have the opportunity to learn:

- Main concepts in digital imaging
- Applications of digital imaging to the medical domain
- Steps of building an efficient image retrieval and annotation system
- Steps of building a visual interface for medical images annotation and retrieval
- Programming environments such as MATLAB for image processing and ASP for interactive interfaces; MATLAB is the most used software package in both industry and academia for image processing algorithm testing

Furthermore, the student will get insight on doing research in multimedia retrieval, medical imaging, visualization, and human computer interaction field, which all have applicability to the real world.