DOCTORAL PROGRAM IN COMPUTER SCIENCE

2010/2013

Thesis Proposal

Title:

Feature Based Repositories For Medical Imaging Content Based Retrieval

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Introduction

Nowadays, medical imaging is a valuable and indispensable tool in healthcare systems, representing to physicians a key factor for delivering high quality decisions. The PACS (Picture Archiving and Communication System) concept embraces a set of technologies for the archiving, distribution, visualization and acquisition of medical images over a computer network. Compared with the traditional analogue film, PACS brings significant benefits in the productivity, economy and management of a healthcare institution. Its current success was boosted by the introduction of the DICOM standard, allowing interoperability between systems from different manufactures.

The deployment of PACS has enabled faster and broader access to medical image data. However PACS repositories are still far from being considered as the basis for auxiliary knowledge build-up that may be useful in multiple diagnosis instances. A tool that fully exploits the DICOM meta-data information was developed and has already proved its capabilities to offer image query and retrieve services [1, 2]. However meta-data is not suitable for content oriented query and retrieve.

Content Based Image Retrieval (CBIR) in the Medical Domain has peculiar aspects when compared to the already live and generic domains of multimedia and entertainment [3]. Colour is normally absent, very precise structural information predominates and often subtle features play a key role to uncover the diagnosis associated to a particular imaging study. Image semantics is often determined by the expert observer based on prior reading skills and memorized features that are seamless matched against new instances. We believe that if a wide scope image related feature repository is somehow integrated within the PACS framework significant advances could be accomplished through medical CBIR as a real decision support tool

Objectives

This PhD work must address some fundamental issues related with visual feature extraction and how subsets of features could be assembled into DICOM persistent objects in order to provide effective CBIR tools. For particular modality instances the work has to evolve from image segmentation tasks towards the consequent definition of suitable feature based data structures. Several well-defined clinical imaging contexts may be instantiated for this work: eg. MR Brain Imaging, Mammography and Thoracic Computed Tomography.

This student must propose novel methods for the integration of these data structures within standard DICOM framework. Finally, the validation process must include query and retrieval trials in order to assess the effectiveness of the feature repository contributions.

References

1. Dicoogle - an Open Source Peer-to-Peer PACS, Carlos Costa, Carlos Ferreira, Luís Bastião, Luís Ribeiro and Augusto Silva, et al., Journal of Digital Imaging, October 2010, DOI 10.1007/s10278-010-9347-9.

2. Indexing and retrieving DICOM data in disperse and unstructured archives, Carlos Costa, Filipe Freitas, Marco Pereira, Augusto Silva and José L. Oliveira, International Journal of Computer Assisted Radiology and Surgery, 2009, Volume 4, Number 1, Pages 71-77

3. Content-Based Image Retrieval in Radiology: Current Status and Future Directions, Ceyhun Burak Akgül, Daniel L. Rubin, Sandy Napel, Christopher F. Beaulieu, Hayit Greenspan and Burak Acar, Journal of Digital Imaging, April 2010, DOI: 10.1007/s10278-010-9290-9