

Chapter 8.3

A New System for the Integration of Medical Imaging Processing Algorithms into a Web Environment

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ABSTRACT

This chapter presents an architecture for the integration of various algorithms for digital image processing (DIP) into web-based information systems. The proposed environment provides the development of tools for intensive image processing and their integration into information systems by means of JAVA applets. The functionality of the system is shown through a set of tools for biomedical application. The main feature of this architecture is

that it allows the application of various types of image processing, with different computational costs, through a web browser and in a transparent and user-friendly way.

INTRODUCTION

The rapid advance of the medical imaging field is revolutionizing medicine. Technologies such as computed axial tomography (CT Scan), magnetic resonance imaging (MRI), Helicoidal CT Scan, and the fusion of CT Scan and positron emission

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tomography (PET), all provide an effective map of the human anatomy in a non-invasive manner.

Clinical practice usually relies on computing techniques to simplify the diagnosis of the medical expert. Medical imaging is not restricted to the visualization of anatomical structures, it is also used for diagnosis, surgical planning, simulation, radiotherapy planning, etc. These applications enable the clinicians to virtually interact with the anatomical structures and as such achieve the knowledge that enhances their performances. All the aforementioned techniques belong to a discipline known as Digital Image Processing (DIP). Traditionally, the medical DIP applications were carried out in expensive work-stations provided by the CT or PET machine supplier. These kinds of applications have certain drawbacks, such as administration and maintenance, which make them unsuitable for some environments.

The current trend in software development is the creation of applications that can be integrated into a Web environment and enjoy advantages such as placement independence, centralized application maintenance, and the use of firewalls without changing the filter rules. Web applications have proliferated due to their rapid learning and easy use as well as their personalization capability that provides a user-friendly interface. This trend towards Web developments is also being introduced into the medical field, to the detriment of the traditional clinical applications. DIP-related applications have high computational costs and therefore hospitals have to invest heavily in computing equipment in order to provide the clinicians with powerful mainframes. At this point, it seems logical to differentiate between algorithms of low and high computational cost.

It should be borne in mind that, as DIP is not a recent discipline, there exist libraries that include different algorithms for digital image processing. Already implemented algorithms should therefore be reused in new developments.

State of the Art

There currently exists a wide range of applications that allow the digital processing of medical images by means of a Web browser. The following list represents applications with two common factors: the DIP is processed at the client and the implemented algorithms tend to have a low computational cost.

- RAIM Java is a DICOM (Digital Imaging and Communication in Medicine) image viewer for biomedical imaging that was developed by the Biomedical Digital Imaging Center of UDIAT-CD S.A. (<http://www.cspt.es/webcsptcastella/udiat/default.htm>). This viewer was developed with Java technology and can therefore be used in almost any computer and graphic operative system. Since the visual display was conceived as an applet, it has to be executed within a Web browser; this allows the images to be processed in various ways, such as change of visualization window (Window-Level), rotation, scale, etc.
- CHILI: Digital radiology (<http://www.chili-radiology.com>) is a set of software components oriented towards tele-radiology and PACS (Picture Archiving and Communication Systems). It is a product from CHILI GmbH (Germany) and was developed in cooperation with the German Cancer Research Center and the *Steinbeis Transferzentrum Medizinische Informatik* company. CHILI WEB is one of its products and is composed by the CHILI/Web Server with the CHILI/Web Client. The CHILI/Web Server first receives the images of the modalities through the DICOM protocol and later stores them in a relational data base. The CHILI/WEB Server can work with an existing PACS. The CHILI/

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