Chapter XVIII
A Software Tool for Reading DICOM Directory Files

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ABSTRACT

DICOMDIR directory files are useful in medical software applications because they allow organized access to images and information sets that come from radiological studies that are stored in conformance with the digital imaging and communication in medicine (DICOM) standard. During the medical application software development, specialized programming libraries are commonly used in order to solve the requirements of computation and scientific visualization. However, these libraries do not provide suitable tools for reading DICOMDIR files, making necessary the implementation of a flexible tool for reading these files, which can be also easily integrated into applications under development. To solve this problem, this work introduces an object-oriented design and an open-source implementation for such reading tool. It produces an output data tree containing the information of the DICOM images and their related radiological studies, which can be browsed easily in a structured way through navigation interfaces coupled to it.

INTRODUCTION

The digital imaging and communications in medicine (DICOM) standard (National Electrical Manufacturers Association (NEMA0, 2004a; Revet, 1997) was published in 1993. Its main goal was to establish norms for handling, storing, and interchanging medical images and associated digi-

tal information within open systems. Also it was to facilitate the interoperability among acquisition equipments and other medical devices, as well as their integration within specialized information systems in the medical and health care area.

Since then, the appearance and use of computer-assisted medical applications have increased, as a result of the accelerated technological develop-

ment and the standardization process of medical information representation and handling, which generated a greater demand of development tools for those applications.

These applications range from health care information systems and picture archiving and communication systems (PACS) () solutions, to technological support systems for medical procedures, such as image-based diagnosis and surgical planning, which previously depended on the knowledge and expertise of the physicians.

In such applications, the handling of images coming from different acquisition modalities is essential. These images generated from radiological studies and stored according to the specifications of parts 10, 11 and 12 of the DICOM standard (NEMA, 2004e, f,& g) must be retrieved from storage media as a bidimensional display or in tridimensional reconstructions and other special processes, such as fusion and segmentation of images. The use of DICOMDIR directory files is almost mandatory for searching, accessing, and browsing medical images because they index the files belonging to the patient on whom the studies were performed, thus making it easier to access to those images and their associated medical information.

During the medical application software development, the use of programming interfaces (APIs) or class libraries is frequent in order to solve the computation and visualization needs, as well as for providing DICOM support to the applications. In that sense, there exist numerous public domain applications that can be used by radiologists and other specialists for reading and displaying DICOM images files and even for reading DICOMDIR index files, which cannot be integrated into applications under development because of their proprietary code.

Companies, such as Lead Technologies, ETIAM, Merge, Laurel Bridge, and DeJarnette, have commercial software development kits (SDKs) that provide complete implementations of the DICOM standard, but the acquisition costs for these SDKs are high. Open-source libraries are an alternative choice for integrating DICOM support into applications. Regarding this matter, libraries, such as visualization tool kit (VTK) (), insight segmentation and registration tool kit (ITK), DICOM tool kit (DCMTK), and virtual vision machine (VVM), allow the reading of DICOM images, but they do not provide mechanisms for reading DICOMDIR files. Like in the DCMTK case, there are other libraries that provide tools for a basic and low-level access to the information contained in the files. However, they have disadvantages, such as troublesome information retrieving process and reading tools, which are difficult to integrate into the applications.

Due to the lack of an adequate tool for reading and handling DICOMDIR files in a structured and simple way, which could be also easily coupled to browsing interfaces and attached to medical application under development, we introduce in this article the design and implementation of a DICOMDIR files reader. This tool has been successfully integrated into an application for neurosurgery preoperative planning (Montilla, Bosnjak, Jara, & Villegas, 2005), but it also can be attached to any other software under development that requires the handling of DICOM images and DICOMDIR directory files.

The next sections include the revision of related works, the essential theoretical background that frames this work within the DICOM standard context; the description of the methodology used for the implementation of the tool; and, finally, the discussion and conclusions obtained from the integration and test of the implemented reader into a medical application.

ANTECEDENTS AND RELATED WORKS

The creation of the American College of Radiology (ACR)-NEMA committee in 1983 was the product of earlier attempts by the American College

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