

Chapter 3

Clinical Data Mining in Small Hospital PACS: Contributions for Radiology Department Improvement

Milton Santos

University of Aveiro, Portugal

Carlos Costa

University of Aveiro, Portugal

Luís Bastião

University of Aveiro, Portugal

Augusto Silva

University of Aveiro, Portugal

Nelson Rocha

University of Aveiro, Portugal

ABSTRACT

Technological developments in the medical imaging acquisition and storage process have triggered the use of PACS (Picture Archiving and Communication Systems) with gradually larger archives. Nowadays, there is data stored in the DICOM (Digital Imaging and Communication in Medicine) file that is not searchable using the traditional PACS database. However, it may represent an important source of information for continuous professional practice improvement. The use of DICOM Data Mining tools has been a valuable asset to analyze the information stored in the DICOM file and can result in gathering important data for the professional practice improvement. These tools can also contribute to the PACS information audit and facilitate access to relevant clinical data within programs for quality continuous improvement. By allowing the construction of multiple views over data repository in a flexible and quickly way and with the possibility to export data for further statistical analysis, Dicooogle permits the identification of data and process inconsistencies that can contribute to radiology department improvement, such as in dose surveillance and patient safety programs and image quality control initiatives. However, the assessment of relevant data for practice improvement must take into account several factors related to the informational environment, professional reality, and healthcare goals and mission. This chapter describes a method to examine and perform studies over a medical imaging repository. Moreover, a case study of a small hospital where the obtained results are discussed is shown.

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INTRODUCTION

Technological developments associated with the radiology practice are changing the way as medical images and associated data are produced and handled. The gradual transition of radiology departments to fully digital environments, in which all acquired image data are available in digital format, promoted the adoption of new workflows that integrate new technologies for image acquisition, process and distribution (Larsson et al., 2007). Furthermore it has modified the way as different healthcare professionals interact with the medical image and related data, particularly after the adoption of PACS (Bick & Lenzen, 1999; Reiner & Siegel, 2002) in daily practice.

In the radiology department, there are different equipment's and image modalities like, for instance, Computed Radiography (CR), Digital Radiography (DX), Computed Tomography (CT), Ultrasound (US), and Magnetic Resonance (MR) equipment. The proliferation of those electronic medical devices has increased the production of digital images in the different therapeutic agents and nowadays it is a very important tool to support medical decisions. The main difficulties when handling those studies are related to the integration of data produced by different equipment and manufacturers.

The examination data, produced by digital modalities, can contain information useful in different scenarios, for example, to monitor patient dosimetry, radiographic procedures, and image quality. There are important parameters such as image processing parameters, exposure index, patient dose and geometric information that are generated by the modality and transferred to the PACS database as DICOM metadata.

A classic medical image file, i.e. a DICOM persistent object, may contain several data elements, including the pixel image data, tagged fields with free-text/numeric values, structured reports and several descriptive attributes such as, image modality, equipment reference and dose metrics.

Nevertheless, a traditional PACS archive database only stores a small number of fields to support the mandatory DIM (DICOM Information Model). There is a great proportion of DICOM metadata that is not searchable. However, there are scenarios where such information is very important. For instance, clinical radiation doses studies are not possible with traditional PACS solutions.

In this chapter, the authors explore a method to analyze a medical imaging repository, taking advantage of an Open Source tool named Dicoogle, that is able to extract information from existent PACS repositories, without complex setup processes. We will show the advantages of using Dicoogle, as a DICOM Data Mining tool for PACS archive information auditing and assess whether the information obtained may provide means for continuous Quality Assurance at the Radiology Department. The work results are discussed and several enhancements are suggested.

DIGITAL MEDICAL IMAGING

PACS and the Radiology Daily Practice

The adoption of PACS has revolutionized the practice of radiology and healthcare delivery during the past years. Their success is largely supported by an industry offering archiving solutions and reading stations that fulfill the needs of the users in radiology and in other care delivery departments. In the radiology department daily practices, PACS interacts with other information systems to support the hospital and department activities. Some of these systems are, for example, the Electronic Healthcare Record (EHR), the Hospital Information System (HIS), and the Radiology Information System (RIS). The good integration between the PACS and the various technology and information systems is guaranteed by the Integrating Healthcare Enterprise (IHE) initiative that provides a solid framework to ensure

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