

Chapter 3

The Digital Imaging and Communications in Medicine (DICOM): Description, Structure and Applications

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Abstract

This chapter is designed to introduce an exciting image data representation standard known as DICOM (Digital Imaging and Communications in Medicine) in medical imaging community. DICOM is a global information standard that is used and soon will be used by virtually every medical profession that utilizes images within healthcare industry. It is designed to ensure the interoperability of systems used to produce, store, display, send, retrieve, query, or print medical images such as computed tomography (CT) scans, Magnetic Resonance Imaging (MRI), and ultrasound. DICOM Standard has also been developed to meet the needs of manufacturers and users of medical imaging equipment for interconnection of devices on standard networks. The daily operations of DICOM Standard are currently managed by the National Electrical Manufacturers Association (NEMA). We describe a brief history, structure, current applications, and its potential use as a tool in different industries in this chapter.

Keywords:

DICOM, MRI, CT, Medical Imaging, Radiotherapy, Optimization

3.1 Introduction

3.1.1 History

The digital imaging technology has changed the way systems communicate with others using image data from simple digital pictures to complex medical images^{1,2,3,7,11,13,21}. In medical community, many images have been taken to diagnose patients in hospitals since late 1970's. Such images may include computed tomography (CT) (see Figure 3-1), magnetic resonance imaging (MRI), nuclear medicine, and ultrasound.

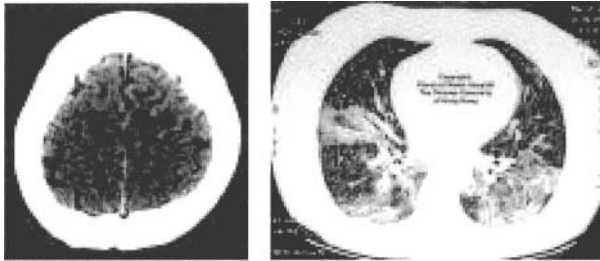


Figure 3-1. A CT image

It soon became a daily activity to transfer such image data from one location to another within the same institution or from one institution to another where different machines were used for analysis. There were two immediate needs for maintaining the data integrity during this transfer and for developing a standard for how the data should be stored. To meet this demand, the American College of Radiology (ACR) and the National Electrical Manufacturers Association (NEMA) formed a joint committee, ACR-NEMA Digital Imaging and Communications Standards Committee in early 1983. The mission of this group was to find or develop an interface between imaging equipment and whatever the user wanted to connect. Furthermore, they needed to develop standard for a dictionary of the data elements needed for proper image display and interpretation¹².

The committee launched surveys to evaluate many existing interface standards, but found none to be entirely satisfactory. However, they found useful ideas from some of the existing standards. For example, the American Association of Physicists in Medicine (AAPM) had already developed a standard format for recording images on magnetic tape³. The header portion would contain a description of the image along with the data elements (such as patient name) identifying it. A concept of using data elements of variable