Design of Radiology Viewer

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Abstract— Radiology is a specialization in the medical field that uses images to diagnose and treat diseases seen within human body. DICOM is the standard used for these images. It supports advanced medical imaging applications that have "changed the face of clinical medicine". In the Design of radiology viewer includes conversion of DICOM image to .jpeg format and allowed to analyze these images for radiologist and are also allowed to view the patient details parallelly. Radiologist can also provide with the option to write description about the problems they have analyzed. This images along with details are stored and can be viewed by other radiologist as and when they require. Radiology viewer benefits in detail examination of patients and to view patient's details whenever it is required.

I. Introduction

Radiology is the branch of medical that deals with the study of imaging technologies like x-ray etc and its diagnosis and treatment. Based on the reporting of the radiographer the radiologist reads the images and produce the report of their findings. These images are in DICOM format.

DICOM Stands for Digital imaging and communications in medicine. DICOM handles medical images. It can integrate with several devices such as Scanner, server, Workstations, Printers network hardware from multiple- manufacturers into a picture archiving and communication system (PACS). DICOM is the standard that is adopted by all the hospitals.

PACS stands for Picture archiving and communication system .The DICOM uses this system. PACS is a medical imaging technology that helps in economical storage and convenient access to images from multiple source machines. The PACS contains many files and all of these files are in the DICOM format. The DICOM files can also include scanned documents but this procedure should follow industrial standard. The communication with PACS server can be done using C-FIND. C-FIND is the message sent from client to PACS server. This message includes all the list of attributes that client requires for study. Retrieving of image file from PACS system is done through C-MOVE, C-GET request. C-MOVE tells exact location where DICOM file must reside in client system. This request is used to share data within the organization. C-GET request tells the PACS system from where the request has come from and send the file to the same network address. This request is used to share data between the organizations.

II. DICOM Image Files

The output of all medical imaging technology is the DICOM files. DICOM image file structure is shown in the figure1 below.
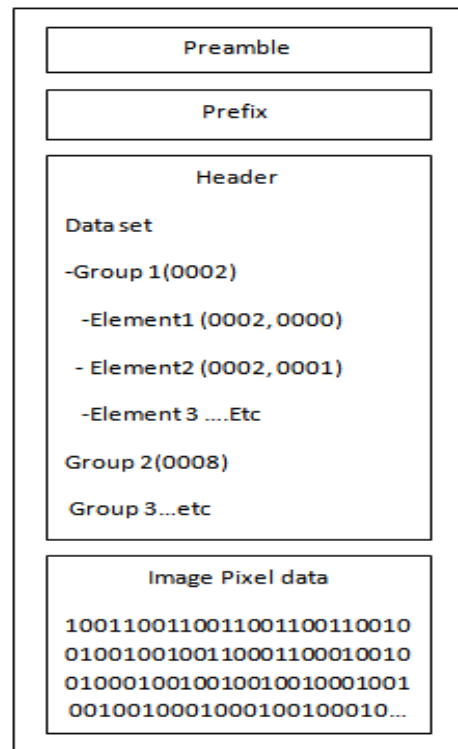

Fig1: Structure of DICOM image file

The DICOM image file contain preamble is of about 128 byte length. The preamble is not mandatory. Suppose preamble value does not exist for a file then 128 byte need to be replaced by 00H. Prefix is of about 4byte length. It has the value 'D' 'I' 'C' 'M'. The prefix is followed header. The header consists of Meta-data and transfer syntax. The header has data called data set. The meta-data includes patient information, image information and information about imaging devices.

Data Set represents real-world Information Object. A Data Set consists of Data Elements. Data set consist of one or more data elements. Each of these data elements are uniquely identified by a Data Element Tag. A data element tags can occur in the nested data set. There are two type of data elements they are Standard Data elements and Private data elements. Standard Data elements have an even group Number. It is used for DIMSE commands. Private data

elements have an odd Group Number. The private data elements are the additional data added to DICOM file they are not same for all DICOM files. But standard data elements are common for DICOM files.

The figure2 shows the structure of each data element in the data set. Each data elements consist of Tag, VR, value length, value field.

Tag: Tag uniquely represents each data elements .Tag is included in all Data element. It has two parts group and element about group we have discussed already. The related groups have same group number. Elements specifies element of a group.

VR (value representation): it is an optional field. If the VR is present then it is called Explicit VR. If VR is not present it is called implicit VR. The VR represents data type of values of data element. The examples for VR are UI (unique identifier), US (Unsigned short), CS(Code String)….etc.

Value Length: It represents the length of the data element. It is always even. It is either 16-bits or 32-bits.

Value field [8]: It is even number of bytes containing the value of data elements.

III. TRANSFER SYNTAX

The transfer syntax contains rules for encoding data. There are three transfer syntax namely Little Endian Explicit, Big Endian Explicit, Little Endian implicit. The transfer syntax is identified by transfer syntax UID which is present in header of DICOM image file. The transfer syntax sets the following: the VR is set to explicit. It tells the order that byte of multiple byte data types are serialized for, it tells which algorithm should be used for compression.
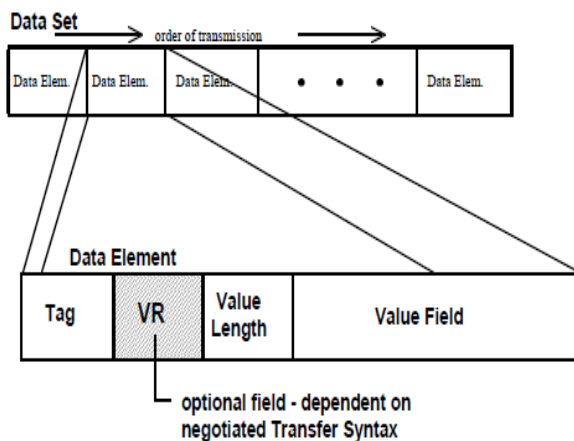

Fig2: structure of data elements

IV. DICOM DATA DICTIONARY

DICOM files contains DICOM attributes, Some attributes are standard but some are not . Data Dictionary is used for encoding all standard DICOM attributes. DICOM Vendor

can create his own DICOM Dictionary as per his requirement including all required data attributes.

The table below shows an DICOM Data Dictionary.

Group, Element) tag	Attribute (data element) name	VR	VM	Retired status
(0008,0001)	*Length to End RET*			RET
(0008,0005)	Specific Character Set	CS	1−n	
...				
(0010,0010)	Patient Name	PN	1	
(0010,0020)	Patient ID	LO	1	
(0010,0021)	Issue of Patient ID	LO	1	
(0010,0030)	Patient's Birth Date	DA	1	
(0010,0032)	Patient's Birth Time	TM	1	
(0010,0040)	Patient's Sex	CS	1	
...				
(0010,1000)	Other Patient IDs	LO	1-n	
(0010,1001)	Other Patient Names	PN	1-n	
...				
(FFFE,E00D)	Item delimitation Item		1	
(FFFE,E0DD)	Sequence Delimitation Item		1	

V. PIXEL DATA AND PROCESS IMAGE

(i) Rows and Columns[10]

Rows (0028, 0010) and Columns (0028, 0011) define the size of the image. Rows is the height and Columns is the width[10].

(ii)   Samples per Pixel[10]

Samples per pixel define the number of color channels. In the grayscale images like CT and MR it is set to 1 for the single grayscale channel and for color images it is set to 3 for the three color channels Red, Green and Blue.

(iii)   PhotometricInterpretation[10]

The photometric interpretation element is rather unique to DICOM. It defines what every color channel holds. You may refer it to the color space used to encode the image.

For an example in "RGB" meaning the first channel Red, the second is Green and the third is Blue. In grayscale images (like CT or MR) it is usually "MONOCHROME2" meaning its grayscale and 0 should be interpreted as Black. In some objects like fluoroscopic images it may be "MONOCHROME1" meaning its grayscale and 0 should be interpreted as White. Other values may be "YBR_FULL" or "YBR_FULL_422" meaning the color channels are in the YCbCr color space that is used in JPEG.

(iv)   Planar configuration[10]

Planar configuration can be either 0 meaning the channels are interlaced which is the common way of serializing color pixels or 1 meaning its separated i.e. first all the reds, then all the greens and then all the blues like in print. The separated way is rather rare and when it is used, it is usually with RLE compression. The following image shows the two ways. If this element is missing, the default is interlaced.

CONCLUSION

Radiology viewer displays detailed images of internal organs. This is used in medical fields. The .dcm file is compressed using JPEG2000 which provides some of the benefits such as it reduces the cost of storage and maintenance, it can handle larger images easily, the outputted file size is small, it does not requires license fee. Because of all these reasons its maintenance is easy and also it helps doctors to diagnose disease more easily.

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