Concept for DICOM about 3D Image Data Interchange

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Digital imaging and communications in medicine abbreviated as DICOM, is the ubiquitous standard in the radiology digital imaging industry for the exchange of image and related information. DICOM defines format and communication standard of 2d image. Many applications and equipments which conform to DICOM have been put into use. DICOM is much helpful for the archiving, retrieving and communicating of the medical image and associated information.

2d image cannot fulfill the requirement of the diagnoses. Formerly, if physicians need to know the volume or 3d aspect of the organs or tissues, they gather a series of slices and construct the volume in mind. It needs a lot of mental work and is not so precise. In order to help physicians during their work, applications which perform the construction of a 3d image from a series of slices were developed. The applications can construct and render 3d image. Since there is no definition of a standard like DICOM, different applications have to define their own methods to store and handle the 3d image. It is difficult for applications to exchange 3d image data. This situation should be changed by extending the current DICOM standard of multi-dimensional interchange defined in the coming supplements.

We propose one approach that can be used for a definition of a 3d DICOM image. Normally 2d image has width and height dimension. And the image data is stored in an array with size width×height stored bit by bit from left to right in a line and from top to bottom line by line. For 3d image, another dimension should be added. It is depth dimension. The 3d image format should be width×height×depth. The representation of 3d image should be in Cartesian coordinate system. Cartesian coordinate system is as reference coordinate system. And the patient's orientation should also be defined according to this reference coordinate system. For 3d object rendering, one important feature is rotation which is to show different views of the 3d object. The application that renders the 3d image can rotate the object by multiplying rotating metrics. When the physician wants to annotate something at one specific angle, the annotation and orientation should be recorded and coded in DICOM file. Although the 3d image consists of a series of 2d images so that inner information is shown in the inner slices. The slices are took from one fixed direction. In 2d image viewer environment, physician has to take another set of slices in order to observe from another direction. It is expensive and sometime harmful for the patient. This problem can be solved easily. The 3d viewer application can perform cut operation on 3d object by setting a cut-plane in arbitrary direction, and fly-in and fly-out by moving the cut-plane in the object. The cut-plane is defined as (origin, normal) pair. When the physician finds some important information in one direction and makes some annotations about it, both direction and annotation should be stored in this 3d DICOM file for future use. The cut-plane can be stored as (origin, normal) pair.

Conclusion: Till now DICOM has no explicit definition of 3d image. Therefore 3d image and associated information cannot be communicated between different systems. It postpones the development of telemedicine. Our proposal will supply the current DICOM standard.

Key words: DICOM, 3d, cut-plane, annotation

Published in Proceedings of TTC2003, Tromso (Norway), September 2003, pp.40