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Review Paper on Finite Element Analysis of (DICOM) Digital Imaging and Communications in Medicine Images

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ABSTRACT

Computer Tomography (CT) and magnetic resonance imaging (MRI) are the two most common techniques used to acquire detailed anatomical information in the field of medical imaging. Medical Practitioner requires skills and experience to co-relate these images for the correct diagnosis. Medical practitioner faces difficulty in accessing these images as it not platform independent, these images can be access only at platform where the scanner is attached. Hence, This Proposed System developed a program, which not only overcome these difficulties but also enhances the visualization of the CT scan images as well as facilitates to distinguish the soft tissues and bone tissues clearly thereby minimizing the ambiguity to tackle the problem during image guided surgery. Further it has been attempted to develop the actual computer aided 3 D model from the slices of CT scan images which can be analyzed by Finite Element Method to know the responses at various loading conditions. The resulted information will be helpful for the medical practitioner to suggest proper prevention and precaution to the patients.

Keywords: Computer Tomography, Finite Element Analysis, Rapid prototyping, Computer Aided modeling.

I. INTRODUCTION

Medical Imaging techniques are used for diagnosing and treatment of many diseases as well as surgical operations. CT and MR imaging techniques are the mostly used ones. Reconstruction of 3D volume and surface models of the tissues, by using 2D image slices, provides many advantages to medical doctors. For a long time, 3D models have being used in medical applications. During the treatment period, tracing the temporal changes of the abnormalities is a very important task for deciding whether the treatment is positively effective or something going wrong. For detection of changes that appear in tissues, firstly the location and the geometric quantities of the abnormal regions are required.

Diagnostic imaging devices such as computer Tomography and Magnetic resonance imaging are able to produce anatomical description of various features such as tissues and organs. These scan image distinguish bone tissue and soft tissue with different intensity in a computer. Doctor uses CT scan or MRI to know the exact cause and the region of the affected portion for the patient.[1] The CT scan images or MRI are stored in the Dicom form which cannot be easily decoded to visualize the actual image without the proper hardware which is normally associated with the scanner. The cost of such system is not affordable by many doctor therefore, medical practitioner faces difficulty in explaining these images to the common people. Medical practitioner also requires their skill and experience to understand these images. Therefore it is needed to visualize these images in the proper form so that it can be helpful for the medical

practitioner as well as common people to understand the anatomical structure or the abnormalities associated with the patient [2]. The interpretation of the dataset requires special training and depends on the experience. The platform dependency to visualize these images is overcome by introducing a variety of algorithms as well as developing software to view extract geometric information of objects from volumetric image data. The developed software scroll or animate the CT scan images as per the requirement, this process is useful for a surgeon in image guided surgery. The actual physical model is generated by Rapid prototyping technique concept and the developed Computer Aided model by stacking the CT scan images which is analyzed by finite element method.

II. EXISTING SYSTEM

DICOM (Digital Imaging and Communications in Medicine) standards are of course the hot topic at every radiological trade show. Unlike previous attempts at developing a standard, this one seems to have the potential to actually achieve its objective, which in a nutshell, is to allow vendors to produce a piece of equipment or software that has a high probability of communicating with devices from other vendors.

The developed actual physical model from the ct scan technique has as a great significance in the field of medical sciences .The methodology and the concept of generation of actual physical model is well adopted by the orthopedic surgeon of Central Indian Institute of Medical Sciences, (CIIMS) Nagpur. The medical practioner team requires to know the status of post operated facet joint of a female patient whose Lumbosacral vertebral column region gets severely damaged in an accident.. After surgery still the patient faces a problem of the lower back pain. Hence it decided to have the actual physical model so that the post operated statues of the surgery can be checked. A 3D physical model is generated by using the technique of rapid prototyping. To develop 3D model, the data is acquired from the transverse CT scan slices of 1.5 mm increment from the sacrum portion to the lumber L1 portion.

DICOM file is encrypted file containing information of patient, doctor, CT Scan Machine, Diagnosis and Image Data.

CT scan images are normally stored in computer in dicom image format. Some special software like 3D Doctor, NASTRAN is used to perform input/output operation with DICOM image file.

III. PROPOSED SYSTEM

Finite Element Approach

In recent years, the finite element method (FEM) has widely been used to simulate the mechanical deformation of tissues and organs during examinations or interventions. To build up an FEM mesh from a medical image, the contour information of segmented regions of interest need to be first extracted from a volume of data. Then, the volume is meshed into nodes and elements, and material properties are endowed to each element in accordance with the segmentation information. By further applying the boundary condition and mechanical loadings on the corresponding nodes or elements, commercial FEM software packages such as ANSYS may calculate the mechanical stress and strain, and predict the deformation and motion in the field of view.

Basic DICOM File Structure

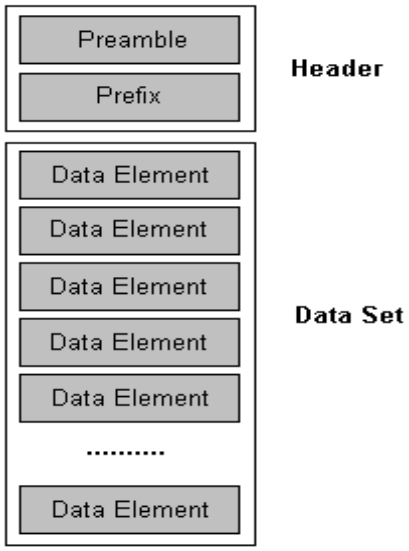

Figure 1

The DICOM File Format is described by the American College of Radiology (ACR) and National Electrical Manufacturers Association (NEMA) in PS3.10 specification "Media Storage and File Format for Media Interchange", of the DICOM Standard. An illustration of the basic file structure can be seen below.

The header consists of a 128 byte File Preamble, followed by a 4 byte DICOM prefix. The header may or may not be included in the file.

The DICOM Standard does not require any structure for the fixed size Preamble. It is not required to be structured as a DICOM Data Element with a Tag and a Length. It is intended to facilitate access to the images and other data in the DICOM file by providing compatibility with a number of commonly used computer image file formats.

The proposed system work as follows

In This Modules

1. First application systems take a DICOM file (Image) form dataset.
2. Then it remove tissue from object
3. Convert into Plane object form object
4. Then it getting finite elements and get the boundary
5. Perform the operation on selected image for Grid Size

Feature of the developed software is useful in generating the actual physical model by RP (Rapid prototyping) technique. RP technology can make significant impact in the field of Biomedical engineering application and surgery. A physical model enables correct identification of the abnormalities, accurate understanding of the anatomical structure, it also helps in implant design of body organs. A precise model facilitates the pre-operative planning of an optimal surgical approach and enables selection of correct and appropriate implants.

IV. REFERENCES

[1]. Ashish B. Deoghare 1, P.M.Padole2 "Finite Element Analysis of Three Dimensional Medical Model Generated from CT Scan data." IISc, Bangalore , India, December 12-13, 2007

[2]. M Larobina and Loredana Murino "Medical Image File Formats "December 2014

[3]. The Encyclopedia of Graphics File Formats. http://www.fileformat.info/mirror/egff/(accessed in June 2013)

[4]. Yoshikazu SHIMIZU1, Kazuhiro USUI1, Kouji ARAKI2, Norimasa KUROSAKI1, Hideaki TAKANOBU3,5 and Atsuo TAKANISHI4,5 "Study of Finite Element Modeling from CT Images" d August 2, 2005

[5]. J.J. Timmons on "End-to-end workflow for finite element analysis of tumor treating fields in glioblastomas"In 17 Oct. - 2017

[6]. Hiromitsu Takano, Ikuho Yonezawa1, Mitsugu Todo on "Biomechanical Study of Vertebral Compression Fracture Using Finite Element Analysis" 18 Nov 2017