

INF219 - DICOM and Text Visualization for Volumeshop

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1 Introduction

This project adds support for Digital Imaging and Communications in Medicine (DICOM) and text labels for Volumeshop. With time-dependent DICOM dataset, the user can choose which frame to display. The text label plugin has two modes; free-mode which enables the user to move the text labels around freely, and smart-mode which automatically snaps the text labels near to a volume.

2 DICOM

DICOM was created by the National Electrical Manufacturers Association (NEMA) to aid the distribution and viewing of medical images, such as CT scans, MRIs, and ultrasound. It is a standard for handling, storing, printing, and transmitting information in medical imaging, and is the most common standard for receiving scans from a hospital.

DICOM files can contain many series of slices. Each serie can be different scan angles or just one image. Some series have repeating slice locations(z position) which means that the slice serie is a time-dependent data.

In many cases, prior to publishing (for instance, on the Web) or distributing in any way DICOM files containing medical images of interest, it is necessary to remove all personal identifying information from those files, that is, to anonymize them. Some DICOM software allows removing from DICOM files all information that may spread patient's or physicians' privacy.

3 File Format Description

The first 128 bytes in the DICOM file is usually set to zero, followed by the letters 'DICM' which is the file identifier. This is followed by the header information, which is organized in groups and elements.

Group 0002 has the file meta information. It stores an important value group length which tells how many groups the header information contains.

On 0002:0010(group:element) Transfer Syntax Unique Identification is located. It tells the byte order and compression of the image. Different computers store integer values differently. This is called Big Endian and Little Endian ordering.

Consider a 16-bit integer with the value 258. The most significant byte stores the value 01 (256), while the least significant byte stores the value 02. Some computers stores this as 01:02, while others store it as 02:01. Therefore with 16-bits per sample a DICOM viewer may need to swap the byte order of the data to match the ordering used by your computer.

Important groups and elements are:

Location	Description
0002 0010	Transfer Syntax UID (tells structure of image data)
0008 0060	Modality (CT, MRI, etc)
0010 0010	Patient name
0018 0050	Slice thickness
0028 0002	Samples per pixel (1 is grayscale, 3 is RGB)
0028 0008	Number of Frames (slices / size of z)
0028 0010	Rows (size of y)
0028 0011	Columns (size of x)
0028 0100	Bits per sample (8-bit, 16-bit)
7FE0 0000	Pixel data size in bytes
7FE0 0010	Pixel data

4 C++ DICOM library

The loading of the DICOM data is done with the C/C++ DICOM library GDCM. It reads and writes DICOM files. GDCM includes a lot of heuristics that allow reading headers with oddities (non-standards).

The DICOM plugins consists of two plugins which are the importer and the renderer. In the importer the user selects which files to load and which slice serie to load.

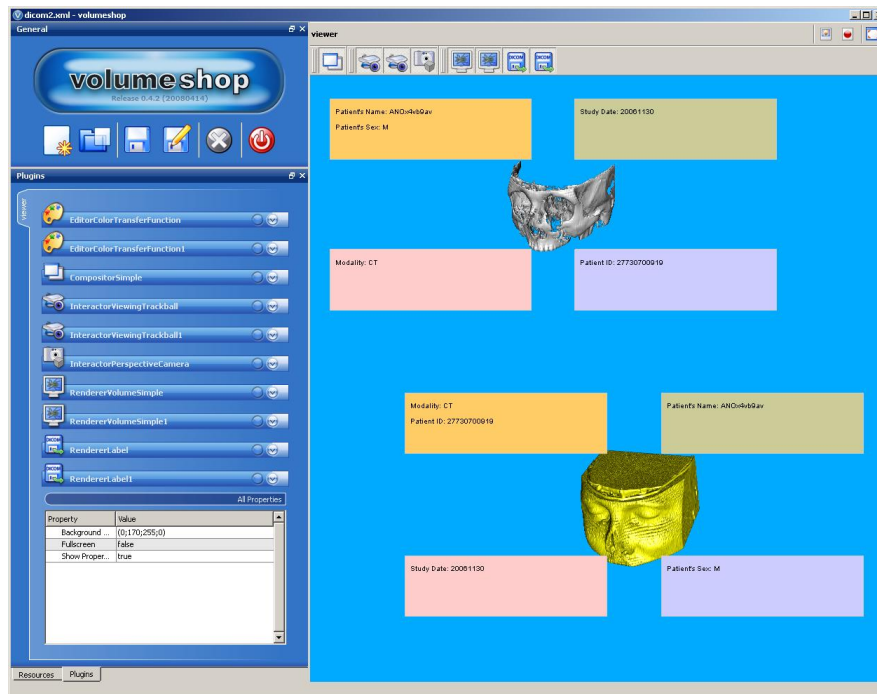
Some slice series have repetitive slice location, meaning that it is a time-dependent data. If this occurs the plugin importer will give you the option to choose your time step.

5 Text boxes

Text boxes are painted to the Volumeshop canvas to show DICOM information for each volume. From the plugin panel the user selects which DICOM tags to show on each text box. As default some DICOM values are already set. Text boxes have two different modes; smart-move and free-mode.

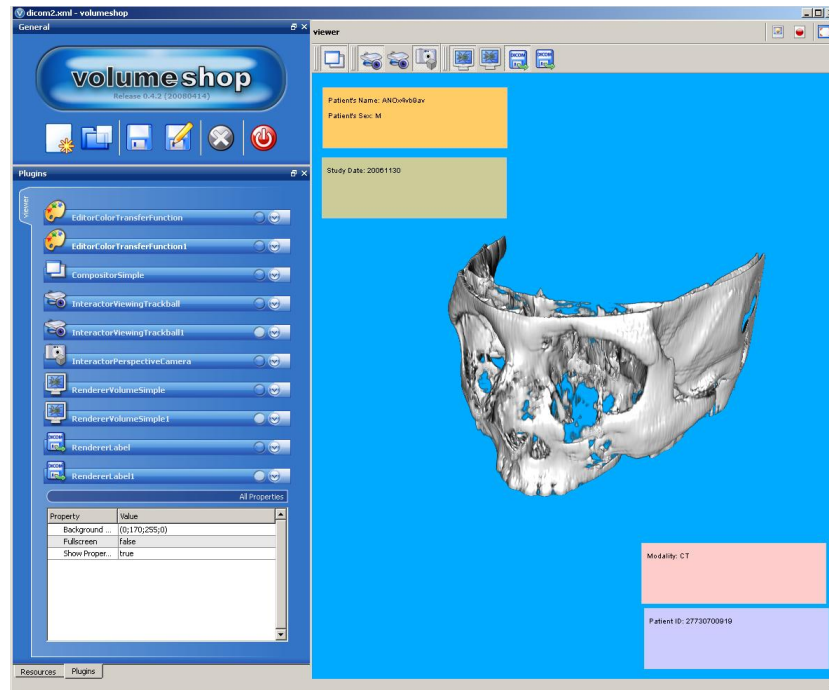
5.1 Smart-move

In this mode four text boxes are attached around the volume. When the user moves, rotates or scales the volume, the text boxes automatically aligns in a nice way close to the volume.



5.2 Free-mode

When in free-mode text boxes can be moved around freely by the user. If two or more text boxes are overlapping, the last selected text box is on the top. If the center mouse button is clicked, all text boxes are placed to the corner as a default location.



References

- [1] http://en.wikipedia.org/wiki/Digital_Imaging_and_Communications_in_Medicine
- [2] <http://www.sph.sc.edu/comd/rorden/dicom.html>