

A Real-Time Digital Scrutinizing System Using 3D-Doctor

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Abstract- In the medical industry, the human body parts can be extracted using 3D- DOCTOR Software. This software was developed using object-oriented technology by Able Software Corp. An efficient analysis of 3D images, object boundaries, 3D models and other associated data items in an easy-to-use environment can be achieved by 3D Doctor. And also 3D image segmentation, 3D surface modeling, rendering, volume rendering, 3D image processing, disconsolation, registration, automatic alignment, measurements, and many other functions can be done by it. Now-a-days, 3D-DOCTOR being used by leading Hospitals, Medical Schools, and Research Organizations around the world.

Keywords- Medical Image Rendering, 3D-DOCTOR, 3D – Printing.

I. INTRODUCTION

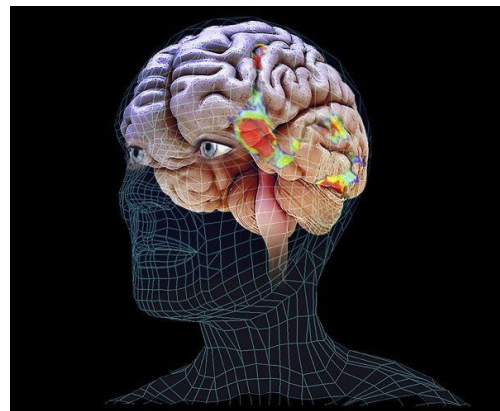
3D-DOCTOR supports both grayscale and color images which are stored in .DICOM, .TIFF, .Interfile, .GIF, .JPEG, .PNG, .BMP, .PGM, .RAW file formats. 3D- surface models and volume rendering from 2D cross section images are can be shaped in PC by 3D-Doctor. Leading hospitals, medical schools and research organizations around the world are currently using 3D-DOCTOR now-a-days.

It is an advanced 3D modeling, image processing and measurement software for MRI, CT, PET, Microscopy, Scientific, and Industrial Imaging Applications (IIA). The polygonal mesh models are can be exported to STL, DXF, IGES, 3DS, OBJ, VRML, XYZ and other formats for surgical planning, simulation, quantitative analysis and rapid prototyping applications. The tool which is called as 3D-DOCTOR's vector-based tools is utilized for easy image data handling, measurement, and analysis. 3D CT/MRI images can be re-sliced easily along an arbitrary axis.

Multi-modality images can be indexed to generate image fusions. The function 3D-Doctor's Image alignment is operated to align the misaligned slices by automatically or semi-automatically. Other image processing functions like template-based film cropping, image replacing to correct slices of uneven thickness, volume resizing, and image

rotation are available to work with an image. The 3D Basic scripting tool makes it easy to create Basic-like sophisticated 3D imaging programs. This software does 3D Image Segmentation, 3D Surface Modeling, Rendering, Volume Rendering, 3D Image Processing, Deconvolution, Registration, Automatic Alignment, Measurements, and many other functions.

As mentioned earlier, 3D-DOCTOR supports a variety of image formats in both 2D and 3D. These formats include DICOM, TIFF, JPEG, BMP, Interfile, GIF, PNG and RAW. Other non-standard image formats are also supported, but only with known dimensions (number of columns, rows and planes), bit depth per pixel, little endian or big endian, and the size of file header.



II. BASICS OF 3D- DOCTOR

The following lists some of the main differences between 3D-DOCTOR and other packages.

- 3D-DOCTOR uses its unique vector-based technologies to create better 3D models from volumetric and gives the feature of easy editing.
- To maintain all the details for high quality rapid prototyping applications, the Surface model uses smaller number of triangles.
- The technique called Smart Memory Management allows many number slices unlimitedly. So the

Software is capable of processing over 2000 image slices with 256 MB RAM.

- The software handles DICOM and other image formats, such as TIFF, JPEG, PNG, GIF, BMP, Interfile and RAW (vendor proprietary formats) and the output will be in the form of STL (ASCII and Binary), VRML, DXF, 3D Studio, IGES, WavefrontOBJ.
- The advance feature of the Software is classifying and separating the colors of an image.
- And this package supports CT, MRI, PET, Microscopy, Industrial CT, Scanned Film Images, Boundary Slices, Slice Data and XYZ Points.
- Once an image is reported the bugs are fixed automatically, so it shows that the report of image part is bug free.
- When compare to other medical equipments, 3D-DOCTOR is reasonably prices.

III. 3D SURFACE RENDERING

3D Surface models will be generated from object boundary lines or contours with the help of 3D surface rendering command. Here 3D surface model consists of triangle faces so that multiple objects can be combined together by using this command. The software gives two types of rendering called Simple Surface Rendering and Complex Surface Rendering and both are adopted to create 3D surface model but use different algorithms and are suitable for different objects.

The proprietary algorithm is used in Simple Surface Rendering to create smooth and simpler surface models. This method is fast and the models are better suited for rapid prototyping and volume calculation applications.

The triangulation algorithm is used in Complex Surface Rendering. This method is slow but robust, and is better for rendering objects with complicated branches and topologies. With 3D-DOCTOR, the proper rendering method can be selected for an object and multiple objects created using different rendering methods can be mixed for 3D display.

IV. CREATION OF 3D RENDERING FROM 2D IMAGE SLICES

The software 3D-Doctor will generate a 3D rendered image from a 2D image slices in the following procedure:

- First, 2D image slices have to be loaded into the stack list and there images can be viewed closer and longer with the help of F2 and F3 keys vice versa.
- To faster the segmentation, the command “Auto segment” will be processed and the command “Interactive Segment/Boundary Editor” will be processed to trace object boundaries either by manual or by automatic.
- Using the command “3D Rendering/Surface Rendering”, 3D surface models are created. While the 3D surface models are displayed, the command “View/Object” is triggered to change the transparency and color properties and functions under Tools submenu for further analysis.
- The volume of 3D visualization is achieved by volume rendering option and finally the quantitative analysis reports are generated after Boundary Reports are updated.

V. MEASUREMENTS THROUGH

3D DOCTOR

3D-DOCTOR can make a variety of image measurements, including distance, area, surface area, volume, profile, and image region histogram. Even each and every edge is measured by using the tool “Angle Measurement”. The surface models are calculated with the help of image distance, thickness, area of a region, surface area, volume, image density profile and image histogram of a region in any shape as an input.

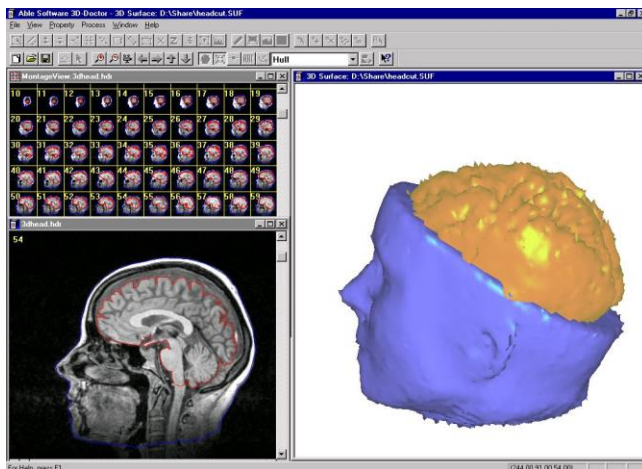
3D-DOCTORÆs restoration functions are the solution to de-blur and restore the 3D image to its original quality with either fast nearest neighbor or maximum entropy deconvolution. It is a complex mathematical problem, but 3D-DOCTOR makes it possible to solve.

3D-DOCTORÆs image registration function, registers or geometrically corrects a 3D image by giving 4 or more control points and easily combine two registered images using fusion command.

VI. THE 3D VOLUME OF 3D SURFACE MODEL

The volume of a 3D surface model can be calculated easily using the Process/Calculate Volume command within the surface model window. It computes both volume and surface area. But before completing the process of rendering, the scaling parameter is to be entered using the command “Calibration” to adjust the scale and volume unit. So the volume of the image will be calculated only when the 3D

image model format is supported by 3D-DOCTOR, such as DXF, STL, raw triangle, etc.,



3D Mesh Model produced by 3D-Doctor
3D Output from a 3D Printer

The command of “3D Rendering/Volume Rendering/Smooth Rendering” is utilized to make rendering 3D process which is used to view the accurate pictorial representation of medical images. The rendering process is purposely used to take accurate decision in the field of medical science. Once the interactive segmentation starts, the image plane is refreshed to apply color to each and every pixel that fall within the threshold range which is specified by the Min and Max values. Use the slider bar to adjust the Min and Max values.

According to the current threshold selection, the display of the image slice is updated in real-time. The boundary of current image plane can be extracted with the help of the command “Segment Plane”. To apply threshold values for all the slices, “Segment All” Command have to be implemented and finally, “Finish” command id used to leave the interactive segmentation function.

VII. CONCLUSION

3D-Doctor Software has been one of the tremendous analysis software that is used to extract information from image files to create 3D model. It provides engineering team more accurate result for internal human parts and also creates visual models for complex blood vessels such as coronary artery, aorta and superficial femoral artery (SFA) in a much faster turnaround time. With 3D-DOCTOR, images can be loaded up quickly and 3D models and to passed to the team to see firsthand the anatomy before making next decision. Accumulatively, the 3D-DOCTOR software helps in time savings, assists in making initial decision to choose the patient and help in analyzing the patients’ problem before creating visual models for device deployment in the lab.

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