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Publishing on the WWW. Part 8 - Creating standalone animations from the DICOM format

V Grech

Contact information: Dr. Victor Grech, Consultant Paediatric Cardiologist & Editor-in-Chief, Images Paediatr Cardiol, Paediatric Department, St. Luke's Hospital, Guardamangia MSD09 - Malta ; Email: victor.e.grech@gov.mt

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Abstract

Cardiology images and animations are often available in DICOM format. This article will briefly describe the simplest and least expensive methods of converting DICOM images to small and manageable AVI format files.

MeSH: Computer Communication, Information, Internet, Networks/standards, Systems/standards

Introduction

Cardiology images and animations, such as angiograms, are often available in DICOM (Digital Imaging and Communications in Medicine) format, usually on CDROM. This format was created by the US National Electrical Manufacturers Association (NEMA) for the distribution and viewing of all kinds of medical images (e.g. computerised tomography scans, magnetic resonance imaging scans, ultrasound scans and angiograms).^{1,2} The universal acceptance of a common standard allows such images to be created, distributed and viewed worldwide.

Many DICOM viewers allow the export of still images in JPG or GIF format³ but the export possibilities are often limited to the acquisition of still frames.^{4,5} Exported animations, such as angiograms, are often preferred in cardiology, and can be directly incorporated into Powerpoint presentations or used on the WWW.⁶

Many readers in the medical profession resort to an internal/external medical illustration department/company for the creation and editing of such animations. This article will briefly describe the simplest and least expensive methods of converting DICOM images to small and manageable AVI format files.

Method

Viewstar (Comview) is a DICOM viewer that is simple to use and free. It is available at <http://www.etelecardiology.com> after free registration. The downloadable installation file is 7.4 MB at the time of writing. Incidentally, the software also permits medical professionals to send and receive DICOM patient files securely over the internet.

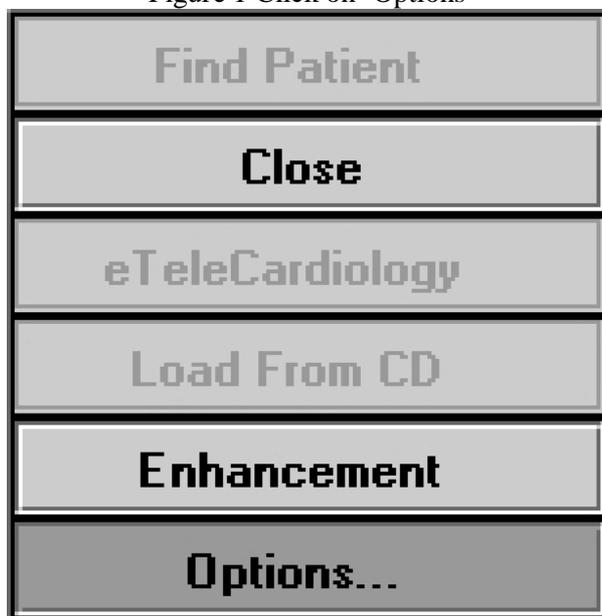
Viewstar exports still images in both GIF and JPG format. It also permits the exportation of complete animations (Viewstar Version 3.10.00), such as angiography runs, after the installation of the appropriate codec. Codecs are used to compress animations (and therefore

shrink them in size).⁷ Many different codecs are available, and the codec required by Viewstar is Indeo 5.

With the September 2002 update to Windows XP, Microsoft suspended distribution of Indeo codecs as part of the Windows operating system, so this codec must be installed separately. The Indeo codecs are now owned by the Ligos Corporation and may be purchased for a small fee (less than \$20) from <http://www.ligos.com/indeo.htm> as a file called Indeo XP. This can be installed on all Windows operating systems from Windows 95 through to Windows XP. The download file is 2.1 MB at the time of writing. The older, free Indeo codec installation software (iv5setup.exe - 1.07 MB) is still available at <http://download.ligos.com/dld-product/indeo/iv5setup.exe>.

Through Viewstar, DICOM angiocardiology runs (512 by 512 pixels) are typically five to ten megabytes in size, but are exported to approximately one tenth of their original size as an AVI file with Indeo compression. Playback on the Windows operating system is, by default, in the standard Windows Media Player, but will play back only if the Indeo codec is installed on the computer that is expected to perform the playback. The steps are illustrated below: Select patient and loop then click on 'options' (fig 1).

Figure 1 Click on 'Options'



A new dialog box will pop up: choose 'Export Image' (fig 2).

A new dialog box will pop up: choose 'AVI' from 'Types Of File' (fig 3: red arrow). By default, Viewstar saves in its 'Export' folder, typically:

C:\Program Files\ComView\ViewStar\export. However, the animation may be saved in any location of choice using the pull-down menus (blue arrow)

The animation can now be used as is but the computer on which the animation is to be played back must also have the Indeo codec installed, as mentioned above. Moreover, the animation may be excessively long and may only contain a short part that is truly of interest. Cropping the animation to include only the part of interest will make the animation both more interesting to the target audience and will reduce the overall physical file size of both animation and resulting presentation.

A very simple program that can do this is Animation Shop (Jasc Software - <http://jasc.com>). This software usually forms part of the Paint Shop Pro bundle. Steps: Open the AVI file in Animation Shop using the usual 'File'-'Open' dialog boxes. Leave the AVI import options dialog box that pops up unchanged by clicking on the 'OK' button (Fig 4). Allow a few seconds for Animation Shop to load the clip.

Figure 2 Click on 'Export Image'



Figure 3 Saving an animation in AVI format

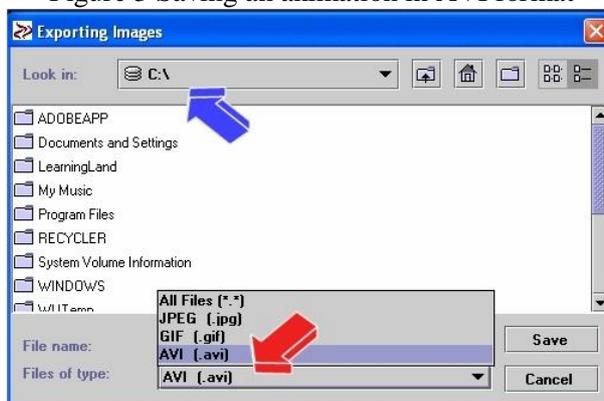
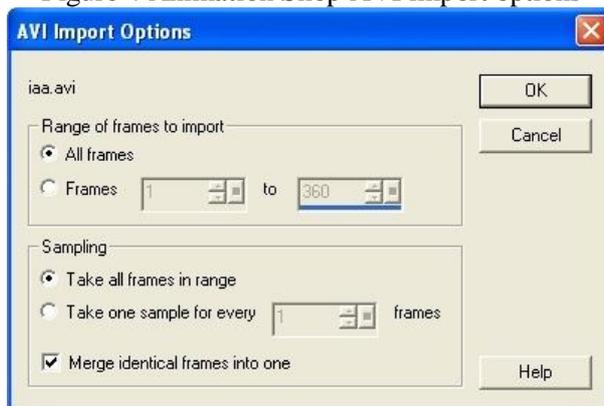


Figure 4 Animation Shop AVI import options



The clip can now be viewed as a series of still frames (fig 5). The entire clip may be viewed by moving the horizontal slider at the bottom of the clip. The clip that is being used for this demonstration is an angiogram of an interrupted aortic arch. It is 4MB in size, 512 by 512 pixels and 360 frames in length, having been exported from its original DICOM format via Viewstar to an AVI file with Indeo compression.

Figure 5 Animation as a series of still frames



We will now retain only those frames that are of interest. The frames of interest can be located by dragging the slider at the bottom of the animation. In this case, the frames that were to be retained began from frame 72 (frame numbers at bottom just over horizontal slider). Click on the frame just before in order to select it (in this case, frame 71). Then move the slider to the start of the animation, and click on frame one while holding down the keyboard 'shift' key. This selects frame 1 and all of the intervening frames (2-70). Release the 'shift' key and press the keyboard 'delete' key and all of these frames (1-70) will be removed. The new frame 1 is now the old frame 72.

The same process can be done for the frames that are not of interest at the end of the animation. In this case, only frames before 156 were deemed worth retaining. Therefore click on frame 157, move the slider to the end of the clip, and click the final frame while simultaneously holding down the shift key, then press delete as described above. The new animation is now 156 frames long.

Not all of the viewing area of the angiogram is of interest. We can also crop to the area of interest using the following steps. First click on the 'Crop' tool (fig 6).

Then select the area of interest on any still frame by clicking and dragging (fig 7). Once the mouse is released, the crop box may be resized by click on the edges and dragging. The crop box can also be moved by clicking and dragging within the crop box itself.

Because of eventual codec constraints when later saving the animation, it is best to leave the animation square dimensions in multiples of four. The starting point of the crop box, the current crop position and the area that will be left after cropping are shown at the bottom left of the screen (figure 8). In this example, the starting point of the crop box at the top left corner is at coordinates 27,0 (from left, from top), the finishing coordinate at the bottom right corner is at 435,428 resulting in a final animation that has been cropped to 408 by 428 pixels. Now press the 'Crop' button (figure 9). This will take a while.

Figure 6 Crop tool



Figure 7 Area to be cropped



Figure 8 Crop box location

$(27, 0) \rightarrow (435, 428) = (408 \times 428)$

Figure 9 'Crop' action box



This animation can now be saved as is for backup purposes. The usual dialog is used: 'File' – 'Save As'. Chose save location and filename and click 'Save'. A series of dialog boxes will come up. Leave all as is by default. In particular, in the 'Choose Compressor' options, keep the 'Full Frames (uncompressed)' option and in the 'Frame rate' options, leave at 15 frames per second. This animation can now be played back using the Windows Media Player, but the animation is just over 32 MB in size! It is much bigger than it used to be simply because it is uncompressed.

At this point, one may choose to compress the image and decrease its physical size by using one of a variety of codecs. The MPEG-1 codec is playable on virtually all platforms, including the Apple Mac, and was developed by the Moving Picture Experts Group (MPEG), a working group in charge of the development of standards for coded representation of digital audio and video. The group was established in 1988, and has produced MPEG-1, the standard on which Video CD and MP3 are based and MPEG-2, the standard on which Digital Versatile Disc (DVD) is based.

However, for a file to be encoded in this format, an MPEG-1 software encoder is needed. Suitable encoders are made by Ligos and by Xing (see links below) Encoding with the former software resulted in a file size of 862KB, a compression ratio of >35:1 (figure 10).

Figure 10 Final angiogram in MPEG-1 format



(http://ligos.com/lxs_mpeg_encoder.htm)

(<http://www.real.com/accessories/?prod=xingmpegencoder>)

Alternatively, the file can be saved in MPEG-4 format, a more recent codec. No additional software is needed if the MPEG-4 codecs are installed. The MPEG-4 codecs are said by Microsoft to be installed with the latest free download and upgrade of Window Media Player: From Microsoft: Windows Media Player full-install codecs

The following codecs are installed as part of the full installation of Microsoft Windows Media Player: Microsoft MPEG-4 version 1, and version 2, and version 3 video codecs:

http://www.microsoft.com/windows2000/en/datacenter/help/default.asp?url=/windows2000/en/datacenter/help/ns_tools_yrtc.htm

Saving in MPEG-4 format can be done by saving the animation again (under a different filename) using Animation Shop but at the dialog box 'Choose Compressor' options, change to MPEG-4 3688 V3. The resulting file not only looks better to the eye, with less pixelation, but is also almost a third of the size of the MPEG-1 file at 309KB.

If the MPEG-4 codec is not installed, the following file may be downloaded from the internet from a variety of sources: mpg4vki.zip. Follow these instructions to install:

Download and extract the files in the zip file to a temporary directory. Three files will be extracted. Right click on the .inf file and select 'install' to start the installation. If the installer detects a newer version of the file and ask you whether to keep it or not, do keep the newer version. Another MPEG-4 codec source is the Nimo Codec Pack <http://nimo.titanesk.com/modules/news>.

Some of the readers may be using Apple Mac operating systems, and may be more comfortable with the Apple Quick-Time format (MOV). Any of the above animations may be converted to MOV and vice-versa by means of the free (at the time of writing) RAD video tools. This software may be downloaded from <http://www.radgametools.com/default.htm>.

Figure 11 Final angiogram in MPEG-4 format



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Further reading

For more general information on the DICOM standard see
<http://www.psychology.nottingham.ac.uk/staff/cr1/dicom.html>

NEMA DICOM information

http://www.nema.org/DocUploads/1721FE52-BDDC-4380-BF82377D468E4B7F//DICOM_1.pdf

MPEG home page

<http://mpeg.telecomitalialab.com/>

Quick-Time home page

<http://www.apple.com/quicktime/whyqt/>

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